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**EPA FALL-OFF
TEST
(WDW-3)**

DATE:

2011



March 2, 2012

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505

**RE: 2011 Annual Bottom-Hole Pressure Survey & Pressure Falloff Test for
Mewbourne Well No. 1, Chukka Well No. 2, and Gaines Well No. 3
Navajo Refining Company
Disposal Wells WDW-1, WDW-2, WDW-3**

Mr. Chavez,

Enclosed, please find three (3) copies of our 2011 Pressure Falloff (PFO) Test & Bottom-Hole Pressure Survey for Mewbourne Well No. 1, Chukka Well No. 2, and Gaines Well No. 3.

If you have any questions, please contact me at the above address or by telephone at (575) 746-5382.

Sincerely,

Robert Combs, PhD
Environmental Specialist

Electronic cc (wo/enc):

MGM, JEL

Environmental File:

2011 Pressure Falloff Test & Bottom-Hole Pressure Survey
Environmental Library

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Thursday, March 15, 2012 11:13 AM
To: robert.combs@hollyfrontier.com
Subject: WDWs Fall-Off Testing & Electronic Data Compilation from Individual FOTs for Software Evaluation

Robert:

Could you please send the supporting electronic data for the FOTs per well to the OCD?

Navajo should have the type of electronic data that the OCD requires in case you have questions.

Thank you.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
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**2011 PRESSURE FALLOFF TEST AND BOTTOM-HOLE
PRESSURE SURVEY ON GAINES WELL NO. 3**

**NAVAJO REFINING COMPANY
ARTESIA, NEW MEXICO
PROJECT NO. 70A6645**

**SUBMITTED:
FEBRUARY 2012**

**SUBSURFACE TECHNOLOGY, INC.
6925 PORTWEST DR., STE. 110
HOUSTON, TEXAS 77024
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EXECUTIVE SUMMARY

Subsurface Construction Corp. (Subsurface) was contracted by Navajo Refining Company (Navajo) to perform a pressure falloff test and bottom-hole pressure survey on Navajo's Gaines Well No. 3. The test was performed in accordance with The New Mexico Oil Conservation Division (OCD) falloff test guidelines (*New Mexico Oil Conservation Division UIC Class I Well Fall-Off Test Guidance, December 3, 2007*).

The test provides the state regulatory agency with the necessary information to assess the validity of requested or existing injection well permit conditions and satisfy the permitting objective of protecting the underground sources of drinking water (USDW). Specifically, 40 CFR, Part 146, states "The Director shall require monitoring of the pressure buildup in the injection zone annually, including at a minimum, a shutdown of the well for a time sufficient to conduct a valid observation of the pressure fall-off curve". (40 CFR § 146.13 for Non-Hazardous Class I Wells)

The falloff testing was conducted according to the test plan submitted to, and approved by, the OCD. In accordance with the test plan, Mewbourne Well No. 1 and Chukka Well No. 2 were shut in during the test period. The testing consisted of a 30-hour injection period and a 30-hour falloff period. Bottom-hole gauges were also placed in the offset wells: Mewbourne Well No. 1 and Chukka Well No. 2. These wells are owned by Navajo and are also used to inject plant waste into the same injection interval as Gaines Well No. 3.

As prescribed by the guidelines, this report discusses supporting and background information for Gaines Well No. 3, the one-mile area of review (updated since the 2010 falloff testing), and geology. In addition, information on the offset wells is provided. Daily testing activities and the point of shut-in is also provided. The pressure falloff testing and analysis results are discussed in Section 15.



1. FACILITY INFORMATION

- a. Name: Navajo Refining Company (subsidiary of the Holly Corporation)
- b. Facility Location: Highway 82 East, Artesia, New Mexico 88211
- c. Operator's OGRD Number: Section 1, Township 18 South, Range 27 East

2. WELL INFORMATION

- a. OCD UIC Permit Number: UIC-CLI-008-3
- b. Well Classification: Class I Non-Hazardous
- c. Well Name and Number: Gaines Well No. 3
- d. API Number: 30-015-26575
- e. Well Legal Location: 760 FSL, 2250 FWL

3. CURRENT WELLBORE SCHEMATIC

The Gaines Well No. 3 wellbore schematic is presented in Figure 1. The schematic contains data, as requested by the guidelines and includes the following:

- a. Tubing: 4-1/2-inch, 11.6 pound per foot, steel construction, API grade J-55, with long thread connections (LTC).
- b. Packer: Arrow X-1, 7-inch by 2-7/8-inch set in tension (37,000 pounds) at 7,575 feet.
- c. Tubing Length: 7,568 feet with a 0.54-foot, 4-1/2-inch by 2-7/8-inch crossover in the top of the packer. There are no profile nipples in the tubing or the packer as this was not a requirement of the permit.
- d. Size, Type, and Depth of Casing: There are four casing strings in the well and one below the injection interval. The information for these casing strings was obtained from OCD records on file with the state and geophysical logs. The casing strings are:
 - i. 13-3/8-inch, 54.5 pound per foot, steel construction, API grade J-55, with short thread connections (STC), set at a depth of 400 feet. The casing was cemented to the surface with 425 sacks of cement. The casing was set in open hole with a diameter of 17.5 inches. This information was obtained from OCD records.



- ii. 9-5/8-inch, 36 pound per foot, steel construction, API grade J-55, STC, set at a depth of 2,600 feet. The casing was cemented to the surface with 1,025 sacks of cement. The casing was set in open hole with a diameter of 12.25 inches. This information was obtained from OCD records.
- iii. 7-inch, 26 pound per foot and 29 pound per foot, steel construction, API grade N-80 and P-110, STC, set at a depth of 9,450 feet. The casing was cemented with 1,350 sacks of cement to 900 feet from surface. The casing was set in open hole with a diameter of 8.75 inches. The top cement and weight of the pipe was verified with a CBL and caliper log run on October 13, 2006. The remainder of the information was obtained from OCD records.
- iv. Below the cement plug at 9,022 feet is the top of a 4-1/2-inch liner. The liner is a string of 4-1/2-inch casing installed to a depth of 10,119 feet. There is a cast iron bridge plug set in the liner at 9,800 feet, which is above the original perforations, between 9,861 feet and 9,967 feet. The current injection interval is above the plug at 9,022 feet. The cement plug also isolates the lower section of the original wellbore. This information was obtained from OCD records.
- e. The top of cement was determined from a CBL run in the 7-inch casing string on October 13, 2006. The top of cement in the 7-inch casing was found at 900 feet below the surface. The top of cement in the 9-5/8-inch and 13-3/8-inch casing strings was verified through OCD records and volume calculations.
- f. The 7-inch casing was perforated on October 14 and October 15, 2006. The casing was perforated with a 0.5-inch diameter hole at 2 shots per foot on a 60° phasing. The perforations are located between 7,660 feet and 8,450 feet and from 8,540 feet to 8,620 feet.
- g. The total depth of the well is 10,119 feet with the plug back depth at 9,022 feet. On August 30, 2009 fill was tagged at 8,986 feet.
- h. The bottom-hole pressure gauges consisted of two memory readout (MRO) backup pressure gauges. The MROs was placed at 7,660 feet (top of the perforations) and two feet lower at 7,658 feet.

4. ELECTRIC LOG ENCOMPASSING THE COMPLETED INTERVAL

The dual induction log is presented in Appendix A and encompasses the completed interval between 7,660 feet and 8,620 feet. The dual induction log was submitted to the OCD with the original permit after the well was drilled by the Mewbourne Oil Company. The log was resubmitted to the OCD when the well was re-permitted as a Class I injection well.

5. RELEVANT PORTIONS OF POROSITY LOG USED TO ESTIMATE FORMATION POROSITY

The neutron density log is presented in Appendix B and encompasses the completed interval between 7,660 feet and 8,620 feet. The neutron density log was submitted to the OCD with the original permit after the well was drilled by Mewbourne Oil Company. The log was resubmitted to the OCD when the well was re-permitted as a Class I injection well. The porosity of the formation, 10%, and the reservoir thickness, 175 feet, were determined from this log. These values were used in the analysis of the pressure falloff data (Section 15). Additional information concerning the geology of the injection reservoir is discussed in Section 11

6. PVT DATA OF THE FORMATION AND INJECTION FLUID

The Gaines Well No. 3 was recompleted in October 2006, prior to the issuance of the current well testing guidelines (December 3, 2007). At the time, no directives were in place to test formation fluids or derive formation characteristics from cores. However, reservoir fluid samples were obtained and the density and total dissolved solids (TDS) were measured at 1.03 g/l and 26,500 mg/l, respectively. The analytical results of the analysis of the formation fluid are summarized in Table I.

The viscosity of the formation fluid, formation water compressibility, and total system compressibility were estimated in reference to bottom-hole temperature using industry accepted correlations. These correlations are found in the Society of Petroleum Engineer's "Advances in Well Test Analysis, Monograph Volume 5" and "Pressure Buildup and Flow Tests in Wells, Monograph Volume 1".

a. Estimation of Formation Fluid and Reservoir Rock Compressibility:

The fluid compressibility of the formation brine was estimated for a sodium chloride solution (26,500 mg/l) at the bottom-hole temperature of 127°F using Appendix C (Figure D.16 SPE Monograph 5). This value was $2.9 \times 10^{-6} \text{ psi}^{-1}$. The formation pore volume compressibility was estimated using Appendix D (Figure G.5 SPE Monograph 1). This value was $5.5 \times 10^{-6} \text{ psi}^{-1}$. The total system compressibility is the sum of the fluid compressibility and the pore volume compressibility, $8.4 \times 10^{-6} \text{ psi}^{-1}$. The temperature used with the correlations was recorded during the temperature survey conducted in the Gaines Well No. 3 on October 13, 2006, and included in this report as Appendix E.

b. Formation Fluid Viscosity with Reference Temperature:

The formation fluid had a TDS concentration of 26,500 mg/l. This equates to an approximate equivalent percentage of NaCl of 4.5%. The average viscosity of the formation fluid was estimated using Appendix F (Figure D.35 SPE Monograph 5). This value was 0.57 centipoise (cp) at 127°F.

c. Formation Fluid Specific Gravity/Density with Reference Temperature:

The average formation fluid density was measured at 1.03 g/l at 70°F (Table I).

d. Injection Fluid Specific Gravity, Viscosity and Compressibility with Reference Temperature:

The specific gravity of the refinery waste water was measured during the injection portion of the reservoir testing. The specific gravity was 1.03 (8.54 pounds per gallon). This equates to an approximate equivalent percentage of NaCl of 4%. Using the same methodology described above, the viscosity of the injected fluid was 0.54 cp at 127°F. The compressibility of the injected plant waste was $2.9 \times 10^{-6} \text{ psi}^{-1}$ at 127°F.

7. DAILY RATE HISTORY DATA (MINIMUM OF ONE MONTH PRECEDING THE FALLOFF TEST)

The daily rate history is summarized in Appendix G.



8. CUMULATIVE INJECTION INTO THE FORMATION FROM TEST WELL AND OFFSET WELLS

The total volume of fluid injected into all three well as of January 29, 2012, was 2,616,537,360 gallons. The volume of fluid injected into the Mewbourne Well No. 1 was 1,424,180,654 gallons. The volume of fluid injected into the Chukka Well No. 2 was 837,093,221 gallons. The volume of fluid injected into the Gaines Well No. 3 was 355,263,485 gallons. The area of review (AOR) indicates that there are no other wells injecting into the intervals in which the Navajo wells inject. The volumes injected were obtained from plant records.

9. PRESSURE GAUGES

Two (2) downhole memory readout pressure gauges were used for the Gaines Well No. 3 buildup and falloff testing. The upper gauge was used as a backup gauge. The downhole MRO gauges were set at 7,658 feet and 7,660 feet. Bottom-hole MRO pressure gauges were also placed in each of the offset wells (Mewbourne Well No. 1 and Chukka Well No. 2). The pressure gauges were set at 7,924 feet in the Mewbourne Well No. 1 and at 7,570 feet in the Chukka Well No. 2.

- a. Describe the type of down hole surface pressure readout gauge used including manufacture and type:

In the Gaines Well No. 3, two MRO pressure gauges were used to record the pressure and temperature data during the injection/falloff testing. Both gauges were sapphire crystal gauges. The MRO pressure gauges (Serial Nos. 76404 and 77120) were used. Both gauges were sapphire crystal gauges and were manufactured by Spartek Systems.

In the Mewbourne Well No. 1, two MRO pressure gauges were used to monitor the bottom-hole pressure and temperature during the testing of the Gaines Well No. 3. Both gauges were sapphire crystal gauges with Serial Nos. 76111 and 76888. Both gauges were manufactured by Spartek Systems.

In the Chukka Well No. 2, two MRO pressure gauges were used to monitor the bottom-hole pressure and temperature during the testing of the Gaines Well No. 3. Both gauges were sapphire crystal gauges with Serial Nos. 76077 and 76120. Both gauges were manufactured by Spartek Systems.

- b. List the full range, accuracy and resolution of the gauge:

In Gaines Well No. 3, the MRO pressure gauges, Serial Nos. 76404 and 77120, has a full range of 0 psi to 10,000 psi, an accuracy of 0.022% of full scale, and a resolution of 0.0003% of full scale.

In Mewbourne Well No. 1, the MRO pressure gauges, Serial Nos. 76111 and 76888, have a full range of 0 psi to 10,000 psi, an accuracy of 0.022% of full scale, and a resolution of 0.0003% of full scale.

In Chukka Well No. 2, the MRO pressure gauges, Serial Nos. 76077 and 76120, have a full range of 0 psi to 10,000 psi, an accuracy of 0.022% of full scale, and a resolution of 0.0003% of full scale.

- c. Provide the manufacturer's recommended frequency of calibration and a calibration certificate showing date the gauge was last calibrated:

The certificate of calibration for each of the pressure gauges used during the testing are included as Appendix H. The manufacturer's recommended calibration frequency is one year.

10. ONE MILE AREA OF REVIEW (AOR)

Federal Abstract Company was contracted by Subsurface and instructed to undertake a review of well changes made within a one-mile Area of Review (AOR) of the Mewbourne Well No. 1, Chukka Well No. 2, and Gaines Well No. 3. In 2011, an update of the original AOR, submitted with the Discharge Application Permit 2003, was completed within the one-mile AOR for all three wells. The current update includes all existing wells within the one-mile AOR and any changes that have occurred to these wells since the 2010 update.

No new fresh water wells were reported within the search area since the submittal of the 2010 report. The discharge application lists the water wells located in the Area of Review.

a. Identify wells located within the one mile AOR:

Table II also contains a listing of all wells within the one-mile AOR of Mewbourne Well No. 1, Chukka Well No. 2, and Gaines Well No. 3. Figure 6 is a Midland Map Company base map of the area containing the one mile AOR.

b. Ascertain the status of wells within the one mile AOR:

Table II contains a listing of all wells within the one-mile AOR, with their current status. Tables III through XIII contain a list of all wells within the one-mile AOR that have had modifications to the current permit or have had new drilling and/or completion permits issued since the 2010 annual report submittal.

Ninety-four (94) wells were found in which the owner had changed. Two (2) new plugged and abandoned oil and gas wells were found. No wells were placed in temporarily abandoned status. One (1) well was found that was returned to production status. One (1) well was found that had been recompleted.

There were thirty-two (32) new drills and permits to drill, of which none penetrated the Wolfcamp interval. All plugged and abandoned wells were successfully plugged and isolated from the Mewbourne Well No. 1, Chukka Well No. 2, and Gaines Well No. 3 injection intervals according to current OCD records.

c. Provide details on any offset producers and injectors completed in the same interval:

Navajo has two injection wells in the same interval. Mewbourne Well No. 1 is listed at ID No. 59 in Table II and no changes have occurred to this well. Chukka Well No. 2 is listed at ID No. 120 in Table II and no changes have occurred to this well. The wellbore schematics for the Mewbourne Well No. 1 and Chukka Well No. 2 are presented as Figure 3 and Figure 4, respectively.

11. GEOLOGY

The injection zones are porous carbonates of the lower portion of the Wolfcamp Formation, the Cisco Formation, and the Canyon Formation. These formations occur in the Mewbourne Well No. 1, the Chukka Well No. 2, and the Gaines Well No. 3 at the depths shown in the table below.

Injection Zone Formation	Mewbourne Well No. 1 (KB = 3,693 ft)		Chukka Well No. 2 (KB = 3,623 ft)		Gaines Well No. 3 (KB = 3,625 ft)	
	MD below KB (ft)	SS Depth (ft)	MD below KB (ft)	SS Depth (ft)	MD below KB (ft)	SS Depth (ft)
Lower Wolfcamp	7,450	-3,757	7,270	-3,647	7,303	-3,678
Cisco	7,816	-4,123	7,645	-4,022	7,650	-4,025
Canyon	8,475	-4,782	8,390	-4,767	8,390	-4,765
Base of Injection Zone (base of Canyon)	9,016	-5,323	8,894	-5,271	8,894	-5,269

a. Description of the geological environment of the injection interval:

The lower portion of the Wolfcamp Formation (Lower Wolfcamp) is the shallowest porous unit in the proposed injection interval. The Wolfcamp Formation (Permian-Wolf campaign age) consists of light brown to tan, fine to medium-grained, fossiliferous limestones with variegated shale interbeds (Meyer, 1966, page 69). The top of the Wolfcamp Formation was correlated for this study to be below the base of the massive, dense dolomites of the overlying Abo Formation. The base of the Wolfcamp coincides with the top of the Cisco Formation. The thickness of log porosity greater than 5% in the entire Wolfcamp Formation ranges from 0 feet to 295 feet in a band three miles wide that trends northeast-southwest across the study area.

The Cisco Formation (Pennsylvanian-Virgilian age) of the Northwest Shelf is described by Meyer (1966, page 59) as consisting of uniform, light colored, chalky, fossiliferous limestones interbedded with variegated shales. Meyer (1966, page 59) also describes the Cisco at the edge of the Permian basin as consisting of biohermal (mound) reefs composed of thick, porous, coarse-grained dolomites.

Locally, the Cisco consists of porous dolomite that is 745 feet thick in Chukka Well No. 2, 659 feet thick in Mewbourne Well No. 1, and 720 feet in Gaines Well No. 3. The total thickness of intervals with log porosity greater than 5% is approximately 310 feet in Mewbourne Well No. 1, 580 feet in Chukka Well No. 2, and 572 feet in Gaines Well No. 3. The total thickness with log porosity greater than 10% is approximately 100 feet in Mewbourne Well No. 1, 32 feet in Chukka Well No. 2, and 65 feet in Gaines Well No. 3. The thickness of the porous intervals in the Cisco ranges from 0 feet in the northwestern part of the study area to nearly 700 feet in a band three miles wide that trends northeast-southwest.

The Canyon Formation (Pennsylvanian-Missourian age) consists of white to tan to light brown fine grained, chalky, fossiliferous limestone with gray and red shale interbeds (Meyer, 1966, page 53). Locally, the Canyon occurs between the base of the Cisco dolomites and the top of the Strawn Formation (Pennsylvanian-Desmoinesian age). The total thickness of intervals with log porosity greater than 5% is 34 feet in Mewbourne Well No. 1, 30 feet in Chukka Well No. 2, and 10 feet in Gaines Well No. 3. No intervals appear to have log porosity greater than 10% in any of the three injection wells.

- b. Discuss the presence of geological features, i.e., pinchouts, channels, and faults, if applicable:

From the geological study completed and submitted in the Discharge Plan Application and Application for Authorization to Inject, the reservoir appears to be continuous, with the possibility of anisotropic conditions extending to the west-southwest. The injection intervals that were studied are well confined by the Abo and Yeso low porosity carbonate beds, Tubbs shale, and Salado salt. The Cisco and Wolfcamp formations follow the Vacuum arch and have a southeasterly dip. No faults existed in the study area, but the study also shows that faulting occurs via the K-M fault located 6 miles northwest of Artesia and trends northeast-southwest. The distance to this fault line occurs no closer than 16 miles. No faults are known to exist in the confining zone within the AOR.

- c. Provide a portion of relevant structure map, if necessary:

The structure map for Strawn is presented as Appendix I. The structure map for the Wolfcamp presented as Appendix J and the structure map for the Cisco Formation is presented as Appendix K.

12. OFFSET WELLS

There are only two offset wells identified in the AOR that inject into the same interval: the Mewbourne Well No. 1 and the Chukka Well No. 2. Both wells were shut-in during the buildup and falloff portions of the testing.

- a. Identify the distance between the test well and any offset well completed in the same injection interval:

The Mewbourne Well No. 1 is approximately 7,900 feet from Gaines Well No. 3, the test well. The Chukka Well No. 2 is approximately 3,130 feet from the Gaines Well No. 3.

- b. Report the status of the offset wells during both the injection and shut-in portions of the test:

Both the Mewbourne Well No. 1 and Chukka Well No. 2 were shut-in during the buildup and falloff portions of the testing. Bottom-hole pressure gauges were lowered into each well approximately 48 hours before shutting in the Gaines Well No. 3. The bottom-hole pressure and temperature data are graphically depicted in Figure 2 for the Mewbourne Well No. 1 and Figure 5 for the Chukka Well No. 2.

- c. Describe the impact, if any, the offset wells had on the testing:

The offset wells were shut in prior to beginning the 30-hour injection period and remained shut-in during the 30 hour falloff portion of the testing.

13. CHRONOLOGICAL LISTING OF THE DAILY TESTING ACTIVITIES (OPERATIONS LOG)

Appendix L contains the formal Chronology of Field Activities. This chronology was developed from the field activity reports.

- a. Date of the testing:

The bottom hole gauges were placed into the wells on January 22, 2012 and the 48 hour injection monitoring period portion of the testing started on January 22,



2012, at 08:40 a.m., and continued until January 24, 2012, at 08:45 a.m. On January 24, 2012 at 08:45 a.m. the Mewbourne Well No. 1 and Chukka Well No. 2 was shut-in and the 30 hour buildup portion for Gaines Well No. 3 was started. The buildup portion of the testing ended at 07:33 p.m. on January 25, 2012 and Gaines Well No. 3 was shut-in with both of the offset wells remaining shut-in for the duration of the 30 hour falloff portion of the testing. The falloff test ended on January 27, 2012, at 09:14 a.m. On January 27, 2012, at 09:14 a.m., five-minute gradient stops were made while pulling out of the wellbore with the pressure gauges. At 06:00 p.m., on January 27, 2012, the well was turned over to Navajo plant operations personnel.

b. Time of the injection period:

The buildup portion of the testing began on January 22, 2012, when the injection rate was set at an average injection rate of 211 gallons per minute (gpm). The injection rate was held constant for 30.57 hours. The injection period used in the pressure falloff analysis was 11,208 hours, which includes the total volume since the last falloff test.

c. Type of injection fluid:

The injected fluid was non-hazardous waste water from the plant. The density averaged 8.3 pounds per gallon during the 30-hour injection period (OCD Guideline Section VII.6).

d. Final injection pressure and temperature prior to shutting in the well:

The final flowing pressure (P_{wf}) and temperature (T_{wf}) were 3853.88 psia and 93.31°F, respectively.

e. Total shut-in time:

The Gains Well No. 3 was shut-in for a total of 37.27 hours.

f. Final static pressure and temperature at the end of the fall-off portion of the test:

The final static pressure at 7660 feet was 3800.55 psia. The final temperature was 101.05 °F.

14. DESCRIBE THE LOCATION OF THE SHUT-IN VALVE USED TO CEASE FLOW TO THE WELL FOR THE SHUT-IN PORTION OF THE TEST

On the pipeline to the Gaines Well No. 3 there are two, 4-inch motor controlled valves installed on the incoming pipeline before the pod filters. Two 4-inch valves are installed between the pod filters and the wellhead. There is one, 6-inch valve installed in the main line between the pod filters and the wellhead. A 4-1/16-inch wing valve is installed on the wellhead. All valves were closed during the falloff portion of the testing. A diagram of the wellhead is shown in Figure 7 and a diagram of the valve locations are shown in Figure 8.

15. PRESSURE FALLOFF ANALYSIS

The following discussion of the analysis of the pressure data recorded during the falloff testing of the Gaines Well No. 3 satisfies Sections 15 through 19 of the OCD's falloff test guidelines. Where appropriate, the specific guideline addressed is annotated. Specific parameters used in the equations and discussed previously in this report are also annotated. The plots included with this report are summarized in Table IX. The inclusion of these plots in this report satisfies OCD Guideline Section IX.18.

The pressure data obtained during the falloff test were analyzed using the commercially available pressure transient analysis software program PanSystem®. Appendix M contains the output from this software program. Figure 9 shows the pressure data recorded by the bottom-hole gauge from the time the tool was in place. Figure 10 shows the pressure and temperature data recorded by the bottom-hole gauge from the time the tool was in place until it was pulled. Figure 11 is a Cartesian plot of the injection rates versus time for the injection period (467 days) since the 2010 falloff testing. The superposition time function was used to account for all rate changes during the since the last stable shutin period. Figure 12 is a plot of the surface pressures and injection rates versus time for the stabilized injection period (30 hours) of the testing. Figure 13 is a plot of the historical injection rates and surface pressures versus calendar time since injection began in 1999.

Figure 14 is a log-log diagnostic plot of the falloff data, showing change in pressure and pressure derivative versus elapsed shut in time. The wellbore storage, radial flow and change in reservoir characteristics flow regimes are indicated on the log-log plot and the superposition Horner plot (OCD Guideline Section IX.18.c and IX.18.d)

Wellbore storage begins at 0.002 hours and continues to an elapsed shut in time of 0.019 hours. Radial flow begins at an elapsed shut in time of 7.16 hours and continues until 11.61 hours (OCD Guideline Section IX.15.b).

The reservoir permeability was determined from the radial flow region of the superposition Horner plot, Figure 15. The radial flow regime begins at a logarithmic Horner time of 6,318,908 and continues until a Horner time of 3,177,019, at which time the pressure data departs the semi-log straight-line. Figure 16 shows an expanded view of the radial flow regime. The slope of the radial flow period, as calculated by the analysis software, was 1.60439 psi/cycle (OCD Guideline Section IX.15.c). The measured injection rate prior to shut in was 1808.57 bbl/day (52.75 gpm).

An estimate of mobility-thickness (transmissibility, OCD Guideline Section IX.15.d), kh/μ , for the reservoir was determined to be 183,293 md-ft/cp from the following equation:

$$\frac{k h}{\mu} = 162.6 \frac{q B}{m}$$

where,

- kh/μ = formation mobility-thickness, millidarcy-feet/centipoise
- q = rate prior to shut in, bpd
- B = formation volume factor, reservoir volume/surface volume
- m = slope of radial flow period, psi/cycle

$$\begin{aligned} \frac{k h}{\mu} &= 162.6 \frac{(1808.57)(1.0)}{(1.60439)} \\ &= 183,293 \end{aligned}$$

The permeability-thickness (flow capacity, OCD Guideline Section IX.15.i), kh , was determined to be 104,477 md-ft by multiplying the mobility-thickness, kh/μ , by the viscosity of the formation fluid (see Section 6), μ , of 0.57 centipoise:

$$\begin{aligned}
 kh &= \left(\frac{kh}{\mu} \right) \mu \\
 &= 183,293 \times 0.57 \\
 &= 104,477 \text{ md-ft}
 \end{aligned}$$

The reservoir permeability (OCD Guideline Section IX.15.e) using the total thickness (see Section 5 and Section 11) of 175 feet was 597 md:

$$\begin{aligned}
 k &= \frac{(kh)}{h} \\
 &= \frac{104,477}{175} \\
 &= 597 \text{ md}
 \end{aligned}$$

To determine whether the proper viscosity was used in arriving at this permeability, the travel time for a pressure transient to pass beyond the waste front needs to be calculated (OCD Guideline Section VIII.5). The distance to the waste front is determined from the following equation:

$$r_{\text{waste}} = \left(\frac{0.13368 V}{\pi h \phi} \right)^{1/2}$$

where,

r_{waste}	=	radius to waste front, feet
V	=	total volume injected into the injection interval, gallons
h	=	formation thickness, feet
ϕ	=	formation porosity, fraction
0.13368	=	constant

A cumulative volume of approximately 355,263,485 gallons of waste has been injected into Gaines Well No. 3 (see Section 8). The formation has a porosity of 0.10 (see Section 5 and Section 11).

The distance to the waste front was determined to be 929 feet:

$$r_{\text{waste}} = \left(\frac{(0.13368)(355,263,485)}{(\pi)(175)(0.10)} \right)^{1/2}$$

$$= 929 \text{ feet}$$

The time necessary for a pressure transient to traverse this distance is calculated from the following equation:

$$t_{\text{waste}} = 948 \frac{\phi \mu_{\text{waste}} C_t r_{\text{waste}}^2}{k}$$

where,

- t_{waste} = time for pressure transient to reach waste front, hours
- ϕ = formation porosity, fraction
- μ_{waste} = viscosity of the waste at reservoir conditions, centipoise
- r_{waste} = radius to waste front, feet
- C_t = total compressibility of the formation and fluid, psi
- k = formation permeability, millidarcies
- 948 = constant

The pore volume compressibility is $8.4 \times 10^{-6} \text{ psi}^{-1}$ (see Section 6). The time necessary for a pressure transient to traverse the distance from the wellbore to the leading edge of the waste front would be 0.68 hours:

$$t_{\text{waste}} = 948 \frac{(0.10)(0.59)(8.4 \times 10^{-6})(929)^2}{597}$$

$$= 0.68 \text{ hours}$$

Since the time required to pass through the waste is less than the 7.16 hours required to reach the beginning of the radial flow period, the assumption that the pressure transient was traveling through formation fluid during the period of the semi-log straight line was correct.

The near wellbore skin damage (OCD Guideline Section IX.15.f) was determined from the following equation:

$$s = 1.151 \left[\frac{p_{\text{wf}} - p_{1\text{hr}}}{m_1} - \log \left(\frac{k}{\phi \mu c_t r_w^2} \right) + 3.23 \right]$$

where,

- s = formation skin damage, dimensionless
- 1.151 = constant
- p_{wf} = flowing pressure immediately prior to shut in, psi
- $p_{1\text{hr}}$ = pressure determined from extrapolating the first radial flow semi-log line to a Δt of one hour, psi
- m_1 = slope of the first radial flow semi-log line, psi/cycle
- k = permeability of the formation, md
- ϕ = porosity of the injection interval, fraction
- μ = viscosity of the fluid the pressure transient is traveling through, cp
- c_t = total compressibility of the formation plus fluid, psi^{-1}
- r_w = radius of the wellbore, feet
- 3.23 = constant

The final measured flowing pressure was 3853.88 psia. The pressure determined by extrapolating the radial flow semi-log line to a Δt of one hour, $p_{1\text{hr}}$, was 3804.91 psia (calculated from the analysis software). The wellbore radius, r_w , is 0.3246 feet (completion records). Using these values in addition to the previously discussed parameters results in a skin of :

$$s = 1.151 \left[\left[\frac{3853.88 - 3804.91}{1.60439} \right] - \log \left(\frac{597}{(0.10)(0.57)(8.4 \times 10^{-6})(0.3246)^2} \right) + 3.23 \right]$$

$$= 27.25$$

The change in pressure, Δp_{skin} , in the wellbore associated with the skin factor (OCD Guideline Section IX.15.g) was calculated using the following equation:

$$\Delta p_{\text{skin}} = 0.869(m)(s)$$

where,

0.869 = constant

m = slope from superposition plot of the well test, psi/cycle

s = skin factor calculated from the well test

The change in pressure, Δp_{skin} , using the previously calculated and defined values was determined to be 38.0 psi:

$$\begin{aligned} \Delta p_{\text{skin}} &= 0.869(m)(s) \\ &= 0.869 (1.60439) (27.25) \\ &= 38.0 \text{ psi} \end{aligned}$$

The flow efficiency (E, OCD Guideline Section IX.15.h) was determined from the following equation:

$$E = \frac{p_{\text{wf}} - \Delta p_{\text{skin}} - p_{\text{static}}}{p_{\text{wf}} - p_{\text{static}}}$$

where:

E = flow efficiency, fraction

p_{wf} = flowing pressure prior to shutting in the well for the fall-off test,

p_{static} = final pressure from the pressure falloff test

Δp_{skin} = pressure change due to skin damage

Using the previously determined parameters, the flow efficiency was calculated to be 0.29

$$E = \frac{3853.88 - 38.0 - 3800.55}{3853.88 - 3800.55} \\ = 0.29$$

The radius of investigation (OCD Guideline Section IX.15.a) was calculated using the analysis software and was determined to be 6,252 feet at an elapsed shut in time of 37.21 hours.

$$R_{inv} = 0.029 \sqrt{\frac{k \Delta t_s}{\theta \mu c_t}}$$

where,

- k = formation permeability, millidarcies
- Δt_s = elapsed shut-in time, hours
- θ = formation porosity, fraction
- μ = viscosity of the fluid the pressure transient is traveling through, cp
- c_t = total compressibility of the formation plus fluid, psi^{-1}
- 0.029 = constant

$$R_{inv} = 0.029 \sqrt{\frac{597(37.27)}{0.10(0.57)(8.4 \times 10^{-6})}} \\ R_{inv} = 6,252 \text{ft}$$

As indicated on Figure 14, the pressure data departs the radial flow region at an elapsed time from shut in of 11.6 hours. Another change in slope is seen at an elapsed time from shut in of 56.34 hours. No pressure or temperature anomalies were noted that would cause this type of pressure response observed on the derivative log-log plot (OCD Section VIII.9). A review of the geology of the injection zones (Section 11) indicates that all three of the formations in which the Gaines Well No. 3 injects into have varying thicknesses and porosities within the mapped area. Changes in formation thickness, porosity, and fluid viscosity can cause the slope changes seen on the derivative log-log plot.

The Hall plot (OCD Guideline Section IX.18.h) is presented as Figure 17. No slope changes are seen in the plotted data. The pressure and rate data used in the Hall plot analysis was obtained from May 7, 2011 to June 27, 2011. Data after June 27, 2011 had unrealistic values at several data points, this appeared to be a wireless communication signal interference in the data gathering system.

A comparison of the current analysis results with previous analysis results as well as with the reservoir parameters submitted with the permit application is presented in Table X (OCD Guideline Section IX.19).

On January 27, 2012, a static pressure gradient survey was conducted while pulling the pressure gauges out of the well. Static gradient stops were conducted at 7,660 feet, 7,000 feet, 6,000 feet, 5,000 feet, 4,000 feet, 3,000 feet, 2,000 feet, 1,000 feet, and at the surface. The bottom-hole pressure and temperature, at 7,660 feet, was measured after the well had been shut-in for 2 days and was 3,800.50 psia and 101.04 °F, respectively. The gradient survey is summarized in Table XI. The data are depicted graphically in Figure 18.

16. TEMPERATURE SURVEY

A differential temperature survey was performed on January 27, 2012. The temperature log was run from surface to 9,005 feet, logging depth. The fluid level in the wellbore was at the surface with 462 psia of wellhead pressure. The wellbore temperature at 500 feet was 75.1° F.

The temperature gradient was interrupted at the depth interval of 500 feet to 6,500 feet. At 500 feet the wellbore temperature was approximately 75.1° F. At 6500 feet, the wellbore temperature was approximately 105.7°. This yields a temperature differential of 30.6° F and a temperature gradient of 0.51 psi per 100 feet.

From 6,500 feet to 7,500 feet, the temperature increases from 105.7° F to 112.2° F before reaching the injection interval. Once past the packer at 7,570 feet the temperature starts to decrease from 109.7° F at the packer to 102.8° F at 7,700 feet, and again from 8,300 feet at 107.7° F to 8,550 feet at 99° F. Once below the perforations the temperature rises from 99° F to 140.9° F at 9,000 feet. The final temperature was 140.9 F at 9,004 feet. The differential temperature survey can be found in Appendix N.

**17. NEW MEXICO OIL CONSERVATION DIVISION THREE YEAR
RECORDING KEEPING STATEMENT**

Navajo will keep the raw test data, generated during the testing, on file for a minimum of three years. The raw test data will be made available to OCD upon request.

TABLES

TABLE I
FORMATION WATER ANALYSIS SUMMARY

Chemical	Mewbourn Well No. 1	Chukka Well No. 2	Gaines Well No. 3	Average
Date	July 31, 1998	June 14, 1999	Nov 8, 2006	
Fluoride (mg/l)	2.6	9.7	Not Detected	6.15
Chloride (mg/L)	19,000	15,000	10,447	14,815.67
NO3-N (mg/L)	<10	<10	--	<10
SO4 (mg/L)	2,200	2000	1,908	2,036
CaCO3 (mg/L)	1000	1210	--	1105
Specific Gravity (g/L)	1.034	1.0249	--	1.0295
TDS (mg/L)	33,000	20,000	--	26,500
Specific Conductance (uMHOs/cm)	52,000	43,000	--	47,500
Potassium (mg/L)	213	235	85.5	177.83
Magnesium (mg/L)	143	128	155	142
Calcium (mg/L)	390	609	393	464
Sodium (mg/L)	12,770	8,074	6,080	8,974.67
pH (s.u.)	8.1	7.2	--	7.65

The data in the above table was referenced from "Discharge Plan Application and Application for Authorization to Inject per Oil Conservation Division Form C-108, into Class I Wells WDW-1 and Proposed WDW-2 and WDW-3" and the "Discharge Permit Approval Conditions", "Reentry and Completion Report Waste Disposal Well No. 2", and "Reentry and Completion Report Waste Disposal Well No. 3".

