State of New Mexico
Energy, Minerals and Natural Resources Department

Susana Martinez
Governor

Tony Delfin
Deputy Cabinet Secretary

David R. Catanach, Division Director
Oil Conservation Division

***Response Required – Deadline Enclosed***
*Underground Injection Control Program*

July 28, 2016

Mr. Nevin Bannister
Chief Operating Officer
OWL SWD Operating, LLC
8214 Westchester Drive, Suite 850
Dallas, TX 75225

**RE: NOTICE TO OPERATOR: REQUIREMENT TO CONDUCT INJECTION SURVEY**
Maralo Sholes B Well No. 2 (API 30-025-09806)
660' FSL, 660' FEL; Unit P, Sec 25, T25S, R36E, NMPM, Lea County, New Mexico
Injection Authority: Administrative Order SWD-1127
Order Date: June 1, 2008
Permitted Interval: Yates and Seven Rivers formations; 2938 feet to 3055 feet

Mr. Bannister:

The Division is in receipt of a formal correspondence by the City of Jal regarding the potential impacts of the operation of the injection well referenced above (the "subject well"). This correspondence presents concerns for the protection of underground source of drinking water in the vicinity of the subject well. In response to this correspondence, the Engineering Bureau is conducting a technical review of the well file and operation with respect to the conditions contained in the administrative order.

OWL SWD Operating, LLC (the "operator" or "OWL") has responded to recent requests for inspection and upgrade of the wellhead in order to monitor an intermediate casing string that is only sealed in place with drilling mud and not cement. This situation is being assessed for potential vertical migration of fluids behind casing and may require additional testing based on the results of the Bradenhead monitoring.

During the review of the well file, the Division found that the reported volumes of injection fluids increased significantly during the calendar year 2015 (see attachment). The average daily injection rate for 2015 was approximately 19,500 barrels of water per day (BWPD) while the highest single-month rate happened in August with approximately 30,790 BWPD. All of the reported volumes were



**Final Report for Maralo Sholes B Well No. 2**
**Attachment 1**

injected with a surface pressure of zero (0) pounds per square inch (PSI). Conversely, the injection volumes for the period from 2009 to 2014 showed an average of 3300 BWPD with all volumes injected with a surface pressure of 0 PSI.

The Division is required "*to ensure that the injected water enters only the proposed injection interval*" as a condition of the administrative order. Based on the recent injection information and lack of any quantitative testing, the Division cannot confidently determine that the injection fluids are staying within the permitted interval. Therefore, the Division is stipulating that the operator conduct an injection survey for the subject well with the results to be submitted within the next twenty-one (21) days of this correspondence date.

The type of injection survey may be either a temperature survey or a radioactive tracer survey. At a minimum, the injection survey will be conducted to established industry protocols with results that provide a clear interpretation. A description of activities to conduct the proposed injection survey must be submitted in a Notice of Intent Sundry for approval by the Hobbs District Supervisor. Scheduling of the injection survey must provide the opportunity for Division personnel to be present to witness the activities. All test results, logs and reports prepared as a result of the injection survey are to be submitted to the attention of the Division Director in Santa Fe.

In the event that a satisfactory response is not received to this letter of direction within the prescribed period, enforcement will occur. Such enforcement may include immediate shut-in and an application for appearance by OWL before a Division Examiner to terminate the injection authority granted in the administrative order.

Please contact Mr. Daniel Sanchez, Fields Operations Manager (505.476.3493), with any questions regarding this correspondence.

Sincerely,

David R Catanach

DAVID R. CATANACH
Director

DRC/prg

Attachment: GRAPH 1: INJECTION RATE VS. TIME: Maralo Sholes B No. 2 (30-025-09806; SWD-1127)

cc: Oil Conservation Division – Hobbs District Office
Well File API 30-025-09806
Administrative Order SWD-1127
Bureau of Land Management – Carlsbad Field Office
Mr. Bob Gallagher, City Manager, City of Jal

# CITY OF JAL

JAL, NEW MEXICO 88252

PO DRAWER 340
PHONE 395-3340

NEW MEXICO
small town. big heart.

April 28, 2016



Mr. Matthew Earthman
Souder, Miller & Assocs.
3451 Candelaria Rd NE
Albuquerque, NM 87112

Mr. Earthman,

I want to take this opportunity to communicate with you about a concern that was brought to the city by several individuals and companies. The concern is in reference to our pending application for 900 acre feet of water and nine well locations.

There are several disposal wells in the same section that we are considering to place our wells, Section 25, T 25S, R 36E, that would be utilized for drinking water. In particular, there is a disposal well, Owl Maralo Sholes B #2, that has continued to inject large volumes of disposal water, 13 million barrels in 2015. In addition to the ongoing volumes of water, a company is now constructing a 16 inch line that will travel west out of the Jal area. The purpose for this line, as we understand it, would be to transport produced water for disposal in the above-mentioned disposal well.

Before the city undertakes the expenditure to drill water supply wells in the area close to this well, we would like to ensure this salt water disposal well is injecting into the permitted Seven Rivers Zone and will not cause problems with shallow fresh water aquifers.

Our specific request is for you to involve the Oil Conservation Division and the State Engineer Office in requiring the following information.

1. Provide documentation to demonstrate wellbore integrity;
2. To run a spinner survey to demonstrate injection is within the permitted interval

We strongly believe that these tests and any others that the regulatory agencies believe are warranted should be conducted immediately and then on a regular basis thereafter to ensure that the drinking water to the residents of our community has not been negatively impacted or contaminated in any manner.

Please do not hesitate to contact me should you have any questions or require additional information.

Respectfully,

Bob Gallagher, City Manager

XC: David Martin, Sec. EMNRD
David Catanach, Director, OCD
Tom Blaine, State Engineer

**Final Report for Maralo Sholes B Well No. 2**
**Attachment 2**

# TEMP SURVEY W/ TRACER AND CHANNEL CHECKS

Company OWL SWD OPERATING , LLC
Well MARLO SHOLES B WELL #2
Field N/A
County LEA State NEW MEXICO

Location: API # : 30-025-09806
660' FSL & 660' FEL
UNIT P, NMPM
SEC 25 TWP 25S RGE 36E

Other Services

Elevation
K.B. N/A
D.F. 3023'
G.L. 3021'

Company OWL SWD OPERATING , LLC
Well MARLO SHOLES B WELL #2
Field N/A
County LEA
State NEW MEXICO

Permanent Datum GL Elevation 3021'
Log Measured From 2'
Drilling Measured From DF

| | | |
|---|---|---|
| Date | 9-2-2016 | 1.375" TOOLS |
| Run Number | ONE | |
| Depth Driller | 3065' | |
| Depth Logger | 3005' | |
| Bottom Logged Interval | 3005' | |
| Top Log Interval | SURFACE | |
| Open Hole Size | N/A | |
| Type Fluid | WATER | |
| Density / Viscosity | N/A | |
| Max.Recorded Temp. | 99.5 DEG. | |
| Estimated Cement Top | N/A | |
| Time Well Ready | ROA | |
| Time Logger on Bottom | 1:05 PM | |
| Equipment Number | HU #08 | |
| Location | SNYDER TEXAS | |
| Recorded By | HAGINS, T. | |
| Witnessed By | MR JIM WARD | |

| Borehole Record | | | | Tubing Record | | | |
|---|---|---|---|---|---|---|---|
| Run Number | Bit | From | To | Size | Weight | From | To |
| | | | | 4.5" | IPC | 0 | 2852' |

| Casing Record | Size | Wgt/Ft | Top | Bottom |
|---|---|---|---|---|
| Surface String | 10.75" | 36# | 0 | 410 |
| Prot. String | 8.625" | 22# | 0 | 1223' |
| Production String | 7" | 20# | 0 | 2935' |
| Liner | | | | |

<<< Fold Here >>>



Comments

LOG CORRECTED TO DEPTH OF 7" CASING SHOE AT 2935'.

**Final Report for Maralo Sholes B Well No. 2**
**Attachment 3**

## PERFORATIONS

SQUEEZED: 2733-2824', 2871-2910.
OPEN HOLE: 2935-3055'

### INJECTION WELL:

SHUT-IN DATE N/A HOUR N/A TOTAL S.I. TIME N/A S.I. PRESS N/A
METERED INJ. RATE 6300 BPD PRESSURE VACUUM TEMP N/A FLUID TYPE WATER
TOTAL VOLUME TO DATE N/A FLUID LEVEL TUBING N/A

### PRODUCER:

FLOWING PUMPING CHOKE SETTING HOURS PROD.
FLUID LEVEL CSG. TBG. RATE B/W B/O
FLUID TYPE

### FRAC OR ACID WELLS:

TIME FINISHED FRAC OR ACID ACID FLUID - GALS SAND #
RATE - BPM PRESSURE

## CONCLUSIONS

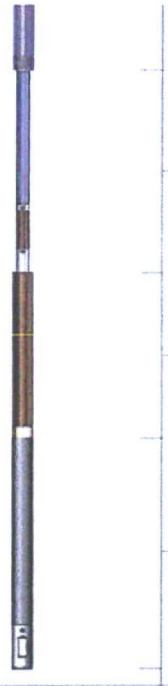
THIS SURVEY WAS RAN TO DETERMINE THE ZONES OF INJECTION AND TO DETECTED ANY CHANNEL OR PACKER LEAKS.

NO CHANNELS OR PACKER LEAKS WERE DETECTED AT TIME OF SURVEY. THE CHANNEL AND PACKER CHECKS HAVE BEEN PRESENTED ON THIS LOG.

NOTE: INJECTION TRACER INTENSITY LOSS CALCULATIONS INDICATED THAT 20% WAS EXITING THE WELL BORE AT 2935-2955'. THE REMAINING 80% WAS EXITING THE WELL BORE FROM 2955' TO BELOW THE DEPTH GAMMA OF 3002'.

THE TEMPERATURE AND TRACER INDICATED THAT FLUID IS MOVING BELOW DEPTH LOGGER AT 3005'.

| Sensor | Offset (ft) | Schematic | Description | Len (ft) | OD (in) | Wt (lb) |
|---|---|---|---|---|---|---|
| | |  | 1.375-7<br>1.375" WEIGHT BAR | 7.00 | 1.38 | 50.00 |
| | | | 1.375-3 | 5.00 | 1.38 | 100.00 |



| | | | | | |
|---|---|---|---|---|---|
| | | TREJCT-137_57 (137_57_1)<br>1.375" EJECTOR | 3.08 | 1.38 | 10.00 |
| CCL | 4.04 | CCL-137_19 (137_19_01)<br>CCL | 2.50 | 1.38 | 3.00 |
| | | GR-1.375 (0001)<br>GAMMA | 3.54 | 1.38 | 5.00 |
| GR | 0.00 | | | | |

| | |
|---|---|
| Dataset: | msb#2.db: field/well/GAMMA/pass1 |
| Total Length: | 21.12 ft |
| Total Weight: | 168.00 lb |
| O.D. | 1.38 in |

Company:
Well:
File: C:\Warrior\Data\msb#2.db
Dataset: field/well/TRACER/_tracer_/_shottabl_/1
Reference Rate: 7222.7 b/d

## TRACER RESULTS

| # | Depth (ft) | Time | Integration | Flow (%) | Delta (%) | Comment |
|---|---|---|---|---|---|---|
| 1 | 2874.50 | 13:28:24 | 349943.00 | 99.99 | | |
| 2 | 2924.22 | 13:28:49 | 349979.00 | 100.00 | -0.01 | |
| 3 | 2955.57 | 13:29:15 | 282989.00 | 80.86 | 19.14 | |
| 4 | 2999.88 | 13:29:46 | 149440.00 | 42.70 | 38.16 | |

RENEGADE SERVICES

## INJECTION TEMPERATURE SURFACE TO DEPTH LOGGER

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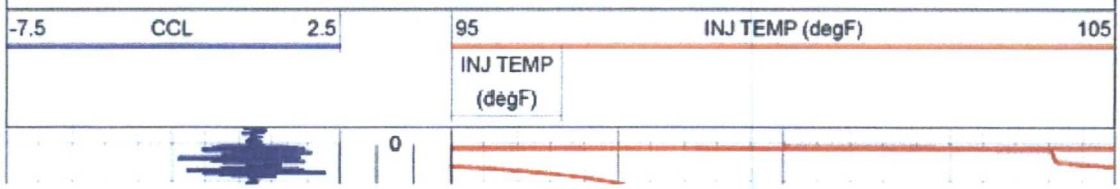
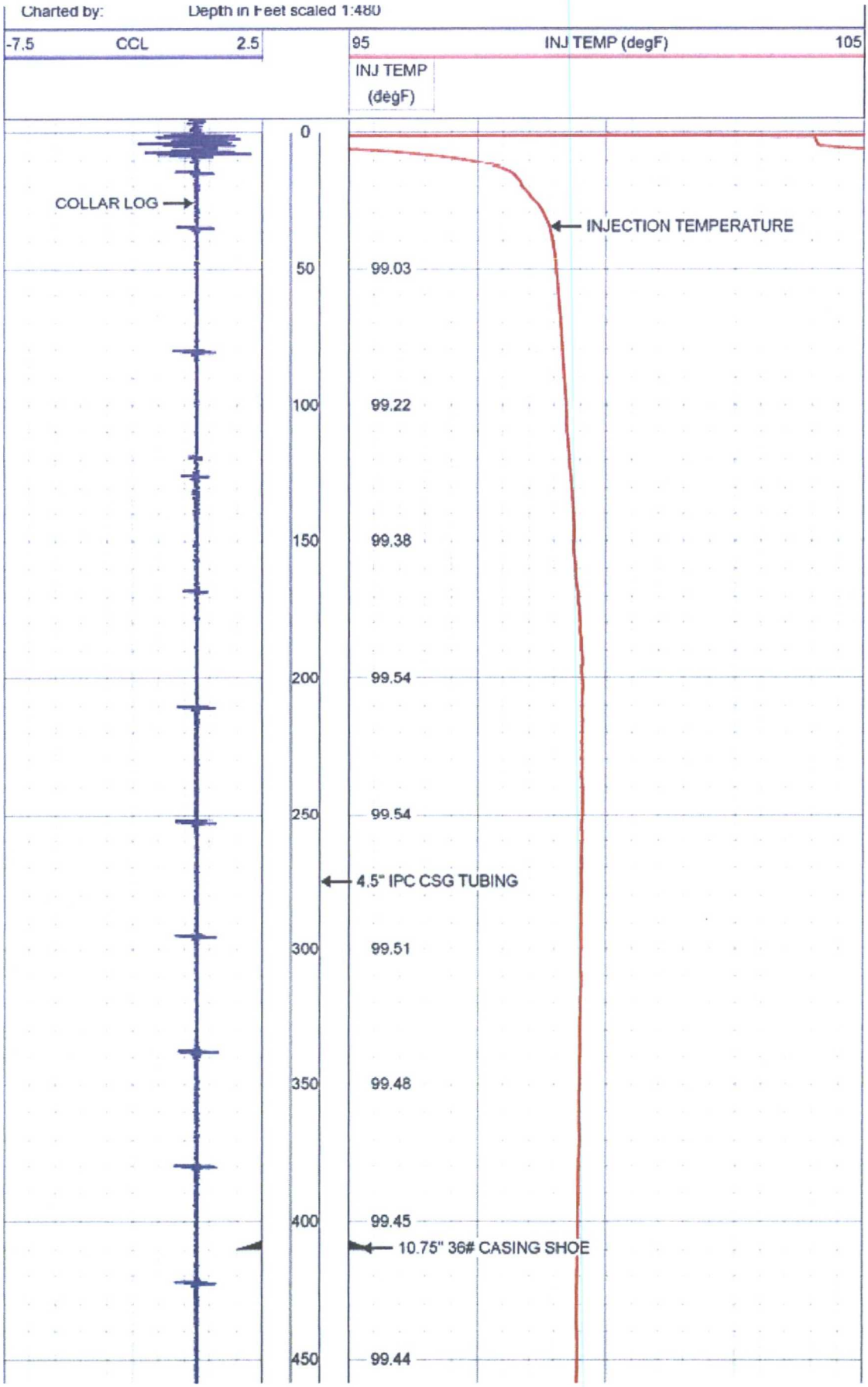
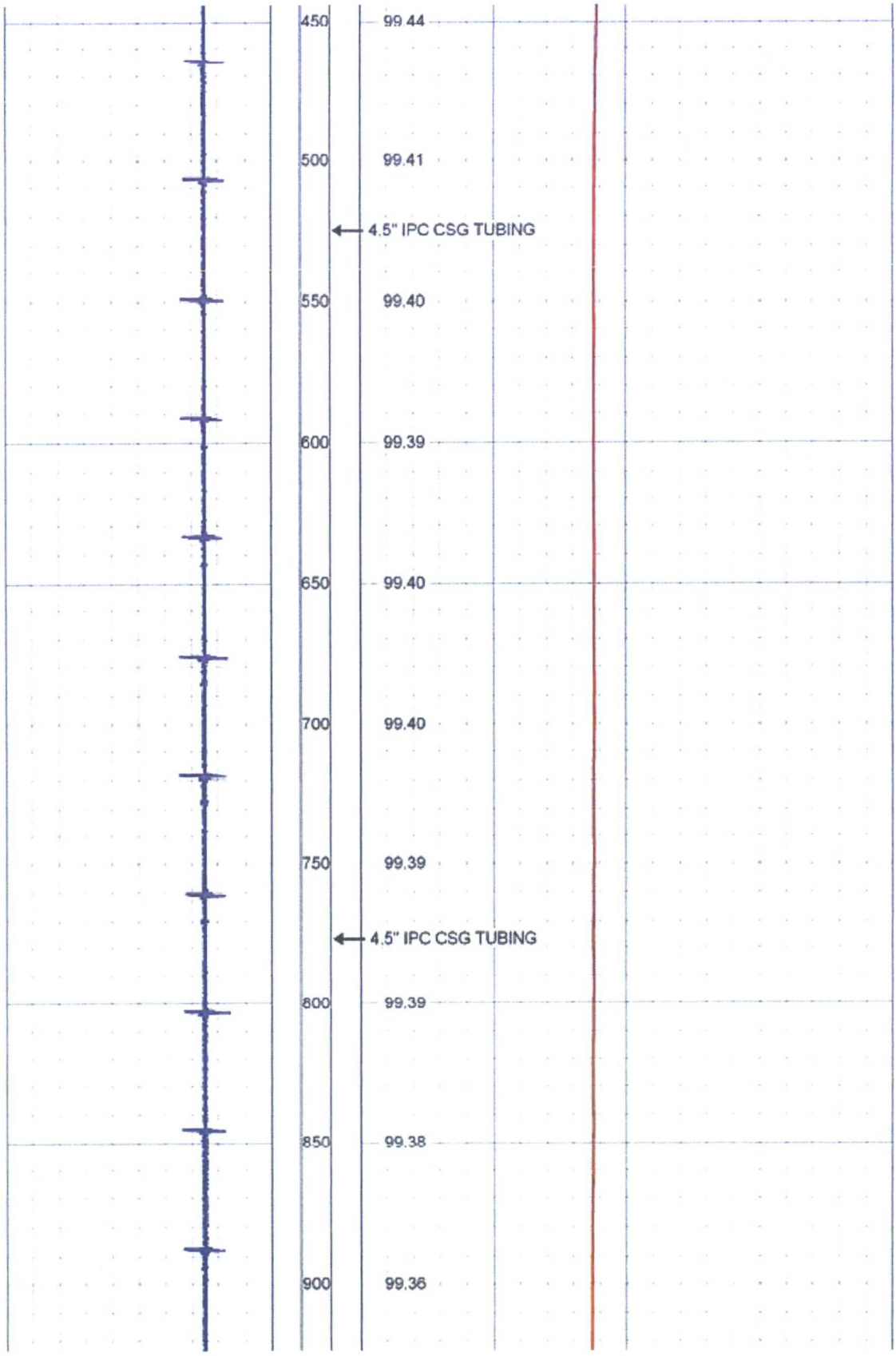
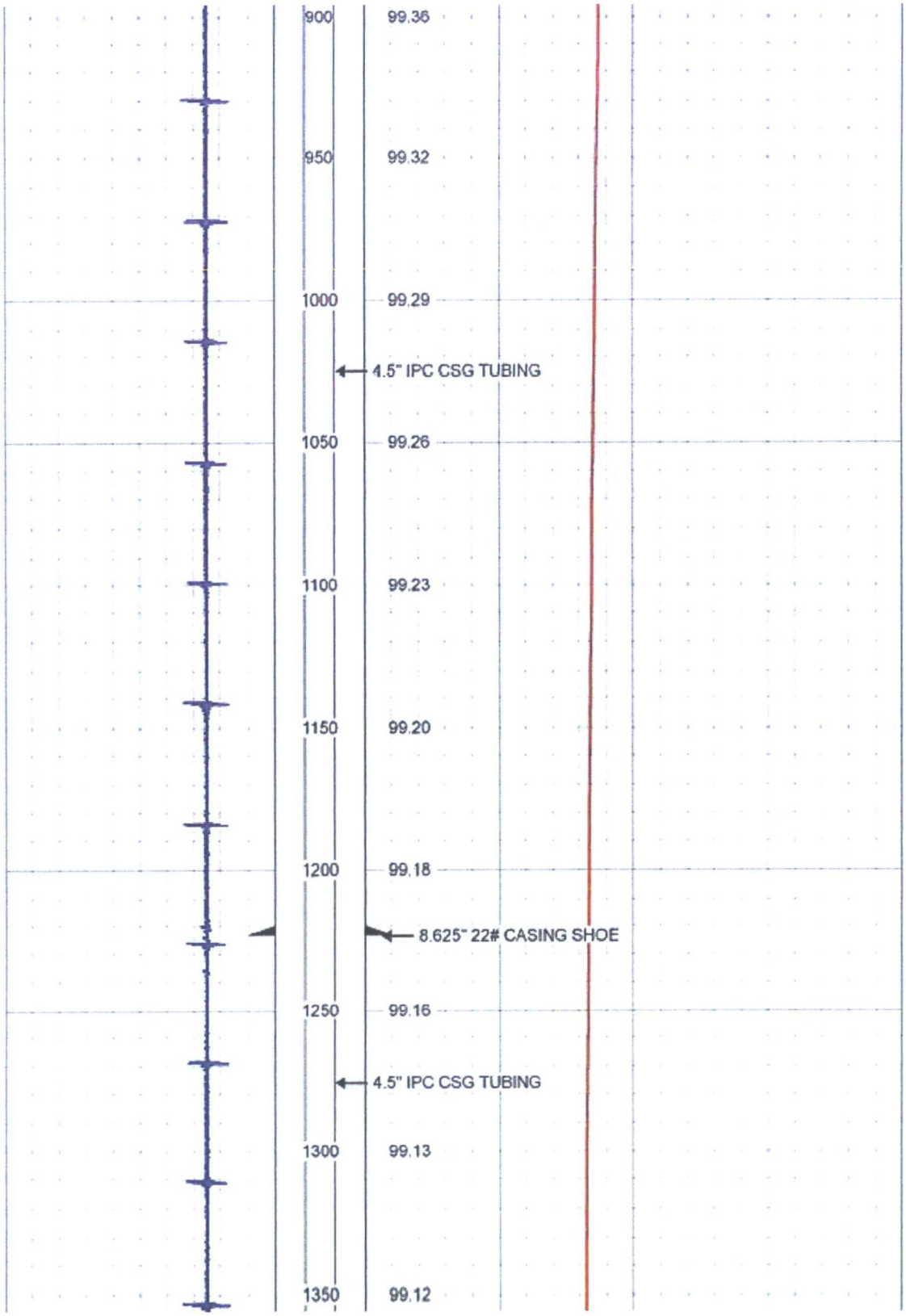
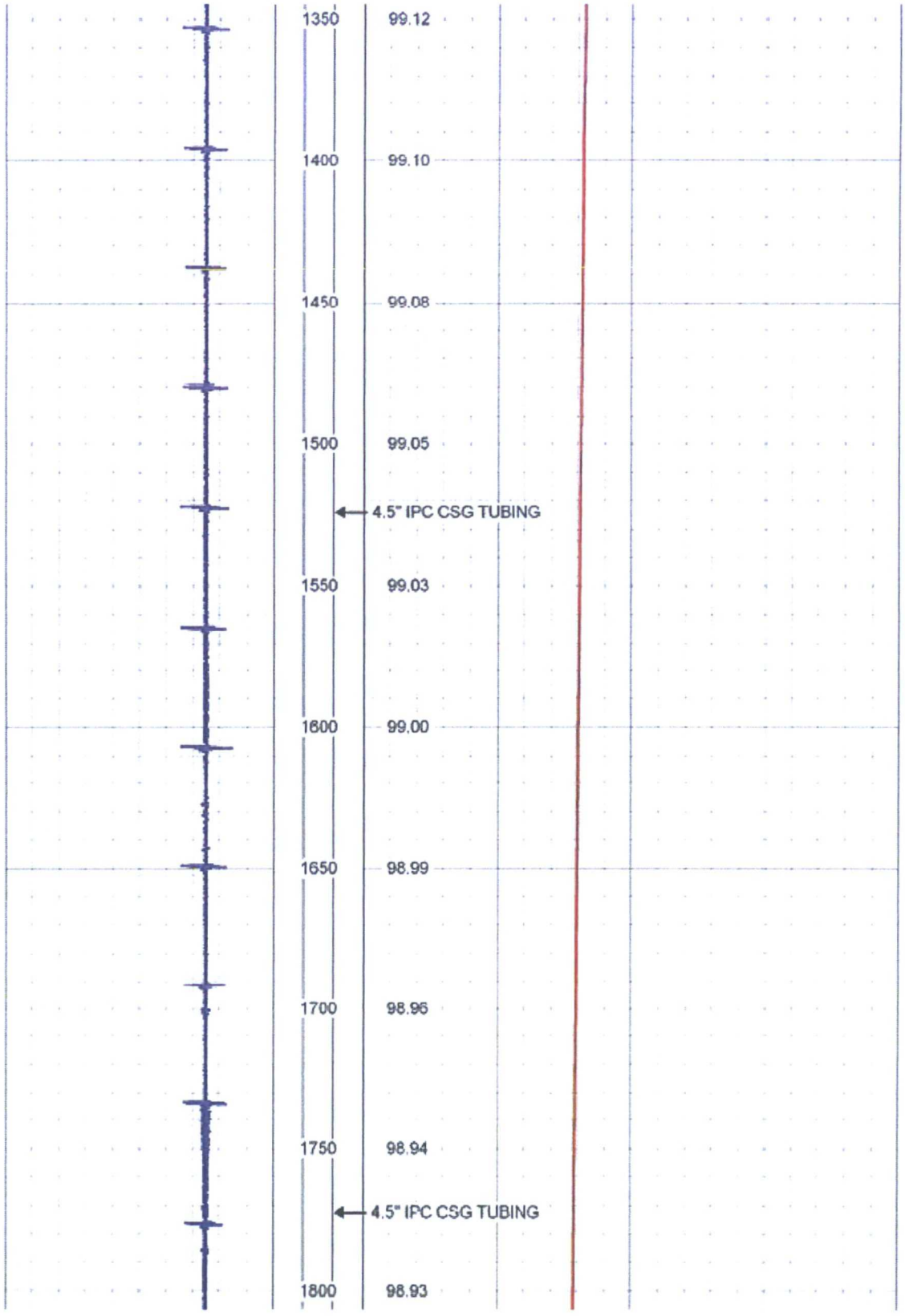
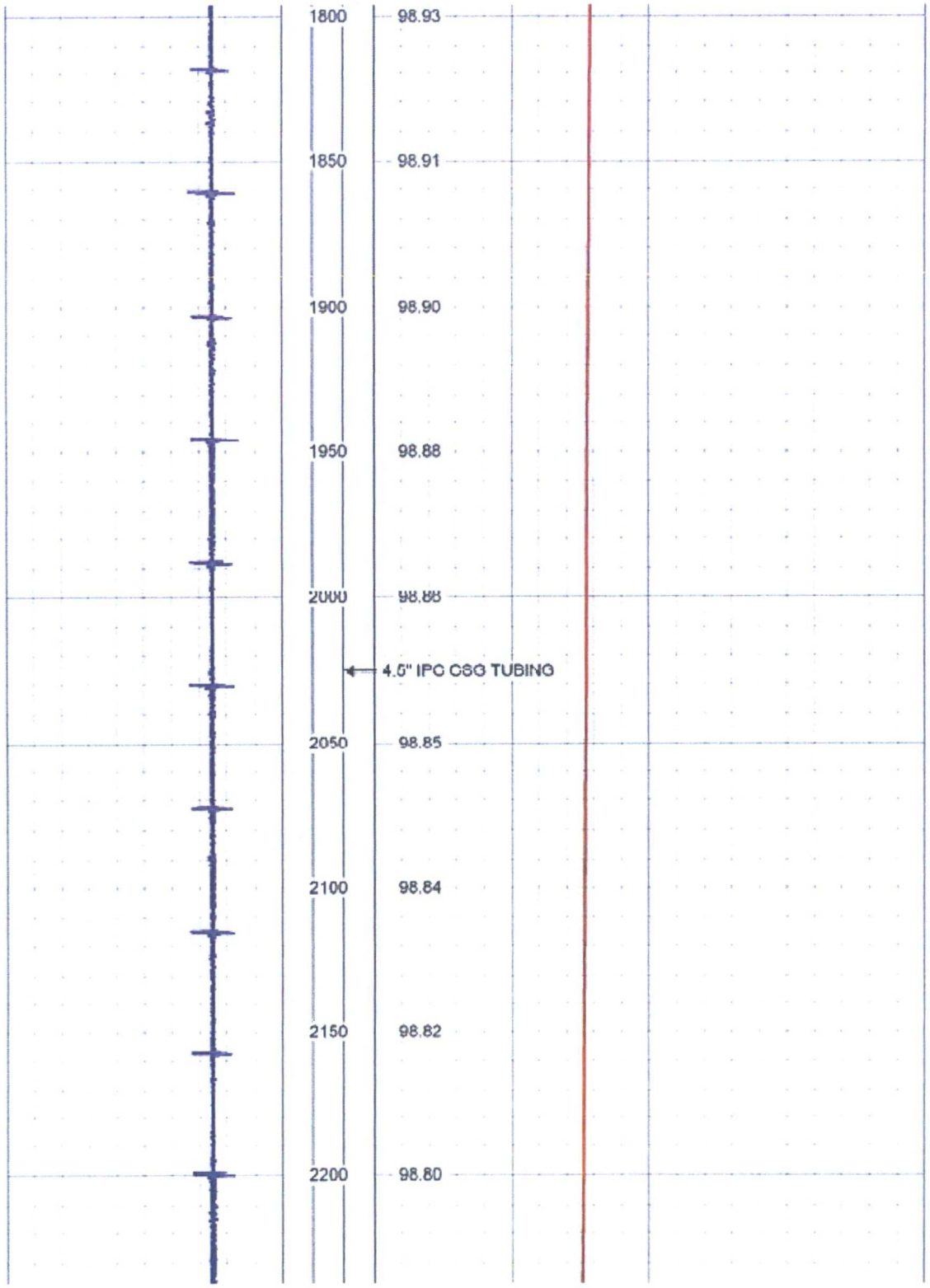