TABLE II

Tabulation of Wells Within One Mile Area of Review

ID	NO	API	Unit	TOWNS			WELL			DATE - Comp or Plug						
				Sec	HIP	RNG	NS FTG	EW FTG	WELL NAME	OPERATOR	TYPE	STATUS	PLUG DATE			
1	30-015-00693	A	36	175	27E	330N	330E	27E	330E	DELHI #001	GEORGE A CHASE & C SERVICE	O	T/A	6/24/1948	8/30/1941	
2	30-015-00694	A	36	175	27E	990N	990E	27E	990N	STATE #013	DELHI OIL CORP.	O			6/24/1948	
3	30-015-00646	A	36	175	27E	990N	330E	27E	990N	DELHI #007	GEORGE A CHASE & C SERVICE	O	T/A		4/21/1950	
4	30-015-00668	G	36	175	27E	1650N	2310E	27E	1650N	SOUTH RED LAKE GRAYBURG UNIT #010	LEGACY RESERVES OPERATING, LP	O	SHUT IN		12/16/1947	
5	30-015-00690	G	36	175	27E	1830N	2205E	27E	1830N	CONKLIN #002	GEORGE A CHASE & C SERVICE	O	ACTIVE		3/6/1949	
6	30-015-00667	G	36	175	27E	2310N	2310E	27E	2310N	SOUTH RED LAKE GRAYBURG UNIT #011	FAIRWAY RESOURCES OPERATING INC	I	ACTIVE		3/23/1949	
7	30-015-00666	G	36	175	27E	2310N	2310E	27E	2310N	CONKLIN #001	GEORGE A CHASE & C SERVICE	O	P&A	N/A	1/10/1942	
8	30-015-00689	H	36	175	27E	1650N	330E	27E	1650N	GATES STATE #001	GEORGE A CHASE JR & C SERVICE	O	ACTIVE		8/4/1950	
9	30-015-00647	H	36	175	27E	1650N	990E	27E	1650N	GATES STATE #002	ASPEN OIL INC	O	ACTIVE	10/21/2003	10/21/2003	
10	30-015-00669	H	36	175	27E	2310N	330E	27E	2310N	HOMAN #001	GEORGE A CHASE JR & C SERVICE	O	P&A	5/6/2008	5/6/2008	
11	30-015-00688	I	36	175	27E	2310S	330E	27E	2310S	RAMAPO #001	KERSEY & CO	O	P&A	10/28/1941	10/28/1941	
12	30-015-00670	I	36	175	27E	2970N	330E	27E	2970N	RAMAPO #003	KERSEY & CO	O	P&A	1/3/1950	1/3/1950	
13	30-015-00687	I	36	175	27E	2310S	990E	27E	2310S	RAMAPO #002	KERSEY & CO	G	P&A	5/7/1948	5/7/1948	
14	30-015-00685	I	36	175	27E	1650S	330E	27E	1650S	EMPIRE ABO UNIT G #020	ARCO OIL & GAS	O	P&A	7/10/1989	7/10/1989	
15	30-015-00671	J	36	175	27E	2310S	2310E	27E	2310S	RAMAPO #003	ROJO GRANDE COMPANY LLC	O	P&A	1/24/2000	2/13/1942	
16	30-015-01221	J	36	175	27E	2300S	2300E	27E	2300S	SOUTH RED LAKE GRAYBURG UNIT #023	MCQUADRANGLE, LC	O	ZONE ABAN	8/13/2002	2/27/1948	
17		J	36	175	27E					DOOLEY STATE #3	MARTIN YATES III	O	ZONE ABAN		4/22/1961	
18	30-015-05934	J	36	175	27E	1650S	1650E	27E	1650S	EMPIRE ABO UNIT #019A	BP AMERICA PRODUCTION COMPANY	O	ACTIVE		2/26/1961	
19	30-015-01220	K	36	175	27E	2310S	2330W	27E	2310S	SOUTH RED LAKE GRAYBURG UNIT #022	MCQUADRANGLE, LC	O	ZONE ABAN	7/17/2002	2/3/1949	
20	30-015-00674	K	36	175	27E	2310S	2310W	27E	2310S	RAMAPO #002	ROJO GRANDE COMPANY LLC	O	ACTIVE		5/15/1947	
21	30-015-01219	K	36	175	27E	2310S	1650W	27E	2310S	SOUTH RED LAKE GRAYBURG UNIT #021	MCQUADRANGLE, LC	I	ACTIVE		1/20/1948	
22	30-015-23913	K	36	175	27E	1650S	1650W	27E	1650S	SOUTH RED LAKE GRAYBURG UNIT #043	MCQUADRANGLE, LC	O	ACTIVE		12/11/1981	
23		K	36	175	27E					DOOLEY STATE ABO #3	MARTIN YATES III	O	ACTIVE		4/19/1961	
24	30-015-00673	K	36	175	27E	1650S	2310W	27E	1650S	RAMAPO #001	ROJO GRANDE COMPANY LLC	O	ZONE ABAN	1/24/2000	1/24/2000	
25	30-015-00682	N	36	175	27E	990S	1650W	27E	990S	RAMAPO #004	ROJO GRANDE COMPANY LLC	O	ZONE ABAN	1/24/2000	1/24/2000	
26	30-015-00683	N	36	175	27E	965S	1650W	27E	965S	SOUTH RED LAKE GRAYBURG UNIT #028	FAIRWAY RESOURCES OPERATING INC	I	ACTIVE		4/16/1948	
27	30-015-01218	N	36	175	27E	330S	2310W	27E	330S	EMPIRE ABO UNIT #018	BP AMERICA PRODUCTION COMPANY	O	P&A	3/11/2009	3/11/2009	
28	30-015-00684	O	36	175	27E	990S	2310E	27E	990S	STATE B-6961 NO. 1-A	BURNHAM OIL COMPANY	O	P&A	5/13/1947	5/13/1947	
29	30-015-01251	O	36	175	27E	660S	1980E	27E	660S	EMPIRE ABO UNIT #019	BP AMERICA PRODUCTION COMPANY	O	P&A	4/27/2009	9/8/1959	
30		I	36	175	27E								MISPLLOT OF 14			
31	30-015-00677	P	36	175	27E	330S	990E	27E	330S	EMPIRE ABO UNIT #020	BP AMERICA PRODUCTION COMPANY	O	P&A	4/10/2009	4/13/2009	
32	30-015-01616	P	30	175	28E	330S	990E	28E	330S	BLAKE STATE #001	APACHE CORPORATION	O	ACTIVE		3/7/1953	
33	30-015-01638	A	31	175	28E	330N	990E	28E	330N	STATE NO. 1	BEDINGFIELD, MALCO, RESLER	O	P&A	7/15/1952	7/15/1952	
34	30-015-21594	B	31	175	28E	330N	1650E	28E	330N	POWCO STATE #001	FINNEY OIL COMPANY	O	ACTIVE		11/15/1975	
35	30-015-01636	C	31	175	28E	330N	2310E	28E	330N	DELHI-STATE NO. 1	BEDINGFIELD, J E	O	P&A	12/23/1952	12/23/1952	
36	30-015-25621	B	31	175	28E	980N	1620E	28E	980N	POWCO STATE #002	FINNEY OIL COMPANY	O	ACTIVE		7/15/1986	
37	30-015-01633	1	31	175	28E	330N	330W	28E	330N	ASTON & FAIR A #001	GEORGE A CHASE JR DBA G AND C SERVICE	O	ACTIVE		6/23/1942	
38	30-015-01634	D	31	175	28E	350N	345W	28E	350N	STATE 31 NO. 1X	ASTON & FAIR	O	NO COMPL	1/5/1946	1/5/1946	
39	30-015-01645	F	31	175	28E	990N	990W	28E	990N	BEDINGFIELD STATE 1 NO. 1	MCLAUGHLIN, C T	O	P&A	2/16/1950	2/16/1950	
40	30-015-02666	2	31	175	28E	2310N	330W	28E	2310N	HUDSON SAKIN STATE #001	APACHE CORPORATION	O	P&A	5/29/1948	5/29/1948	
41	30-015-24887	2	31	175	28E	2310N	990W	28E	2310N	HUDSON SAKIN STATE #002	APACHE CORPORATION	O	ACTIVE		7/7/1984	
42	30-015-01643	F	31	175	28E	2310N	2260W	28E	2310N	EMPIRE ABO UNIT #022	BP AMERICA PRODUCTION COMPANY	O	P&A	7/10/2009	6/7/1960	
43	30-015-01635	F	31	175	28E	2310N	2310W	28E	2310N	ASTON & FAIR #001Y	GEORGE A CHASE JR DBA G AND C SERVICE	O	ACTIVE		5/8/1948	
44	30-015-01637	G	31	175	28E	2310N	2310E	28E	2310N	MALCO STATE #001	GEORGE A CHASE JR DBA G AND C SERVICE	O	ACTIVE		10/12/1953	
45	30-015-01652	G	31	175	28E	2288N	1625E	28E	2288N	BOLING #001	KERSEY & CO	O	ACTIVE		8/10/1960	
46	30-015-10537	H	31	175	28E	2277N	330E	28E	2277N	330E	LIME ROCK RESOURCES A, L.P.	O	ACTIVE		9/23/1965	
47	30-015-10833	I	31	175	28E	1980S	660E	28E	1980S	660E	LIME ROCK RESOURCES A, LP	O	ACTIVE		6/17/1966	
48	30-015-01644	I	31	175	28E	1650S	330E	28E	1650S	330E	EMPIRE ABO UNIT #024A	BP AMERICA PRODUCTION COMPANY	O	P&A	6/12/2009	4/29/1960
49	30-015-01642	J	31	175	28E	1650S	2310E	28E	1650S	2310E	STATE FW #001	APACHE CORPORATION	O	ACTIVE		12/23/1962
50	30-015-01650	J	31	175	28E	1650S	1958E	28E	1650S	1958E	EMPIRE ABO UNIT #023A	BP AMERICA PRODUCTION COMPANY	O	P&A	9/17/2003	9/17/2003

TABLE II

Tabulation of Wells Within One Mile Area of Review

ID	NO	API	Unit	TOWNS			HIP	RNG	NS	FTG	EW	FTG	WELL NAME	OPERATOR	WELL TYPE	PLUG DATE	STATUS	DATE - Comp or Plug
				Sect	No.	Unit												
51	30-015-01651	K	31	17S	28E	1650S	2387W	EMPIRE ABO UNIT #022B	BP AMERICA PRODUCTION COMPANY	O	10/22/2009	P&A	4/10/1960					
52	30-015-01640	3	31	17S	28E	2310S	330W	RAMPO #002	APACHE CORPORATION	O		ACTIVE	7/16/1955					
53	30-015-01648	3	31	17S	28E	1651S	1089E	EMPIRE ABO UNIT #021A	BP AMERICA PRODUCTION COMPANY	O	8/24/2002	ZONE ABAN	8/24/2002					
54	30-015-01639	4	31	17S	28E	990S	330W	RAMPO #001	APACHE CORPORATION	O		ACTIVE	5/1/1948					
55	30-015-01647	4	31	17S	28E	660S	660W	EMPIRE ABO UNIT #021	BP AMERICA PRODUCTION COMPANY	O	7/23/2005	P&A	1/31/1960					
56	30-015-01646	N	31	17S	28E	660S	2082W	EMPIRE ABO UNIT #022A	BP AMERICA PRODUCTION COMPANY	O		P&A	1/22/1960					
57	30-015-10118	N	31	17S	28E	766S	2188W	STATE FV #001	APACHE CORPORATION	O		ACTIVE	3/1/1963					
58	30-015-01653	O	31	17S	28E	990S	1650E	PARKER-STATE NO. 1	OTIS A ROBERTS	O	1/18/1942	P&A	1/18/1942					
59	30-015-27592	O	31	17S	28E	660S	2310E	WDW #001	NAVAJO REFINING CO. PIPELINE DIVISION	I		ACTIVE	8/4/1998					
60	30-015-01649	O	31	17S	28E	660S	1939E	EMPIRE ABO UNIT #023	BP AMERICA PRODUCTION COMPANY	O	8/14/2009	P&A	2/24/1960					
61	30-015-20042	P	31	17S	28E	990S	660E	NORTHWEST ARTESIA UNIT #011	LIME ROCK RESOURCES A, LP	O		ACTIVE	5/8/1967					
62	30-015-01641	P	31	17S	28E	660S	660E	EMPIRE ABO UNIT #024	APACHE CORPORATION	O		ACTIVE	3/12/1960					
63	30-015-01654	D	32	17S	28E	330N	330W	ASTON-STATE NO. 1	BEDINGFIELD, J E	O	5/12/1953	P&A	5/12/1953					
64	30-015-01671	E	32	17S	28E	2280N	978W	EMPIRE ABO UNIT #025B	BP AMERICA PRODUCTION COMPANY	O	8/14/2008	P&A	9/13/1960					
65	30-015-01657	F	32	17S	28E	2280N	1980W	AA STATE NO. 1	APACHE CORPORATION	O		ACTIVE	8/24/1960					
66	30-015-10818	K	32	17S	28E	2310S	2105W	NORTHWEST ARTESIA UNIT #008	SDX RESOURCES INC	O	11/6/2006	P&A	11/6/2006					
67	30-015-01661	K	32	17S	28E	1650S	2310W	EMPIRE ABO UNIT #026B	APACHE CORPORATION	O		ACTIVE	3/27/1960					
68	30-015-10795	L	32	17S	28E	2310S	660W	NORTHWEST ARTESIA UNIT #009	LIME ROCK RESOURCES A, LP	O	5/28/2008	P&A	5/15/1966					
69	30-015-01662	L	32	17S	28E	1650S	990W	EMPIRE ABO UNIT #025A	APACHE CORPORATION	O		ACTIVE	4/13/1960					
70	30-015-20043	M	32	17S	28E	990S	760W	NORTHWEST ARTESIA UNIT #012	APACHE CORPORATION	O		T/A	5/9/1967					
71	30-015-01660	M	32	17S	28E	660S	660W	EMPIRE ABO UNIT #025	BP AMERICA PRODUCTION COMPANY	O	1/14/2009	P&A	3/5/1960					
72	30-015-10834	N	32	17S	28E	990S	2030W	NORTHWEST ARTESIA UNIT #013	SDX RESOURCES INC	O	9/15/2006	P&A	9/15/2006					
73	30-015-01659	N	32	17S	28E	660S	1980W	EMPIRE ABO UNIT #026A	APACHE CORPORATION	O		ACTIVE	2/14/1960					
74	30-015-21539	N	32	17S	28E	150S	1400W	EMPIRE ABO UNIT #261	APACHE CORPORATION	O		ACTIVE	7/25/1975					
75	30-015-22009	O	32	17S	28E	330S	2481E	EMPIRE ABO UNIT #272	APACHE CORPORATION	O		ACTIVE	7/18/1977					
76	30-015-02606	3	5	18S	28E	330N	1941W	EMPIRE ABO UNIT #026E	BP AMERICA PRODUCTION COMPANY	O	6/16/2009	P&A	7/18/1960					
77	30-015-22697	3	5	18S	28E	1080N	1914W	EMPIRE ABO UNIT #261A	APACHE CORPORATION	O		ACTIVE	1/4/1979					
78	30-015-02607	4	5	18S	28E	660N	660W	EMPIRE ABO UNIT #025C	APACHE CORPORATION	O		ACTIVE	3/27/1960					
79	30-015-22750	4	5	18S	28E	660N	150W	EMPIRE ABO UNIT #251	APACHE CORPORATION	O		ACTIVE	1/12/1979					
80	30-015-02608	E	5	18S	28E	1660N	330W	STATE E AI #001	CONOCOPHILLIPS COMPANY	O	1/13/2006	P&A	1/13/2006					
81	30-015-24485	E	5	18S	28E	1980N	990W	ILLINOIS CAMP A COM #001	CONOCOPHILLIPS COMPANY	G		ACTIVE	8/10/1983					
82	30-015-02602	F	5	18S	28E	1650N	1650W	EMPIRE ABO UNIT #026D	APACHE CORPORATION	O		ACTIVE	12/30/1959					
83	30-015-25522	L	5	18S	28E	2240S	400W	WALTER SOLT STATE #001	APACHE CORPORATION	S		ACTIVE	8/12/1983					
84	30-015-10244	L	5	18S	28E	2310S	330W	STATE AG #001	MACK ENERGY CORP	O	3/27/2001	ZONE ABAN	3/27/2001					
87	30-015-20019	1	6	18S	28E	330N	330E	NORTHWEST ARTESIA UNIT #016	LIME ROCK RESOURCES A, LP	O		ACTIVE	3/14/1967					
88	30-015-02615	1	6	18S	28E	660N	660E	EMPIRE ABO UNIT #024B	APACHE CORPORATION	O		ACTIVE	2/29/1960					
89	30-015-02625	2	6	18S	28E	470N	2170E	EMPIRE ABO UNIT #023C	APACHE CORPORATION	O		T/A	12/21/1959					
90	30-015-21542	2	6	18S	28E	1260N	1580E	EMPIRE ABO UNIT #231	APACHE CORPORATION	O		ACTIVE	11/1/1975					
91	30-015-02621	3	6	18S	28E	660N	1980W	EMPIRE ABO UNIT #022E	APACHE CORPORATION	O		ACTIVE	12/29/1959					
92	30-015-21626	G	6	18S	28E	1361N	2531E	EMPIRE ABO UNIT #231A	APACHE CORPORATION	O		SHUT IN	10/22/1975					
93	30-015-02613	4	6	18S	28E	990N	660W	EMPIRE ABO UNIT #021B	APACHE CORPORATION	O		ACTIVE	12/30/1959					
94	30-015-23116	5	6	18S	28E	2050N	100W	EMPIRE ABO UNIT #213	APACHE CORPORATION	O		ACTIVE	6/2/1980					
95	30-015-02619	5	6	18S	28E	1990N	660W	EMPIRE ABO UNIT #021C	APACHE CORPORATION	O		ACTIVE	10/30/1959					
96	30-015-22637	5	6	18S	28E	2450N	400W	EMPIRE ABO UNIT #212	APACHE CORPORATION	O		ACTIVE	12/28/1978					
97	30-015-21395	5	6	18S	28E	2630N	1300W	EMPIRE ABO UNIT #211	APACHE CORPORATION	O		ACTIVE	2/11/1975					
98	30-015-22012	F	6	18S	28E	1350N	1572W	EMPIRE ABO UNIT #222	APACHE CORPORATION	O		ACTIVE	3/13/1977					
99	30-015-02626	F	6	18S	28E	1650N	1650W	STATE NO. 1	SARKIN, DAVID C & OLIVER, HENRY F	O	2/21/1942	P&A	2/21/1942					
100	30-015-10107	F	6	18S	28E	1874N	1874W	STATE FX #001	DORAL ENERGY CORP	O		ACTIVE	8/8/1963					
101	30-015-02620	F	6	18S	28E	1990N	2082W	EMPIRE ABO UNIT #022D	APACHE CORPORATION	O		ACTIVE	11/26/1959					
102	30-015-22527	F	6	18S	28E	2630N	1930W	EMPIRE ABO UNIT #223	APACHE CORPORATION	O		ACTIVE	5/19/1978					

Tabulation of Wells Within One Mile Area of Review

ID	NO	API	Unit	TOWNS		RNG	NS	FTG	EW	FTG	WELL NAME	OPERATOR	WELL TYPE	PLUG DATE	STATUS	DATE - Comp or Plug
				Sect	HIP											
103	30-015-21746	F	6	18S	28E	2610N	2713W	EMPIRE ABO UNIT #221	APACHE CORPORATION	O	ACTIVE	4/23/1976				
104	30-015-22913	G	6	18S	28E	1750N	1600E	EMPIRE ABO UNIT #235	APACHE CORPORATION	O	ACTIVE	7/8/1979				
105	30-015-22593	G	6	18S	28E	1900N	2441E	EMPIRE ABO UNIT #234	BP AMERICA PRODUCTION COMPANY	O	12/3/2008 P&A	8/27/1978				
106	30-015-02614	G	6	18S	28E	1980N	1980E	EMPIRE ABO UNIT #023B	APACHE CORPORATION	O	ACTIVE	1/26/1960				
107	30-015-21737	G	6	18S	28E	2253N	1576E	EMPIRE ABO UNIT #232	BP AMERICA PRODUCTION COMPANY	O	5/7/2009 P&A	4/13/1976				
108		H	6	18S	28E						MISPLLOT OF 107					
109	30-015-22490	G	6	18S	28E	2550N	2050E	EMPIRE ABO UNIT #233	BP AMERICA PRODUCTION COMPANY	O	4/3/2009 P&A	6/5/1978				
110	30-015-02616	H	6	18S	28E	1650N	990E	EMPIRE ABO UNIT #024C	APACHE CORPORATION	O	ACTIVE	3/24/1960				
111	30-015-23547	H	6	18S	28E	1950N	660E	EMPIRE ABO UNIT #241	BP AMERICA PRODUCTION COMPANY	O	9/19/2008 P&A	4/12/1981				
112	30-015-02617	I	6	18S	28E	2310S	990E	EMPIRE ABO UNIT #024K	BP AMERICA PRODUCTION COMPANY	O	12/12/2002 P&A	12/12/2002				
113	30-015-22528	J	6	18S	28E	2300S	1570E	EMPIRE ABO UNIT #232A	BP AMERICA PRODUCTION COMPANY	O	4/7/2009 P&A	2/5/1979				
114	30-015-02611	J	6	18S	28E	2310S	2310E	STATE NO. 1	BARNEY COCKBURN	O	8/15/1949 P&A	8/15/1949				
115	30-015-02628	J	6	18S	28E	2260S	2270E	EMPIRE ABO UNIT #023D	BP AMERICA PRODUCTION COMPANY	O	ACTIVE	5/23/1979				
116	30-015-22491	J	6	18S	28E	1700S	2350E	EMPIRE ABO UNIT #231B	BP AMERICA PRODUCTION COMPANY	O	9/2/2009 P&A	8/13/1978				
117	30-015-02618	J	6	18S	28E	1647S	2076E	CAPITOL STATE NO. 1	MILLER BROS OIL CO	G	3/21/1955 P&A	3/21/1955				
118	30-015-02623	K	6	18S	28E	2248S	2075W	EMPIRE ABO UNIT #022F	APACHE CORPORATION	O	ACTIVE	2/22/1960				
119		K	6	18S	28E						MISPLLOT					
120		L	6	18S	28E			WDW-2 (ORIGINAL LOCATION)	NAVAJO REFINING COMPANY							
121	30-015-02622	G	6	18S	28E	2219S	660W	EMPIRE ABO UNIT #021D	APACHE CORPORATION	O	ACTIVE	1/23/1960				
122	30-015-23548	G	6	18S	28E	1950S	1000W	EMPIRE ABO UNIT #211A	APACHE CORPORATION	O	ACTIVE	7/17/1980				
123	30-015-02627	7	6	18S	28E	949S	990W	STATE M-AI #002	RUTH OIL CO, LLC	O	ACTIVE	10/21/1960				
124	30-015-26943	7	6	18S	28E	990S	730W	CHALK BLUFF 6 STATE #001	MEWBOURNE OIL CO	G	ACTIVE	4/16/1992				
125	30-015-02610	N	6	18S	28E	955S	1750W	EMPIRE ABO UNIT #022C	APACHE CORPORATION	O	ACTIVE	8/5/1960				
126	30-015-02624	O	6	18S	28E	968S	2270E	STATE CD NO. 1	PAN AMERICAN PETROLEUM CO	O	5/1/1961 P&A	5/1/1961				
127	30-015-25503	P	6	18S	28E	660S	330E	KIMBERLY STATE NO. 1	DICKSON PETROLEUM CO	O	12/30/1985 P&A	12/30/1985				
128	30-015-02612	P	6	18S	28E	330S	330E	STATE NO. 1	D & H OIL CO	O	5/13/1952 P&A	5/13/1952				
129	30-015-01215	1	1	18S	27E	667N	666E	EMPIRE ABO UNIT #020D	APACHE CORPORATION	O	ACTIVE	11/5/1959				
130	30-015-00708	2	1	18S	27E	660N	1980E	EMPIRE ABO UNIT #019B	LIME ROCK RESOURCES II-A, L.P.	O	ACTIVE	7/7/1959				
131		C	1	18S	27E			HILL #4	MALCO REFINERIES		5/10/1948 P&A	5/10/1948				
132		C	1	18S	27E						MISPLLOT					
133	30-015-00710	3	1	18S	27E	660N	1980W	AAO FEDERAL No. 013	ALAMO PERMIAN RESOURCES, LLC	O	ACTIVE	7/21/2004				
134	30-015-26741	F	1	18S	27E	1650N	1350W	CHALK BLUFF FEDERAL COM #002	MEWBOURNE OIL CO	G	ACTIVE	8/24/1991				
135	30-015-00706	F	1	18S	27E	2310N	1980W	EMPIRE ABO UNIT #018A	ALAMO PERMIAN RESOURCES, LLC	O	ACTIVE	5/31/1959				
136	30-015-00709	G	1	18S	27E	1980N	1980E	EMPIRE ABO UNIT #019C	ALAMO PERMIAN RESOURCES, LLC	O	ACTIVE	8/2/1959				
137		G	1	18S	27E						MISPLLOT					
138	30-015-21552	G	1	18S	27E	2500N	2500E	EMPIRE ABO UNIT #191	CFM OIL, LLC	O	ACTIVE	9/7/1975				
139	30-015-00711	H	1	18S	27E	1980N	660E	EMPIRE ABO UNIT #020C	ALAMO PERMIAN RESOURCES, LLC	O	ACTIVE	10/13/1959				
140	30-015-21783	H	1	18S	27E	2490N	1299E	EMPIRE ABO UNIT #202	ALAMO PERMIAN RESOURCES, LLC	O	ACTIVE	5/13/1976				
141	30-015-22656	H	1	18S	27E	2400N	700E	EMPIRE ABO UNIT #203	APACHE CORPORATION	O	ACTIVE	10/10/1978				
142		H	1	18S	27E			CRONIN #1	MANHATTAN OIL		7/1/2027 P&A	7/1/1927				
143	30-015-21553	H	1	18S	27E	2501N	20E	EMPIRE ABO UNIT #201	ALAMO PERMIAN RESOURCES, LLC	O	ACTIVE	7/19/1975				
144	30-015-27163	I	1	18S	27E	1980S	990E	CHALK BLUFF FEDERAL COM #003	MEWBOURNE OIL CO	G	ACTIVE	1/16/1993				
145	30-015-00697	I	1	18S	27E	1980S	660E	EMPIRE ABO UNIT #020K	BP AMERICA PRODUCTION COMPANY	O	1/5/2003 P&A	1/5/2003				
146	30-015-22657	J	1	18S	27E	2490S	2200E	EMPIRE ABO UNIT #193	ALAMO PERMIAN RESOURCES, LLC	O	ACTIVE	10/26/1978				
147	30-015-00696	J	1	18S	27E	1980S	1980E	EMPIRE ABO UNIT #019Q	ALAMO PERMIAN RESOURCES, LLC	O	ACTIVE	8/20/1959				
148	30-015-22560	J	1	18S	27E	220S	1390E	EMPIRE ABO UNIT #192	BP AMERICA PRODUCTION COMPANY	O	ACTIVE	6/25/1978				
149	30-015-21873	J	1	18S	27E	1526S	1470E	EMPIRE ABO UNIT #191A	ALAMO PERMIAN RESOURCES, LLC	O	ACTIVE	9/23/1976				
150	30-015-22658	J	1	18S	27E	1500S	2130E	EMPIRE ABO UNIT #194	APACHE CORPORATION	O	ACTIVE	11/14/1978				
151	30-015-22559	K	1	18S	27E	2290S	2445W	EMPIRE ABO UNIT #184	APACHE CORPORATION	O	SHUT IN	7/25/1978				
152	30-015-22096	K	1	18S	27E	2370S	1510W	EMPIRE ABO UNIT #183	APACHE CORPORATION	O	ACTIVE	7/24/1977				

Tabulation of Wells Within One Mile Area of Review

ID	NO	API	Unit	TOWNS		RNG	NS FTG	EW FTG	WELL NAME	OPERATOR	WELL TYPE	PLUG DATE	STATUS	DATE - Comp or Plug
				Sect	HIP									
153	30-015-21554	K	1	18S	27E	1367S	1440W	EMPIRE ABO UNIT #181	BP AMERICA PRODUCTION COMPANY	O	4/17/2003	P&A	4/17/2003	4/17/2003
154	30-015-00707	K	1	18S	27E	1980S	1980W	EMPIRE ABO UNIT #018B	APACHE CORPORATION	O		ACTIVE	5/22/1959	5/22/1959
155	30-015-21792	K	1	18S	27E	1533S	2370W	EMPIRE ABO UNIT #182	LIME ROCK RESOURCES A, L.P.	O		ACTIVE	6/1/1976	6/1/1976
156	30-015-00713	N	1	18S	27E	995S	1644W	EMPIRE ABO UNIT #018D	BP AMERICA PRODUCTION COMPANY	O	9/27/2003	P&A	9/27/2003	9/27/2003
157	30-015-26575	N	1	18S	27E	790S	2250W	WDW-3	NAVAJO REFINING COMPANY	I		ACTIVE	3/7/1991	3/7/1991
158	30-015-20394	O	1	18S	27E	953S	2197E	EMPIRE ABO FEDERAL NO. 5	HUMBLE OIL & REFINING CO	O	4/9/1971	P&A	4/9/1971	4/9/1971
159	30-015-00698	O	1	18S	27E	660S	1980E	EMPIRE ABO UNIT #191	BP AMERICA PRODUCTION COMPANY	S		ACTIVE	11/8/1959	11/8/1959
160	30-015-00699	P	1	18S	27E	940S	330E	EMPIRE ABO UNIT #020B	APACHE CORPORATION	O		ACTIVE	12/2/1961	12/2/1961
161	30-015-26404	A	12	18S	27E	660N	990E	FEDERAL T #001	APACHE CORPORATION	I		ACTIVE	9/13/1990	9/13/1990
162	30-015-25099	H	12	18S	27E	1809N	990E	COMSTOCK FEDERAL #006	HARLOW ENTERPRISES LLC	O		ACTIVE	9/11/1985	9/11/1985
165	30-015-25997	C	7	18S	28E	940N	1757W	LAUREL STATE #001	EASTLAND OIL CO	O		ACTIVE	2/23/1987	2/23/1987
166	30-015-25675	2	7	18S	28E	940N	1757W	LAUREL STATE #002	EASTLAND OIL CO	O		ACTIVE	11/10/1988	11/10/1988
167	30-015-25236	F	7	18S	28E	1980N	1980W	STATE BY #001	MOREXCO INC	O		ACTIVE	6/10/1985	6/10/1985
168	30-015-22636	J	7	18S	28E	1950N	1300W	PRE-ONGUARD WELL #213	DYAD PE	O		ABAN LOCATION		
169	30-015-22635	J	8	18S	28E	1900N	100W	PRE-ONGUARD WELL #212	DYAD PE	O		ABAN LOCATION		
170	30-015-24372	J	8	18S	28E	1980S	990E	PRE-ONGUARD WELL #001	DYAD PE	O		ABAN LOCATION		
171	30-015-27636	H	7	18S	28E	2310N	810E	CHALK BLUFF 6 STATE #002	PHILLIPS PETROLEUM	O		ABAN LOCATION		
353	30-015-27286	M	36	17S	27E	660S	990W	CHALK BLUFF 36 STATE #001	MEWBOURNE OIL CO	O		ABAN LOCATION		
354	30-015-24612	M	36	17S	27E	790S	990W	STATE M #001	PRONGHORN MANAGEMENT CORP	O	4/21/2009	P&A	3/30/1993	3/30/1993
355	30-015-00676	M	36	17S	27E	330N	990W	EMPIRE ABO UNIT #017	LIME ROCK RESOURCES A, L.P.	O		ACTIVE	10/11/1983	10/11/1983
356	30-015-10184	M	36	17S	27E	330S	920W	STATE #006	ASPEN OIL INC	O		ACTIVE		
358	30-015-21623	M	36	17S	27E	360S	455W	STATE #007	GEORGE A CHASE JR & C SERVICE	O		ACTIVE		
359	30-015-00662	M	36	17S	27E	330S	330W	STATE NO. 2	ACREY, B L & F D	O		ACTIVE		
595	30-015-02605	B	5	18S	28E	930N	2271E	EMPIRE ABO UNIT NO. 27 E	BP AMERICA PRODUCTION UNIT	O	10/15/1942	P&A	10/15/1942	10/15/1942
748	30-015-00715	4	1	18S	27E	330N	330W	SOUTH RED LAKE GRAYBURG UNIT #037	LEGACY RESERVES OPERATING LP	O	6/12/2009	P&A	3/30/1960	3/30/1960
748	30-015-00701	D	1	18S	27E	330N	330W	SOUTH RED LAKE GRAYBURG UNIT 37 WW	FAIRWAY RESOURCES OPERATING LLC	I		ACTIVE		
749	30-015-00712	D	1	18S	27E	647N	667W	EMPIRE ABO UNIT I NO. 17	ARCO OIL & GAS	O		ACTIVE		
750		E	1	18S	27E	1650N	330W	BRAINARD	JONES	O	1/24/1987	P&A	1/24/1987	1/24/1987
751	30-015-00704	E	1	18S	27E	1980N	660W	EMPIRE ABO UNIT J NO. 17	ARCO OIL & GAS	O	5/10/1939	P&A	5/10/1939	5/10/1939
752	30-015-00703	L	1	18S	27E	1980S	660W	EMPIRE ABO UNIT #017A	BP AMERICA PRODUCTION COMPANY	O	3/26/1959	P&A	3/26/1959	3/26/1959
753	30-015-22815	M	1	18S	27E	670S	330W	EMPIRE ABO UNIT #171	LIME ROCK RESOURCES A, L.P.	O	3/27/2009	P&A	5/22/1995	5/22/1995
754		M	1	18S	27E					O		ACTIVE	5/22/1979	5/22/1979
755	30-015-00714	N	1	18S	27E			HILL #1	VALLEY REFINING CO			MISPLOT OF 756		
756	30-015-00705	M	1	18S	27E	990S	660W	EMPIRE ABO UNIT #017B	BP AMERICA PRODUCTION COMPANY	O	12/20/1943	P&A	12/20/1943	12/20/1943
757		A	2	18S	27E	330N	610E	STATE 2	BRAINARD & GUY	O	7/21/2004	P&A	6/25/1959	6/25/1959
758	30-015-00721	1	2	18S	27E	330N	990E	SOUTH RED LAKE GRAYBURG UNIT #036	FAIRWAY RESOURCES OPERATING LLC	O	1/31/1942	NO COMPL	1/31/1942	1/31/1942
765	30-015-00724	1	2	18S	27E	990N	330E	EMPIRE ABO UNIT #016B	LIME ROCK RESOURCES A, L.P.	O		PROD	11/6/1947	11/6/1947
766	30-015-00737	B	2	18S	27E	905N	1601E	SOUTH RED LAKE GRAYBURG UNIT #038	FAIRWAY RESOURCES OPERATING LLC	O		ACTIVE		
772	30-015-00745	H	2	18S	27E	1980N	660E	STATE H #001	MACK ENERGY CORPORATION	O		ACTIVE	5/23/1948	5/23/1948
773	30-015-00742	H	2	18S	27E	1650N	990E	SOUTH RED LAKE GRAYBURG UNIT 39 WW	S&J OPERATING COMPANY	O	3/7/2008	P&A	3/7/2008	3/7/2008
774	30-015-00740	G	2	18S	27E	1650N	2197E	SOUTH RED LAKE GRAYBURG UNIT #040	MCQUADRANGLE, LC	O	2/8/1991	P&A	2/8/1991	2/8/1991
778		G	2	18S	27E	2310N	1650E	HUDSON #2	MCQUADRANGLE, LC	I	7/10/2002	P&A	7/10/2002	7/10/2002
779	30-015-00741	G	2	18S	27E	2310N	1980E	EMPIRE ABO UNIT #015B	RUTTER & WILBANKS	O		ACTIVE	1/1/1957	1/1/1957
781		J	2	18S	27E	2310S	2310E	STATE B-2	APACHE CORPORATION	O		ACTIVE	6/6/1959	6/6/1959
785	30-015-00717	I	2	18S	27E	1980S	660E	EMPIRE ABO UNIT #016	MALCO REFINING CO	O	1/1/1947	P&A	1/1/1947	1/1/1947
786	30-015-00716	J	2	18S	27E	1980S	1830E	EMPIRE ABO UNIT #015	APACHE CORPORATION	O		ACTIVE	2/6/1995	2/6/1995
789	30-015-22896	K	2	18S	27E	1820S	2550W	EMPIRE ABO UNIT #143A	APACHE CORPORATION	O		ACTIVE	3/23/1959	3/23/1959
791	30-015-22914	I	2	18S	27E	1310S	590E	EMPIRE ABO UNIT #161	WALTER SOLT, LLC	O		ACTIVE	5/13/1979	5/13/1979
792		O	2	18S	27E				COG OPERATING, LLC	O		ACTIVE	9/13/1979	9/13/1979
793	30-015-22609	N	2	18S	27E	1200S	1900W	EMPIRE ABO UNIT #143	APACHE CORPORATION	O		MISPLOT OF 814	12/20/1978	12/20/1978

TABLE II

Tabulation of Wells Within One Mile Area of Review

ID	NO	API	Unit No.	Sec	HP	TOWNS	RNG	NS	FTG	EW	FTG	WELL NAME	OPERATOR	WELL TYPE	PLUG DATE	STATUS	DATE - Comp or Plug
795	796	30-015-21544	P	2	18S		27E	1110S	1322E	EMPIRE ABO UNIT #151		EMPIRE ABO UNIT #151	APACHE CORPORATION	O		MISPLUG OF 765	11/4/1975
	797	30-015-22885	O	2	18S		27E	1040S	2025E	EMPIRE ABO UNIT #155		EMPIRE ABO UNIT #155	APACHE CORPORATION	O		T/A	5/1/1979
	799	30-015-00722	P	2	18S		27E	660S	660E	EMPIRE ABO UNIT #016A		EMPIRE ABO UNIT #016A	APACHE CORPORATION	O	2/24/2009	P&A	1/20/1959
	800	30-015-22808	O	2	18S		27E	600S	1330E	EMPIRE ABO UNIT #156		EMPIRE ABO UNIT #156	BP AMERICA PRODUCTION COMPANY	O	2/5/2009	P&A	4/12/1979
	801	30-015-00731	O	2	18S		27E	660S	1980E	EMPIRE ABO UNIT #015A		EMPIRE ABO UNIT #015A	BP AMERICA PRODUCTION COMPANY	O	2/11/2009	P&A	11/19/1958
	802	30-015-22669	O	2	18S		27E	800S	2500E	EMPIRE ABO UNIT #154		EMPIRE ABO UNIT #154	BP AMERICA PRODUCTION COMPANY	O	1/27/2009	P&A	12/4/1978
	805	30-015-22013	O	2	18S		27E	90S	1456E	EMPIRE ABO UNIT #153		EMPIRE ABO UNIT #153	BP AMERICA PRODUCTION COMPANY	O	10/30/2008	P&A	4/20/1977
	806	30-015-21825	O	2	18S		27E	320S	2602E	EMPIRE ABO UNIT #152		EMPIRE ABO UNIT #152	APACHE CORPORATION	O		T/A	6/17/1976
	807	30-015-22608	N	2	18S		27E	100S	1950W	EMPIRE ABO UNIT #142		EMPIRE ABO UNIT #142	BP AMERICA PRODUCTION COMPANY	O		P&A	
	808	30-015-21807	M	2	18S		27E	275S	1243W	EMPIRE ABO UNIT #132		EMPIRE ABO UNIT #132	BP AMERICA PRODUCTION COMPANY	O		(No info on dates)	7/1/1976
	812	30-015-00730	N	2	18S		27E	660S	1980W	EMPIRE ABO UNIT #014		EMPIRE ABO UNIT #014	APACHE CORPORATION	O		ACTIVE	10/21/1958
	813	30-015-00720	A	2	18S		27E	990N	1650E	RIVERWOLF UNIT #004		RIVERWOLF UNIT #004	BP AMERICA PRODUCTION COMPANY	O	12/12/2008	P&A	10/21/1959
	814	30-015-22051	K	2	18S		27E	1370S	2445W	EMPIRE ABO UNIT #141A		EMPIRE ABO UNIT #141A	APACHE CORPORATION	O		ACTIVE	5/17/1977
	836	30-015-00869	A	11	18S		27E	330N	653E	EMPIRE ABO UNIT #016C		EMPIRE ABO UNIT #016C	BP AMERICA PRODUCTION COMPANY	O	10/25/2004	P&A	10/25/2004
	837	30-015-22568	B	11	18S		27E	400N	1450E	EMPIRE ABO UNIT #151B		EMPIRE ABO UNIT #151B	BP AMERICA PRODUCTION COMPANY	O	8/16/2006	P&A	8/16/2006
	838	30-015-22838	B	11	18S		27E	200N	1925E	EMPIRE ABO UNIT #153B		EMPIRE ABO UNIT #153B	BP AMERICA PRODUCTION COMPANY	O	1/4/2009	P&A	5/6/1979
	839	30-015-00868	B	11	18S		27E	660N	1980E	EMPIRE ABO UNIT #015C		EMPIRE ABO UNIT #015C	BP AMERICA PRODUCTION COMPANY	O	7/16/2004	P&A	7/16/2004
	840	30-015-22569	B	11	18S		27E	560N	2588E	EMPIRE ABO UNIT #152B		EMPIRE ABO UNIT #152B	BP AMERICA PRODUCTION COMPANY	O	9/24/2008	P&A	8/23/1978
	841	30-015-22834	C	11	18S		27E	225N	2280W	EMPIRE ABO UNIT #141B		EMPIRE ABO UNIT #141B	APACHE CORPORATION	O		ACTIVE	5/21/1979
	842	30-015-00864	C	11	18S		27E	660N	1980W	EMPIRE ABO UNIT M NO. 14		EMPIRE ABO UNIT M NO. 14	ARCO OIL & GAS	O	9/5/1957	P&A	9/5/1957
	843	30-015-22833	D	11	18S		27E	450N	1175W	EMPIRE ABO UNIT #133B		EMPIRE ABO UNIT #133B	APACHE CORPORATION	O		ACTIVE	5/23/1979
	844	30-015-00867	D	11	18S		27E	660N	660W	EMPIRE ABO UNIT M NO. 13		EMPIRE ABO UNIT M NO. 13	ARCO OIL & GAS	O	4/26/1958	P&A	4/26/1958
	846	30-015-22556	D	11	18S		27E	1100N	1200W	EMPIRE ABO UNIT M NO. 131		EMPIRE ABO UNIT M NO. 131	ARCO OIL & GAS	O	7/10/1978	P&A	7/10/1978
	848	30-015-20510	F	11	18S		27E	1650N	1653W	MALCO S NO. 1		MALCO S NO. 1	AMOCO PRODUCTION CO	O	10/16/1971	P&A	10/16/1971
	849	30-015-00865	F	11	18S		27E	1650N	1980W	EMPIRE ABO UNIT N NO. 14		EMPIRE ABO UNIT N NO. 14	ARCO OIL & GAS	O	2/3/1961	P&A	2/3/1961
	850	30-015-00866	E	11	18S		27E	1980N	660W	EMPIRE ABO UNIT N NO. 131		EMPIRE ABO UNIT N NO. 131	ARCO OIL & GAS	O	3/27/1958	P&A	3/27/1958
	851	30-015-00870	J	11	18S		27E	1980S	1980E	SMITH-MCPHERSON NO. 1		SMITH-MCPHERSON NO. 1	AMOCO PRODUCTION CO	O	9/1/1956	P&A	9/1/1956
	852	30-015-01201	N	11	18S		27E			AN ETZ #3		AN ETZ #3	OSCAR HOWARD	O	4/15/2027	P&A	
	853	30-015-01202	O	11	18S		27E			AN ETZ #2		AN ETZ #2	OSCAR HOWARD	O	2/4/2027	P&A	
	854	30-015-00863	N	11	18S		27E			VICKERS #1		VICKERS #1	B.R. POLK, JR.	O	10/14/1949	P&A	10/14/1949
	855	30-015-24857	M	11	18S		27E	700S	990W	FEDERAL DH GAS COM #001		FEDERAL DH GAS COM #001	CHESAPEAKE OPERATING INC	G		ACTIVE	5/18/1984
	856	30-015-20535	D	12	18S		27E	330N	455W	FEDERAL EA 2		FEDERAL EA 2	ROBERT G COX	O	8/7/1973	P&A	8/7/1973
	857	30-015-00871	D	12	18S		27E	330N	330W	FEDERAL EA #001		FEDERAL EA #001	RHONDA OPERATING CO	O	4/12/1994	P&A	4/12/1994
	858	30-015-23115	D	12	18S		27E	330N	380W	FEDERAL EA NO. 3		FEDERAL EA NO. 3	RHONDA OPERATING CO	O	3/16/1980	D&A	3/16/1980
	859	30-015-25738	G	12	18S		27E	2310N	2310E	COMSTOCK FEDERAL #009		COMSTOCK FEDERAL #009	HARLOW ENTERPRISES LLC	O		ACTIVE	4/25/1987
	860	30-015-25270	F	12	18S		27E	2310N	2310W	CHUKKA FEDERAL #001		CHUKKA FEDERAL #001	BILL MILLER	O		ACTIVE	4/23/1985
	861	30-015-20894	E	12	18S		27E	1980N	660W	WDW #002		WDW #002	NAVAJO REFINING COMPANY	I		ACTIVE	7/18/1973
	862	30-015-00874	J	12	18S		27E	2310S	2355E	COMSTOCK FEDERAL #007		COMSTOCK FEDERAL #007	HARLOW ENTERPRISES LLC	O	2/18/1943	D&A	6/29/1948
	863	30-015-00872	L	12	18S		27E	310S	990W	MAGRUDER NO. 1		MAGRUDER NO. 1	MCKEE-JONES	O		ACTIVE	3/16/1985
	864	30-015-25201	K	12	18S		27E	1650S	1770W	COMSTOCK FEDERAL #002		COMSTOCK FEDERAL #002	HARLOW ENTERPRISES LLC	O	10/10/1986	D&A	
	865	30-015-25649	L	12	18S		27E	1650S	990W	COMSTOCK FEDERAL NO. 8		COMSTOCK FEDERAL NO. 8	FRED POOL DRILLING CO	O		ACTIVE	5/19/1986
	866	30-015-25545	M	12	18S		27E	990S	990W	COMSTOCK FEDERAL #003		COMSTOCK FEDERAL #003	HARLOW ENTERPRISES LLC	O		ACTIVE	2/27/1945
	867	30-015-00873	M	12	18S		27E			MAGRUDER #2		MAGRUDER #2	R.E. MCKEE ET AL	O	2/27/1945	P&A	2/27/1945
	868	30-015-26017	N	12	18S		27E	990S	1650W	COMSTOCK FEDERAL #010		COMSTOCK FEDERAL #010	EASTLAND OIL CO	O	1/23/2003	P&A	1/23/2003
	869	30-015-25100	N	12	18S		27E	330S	1650W	COMSTOCK FEDERAL #001		COMSTOCK FEDERAL #001	HARLOW ENTERPRISES LLC	O		ACTIVE	12/10/1984
	870	30-015-25202	O	12	18S		27E	330S	2310E	COMSTOCK FEDERAL #005		COMSTOCK FEDERAL #005	HARLOW ENTERPRISES LLC	O		ACTIVE	4/19/1985
	871	30-015-06171	I	12	18S		27E	1069S	251E	MICHAEL CRONIN NO. 3		MICHAEL CRONIN NO. 3	PILCHER OIL & GAS	O	5/20/2026	P&A	
	872		P	12	18S		27E			MICHAEL CRONIN #1		MICHAEL CRONIN #1	PILCHER OIL & GAS	O	2/15/1932	P&A	2/15/1932

TABLE II

Tabulation of Wells Within One Mile Area of Review

ID	Unit	TOWNS	NO	API	No.	Sect	HIP	RNG	NS FTG	EW FTG	WELL NAME	OPERATOR	WELL TYPE	PLUG DATE	STATUS	DATE - Comp or Plug
873	30-015-00875	P	12	18S	27E	330S	330E	MAGRUDER NO. B-4	CITIES SERVICE OIL CO	O	7/30/1952	P&A	7/30/1952	7/30/1952	7/30/1952	7/30/1952
874	30-015-00876	P	12	18S	27E	100S	500E	MAGRUDER NO. 5	ROBERT E MCKEE	O	2/8/1954	P&A	2/8/1954	2/8/1954	2/8/1954	2/8/1954
875	30-015-06170	P	12	18S	27E	200S	200E	MICHAEL CRONIN NO. 2	PILCHER OIL & GAS	O	2/22/2026	P&A	2/22/2026	P&A	2/22/2026	P&A
876	30-015-01200	A	13	18S	27E	0	0	STATE NO. 1	HASSENFUSH-DONNELLY	O	1/1/2026	P&A	1/1/2026	P&A	1/1/2026	P&A
877	30-015-06137	A	13	18S	27E	250N	990E	STATE NO. 2	EASTLAND OIL CO	O	1/1/2026	D&A	1/1/2026	D&A	1/1/2026	D&A
878	30-015-25394	C	13	18S	27E	330N	2310W	ARTESIA STATE #002	BILL MILLER	O		ACTIVE			9/28/1985	9/28/1985
879	30-015-25241	C	13	18S	27E	330N	1650W	ARTESIA STATE #001	BILL MILLER	O		ACTIVE			4/13/1985	4/13/1985
880	30-015-00884	C	13	18S	27E	990N	1650W	STATE NO. 3	DALE RESLER	O	1/29/1945	P&A	1/29/1945	1/29/1945	1/29/1945	1/29/1945
881	30-015-25370	D	13	18S	27E	480N	940W	ARTESIA STATE UNIT #002A	APACHE CORPORATION	O		ACTIVE			8/27/1985	8/27/1985
882	30-015-00883	D	13	18S	27E	990N	990W	ARTESIA STATE UNIT #001	APACHE CORPORATION	O		ACTIVE			12/11/1944	12/11/1944
883	30-015-00880	E	13	18S	27E	1650N	990W	STATE NO. 1	DALE RESLER - JONES	O	1/26/1945	P&A	1/26/1945	1/26/1945	1/26/1945	1/26/1945
884	30-015-24881	F	13	18S	27E	1880N	1830W	ANADARKO 13 FEDERAL #001	DAVID G HAMMOND	O	7/17/2011	P&A	7/17/2011	P&A	6/18/1984	6/18/1984
885	30-015-00888	F	13	18S	27E	1980N	1650W	PAGE NO. 1	RALPH NIX & JERRY CURTIS	O	11/28/1954	P&A	11/28/1954	P&A	11/28/1954	11/28/1954
886	30-015-00879	F	13	18S	27E	2310N	1650W	JONES-GOVT NO. 1	DALE RESLER	O	3/14/1945	D&A	3/14/1945	D&A	3/14/1945	3/14/1945
888	30-015-25078	G	13	18S	27E	1724N	2279E	ANADARKO 13 FEDERAL NO. 1	DICKSON PETROLEUM, INC	O	12/30/1984	D&A	12/30/1984	D&A	12/30/1984	12/30/1984
889	30-015-00891	A	14	18S	27E	990N	330E	ARTESIA STATE UNIT TRACT 4 NO. 1	ANADARKO PETROLEUM CORP	O	6/30/1944	P&A	6/30/1944	P&A	6/30/1944	6/30/1944
896	30-015-00893	G	14	18S	27E	1650N	1650E	STATE NO. 1	RESLER	O	1/1/1900	D&A	1/1/1900	D&A	1/1/1900	1/1/1900
897	30-015-00895	H	14	18S	27E	1650N	330W	ARTESIA STATE UNIT #001B	APACHE CORPORATION	O		ACTIVE			2/8/1945	2/8/1945
901	30-015-00695	L	1	18S	27E	1650S	330W	HILL NO. 1	WILLIAM & EDWARD HUDSON	O	6/18/1948	D&A	6/18/1948	D&A	6/18/1948	6/18/1948
910	30-015-00744	J	2	18S	27E	2310S	1640E	STATE 1	COMPTON-SMITH	O		P&A				
911	30-015-31123	H	36	17S	27E	1980N	760E	NO BLUFF 36 STATE COM #002	LIME ROCK RESOURCES A, LP	G		ACTIVE				
912	30-015-31036	H	36	17S	27E	2310N	990E	GATES STATE #003	GEORGE A CHASE JR & C SERVICE	O		ACTIVE				
916	30-015-31592	N	36	17S	27E	330S	2310E	RAMAPO #007	ROJO GRANDE COMPANY LLC	O	12/21/2001	P&A	12/21/2001	P&A	12/21/2001	12/21/2001
917	30-015-30784	A	31	17S	28E	330N	480E	NW STATE #012	LIME ROCK RESOURCES A, LP	O		ACTIVE				
918	30-015-30893	A	31	17S	28E	973N	959E	NW STATE #028	LIME ROCK RESOURCES A, LP	O		ACTIVE				
919	30-015-32162	1	31	17S	28E	460N	990W	ENRON STATE #004	LIME ROCK RESOURCES A, LP	O		ACTIVE				
920	30-015-30783	H	31	17S	28E	1650N	330E	NW STATE #011	LIME ROCK RESOURCES A, LP	O		ACTIVE				
921	30-015-30849	I	31	17S	28E	2310S	270E	NW STATE #009	LIME ROCK RESOURCES A, LP	O		ACTIVE				
922	30-015-30760	P	31	17S	28E	735S	330E	NW STATE #010	LIME ROCK RESOURCES A, LP	O		ACTIVE				
923	30-015-31920	D	32	17S	28E	990N	990W	ENRON STATE #002	APACHE CORPORATION	O		ACTIVE				
924	30-015-30781	K	32	17S	28E	1900S	2146W	NW STATE #005	LIME ROCK RESOURCES A, LP	I		ACTIVE				
925	30-015-30777	L	32	17S	28E	2310S	990W	NW STATE #006	APACHE CORPORATION	O		ACTIVE				
926	30-015-30685	M	32	17S	28E	990S	990W	NW STATE #007	APACHE CORPORATION	O		ACTIVE				
927	30-015-30815	N	32	17S	28E	1090S	2126W	NW STATE #008	LIME ROCK RESOURCES A, LP	I		ACTIVE				
928	30-015-32310	1	1	18S	27E	990N	990E	AAO FEDERAL #004	APACHE CORPORATION	O	5/4/2004	ACTIVE	5/4/2004	5/4/2004	5/4/2004	5/4/2004
929	30-015-32309	2	1	18S	27E	330N	1690E	AAO FEDERAL #003	APACHE CORPORATION	O	4/10/2003	ACTIVE	4/10/2003	4/10/2003	4/10/2003	4/10/2003
930	30-015-32308	3	1	18S	27E	430N	2310W	AAO FEDERAL #002	APACHE CORPORATION	O	9/19/2002	ACTIVE	9/19/2002	9/19/2002	9/19/2002	9/19/2002
931	30-015-32307	4	1	18S	27E	330N	990W	AAO FEDERAL #001	APACHE CORPORATION	O	12/10/2002	ACTIVE	12/10/2002	12/10/2002	12/10/2002	12/10/2002
932	30-015-22816	O	1	18S	27E	1120S	1440E	EMPIRE ABO UNIT L #192	ARCO OIL & GAS	O	6/23/1980	ABAN LOCATION	6/23/1980	6/23/1980	6/23/1980	6/23/1980
933	30-015-20388	N	1	18S	27E	990S	2297E	EMPIRE ABO #5	ARCO OIL & GAS	O	12/31/9999	SAME AS 158	12/31/9999	SAME AS 158	12/31/9999	12/31/9999
934	30-015-27719	I	12	18S	27E	1650S	990E	CHALK BLUFF 12 FED #001	MEWBOURNE OIL CO	O		ABAN LOCATION				
935	30-015-27437	B	14	18S	27E	660N	1980E	BEAUREGARD ANP STATE COM #001	YATES PETROLEUM CORPORATION	G		ABAN LOCATION				
936	30-015-31086	E	5	18S	28E	1650N	990W	LP STATE #001	MARBOB ENERGY CORP	G		ABAN LOCATION				
937	30-015-31109	E	5	18S	28E	2301N	230W	LP STATE #002	APACHE CORPORATION	O	3/11/2008	P&A	3/11/2008	P&A	3/11/2008	3/11/2008
938	30-015-30785	1	6	18S	28E	430N	330E	NW STATE #015	APACHE CORPORATION	O		PROPOSED				
939	30-015-00264	J	6	18S	28E	2310S	2310E	CAPITAL STATE NO. 1	APACHE CORPORATION	O		ACTIVE				
940	30-015-31087	7	6	18S	28E	990S	330W	LP STATE #003	BARNEY COCKBURN	O		SAME AS 114				
941	30-015-31088	7	6	18S	28E	330S	990W	LP STATE #004	MARBOB ENERGY CORP	O	3/17/2008	P&A	3/17/2008	P&A	3/17/2008	3/17/2008
942	30-015-06250	O	6	18S	28E	470S	2170E		MARBOB ENERGY CORP	O		PROPOSED				
943	30-015-31319	3	7	18S	28E	2310N	330W	LAUREL STATE #003	BP AMERICA PRODUCTION COMPANY	O		SAME AS 89				
									EASTLAND OIL CO	O		ACTIVE				

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ID	NO	API	Unit No.	Sect	HIP	TOWNS	RNG	NS	FTG	EW	FTG	WELL NAME	OPERATOR	WELL TYPE	PLUG DATE	STATUS	DATE - Comp or Plug
944	30-015-26575	D	6	18S	28E	778N	995W	WDW-3 (ORIGINAL LOC.)				NAVAJO REFINING COMPANY	I			ACTIVE	10/12/2004
945	30-015-32959	E	1	18S	27E	1650N	875W	AAO FEDERAL #005				APACHE CORPORATION	O			ACTIVE	4/4/2005
946	30-015-33473	G	1	18S	27E	1750N	1650S	AAO FEDERAL #007				MARBOB ENERGY CORP	O			ACTIVE	2/25/2005
947	30-015-33784	H	1	18S	27E	1650N	330W	AAO FEDERAL #008				MARBOB ENERGY CORP	O			ACTIVE	8/5/2005
948	30-015-34071	F	1	18S	27E	2169N	1963W	AAO FEDERAL #009				MARBOB ENERGY CORP	O			ACTIVE	1/17/2006
949	30-015-34387	L	1	18S	27E	1980S	630W	AAO FEDERAL #011				MARBOB ENERGY CORP	O			ACTIVE	3/9/2006
950	30-015-34555	M	1	18S	27E	890S	660W	AAO FEDERAL #010				MARBOB ENERGY CORP	O			ACTIVE	10/26/2006
951	30-015-34576	K	1	18S	27E	2060S	2160W	AAO FEDERAL #012				MARBOB ENERGY CORP	O			ACTIVE	9/21/2006
952	30-015-34998	N	1	18S	27E	890S	1650W	AAO FEDERAL #012				MARBOB ENERGY CORP	O			ACTIVE	12/17/2006
953	30-015-34028	G	6	18S	28E	2285N	1366E	SLIDER 6 STATE NO. 001				BP AMERICA PRODUCTION COMPANY	O		12/17/2006	P&A	12/17/2006
954	30-015-35050	D	32	17S	28E	330N	500W	ENRON STATE NO. 012				LIME ROCK RESOURCES A, LP	O			ACTIVE	12/21/2006
955	30-015-36939	A	14	18S	27E	660N	990E	VIOLET BIV STATE COM #1				YATES PETROLEUM CORP	O			EXT PERMIT TO DRILL	2/20/2009
956	30-015-33994	A	36	17S	27E	915N	420E	RED LAKE 36 A STATE #2				EDGE PETROLEUM OPERATING COMPANY, INC	O			ACTIVE	4/20/2005
957	30-015-36116	G	36	17S	27E	2305N	1650E	SOUTH RED LAKE UNIT II #57				LEGACY RESERVES OPERATING LP	O			ACTIVE	6/6/2008
958	30-015-32946	J	2	18S	27E	2210S	1650E	SCBP STATE #1				APACHE CORPORATION	O			ACTIVE	4/26/2005
959	30-015-35814	H	2	18S	27E	2063N	441E	STATE H NO. 2				MACK ENERGY CORPORATION	O			ACTIVE	1/11/2008
960	30-015-36343	G	31	17S	28E	1650N	2310E	MALCO STATE NO. 002				GEORGE A CHASE JR DBA G AND C SERVICE	O			ACTIVE	7/9/2008
961	30-015-36978	D	31	17S	28E	990N	330W	ENRON STATE NO. 015				LIME ROCK RESOURCES A, LP	O			ACTIVE	7/3/2009
962	30-015-36554	L	32	17S	28E	1770S	550W	NW STATE NO. 029				LIME ROCK RESOURCES A, LP	O			ACTIVE	1/30/2009
963	30-015-36989	K	32	17S	28E	1630S	1710W	NW STATE NO. 030				LIME ROCK RESOURCES A, LP	O			NO COMPL	7/14/2009
964	30-015-37057	N	32	17S	28E	330S	1750W	NW STATE NO. 031				LIME ROCK RESOURCES A, LP	O			NO COMPL	7/28/2009
965	30-015-37058	M	32	17S	28E	330S	330W	NW STATE NO. 032				LIME ROCK RESOURCES A, LP	O			NO COMPL	8/23/2009
966	30-015-37428	G	31	17S	28E	1980N	1980E	MALCO STATE NO. 3				G&C SERVICE	O			ACTIVE	2/10/2010
967	30-015-36281	1	18S	27E	2193S	1520W		SUN DEVILS FEDERAL NO. 001				MACK ENERGY CORPORATION	O			PERMIT TO DRILL	
968	30-015-38240	G	36	17S	27E	1425N	1520E	KIOWA STATE NO. 3				COG OPERATING, LLC	O			PERMIT TO DRILL	4/11/12
969	30-015-39029	G	36	17S	27E	2210N	2310E	CONKLIN STATE NO. 1-Y				G AND C SERVICE	O			ACTIVE	
970	30-015-39321	M	36	17S	27E	990S	890W	BIG BOY STATE NO. 1				COG OPERATING, LLC	O			PERMIT TO DRILL	
971	30-015-39322	M	36	17S	27E	840S	425W	BIG BOY STATE NO. 3				COG OPERATING, LLC	O			PERMIT TO DRILL	
972	30-015-39323	O	36	17S	27E	870S	1560E	BIG BOY STATE NO. 5				COG OPERATING, LLC	O			PERMIT TO DRILL	
973	30-015-39324	O	36	17S	27E	480S	2210E	BIG BOY STATE NO. 6				COG OPERATING, LLC	O			PERMIT TO DRILL	
974	30-015-39325	O	36	17S	27E	275S	1560E	BIG BOY STATE NO. 7				COG OPERATING, LLC	O			PERMIT TO DRILL	
975	30-015-39401	P	36	17S	27E	1110S	630E	BIG BOY STATE NO. 8				COG OPERATING, LLC	O			PERMIT TO DRILL	
976	30-015-39009	G	2	18S	27E	1650N	2430E	EMPIRE ABO UNIT NO. 417				APACHE CORPORATION	O			PERMIT TO DRILL	
977	30-015-39066	L	2	18S	27E	2551S	1170W	EMPIRE ABO UNIT NO. 415				APACHE CORPORATION	O			PERMIT TO DRILL	
978	30-015-38234	P	30	17S	28E	430S	800E	EMPIRE ABO UNIT NO. 416				APACHE CORPORATION	O			PERMIT TO DRILL	
979	30-015-39299	M	30	17S	28E	990S	990W	ANTHONY NO. 2				LIME ROCK RESOURCES	O			ACTIVE	
980	30-015-39300	M	30	17S	28E	330S	330W	MAPLE STATE NO. 5				COG OPERATING, LLC	O			PERMIT TO DRILL	
981	30-015-38512	D	30	17S	28E	990N	940W	MAPLE STATE NO. 6				COG OPERATING, LLC	O			PERMIT TO DRILL	
982	30-015-39004	P	31	17S	28E	150S	1300E	ENRON STATE NO. 16				LIME ROCK RESOURCES	O			ACTIVE	
983	30-015-39011	O	31	17S	28E	1190S	1320E	EMPIRE ABO UNIT NO. 401				APACHE CORPORATION	O			PERMIT TO DRILL	
984	30-015-39020	O	31	17S	28E	140S	2560E	EMPIRE ABO UNIT NO. 419				APACHE CORPORATION	O			PERMIT TO DRILL	
985	30-015-38513	J	32	17S	28E	2310S	2032E	EMPIRE ABO UNIT NO. 408				APACHE CORPORATION	O			PERMIT TO DRILL	
986	30-015-39006	J	32	17S	28E	2400S	2450E	JEFFER 32 STATE NO. 3				LIME ROCK RESOURCES	O			ACTIVE	
987	30-015-39007	M	32	17S	28E	70S	100W	EMPIRE ABO UNIT NO. 407				APACHE CORPORATION	O			PERMIT TO DRILL	
988	30-015-39064	O	32	17S	28E	1175S	1310E	EMPIRE ABO UNIT NO. 409				APACHE CORPORATION	O			PERMIT TO DRILL	
989	30-015-39008	D	6	18S	28E	160N	1300W	EMPIRE ABO UNIT NO. 403				APACHE CORPORATION	O			PERMIT TO DRILL	
990	30-015-39021	D	6	18S	28E	40N	145W	EMPIRE ABO UNIT NO. 410				APACHE CORPORATION	O			PERMIT TO DRILL	
992	30-015-00715	D	1	18S	27E	330N	330W	EMPIRE ABO UNIT NO. 411				APACHE CORPORATION	O			PERMIT TO DRILL	
								SOUTH RED LAKE II UNIT NO. 37				LEGACY RESERVES OPERATING LP				PERMIT TO DRILL	

TABLE II

DATE - Comp
or Plug

WELL	TYPE	PLUG DATE	STATUS
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10
11	11	11	11
12	12	12	12
13	13	13	13
14	14	14	14
15	15	15	15
16	16	16	16
17	17	17	17
18	18	18	18
19	19	19	19
20	20	20	20
21	21	21	21
22	22	22	22
23	23	23	23
24	24	24	24
25	25	25	25
26	26	26	26
27	27	27	27
28	28	28	28
29	29	29	29
30	30	30	30
31	31	31	31
32	32	32	32
33	33	33	33
34	34	34	34
35	35	35	35
36	36	36	36
37	37	37	37
38	38	38	38
39	39	39	39
40	40	40	40
41	41	41	41
42	42	42	42
43	43	43	43
44	44	44	44
45	45	45	45
46	46	46	46
47	47	47	47
48	48	48	48
49	49	49	49
50	50	50	50
51	51	51	51
52	52	52	52
53	53	53	53
54	54	54	54
55	55	55	55
56	56	56	56
57	57	57	57
58	58	58	58
59	59	59	59
60	60	60	60
61	61	61	61
62	62	62	62
63	63	63	63
64	64	64	64
65	65	65	65
66	66	66	66
67	67	67	67
68	68	68	68
69	69	69	69
70	70	70	70
71	71	71	71
72	72	72	72
73	73	73	73
74	74	74	74
75	75	75	75
76	76	76	76
77	77	77	77
78	78	78	78
79	79	79	79
80	80	80	80
81	81	81	81
82	82	82	82
83	83	83	83
84	84	84	84
85	85	85	85
86	86	86	86
87	87	87	87
88	88	88	88
89	89	89	89
90	90	90	90
91	91	91	91
92	92	92	92
93	93	93	93
94	94	94	94
95	95	95	95
96	96	96	96
97	97	97	97
98	98	98	98
99	99	99	99
100	100	100	100

TABLE III

Well Changes in the Combined One Mile Area of Review Since the 2010 Annual Report for Navajo's WDW-1, WDW-2, and WDW-3

ID	API No.	Unit	Sect	Town	Range	Footages	Well Name	Operator	Changes
7	30 015 00686	G	36	17S	27E	2310 FNL & 2310 FEL	Conklin State No. 1	G & C Service	Intention to plug from 533' to the surface.
884	30 015 24881	F	13	18S	27E	1880 FNL & 1830 FWL	Anadarko 13 Federal No. 1	David G Hammond	Plugged - set CIBP at 1476 feet, dumped 35 feet of cement on top of plug, perforated at 374 feet and perforated at 424 feet, spotted 25 sacks of cement, perforated at 60 feet, pumped 35 sacks of cement and circulated to the surface
768	30 015 00721	A	02	18S	27E	330 FNL & 990 FEL	South Red Lake Grayburg Unit No. 1	Legacy Reserves Operating, LP	Changed from shut-in to producing/flaring gas, changed owners from McQuadrangle to Legacy Reserves Operating, LP
5	30 015 00690	G	36	17S	27E	1830 FNL & 2205 FEL	Conklin No. 2	G and C Service	Run 4-1/2" liner to 475' and cement to surface. Continue production
967	30 015 36240	G	36	17S	27E	1425 FNL & 1520 FEL	Kiowa State No. 3	Cog Operating LLC	NEW: Currently drilling to 4850' in the Giorietta-Yeso; To be perforated in Yeso Formation; Proposed TD 4850'
968	30 015 36029	G	36	17S	27E	2210 FNL & 2310 FEL	Conklin State No. 1-Y	G and C Service	NEW: Drilled to 540' TD, producing oil
969	30 015 39321	M	36	17S	27E	990 FSL & 890 FWL	Big Boy State No. 1	Cog Operating LLC	NEW: Permit to Drill
970	30 015 39322	M	36	17S	27E	840 FSL & 425 FWL	Big Boy State No. 3	Cog Operating LLC	NEW: Permit to Drill
971	30 015 39323	O	36	17S	27E	870 FSL & 1560 FEL	Big Boy State No. 5	Cog Operating LLC	NEW: Permit to Drill
972	30 015 39324	O	36	17S	27E	480 FSL & 2210 FEL	Big Boy State No. 6	Cog Operating LLC	NEW: Permit to Drill
973	30 015 39325	O	36	17S	27E	990 FSL & 2210 FEL	Big Boy State No. 7	Cog Operating LLC	NEW: Permit to Drill
974	30 015 39326	O	36	17S	27E	275 FSL & 1560 FEL	Big Boy State No. 8	Cog Operating LLC	NEW: Permit to Drill
975	30 015 39401	P	36	17S	27E	1110 FSL & 630 FEL	Empire Abo Unit No. 417	Apache Corp	NEW: Permit to Drill
976	30 015 39008	G	02	18S	27E	1650 FNL & 2430 FEL	Empire Abo Unit No. 415	Apache Corp	NEW: Permit to Drill
977	30 015 39066	L	02	18S	27E	2551 FSL & 1170 FWL	Empire Abo Unit No. 416	Apache Corp	NEW: Permit to Drill
978	30 015 36234	P	30	17S	28E	430 FSL & 800 FEL	Anthony No. 2	Lime Rock Resources	NEW: Drilled to 4823' TD, PBTD: 4762'; Perforations in Upper Yeso: 3644'-3932', Middle Yeso: 3962'-4254', and Lower Yeso: 4355'-4719'
979	30 015 39299	M	30	17S	28E	990 FSL & 990 FWL	Maple State No. 5	Cog Operating LLC	NEW: Permit to Drill
980	30 015 39300	M	30	17S	28E	330 FSL & 330 FWL	Maple State No. 6	Cog Operating LLC	NEW: Permit to Drill
981	30 015 38512	D	30	17S	28E	990 FNL & 940 FWL	Enron State No. 16	Lime Rock Resources	NEW: Well is drilled to total depth of 3658'. Will be completed later this year.
982	30 015 39004	P	31	17S	28E	150 FSL & 1300 FEL	Empire Abo Unit No. 401	Apache Corp	NEW: Permit to Drill
983	30 015 39011	O	31	17S	28E	1190 FSL & 1320 FEL	Empire Abo Unit No. 419	Apache Corp	NEW: Permit to Drill
984	30 015 39020	O	31	17S	28E	140 FSL & 2560 FEL	Empire Abo Unit No. 408	Apache Corp	NEW: Drilled to 5093' TD, PBTD: 5070'; Perforations in Upper Yeso: 3441'-4727', 3768'-4076', Middle Yeso: 4130'-4476', and Lower Yeso: 4540'-5007'
985	30 015 38513	J	32	17S	28E	2310 FSL & 2032 FEL	Jeffer 32 State No. 3	Lime Rock Resources	NEW: Permit to Drill
986	30 015 39006	J	32	17S	28E	2400 FSL & 2450 FEL	Empire Abo Unit No. 407	Apache Corp	NEW: Permit to Drill
987	30 015 39007	M	32	17S	28E	70 FSL & 100 FWL	Empire Abo Unit No. 409	Apache Corp	NEW: Permit to Drill
988	30 015 39054	O	32	17S	28E	1175 FSL & 1310 FEL	Empire Abo Unit No. 403	Apache Corp	NEW: Permit to Drill
989	30 015 39008	D	06	18S	28E	160 FNL & 1300 FWL	Empire Abo Unit No. 410	Apache Corp	NEW: Permit to Drill
990	30 015 39021	D	06	18S	28E	40 FNL & 145 FWL	Empire Abo Unit No. 411	Apache Corp	NEW: Permit to Drill
991	30 015 32946	J	02	18S	27E	2210 FSL & 1650 FEL	SCBP State No. 001	Apache Corp	NEW to AOR. TD = 3880'. Changed owner to Apache Corp from Marbob Energy Group

TABLE IV

Wells that have been Plugged and Abandoned since the 2010 Annual Report
Well Changes in the Combined One Mile Area of Review for Navajo's WDW-1, WDW-2, and WDW-3

ID	API No.	Unit	Sect	Town	Range	Footages	Well Name	Operator	Changes
7	30 015 00666	G	36	17S	27E	2310 FNL & 2310 FEL	Conklin State No. 1	G & C Service	Intention to plug from 533' to the surface.
884	30 015 24881	F	13	18S	27E	1880 FNL & 1830 FWL	Anadarko 13 Federal No. 1	David G Hammond	Plugged - set CIBP at 1476 feet, dumped 35 feet of cement on top of plug, perforated at 374 feet and perforated at 424 feet, spotted 25 sacks of cement, perforated at 60 feet, pumped 35 sacks of cement and circulated to the surface

TABLE V
Wells that have been Temporarily Abandoned since the 2010 Annual Report
Well Changes in the Combined One Mile Area of Review for Navajo's WDW-1, WDW-2, and WDW-3

ID	API No.	Unit	Sect	Town	Range	Footages	Well Name	Operator	Changes
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TABLE VI
Wells that have been put back into Production Since the 2010 Annual Report
Well Changes in the Combined One Mile Area of Review for Navajo's WDW-1, WDW-2, and WDW-3

ID	API No.	Unit	Sect	Town	Range	Footages	Well Name	Operator	Changes
768	30 015 00721	A	02	18S	27E	330 FNL & 990 FEL	South Red Lake Grayburg Unit No. 36	Legacy Reserves Operating, LP	Changed from shut-in to producing/flaring gas, changed owners from McQuadrangle to Legacy Reserves Operating, LP

TABLE VII

Wells that have been Recompleted in Upper Zones since the 2010 Annual Report
Well Changes in the Combined One Mile Area of Review for Navajo's WDW-1, WDW-2, and WDW-3

ID	API No.	Unit	Sect	Town	Range	Footages	Well Name	Operator	Changes
8 30 015 00680		G	36	17S	27E	1830 FNL & 2205 FEL	Conklin No. 2	G and C Service	Run 4-1/2" liner to 475' and cement to surface. Continue production

TABLE VIII
Newly Drilled Wells in the Area of Review since the 2010 Annual Report
Well Changes in the Combined One Mile Area of Review for Navajo's WDW-1, WDW-2, and WDW-3

ID	API No.	Unit	Sect	Town	Range	Footages	Well Name	Operator	Changes
967	30 015 38240	G	36	17S	27E	1425 FNL & 1520 FEL	Kiowa State No. 3	Cog Operating LLC	NEW: Currently drilling to 4850' in the Giorietta-Yeso; To be perforated in Yeso Formation; Proposed TD 4850'
968	30 015 39029	G	36	17S	27E	2210 FNL & 2310 FEL	Conklin State No. 1-Y	G and C Service	NEW: Drilled to 540' TD, producing oil
969	30 015 39321	M	36	17S	27E	990 FSL & 890 FWL	Big Boy State No. 1	Cog Operating LLC	NEW: Permit to Drill
970	30 015 39322	M	36	17S	27E	840 FSL & 425 FWL	Big Boy State No. 3	Cog Operating LLC	NEW: Permit to Drill
971	30 015 39323	O	36	17S	27E	870 FSL & 1560 FEL	Big Boy State No. 5	Cog Operating LLC	NEW: Permit to Drill
972	30 015 39324	O	36	17S	27E	480 FSL & 2210 FEL	Big Boy State No. 6	Cog Operating LLC	NEW: Permit to Drill
973	30 015 39325	O	36	17S	27E	990 FSL & 2210 FEL	Big Boy State No. 7	Cog Operating LLC	NEW: Permit to Drill
974	30 015 39326	O	36	17S	27E	275 FSL & 1860 FEL	Big Boy State No. 8	Cog Operating LLC	NEW: Permit to Drill
975	30 015 39401	P	36	17S	27E	1110 FSL & 830 FEL	Empire Abo Unit No. 417	Apache Corp	NEW: Permit to Drill
976	30 015 39009	G	02	18S	27E	1650 FNL & 2430 FEL	Empire Abo Unit No. 415	Apache Corp	NEW: Permit to Drill
977	30 015 39066	L	02	18S	27E	2551 FSL & 1170 FWL	Empire Abo Unit No. 416	Apache Corp	NEW: Permit to Drill
978	30 015 38234	P	30	17S	28E	430 FSL & 800 FEL	Anthony No. 2	Lime Rock Resources	NEW: Drilled to 4823' TD, PBTD: 4762'. Perforations in Upper Yeso: 3844'-3932'. Middle Yeso: 3962'-4254', and Lower Yeso: 4355'-4719'
979	30 015 39299	M	30	17S	28E	990 FSL & 990 FWL	Maple State No. 5	Cog Operating LLC	NEW: Permit to Drill
980	30 015 39300	M	30	17S	28E	330 FSL & 330 FWL	Maple State No. 6	Cog Operating LLC	NEW: Permit to Drill
981	30 015 38512	D	30	17S	28E	990 FNL & 940 FWL	Enron State No. 16	Lime Rock Resources	NEW: Well is drilled to total depth of 3658'. Will be completed later this year.
982	30 015 39004	P	31	17S	28E	150 FSL & 1300 FEL	Empire Abo Unit No. 401	Apache Corp	NEW: Permit to Drill
983	30 015 39011	O	31	17S	28E	1190 FSL & 1320 FEL	Empire Abo Unit No. 419	Apache Corp	NEW: Permit to Drill
984	30 015 39020	O	31	17S	28E	140 FSL & 2560 FEL	Empire Abo Unit No. 408	Apache Corp	NEW: Drilled to 5093' TD, PBTD: 5070'. Perforations in Upper Yeso: 3441'-4727', 3768'-4076', Middle Yeso: 4130'-4476', and Lower Yeso: 4540'-5007'
985	30 015 38513	J	32	17S	28E	2310 FSL & 2032 FEL	Jeffer 32 State No. 3	Lime Rock Resources	NEW: Permit to Drill
986	30 015 39006	J	32	17S	28E	2400 FSL & 2450 FEL	Empire Abo Unit No. 407	Apache Corp	NEW: Permit to Drill
987	30 015 39007	M	32	17S	28E	70 FSL & 100 FWL	Empire Abo Unit No. 409	Apache Corp	NEW: Permit to Drill
988	30 015 39064	O	32	17S	28E	1175 FSL & 1310 FEL	Empire Abo Unit No. 403	Apache Corp	NEW: Permit to Drill
989	30 015 39008	D	06	18S	28E	160 FNL & 1300 FWL	Empire Abo Unit No. 410	Apache Corp	NEW: Permit to Drill
990	30 015 39021	D	06	18S	28E	40 FNL & 145 FWL	Empire Abo Unit No. 411	Apache Corp	NEW: Permit to Drill
995	30 015 33473	G	01	18S	27E	1750 FNL & 1650 FEL	AAO Federal No. 7	Apache Corp	NEW to AOR, change of operator from Marbob Energy Corp to Apache Corp
996	30 015 33784	H	01	18S	27E	1650 FNL & 330 FEL	AAO Federal No. 8	Apache Corp	NEW to AOR, change of operator from Marbob Energy Corp to Apache Corp
997	30 015 34071	F	01	18S	27E	2169 FNL & 1963 FWL	AAO Federal No. 6	Apache Corp	NEW to AOR, change of operator from Marbob Energy Corp to Apache Corp
998	30 015 34555	M	01	18S	27E	890 FSL & 660 FWL	AAO Federal No. 11	Apache Corp	NEW to AOR, change of operator from Marbob Energy Corp to Apache Corp
999	30 015 34576	K	01	18S	27E	2060 FSL & 2160 FWL	AAO Federal No. 10	Apache Corp	NEW to AOR, change of operator from Marbob Energy Corp to Apache Corp

TABLE IX**FIGURES INCLUDED IN THE REPORT**

Figure	Description	OCD Reference
1	Gaines Well #3 Schematic	Section VI.1 and IX.3
2	Plot of Bottom Hole Pressure and Temperature Data Chukka Well #2	n/a
3	Mewbourne Well #1 Schematic	n/a
4	Chukka Well #2 Schematic	n/a
5	Plot of Bottom Hole Pressure and Temperature Data Mewbourne Well #1	n/a
6	Midland Map of One Mile Area of Review	n/a
7	Gaines Well #3 Wellhead Schematic	Section IX.14
8	Diagram of Valve Locations for Shut-in on Gaines Well #3	Section IX.14
9	Gaines Well #3 Test Overview	Section IX.18.f
10	Gaines Well #3 Cartesian Plot of Bottom-Hole Pressure and Temperature vs. Time	Section IX.18.a
11	Gaines Well #3 Cartesian Plot of Injection Rate vs. Time	Section IX.18.b
12	Gaines Well #3 Cartesian Plot of Surface Pressure and Injection Rates vs. Time	Section IX.18.e
13	Historical Surface Pressure and Injection Rates vs. Calendar Time	Section IX.18.g

TABLE IX (cont.)