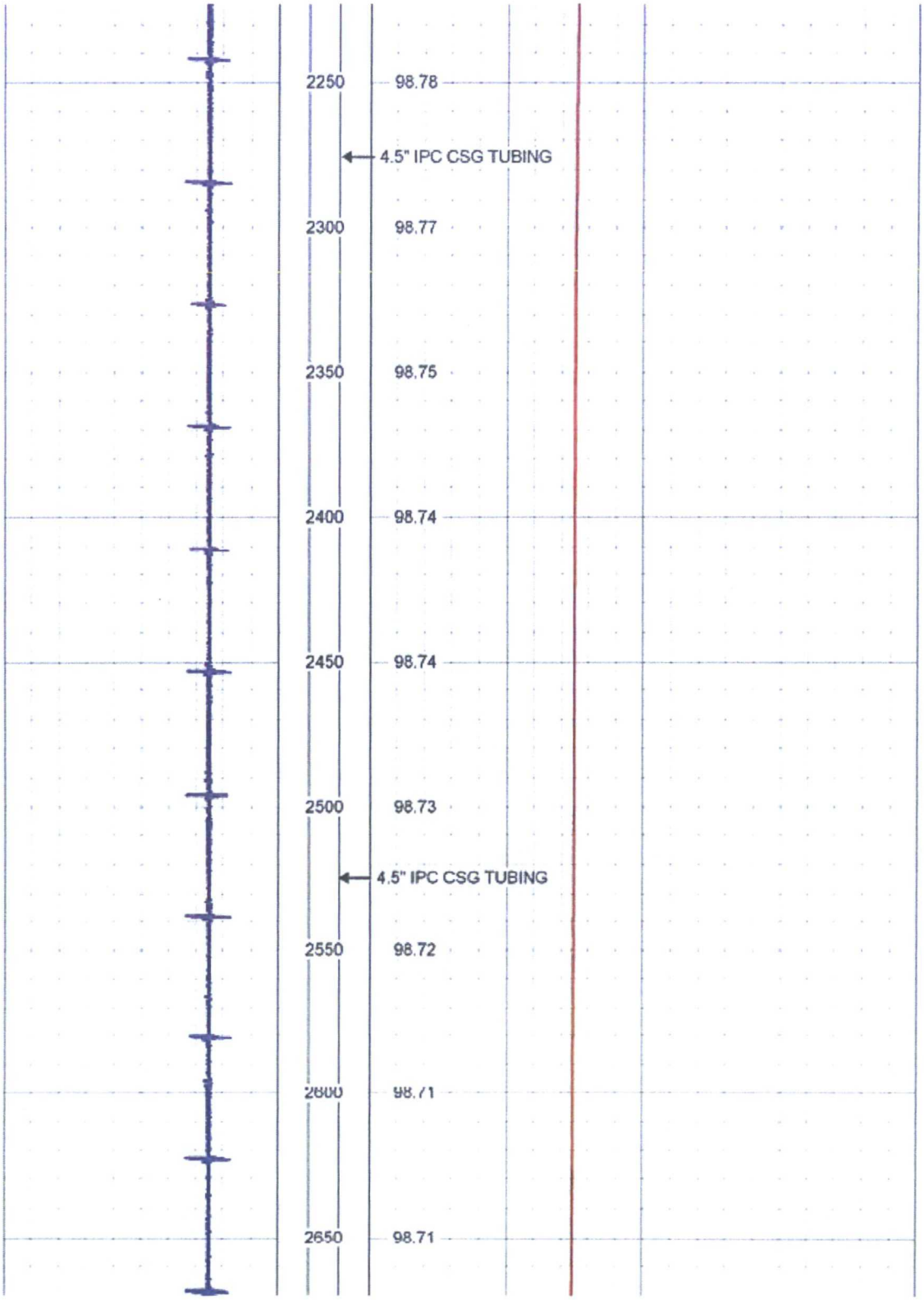

Charted by:
Depth in Feet scaled 1:480
-7.5
CCL
2.5
95
INJ TEMP (degF)
105
INJ TEMP (degF)
COLLAR LOG
INJECTION TEMPERATURE
0
50
99.03
100
99.22
150
99.38
200
99.54
250
99.54
4.5" IPC CSG TUBING
300
99.51
350
99.48
400
99.45
10.75" 36# CASING SHOE
450
99.44

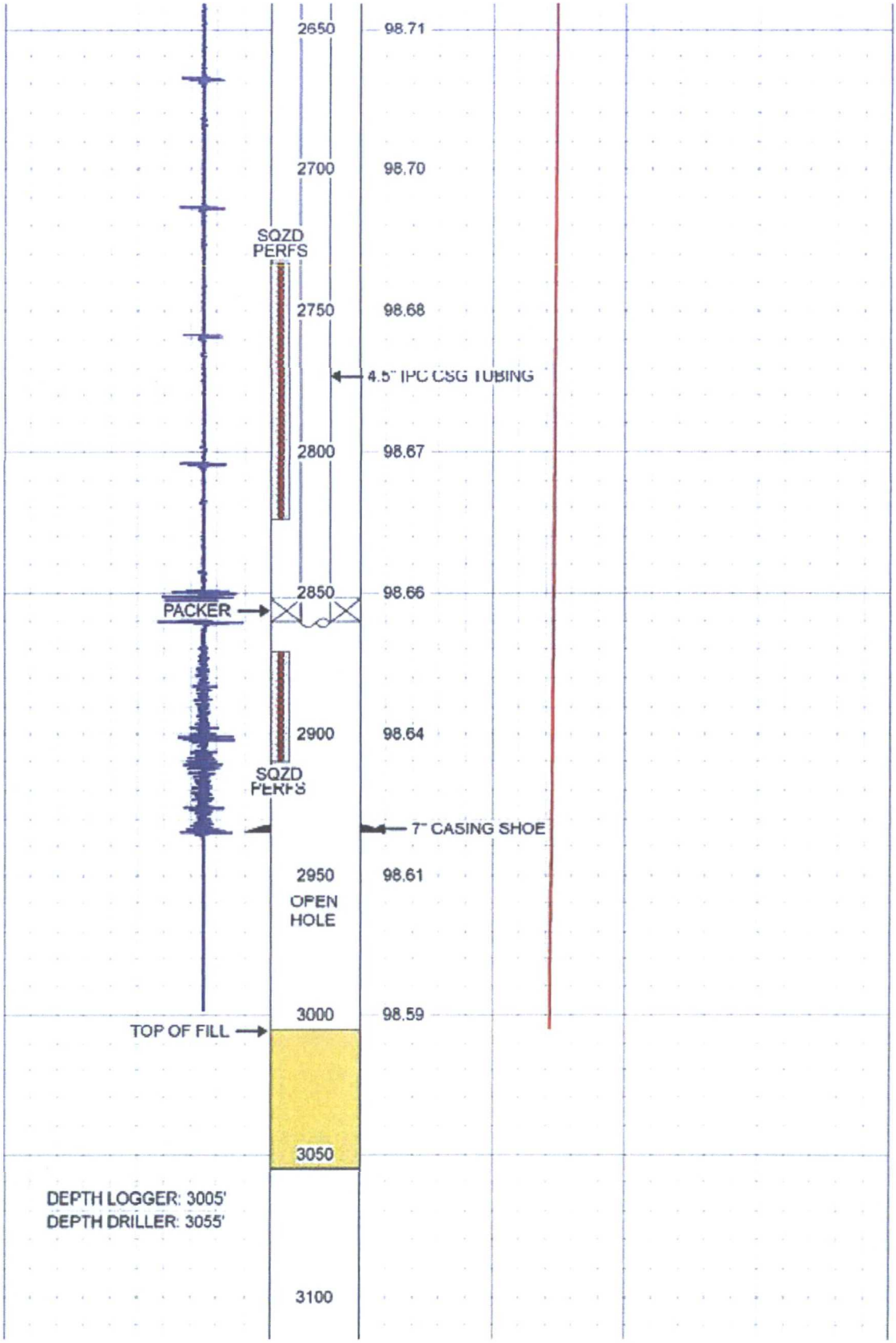

450
99.44
500
99.41
4.5" IPC CSG TUBING
550
99.40
600
99.39
650
99.40
700
99.40
750
99.39
4.5" IPC CSG TUBING
800
99.39
850
99.38
900
99.36

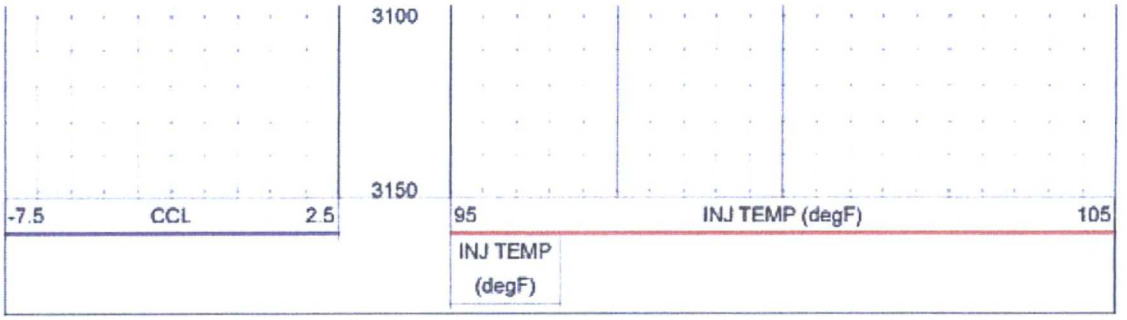

900
99.36
950
99.32
1000
99.29
4.5" IPC CSG TUBING
1050
99.26
1100
99.23
1150
99.20
1200
99.18
8.625" 22# CASING SHOE
1250
99.16
4.5" IPC CSG TUBING
1300
99.13
1350
99.12


1350
99.12
1400
99.10
1450
99.08
1500
99.05
4.5" IPC CSG TUBING
1550
99.03
1600
99.00
1650
98.99
1700
98.96
1750
98.94
4.5" IPC CSG TUBING
1800
98.93


1800
98.93
1850
98.91
1900
98.90
1950
98.88
2000
98.88
4.5" IPC CSG TUBING
2050
98.85
2100
98.84
2150
98.82
2200
98.80


2250
98.78
4.5" IPC CSG TUBING
2300
98.77
2350
98.75
2400
98.74
2450
98.74
2500
98.73
4.5" IPC CSG TUBING
2550
98.72
2600
98.71
2650
98.71


2650
98.71
2700
98.70
SQZD
PERFS
2750
98.68
4.5" IPC CSG TUBING
2800
98.67
2850
98.66
PACKER
2900
98.64
SQZD
PERFS
7" CASING SHOE
2950
98.61
OPEN
HOLE
3000
98.59
TOP OF FILL
3050
DEPTH LOGGER: 3005'
DEPTH DRILLER: 3055'
3100




COMPOSITE

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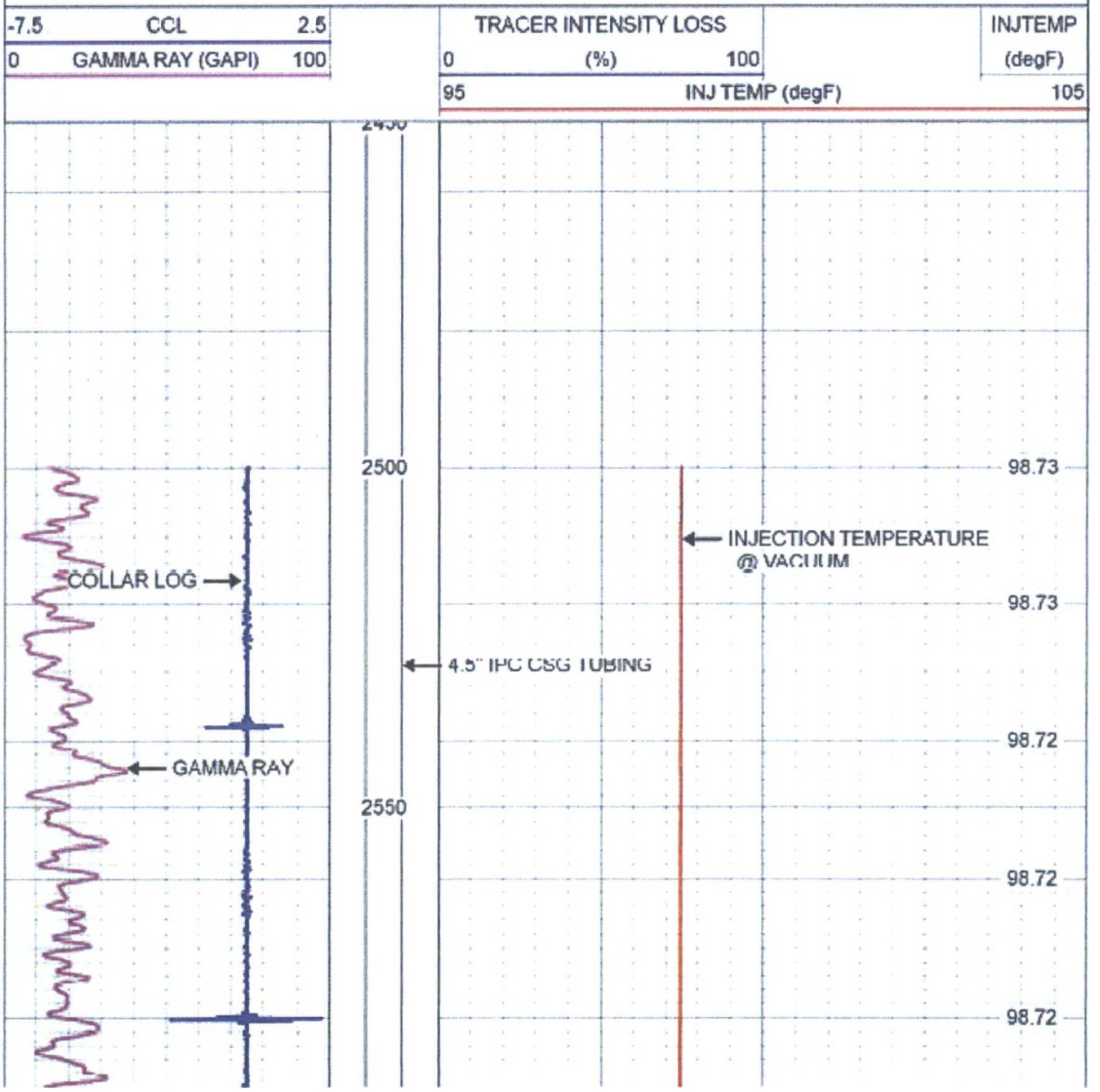
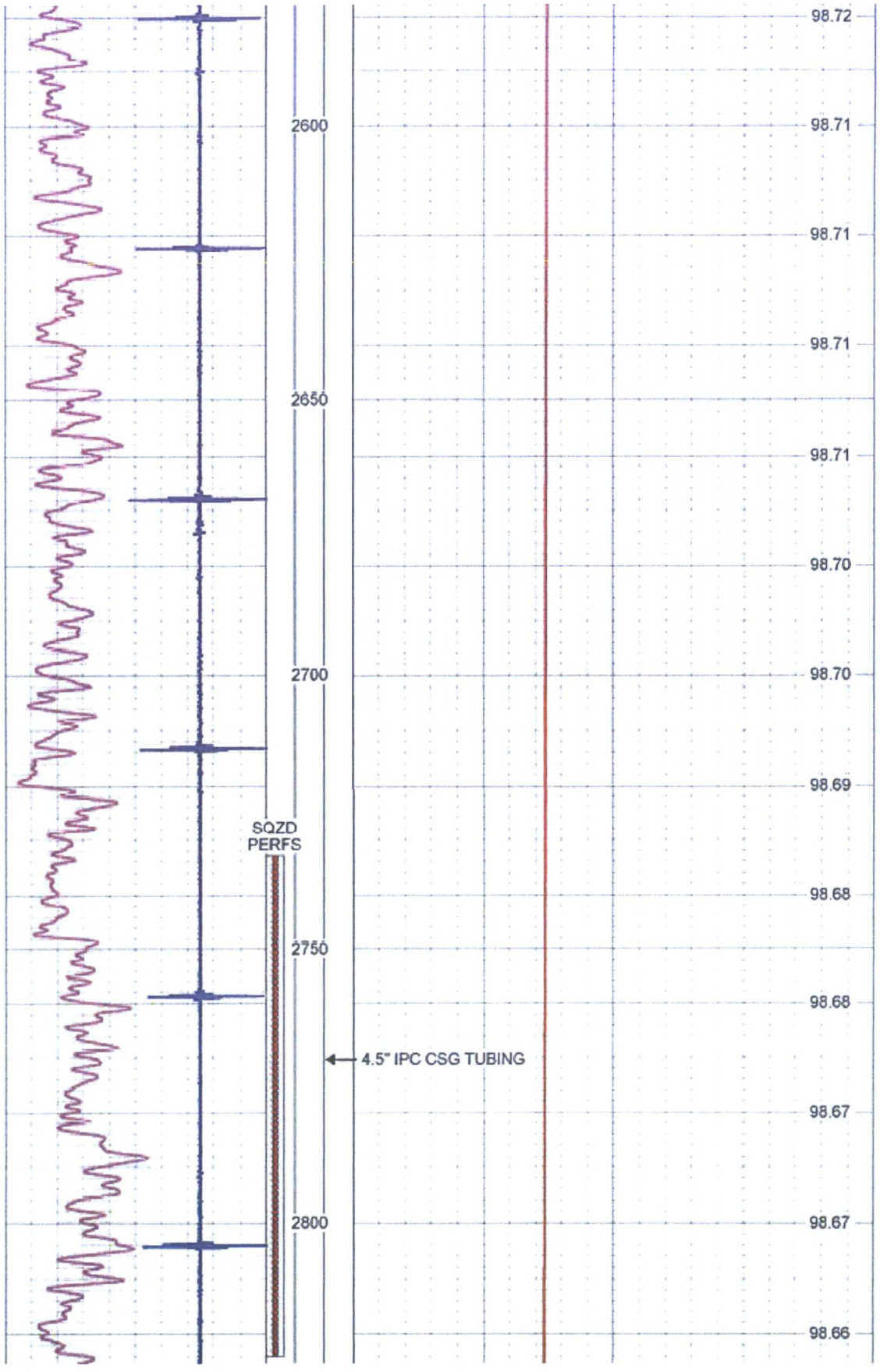
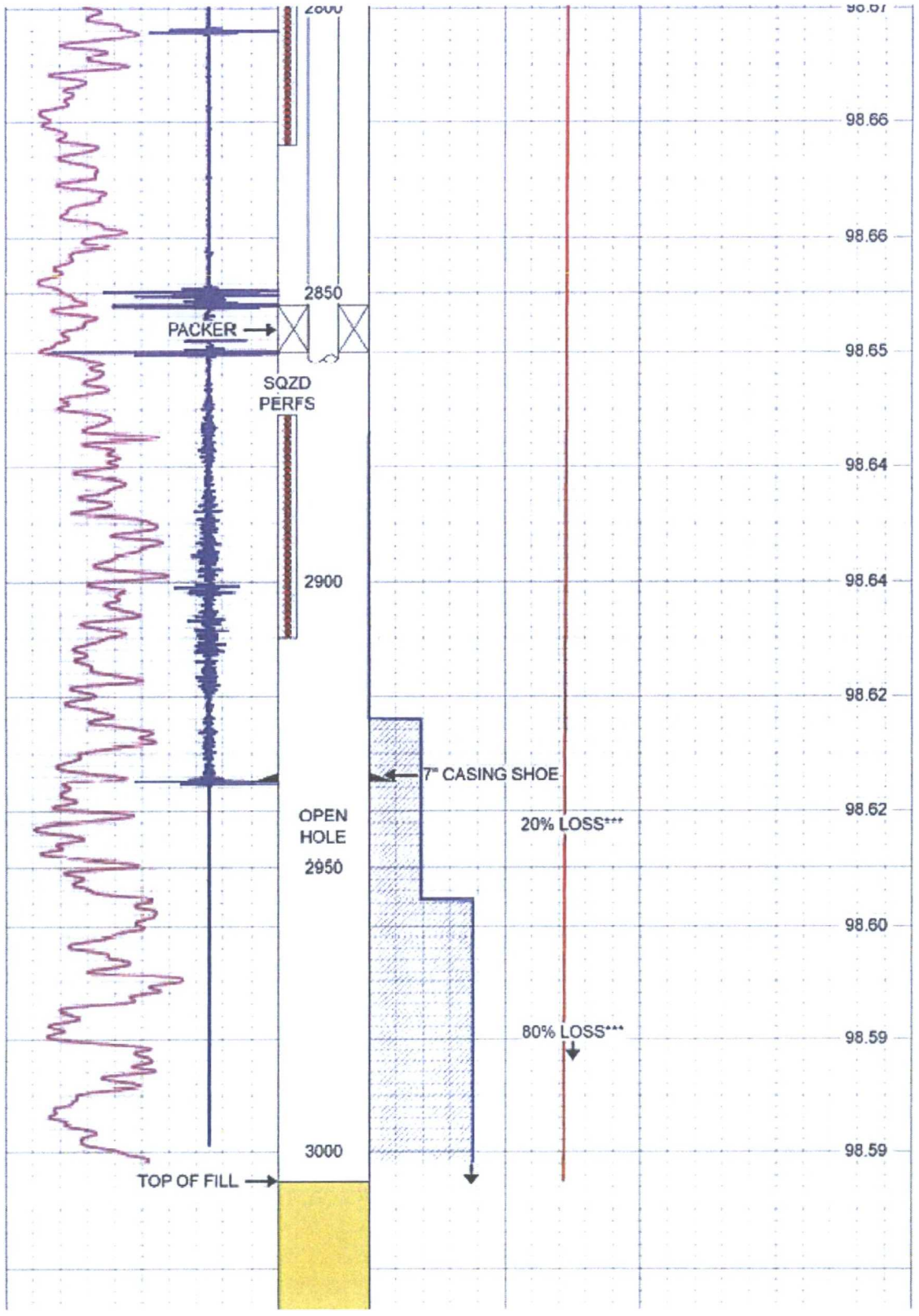
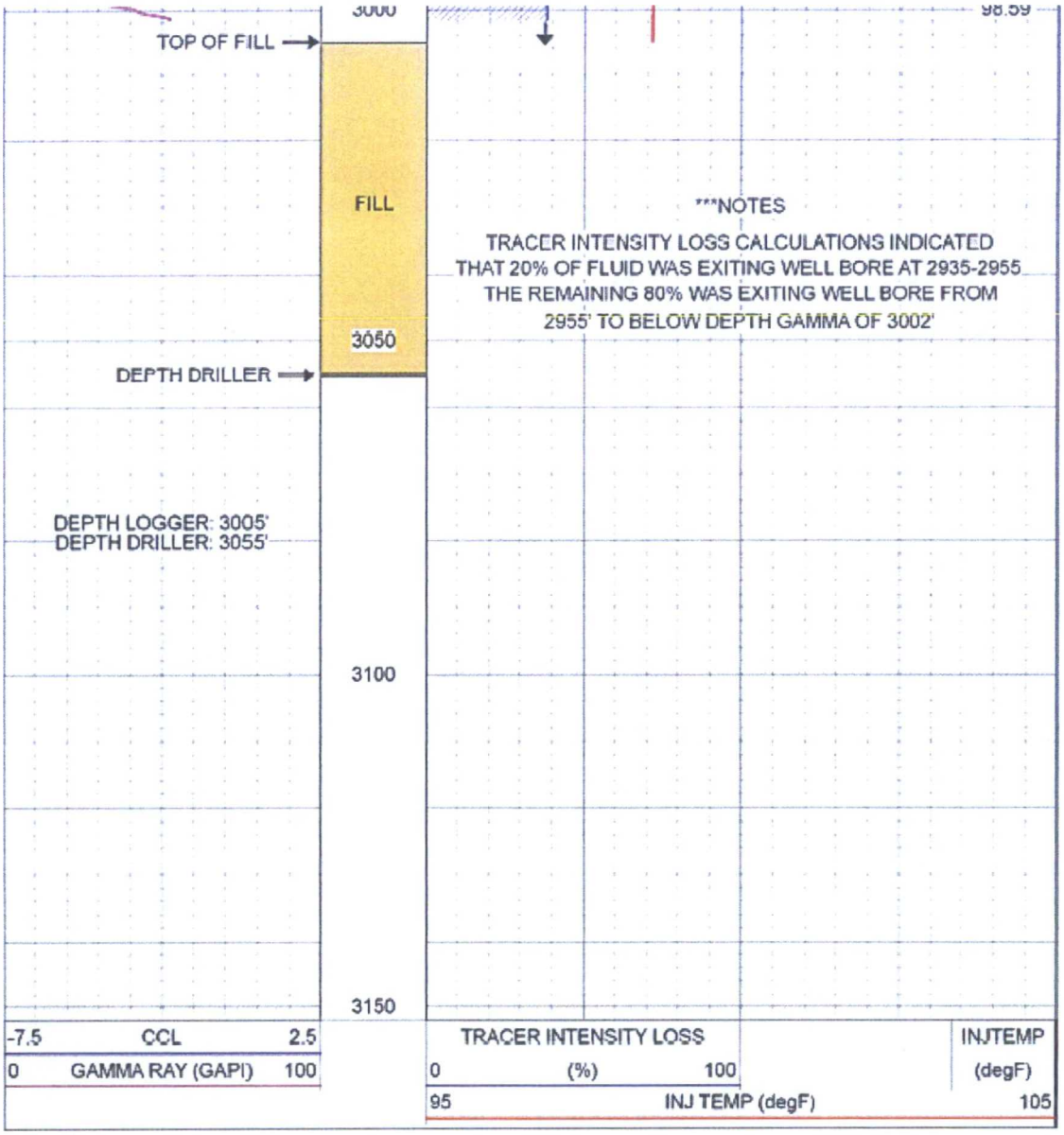



2600
2650
2700
2750
2800
SQZD
PERFS
4.5" IPC CSG TUBING
98.72
98.71
98.71
98.71
98.71
98.70
98.70
98.69
98.68
98.68
98.67
98.67
98.66


2800
98.67
98.66
98.66
2850
PACKER
98.65
SQZD
PERFS
98.64
2900
98.64
98.62
7" CASING SHOE
OPEN
HOLE
20% LOSS***
98.62
2950
98.60
80% LOSS***
98.59
3000
98.59
TOP OF FILL




RENEGADE SERVICES

1200 SEC UPWARD CHANNEL CHECK AT 2925'
NO CHANNEL DETECTED WITH R/A

| | |
|---|---|
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| Dataset Pathname: | VEL/pass1 |
| Presentation Format: | tracer |
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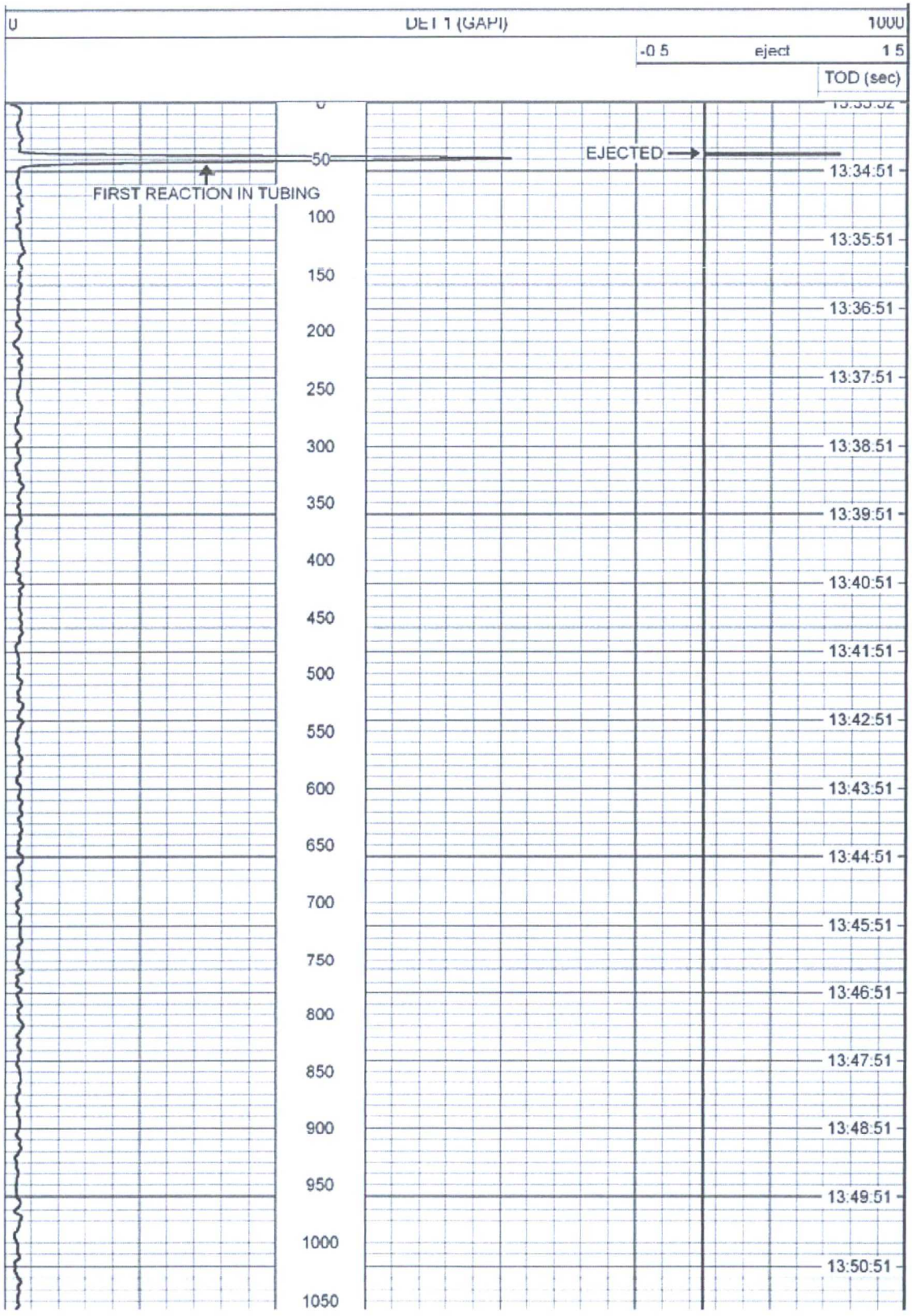
| Charted by: | Time scaled 36"/hour |

0 DET 1 (GAPI) 1000

-0.5 eject 1.5

TOD (sec)


0
DET 1 (GAPI)
1000
-0 5
eject
1 5
TOD (sec)
EJECTED
FIRST REACTION IN TUBING
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
1050
13:34:51
13:35:51
13:36:51
13:37:51
13:38:51
13:39:51
13:40:51
13:41:51
13:42:51
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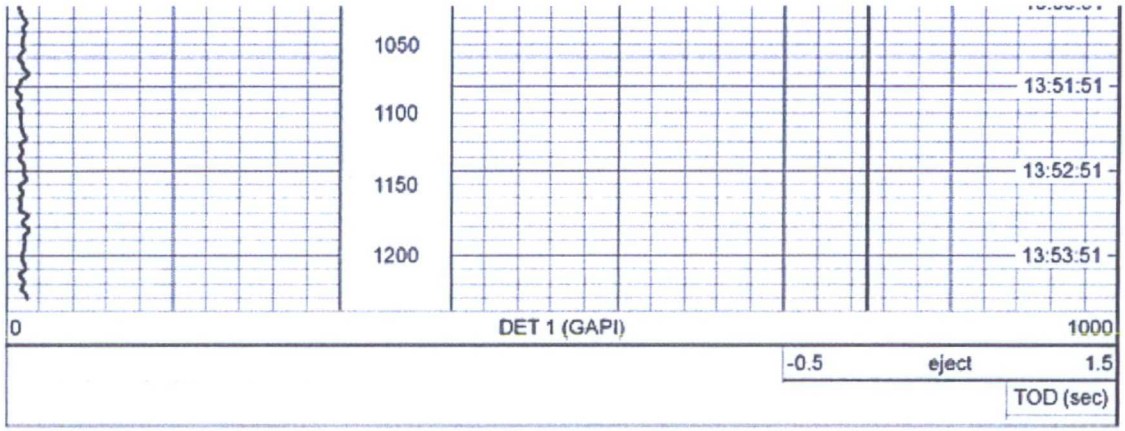
13:48:51
13:49:51
13:50:51




RENEGADE SERVICES

1200 SEC UPWARD CHANNEL CHECK AT 2865'
NO CHANNEL DETECTED WITH R/A

| | |
|---|---|
| Database File: | msb#2.db |
| Dataset Pathname: | VEL/pass2 |
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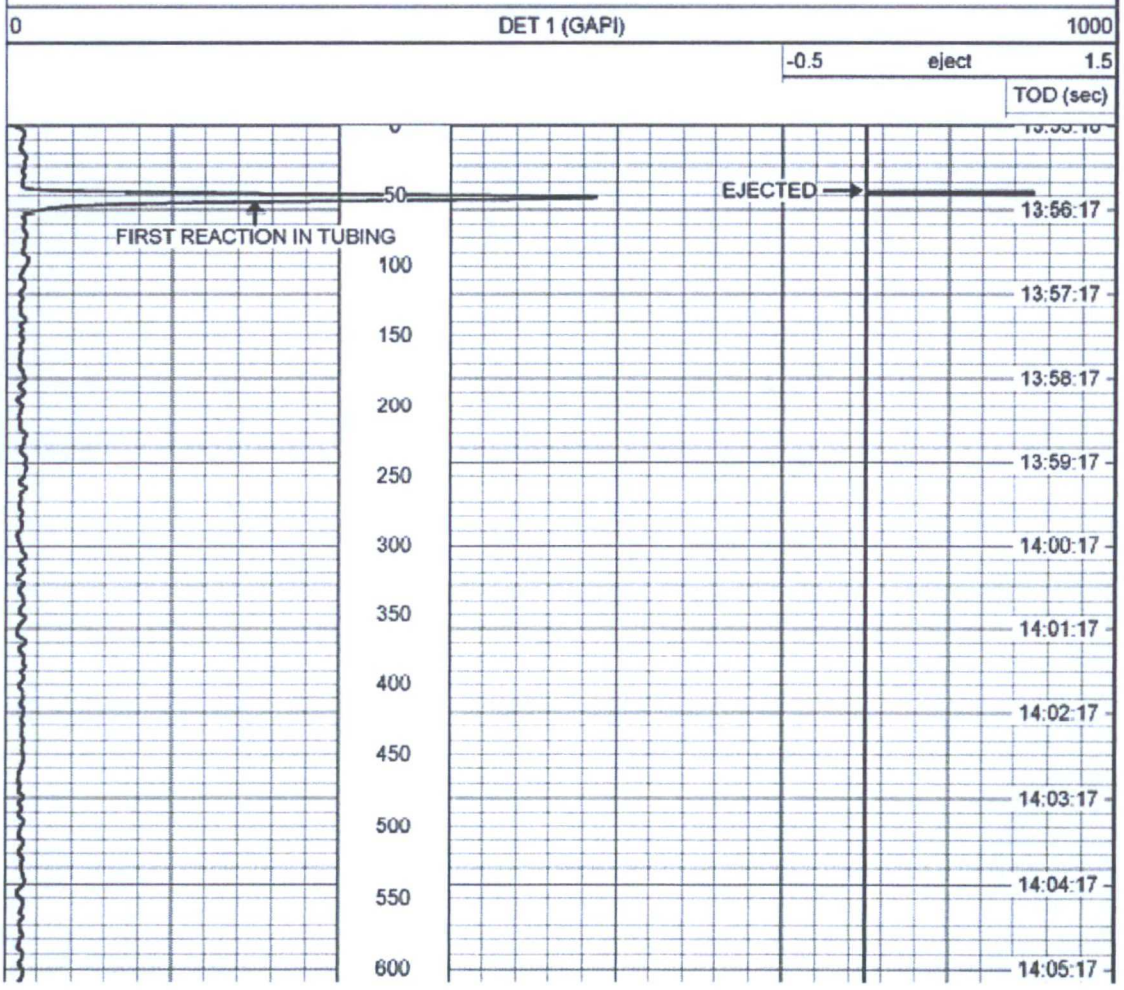