Figure	Description	OCD Reference
14	Gaines Well #3 Derivative Log-Log Plot	Section IX.18.c
15	Gaines Well #3 Superposition Horner (Semi-Log) Plot	Section IX.18.d
16	Gaines Well #3 Expanded Superposition Horner (Semi-Log) Plot	Section IX.18.d
17	Gaines Well #3 Hall Plot	Section IX.18.h
18	Gaines Well #3 Static Pressure Gradient Survey	n/a

TABLE X**Comparison of Permeability, Transmissibility,
Skin, False Extrapolated Pressure, and Fill Depth**

Date of Test	Permeability (k)	Transmissibility (kh/u)	Skin (s)	False Extrapolated Pressure (p*)	Fill Depth
January 22 - 27, 2012	597 md	183,293 md-ft/cp	27.26	3792.34 psia	8,986 feet
November 10 - 13, 2010	568 md	174,376 md-ft/cp	14.64	3622.16 psia	8,986 feet
August 27 - 30, 2009	719 md	233,008 md-ft/cp	54.07	3,475.68 psia	8,986 feet
April 1 - 2, 2008	1,322 md	321,411 md-ft/cp	107	3,430.27 psia	N/A
Permit Parameters	250 md	40,094 md-ft-cp	N/A	N/A	N/A

TABLE XI

**NAVAJO REFINING COMPANY
STATIC PRESSURE GRADIENT SURVEY – GAINES WELL #3
JANUARY 27, 2012**

Depth (ft)	Pressure (psia)	Pressure Gradient (psi/ft)	Temperature (°F)
7660	3800.50		101.04
7000	3513.41	0.4350	107.22
6000	3078.82	0.4346	102.45
5000	2643.32	0.4355	98.12
4000	2208.92	0.4344	94.02
3000	1773.96	0.4350	90.45
2000	1338.35	0.4356	86.61
1000	905.42	0.4329	82.73
0	462.56	0.4429	62.79

FIGURES

SUBSURFACE



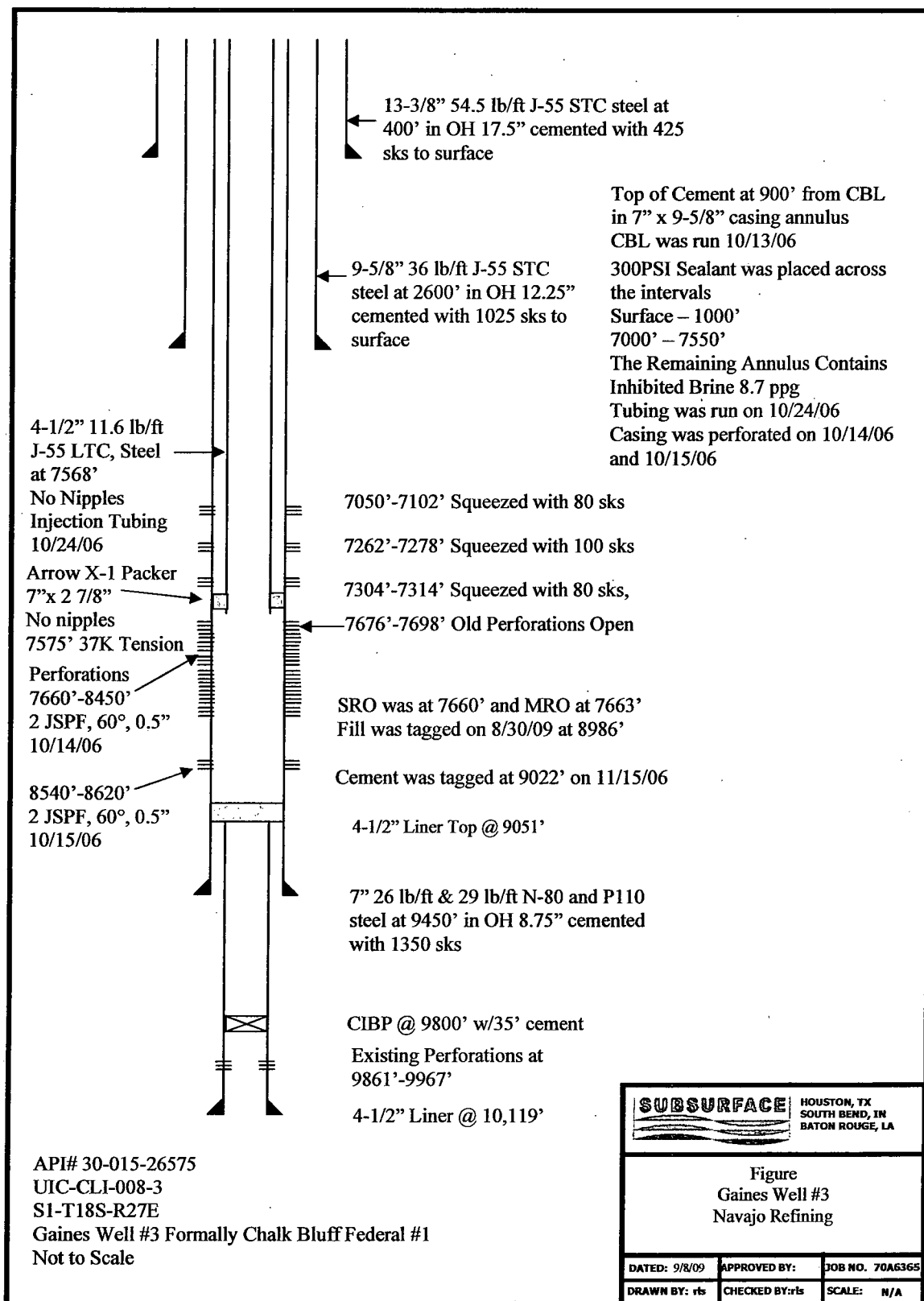


FIGURE 1

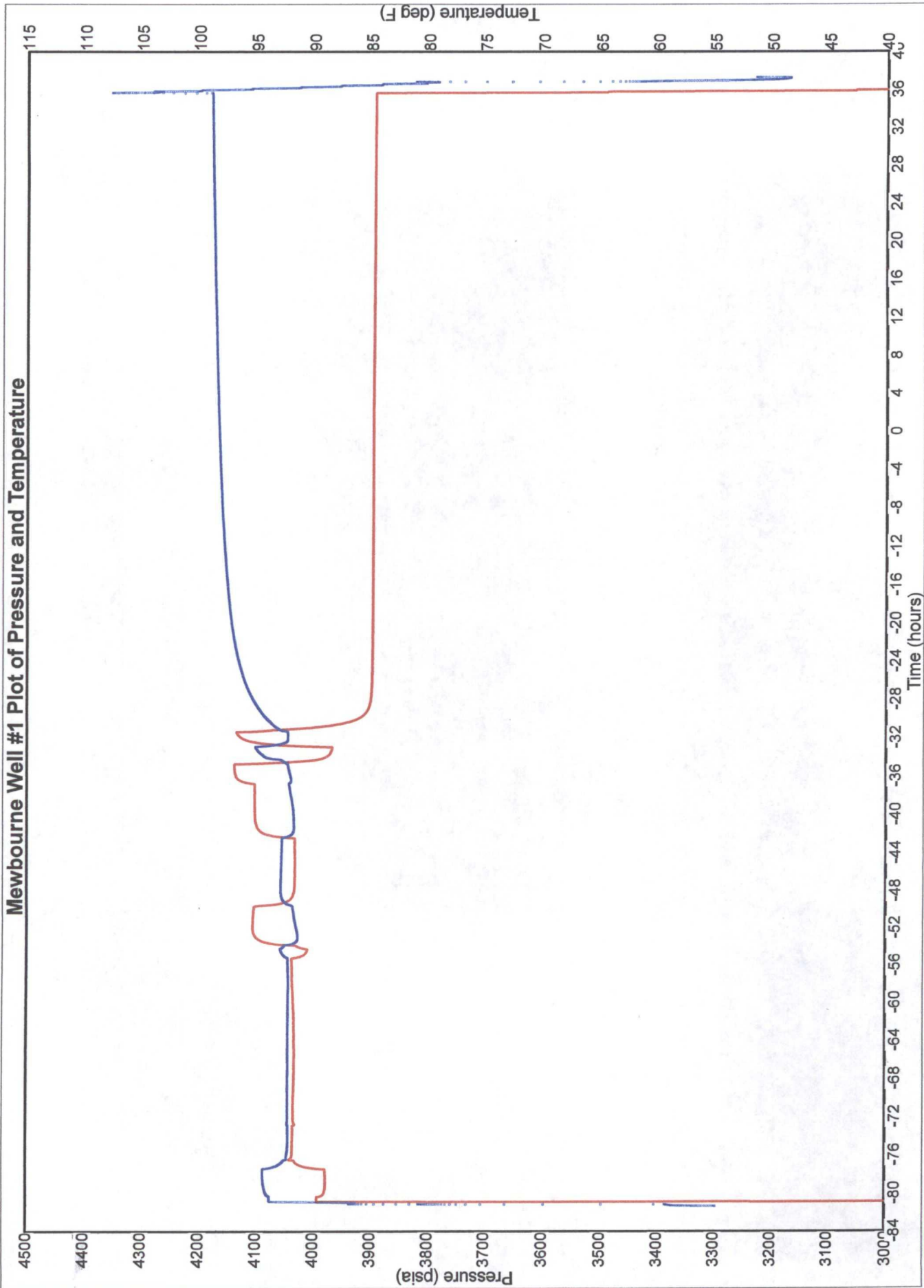


FIGURE 2

BELOW GROUND DETAILS

All depths are referenced to the Kelly bushing elevation of 12.5' above ground level. Ground level elevation is 3,678' above mean sea level.

1. Surface Casing: 13 3/8", 48 lb/ft, J-55, ST&C set at 390' in a 17 1/2" hole. Cemented with 150 sx Class C with 3 % calcium chloride, 375 sx Class C Lite w/3 % calcium chloride and 1/2 lb/sx floccle. Circulated 86 sx to surface.
2. Intermediate Casing: 9 5/8", 36 lb/ft, J-55, ST&C set at 2,555' in a 12 1/4" hole. Cemented w/800 sx of Class C Lite w/ 1/2 lb/sx floccle and 2 lb/sx Gilsomite and 12 % salt. Followed by 200 sx of Class C w/2 % calcium chloride. Circulated 133 sx to surface.
3. Base of the USDW at 493'.
4. Injection Tubing: 4 1/2", 11.6 lb/ft, N-80, SMLS, R3, LT&C set at 7,879'.
5. DV Tool: at 5,498'.
6. Annulus Fluid: 8.7 lb/gal brine water mixed w/UniChem Techni-Hib 370 corrosion inhibitor.

7. Protection Casing: 7", 29 lb/ft, N-80, LT&C: 9094' to 7031'. 7", 29 lb/ft, P-110, LT&C: 7031' to 5845'. 7", 26 lb/ft, P-110, LT&C: 5845' to surface. Casing cemented in two stages as follows:

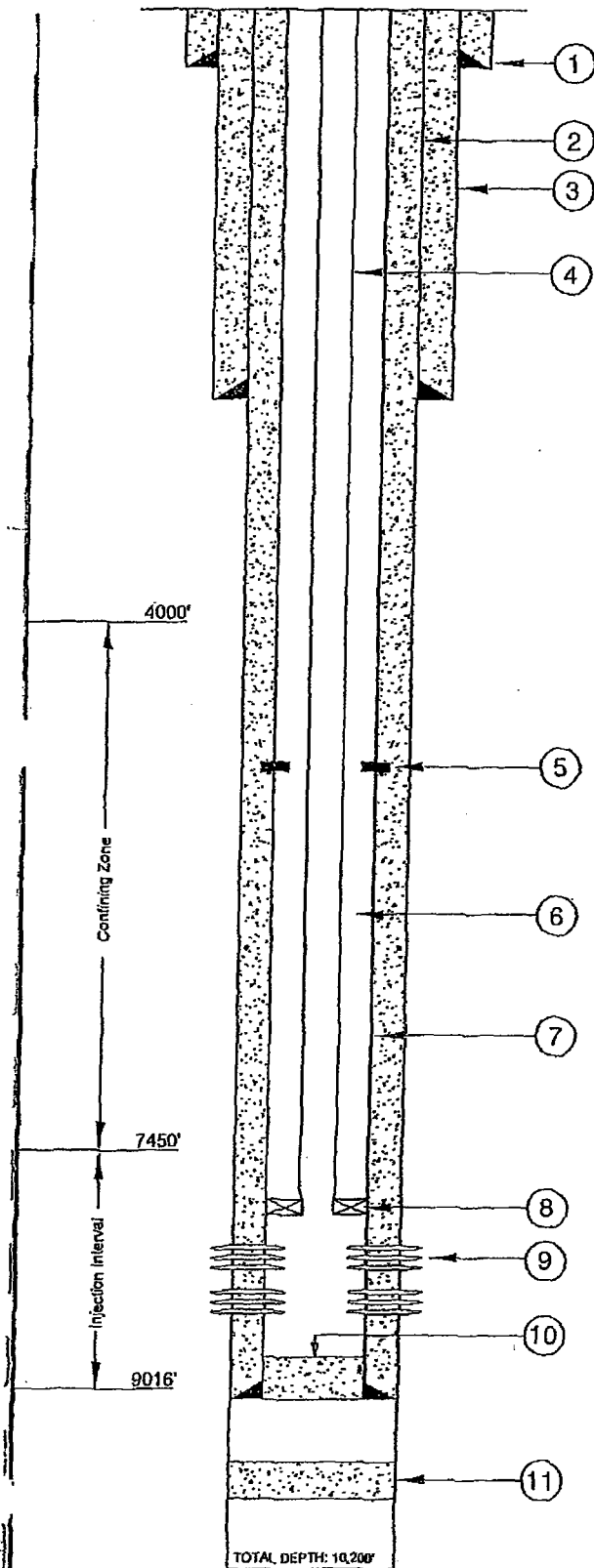
First Stage - 600 sx modified Class H w/0.4 % CFR-3, 5 lb/sx Gilsomite, 0.5 % Halad-344, and 1 lb/sx salt mixed at 13.0 ppg. Opened DV tool at 5498' and circulated 142 sx to surface.

Second Stage - Lead Slurry: 220 sx Interfill "C" (35:65:6) mixed at 11.7 ppg. Tail Slurry: 550 sx modified Class H w/0.4 % CFR-3, 5 lb/sx, Gilsomite, 0.5 % Halad-344, 0.1 % HR-7, and 1 lb/sx mixed at 13.0 ppg. Circulated 75 sx to surface. Top out w/20 sx permium plus 3 % calcium chloride.

8. Packer: 7" x 3.5" EVI Oil Tools (Arrow), Model X-1 retrievable packer set at 7879'. Minimum I.D. is 3.0". Wireline re-entry guide on bottom. To release: turn 1/4 turn to the right and pick up.
9. Perforations (2 SPF):

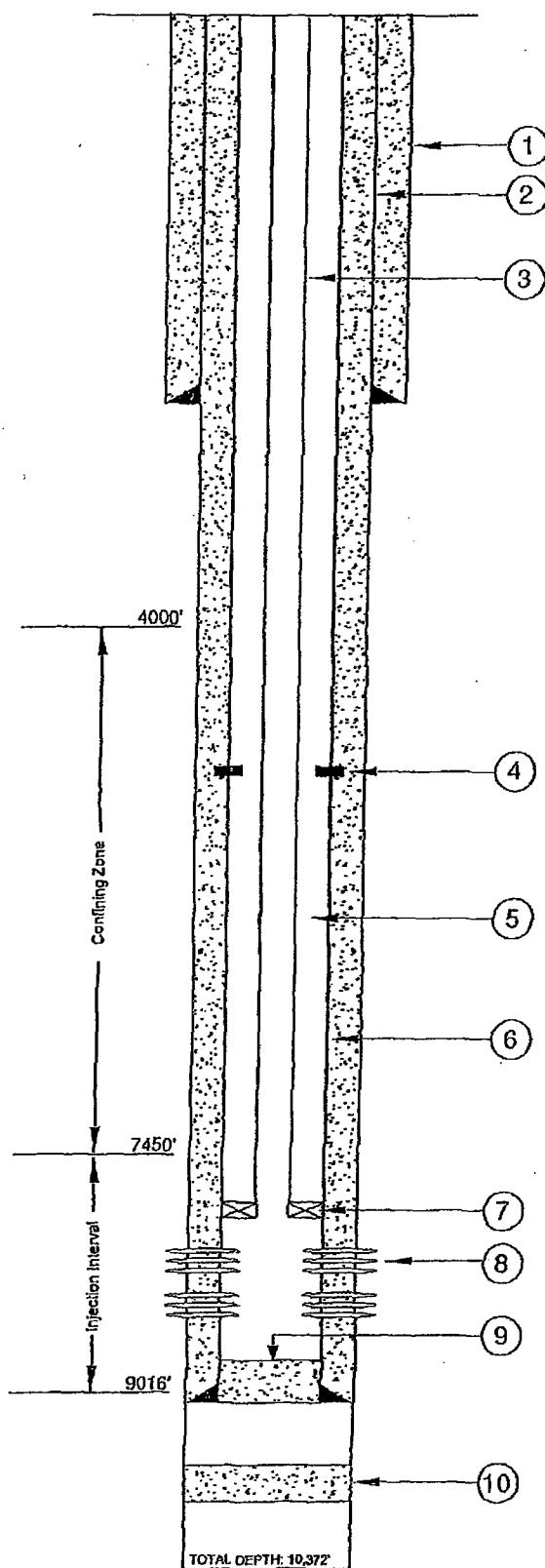
Upper Zone - 7924-7942', 7974-8030', 8050-8056', 8066-8080', 8118-8127', 8132-8140', 8160-8164', 8170-8188'.

Lower Zone - 8220-8254', 8260-8270', 8280-8302', 8360-8366', 8370-8378', 8400-8410', 8419-8423', 8430-8446', 8460-8464', 8470-8476'.
10. PBTD: 9004'.
11. Cement Plug: 45 sx Class H from 9624' to 9734'.



SUBSURFACE		HOUSTON, TX. SOUTH BEND, IN. BATON ROUGE, LA.
PAGE 1		
NAVAJO REFINING COMPANY ARTESIA, NEW MEXICO		
BELOW GROUND DETAILS WASTE DISPOSAL WELL NO. 1		
DATE: 07/13/01	CHECKED BY:	JOB NO: 70D5256
DRAWN BY: WOL	APPROVED BY:	DWG. NO:

FIGURE 3



BELOW GROUND DETAILS

All depths are referenced to the Kelly bushing elevation of 13' above ground level. Ground level elevation is 3610' above mean sea level.

1. Base of the USDW at 473'.
2. Surface Casing: 8 $\frac{5}{8}$ ", 32 lb/ft, set at 1995' in an 11" hole. Cemented to surface with 800 sacks of cement.
3. Injection Tubing: 3 $\frac{1}{2}$ ", 9.2 lb/ft, J-55, smis, NUE 10 rd. set at 7528'.
4. DV Tool: at 5,785'.
5. Annulus Fluid: 8.7 lb/gal brine water mixed w/UniChem Techni-Hib 370 corrosion inhibitor.
6. Protection Casing: 5 $\frac{1}{2}$ ", 17 lb/ft, L-80, LT&C: 8869' to the surface and set in a 7 $\frac{7}{8}$ " hole. Casing cemented in two stages as follows:

First Stage - 575 sacks of modified Class "H" with 0.4 % CFR-3, 5 lb/sk Gilsonite, 0.5 % Halad-344, and 3 lb/sk salt. Mixed at 13.0 ppg. Opened DV tool at 5785 and circulated 20 sacks to surface.

Second Stage - Lead Slurry: 300 sacks of Interfill "C" (35:65:6) mixed at 11.7 ppg. Tail slurry: 695 sacks modified Class "H" with 0.4% CFR-3, 5 lb/sk Gilsonite, 0.5 % Halad-344 and 3 lb/sk salt mixed at 13.0 ppg. Circulated 150 sacks to surface. Topped out with 10 yards of Redi-mix.
7. Packer: 5 $\frac{1}{2}$ " x 2 $\frac{7}{8}$ " Weatherford Completion Tools (Arrow) Model X-1 retrievable packer set at 7528'. Minimum ID is 2.4375". Wireline re-entry guide is on bottom. To release: turn $\frac{1}{4}$ turn to the right and pick up.
8. Perforations (2 SPF):

Zone 1: 7570-7620', 7676-7736'

Zone 2: 7826-7834', 7858-7880', 7886-7904', 7916-7936', 7944-7964', 7990-8042', 8096-8116', 8191-8201', 8304-8319', 8395-8399'.
9. PBTD: 8770'
10. Cement Plug: 45 sacks from 9675' to 9775'.

SUBSURFACE		HOUSTON, TX. SOUTH BEND, IN. BATON ROUGE, LA.	
FIRST 2			
NAVAJO REFINING COMPANY ARTESIA, NEW MEXICO			
BELOW GROUND DETAILS WASTE DISPOSAL WELL NO. 2			
DATE: 07/13/01	CHECKED BY:	JOB NO: 7005256	
DRAWN BY: WDL	APPROVED BY:	DWG. NO:	

FIGURE 4

Chukka Well #2 Plot of Pressure and Temperature

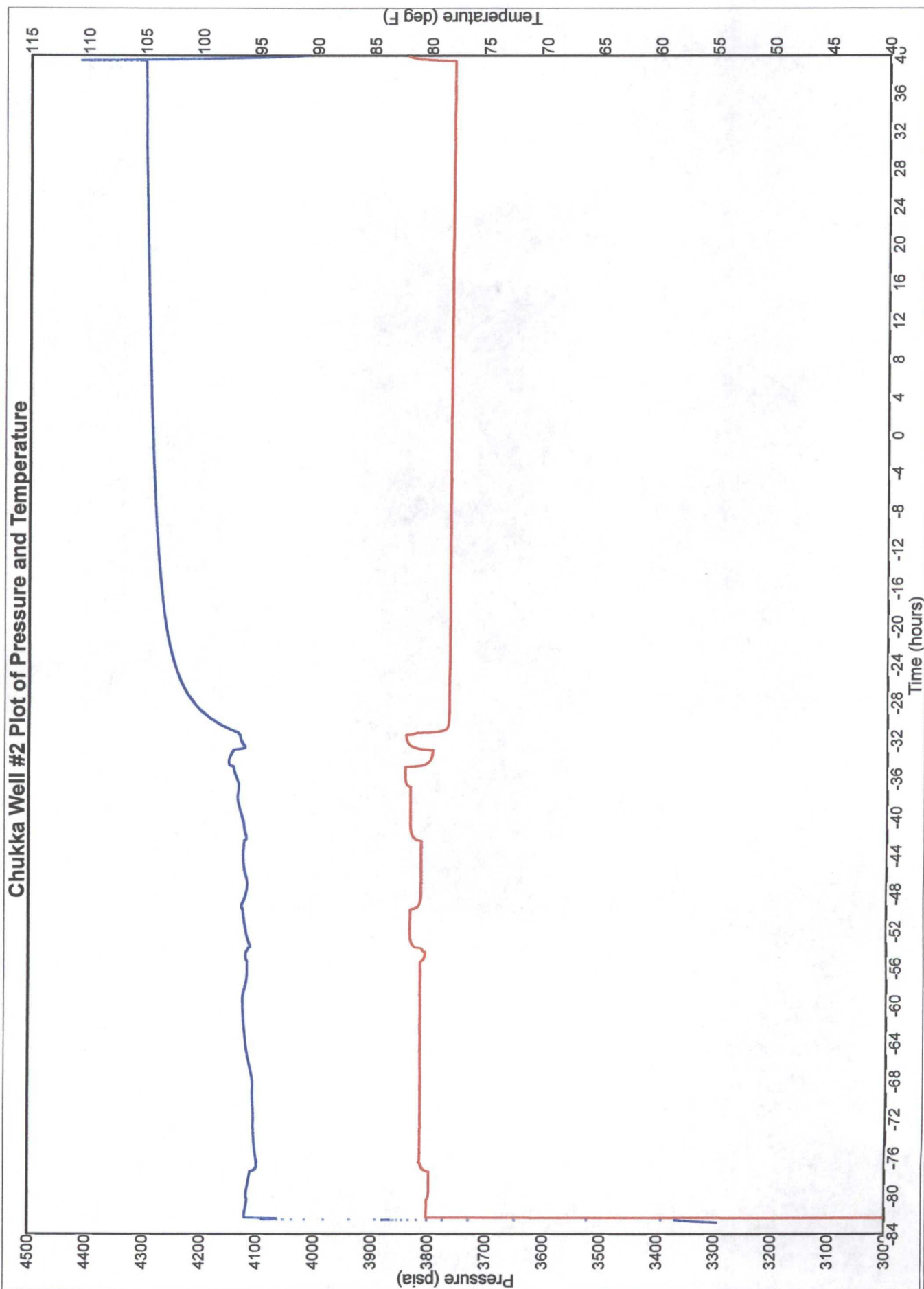


FIGURE 5

SUBSURFACE TECHNOLOGY

WELL: NAVAJO REFINING WDW #3

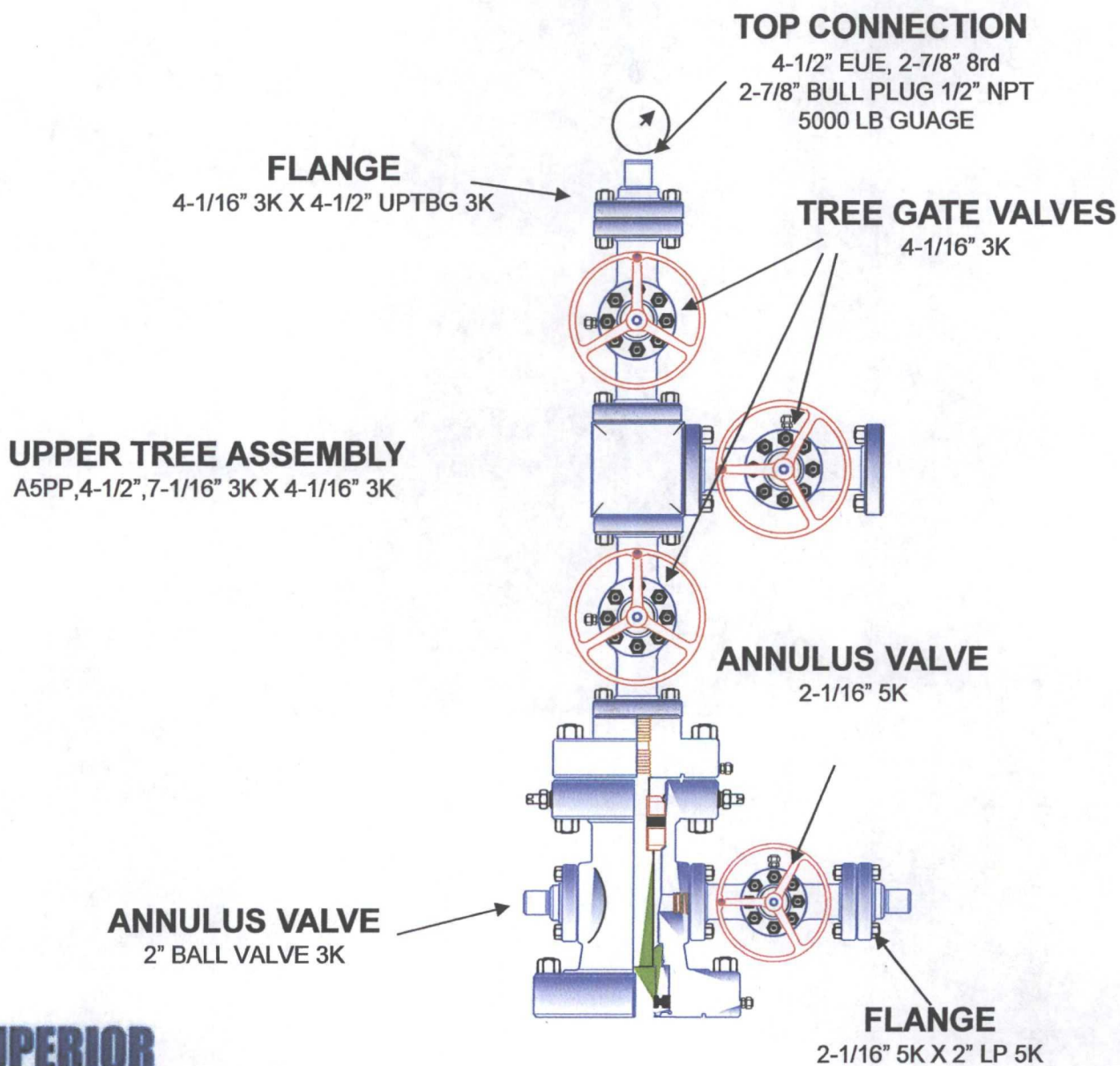
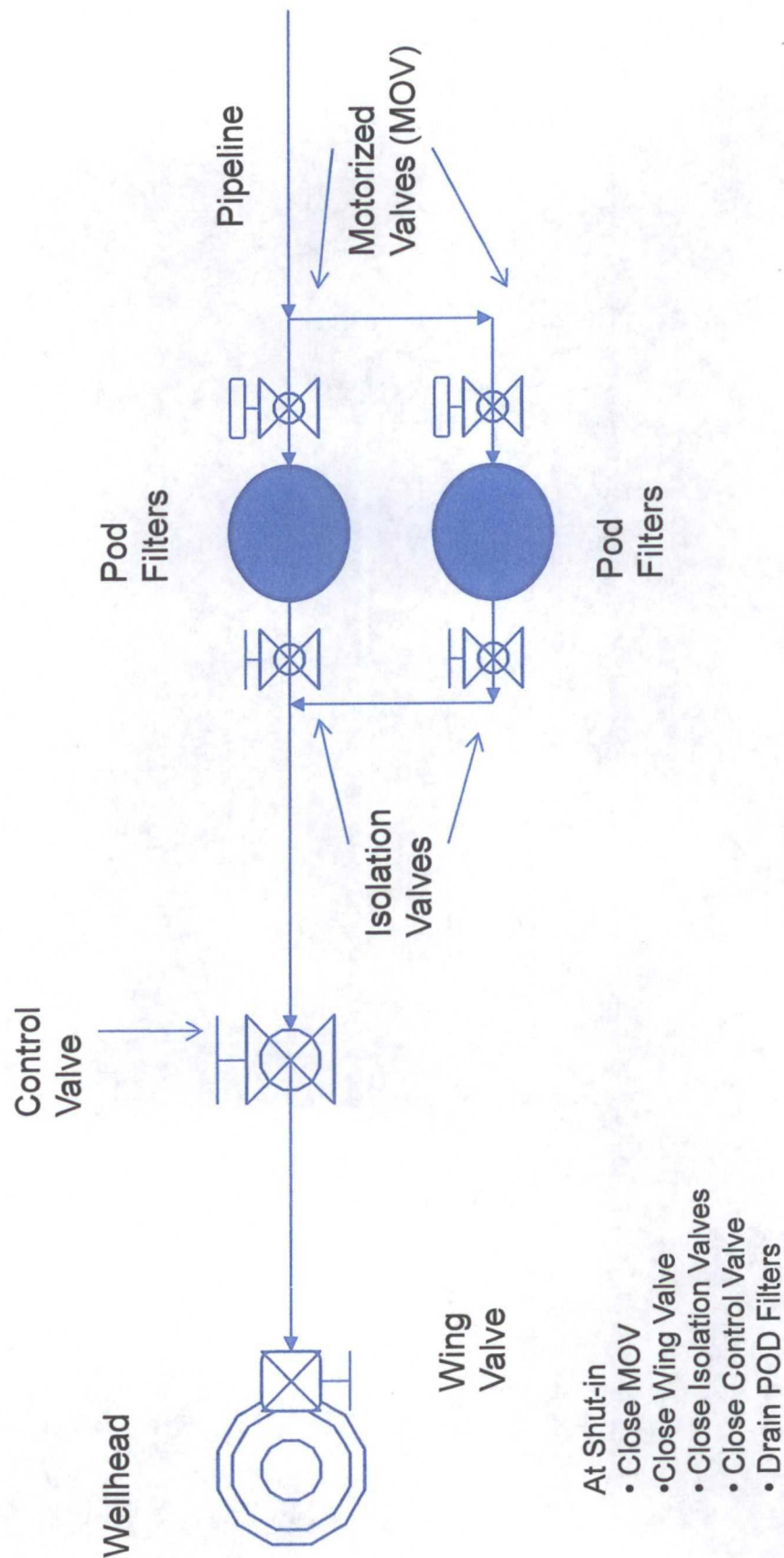