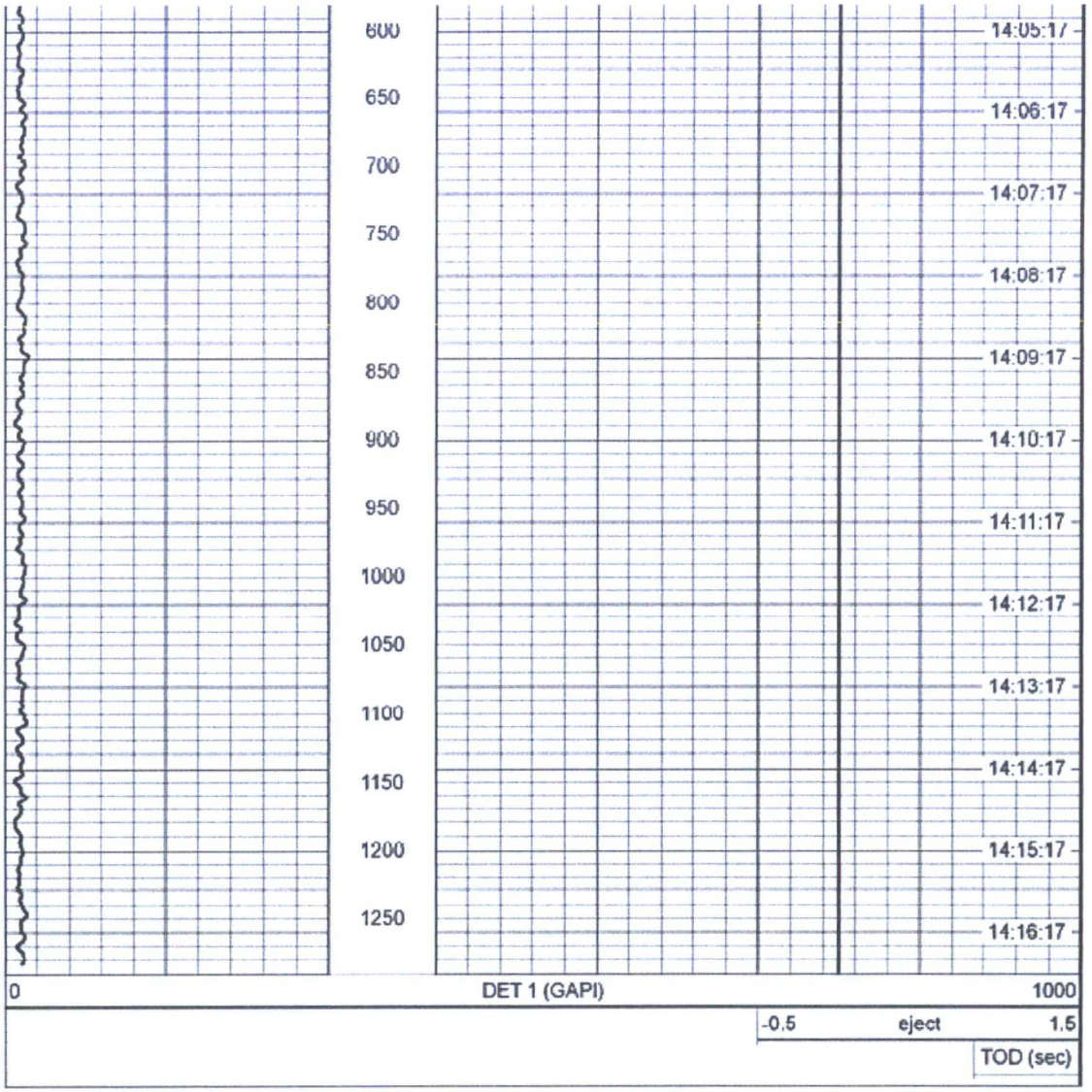


RENEGADE SERVICES

600 SECOND PACKER CHECK AT 2830'
NO LEAK DETECTED WITH R/A

| | |
|---|---|
| Database File: | msb#2.db |
| Dataset Pathname: | VEL/pass3 |
| Presentation Format: | tracer |
| Dataset Creation: | Fri Sep 02 14:17:34 2016 by Log PIP Casedhole Loggi |
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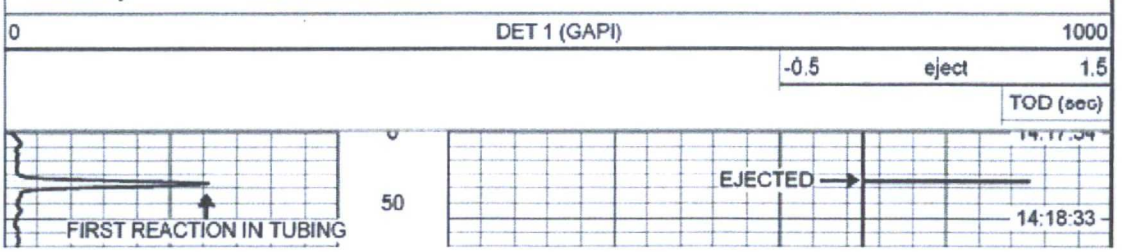
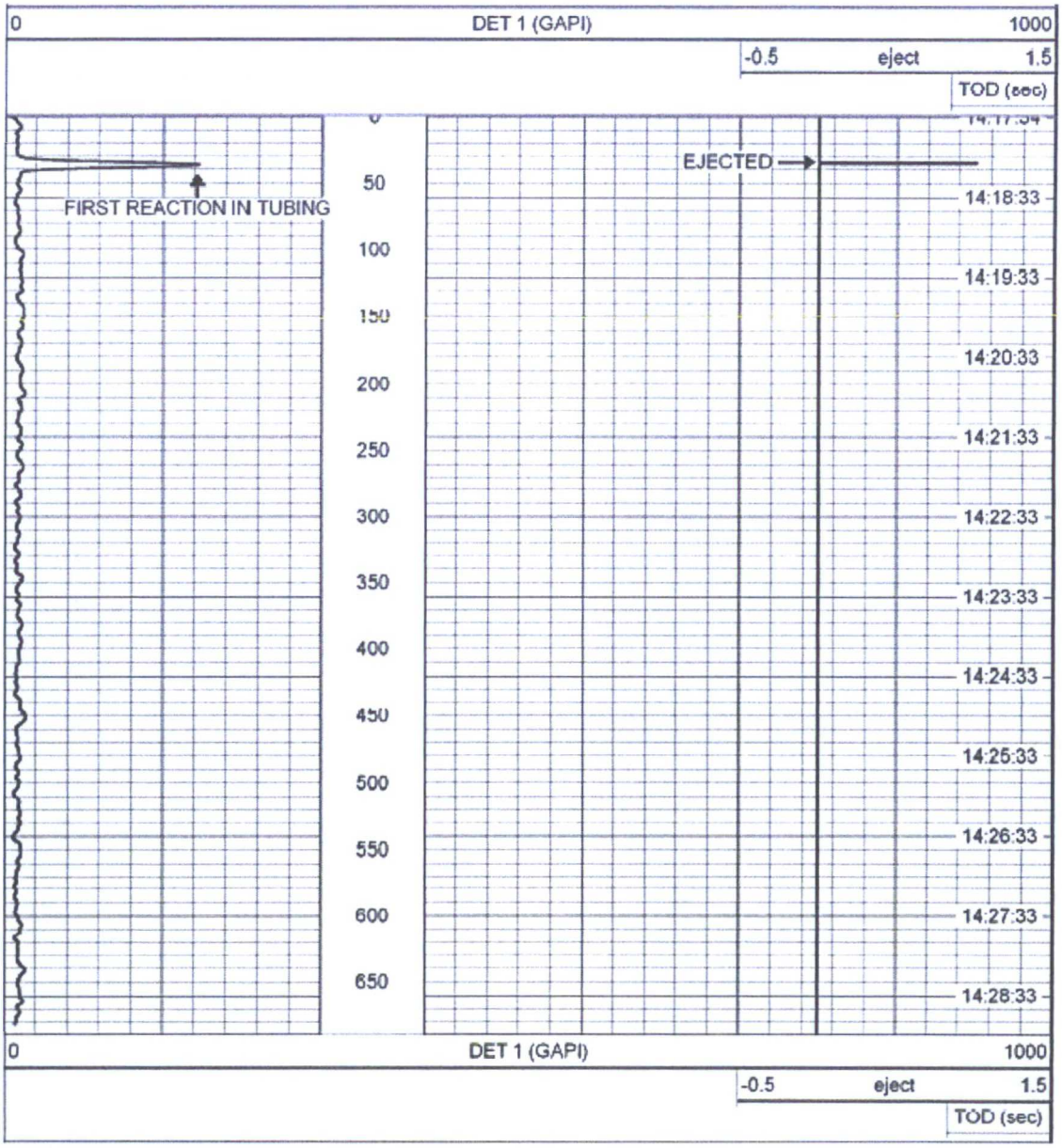





| | |
|---|---|
| Company | OWL SWD OPERATING , LLC |
| Well | MARLO SHOLES B WELL #2 |
| Field | N/A |
| County | LEA |
| State | NEW MEXICO |

**Final Report for Maralo Sholes B Well No. 2**
**Attachment 4**

# OWL SWD Operating

## Maralo Sholes B #2

11/28/16

08:15 arrived location Baker Hughes Coil tubing (Alex Prado, Corey Denzy, Jace Huddle, Rogelio Sosa)rigging up Reservoir Services (Richard Valencia, Abraham Rodriquez) for water transfer, Thru-Tubing Solutions (Darel) thru tubing motor and bit WTX (Robert Pringle) OWL (Tyler Richardson)

09:00 Shut down rig up due to high winds

10:15 Resume rig up

11:00 Renegade wireline (Munny Flores, Zack Ortis) Jim Smith (spinner and temp tools) arrives

11:15 Safety meeting with Baker Hughes and personnel on location

11:30 pressure test wellhead

11:45 RIH with coil and wash out nozzle

13:00 Tagged at 3008' by coil tubing measurements using Nitrogen to lift returns back to surface Reservoir Services monitoring flow back tank for returns Getting back returns equal to amount pumped well not taking fluids

14:30 Leave location coil not making any new hole as of yet

11/29/16

08:30 Arrived location Baker Hughes has been released made no progress on drilling out Will rig up pulling unit this evening to drill out WTX (Robert Pringle) OWL (Tyler Richardson) ESC (Energy Service Company) pulling unit crew (Francisco Silva, Michael Sanchez, Juan Terrazas, Jesse Hernandez)

10:30 Leave location

11/30/16

0830 Arrive location ESC unit laying down 4.5 csg and pkr

09:30 Out of the hole with 4.5 csg and pkr changing tongs and BOP rams from 4.5 to 3.5 for workover string waiting for work string to arrive

10:15 Work string arrives Well-Foam equipment arrives

12:15 RIH with tubing and scraper

12:45 Tongs broke waiting on new set

14:00 Leave location

12/1/16

10:00 Arrive location crew TOOH with tubing and scraper WFR (Wellbore Fishing and Rental tools)(Drew) Ran scraper to 2930'

10:30 RIH with tubing and 6.25 bit (WFR)

11:00 Renegade Wireline arrives

11:30 Rig up Well-Foam continue RIH with tubing and 6.25 bit

12:45 Pickup next joint of tubing and RIH

13:30 Start clean out

14:00 FTH vacuum truck arrives to empty half tank

14:30 Leave location

12/2/16

09:30 Arrive location Renegade Wireline RIH with Temp tool and Spinner wireline td 3072' correlated to casing bottom. Tubing tally td 3057' not using KB on either measurement.

12:00 Leave location

Initial readings on the spinner log show fluids going into the formation at 3005-3010' computed logs should be sent to Santa Fe by @ 12/6/16.

They will run tracer scan after Spinner runs are complete no data on that log yet.

12/3/16

Robert Pringles called said finished running RA Tracerscan (Renegade Wireline Mike Salas) on 12/2/16, 12/3/16 RIH with 3.5 work string to lay down then RIH with 4.5" casing and packer Made it most of the way in will wait til morning to nipple down BOP and circulate packer fluid. Said Tracer showed fluid going into permitted zone. Computed logs will be sent to Santa Fe around 12/6/16 POOH w/4.5" casing and packer lay down 4.5" casing, pick up and RIH w/3.5" work string

12/4/16

Received call from Robert Pringles, said that they had nippled down the BOP and was circulating packer fluid. Tried to test and got communication between 7" and 8 58" casings, will trip out of hole and pick 3.5" work string up to find leak

12/5/16

12:40 Arrived location to check on progrees, POOH with 3.5" work string, Using plugs and packer to isolate where communication between the 7" and 8 5/8" is coming in at, 13:30 RIH w/work string and packer RIH 8 stands and pressure tested below packer held 500# POOH w/4 stands and pressure check below packer.

12/6/16

09:30 POOH W/3.5 work string and RPB found leak at 30' laying work string down Will dig out cellar to top of 8 5/8 @ 20' below surface and check on where leak is.

11:30 out of the hole laid down work string and pkr

12:15 start rigging pulling unit

13:30 finish rigging down unit
14:00 start digging out cellar

12/7/16

12:00 arrive location, Backhoe is back filling hole so rig can back in and rig back up. A culvert has been put inside the cellar. Will put fence around after finish with the well.

12:30 spotting unit to rig up

13:00 rigging up unit

12/8/16

12:30 arrive location 4.5" csg already in the hole, BOP still on well circulating packer fluid. Will run MIT on 12/9/16 at 09:00

12/9/16

09:00 MIT/BHT-OK Ran with 540# ended with 525# 32 minute test
Energy Services Company (Cleve) Ser#6973 Cal date 12/8/16 1000# spring

**Left chart with Robert (OWL) Energy Services Company Pulling unit crew will back fill cellar and connect lines back up after rigging down unit.**

**11:00 leave location Crew rigging down pump truck from well to connect and pump out plug in packer**

**13:00 Robert called said unit is rigged down and well is hooked back up.**

# PUMP-IN TRACER

Company Owl SWD Operating
Well Maralo Sholes B #002
Field Maralo Sholes
County Lea State New Mexico

Location: API # :

660 FSL & 660' FEL

SEC N/A TWP N/A RGE N/A

Other Services
3-Arm Caliper

Elevation
K.B. 2762'
D.F. 2761'
G.L. 2749'

Permanent Datum Ground Level Elevation 2749'
Log Measured From K.B. 13" Above Perm. Datum
Drilling Measured From Kelly Bushing

| | | |
|---|---|---|
| Date | December 2, 2016 | |
| Run Number | ONE | 1.375" Tools |
| Depth Driller | 2935' | |
| Depth Logger | 30?2' | |
| Bottom Logged Interval | 30?2' | |
| Top Log Interval | 2600' | |
| Open Hole Size | N/A | |
| Type Fluid | Water | |
| Density / Viscosity | N/A | |
| Max. Recorded Temp. | 122 1 F | |
| Estimated Cement Top | N/A | |
| Time Well Ready | R.G.A | |
| Time Logger on Bottom | 9:00 AM | |
| Equipment Number | Truck #48 | |
| Location | Levelland | |
| Recorded By | M.Salas | |
| Witnessed By | | |

| Borehole Record | | | | Tubing Record | | | |
|---|---|---|---|---|---|---|---|
| Run Number | Bit | From | To | Size | Weight | From | To |
| | | | | 3.5" | N/A | Surface | 2817' |

| Casing Record | Size | Wgt/Ft | Top | Bottom |
|---|---|---|---|---|
| Surface String | | | | |
| Prot. String | | | | |
| Production String | 7" | 20# | Surface | 2935' |
| Liner | | | | |
| EXP. LINER | | | | |



Comments

**Final Report for Maralo Sholes B Well No. 2**
**Attachment 6**

LOG WAS SET TO 7" CASING-SHOE SET @ 2935'

<<< Fold Here >>>

## PERFORATIONS

OPEN HOLE 2935' - 3072'

INJECTION WELL:

SHUT-IN DATE 12-02-2016 HOUR 3:30 P.M TOTAL S.I. TIME 1 HOUR S.I. PRESS 0 -PSI
METERED INJ. RATE 6542 B/D PRESSURE 0-PSI TEMP 122 DEG. FLUID TYPE WATER
TOTAL VOLUME TO DATE FLUID LEVEL TUBING FULL

PRODUCER:

FLOWING PUMPING CHOKE SETTING HOURS PROD
FLUID LEVEL CSG. TBG. RATE B/W B/O
FLUID TYPE WATER

FRAC OR ACID WELLS:

TIME FINISHED FRAC OR ACID ACID % FLUID - GALS SAND #
RATE - BPM PRESSURE

## CONCLUSIONS

THIS SURVEY WAS RUN TO DETERMINE THE ZONES OF INJECTION.THERE WAS NO INDICATION OF A CHANNEL-UP FROM CASING SHOE

NOTE. A TOTAL OF 507 BARRLES WERE PUMPED DURING SURVEY
100% CASING RATE -6542 - B/D
100% TUBING RATE -6542- B/D

| Sensor | Offset (ft) | Schematic | Description | Len (ft) | OD (in) | Wt (lb) |
|---|---|---|---|---|---|---|
| | | | 1.38CHD<br>1 38 Cable Head | 1.00 | 1.38 | 2.00 |
| | | | SBAR-1.375" (000)<br>7' 1.375" Tungsten Sinker Bar | 7.00 | 1.38 | 61.00 |
| | | | SBAR-168x5 (0001)<br>Sinker Bar 1 3/8 by 5 foot | 5.00 | 1.38 | 30.00 |
| | | | DUMFJCT-PROBE (DUMPROBE) | 2.17 | 1.38 | 10.00 |
| CCL | 8.94 | | CCL-Probe (Probe_1)<br>1 3/8" Probe Logging CCL | 1.89 | 1.38 | 5.00 |
| | | | DUMDET-KC (KCPOS)<br>KC SCINT G/R | 3.46 | 1.38 | 10.00 |
| | | | DUMCAL-PROBE (PROBE01)<br>PROBE XY CALIPER | 3.43 | 1.38 | 20.00 |
| TEMP | 0.00 | | TEMP-Probe (P01)<br>Probe 1 3/8" Temp | 1.55 | 1.38 | 4.00 |

Dataset: maralo-#2.db: MARALO/2/Inj temp/pass1
Total Length: 25.49 ft
Total Weight: 142.00 lb
O.D. 1.38 in

## TRACER RESULTS

| # | Depth (ft) | Time | Integration | Flow (%) | Delta (%) | Comment |
|---|---|---|---|---|---|---|
| 2 | 2625.00 | 18:05:20 | 156472.00 | 100.00 | | |
| 3 | 2852.00 | 18:05:55 | 156472.00 | 100.00 | 0.00 | |
| 4 | 2906.00 | 18:06:24 | 156472.00 | 100.00 | 0.00 | |
| 5 | 2956.00 | 18:06:56 | 156472.00 | 100.00 | 0.00 | |
| 6 | 3015.00 | 18:07:40 | 129882.00 | 83.01 | 16.99 | |
| 7 | 3044.00 | 18:08:16 | 53749.30 | 34.35 | 48.66 | |
| 8 | 3053.00 | 18:08:56 | 20823.60 | 13.31 | 21.04 | |
| 9 | 3056.00 | 18:09:49 | 7049.81 | 4.51 | 8.80 | |
| 10 | 3060.00 | 18:11:13 | 5049.81 | 3.23 | 1.28 | |

## VELOCITY FROM TRACER

| # | Depth (ft) | Time | D Space (ft) | D Time (sec) | Flow (b/d) | Flow (%) | Delta (b/d) | Delta (%) |
|---|---|---|---|---|---|---|---|---|
| 11 | 2363 | 18:05:20 | 0.00 | 0.00 | | | | |
| 12 | 2852 | 18:05:55 | 225.00 | 33.31 | 6537.78 | 100.00 | | |
| 13 | 2906 | 18:06:24 | 54.00 | 29.00 | 6536.99 | 100.00 | 0.79 | 0.00 |
| 14 | 2956 | 18:06:56 | 50.00 | 29.07 | 6542.69 | 100.00 | -5.70 | 0.00 |
| 15 | 3015 | 18:07:40 | 59.00 | 37.60 | 5400.26 | 82.61 | 1142.43 | 17.39 |
| 16 | 3044 | 18:08:16 | 29.00 | 42.94 | 2206.73 | 33.76 | 3193.53 | 48.85 |
| 17 | 3053 | 18:08:56 | 9.00 | 36.06 | 815.47 | 12.47 | 1391.25 | 21.28 |
| 18 | 3056 | 18:09:49 | 3.90 | 53.72 | 230.27 | 3.52 | 585.20 | 8.95 |
| 19 | 3060 | 18:11:13 | 4.00 | 69.32 | 180.42 | 2.76 | 49.85 | 0.76 |

Company:
Well:
File: F:\maralo-#2.db
Dataset: MARALO/2/VEL/_tracer_/_ahottabl_/1
Reference Rate: 6548.2 b/d

## VELOCITY RESULTS

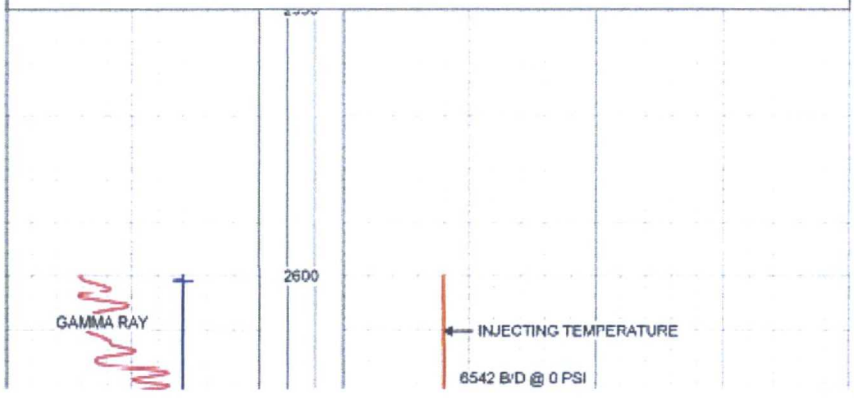
| # | Depth (ft) | Time | D Space (ft) | D Time (sec) | Csg ID (in) | Flow (b/d) | Flow (%) | Delta (%) | Comme |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2920.00 | 18:31:15 | 5.28 | 5.00 | 8.35 | | | | Channel C |
| 9 | 3000.00 | 18:37:11 | 5.28 | 2.26 | 6.81 | 6548.22 | 100.00 | | |
| 8 | 3010.00 | 18:36:37 | 5.28 | 2.60 | 6.80 | 5659.71 | 86.58 | 13.42 | |
| 7 | 3020.00 | 18:35:21 | 5.28 | 6.40 | 6.39 | 2697.26 | 41.19 | 45.39 | |
| 6 | 3030.00 | 18:34:49 | 5.28 | 5.00 | 6.29 | 2502.73 | 38.22 | 2.97 | |
| 5 | 3040.00 | 18:33:42 | 5.28 | 5.80 | 6.39 | 2230.05 | 34.06 | 4.16 | |
| 4 | 3050.00 | 18:32:52 | 5.28 | 12.00 | 6.30 | 1047.91 | 16.00 | 18.05 | |
| 3 | 3060.00 | 18:32:02 | 5.28 | 69.00 | 6.28 | 179.50 | 2.74 | 13.26 | |
| 2 | 3066.00 | 18:31:52 | 0.00 | 300.00 | 6.28 | 0.01 | 0.00 | 2.74 | NO FLO |

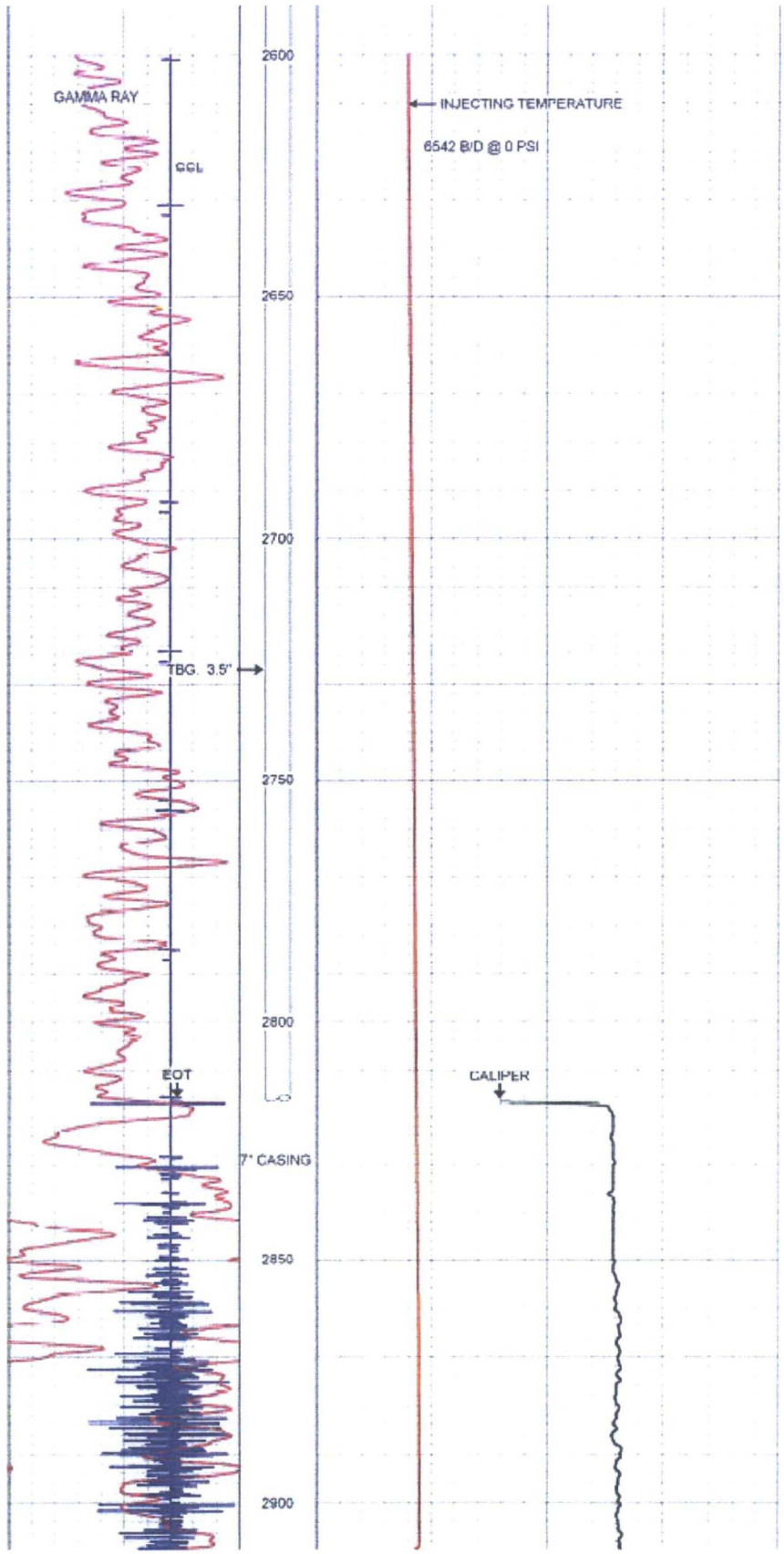
# H2O Injection Composite

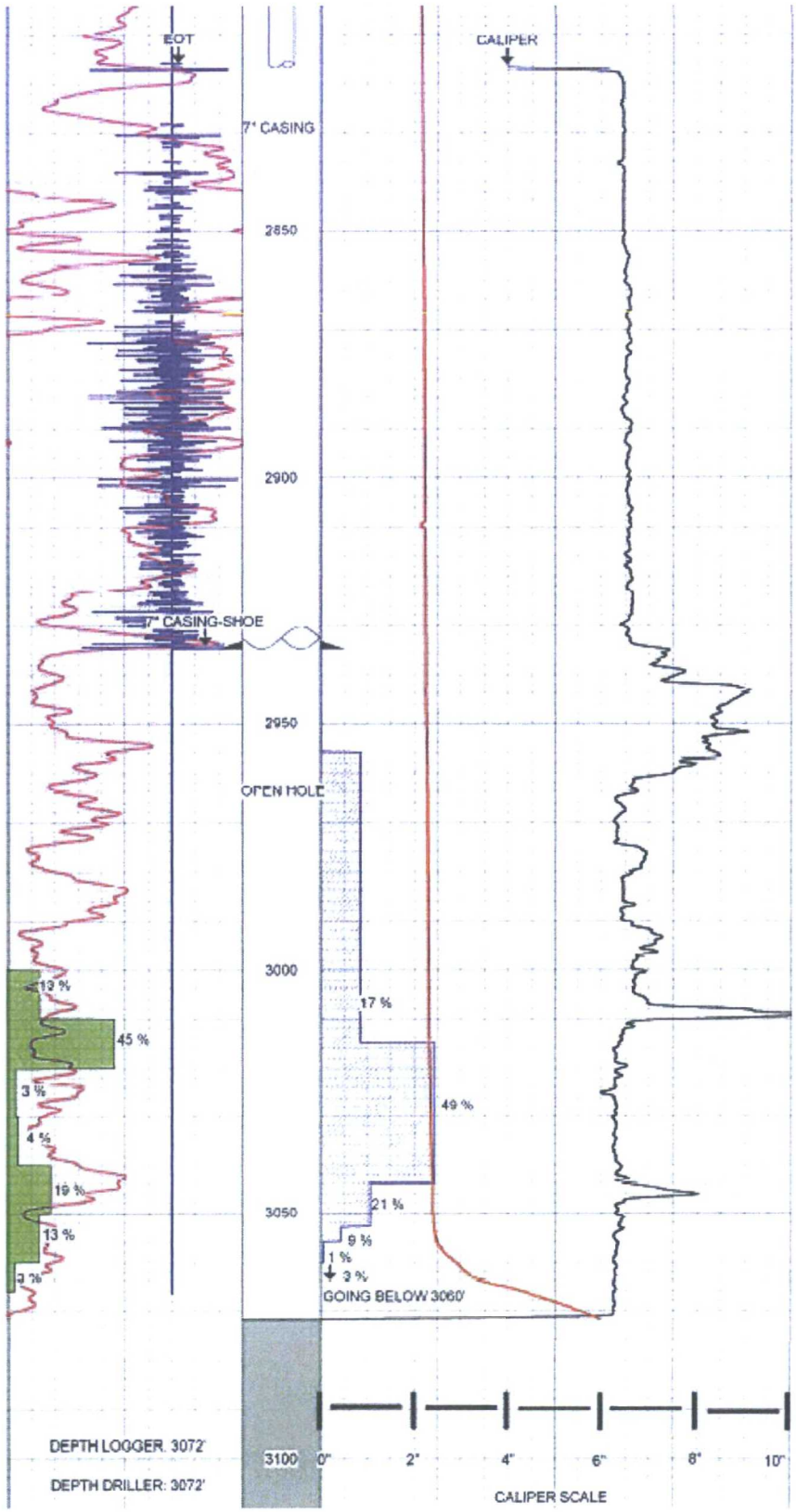
Database File: f:\maralo-#2.db
Dataset Pathname: MARALO/2/VEL/_composFIN
Presentation Format: trccomp
Dataset Creation: Fri Dec 02 20:21:38 2016
Charted by: Depth in Feet scaled 1:240

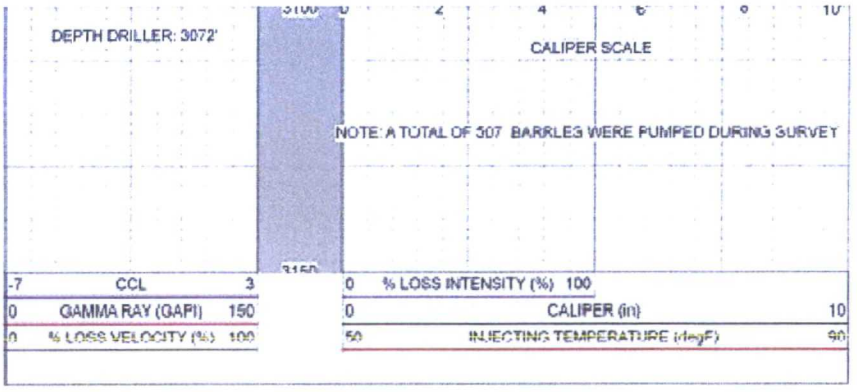
| | | |
|---|---|---|
| -7 | CCL | 3 |
| 0 | GAMMA RAY (GAPI) | 150 |
| 0 | % LOSS VELOCITY (%) | 100 |

| | | |
|---|---|---|
| 0 | % LOSS INTENSITY (%) | 100 |
| 0 | CALIPER (in) | 10 |
| 50 | INJECTING TEMPERATURE (degF) | 90 |



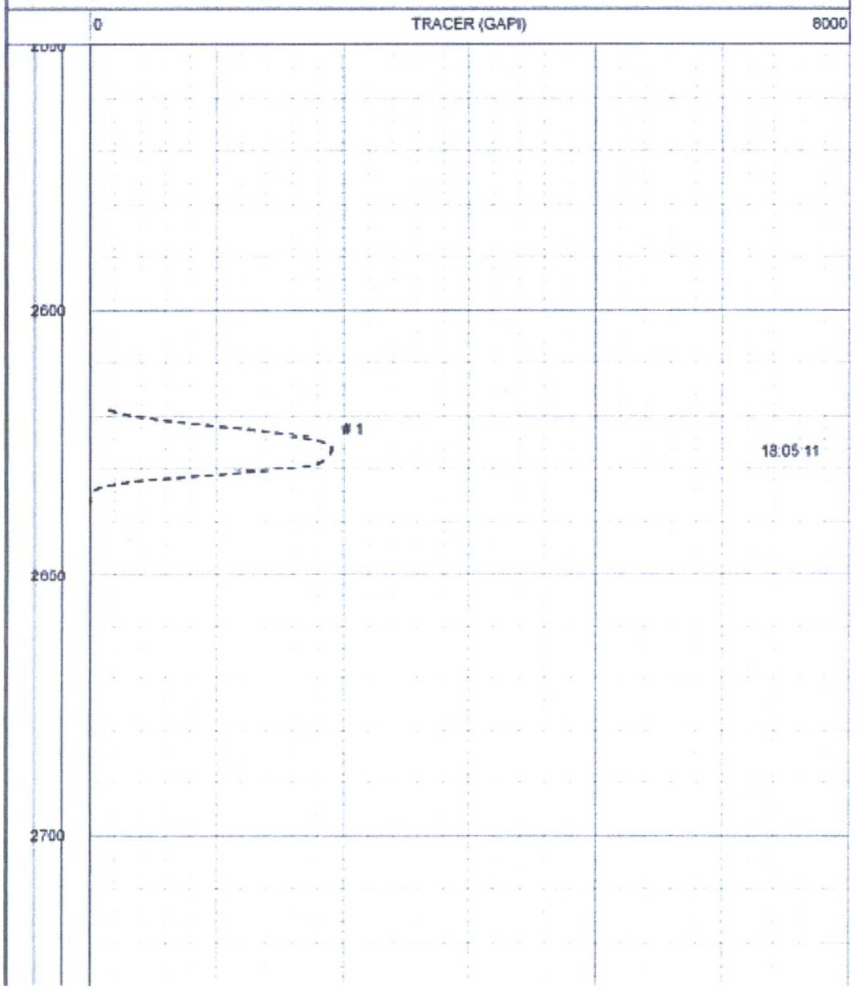

GAMMA RAY
CCL
INJECTING TEMPERATURE
6542 B/D @ 0 PSI
2600
2650
2700
TBG. 3.5"
2750
2800
EOT
CALIPER
7" CASING
2850
2900

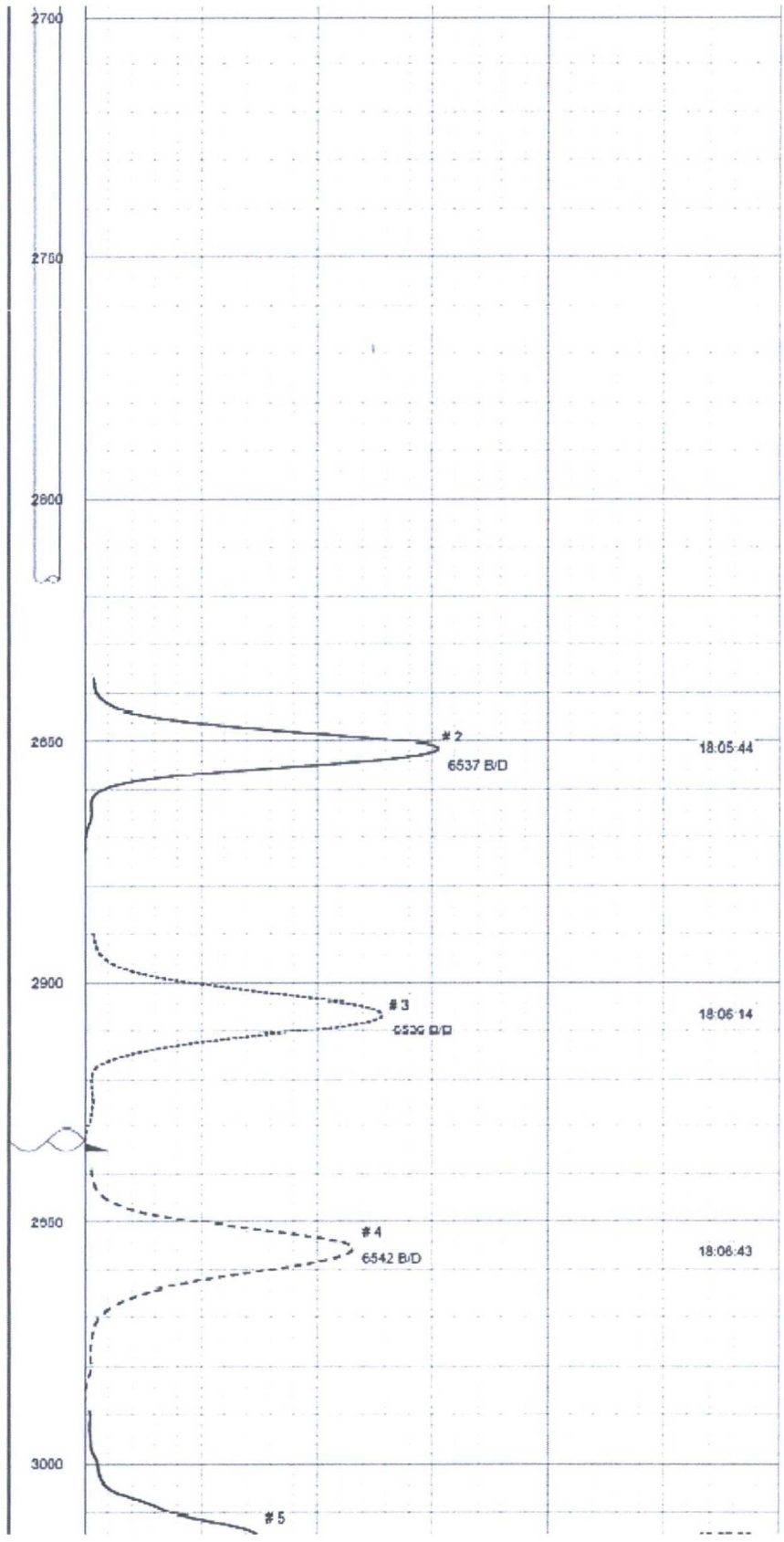

EOT
CALIPER
7" CASING
2850
2900
7" CASING-SHOE
2950
OPEN HOLE
3000
19 %
45 %
3 %
4 %
19 %
13 %
3 %
17 %
49 %
21 %
9 %
1 %
3 %
GOING BELOW 3060'
3050
3100
DEPTH LOGGER: 3072'
DEPTH DRILLER: 3072'
0"
2"
4"
6"
8"
10"
CALIPER SCALE

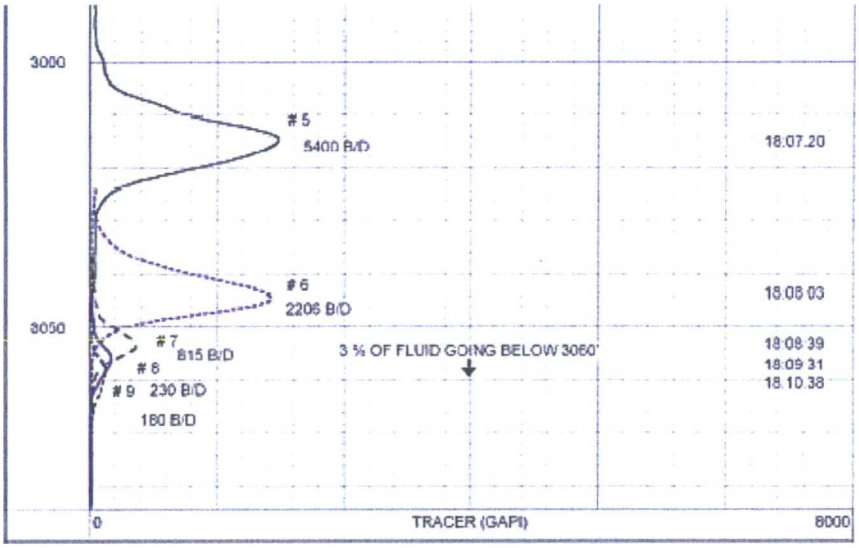


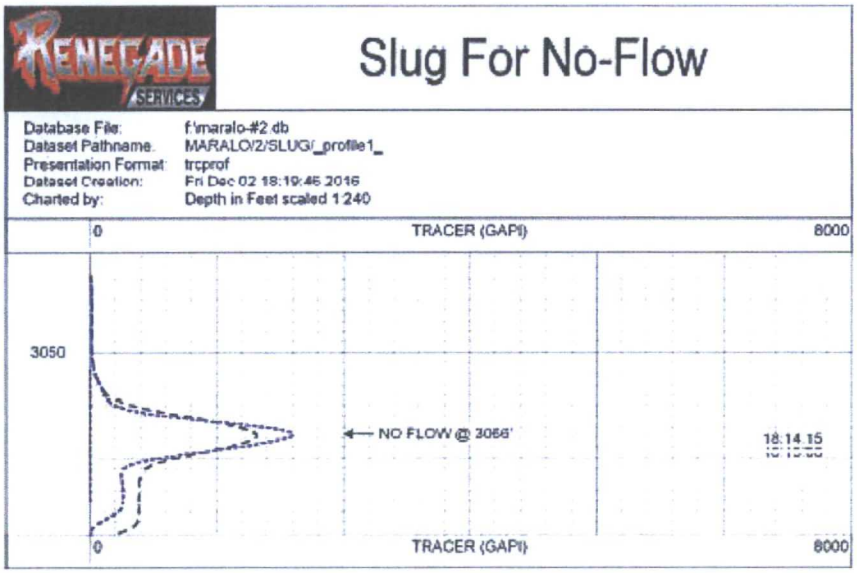

# H2O Tracer Profile

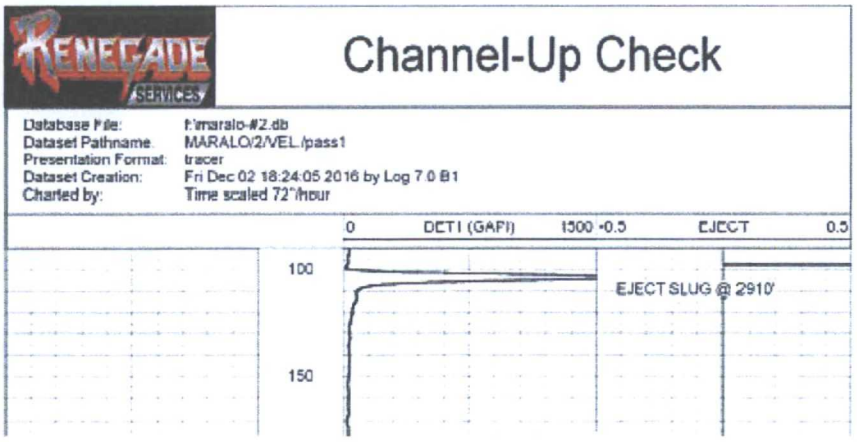
Database File: f:\maralo-#2.db
Dataset Pathname: MARALO#2/TRACER/_profile2_
Presentation Format: trcprof
Dataset Creation: Fri Dec 02 18:11:53 2016
Charted by: Depth in Feet scaled 1:240