FIGURE 7

FIGURE 8
Gaines Well #3
Diagram of Shut-in Valve Control



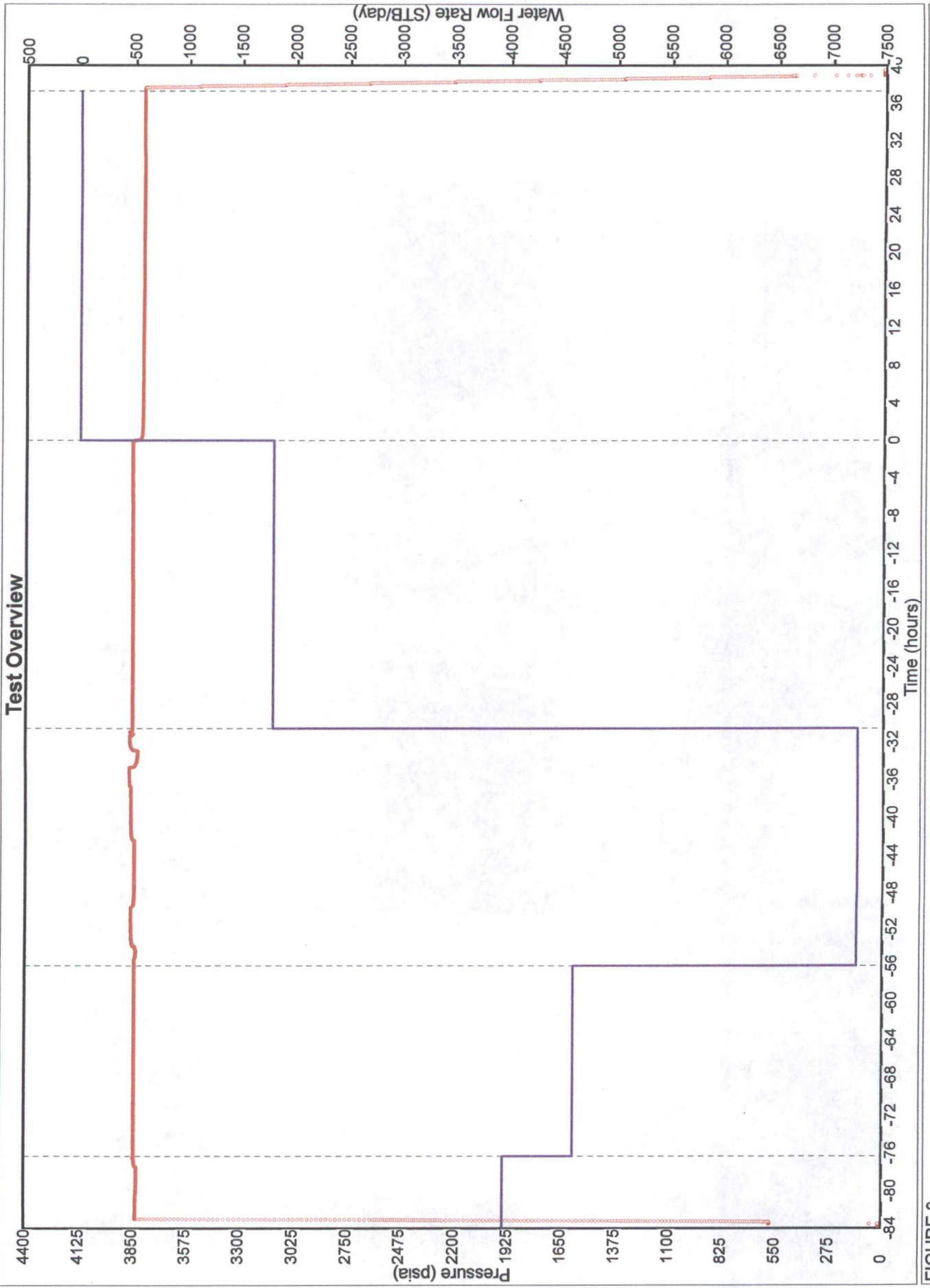


FIGURE 9

Gaines Well #3 Plot of Pressure and Temperature

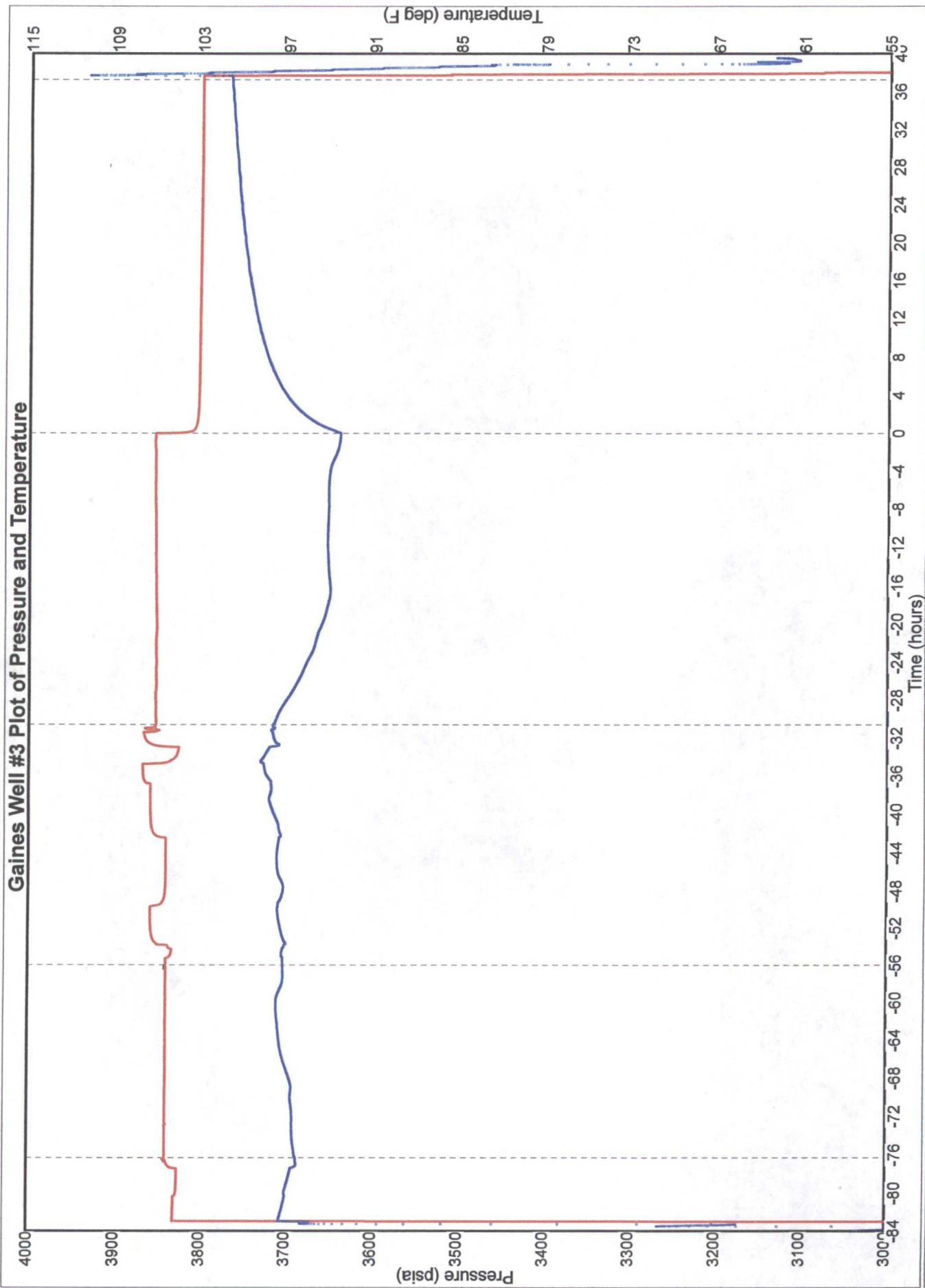


FIGURE 10

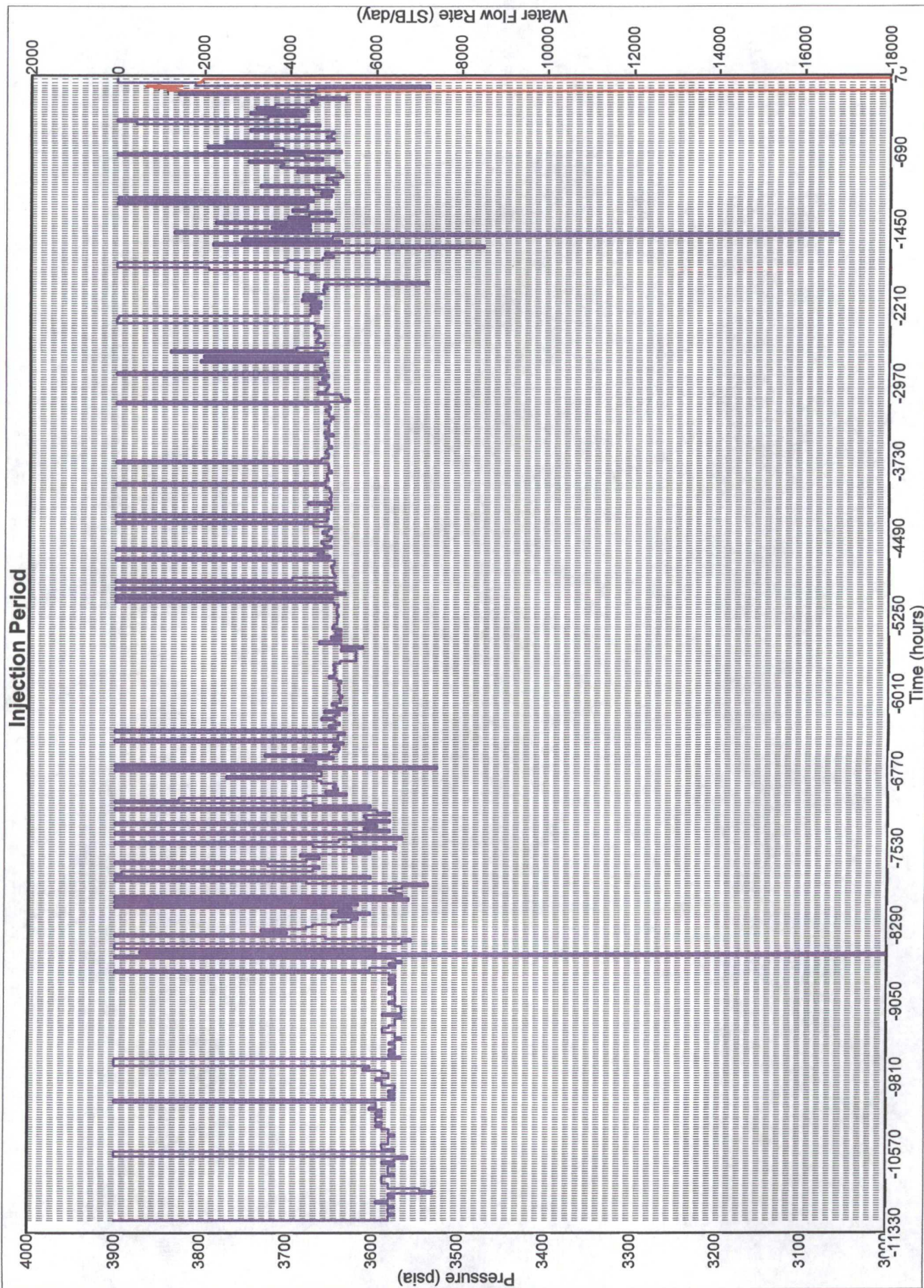


FIGURE 11

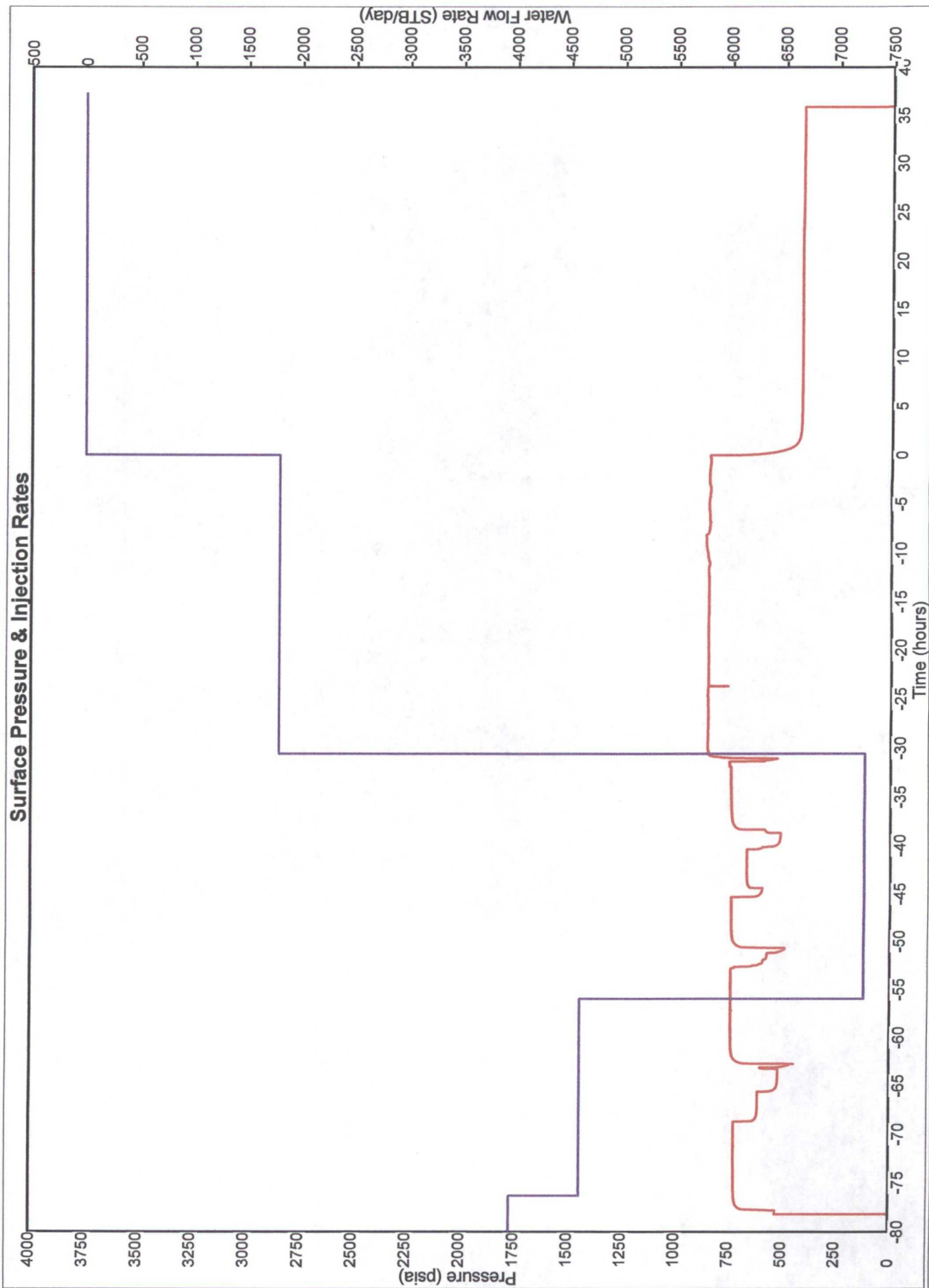


FIGURE 12

Gaines Well No. 3
Cartesian Plot of Surface Pressure and Injection Rates
March 01, 2008 to January 29, 2012

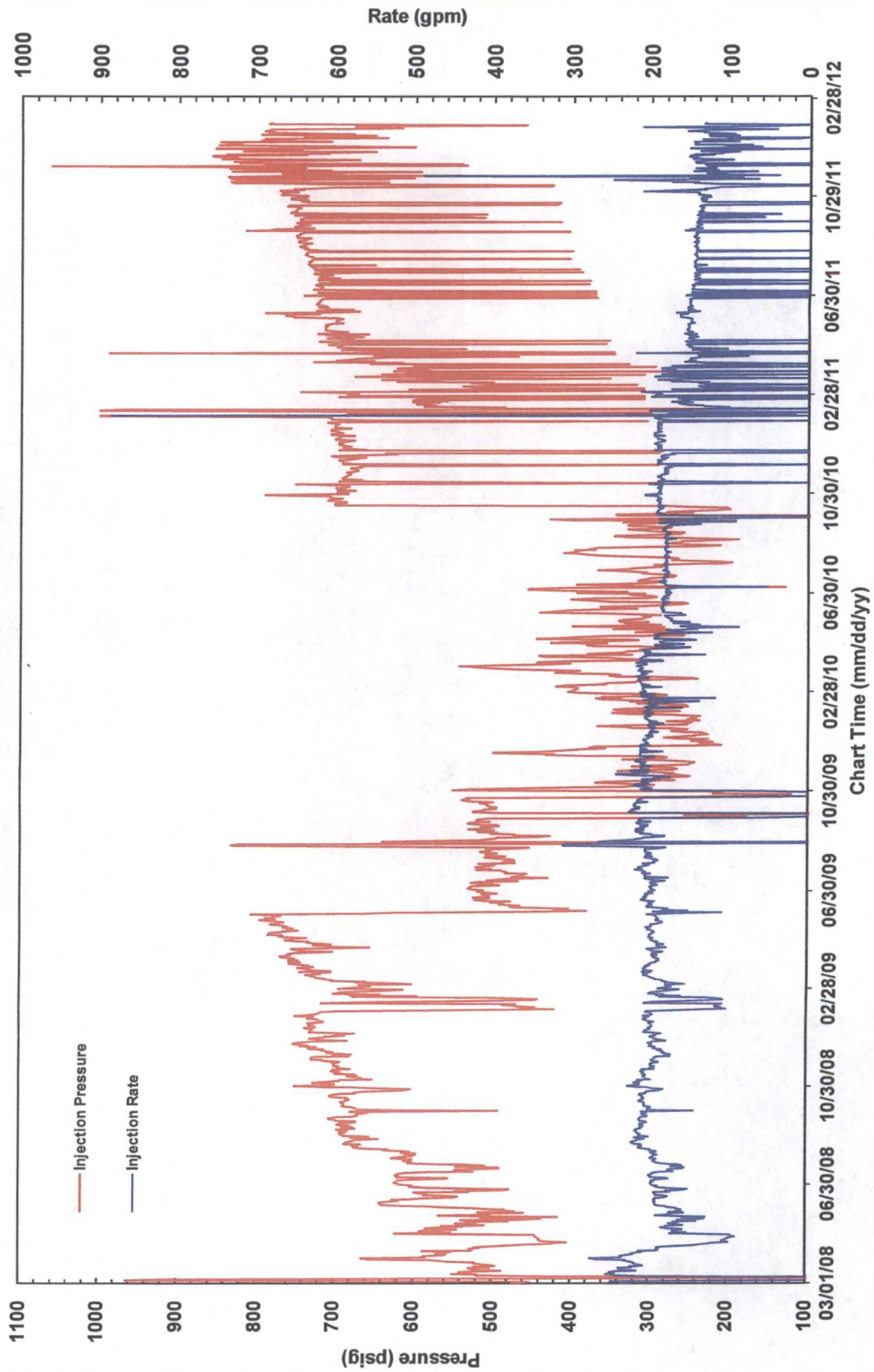


FIGURE 13

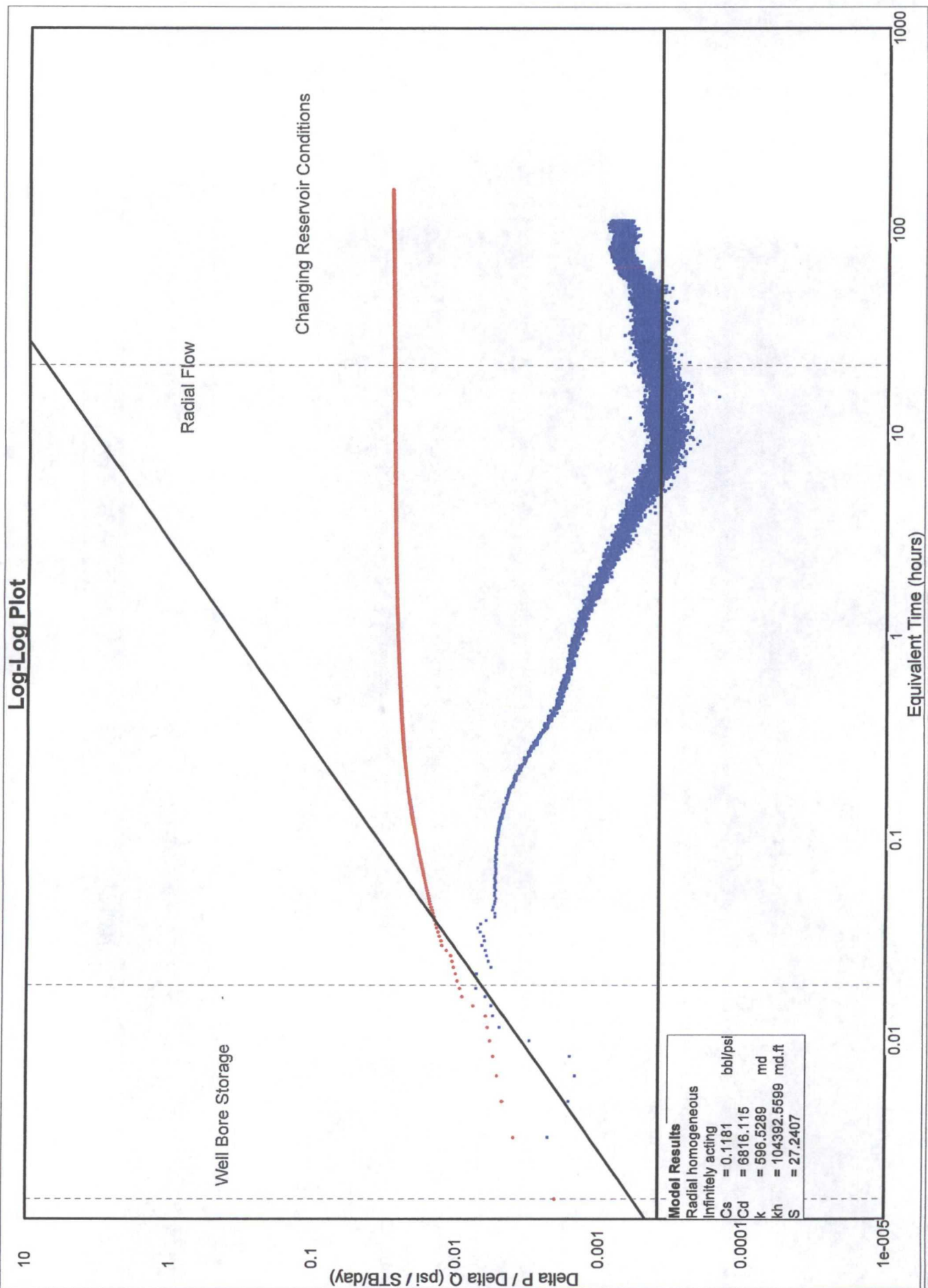


FIGURE 14

Radial Flow Plot

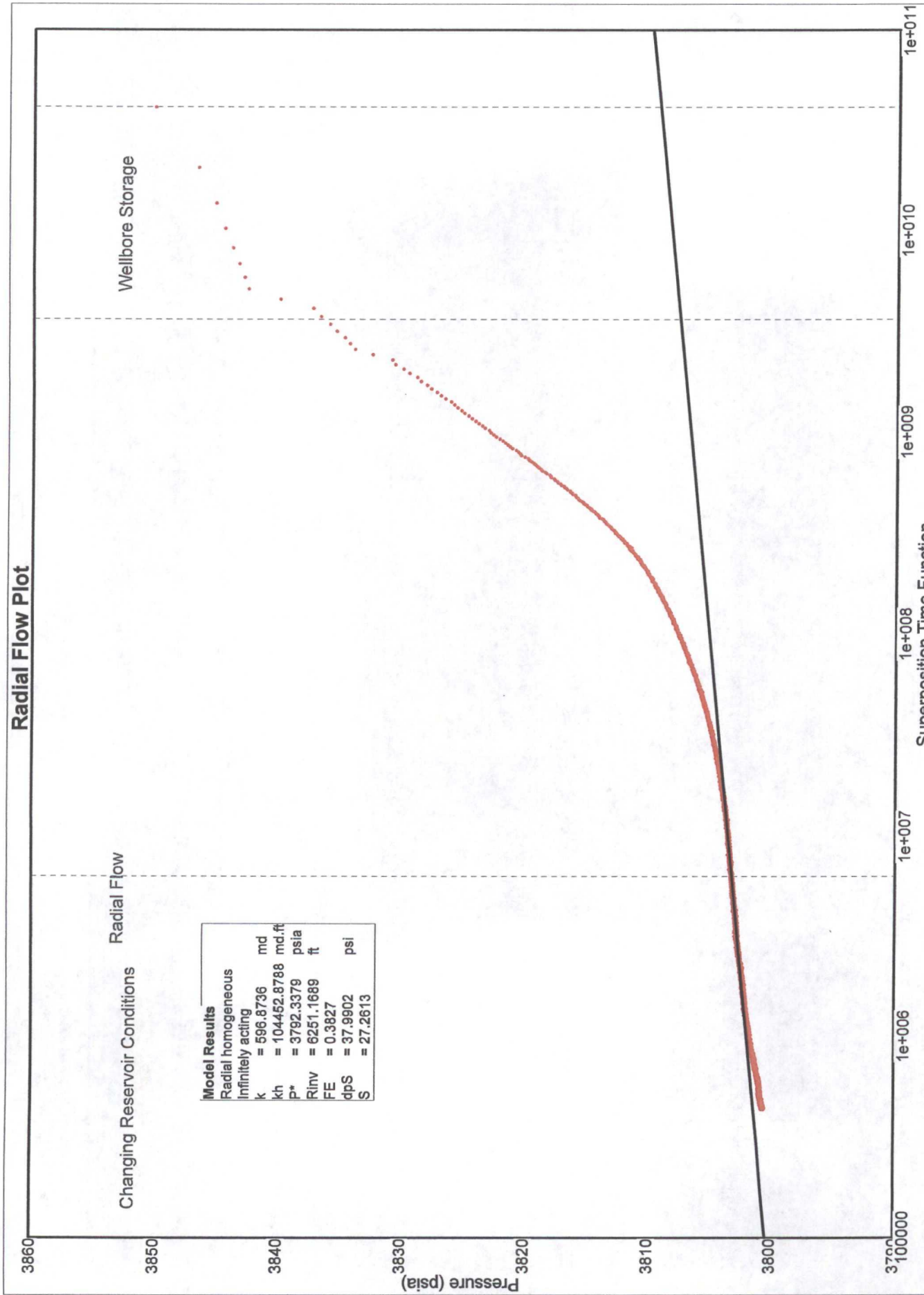


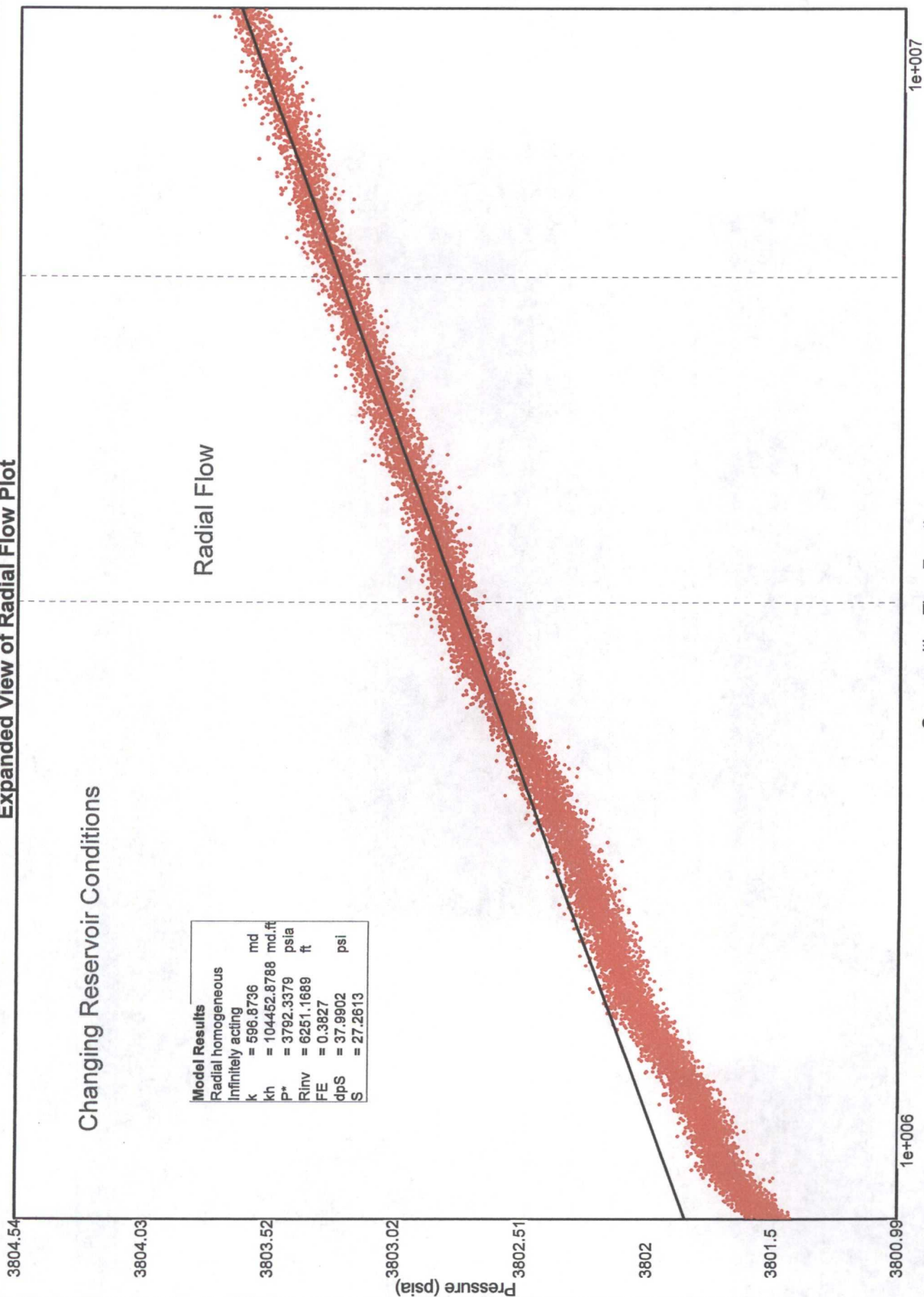
FIGURE 15

Expanded View of Radial Flow Plot

Changing Reservoir Conditions

Model Results	
Radial homogeneous	
Infinitely acting	
k	= 596.8736 md
kh	= 104452.8788 md.ft
P*	= 3792.3379 psia
Rinv	= 6251.1689 ft
FE	= 0.3827
dpS	= 37.9902 psi
S	= 27.2613

Radial Flow



Superposition Time Function

FIGURE 16

Navajo Refining Company
Mewbourne Well No. 3
May 7, 2011 to June 27, 2011
Hall Plot

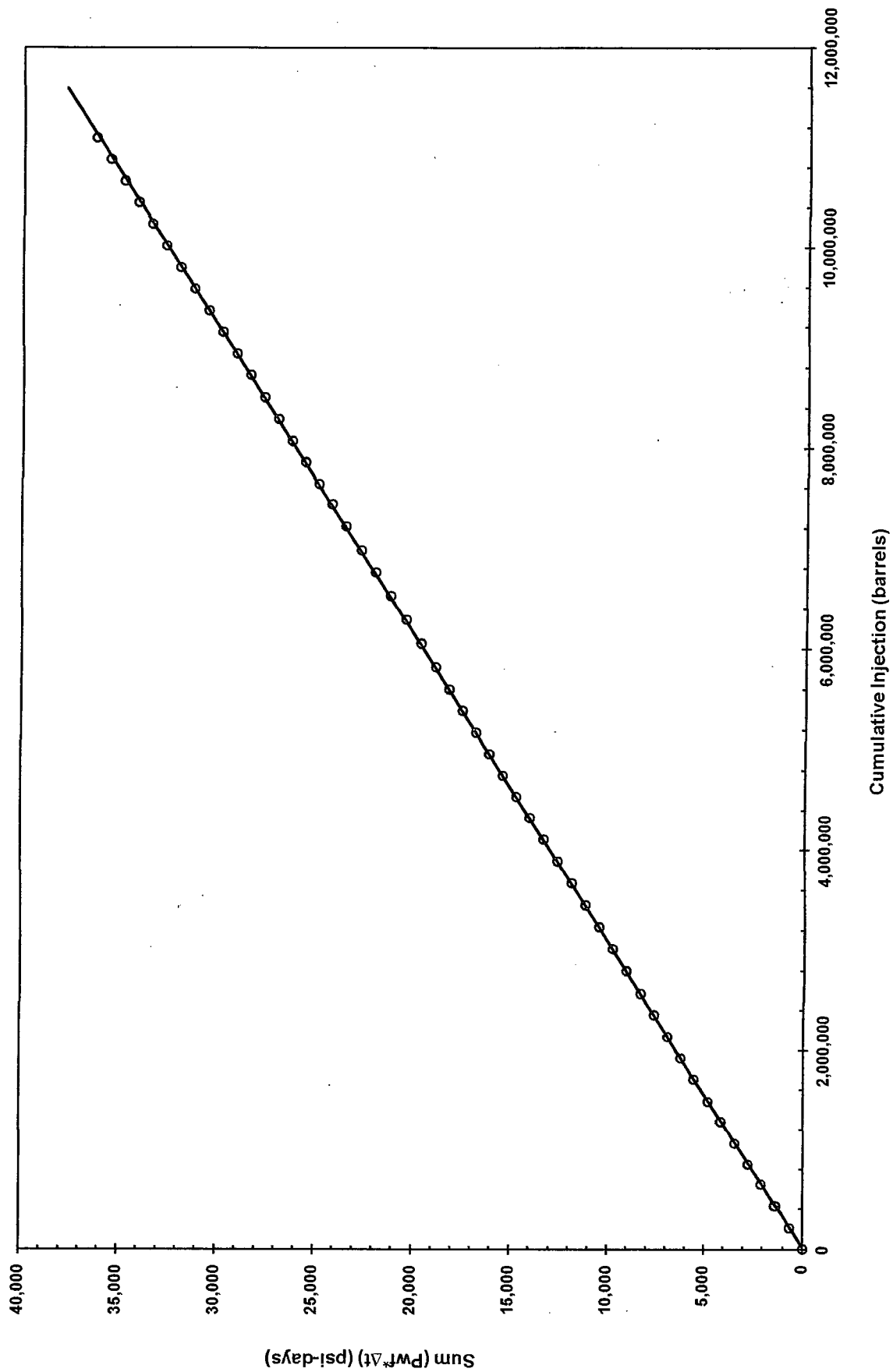


FIGURE 17

**Navajo Refining Company
Static Pressure Gradient Survey
Gaines Well No. 3
January 27, 2012**

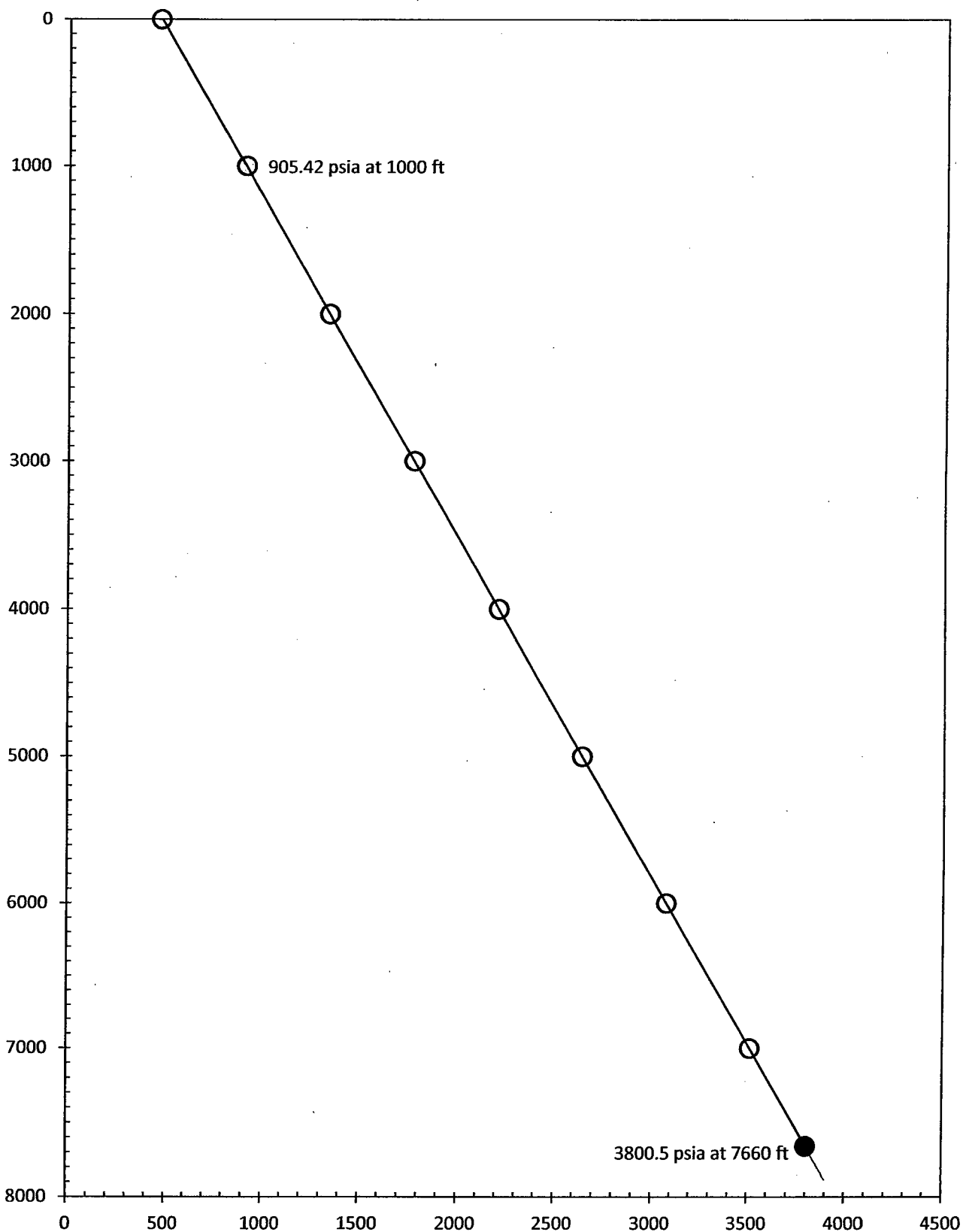


FIGURE 18

APPENDICES

SUBSURFACE



APPENDIX A

**DUAL INDUCTION LOG SECTIONS FROM
7,660 FEET TO 8,620 FEET**

APPENDIX B

**NEUTRON DENSITY LOG SECTIONS FROM
7,660 FEET TO 8,620 FEET**

APPENDIX C
COMPRESSIBILITY OF FLUID

APPENDIX C

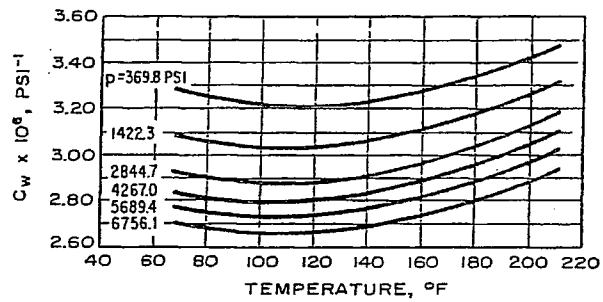


Fig. D.16 Average compressibility of distilled water. After Long and Chierici.¹³

Source: Earlougher, 1977, *Advances in Well Test Analysis*

COMPRESSIBILITY OF PORE VOLUME AND DISTILLED WATER

APPENDIX D

COMPRESSIBILITY OF PORE VOLUME

APPENDIX D

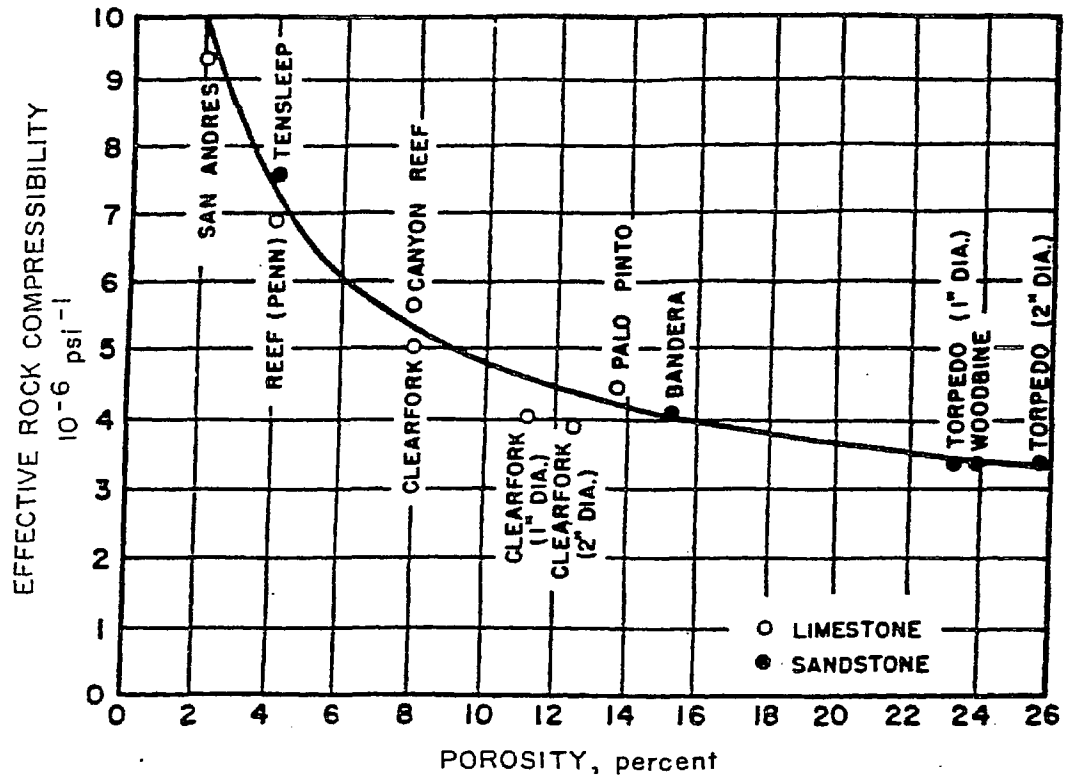


Fig. G.5 Effective formation (rock) compressibility. From Hall, *Trans., AIME* (1953) 198, 309.

Source: Matthews and Russell, 1967, *Pressure Buildup and Flow Tests in Wells*

APPENDIX E

**GAINES WELL NO. 3 2006 TEMPERATURE LOG
SECTIONS FROM 7,660 FEET TO 8,620 FEET**

APPENDIX F

**WATER VISCOSITIES AT VARIOUS SALINITIES
AND TEMPERATURES**

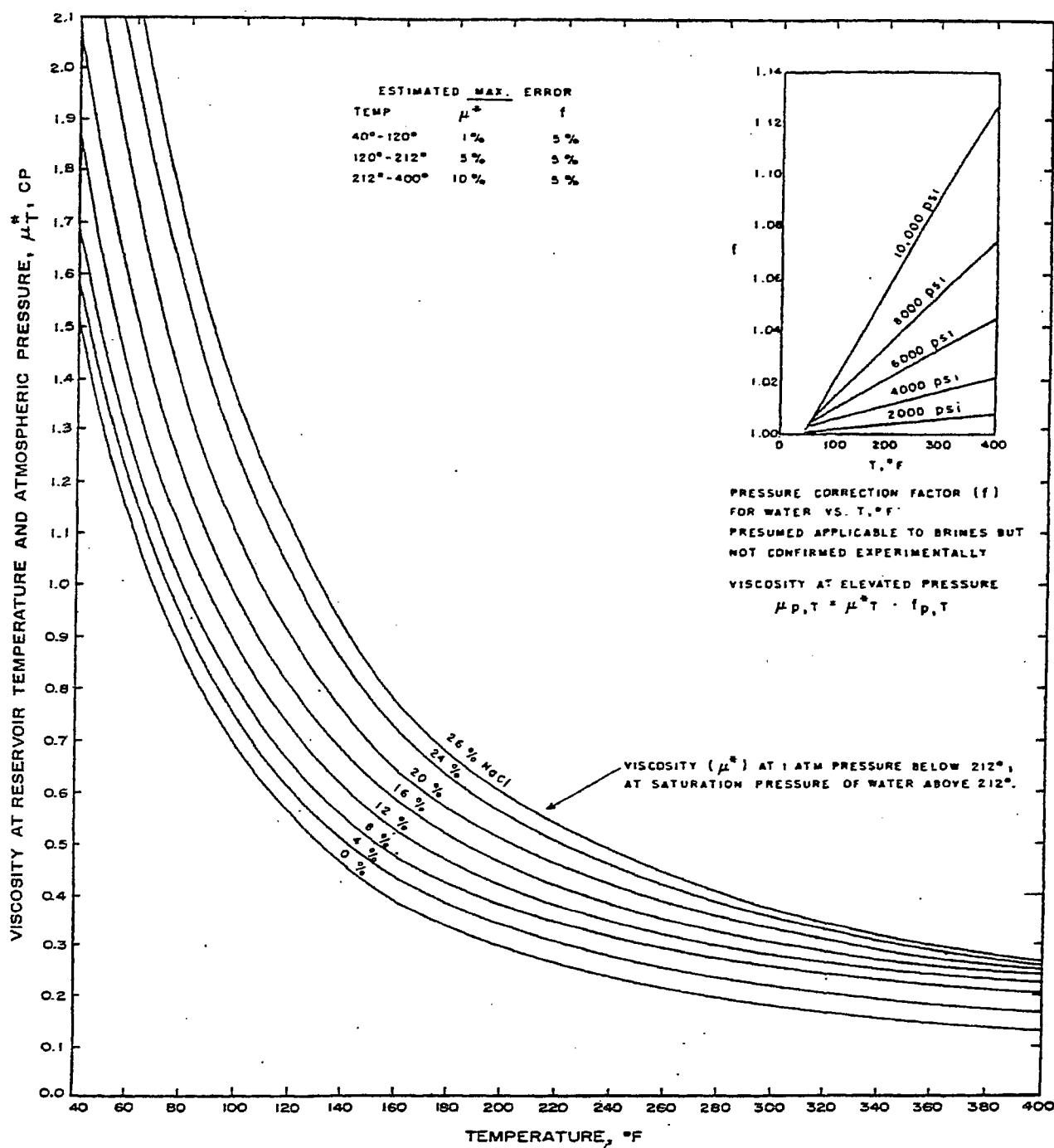


Fig. D.35 Water viscosity at various salinities and temperatures. After Matthews and Russell, data of Chesnut.¹⁸

FROM: Earlougher, R.C., 1977, "Advances in Well Test Analysis", SPE of AIME, Dallas, Texas

APPENDIX G
DAILY RATE HISTORY DATA

APPENDIX G

NAVAJO REFINING INJECTION RATES USED IN ANALYSIS

Date	Elapsed Time (hours)	Average Surface Injection Pressure (psig)	Average Injection Rate (bpd)	Average Injection Rate (gpm)	Comments
10/16/2010	-11208	701.15	6398.27	186.62	Start-up After Last Year's Falloff Testing
10/17/2010	-11184	701.15	6398.27	186.62	
10/18/2010	-11160	696.22	6398.27	186.62	
10/19/2010	-11136	701.15	6547.91	190.98	
10/20/2010	-11112	686.36	6398.27	186.62	
10/21/2010	-11088	710.85	6398.27	186.62	
10/22/2010	-11064	705.84	6540.43	190.76	
10/23/2010	-11040	701.15	6398.27	186.62	
10/24/2010	-11016	671.73	6098.98	177.89	
10/25/2010	-10992	710.85	6398.27	186.62	
10/26/2010	-10968	710.85	6547.91	190.98	
10/27/2010	-10944	706.08	6398.27	186.62	
10/28/2010	-10920	799.11	7433.13	216.80	
10/29/2010	-10896	784.48	7141.33	208.29	
10/30/2010	-10872	686.36	6398.27	186.62	
10/31/2010	-10848	701.15	6398.27	186.62	
10/31/2010	-10824	695.97	6256.10	182.47	
11/1/2010	-10800	696.22	6248.62	182.25	
11/2/2010	-10776	691.29	6248.62	182.25	