2700
2750
2800
2850
2900
2950
3000
# 2
6537 B/D
18:05:44
# 3
18:06:14
# 4
6542 B/D
18:06:43
# 5

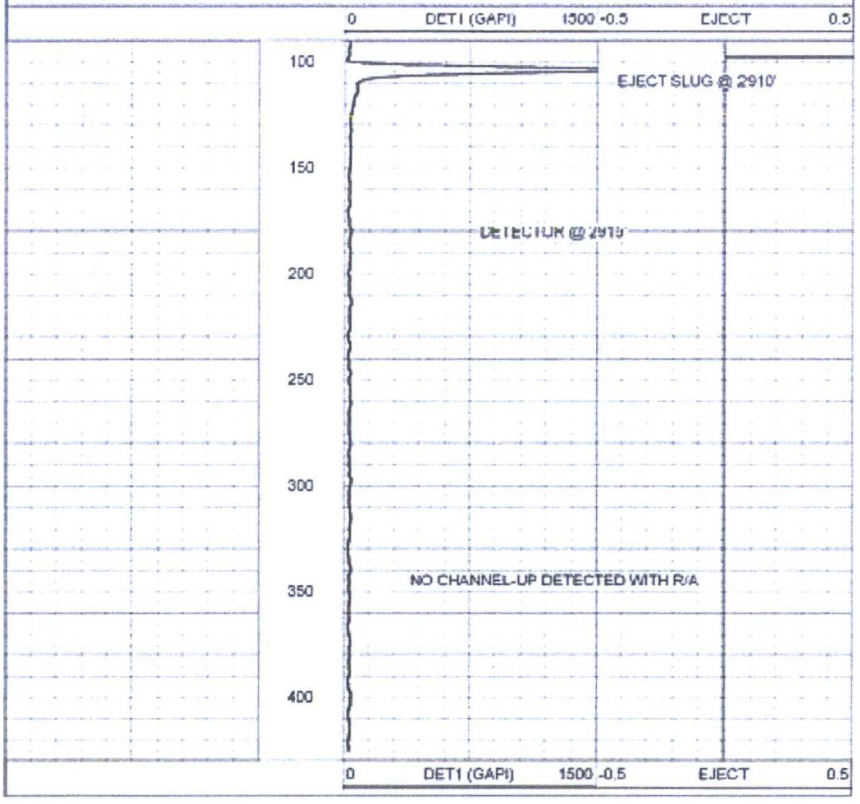

3000
# 5
5400 B/D
18:07:20
# 6
2206 B/D
18:08:03
3050
# 7
815 B/D
# 8
# 9 230 B/D
180 B/D
3 ¾ OF FLUID GOING BELOW 3050'
18:08:39
18:09:31
18:10:38
0
TRACER (GAPI)
8000


RENEGADE SERVICES
Slug For No-Flow
Database File: f:\maralo-#2.db
Dataset Pathname: MARALO/2/SLUG/_profile1_
Presentation Format: trcprof
Dataset Creation: Fri Dec 02 18:19:45 2016
Charted by: Depth in Feet scaled 1:240
0
TRACER (GAPI)
8000
3050
NO FLOW @ 3056'
18:14:15
0
TRACER (GAPI)
8000


RENEGADE SERVICES
Channel-Up Check
Database File: f:\maralo-#2.db
Dataset Pathname: MARALO/2/VEL/pass1
Presentation Format: tracer
Dataset Creation: Fri Dec 02 18:24:05 2016 by Log 7.0.B1
Charted by: Time scaled 72"/hour
0
DET1 (GAPI)
1500 -0.5
EJECT
0.5
100
150
EJECT SLUG @ 2910'

# Channel-Up Check

Database File: f:\maralo-#2.db
Dataset Pathname: MARALO/2/VEL /pass1
Presentation Format: tracer
Dataset Creation: Fri Dec 02 18:24:05 2016 by Log 7.0 B1
Charted by: Time scaled 72"/hour




| | |
|---|---|
| Company | Owl SWD Operating |
| Well | Maralo Sholes B #002 |
| Field | Maralo Sholes |
| County | Lea |
| State | New Mexico |

# CEK ENGINEERING LLC
PETROLEUM ENGINEERING CONSULTANTS

5301 69th Street
Lubbock, TX 79424
(806) 702-8954
www.cekengineering.com


January 12, 2017

Mr. Nevin Bannister
Chief Operating Officer
OWL SWD Operating, LLC
8214 Westchester Drive, Suite 850
Dallas, TX 75225

**RE: Final UIC Geological Assessment Concerning:**
*NOTICE TO OPERATOR: Requirement to Conduct Injection Survey, Dated July 28, 2016 (EMNRD)*
Maralo Sholes B Well No. 2 (API 30-25-09806)
660' FSL & 660' FEL, Sec. 25 T25S R36E
Lea County, New Mexico
Injection Authority: Administrative Order SWD-1127
Order Date: June 1, 2008
Permitted Interval: Yates and Seven Rivers (2938'-3055')

Mr. Bannister:

Per your request, CEK Engineering LLC has performed an Underground Injection Control (UIC) Geological Assessment for the Maralo Sholes B Well No. #2 (API 30-25-09806), herein WELL. The following is our final assessment, completed on or about January 12, 2017, we have incorporated the following:

i.) Discussions from our October 24, 2016 meeting with David Catanach, Phillip Goetze and Michael McMillan (EMNRD) in Santa Fe, New Mexico.
ii.) Results from the cleanout and injection survey re-run, performed December 2, 2016.

We specifically note, to the best of our understanding, the above "NOTICE TO OPERATOR" was sent in response to that certain letter dated April 28, 2016 from the City of Jal, New Mexico to Mr. Matthew Earthman (Souder, Miller & Assoc.) XC: David Martin, Sec. EMNRD; David Catanach, Director OCD; and Tom Blaine, State Engineer, enclosed herein (LETTER).

The LETTER was prepared due to concerns raised by several individuals and companies to the City of Jal, as well as, the City of Jal's pending application of 900 ac-ft of water per annum and nine well locations proposed in the same section (Sec. 25 T25S R36E) as the WELL. The City of Jal's specific concerns were related to the WELL's wellbore integrity, and potential contamination of shallow (< 600' MD) fresh water aquifer in the immediate area.

Additionally, Renegade Services performed an Injection Survey (Temperature, Tracer) on the WELL, September 2, 2016 (SURVEY1); the results of the SURVEY1 were inconclusive, tool set down 50' (3005' MD) above base of injection interval. Because the SURVEY1 results were inconclusive, Maxey G. Brown (OCD District 1 Supervisor) sent Ben Stone (SOS Consulting – OWL Regulatory Consultant) that certain email dated September 6, 2016, enclosed herein (EMAIL).

The EMAIL was prepared, after consultation with David Catanach, to serve as formal notice for OWL to proceed with the cleanout of the 50' of fill and to re-run the injection survey.

**Final Report for Maralo Sholes B Well No. 2**
**Attachment 7**

The following UIC Geological Assessment was prepared to specifically address concerns mention in the LETTER and EMAIL, in addition to informal discussions (email, phone conversations) raised by OWL's Staff/Consultants regarding potential out of zone injection into the Capitan Reef. Additionally, as an attachment to this report, we specifically address comments posed by Mr. Goetze, during our October 24, 2016 meeting, concerning the spatial location of the injected fluids with respect to the Capitan Reef (Seven Rivers Shelf Margin).

**UIC Geological Assessment**

The WELL is injecting into the very top of the Seven Rivers Formation and basal Yates Formation. The WELL is situated (completed) in the back reef lagoonal environment (comprised of shelf carbonates, siliciclastics and evaporites) of the Guadalupian Artesia Group. Neutron/Gamma Ray Well Log signatures identify several highly porous and permeable, regionally extensive, eolian sand/dolomitic grainstone reservoirs. These reservoirs are the, updip, productive members of the Jalmat, Rhodes, and Scharbrough oil and gas fields (combined production to date is ~ 100 MMBO & 1.9 TCF).

The WELL's equivalent (injection interval) in the Capitan Reef (Late/Upper Seven Rivers) Margin is located 3.5+ miles to the west and approximately 200-300' down dip structurally. *Additionally, in our opinion, there is sufficient evidence (HISS 1975, NMOCD Case No. 8405 testimony/Water Sample Analysis, IC Potash Corp Feasibility Study) that the interstitial waters of the Capitan Reef and back reef Artesia Group members near the WELL are mineralized above 10,000 mg/L (TDS), digital copies provided on FTP site.*

Several injection wells (examples in the cross-section) have injected into the same reservoirs at high rates since the late 1960's and possibly earlier. Additionally we have identified 460+ injection wells in the immediate area injecting into the same/similar reservoirs as the WELL. These wellbores have been utilized for secondary recovery operations and salt water disposal since the early 1960's.

Additionally, we observed in the literature core analysis reports indicating that Seven Rivers (in the back reef lagoonal environment) eolian siliciclastics reservoirs have permeability's in excess of 350 millidarcies. These core analysis reports support our Pressure Transient Analysis stochastic modeling.

**Current (12-02-2016) Injection Profile Survey Assessment**

Based on our review of that certain Injection Profile Survey performed by Renegade Services on December 2, 2016 (SURVEY2); we observe that ALL fluid is being injected into the approved permitted interval (Lower Yates / Upper Seven Rivers, 2938'-3055'). We specifically call your attention to the comparison exhibit of SURVEY1 and SURVEY2, enclosed herein; and note that the spinner, temperature, and tracers logs all indicated a no-flow vertical boundary at ~ 3055' (MD). Additionally, both SURVEY 1 and SURVEY 2 indicated a no-flow (no channeling of fluids behind the 7" production casing) vertical boundary at ~ 2935' (top of open-hole section).

**Summary / Professional Opinion**

Based on SURVEY1 and SURVEY2 results for the WELL, and our regional geological/injection well study; it is our professional opinion that the injected fluids into the WELL are remaining within the permitted interval (Lower Yates / Upper Seven Rivers, 2938'-3055'). This opinion is based on regional/local scale geological interpretation, wellbore configuration and surface operations (injection pressures between Vacuum and 575 psi).

Additionally, the WELL **is not** injecting into the Capitan Reef (limestone); the WELL is injecting into the Upper Seven Rivers Sands (minor amounts into dolomitized shelf carbonate grainstones). These same reservoirs are hydrocarbon productive in the updip members in the Jalmat, Rhodes, and Scharbrough oil and gas fields located in the immediate area.

Based on the results of SURVEY1 and SURVEY2, at this time our opinion is, the WELL does not pose a threat to public health or safety (this opinion does not encompass an environment site assessment, which we have not performed nor reviewed). *We reserve the right to revise this statement, based on additional data collected subsequent to the date of this report.*

If you have additional questions, please do not hesitate to contact me at you convenience.

Respectfully,

Chad E. Kronkosky, P.E.
President

**Enclosures (4):**

Letter dated April 28, 2016 from the City of Jal, New Mexico to Mr. Matthew Earthman (Souder, Miller & Assoc.) XC: David Martin, Sec. EMNRD; David Catanach, Director OCD; and Tom Blaine, State Engineer

Email dated September 6, 2016 from Maxey G. Brown (OCD District 1 Supervisor) to Ben Stone (SOS Consulting – OWL Regulatory Consultant).

Jal, New Mexico (Middle Seven Rivers) Lithology Map

Jal, New Mexico (Artesia Group) Injection Wells Map

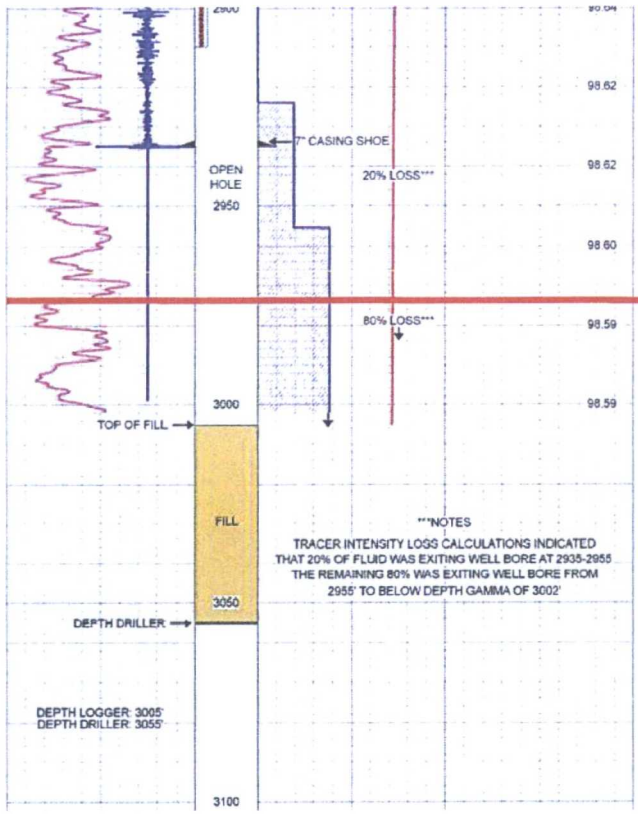
**FTP Website (contact CEK Engineering for instructions to website):**

Hiss, William, "Stratigraphy and Ground-Water Hydrology of the Capitan Aquifer, Southeastern New Mexico and Western Texas", University of Colorado, PhD Dissertation, 1975

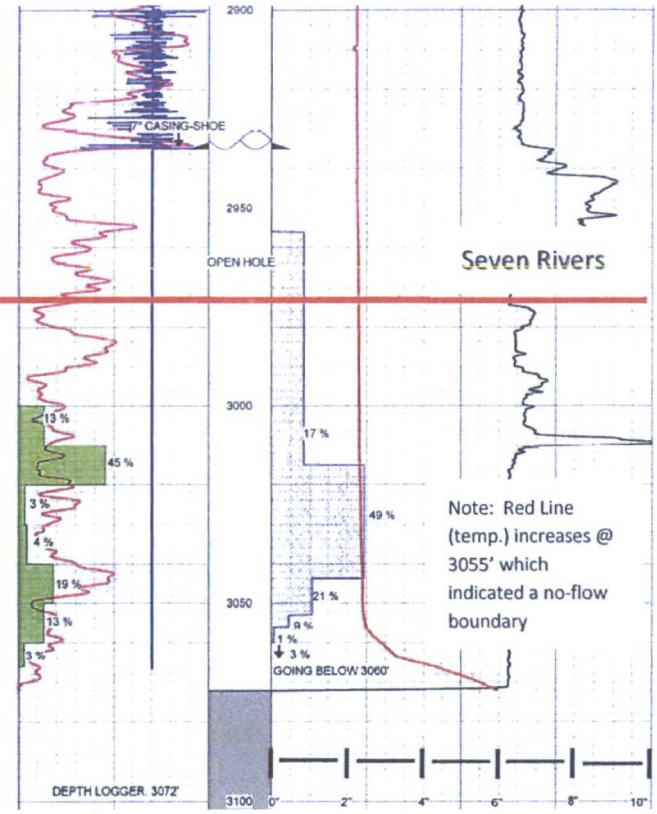
National Instrument 43-101 Technical Report "Ochoa Project Feasibility Study Lea County, New Mexico USA" IC Potash Corp.

NMOCD Case No. 8405, West Jal Disposal #1, Currently Operated by Mesquite SWD.

Injection Profile Comparison




Initial Injection Profile (09-02-2016)




Current Injection Profile (12-02-2016)

# Maralo Sholes B No. 2 (30-025-09806; SWD 1127) Pressure Transient Analysis Uncertainty Modeling

*Chad E. Kronkosky, P.E.*

*January 10, 2017*

## Introduction

The following document and technical calculations were prepared in accordance of generally accepted hydrogeological principles. The following calculations utilize stochastic (monte carlo) simulation methods coupled with the line source solution to the single phase radial flow diffusivity equation, presented as follows:

For an infinite-acting reservoir, Mathews and Russell (1967) propose the following solution to the diffusivity equation.

$$p(r,t) = p_i + \left[\frac{70.6 Q_w \mu}{kh}\right] Ei\left[\frac{-948\phi\mu c_t r^2}{kt}\right]$$

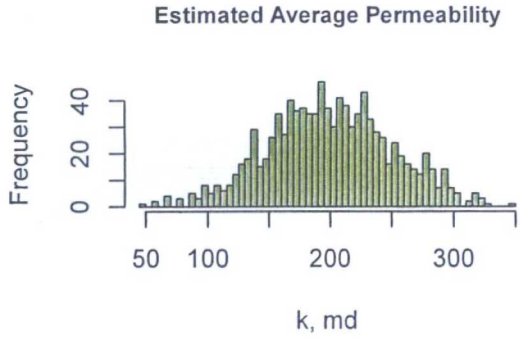
The following Pressure Transient Analysis (with uncertainty) was performed in the "R" programming environment (most off-the-shelf commercial PTA software do not handle uncertainty models well).

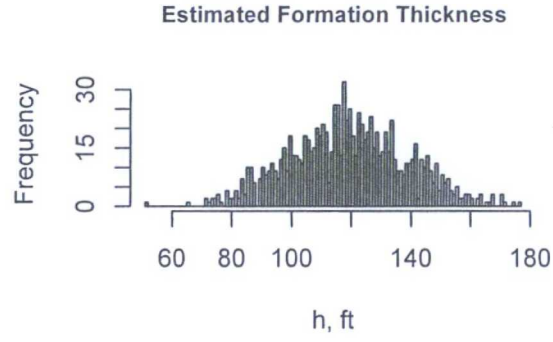
## Uncertainty Analysis

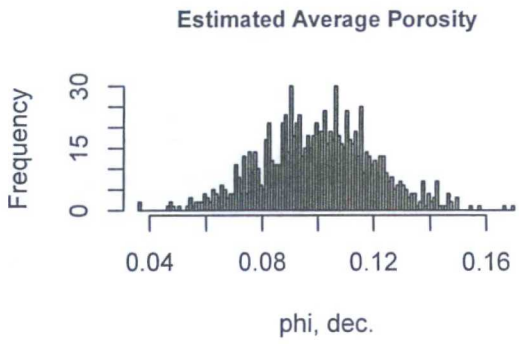
Parameter estimates (e.g. k, h, phi, ct) always exhibit varying degrees of uncertainty. Based on a detailed review of literature/offset publicly available information and sound professional judgement; we estimates the following parameters with normal distributions (1000 samples) with means and standard deviations as follows:

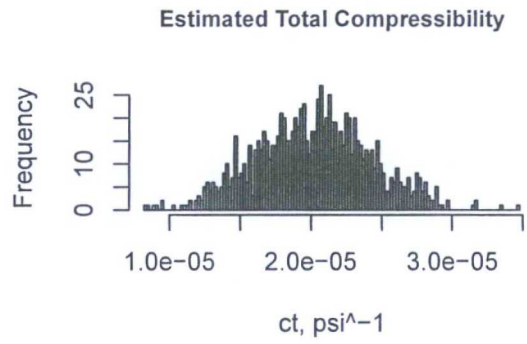
```
library(pracma)

n   <- 1000
k   <- rnorm(n = n, mean = 200, sd = 50)                # md
h   <- rnorm(n = n, mean = 120, sd = 20)                # ft
phi <- rnorm(n = n, mean = .10, sd = 0.02)              # dec.
ct  <- rnorm(n = n, mean = 2*10^(-5), sd =  4*10^(-6))  # psi^-1
```




## Near Wellbore Reservoir Pressure Estimates

An estimate of the near wellbore (static) reservoir pressure (top of openhole section) as of 12-02-2016; was made utilizing the injection survey results obtained from that certain welllog prepared by Renegade Services on 12-02-2016 "Indepth Injection Profile" pressure log.

```
Pwf <- 1285  # psi (from Renegade Service 12-02-2016 Indepth Injection Profile)
q   <- 7200  # bwpd ~ 5 BPM (from Renegade Service 12-02-2016 Indepth Injection Profile)
B   <- 1     # bbl/bbl
u   <- 1     # cp
r   <- 0.33  # ft
t   <- 1     # hr (from Renegade Service 12-02-2016 Indepth Injection Profile)

Pi <- Pwf - ((70.6*q*B*u)/(k*h))*expint((948*phi*u*ct*r^2)/(k*t))
```

We estimate that the near wellbore static reservoir pressure is **995 psi** which means the reservoir is **0.115 psi/ft** underpressured. This explains why most if not all injection wells (within the vacuum/artesia trend) inject on vacuum pressure (i.e. hydrostatic head in the injection tubing is greater than static reservoir head).

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   307.4   927.1   995.1   971.9  1047.0  1154.0
```

## Reservoir Pressure Increase Due To Injection as of (12-2016)

We estimate the reservoir pressure increase due to injection as of (12-2016) using multi-rate (avg. Fulfer and avg. Owl injection rates) superposition principles as follows:

```
t  <- 24*365*((60+23)/12)    # hr (total time of inj 01/2009 to 11/2016 )
t1 <- 24*365*(60/12)         # hr (total time of Fulfer inj 01/2009  to 12/2014)
q1 <- 7250125/(t1/24)        # bwpd (avg rate of Fulfer inj - total inj / total time)
q2 <- 12856680/((t-t1)/24)   # bwpd (avg rate of OWL inj - total inj / total time)
r  <- c(5280/2, 5280, 2*5280, 4*5280)  # ft

Pr <- vector(mode = "list", length = 12)
for(i in 1:4){
 Pr[[i]] <- ((70.6*q1*B*u)/(k*h))*expint((948*phi*u*ct*r[i]^2)/(k*t)) +
            ((70.6*(q2-q1)*B*u)/(k*h))*expint((948*phi*u*ct*r[i]^2)/(k*(t-t1)))
}
```

The estimated reservoir pressure increase 1/2 mile from the wellbore (i.e. AOR boundary) due to injection is **295 psi**.

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   136.2   246.2   294.8   313.4   359.5   847.6
```

The estimated reservoir pressure increase 1 mile from the wellbore due to injection is **218 psi**.

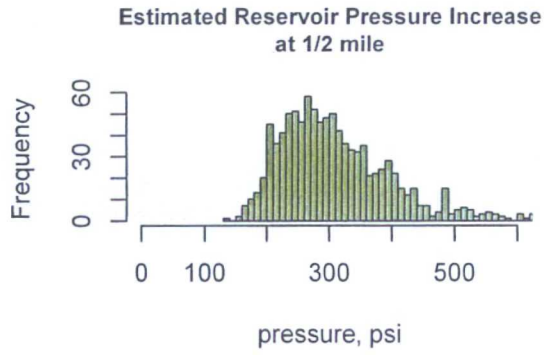
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   102.0   182.2   217.8   229.5   263.8   610.7
```

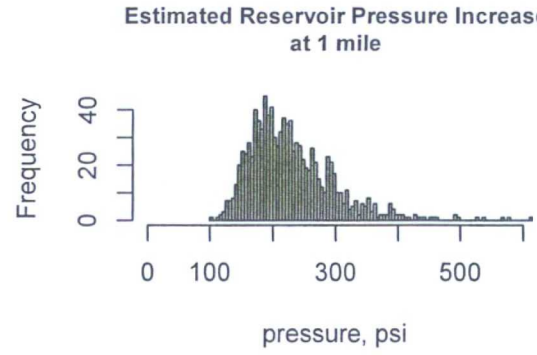
The estimated reservoir pressure increase 2 mile from the wellbore (i.e. Lease/Well identification boundary) due to injection is **141 psi**.

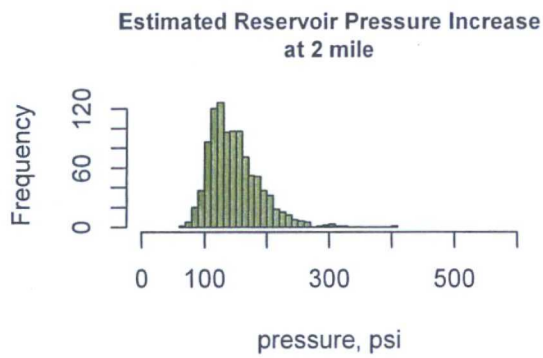
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   68.34  118.60  141.00  147.90  168.80  407.70
```

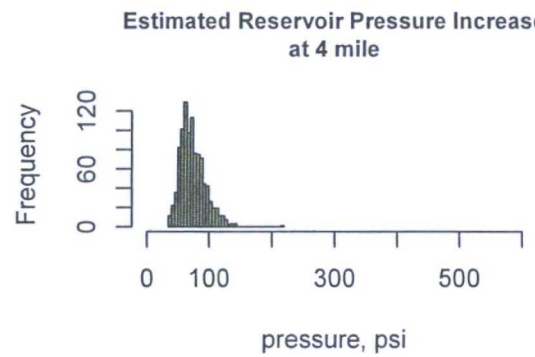
The estimated reservoir pressure increase 4 miles from the wellbore due to injection is **71 psi**.

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   35.38   59.95   71.17   73.98   85.36  218.20
```




## Perturbed/Displaced Reservoir Volume Due To Injection as of (12-2016)

We estimated the perturbed/displaced volume due to injection as of (12-2016) using radial flow volumetrics as follows:

```
A1 <- (q1*(t1/24))/((7758*phi*h)/B)
A2 <- (q2*((t-t1)/24))/((7758*phi*h)/B)
A  <- A1 + A2
```

The estimated perturbed/displaced reservoir fluid due to Fulfer Oil & Cattle LLC injection (01/2009 to 12/2014, 7.25 MMbw at 4000 bwpd) is **80 acres**.

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   39.35   67.69   80.25   84.18   97.13  224.90
```

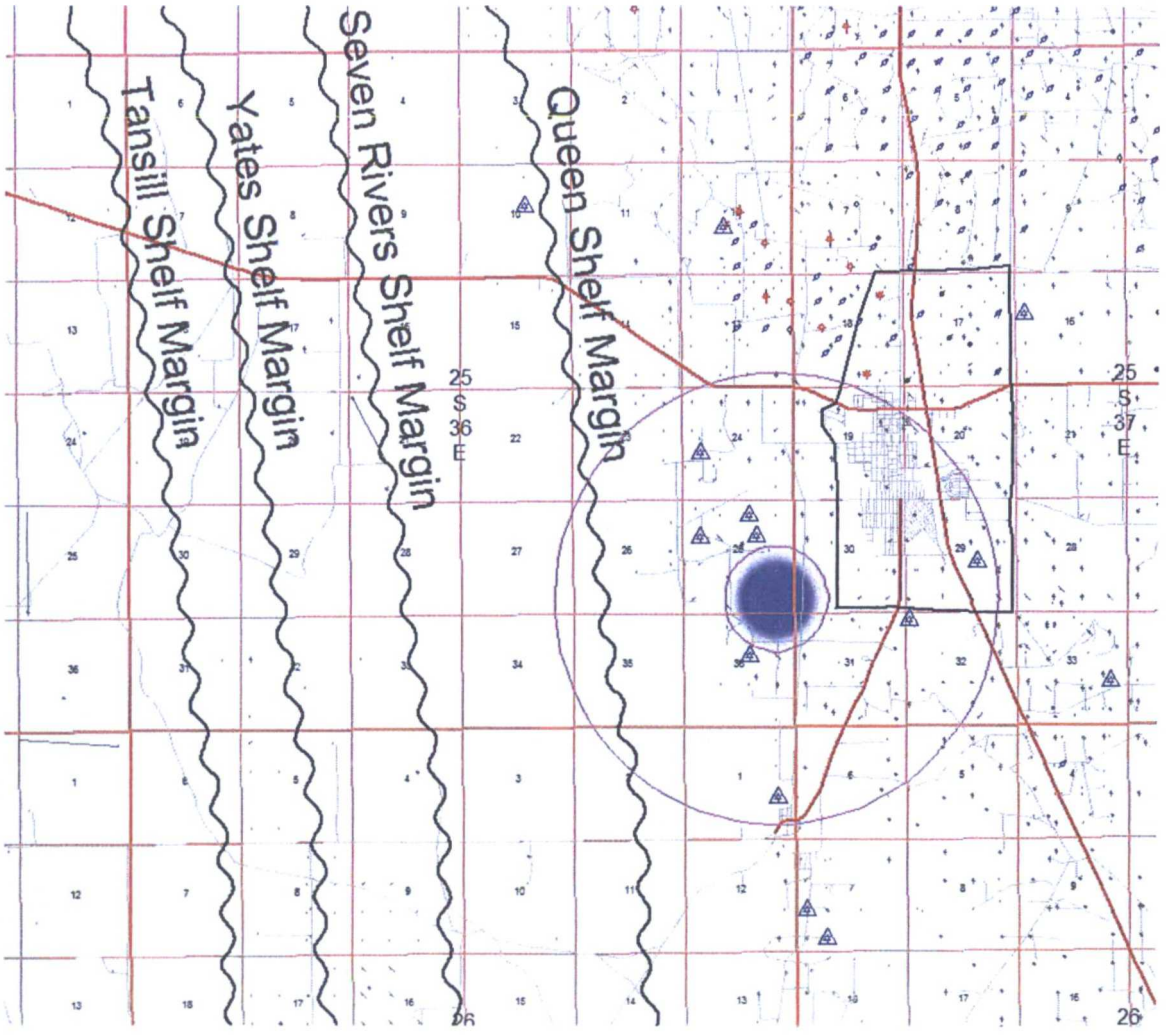
The estimated perturbed/displaced reservoir fluid due to Owl SWD Operating, LLC injection (01/2014 to 11/2016, 12.86 MMbw at 18400 bwpd) is **142 acres**.

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   69.77  120.00  142.30  149.30  172.20  398.80
```

The estimated perturbed/displaced reservoir fluid due to all injection (01/2009 to 11/2016, 20.11 MMbw) is **223 acres**.

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   109.1   187.7   222.5   233.5   269.4   623.7
```

The solid blue circle is our best estimate (based on statistics above) of the present situation (spatially) of the injected fluid. Based on our professional judgement, numerical simulation (e.g. ModFlow) is unwarranted at this time.




*Note: Outer purple circle 2 Mile Lease/Well Identification Boundary; inner purple circle 1/2 Mile AOR.*

## Reservoir Pressure Increase Due To Future Injection (5-year Estimate)

We estimate the reservoir pressure increase due to injection as of (12-2016 + 5-Years) using multi-rate (avg. Fulfer and avg. Owl injection rates - assuming Owl rates remain constant) superposition principles as follows:

```
t  <- 24*365*((60+23+60)/12)  # hr (total time of inj 01/2009 to 11/2016 + 5 years)
t1 <- 24*365*((60)/12)        # hr (total time of fulfer inj 01/2009  to 12/2014)
t2 <- 24*365*((60+23)/12)     # hr (total time of fulfer inj 01/2009  to 11/2016)
q1 <- 7250125/(t1/24)         # bwpd (avg rate of fulfer inj - total inj / total time)
q2 <- 12856680/((t2-t1)/24)   # bwpd (avg rate of OWL inj - total inj / total time)
```

```
q3 <- q2                        # bwpd (avg rate of OWL inj stays constant)
r  <- c(5280/2, 5280, 2*5280, 4*5280)  # ft

for(i in 1:4){
 Pr[[i + 4]] <- ((70.6*q1*B*u)/(k*h))*expint((948*phi*u*ct*r[i]^2)/(k*t)) +
                ((70.6*(q2-q1)*B*u)/(k*h))*expint((948*phi*u*ct*r[i]^2)/(k*(t-t1))) +
                ((70.6*(q3-q2)*u)/(k*h))*expint((948*phi*u*ct*r[i]^2)/(k*(t-t2)))
}
```

The estimated future reservoir pressure increase 1/2 mile from the wellbore (i.e. AOR boundary) due to 5-years of additional injection (at 18400 bwpd) is **63 psi** (from 295 psi to 357 psi).

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   27.86   51.10   63.25   68.37   78.32  231.10
```

The estimated future reservoir pressure increase 1 mile from the wellbore due to 5-years of additional injection (at 18400 bwpd) is **63 psi** (from 218 psi to 280 psi).

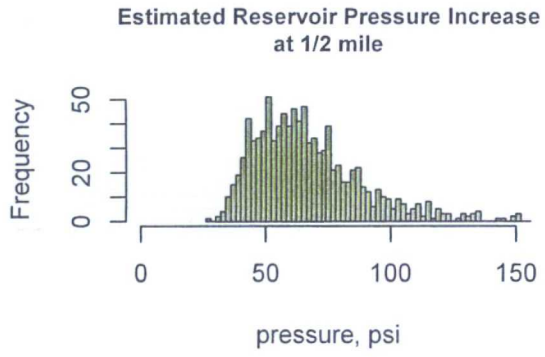
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   27.72   50.85   62.79   67.85   77.69  226.60
```

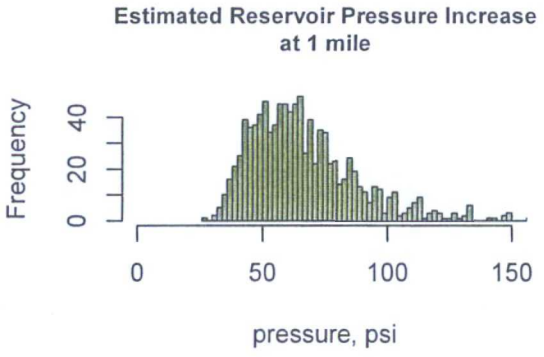
The estimated future reservoir pressure increase 2 mile from the wellbore (i.e. Lease/Well identification boundary) due to 5-years of additional injection is **61 psi** (from 141 psi to 203 psi).

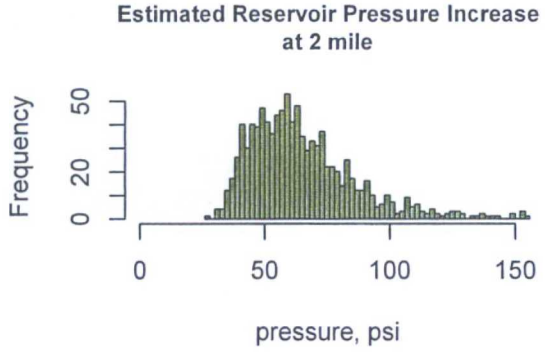
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   27.19   49.69   61.06   65.84   75.59  209.60
```

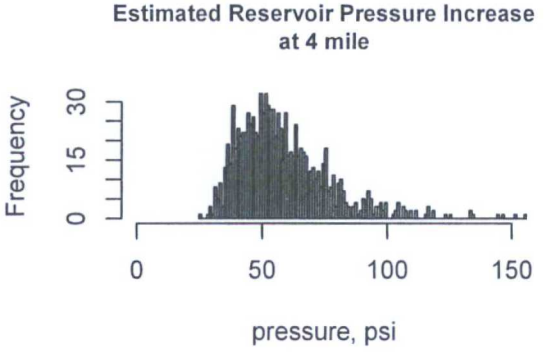
The estimated future reservoir pressure increase 4 miles from the wellbore due to 5-years of additional injection is **55 psi** (from 71 psi to 127 psi).

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   25.18   45.55   54.63   58.60   67.31  158.30
```




## Purturbed/Displaced Reservoir Volume Due To Due To Future Injection (5-year Estimate)

We estimated the perturbed/displaced volume due to injection as of (12-2016 + 5-Years) using radial flow volumetrics as follows:

```
A1 <- (q1*(t1/24))/((7758*phi*h)/B)
A2 <- (q2*((t-t1)/24))/((7758*phi*h)/B)
A3 <- (q3*((t-t2)/24))/((7758*phi*h)/B)
A  <- A1 + A2 + A3
```

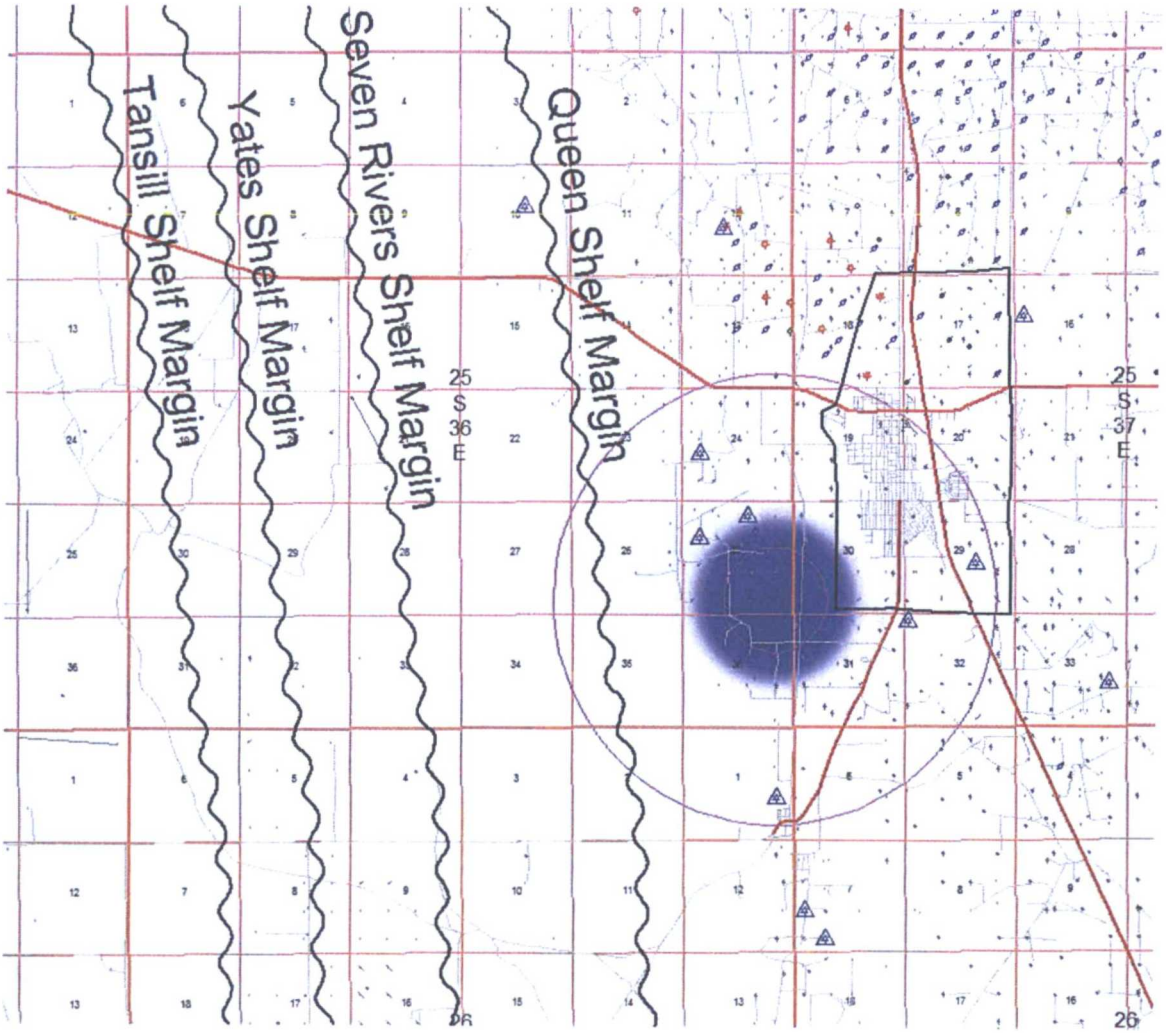
The estimated perturbed/displaced reservoir fluid due to Owl SWD Operating, LLC injection (12/2016 to 12/2021, 33.55 MMbw at 18400 bwpd) is **514 acres**.

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   182.0   313.1   371.2   389.4   449.3  1040.0
```

The estimated perturbed/displaced reservoir fluid due to all injection (01/2009 to 12/2021, 53.69 MMbw) is **965 acres**.

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   473.1   814.0   965.0  1012.0  1168.0  2705.0
```

The solid blue circle is our best estimate (based on statistics above) of the future situation (spatially) of the injected fluid. Based on our professional judgement, numerical simulation (e.g. ModFlow) is unwarranted at this time.




*Note: Outer purple circle 2 Mile Lease/Well Identification Boundary; inner purple circle 1/2 Mile AOR.*

## Reservoir Pressure Decrease (5-year Estimate) If Shut-in 12/2016.

We estimate the reservoir pressure decrease due to secession of injection as of (12-2016 + 5-Years) using multi-rate (avg. Fulfer and avg. Owl injection rates - and shut-in 12-2016 for 5-Years) superposition principles as follows:

```
t  <- 24*365*((60+23+60)/12)  # hr (total time of inj 01/2009 to 11/2016 + 5 years)
t1 <- 24*365*((60)/12)        # hr (total time of fulfer inj 01/2009  to 12/2014)
t2 <- 24*365*((60+23)/12)     # hr (total time of fulfer inj 01/2009  to 11/2016)
q1 <- 7250125/(t1/24)         # bwpd (avg rate of fulfer inj - total inj / total time)
q2 <- 12856680/((t2-t1)/24)   # bwpd (avg rate of OWL inj - total inj / total time)
q3 <- 0                       # bwpd (avg rate of OWL inj stays constant)
r  <- c(5280/2, 5280, 2*5280, 4*5280)  # ft
```

```
for(i in 1:4){
 Pr[[i + 8]] <- ((70.6*q1*B*u)/(k*h))*expint((948*phi*u*ct*r[i]^2)/(k*t)) +
                ((70.6*(q2-q1)*B*u)/(k*h))*expint((948*phi*u*ct*r[i]^2)/(k*(t-t1))) +
                ((70.6*(q3-q2)*u)/(k*h))*expint((948*phi*u*ct*r[i]^2)/(k*(t-t2)))
}
```

The estimated future reservoir pressure decrease 1/2 mile from the wellbore (i.e. AOR boundary) after 5-years from secession of injection is **-270 psi** (from 295 psi to 25 psi).