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11/3/2010	-10752	701.15	6547.91	190.98	
11/4/2010	-10728	691.29	6398.27	186.62	
11/5/2010	-10704	701.15	6398.27	186.62	
11/6/2010	-10680	696.22	6398.27	186.62	
11/7/2010	-10656	686.36	6547.91	190.98	
11/8/2010	-10632	686.36	6248.62	182.25	
11/9/2010	-10608	710.61	6540.43	190.76	
11/10/2010	-10584	750.13	6842.04	199.56	
11/11/2010	-10560	284.58	0.00	0.00	
11/12/2010	-10536	284.33	0.00	0.00	
11/13/2010	-10512	696.47	6540.43	190.76	
11/14/2010	-10488	681.42	6248.62	182.25	
11/15/2010	-10464	666.80	6241.14	182.03	
11/16/2010	-10440	691.29	6398.27	186.62	
11/17/2010	-10416	691.29	6398.27	186.62	
11/18/2010	-10392	691.04	6398.27	186.62	
11/19/2010	-10368	686.36	6547.91	190.98	
11/20/2010	-10344	686.36	6398.27	186.62	
11/21/2010	-10320	681.67	6405.75	186.83	
11/22/2010	-10296	681.42	6248.62	182.25	
11/23/2010	-10272	681.42	6098.98	177.89	
11/24/2010	-10248	686.36	6248.62	182.25	
11/25/2010	-10224	676.66	6098.98	177.89	
11/26/2010	-10200	671.48	6098.98	177.89	

APPENDIX G

11/27/2010	-10176	671.73	6248.62	182.25	
11/28/2010	-10152	676.66	6098.98	177.89	
11/29/2010	-10128	681.42	6248.62	182.25	
11/30/2010	-10104	666.80	5949.33	173.52	
12/1/2010	-10080	671.73	6106.46	178.11	
12/2/2010	-10056	666.80	6098.98	177.89	
12/3/2010	-10032	289.26	0.00	0.00	
12/4/2010	-10008	691.53	6547.91	190.98	
12/5/2010	-9984	681.42	6398.27	186.62	
12/6/2010	-9960	691.29	6547.91	190.98	
12/7/2010	-9936	691.29	6398.27	186.62	
12/8/2010	-9912	691.29	6540.43	190.76	
12/9/2010	-9888	695.97	6547.91	190.98	
12/10/2010	-9864	681.19	6248.62	182.25	
12/11/2010	-9840	671.73	6248.62	182.25	
12/12/2010	-9816	661.87	6098.98	177.89	
12/13/2010	-9792	696.22	6398.27	186.62	
12/14/2010	-9768	706.08	6398.27	186.62	
12/15/2010	-9744	671.73	6248.62	182.25	
12/16/2010	-9720	622.75	5804.85	169.31	
12/17/2010	-9696	637.38	5949.33	173.52	
12/18/2010	-9672	289.26	0.00	0.00	
12/19/2010	-9648	289.26	0.00	0.00	
12/20/2010	-9624	284.33	0.00	0.00	

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12/21/2010	-9600	695.97	6690.07	195.13	
12/22/2010	-9576	661.87	6398.27	186.62	
12/23/2010	-9552	686.36	6547.91	190.98	
12/24/2010	-9528	691.29	6405.75	186.83	
12/25/2010	-9504	686.36	6547.91	190.98	
12/26/2010	-9480	681.42	6547.91	190.98	
12/27/2010	-9456	691.29	6405.75	186.83	
12/28/2010	-9432	696.22	6540.43	190.76	
12/29/2010	-9408	691.29	6697.55	195.35	
12/30/2010	-9384	696.22	6547.91	190.98	
12/31/2010	-9360	696.22	6547.91	190.98	
1/1/2011	-9336	686.36	6248.62	182.25	
1/2/2011	-9312	676.66	6248.62	182.25	
1/3/2011	-9288	701.15	6398.27	186.62	
1/4/2011	-9264	701.15	6547.91	190.98	
1/5/2011	-9240	696.22	6547.91	190.98	
1/6/2011	-9216	696.22	6547.91	190.98	
1/7/2011	-9192	691.29	6697.55	195.35	
1/8/2011	-9168	676.66	6248.62	182.25	
1/9/2011	-9144	706.08	6697.55	195.35	
1/10/2011	-9120	706.08	6697.55	195.35	
1/11/2011	-9096	691.29	6690.07	195.13	
1/12/2011	-9072	696.22	6547.91	190.98	
1/13/2011	-9048	696.22	6398.27	186.62	

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1/14/2011	-9024	706.08	6547.91	190.98	
1/15/2011	-9000	706.08	6547.91	190.98	
1/16/2011	-8976	706.08	6540.43	190.76	
1/17/2011	-8952	681.42	6398.27	186.62	
1/18/2011	-8928	701.15	6547.91	190.98	
1/19/2011	-8904	701.15	6547.91	190.98	
1/20/2011	-8880	701.15	6547.91	190.98	
1/21/2011	-8856	701.15	6398.27	186.62	
1/22/2011	-8832	696.22	6547.91	190.98	
1/23/2011	-8808	701.15	6398.27	186.62	
1/24/2011	-8784	710.85	6547.91	190.98	
1/25/2011	-8760	696.22	6398.27	186.62	
1/26/2011	-8736	304.06	0.00	0.00	
1/27/2011	-8712	656.94	5949.33	173.52	
1/28/2011	-8688	706.08	6547.91	190.98	
1/29/2011	-8664	706.08	6398.27	186.62	
1/30/2011	-8640	706.08	6697.55	195.35	
1/31/2011	-8616	710.85	6547.91	190.98	
2/1/2011	-8592	1000.12	0.00	0.00	
2/2/2011	-8568	1000.12	30346.48	885.11	
2/3/2011	-8544	382.70	575.82	16.79	
2/4/2011	-8520	686.36	6091.50	177.67	
2/5/2011	-8496	299.13	0.00	0.00	
2/6/2011	-8472	299.13	0.00	0.00	

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2/7/2011	-8448	720.71	6697.55	195.35	
2/8/2011	-8424	1000.12	6909.12	201.52	
2/9/2011	-8400	974.90	4919.37	143.48	
2/10/2011	-8376	152.02	0.00	0.00	
2/11/2011	-8352	490.28	4019.44	117.23	
2/12/2011	-8328	485.34	3420.87	99.78	
2/13/2011	-8304	588.40	4455.73	129.96	
2/14/2011	-8280	573.61	4612.86	134.54	
2/15/2011	-8256	578.54	5206.27	151.85	
2/16/2011	-8232	598.09	5505.56	160.58	
2/17/2011	-8208	598.09	5655.21	164.94	
2/18/2011	-8184	568.67	5056.63	147.49	
2/19/2011	-8160	603.27	5942.11	173.31	
2/20/2011	-8136	558.98	5206.27	151.85	
2/21/2011	-8112	603.03	5505.56	160.58	
2/22/2011	-8088	308.82	0.00	0.00	
2/23/2011	-8064	598.09	5655.21	164.94	
2/24/2011	-8040	308.82	0.00	0.00	
2/25/2011	-8016	696.22	6842.04	199.56	
2/26/2011	-7992	308.82	0.00	0.00	
2/27/2011	-7968	681.42	6697.55	195.35	
2/28/2011	-7944	686.36	6547.91	190.98	
3/1/2011	-7920	671.73	6398.27	186.62	
3/2/2011	-7896	681.42	6697.55	195.35	

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3/3/2011	-7872	745.20	7290.97	212.65	
3/4/2011	-7848	519.70	4463.21	130.18	
3/5/2011	-7824	309.07	0.00	0.00	
3/6/2011	-7800	607.96	5949.33	173.52	
3/7/2011	-7776	309.07	0.00	0.00	
3/8/2011	-7752	402.01	149.34	4.36	
3/9/2011	-7728	519.70	4612.86	134.54	
3/10/2011	-7704	539.25	4762.50	138.91	
3/11/2011	-7680	470.97	3570.51	104.14	
3/12/2011	-7656	318.68	0.00	0.00	
3/13/2011	-7632	500.14	4463.21	130.18	
3/14/2011	-7608	529.56	4762.50	138.91	
3/15/2011	-7584	500.14	4313.57	125.81	
3/16/2011	-7560	622.75	5949.33	173.52	
3/17/2011	-7536	568.92	5520.53	161.02	
3/18/2011	-7512	642.31	6547.91	190.98	
3/19/2011	-7488	514.76	4612.86	134.54	
3/20/2011	-7464	352.79	0.00	0.00	
3/21/2011	-7440	549.12	5206.27	151.85	
3/22/2011	-7416	676.66	6697.55	195.35	
3/23/2011	-7392	568.67	5505.56	160.58	
3/24/2011	-7368	308.82	0.00	0.00	
3/25/2011	-7344	642.31	6398.27	186.62	
3/26/2011	-7320	583.47	5804.85	169.31	

APPENDIX G

3/27/2011	-7296	612.89	6098.98	177.89	
3/28/2011	-7272	279.57	0.00	0.00	
3/29/2011	-7248	627.52	6398.27	186.62	
3/30/2011	-7224	581.74	5855.42	170.78	
3/31/2011	-7200	588.40	5804.85	169.31	
4/1/2011	-7176	622.75	6398.27	186.62	
4/2/2011	-7152	607.96	6098.98	177.89	
4/4/2011	-7128	294.20	0.00	0.00	
4/5/2011	-7104	603.03	5949.33	173.52	
4/6/2011	-7080	514.76	4612.86	134.54	
4/7/2011	-7056	328.55	0.00	0.00	
4/8/2011	-7032	656.94	1490.97	43.49	
4/9/2011	-7008	615.00	4422.86	129.00	
4/10/2011	-6984	729.00	5385.71	157.08	
4/11/2011	-6960	652.00	4902.86	143.00	
4/12/2011	-6936	701.00	5180.00	151.08	
4/13/2011	-6912	681.92	5074.29	148.00	
4/14/2011	-6888	673.00	5131.43	149.67	
4/15/2011	-6864	647.00	4797.14	139.92	
4/16/2011	-6840	635.00	4694.29	136.92	
4/17/2011	-6816	469.00	2602.86	75.92	
4/18/2011	-6792	653.00	4800.00	140.00	
4/19/2011	-6768	652.00	4800.00	140.00	
4/20/2011	-6744	347.00	0.00	0.00	

APPENDIX G

4/21/2011	-6720	988.75	7502.86	218.83	
4/22/2011	-6696	348.00	0.00	0.00	
4/23/2011	-6672	644.00	4662.86	136.00	
4/24/2011	-6648	623.00	4425.71	129.08	
4/25/2011	-6624	694.00	5074.29	148.00	
4/26/2011	-6600	536.00	3500.00	102.08	
4/27/2011	-6576	676.00	4974.29	145.08	
4/28/2011	-6552	699.00	5177.14	151.00	
4/29/2011	-6528	694.00	5214.29	152.08	
4/30/2011	-6504	693.00	5080.00	148.17	
5/1/2011	-6480	710.00	5314.29	155.00	
5/2/2011	-6456	358.17	0.00	0.00	
5/3/2011	-6432	706.00	5177.14	151.00	
5/4/2011	-6408	702.00	5177.14	151.00	
5/5/2011	-6384	722.00	5348.57	156.00	
5/6/2011	-6360	353.00	0.00	0.00	
5/7/2011	-6336	694.00	5108.57	149.00	
5/8/2011	-6312	678.00	4971.43	145.00	
5/9/2011	-6288	712.00	5214.29	152.08	
5/10/2011	-6264	704.00	5108.57	149.00	
5/11/2011	-6240	666.00	4800.00	140.00	
5/12/2011	-6216	693.00	5102.86	148.83	
5/13/2011	-6192	715.00	5214.29	152.08	
5/14/2011	-6168	658.92	4865.71	141.92	

APPENDIX G

5/15/2011	-6144	724.00	5382.86	157.00	
5/16/2011	-6120	697.00	5145.71	150.08	
5/17/2011	-6096	686.00	5042.86	147.08	
5/18/2011	-6072	706.00	5240.00	152.83	
5/19/2011	-6048	714.00	5217.14	152.17	
5/20/2011	-6024	715.00	5280.00	154.00	
5/21/2011	-6000	714.00	5214.29	152.08	
5/22/2011	-5976	715.00	5180.00	151.08	
5/23/2011	-5952	713.00	5211.43	152.00	
5/24/2011	-5928	712.00	5208.57	151.92	
5/25/2011	-5904	714.00	5180.00	151.08	
5/26/2011	-5880	711.00	5248.57	153.08	
5/27/2011	-5856	706.00	5140.00	149.92	
5/28/2011	-5832	692.00	4968.57	144.92	
5/29/2011	-5808	701.00	5080.00	148.17	
5/30/2011	-5784	701.00	5114.29	149.17	
5/31/2011	-5760	701.00	5074.29	148.00	
6/1/2011	-5736	697.00	5111.43	149.08	
6/2/2011	-5712	692.00	5071.43	147.92	
6/3/2011	-5688	697.92	5211.43	152.00	
6/4/2011	-5664	755.00	5591.43	163.08	
6/5/2011	-5640	755.00	5588.57	163.00	
6/6/2011	-5616	765.00	5588.57	163.00	
6/7/2011	-5592	766.00	5591.43	163.08	

APPENDIX G

6/8/2011	-5568	722.00	5237.14	152.75	
6/9/2011	-5544	791.00	5754.29	167.83	
6/10/2011	-5520	719.00	5242.86	152.92	
6/11/2011	-5496	671.00	4731.43	138.00	
6/12/2011	-5472	726.00	5242.86	152.92	
6/13/2011	-5448	678.83	5011.43	146.17	
6/14/2011	-5424	715.00	5242.86	152.92	
6/15/2011	-5400	710.00	5108.57	149.00	
6/16/2011	-5376	722.92	5242.86	152.92	
6/17/2011	-5352	712.00	5042.86	147.08	
6/18/2011	-5328	714.00	5071.43	147.92	
6/19/2011	-5304	721.00	5142.86	150.00	
6/20/2011	-5280	726.00	5145.71	150.08	
6/21/2011	-5256	724.00	5140.00	149.92	
6/22/2011	-5232	724.08	5174.29	150.92	
6/23/2011	-5208	721.71	5143.66	150.02	
6/24/2011	-5184	721.92	5137.05	149.83	
6/25/2011	-5160	721.08	5142.86	150.00	
6/26/2011	-5136	719.00	5174.29	150.92	
6/27/2011	-5112	717.00	5074.29	148.00	
6/28/2011	-5088	369.00	0.00	0.00	
6/29/2011	-5064	714.08	5042.86	147.08	
6/30/2011	-5040	372.00	0.00	0.00	
7/1/2011	-5016	742.00	5345.71	155.92	

APPENDIX G

7/2/2011	-4992	713.00	5102.86	148.83	
7/3/2011	-4968	371.00	0.00	0.00	
7/4/2011	-4944	723.00	5108.57	149.00	
7/5/2011	-4920	724.00	5074.29	148.00	
7/6/2011	-4896	371.00	0.00	0.00	
7/7/2011	-4872	623.00	4114.29	120.00	
7/8/2011	-4848	730.00	5105.71	148.92	
7/9/2011	-4824	721.00	5074.29	148.00	
7/10/2011	-4800	720.00	5040.00	147.00	
7/11/2011	-4776	718.00	5042.86	147.08	
7/12/2011	-4752	721.00	5008.57	146.08	
7/13/2011	-4728	723.00	5077.14	148.08	
7/14/2011	-4704	726.92	5080.00	148.17	
7/15/2011	-4680	380.00	0.00	0.00	
7/16/2011	-4656	722.92	4974.29	145.08	
7/17/2011	-4632	655.50	4688.57	136.75	
7/18/2011	-4608	707.00	4834.29	141.00	
7/19/2011	-4584	378.00	0.00	0.00	
7/20/2011	-4560	724.00	5005.71	146.00	
7/21/2011	-4536	706.00	4834.29	141.00	
7/22/2011	-4512	696.00	4771.43	139.17	
7/23/2011	-4488	723.00	4971.43	145.00	
7/24/2011	-4464	721.00	5008.57	146.08	
7/25/2011	-4440	713.00	4902.86	143.00	

APPENDIX G

7/26/2011	-4416	706.00	4797.14	139.92	
7/27/2011	-4392	726.00	4937.14	144.00	
7/28/2011	-4368	729.00	5002.86	145.92	
7/29/2011	-4344	670.67	4597.14	134.08	
7/30/2011	-4320	388.00	0.00	0.00	
7/31/2011	-4296	722.00	4900.00	142.92	
8/1/2011	-4272	728.00	4934.29	143.92	
8/2/2011	-4248	392.00	0.00	0.00	
8/3/2011	-4224	730.00	4937.14	144.00	
8/4/2011	-4200	727.00	4902.86	143.00	
8/5/2011	-4176	731.00	5002.86	145.92	
8/6/2011	-4152	734.00	5011.43	146.17	
8/7/2011	-4128	651.17	4468.57	130.33	
8/8/2011	-4104	737.00	4997.14	145.75	
8/9/2011	-4080	736.00	4968.57	144.92	
8/10/2011	-4056	735.00	5000.00	145.83	
8/11/2011	-4032	736.00	5002.86	145.92	
8/12/2011	-4008	732.00	4974.29	145.08	
8/13/2011	-3984	733.00	4965.71	144.83	
8/14/2011	-3960	731.00	4874.29	142.17	
8/15/2011	-3936	404.00	0.00	0.00	
8/16/2011	-3912	731.00	4865.71	141.92	
8/17/2011	-3888	730.00	4934.29	143.92	
8/18/2011	-3864	737.00	4905.71	143.08	

APPENDIX G

8/19/2011	-3840	738.00	4902.86	143.00	
8/20/2011	-3816	740.00	5002.86	145.92	
8/21/2011	-3792	738.00	4942.86	144.17	
8/22/2011	-3768	739.00	4940.00	144.08	
8/23/2011	-3744	737.00	4934.29	143.92	
8/24/2011	-3720	401.00	0.00	0.00	
8/25/2011	-3696	713.92	4765.71	139.00	
8/26/2011	-3672	736.00	4931.43	143.83	
8/27/2011	-3648	742.00	4937.14	144.00	
8/28/2011	-3624	738.00	4868.57	142.00	
8/29/2011	-3600	745.00	4905.71	143.08	
8/30/2011	-3576	748.00	5002.86	145.92	
8/31/2011	-3552	740.00	4937.14	144.00	
9/1/2011	-3528	743.00	4937.14	144.00	
9/2/2011	-3504	739.00	4931.43	143.83	
9/3/2011	-3480	732.00	4871.43	142.08	
9/4/2011	-3456	749.00	5037.14	146.92	
9/5/2011	-3432	749.00	4837.14	141.08	
9/6/2011	-3408	748.00	4940.00	144.08	
9/7/2011	-3384	740.00	4931.43	143.83	
9/8/2011	-3360	738.00	4937.14	144.00	
9/9/2011	-3336	733.00	4837.14	141.08	
9/10/2011	-3312	750.92	4974.29	145.08	
9/11/2011	-3288	751.08	5037.14	146.92	

APPENDIX G

9/12/2011	-3264	752.00	4942.86	144.17	
9/13/2011	-3240	747.00	4937.14	144.00	
9/14/2011	-3216	748.00	4868.57	142.00	
9/15/2011	-3192	746.00	4971.43	145.00	
9/16/2011	-3168	740.92	4937.14	144.00	
9/17/2011	-3144	405.00	0.00	0.00	
9/18/2011	-3120	816.00	5420.00	158.08	
9/19/2011	-3096	787.08	5240.00	152.83	
9/20/2011	-3072	780.00	5208.57	151.92	
9/21/2011	-3048	729.92	4668.57	136.17	
9/22/2011	-3024	754.00	4871.43	142.08	
9/23/2011	-3000	754.00	4900.00	142.92	
9/24/2011	-2976	750.00	4934.29	143.92	
9/25/2011	-2952	734.92	4697.14	137.00	
9/26/2011	-2928	749.00	4868.57	142.00	
9/27/2011	-2904	749.00	4771.43	139.17	
9/28/2011	-2880	751.00	4928.57	143.75	
9/29/2011	-2856	415.00	0.00	0.00	
9/30/2011	-2832	746.00	4871.43	142.08	
10/1/2011	-2808	746.00	4731.43	138.00	
10/2/2011	-2784	747.00	4834.29	141.00	
10/3/2011	-2760	743.00	4831.43	140.92	
10/4/2011	-2736	512.00	1948.57	56.83	
10/5/2011	-2712	740.00	4771.43	139.17	

APPENDIX G

10/6/2011	-2688	528.17	2022.86	59.00	
10/7/2011	-2664	755.00	4902.86	143.00	
10/8/2011	-2640	510.00	1242.86	36.25	
10/9/2011	-2616	687.00	4182.86	122.00	
10/10/2011	-2592	760.00	4802.86	140.08	
10/11/2011	-2568	759.00	4837.14	141.08	
10/12/2011	-2544	751.00	4634.29	135.17	
10/13/2011	-2520	752.00	4668.57	136.17	
10/14/2011	-2496	752.00	4731.43	138.00	
10/15/2011	-2472	750.00	4700.00	137.08	
10/16/2011	-2448	746.00	4597.14	134.08	
10/17/2011	-2424	747.00	4625.71	134.92	
10/18/2011	-2400	764.00	4797.14	139.92	
10/19/2011	-2376	761.00	4597.14	134.08	
10/20/2011	-2352	420.00	0.00	0.00	Well Shut-in for Testing on Well No. 2
10/21/2011	-2328	418.72	0.00	0.00	Well Shut-in for Testing on Well No. 2
10/22/2011	-2304	416.11	36.36	1.06	Well Shut-in for Testing on Well No. 2
10/23/2011	-2280	737.62	4483.70	130.77	
10/24/2011	-2256	746.27	4683.33	136.60	
10/25/2011	-2232	737.02	4498.54	131.21	
10/26/2011	-2208	759.25	4739.35	138.23	
10/27/2011	-2184	739.46	4498.31	131.20	
10/28/2011	-2160	758.90	4739.89	138.25	
10/29/2011	-2136	738.33	4293.71	125.23	

APPENDIX G

10/30/2011	-2112	754.11	4625.10	134.90	
10/30/2011	-2088	737.49	4324.22	126.12	
10/31/2011	-2064	771.77	4827.79	140.81	
11/1/2011	-2040	770.18	4792.58	139.78	
11/2/2011	-2016	769.78	4881.84	142.39	
11/3/2011	-1992	750.02	4815.46	140.45	
11/4/2011	-1968	750.60	7234.17	211.00	
11/5/2011	-1944	773.23	6065.74	176.92	
11/6/2011	-1920	743.30	4486.40	130.85	
11/7/2011	-1896	755.50	4603.56	134.27	
11/8/2011	-1872	727.90	4207.54	122.72	
11/9/2011	-1848	706.86	3875.86	113.05	
11/10/2011	-1824	585.68	2135.00	62.27	
11/11/2011	-1800	427.66	0.00	0.00	Well Shut-in for Testing on Well No. 1
11/12/2011	-1776	425.67	0.00	0.00	Well Shut-in for Testing on Well No. 1
11/13/2011	-1752	711.30	3960.56	115.52	
11/14/2011	-1728	769.44	4768.57	139.08	
11/15/2011	-1704	832.00	5025.71	146.58	
11/16/2011	-1680	635.00	4831.43	140.92	
11/17/2011	-1656	835.00	5974.29	174.25	
11/18/2011	-1632	820.00	5991.43	174.75	
11/19/2011	-1608	830.00	8548.57	249.33	
11/20/2011	-1584	635.08	2231.43	65.08	
11/21/2011	-1560	836.08	5217.14	152.17	

APPENDIX G

11/22/2011	-1536	602.08	2905.71	84.75	
11/23/2011	-1512	838.92	5002.86	145.92	
11/24/2011	-1488	768.00	16785.71	489.58	Bad Rate Data Point
11/25/2011	-1464	543.00	1314.29	38.33	
11/26/2011	-1440	770.00	4494.29	131.08	
11/27/2011	-1416	695.00	3597.14	104.92	
11/28/2011	-1392	771.00	4488.57	130.92	
11/29/2011	-1368	593.08	2294.29	66.92	
11/30/2011	-1344	834.00	5065.71	147.75	
12/1/2011	-1320	708.00	3974.29	115.92	
12/2/2011	-1296	769.00	4457.14	130.00	
12/3/2011	-1272	837.00	4971.43	145.00	
12/4/2011	-1248	740.92	4077.14	118.92	
12/5/2011	-1224	769.00	4428.57	129.17	
12/6/2011	-1200	1063.00	4425.71	129.08	Bad Pressure Data Point
12/7/2011	-1176	535.00	0.00	0.00	
12/8/2011	-1152	792.00	4557.14	132.92	
12/9/2011	-1128	541.00	20.00	0.58	
12/10/2011	-1104	824.00	4971.43	145.00	
12/11/2011	-1080	800.00	4734.29	138.08	
12/12/2011	-1056	832.00	5008.57	146.08	
12/13/2011	-1032	784.00	4560.00	133.00	
12/14/2011	-1008	671.08	3331.43	97.17	
12/15/2011	-984	847.00	5111.43	149.08	

APPENDIX G

12/16/2011	-960	842.00	5008.57	146.08	
12/17/2011	-936	828.00	4865.71	141.92	
12/18/2011	-912	856.00	5242.86	152.92	
12/19/2011	-888	859.00	5182.86	151.17	
12/20/2011	-864	739.00	4180.00	121.92	
12/21/2011	-840	841.00	5042.86	147.08	
12/22/2011	-816	710.67	3791.43	110.58	
12/23/2011	-792	716.00	3871.43	112.92	
12/24/2011	-768	651.00	3057.14	89.17	
12/25/2011	-744	820.00	4768.57	139.08	
12/26/2011	-720	774.92	4348.57	126.83	
12/27/2011	-696	745.08	0.00	0.00	
12/28/2011	-672	855.00	5202.86	151.75	
12/29/2011	-648	723.08	3871.43	112.92	
12/30/2011	-624	601.08	2097.14	61.17	
12/31/2011	-600	703.08	3608.57	105.25	
1/1/2012	-576	851.00	2514.29	73.33	
1/2/2012	-552	841.00	5034.29	146.83	
1/3/2012	-528	822.00	4865.71	141.92	
1/4/2012	-504	832.00	4968.57	144.92	
1/5/2012	-480	848.92	5040.00	147.00	
1/6/2012	-456	708.00	3088.57	90.08	
1/7/2012	-432	798.00	4217.14	123.00	
1/8/2012	-408	788.00	4700.00	137.08	

APPENDIX G

1/9/2012	-384	793.00	437.14	12.75	
1/10/2012	-360	636.00	0.00	0.00	
1/11/2012	-336	665.00	3502.86	102.17	
1/12/2012	-312	743.00	4362.86	127.25	
1/13/2012	-288	651.00	3085.71	90.00	
1/14/2012	-264	797.00	4417.14	128.83	
1/15/2012	-240	679.17	3231.43	94.25	
1/16/2012	-216	737.00	3660.00	106.75	
1/17/2012	-192	788.92	4634.29	135.17	
1/18/2012	-168	780.00	4491.43	131.00	
1/19/2012	-144	793.00	5322.86	155.25	
1/20/2012	-120	787.00	4588.57	133.83	
1/21/2012	-96	786.00	1414.29	41.25	
1/22/2012	-76.29	644.92	3960.00	115.50	Place Gauges into All Three Wells
1/23/2012	-55.93	617.00	4611.43	134.50	
1/24/2012	-30.57	618.00	7262.86	211.83	Shut In Offset Wells and Start Well #3 Constant Rate Injection Period
1/25/2012	0	678.00	1808.57	52.75	
1/26/2012	37.27	461.00	0.00	0.00	Shut-in Well #3 for Falloff Testing Leaving Offset Wells Shutin
1/27/2012	48	459.00	0.00	0.00	Pull Gauges From Wells and Run Temperature Log

APPENDIX H

GAUGE CALIBRATION SHEETS



SPARTEK SYSTEMS

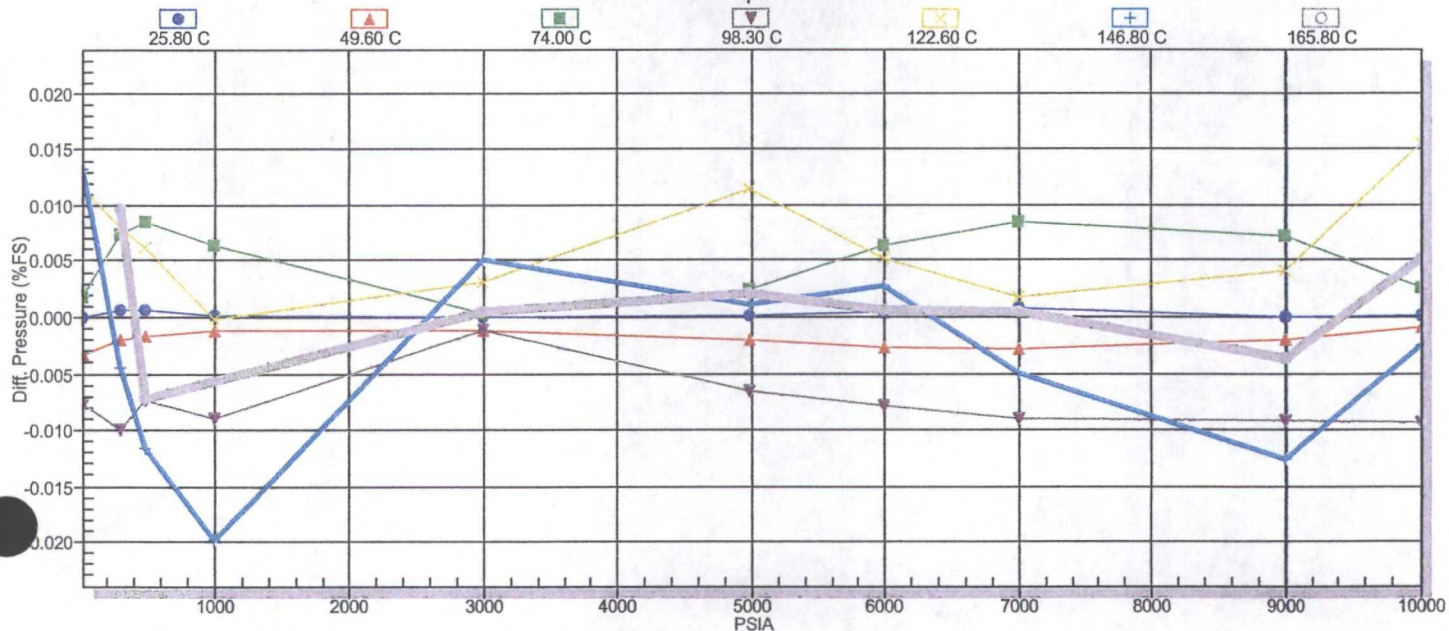
GEOPHYSICAL INSTRUMENTATION

"Providing our customers with Best in Class Technology"

Spartek Systems
#1 Thevenaz Ind. Tr.
Sylvan Lake, AB, Ca, T4S 1P5
Phone (403) 887-2443
Fax (403) 887-4050
URL www.sparteksystems.com

Pressure Gauge Certificate of Calibration

Calibration Report - 76404.



GAUGE NUMBER: 76404

2-D POLYNOMIAL LMS CURVEFIT

Source of f: Pres

Fit Order: 3

Prescale: $x_p = m * (f_p - f_{p0})$

m: 0.01

$f_{p0} = 679762$

Temp

5

$x_t = m * (f_t - f_{t0})$

0.01

$f_{t0} = 147934$

Pressure Equation:

Pressure (PSI) = $A + x_p(B + x_p(C + x_p(D)))$

Temperature Compensation:

$A = A_0 + x_t(A_1 + x_t(A_2 + x_t(A_3 + x_t(A_4))))$

$B = B_0 + x_t(B_1 + x_t(B_2 + x_t(B_3 + x_t(B_4))))$

$C = C_0 + x_t(C_1 + x_t(C_2 + x_t(C_3 + x_t(C_4))))$

$D = D_0 + x_t(D_1 + x_t(D_2 + x_t(D_3 + x_t(D_4))))$

0	1	2	3	4
Pressure (psi) STANDARD FIT COEFFICIENTS:				
A 12.99794347	0.2330350417	0.001448503543	8.059807097E-06	2.546076087E-08
B 3.425793327E-11	2.732094734	-0.002470381242	-2.808599563E-06	-1.357774352E-08
C -9.364561627E-12	7.798827128E-15	-5.296904725E-06	1.130329865E-07	2.416253335E-09
D 1.471188786E-11	3.328730054E-14	2.832889781E-17	1.145768863E-10	-2.228504448E-11
Temperature (C) STANDARD FIT COEFFICIENTS				
A 25.84508201				
B -0.3744317269				
C 1.894632477E-05				
D -1.71314099E-07				

2 points eliminated.

Error File: Gauge # 76404

Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
13.02	25.80	679762.67	147934.25	0.00
303.29	25.60	690391.67	147943.75	0.06
492.47	25.70	697321.33	147956.75	0.06
1001.53	25.90	715981.67	147982.75	0.02
3005.18	25.90	789576.33	148010.25	0.00
4994.65	25.80	862809.33	147991.25	0.02
5995.36	25.90	899684.00	147968.00	0.05
6996.43	25.80	936553.00	147921.25	0.08
9002.25	25.80	1010378.00	147797.25	0.00
10004.67	25.90	1047231.00	147721.25	0.02
13.02	49.60	680117.67	141661.00	-0.33
303.29	49.70	690206.67	141675.25	-0.20
492.47	49.60	696783.67	141683.50	-0.16
1001.53	49.60	714492.00	141701.50	-0.12
3005.19	49.50	784326.67	141739.00	-0.11
4994.66	49.60	853811.33	141729.00	-0.20
5995.37	49.50	888789.67	141709.00	-0.26
6996.44	49.60	923776.33	141674.25	-0.28
9002.26	49.60	993832.67	141572.75	-0.20
10004.68	49.60	1028780.33	141499.50	-0.08
13.03	74.00	680338.67	135239.25	0.17
303.29	74.00	689952.67	135250.25	0.73
492.48	74.00	696212.67	135257.25	0.86
1001.53	74.00	713046.00	135275.25	0.64
3005.19	74.00	779388.33	135308.25	0.03
4994.65	74.10	845380.33	135306.25	0.25
5995.37	74.00	878599.00	135288.75	0.64
6996.44	74.00	911827.67	135262.50	0.86
9002.26	74.00	978373.33	135182.50	0.73
10004.67	74.20	1011573.67	135120.00	0.26
13.04	98.30	680447.67	129003.25	-0.77
303.31	98.30	689578.33	129014.00	-0.99
492.49	98.30	695543.67	129019.75	-0.73
1001.55	98.30	711576.00	129037.50	-0.90
3005.20	98.30	774797.33	129066.25	-0.12
4994.67	98.30	837614.67	129069.25	-0.65
5995.38	98.30	869227.00	129056.75	-0.79
6996.45	98.30	900849.67	129035.50	-0.90
9002.27	98.40	964183.67	128969.00	-0.92
10004.69	98.40	995802.33	128923.25	-0.93
13.05	122.60	680623.67	123046.00	1.17
303.32	122.70	689309.33	123054.00	0.80
492.50	122.60	694975.33	123060.50	0.63
1001.56	122.60	710227.67	123076.50	-0.01
3005.21	122.70	770470.33	123108.75	0.31
4994.68	122.60	830430.67	123115.50	1.15
5995.39	122.60	860569.67	123102.75	0.53
6996.47	122.60	890723.33	123084.75	0.17
9002.28	122.70	951127.00	123039.00	0.42
10004.70	122.70	981270.67	122997.75	1.55
13.06	146.80	680801.33	117455.75	1.33
303.34	146.90	689032.33	117466.50	-0.43
492.51	146.80	694413.33	117474.25	-1.17
1001.58	146.70	708942.33	117488.25	-1.99
3005.22	146.70	766486.00	117519.75	0.51
4994.69	146.80	823742.67	117526.75	0.12
5995.40	146.80	852585.67	117520.50	0.27
6996.46	146.80	881413.33	117509.50	-0.49
9002.28	146.90	939126.33	117469.75	-1.27
10004.68	146.80	967923.00	117434.25	-0.25
303.32	165.80	689042.00	113002.50	0.97
492.50	165.90	694186.67	113010.00	-0.72
3005.21	165.90	763520.67	113055.25	0.04
4994.67	165.90	818745.33	113066.25	0.21
5995.38	165.90	846580.33	113067.00	0.07
6996.44	165.90	874446.00	113064.75	0.06
9002.25	165.80	930216.00	113036.50	-0.36
10004.67	165.90	958059.00	113016.00	0.53



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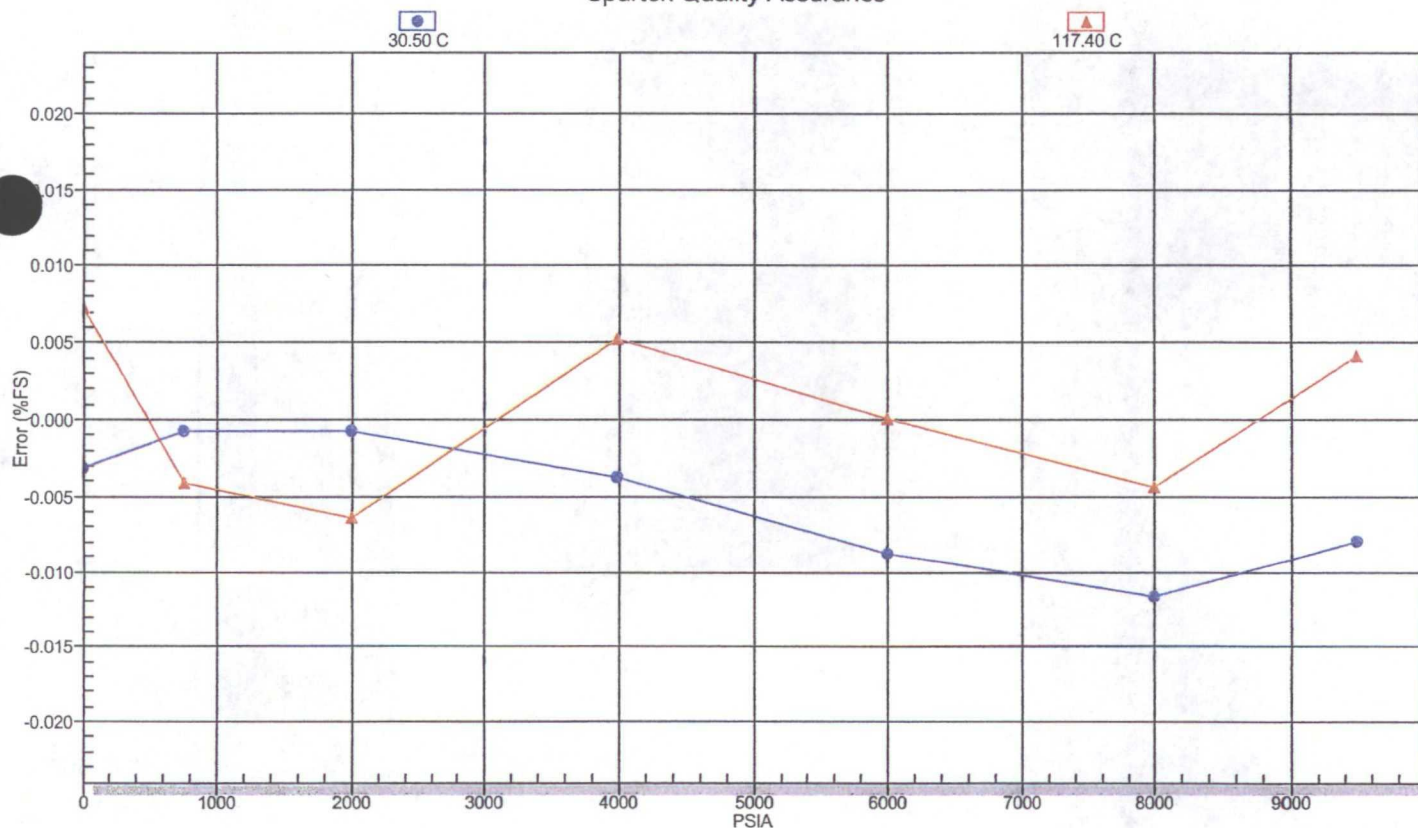
Pressure Gauge Certificate of Conformance

SERIAL NUMBER	76404	CALIBRATION DATE	JUN 11/11
MODEL NUMBER	0 FF0	PRESSURE REFERENCE	NIST Traceable
PRESSURE RANGE	13.02 - 10004.67 psi	TEMP. REFERENCE	NIST Traceable
TEMP. RANGE	25.80 - 165.80 °C	TRACEABILITY DOC.	CAL-STANDARD-001

ACCURACY

As shown in the graph below, this Spartek Gauge conformed to within $\pm 0.024\%$ F.S. of the pressure standard used in calibration, which is accurate to within $\pm 0.01\%$ of reading. This gives an overall accuracy of $\pm(0.024\% \text{ F.S.} + 0.01\% \text{ of reading})$

Spartek Quality Assurance



Accepted By: _____

Date: JUN 14/11

Ramp report: Serial # 76404

Gauge range = 10004.700 PSI. Max. DIFF. = 2.401

Ramp check result: PASS, Max Err = 0.012% F.S.