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  -756.4  -329.3  -270.4  -286.4  -226.0  -125.3
```

The estimated future reservoir pressure decrease 1 mile from the wellbore after 5-years from secession of injection is **-192 psi** (from 218 psi to 25 psi).

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -544.70 -232.90 -192.10 -202.70 -160.60  -91.07
```

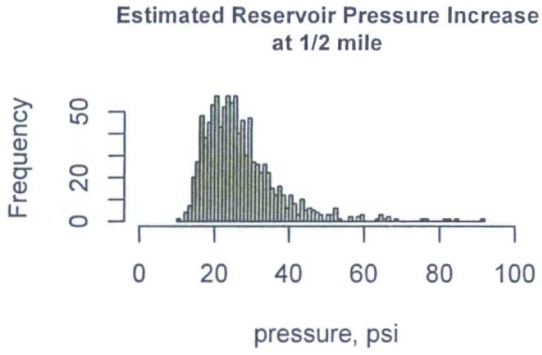
The estimated future reservoir pressure decrease 2 mile from the wellbore (i.e. Lease/Well identification boundary) after 5-years from secession of injection is **-117 psi** (from 141 psi to 24 psi).

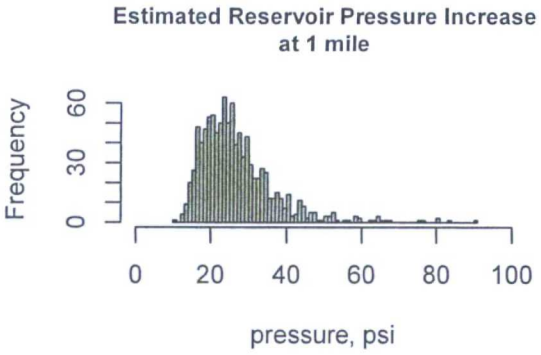
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -342.50 -139.00 -116.80 -121.50  -98.57  -57.52
```

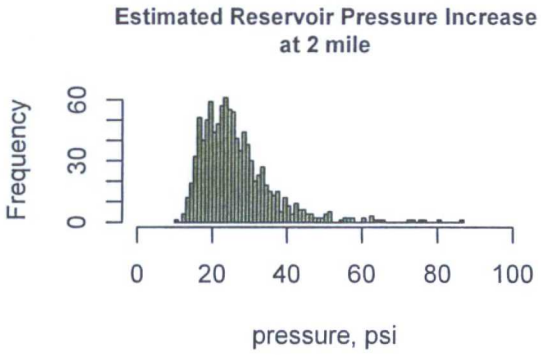
The estimated future reservoir pressure decrease 4 miles from the wellbore after 5-years from secession of injection is **-48 psi** (from 71 psi to 23 psi).

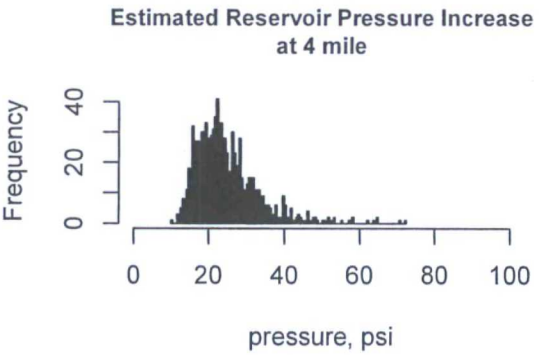
```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -155.8000  -58.3100  -47.8100  -49.3400  -38.2600    0.5565
```

**We Specificly Note That (5-Years) After The Secession of Injection The Reservoir Pressure Will Have Only Increased 25 psi From Initial (prior to injection) Conditions**


Estimated Reservoir Pressure Increase
at 1/2 mile
Frequency
0
20
50
0
20
40
60
80
100
pressure, psi


Estimated Reservoir Pressure Increase
at 1 mile
Frequency
0
30
60
0
20
40
60
80
100
pressure, psi


Estimated Reservoir Pressure Increase
at 2 mile
Frequency
0
30
60
0
20
40
60
80
100
pressure, psi


Estimated Reservoir Pressure Increase
at 4 mile
Frequency
0
20
40
0
20
40
60
80
100
pressure, psi

NEW MEXICO
small town, big heart.

# CITY OF JAL

JAL, NEW MEXICO 88252

PO DRAWER 340
PHONE 395-3340

April 28, 2016



Mr. Matthew Earthman
Souder, Miller & Assocs.
3451 Candelaria Rd NE
Albuquerque, NM 87112

Mr. Earthman,

I want to take this opportunity to communicate with you about a concern that was brought to the city by several individuals and companies. The concern is in reference to our pending application for 900 acre feet of water and nine well locations.

There are several disposal wells in the same section that we are considering to place our wells, Section 25, T 25S, R 36E, that would be utilized for drinking water. In particular, there is a disposal well, Owl Maralo Sholes B #2, that has continued to inject large volumes of disposal water, 13 million barrels in 2015. In addition to the ongoing volumes of water, a company is now constructing a 16 inch line that will travel west out of the Jal area. The purpose for this line, as we understand it, would be to transport produced water for disposal in the above-mentioned disposal well.

Before the city undertakes the expenditure to drill water supply wells in the area close to this well, we would like to ensure this salt water disposal well is injecting into the permitted Seven Rivers Zone and will not cause problems with shallow fresh water aquifers.

Our specific request is for you to involve the Oil Conservation Division and the State Engineer Office in requiring the following information.

1. Provide documentation to demonstrate wellbore integrity;
2. To run a spinner survey to demonstrate injection is within the permitted interval

We strongly believe that these tests and any others that the regulatory agencies believe are warranted should be conducted immediately and then on a regular basis thereafter to ensure that the drinking water to the residents of our community has not been negatively impacted or contaminated in any manner.

Please do not hesitate to contact me should you have any questions or require additional information.

Respectfully,

Bob Gallagher, City Manager

XC: David Martin, Sec. EMNRD
David Catanach, Director, OCD
Tom Blaine, State Engineer

State of New Mexico
Energy, Minerals and Natural Resources Department

Susana Martinez
Governor

Tony Delfin
Deputy Cabinet Secretary

David R. Catanach, Division Director
Oil Conservation Division

***Response Required – Deadline Enclosed***
*Underground Injection Control Program*

July 28, 2016

Mr. Nevin Bannister
Chief Operating Officer
OWL SWD Operating, LLC
8214 Westchester Drive, Suite 850
Dallas, TX 75225

**RE: NOTICE TO OPERATOR: REQUIREMENT TO CONDUCT INJECTION SURVEY**
Maralo Sholes B Well No. 2 (API 30-025-09806)
660' FSL, 660' FEL; Unit P, Sec 25, T25S, R36E, NMPM, Lea County, New Mexico
Injection Authority: Administrative Order SWD-1127
Order Date: June 1, 2008
Permitted Interval: Yates and Seven Rivers formations; 2938 feet to 3055 feet

Mr. Bannister:

The Division is in receipt of a formal correspondence by the City of Jal regarding the potential impacts of the operation of the injection well referenced above (the "subject well"). This correspondence presents concerns for the protection of underground source of drinking water in the vicinity of the subject well. In response to this correspondence, the Engineering Bureau is conducting a technical review of the well file and operation with respect to the conditions contained in the administrative order.

OWL SWD Operating, LLC (the "operator" or "OWL") has responded to recent requests for inspection and upgrade of the wellhead in order to monitor an intermediate casing string that is only sealed in place with drilling mud and not cement. This situation is being assessed for potential vertical migration of fluids behind casing and may require additional testing based on the results of the Bradenhead monitoring.

During the review of the well file, the Division found that the reported volumes of injection fluids increased significantly during the calendar year 2015 (see attachment). The average daily injection rate for 2015 was approximately 19,500 barrels of water per day (BWPD) while the highest single-month rate happened in August with approximately 30,790 BWPD. All of the reported volumes were

injected with a surface pressure of zero (0) pounds per square inch (PSI). Conversely, the injection volumes for the period from 2009 to 2014 showed an average of 3300 BWPD with all volumes injected with a surface pressure of 0 PSI.

The Division is required "*to ensure that the injected water enters only the proposed injection interval*" as a condition of the administrative order. Based on the recent injection information and lack of any quantitative testing, the Division cannot confidently determine that the injection fluids are staying within the permitted interval. Therefore, the Division is stipulating that the operator conduct an injection survey for the subject well with the results to be submitted within the next twenty-one (21) days of this correspondence date.

The type of injection survey may be either a temperature survey or a radioactive tracer survey. At a minimum, the injection survey will be conducted to established industry protocols with results that provide a clear interpretation. A description of activities to conduct the proposed injection survey must be submitted in a Notice of Intent Sundry for approval by the Hobbs District Supervisor. Scheduling of the injection survey must provide the opportunity for Division personnel to be present to witness the activities. All test results, logs and reports prepared as a result of the injection survey are to be submitted to the attention of the Division Director in Santa Fe.

In the event that a satisfactory response is not received to this letter of direction within the prescribed period, enforcement will occur. Such enforcement may include immediate shut-in and an application for appearance by OWL before a Division Examiner to terminate the injection authority granted in the administrative order.

Please contact Mr. Daniel Sanchez, Fields Operations Manager (505.476.3493), with any questions regarding this correspondence.

Sincerely,

David R Catanach

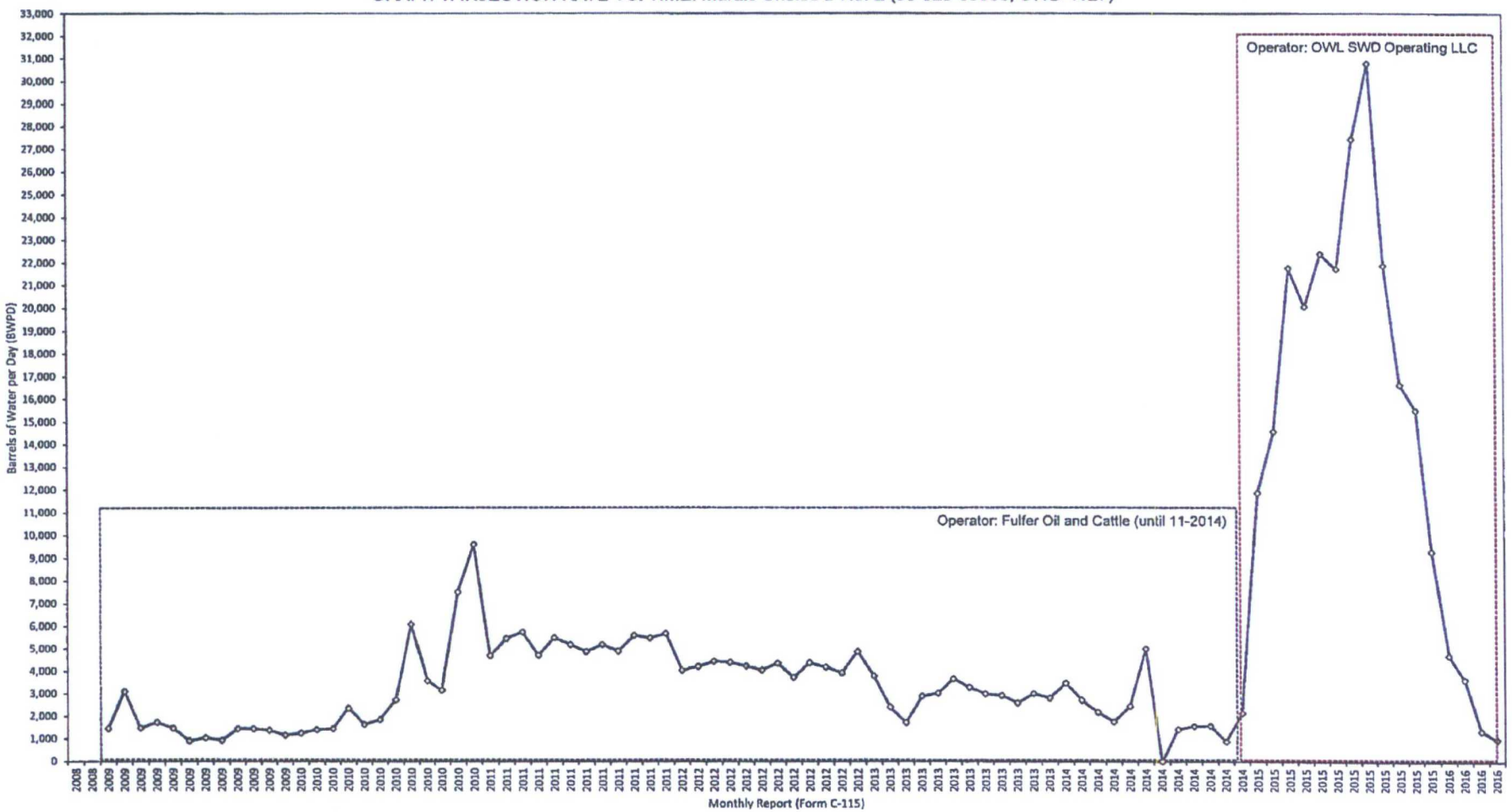
DAVID R. CATANACH
Director

DRC/prg

Attachment: GRAPH 1: INJECTION RATE VS. TIME: Maralo Sholes B No. 2 (30-025-09806; SWD-1127)

cc: Oil Conservation Division – Hobbs District Office
Well File API 30-025-09806
Administrative Order SWD-1127
Bureau of Land Management – Carlsbad Field Office
Mr. Bob Gallagher, City Manager, City of Jal

GRAPH 1: INJECTION RATE VS. TIME: Maralo Sholes B No. 2 (30-025-09806; SWD-1127)



Mr. Bob Gallagher, City Manager
City of Jal
P. O. Drawer 340
Jal, NM 88252

**Brown, Maxey G, EMNRD**

| | |
|---|---|
| **From:** | Brown, Maxey G, EMNRD |
| **Sent:** | Tuesday, September 06, 2016 3:13 PM |
| **To:** | Ben Stone (ben@sosconsulting.us) |
| **Cc:** | Catanach, David, EMNRD; Goetze, Phillip, EMNRD |
| **Subject:** | OWL Maralo Sholes B #2 |

30-025-09806

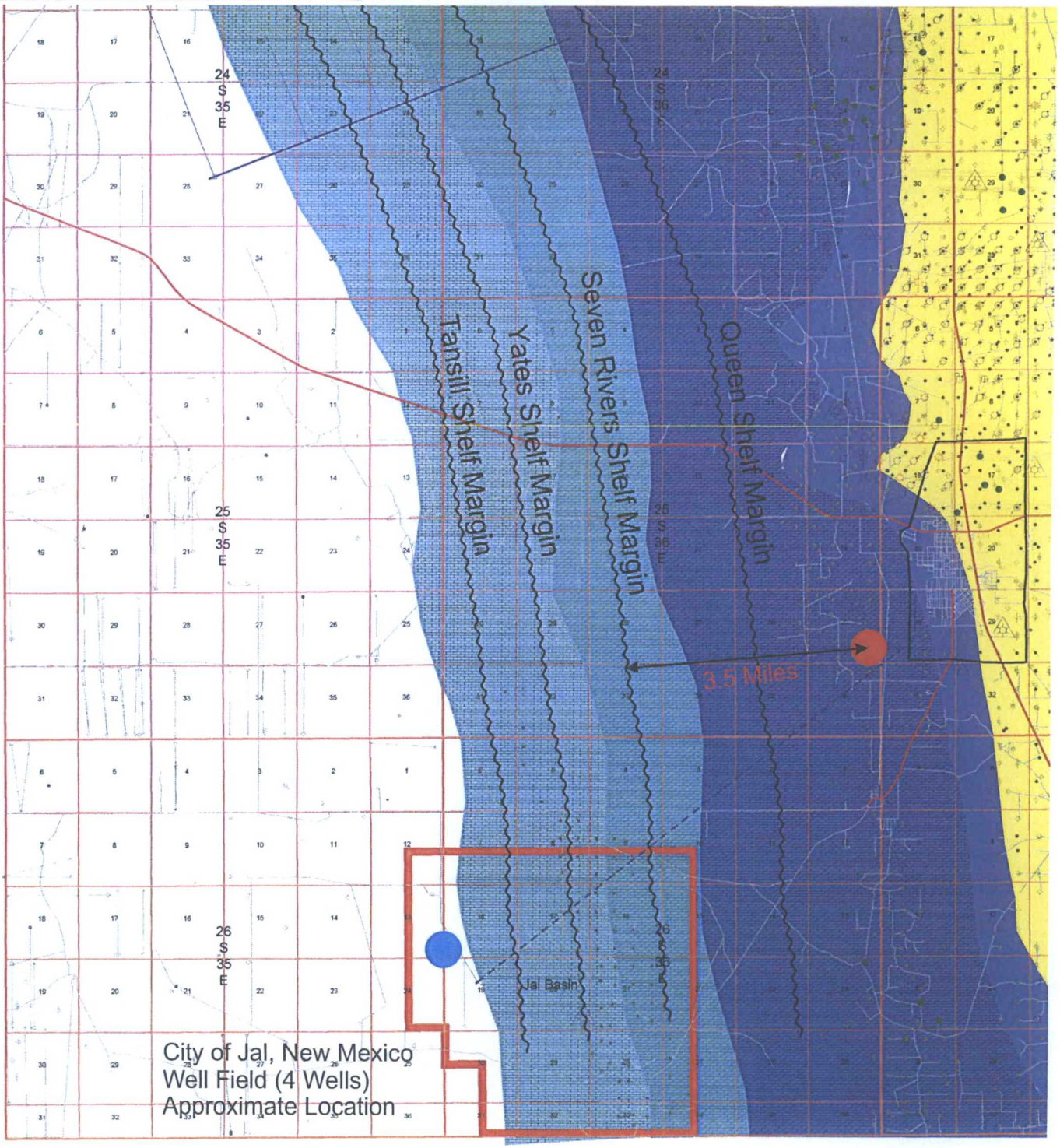
HOBBS OCD

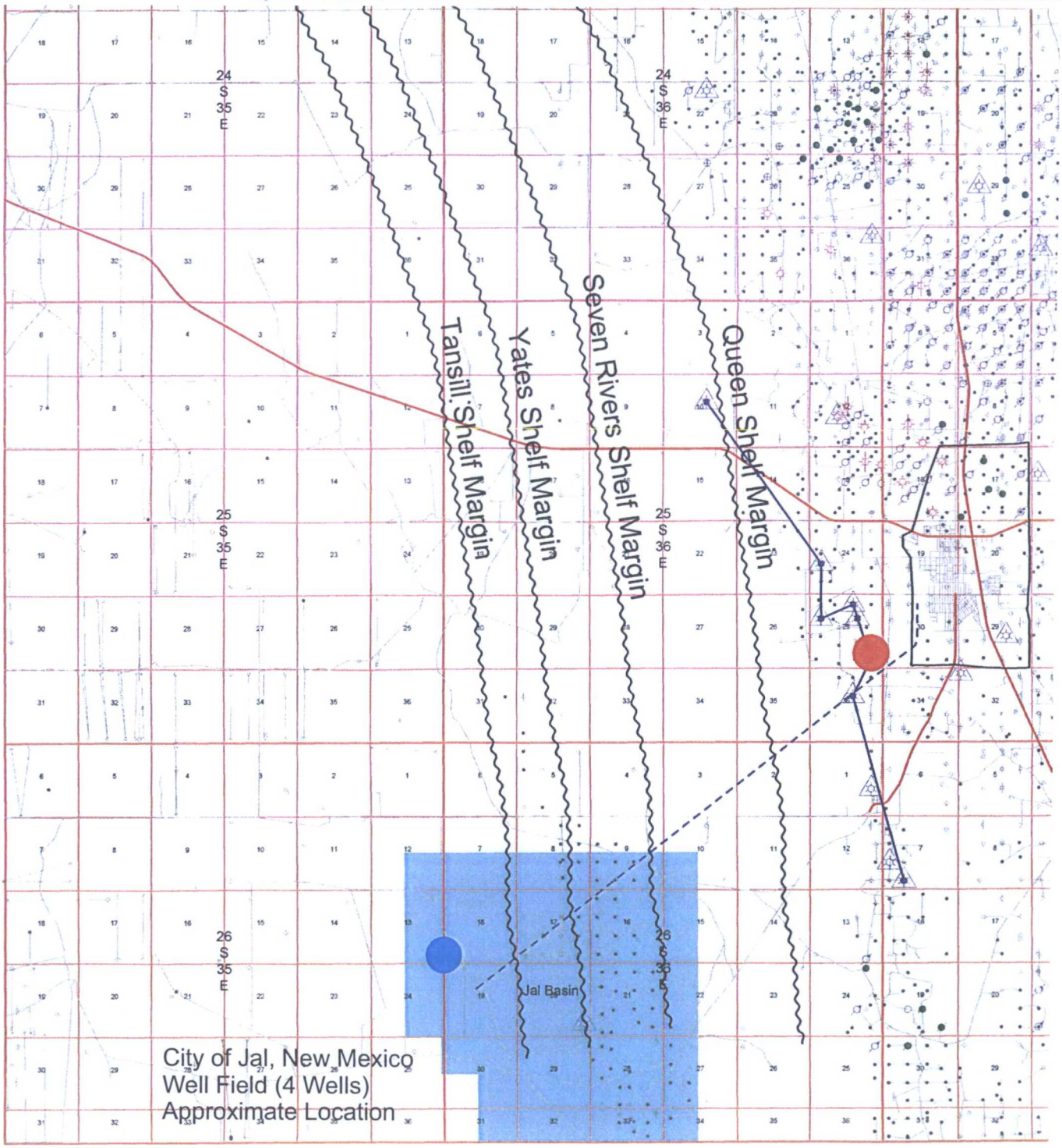
Sep 6, 2016

RECEIVED

Ben,
I am approving the C103 I received from you today. After discussing the recent profile with Director Catanach, please move forward with the cleanout of the 50' of fill and re-run the injection profile. The condition of approval is that the profile be completed and copies to the Santa Fe office by **October 7, 2016.** At this time OWL will not receive a formal letter stating these requirements. This email will be used as notice. Please pass this information to your contacts at OWL.
Thanks.

Maxey G. Brown
OCD District 1 Supervisor
575-393-6161 ext. 102


24 S 35 E
25 S 35 E
26 S 35 E
Tansill Shelf Margin
Yates Shelf Margin
Seven Rivers Shelf Margin
Queen Shelf Margin
3.5 Miles
Jal Basin
City of Jal, New Mexico
Well Field (4 Wells)
Approximate Location




Jal, New Mexico (Artesia Group) Injection W