DW Pressure	Gauge Pressure	RPM4 Pressure	Differential	%F.S.	Oven Temp.	Gauge Temp.
9496.60	9495.81	9496.38	-0.79	0.0079	30.50	31.01
8000.40	7999.24	8000.21	-1.16	0.0116	30.60	30.69
5995.36	5994.48	5994.98	-0.88	0.0088	30.40	30.38
3992.86	3992.49	3992.50	-0.37	0.0037	30.30	30.22
2002.91	2002.85	2002.60	-0.07	0.0007	30.60	30.27
753.95	753.88	753.61	-0.07	0.0007	30.60	30.39
13.02	12.70	12.51	-0.32	0.0032	30.60	30.53
9496.60	9497.03	9496.30	0.42	0.0042	117.40	117.41
8000.41	7999.97	8000.16	-0.44	0.0044	117.50	117.35
5995.36	5995.38	5994.97	0.02	0.0002	117.50	117.29
3992.87	3993.39	3992.50	0.52	0.0052	117.60	117.39
2002.92	2002.29	2002.55	-0.63	0.0063	117.60	117.57
753.95	753.54	753.61	-0.41	0.0041	117.60	117.73
13.02	13.75	12.49	0.73	0.0073	117.80	117.87



SPARTEK SYSTEMS

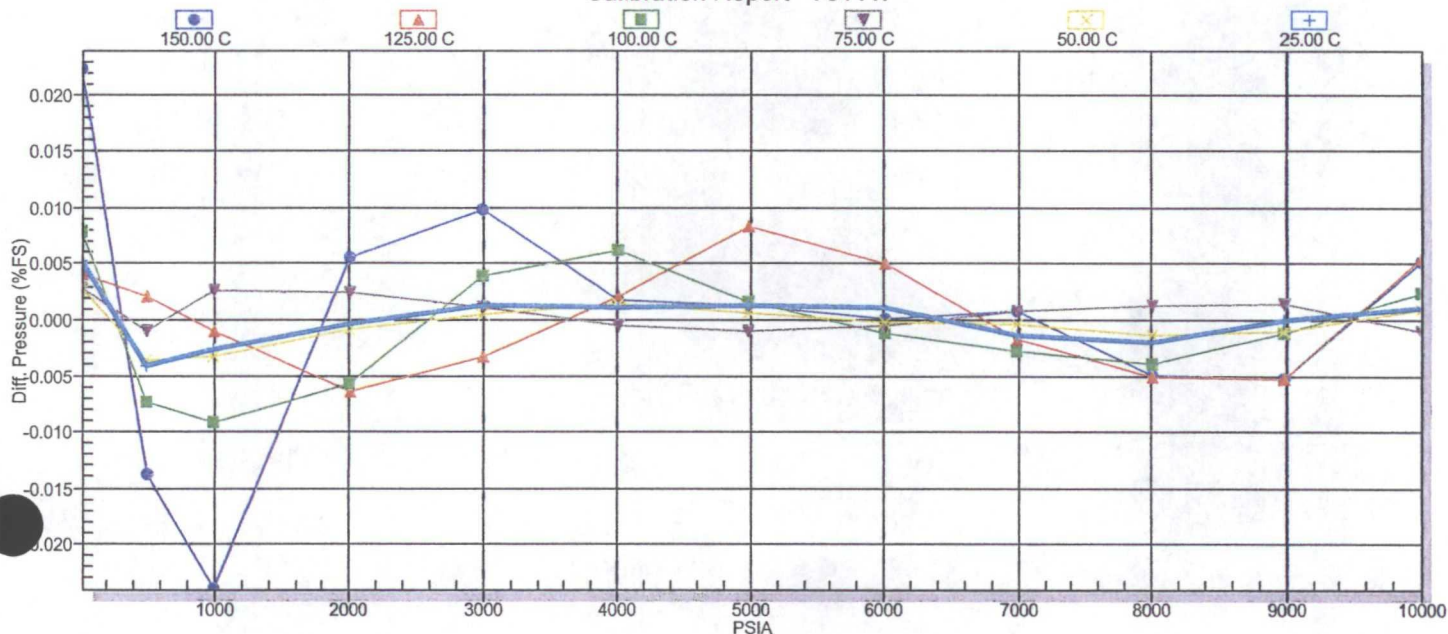
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Pressure Gauge Certificate of Calibration

Calibration Report - 76111.



GAUGE NUMBER: 76111

2-D POLYNOMIAL LMS CURVEFIT

Source of f: Pres

Fit Order: 3

Prescale: $x_p = m * (f_p - f_{p0})$

m:

0.01

$f_{p0} = 679270$

Temp

4

$x_t = m * (f_t - f_{t0})$

0.01

$f_{t0} = 116826$

Pressure Equation:

Pressure (PSI) = $A + x_p(B + x_p(C + x_p(D)))$

Temperature Compensation:

$A = A_0 + x_t(A_1 + x_t(A_2 + x_t(A_3 + x_t(A_4))))$

$B = B_0 + x_t(B_1 + x_t(B_2 + x_t(B_3 + x_t(B_4))))$

$C = C_0 + x_t(C_1 + x_t(C_2 + x_t(C_3 + x_t(C_4))))$

$D = D_0 + x_t(D_1 + x_t(D_2 + x_t(D_3 + x_t(D_4))))$

0	1	2	3	4
Pressure (psi) STANDARD FIT COEFFICIENTS:				
A 16.91499981	0.2299796981	-0.001081970647	1.952581211E-06	5.434004799E-10
B 3.480231467	-0.00321146027	2.770196636E-06	2.540639531E-09	-1.370676188E-11
C -3.199752514E-05	1.974442629E-07	-2.947228038E-12	-4.481348121E-12	9.790790267E-15
D 3.598722956E-09	-3.108144869E-11	-4.031623283E-14	9.192935329E-16	-1.861916648E-18

Temperature (C) STANDARD FIT COEFFICIENTS

A 150.0081337

B -0.4528790111

C 0.0002627521854

D -3.082918538E-07

0 points eliminated.

Error File: Gauge # 76111

Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
14.70	150.00	679270.31	116826.50	2.23
507.13	150.00	693331.00	116774.25	-1.37
999.42	150.00	707495.00	116782.25	-2.39
2013.05	150.00	736913.31	116792.75	0.56
2997.68	150.00	765550.00	116805.00	0.98
4011.27	150.00	795142.69	116848.50	0.18
4995.89	150.00	823974.69	116846.75	0.14
6009.45	150.00	853726.31	116839.25	0.02
6994.05	150.00	882693.31	116830.75	0.08
8007.57	150.00	912520.00	116811.75	-0.49
8992.13	150.00	941539.69	116795.25	-0.52
10005.64	150.00	971436.69	116770.75	0.52
14.70	125.00	678911.00	122597.50	0.40
507.13	125.00	693821.69	122608.00	0.21
999.42	125.00	708750.31	122596.50	-0.10
2013.05	125.00	739581.69	122607.25	-0.64
2997.68	125.00	769658.00	122611.25	-0.32
4011.27	125.00	800717.69	122610.50	0.22
4995.89	125.00	830970.69	122605.50	0.84
6009.45	125.00	862149.31	122594.75	0.51
6994.05	125.00	892473.69	122577.25	-0.17
8007.57	125.00	923740.69	122555.25	-0.51
8992.13	125.00	954150.00	122529.50	-0.53
10005.64	125.00	985487.00	122493.25	0.55
14.70	100.00	678737.00	128535.00	0.79
507.13	100.00	694359.69	128504.25	-0.74
999.42	100.00	710043.69	128512.75	-0.92
2013.05	100.00	742435.69	128530.75	-0.57
2997.68	100.00	774007.31	128537.50	0.39
4011.27	100.00	806566.69	128539.25	0.62
4995.89	100.00	838248.00	128535.75	0.16
6009.45	100.00	870930.69	128522.75	-0.11
6994.05	100.00	902739.69	128504.00	-0.28
8007.57	100.00	935529.00	128475.00	-0.39
8992.13	100.00	967432.31	128440.25	-0.11
10005.64	100.00	1000313.69	128400.50	0.24
14.70	75.00	678593.00	134881.00	0.29
507.13	75.00	695053.69	134883.25	-0.10
999.42	75.00	711559.69	134893.25	0.26
2013.05	75.00	745599.00	134912.75	0.25
2997.68	75.00	778752.69	134920.50	0.11
4011.27	75.00	812971.69	134921.00	-0.05
4995.89	75.00	846294.31	134911.00	-0.09
6009.45	75.00	880676.31	134893.50	-0.05
6994.05	75.00	914143.69	134867.25	0.08
8007.57	75.00	948652.00	134831.75	0.13
8992.13	75.00	982228.69	134790.50	0.15
10005.64	75.00	1016819.69	134735.75	-0.10
14.70	50.00	678422.00	141460.50	0.28
507.13	50.00	695724.31	141468.00	-0.36
999.42	50.00	713079.00	141481.00	-0.32
2013.05	50.00	748919.69	141500.25	-0.09
2997.68	50.00	783852.31	141507.00	0.05
4011.27	50.00	819922.69	141502.25	0.15
4995.89	50.00	855055.69	141489.00	0.06
6009.45	50.00	891307.31	141462.50	-0.02
6994.05	50.00	926604.69	141429.25	-0.03
8007.57	50.00	962999.31	141384.00	-0.14
8992.13	50.00	998403.69	141327.50	-0.10
10005.64	50.00	1034886.00	141256.25	0.10
14.70	25.00	678061.31	148031.25	0.53
507.13	25.00	696313.69	148041.00	-0.41
999.42	25.00	714640.31	148056.00	-0.26
2013.05	25.00	752486.31	148071.50	-0.04
2997.68	25.00	789389.69	148079.75	0.13
4011.27	25.00	827496.69	148070.75	0.12
4995.89	25.00	864625.31	148049.25	0.13
6009.45	25.00	902948.00	148016.75	0.11
6994.05	25.00	940249.69	147972.25	-0.12

8007.57	25.00	978714.69	147910.25	-0.20
8992.13	25.00	1016143.69	147838.50	-0.01
10005.64	25.00	1054710.00	147753.50	0.11



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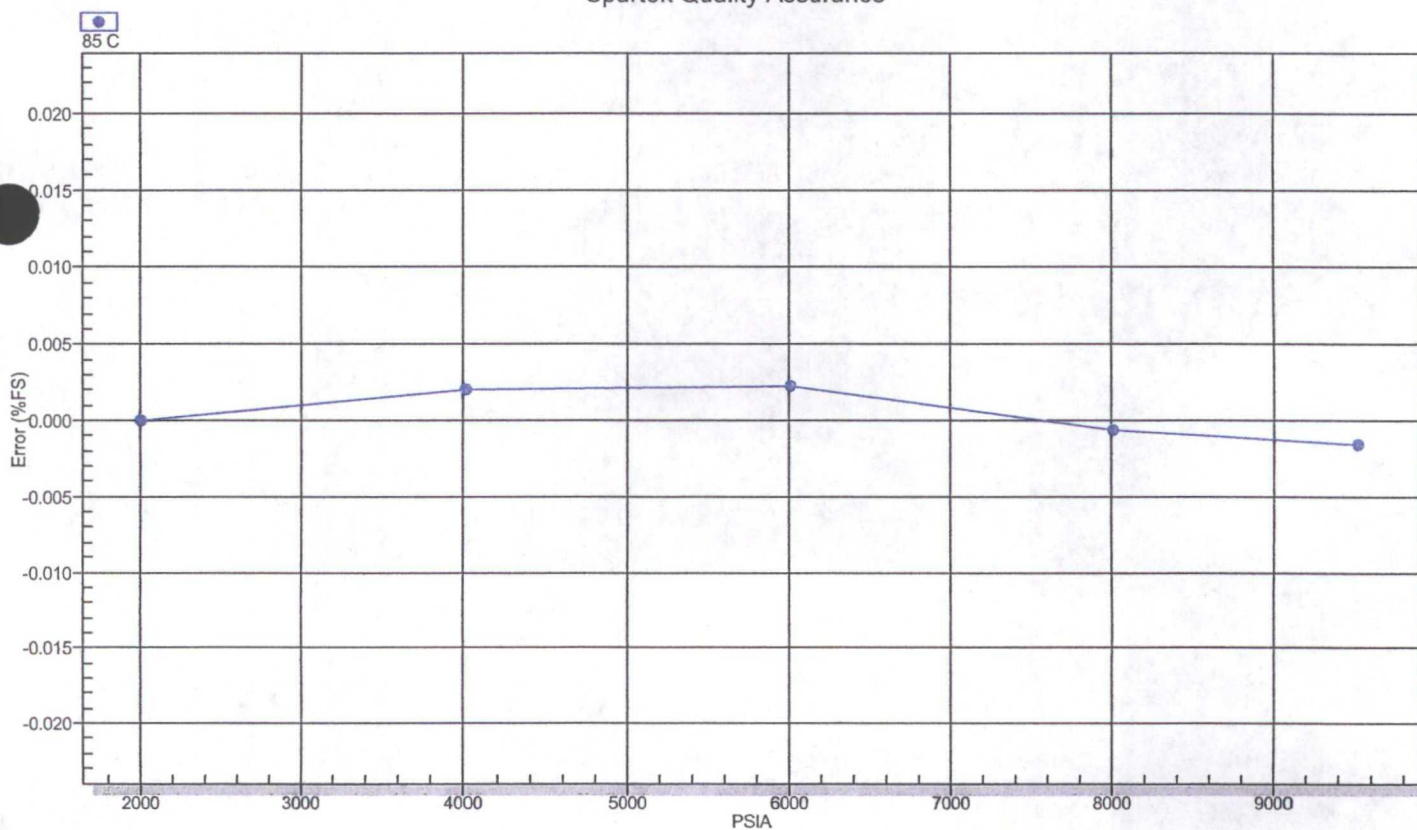
Pressure Gauge Certificate of Conformance

SERIAL NUMBER	76111	CALIBRATION DATE	JAN 13/11
MODEL NUMBER	1139 FF0	PRESSURE REFERENCE	NIST Traceable
PRESSURE RANGE	14.70 - 10005.64 psi	TEMP. REFERENCE	NIST Traceable
TEMP. RANGE	25.00 - 150.00 °C	TRACEABILITY DOC.	CAL-STANDARD-001

ACCURACY

As shown in the graph below, this Spartek Gauge conformed to within $\pm 0.024\%$ F.S. of the pressure standard used in calibration, which is accurate to within $\pm 0.01\%$ of reading. This gives an overall accuracy of $\pm (0.024\% \text{ F.S.} + 0.01\% \text{ of reading})$

Spartek Quality Assurance



Accepted By: _____

Jeff Banas

Date: JAN 14/11



SPARTEK SYSTEMS

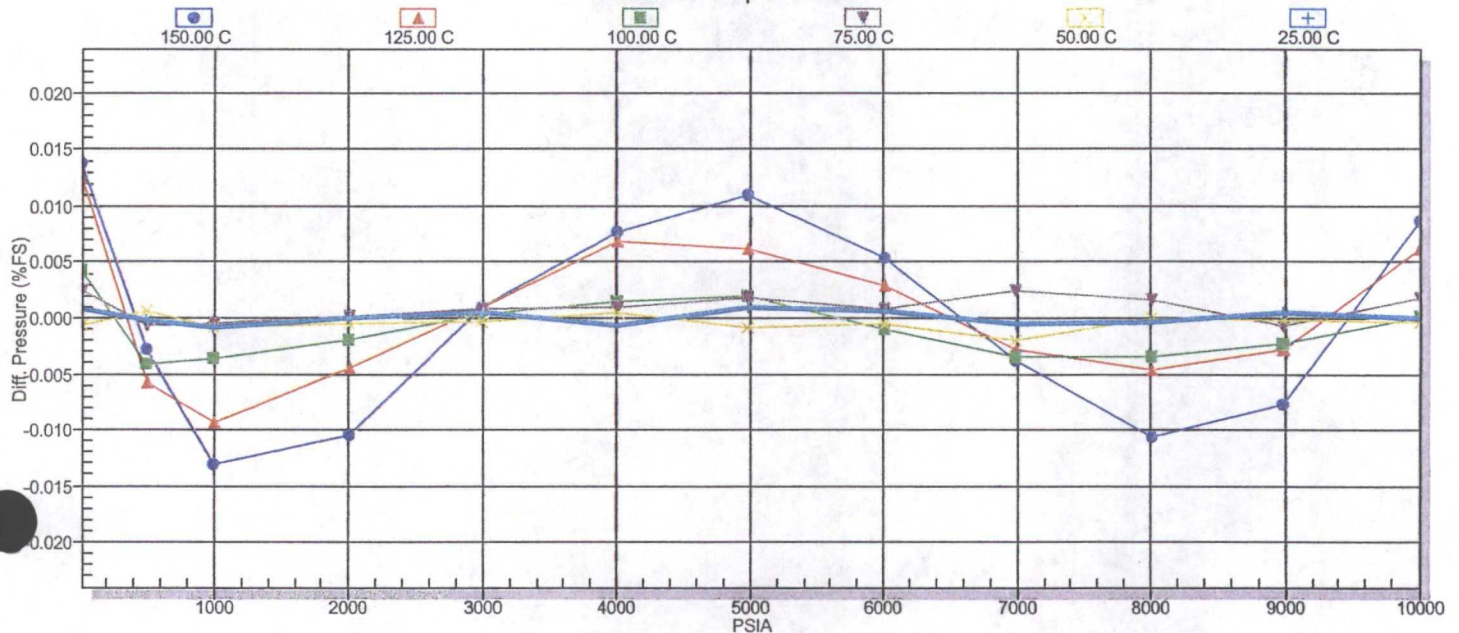
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Pressure Gauge Certificate of Calibration

Calibration Report - 76888.



GAUGE NUMBER: 76888

2-D POLYNOMIAL LMS CURVEFIT

Source of f: Pres

Fit Order: 3

Prescale: $x_p = m * (f_p - f_{p0})$

m: 0.01

$f_{p0} = 694079$

Temp

4

$x_t = m * (f_t - f_{t0})$

0.01

$f_{t0} = 126998$

Pressure Equation:

Pressure (PSI) = $A + x_p(B + x_p(C + x_p(D)))$

Temperature Compensation:

$A = A_0 + x_t(A_1 + x_t(A_2 + x_t(A_3 + x_t(A_4))))$

$B = B_0 + x_t(B_1 + x_t(B_2 + x_t(B_3 + x_t(B_4))))$

$C = C_0 + x_t(C_1 + x_t(C_2 + x_t(C_3 + x_t(C_4))))$

$D = D_0 + x_t(D_1 + x_t(D_2 + x_t(D_3 + x_t(D_4))))$

0	1	2	3	4
Pressure (psi) STANDARD FIT COEFFICIENTS:				
A 16.07134192	0.3901406668	-0.001952144141	5.077063477E-06	-4.724807462E-09
B 3.969002303	-0.003676133953	5.41796378E-06	-8.95019131E-09	4.102524076E-12
C -3.023595064E-05	4.314638646E-07	-2.000125662E-09	3.595830933E-12	-1.824536502E-15
D 7.218774821E-09	-8.533993659E-11	3.72461693E-13	-6.182561979E-16	2.408526044E-19

Temperature (C) STANDARD FIT COEFFICIENTS

A 150.1401871
B -0.4166474323
C 0.0002247169682
D -2.60415077E-07

0 points eliminated.

Error File: Gauge # 76888

Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
14.70	150.00	694079.00	126998.00	1.37
507.13	150.00	706455.31	126962.25	-0.27
999.42	150.00	718862.31	126970.50	-1.31
2013.05	150.00	744533.00	126985.00	-1.05
2997.68	150.00	769560.69	126999.75	0.10
4011.27	150.00	795390.00	127049.75	0.77
4995.89	150.00	820477.31	127054.50	1.09
6009.45	150.00	846283.69	127053.50	0.54
6994.05	150.00	871335.69	127053.75	-0.38
8007.57	150.00	897088.31	127044.50	-1.06
8992.13	150.00	922083.69	127036.50	-0.77
10005.64	150.00	947774.69	127024.75	0.87
14.70	125.00	693599.00	133239.75	1.24
507.13	125.00	706656.31	133233.25	-0.57
999.42	125.00	719758.69	133248.25	-0.93
2013.05	125.00	746794.69	133264.25	-0.45
2997.68	125.00	773083.31	133277.00	0.09
4011.27	125.00	800159.69	133287.75	0.69
4995.89	125.00	826441.31	133290.00	0.62
6009.45	125.00	853478.69	133291.25	0.29
6994.05	125.00	879711.69	133287.25	-0.28
8007.57	125.00	906680.31	133273.50	-0.46
8992.13	125.00	932846.69	133260.75	-0.27
10005.64	125.00	959731.69	133239.25	0.63
14.70	100.00	693288.69	139739.50	0.42
507.13	100.00	707053.31	139715.50	-0.41
999.42	100.00	720840.00	139726.25	-0.35
2013.05	100.00	749233.69	139747.25	-0.20
2997.68	100.00	776818.69	139763.75	0.04
4011.27	100.00	805203.00	139774.25	0.14
4995.89	100.00	832758.69	139777.50	0.20
6009.45	100.00	861093.00	139777.25	-0.10
6994.05	100.00	888584.31	139767.75	-0.34
8007.57	100.00	916851.69	139753.25	-0.34
8992.13	100.00	944266.31	139732.50	-0.24
10005.64	100.00	972439.00	139707.00	0.02
14.70	75.00	693081.31	146617.00	0.24
507.13	75.00	707575.31	146599.75	-0.06
999.42	75.00	722073.69	146612.25	-0.05
2013.05	75.00	751925.00	146635.00	0.01
2997.68	75.00	780915.69	146653.00	0.08
4011.27	75.00	810742.31	146663.25	0.10
4995.89	75.00	839695.31	146664.75	0.17
6009.45	75.00	869466.00	146660.00	0.07
6994.05	75.00	898357.00	146646.75	0.24
8007.57	75.00	928048.69	146627.50	0.17
8992.13	75.00	956844.31	146604.25	-0.07
10005.64	75.00	986437.00	146568.75	0.18
14.70	50.00	692867.00	153703.50	-0.07
507.13	50.00	708143.31	153695.25	0.07
999.42	50.00	723405.69	153708.00	-0.09
2013.05	50.00	754842.31	153734.25	-0.05
2997.68	50.00	785371.00	153751.00	-0.03
4011.27	50.00	816780.69	153757.00	0.04
4995.89	50.00	847263.69	153756.50	-0.08
6009.45	50.00	878614.69	153747.75	-0.06
6994.05	50.00	909021.00	153728.50	-0.19
8007.57	50.00	940277.00	153698.75	-0.01
8992.13	50.00	970577.00	153662.00	-0.02
10005.64	50.00	1001710.00	153619.75	-0.03
14.70	25.00	692621.31	160787.25	0.08
507.13	25.00	708739.69	160756.75	-0.02
999.42	25.00	724854.00	160774.75	-0.08
2013.05	25.00	758037.31	160801.75	0.01
2997.68	25.00	790258.31	160817.00	0.06
4011.27	25.00	823402.31	160824.50	-0.06
4995.89	25.00	855573.69	160817.25	0.10
6009.45	25.00	888644.69	160800.75	0.06
6994.05	25.00	920724.31	160777.25	-0.06

8007.57	25.00	953681.00	160736.75	-0.04
8992.13	25.00	985636.31	160690.25	0.04
10005.64	25.00	1018452.31	160633.25	0.01



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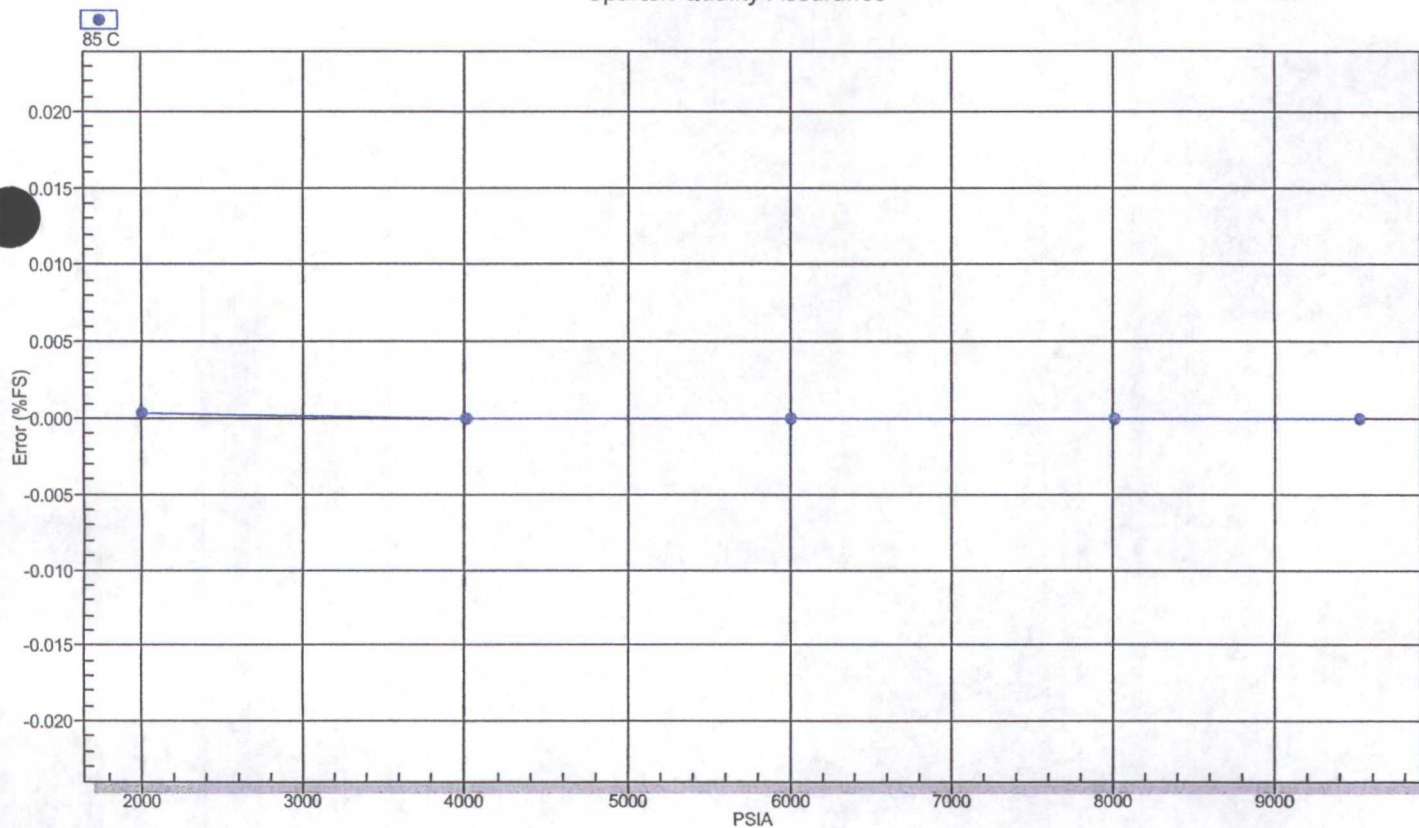
Pressure Gauge Certificate of Conformance

SERIAL NUMBER	76888	CALIBRATION DATE	JAN 13/11
MODEL NUMBER	1139 FF4	PRESSURE REFERENCE	NIST Traceable
PRESSURE RANGE	14.70 - 10005.64 psi	TEMP. REFERENCE	NIST Traceable
TEMP. RANGE	25.00 - 150.00 °C	TRACEABILITY DOC.	CAL-STANDARD-001

ACCURACY

As shown in the graph below, this Spartek Gauge conformed to within $\pm 0.024\%$ F.S. of the pressure standard used in calibration, which is accurate to within $\pm 0.01\%$ of reading. This gives an overall accuracy of $\pm(0.024\% \text{ F.S.} + 0.01\% \text{ of reading})$

Spartek Quality Assurance



Accepted By: _____

Jeff Barnes

Date: JAN 14/11



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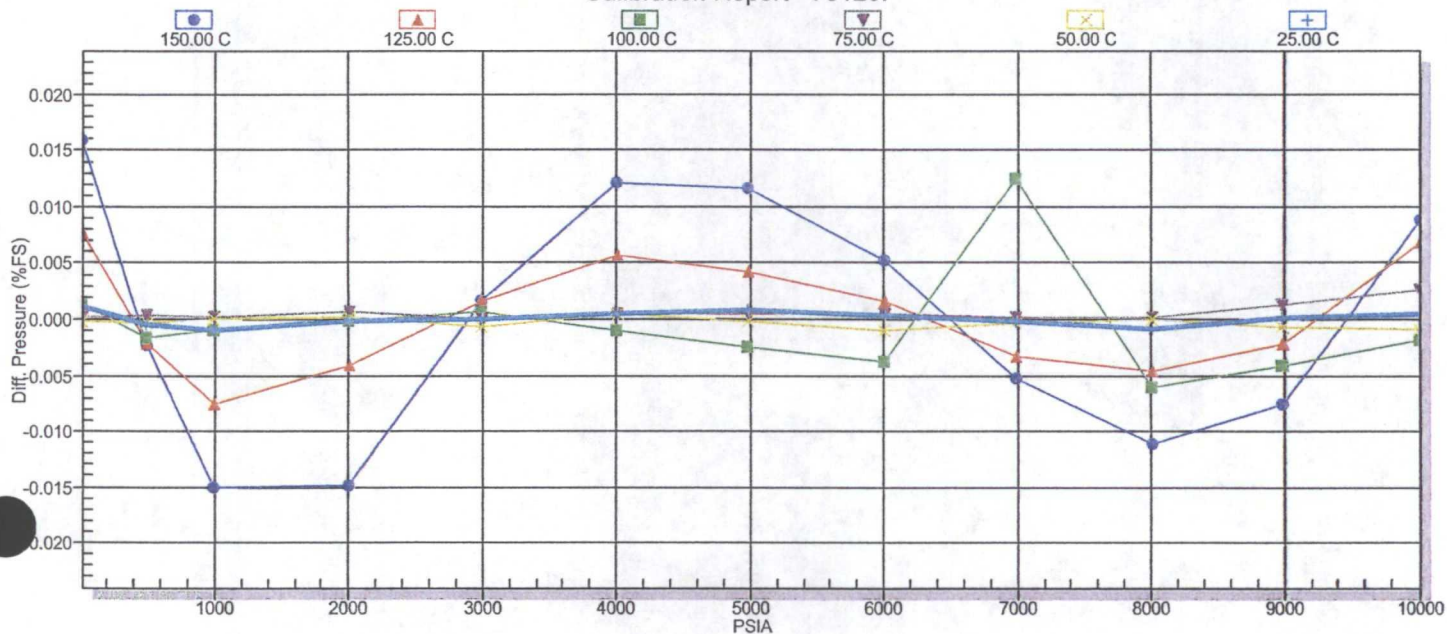
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Pressure Gauge Certificate of Calibration

Calibration Report - 76120.



GAUGE NUMBER: 76120

2-D POLYNOMIAL LMS CURVEFIT

Source of f: Pres

Fit Order: 3

Prescale: $x_p = m * (f_p - f_{p0})$

m: 0.01

$f_{p0} = 696608$

Temp

4

$x_t = m * (f_t - f_{t0})$

0.01

$f_{t0} = 129408$

Pressure Equation:

Pressure (PSI) = $A + x_p(B + x_p(C + x_p(D)))$

Temperature Compensation:

$A = A_0 + x_t(A_1 + x_t(A_2 + x_t(A_3 + x_t(A_4))))$

$B = B_0 + x_t(B_1 + x_t(B_2 + x_t(B_3 + x_t(B_4))))$

$C = C_0 + x_t(C_1 + x_t(C_2 + x_t(C_3 + x_t(C_4))))$

$D = D_0 + x_t(D_1 + x_t(D_2 + x_t(D_3 + x_t(D_4))))$

0	1	2	3	4
Pressure (psi) STANDARD FIT COEFFICIENTS:				
A 16.25808819	0.3379612244	-0.001867626497	5.220111456E-06	-5.220941546E-09
B 3.936749564	-0.003717062066	6.601103964E-06	-1.43353432E-08	1.141099494E-11
C -2.954784519E-05	5.054920853E-07	-3.066726504E-09	8.112698923E-12	-7.879956916E-15
D 7.048819282E-09	-1.017749085E-10	5.965791034E-13	-1.558180303E-15	1.497077875E-18

Temperature (C) STANDARD FIT COEFFICIENTS

A 150.0948355

B -0.4155932248

C 0.0002384316045

D -3.026519777E-07

0 points eliminated.

Error File: Gauge # 76120

Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
14.70	150.00	696608.69	129408.75	1.59
507.07	150.00	709080.69	129393.00	-0.22
999.41	150.00	721586.31	129401.50	-1.52
2013.03	150.00	747465.00	129416.00	-1.49
2997.69	150.00	772714.00	129430.25	0.16
4011.29	150.00	798738.31	129443.00	1.21
4995.91	150.00	824016.00	129448.25	1.17
6009.48	150.00	850026.69	129449.25	0.52
6994.09	150.00	875272.31	129448.50	-0.52
8007.64	150.00	901237.00	129443.50	-1.12
8992.20	150.00	926420.00	129429.25	-0.76
10005.73	150.00	952299.00	129410.75	0.89
14.70	125.00	696184.69	135642.75	0.78
507.07	125.00	709370.69	135638.50	-0.22
999.41	125.00	722576.00	135646.00	-0.75
2013.03	125.00	749824.00	135664.00	-0.42
2997.69	125.00	776320.00	135678.00	0.16
4011.29	125.00	803597.69	135686.50	0.57
4995.91	125.00	830077.00	135689.25	0.42
6009.48	125.00	857318.69	135688.50	0.17
6994.09	125.00	883747.00	135680.50	-0.32
8007.64	125.00	910928.31	135670.00	-0.46
8992.20	125.00	937299.00	135656.75	-0.21
10005.73	125.00	964399.69	135635.75	0.69
14.70	100.00	695940.00	142240.25	0.13
507.07	100.00	709833.69	142216.50	-0.16
999.41	100.00	723737.31	142225.75	-0.10
2013.03	100.00	752365.31	142246.75	-0.01
2997.69	100.00	780177.69	142267.50	0.07
4011.29	100.00	808787.00	142273.25	-0.09
4995.91	100.00	836563.00	142274.25	-0.25
6009.48	100.00	865136.00	142271.75	-0.38
6994.09	100.00	892911.00	142262.25	1.24
8007.64	100.00	921364.31	142245.50	-0.60
8992.20	100.00	949017.69	142224.50	-0.42
10005.73	100.00	977433.31	142196.50	-0.19
14.70	75.00	695785.31	149145.50	0.02
507.07	75.00	710406.00	149136.00	0.03
999.41	75.00	725024.69	149142.50	0.02
2013.03	75.00	755121.31	149158.00	0.06
2997.69	75.00	784350.69	149173.00	-0.01
4011.29	75.00	814430.00	149180.50	0.05
4995.91	75.00	843624.31	149176.75	0.06
6009.48	75.00	873659.00	149174.00	0.06
6994.09	75.00	902794.69	149158.50	0.01
8007.64	75.00	932748.31	149136.00	0.02
8992.20	75.00	961800.31	149106.50	0.12
10005.73	75.00	991651.31	149068.00	0.27
14.70	50.00	695620.69	156234.50	-0.01
507.07	50.00	711018.00	156208.75	-0.03
999.41	50.00	726416.31	156224.25	-0.01
2013.03	50.00	758118.00	156249.00	0.01
2997.69	50.00	788906.00	156265.50	-0.07
4011.29	50.00	820590.00	156271.75	0.04
4995.91	50.00	851341.31	156269.25	-0.01
6009.48	50.00	882957.69	156252.25	-0.09
6994.09	50.00	913645.31	156233.50	-0.03
8007.64	50.00	945179.31	156201.00	0.01
8992.20	50.00	975764.69	156166.50	-0.07
10005.73	50.00	1007180.31	156118.00	-0.09
14.70	25.00	695426.69	163269.25	0.11
507.07	25.00	711677.00	163252.75	-0.05
999.41	25.00	727930.69	163270.50	-0.10
2013.03	25.00	761399.31	163293.00	-0.02
2997.69	25.00	793903.69	163308.00	0.00
4011.29	25.00	827346.31	163311.00	0.05
4995.91	25.00	859805.69	163303.75	0.07
6009.48	25.00	893182.00	163286.50	0.03
6994.09	25.00	925553.00	163255.25	-0.01

8007.64	25.00	958822.69	163215.25	-0.09
8992.20	25.00	991082.69	163166.00	0.02
10005.73	25.00	1024207.31	163102.25	0.04



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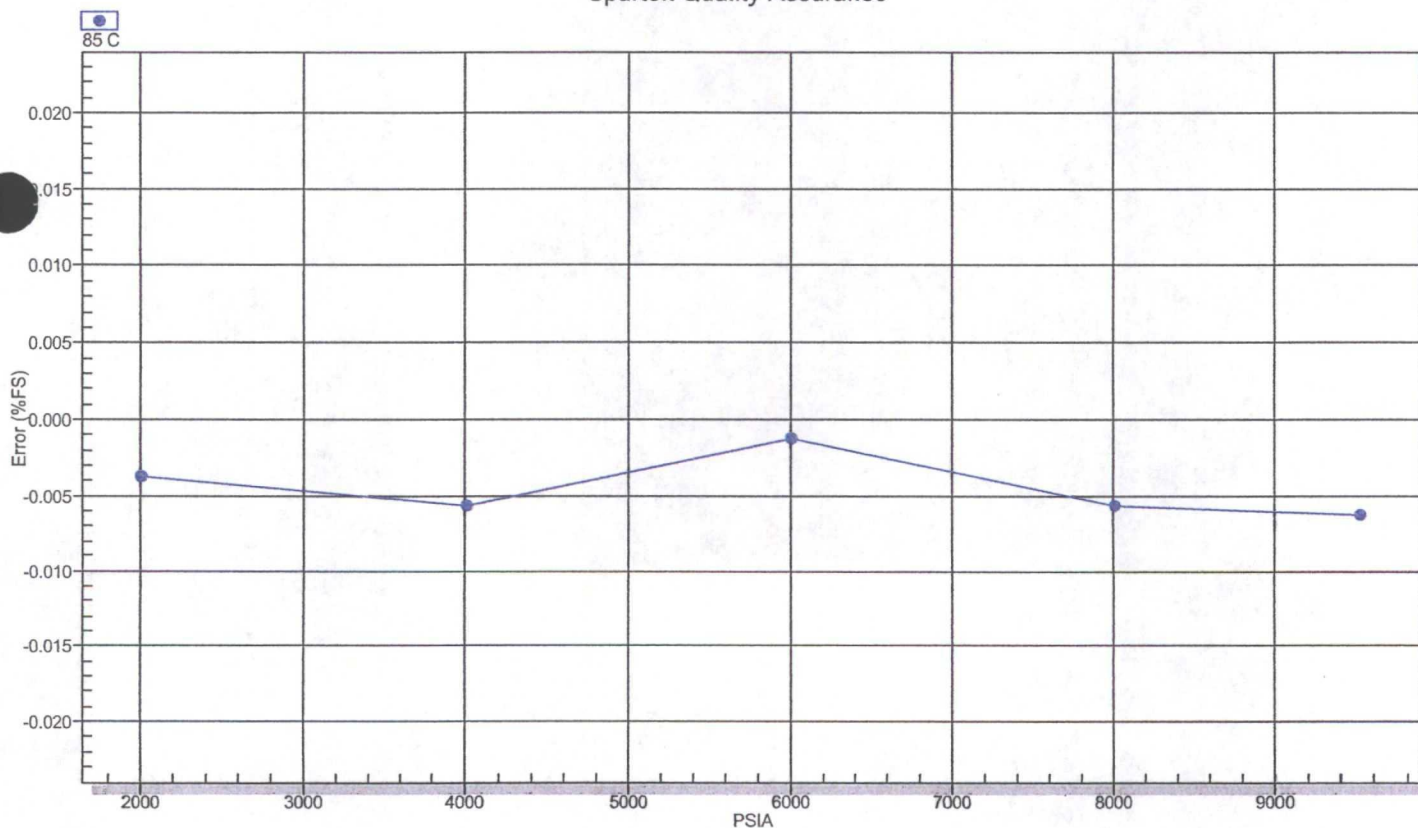
Pressure Gauge Certificate of Conformance

SERIAL NUMBER	76120	CALIBRATION DATE	MAR 01/11
MODEL NUMBER	1139 FF4	PRESSURE REFERENCE	NIST Traceable
PRESSURE RANGE	14.70 - 10005.73 psi	TEMP. REFERENCE	NIST Traceable
TEMP. RANGE	25.00 - 150.00 °C	TRACEABILITY DOC.	CAL-STANDARD-001

ACCURACY

As shown in the graph below, this Spartek Gauge conformed to within $\pm 0.024\%$ F.S. of the pressure standard used in calibration, which is accurate to within $\pm 0.01\%$ of reading. This gives an overall accuracy of $\pm(0.024\% \text{ F.S.} + 0.01\% \text{ of reading})$

Spartek Quality Assurance



Accepted By: _____

Date: MAR 03/11





SPARTEK SYSTEMS

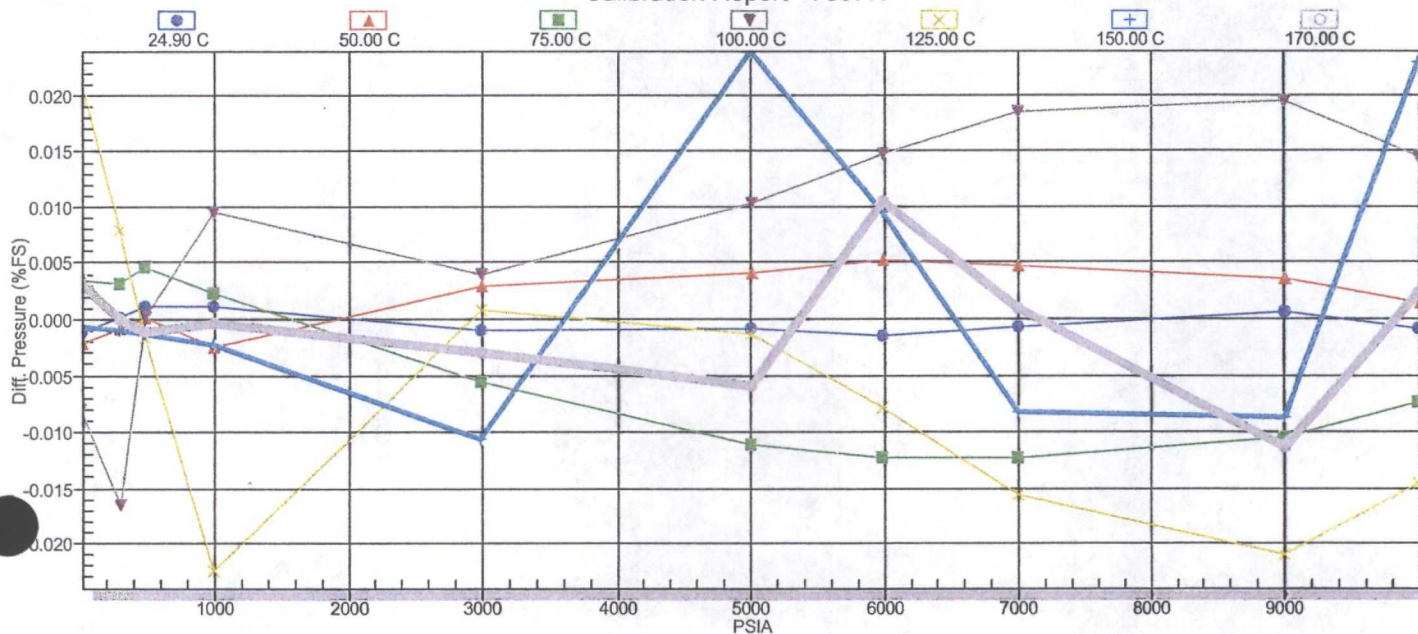
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Pressure Gauge Certificate of Calibration

Calibration Report - 76077.



GAUGE NUMBER: 76077

2-D POLYNOMIAL LMS CURVEFIT

Source of f: Pres

Fit Order: 3

Prescale: $xp = m * (fp - fp0)$

m: 0.01

$fp0 = 696205$

Temp

5

$xt = m * (ft - ft0)$

0.01

$ft0 = 150709$

Pressure Equation:

Pressure (PSI) = $A + xp(B + xp(C + xp(D)))$

Temperature Compensation:

$A = A0 + xt(A1 + xt(A2 + xt(A3 + xt(A4))))$

$B = B0 + xt(B1 + xt(B2 + xt(B3 + xt(B4))))$

$C = C0 + xt(C1 + xt(C2 + xt(C3 + xt(C4))))$

$D = D0 + xt(D1 + xt(D2 + xt(D3 + xt(D4))))$

0	1	2	3	4
Pressure (psi) STANDARD FIT COEFFICIENTS:				
A 13.0136963	-0.01597146349	-0.003409903515	-3.126272132E-05	-1.079801947E-07
B -1.20366904E-10	2.566524369	-0.00181832986	6.893628782E-06	6.462276628E-08
C 2.439273265E-10	2.918895194E-13	2.465612196E-06	-2.155514842E-07	-6.037720502E-09
D -5.390582477E-11	-1.859576295E-13	-2.104819019E-16	3.934133943E-10	4.404493663E-11
Temperature (C) STANDARD FIT COEFFICIENTS				
A 25.09298827				
B -0.3345891166				
C 0.0002234251032				
D 3.202327425E-07				

0 points eliminated.

Error File: Gauge # 76077

Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
13.14	24.90	696205.67	150709.75	-0.11
304.14	24.90	707549.00	150725.00	0.02
492.97	25.10	714910.33	150735.25	0.12
1002.43	25.00	734759.00	150758.25	0.11
2996.09	25.00	812351.33	150789.25	-0.10
5006.81	24.90	890382.33	150760.25	-0.08
5993.35	24.90	928536.00	150727.00	-0.14
6998.81	25.00	967319.00	150681.50	-0.07
8995.36	25.00	1043926.00	150543.75	0.07
9997.60	25.00	1082145.33	150451.25	-0.09
13.14	50.00	696469.67	143706.00	-0.22
304.14	50.00	707208.67	143719.50	-0.08
492.98	50.00	714178.00	143728.25	0.02
1002.44	50.00	732959.67	143746.50	-0.24
2996.11	50.00	806452.67	143774.75	0.29
5006.82	50.00	880374.67	143759.25	0.40
5993.37	50.00	916544.67	143735.25	0.53
6998.82	50.00	953316.00	143701.00	0.47
8995.37	50.00	1025999.00	143592.50	0.36
9997.62	50.00	1062286.33	143521.00	0.14
13.13	75.00	696703.67	136798.75	0.35
304.13	75.00	706894.67	136809.25	0.32
492.96	75.00	713514.00	136819.25	0.47
1002.42	75.00	731349.67	136839.00	0.23
2996.09	75.00	801097.67	136866.25	-0.56
5006.80	75.00	871290.00	136856.25	-1.11
5993.35	75.10	905646.00	136839.00	-1.22
6998.80	75.10	940581.67	136810.00	-1.23
8995.35	75.00	1009673.33	136724.25	-1.05
9997.60	75.00	1044186.67	136663.75	-0.74
13.09	100.00	696777.00	130141.75	-0.81
304.09	100.00	706451.00	130154.00	-1.65
492.93	100.00	712802.00	130163.25	0.01
1002.38	100.00	729812.67	130178.00	0.95
2996.04	100.10	796156.67	130204.00	0.40
5006.74	100.00	862936.00	130200.25	1.03
5993.28	100.00	895628.00	130188.25	1.47
6998.73	100.00	928874.67	130163.75	1.84
8995.27	100.00	994653.67	130090.75	1.94
9997.52	100.00	1027532.67	130041.50	1.46
13.05	125.00	697214.67	123832.75	2.18
304.05	125.10	706374.67	123836.75	0.78
492.88	125.00	712319.00	123847.00	-0.17
1002.33	125.00	728379.00	123862.25	-2.24
2996.00	125.10	791594.67	123885.25	0.09
5006.69	125.10	855234.67	123884.00	-0.14
5993.24	125.10	886388.00	123871.75	-0.79
6998.69	125.00	918084.00	123856.00	-1.55
8995.23	124.90	980807.67	123795.50	-2.09
9997.47	125.00	1012148.67	123744.50	-1.45
13.03	150.00	697797.67	117358.25	-0.07
304.02	150.10	706476.33	117368.25	-0.10
492.86	150.00	712115.67	117374.50	-0.13
1002.32	150.00	727356.33	117391.50	-0.23
2995.98	150.00	787272.67	117411.75	-1.07
5006.68	150.00	848086.67	117414.00	2.39
5993.23	149.90	877838.33	117409.25	0.94
6998.68	150.00	908103.67	117395.75	-0.82
8995.23	150.00	968022.33	117346.50	-0.87
9997.48	149.90	997991.00	117315.25	2.29
12.99	170.00	698213.00	111793.50	0.33
303.99	169.80	706531.33	111800.50	-0.01
492.82	170.10	711940.67	111810.00	-0.11
1002.28	170.00	726572.33	111814.00	-0.03
2995.95	169.90	784153.00	111836.25	-0.29
5006.65	170.10	842570.67	111840.25	-0.60
5993.20	169.90	871331.00	111837.50	1.04
6998.64	169.90	900556.33	111835.25	0.09
8995.20	169.90	958388.00	111791.00	-1.14

9997.44

170.10

987328.67

111770.50

0.23



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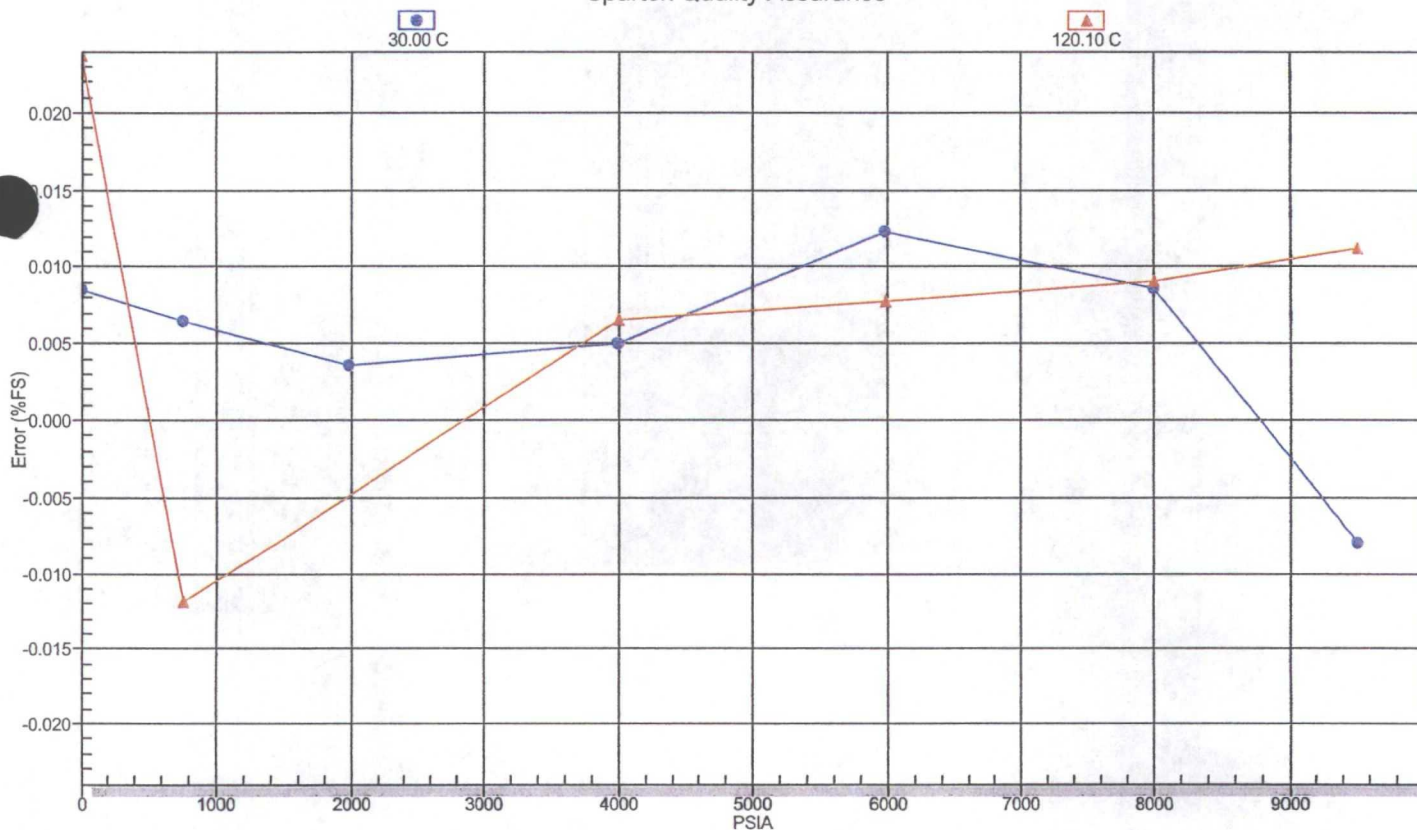
Pressure Gauge Certificate of Conformance

SERIAL NUMBER	76077	CALIBRATION DATE	JUN 30/11
MODEL NUMBER	0 FF0	PRESSURE REFERENCE	NIST Traceable
PRESSURE RANGE	13.14 - 9997.60 psi	TEMP. REFERENCE	NIST Traceable
TEMP. RANGE	24.90 - 170.00 °C	TRACEABILITY DOC.	CAL-STANDARD-001

ACCURACY

As shown in the graph below, this Spartek Gauge conformed to within $\pm 0.024\%$ F.S. of the pressure standard used in calibration, which is accurate to within $\pm 0.01\%$ of reading. This gives an overall accuracy of $\pm(0.024\% \text{ F.S.} + 0.01\% \text{ of reading})$

Spartek Quality Assurance



Accepted By: _____

Date: JUL 07/11

Ramp report: Serial # 76077
 Gauge range = 9997.621 PSI. Max. DIFF. = 2.399
 Ramp check result: PASS, Max Err = 0.024% F.S.

DW Pressure	Gauge Pressure	RPM4 Pressure	Differential	%F.S.	Oven Temp.	Gauge Temp.
9504.50	9503.71	9504.65	-0.79	0.0079	30.00	30.46
8006.05	8006.91	8006.20	0.86	0.0086	30.10	30.10
5993.35	5994.57	5993.45	1.23	0.0123	29.90	29.74
4003.83	4004.33	4003.72	0.50	0.0050	30.00	29.58
1993.77	1994.14	1993.62	0.36	0.0036	29.90	29.60
755.13	755.78	754.91	0.65	0.0065	29.90	29.71
13.15	14.00	12.54	0.85	0.0085	29.90	29.79
9504.52	9505.64	9504.44	1.12	0.0112	120.10	119.78
8006.07	8006.98	8006.00	0.91	0.0091	119.90	119.74
5993.36	5994.14	5993.25	0.78	0.0078	120.10	119.68
4003.84	4004.51	4003.68	0.66	0.0066	120.00	119.72
755.13	753.95	754.68	-1.18	0.0118	120.00	119.95
13.15	15.52	12.27	2.37	0.0237	119.90	120.06



SPARTEK SYSTEMS

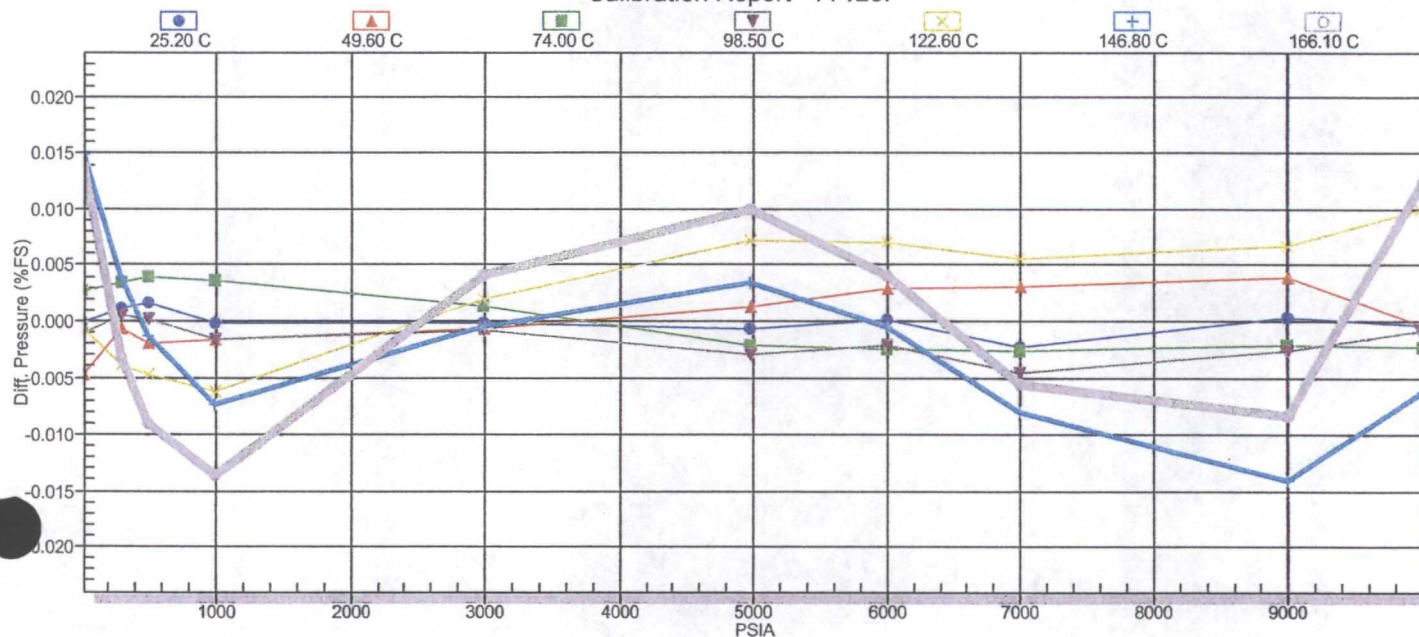
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"Providing our customers with Best in Class Technology"

Spartek Systems
#1 Thevenaz Ind. Tr.
Sylvan Lake, AB, Ca, T4S 1P5
Phone (403) 887-2443
Fax (403) 887-4050
URL www.sparteksystems.com

Pressure Gauge Certificate of Calibration

Calibration Report - 77120.



GAUGE NUMBER: 77120

2-D POLYNOMIAL LMS CURVEFIT

Source of f: Pres

Fit Order: 3

Prescale: $x_p = m * (f_p - f_{p0})$

m: 0.01

$f_{p0} = 699891$

Temp

4

$x_t = m * (f_t - f_{t0})$

0.01

$f_{t0} = 167028$

Pressure Equation:

Pressure (PSI) = $A + x_p(B + x_p(C + x_p(D)))$

Temperature Compensation:

$A = A_0 + x_t(A_1 + x_t(A_2 + x_t(A_3 + x_t(A_4))))$

$B = B_0 + x_t(B_1 + x_t(B_2 + x_t(B_3 + x_t(B_4))))$

$C = C_0 + x_t(C_1 + x_t(C_2 + x_t(C_3 + x_t(C_4))))$

$D = D_0 + x_t(D_1 + x_t(D_2 + x_t(D_3 + x_t(D_4))))$

0	1	2	3	4
Pressure (psi) STANDARD FIT COEFFICIENTS:				
A 13.0432838	0.1499180608	-3.080875207E-05	-1.263127066E-06	-3.057087791E-09
B 4.000558812	-0.003070597307	-5.067364471E-07	-9.711693386E-10	7.200526642E-12
C 2.702005388E-07	-3.059959235E-08	-7.953499894E-10	-5.804401761E-12	-1.267193684E-14
D 4.206977423E-10	1.411644212E-11	3.018115908E-13	1.922674542E-15	3.882800519E-18
Temperature (C) STANDARD FIT COEFFICIENTS				
A 25.39179459				
B -0.3341482087				
C -1.996610629E-05				
D -1.908812792E-07				

0 points eliminated.

Error File: Gauge # 77120

Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
13.08	25.20	699891.33	167028.75	-0.02
300.10	25.30	707069.33	167038.00	0.11
504.31	25.10	712175.67	167043.75	0.16
1000.87	25.20	724587.67	167063.75	-0.02
3003.67	25.20	774683.33	167113.00	-0.02
4989.63	25.20	824350.00	167129.75	-0.06
6003.59	25.20	849698.67	167131.00	0.01
6996.87	25.10	874506.33	167124.50	-0.22
8995.48	25.10	924358.67	167081.75	0.03
9994.76	25.20	949234.67	167050.25	-0.04
13.09	49.60	700133.67	159748.50	-0.48
300.12	49.60	706942.00	159756.00	-0.06
504.32	49.50	711776.33	159765.00	-0.19
1000.88	49.70	723542.33	159784.75	-0.16
3003.69	49.60	771010.67	159828.75	-0.06
4989.66	49.50	818087.00	159854.00	0.13
6003.62	49.60	842114.00	159855.50	0.29
6996.92	49.50	865638.67	159852.50	0.32
8995.53	49.50	912920.00	159823.25	0.40
9994.82	49.60	936516.00	159798.75	-0.03
13.07	74.00	700346.67	152463.25	0.26
300.09	74.00	706808.33	152470.75	0.34
504.30	74.00	711406.00	152482.00	0.39
1000.86	74.10	722584.00	152497.00	0.35
3003.66	74.10	767679.00	152540.25	0.13
4989.63	74.00	812391.33	152561.00	-0.21
6003.60	74.00	835215.67	152565.50	-0.24
6996.88	74.00	857566.00	152565.50	-0.26
8995.49	74.00	902490.67	152544.25	-0.21
9994.78	74.10	924917.00	152522.25	-0.24
13.05	98.50	700484.00	145396.75	-0.11
300.06	98.40	706638.00	145405.00	0.05
504.27	98.30	711013.67	145413.25	0.02
1000.83	98.30	721653.33	145430.00	-0.16
3003.64	98.40	764589.67	145466.25	-0.08
4989.60	98.40	807156.33	145488.00	-0.30
6003.54	98.50	828883.67	145490.25	-0.21
6996.81	98.40	850155.00	145491.25	-0.45
8995.43	98.40	892930.00	145475.75	-0.26
9994.72	98.40	914281.67	145452.25	-0.08
13.03	122.60	700623.33	138676.00	-0.05
300.08	122.60	706476.33	138682.75	-0.39
504.28	122.60	710644.00	138690.75	-0.48
1000.82	122.60	720781.67	138703.00	-0.63
3003.61	122.60	761726.67	138742.00	0.19
4989.58	122.70	802337.00	138761.50	0.72
6003.54	122.60	823062.67	138766.50	0.70
6996.82	122.60	843354.00	138765.25	0.56
8995.43	122.60	884160.00	138756.25	0.67
9994.72	122.70	904535.67	138740.75	1.00
13.09	146.80	700837.67	132357.75	1.48
300.12	146.80	706393.00	132365.50	0.38
504.33	146.70	710353.00	132372.50	-0.14
1000.88	146.80	720002.33	132386.50	-0.73
3003.68	146.70	759062.67	132420.00	-0.05
4989.66	146.80	797869.33	132439.25	0.35
6003.62	146.70	817682.33	132446.00	-0.05
6996.91	146.70	837080.33	132448.75	-0.80
8995.52	146.80	876083.67	132443.50	-1.41
9994.80	146.90	895561.67	132431.25	-0.63
13.09	166.10	701051.00	127439.00	1.38
300.11	166.10	706365.00	127449.50	-0.32
504.32	166.00	710162.00	127457.50	-0.91
1000.88	166.10	719427.00	127469.50	-1.36
3003.68	166.10	757029.33	127498.75	0.40
4989.65	166.10	794474.00	127521.00	1.00
6003.60	166.10	813606.33	127528.00	0.41
6996.88	166.10	832345.67	127536.00	-0.56
8995.49	166.00	870021.67	127536.50	-0.83

9994.77

166.00

888846.00

127534.25

1.25



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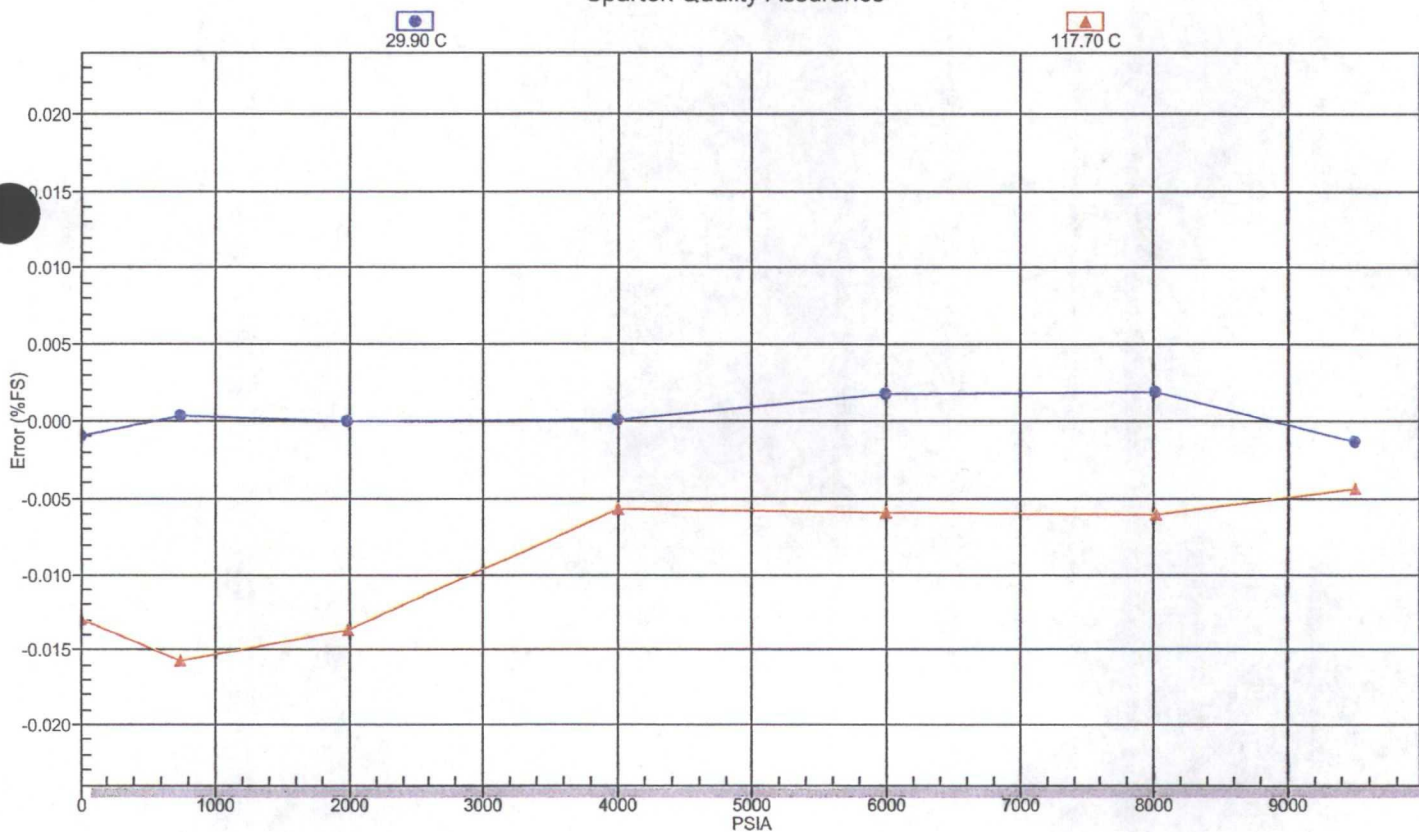
Pressure Gauge Certificate of Conformance

SERIAL NUMBER	77120	CALIBRATION DATE	JUL 19/11
MODEL NUMBER	0 FF0	PRESSURE REFERENCE	NIST Traceable
PRESSURE RANGE	13.08 - 9994.76 psi	TEMP. REFERENCE	NIST Traceable
TEMP. RANGE	25.20 - 166.10 °C	TRACEABILITY DOC.	CAL-STANDARD-001

ACCURACY

As shown in the graph below, this Spartek Gauge conformed to within $\pm 0.024\%$ F.S. of the pressure standard used in calibration, which is accurate to within $\pm 0.01\%$ of reading. This gives an overall accuracy of $\pm (0.024\% \text{ F.S.} + 0.01\% \text{ of reading})$

Spartek Quality Assurance



Accepted By: _____

Date: JUL 21/11

Ramp report: Serial # 77120

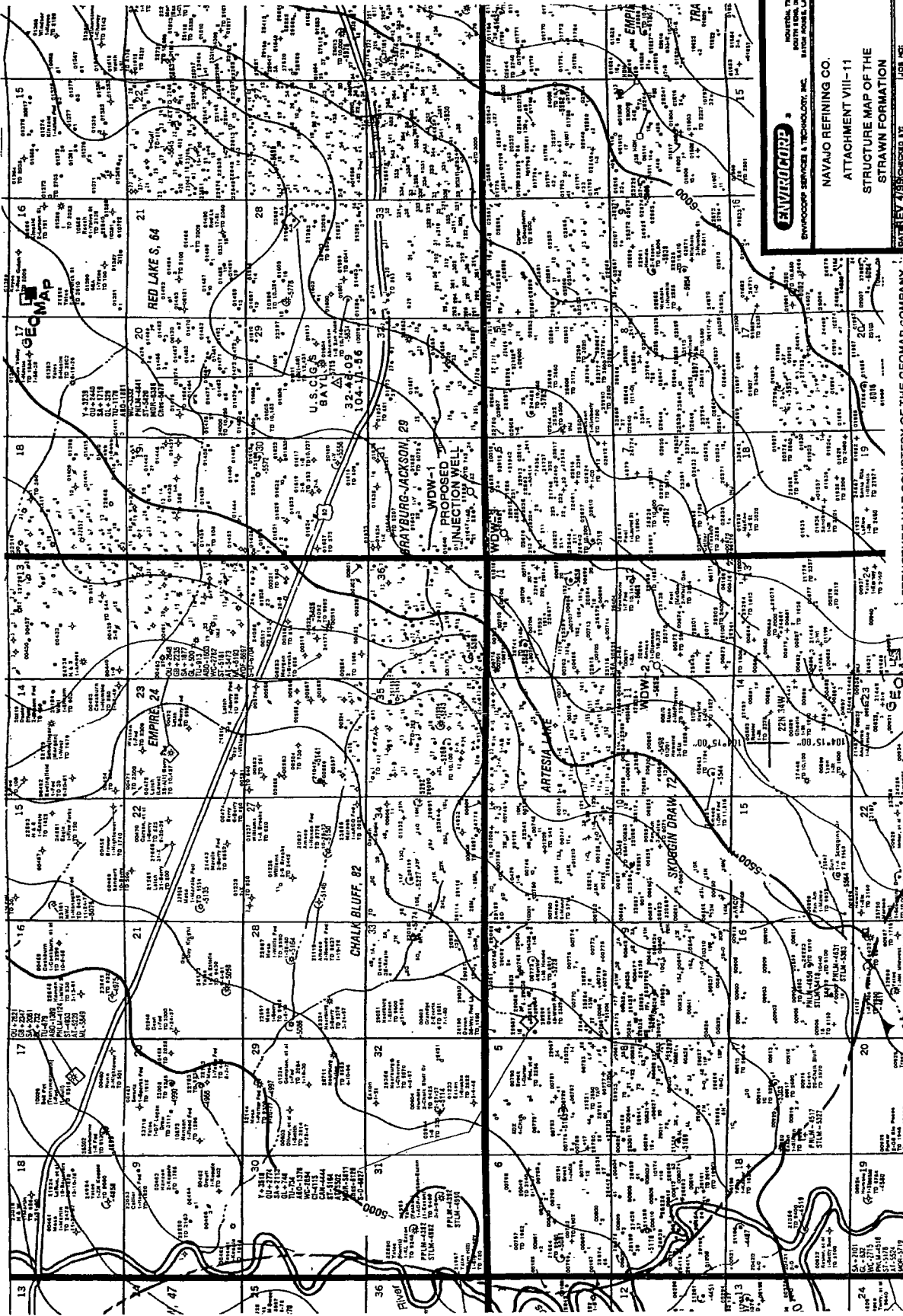
Gauge range = 9994.815 PSI. Max. DIFF. = 2.399

Ramp check result: PASS, Max Err = 0.016% F.S.

DW Pressure	Gauge Pressure	RPM4 Pressure	Differential	%F.S.	Oven Temp.	Gauge Temp.
9499.10	9498.97	9499.18	-0.13	0.0013	29.90	29.97
8014.48	8014.67	8014.66	0.19	0.0019	30.00	29.86
6003.61	6003.79	6003.85	0.18	0.0018	30.00	29.81
4000.87	4000.88	4000.93	0.01	0.0001	30.00	29.84
1989.27	1989.27	1989.30	0.00	0.0000	30.00	29.96
738.26	738.29	737.97	0.03	0.0003	30.10	30.10
13.08	12.99	12.45	-0.09	0.0009	30.00	30.20
9499.11	9498.67	9499.17	-0.43	0.0043	117.70	117.27
8014.49	8013.89	8014.59	-0.59	0.0059	117.70	117.33
6003.60	6003.01	6003.80	-0.59	0.0059	117.80	117.40
4000.86	4000.29	4000.94	-0.56	0.0056	117.70	117.53
1989.26	1987.89	1989.17	-1.37	0.0137	117.70	117.70
738.24	736.67	737.94	-1.57	0.0157	117.70	117.82
13.06	11.76	12.41	-1.29	0.0129	117.80	117.94

APPENDIX I

STRAWN STRUCTURE MAPS



ENVIROCORP
ENVIRONMENTAL SERVICES & TECHNOLOGY, INC.
NAVJO REFINING CO.
ATTACHMENT VIII-11
STRUCTURE MAP OF THE
STRAWN FORMATION
DRAWN BY: JAMES M. JONES
APPROVED BY: JAMES M. JONES
DATE: JULY 1957

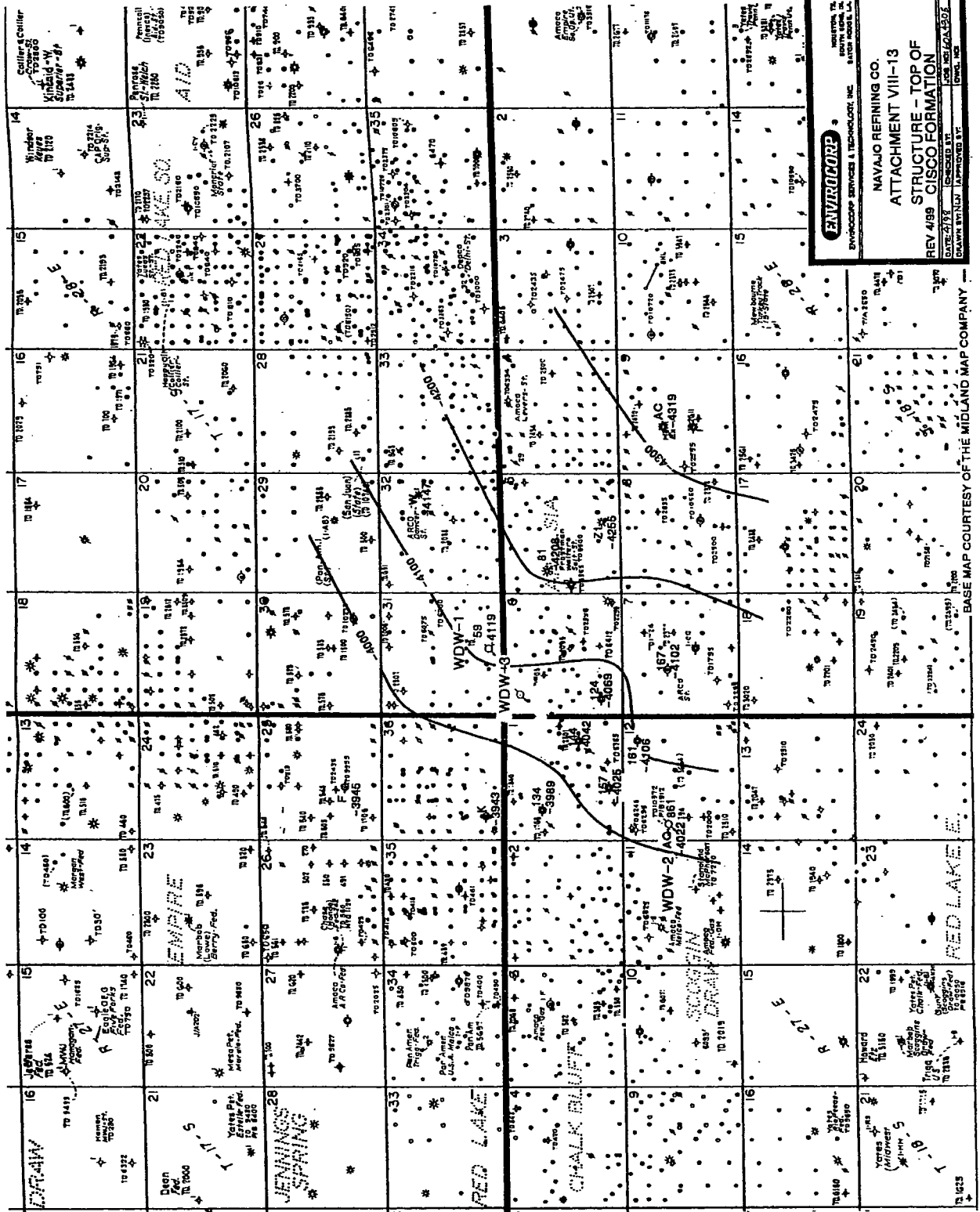
STRUCTURE MAP COURTESY OF THE GEOMAP COMPANY
Poster, July 1957

APPENDIX J

WOLFCAMP STRUCTURE MAPS

APPENDIX K

CISCO STRUCTURE MAPS



157-
-4025
ID NO. SURSEA DEPTH

APPENDIX L

CHRONOLOGY OF FIELD ACTIVITIES

APPENDIX L

CHRONOLOGY OF FIELD ACTIVITIES

Saturday January 21st, 2012

Russell Smith:

Travel to Artesia, NM, and contacted contractors. Note all times are in Mountain Standard Time (MST).

Sunday January 22nd, 2012

Russell Smith:

Subsurface arrived at the Navajo Plant at 6:30 am MST. Memory read out (MRO) gauges were placed into each well as follows;

MST

Well No.1 --- 2 MROs spotted on depth at 7924 feet 10:42 am MST, wire was 092 carbon steel

Well No.2 -- 2 MROs spotted on depth at 7570 feet 10:08 pm MST, wire was 092 stainless steel

Well No.3 ---- 2 MROs spotted on depth at 7660 feet 08:46 pm MST, wire was 092 carbon steel

Monday January 23rd, 2012

Russell Smith:

Checked on wells, worked on report and traveled from Artesia, NM to Clovis, NM

Tuesday, January 24th, 2012

Russell Smith:

Travel from Clovis, NM to Artesia, NM, had meeting with Navajo representative Robert Comes, and checked wells.



Wednesday, January 25th, 2012

Russell Smith:

Subsurface arrived at the well. At 06:30 am (MST) wireline crew started out of the WDW-1 wellbore with memory read out (MRO) pressure gauges making five minute gradient stops every 1,000 feet. At 09:08 am (MST) wireline crew was out of the Well No. 1 wellbore and moved over to the Well No.-3. At 09:08 am (MST) wireline crew started of Well No. 3 wellbore with MRO gauges making gradient stops every 1000 feet. At 11:03 am (MST) wireline crew moved over to Well No. 2 and started out of the wellbore with MRO gauges. At 11:30 am Gray wireline started to perform temperature survey on Well No. 3. At 04:00 pm (MST) wireline crew had pulled all gauges and left the well site. At 5:30 pm Gray Wireline had completed the temperature profile of Well No. 3.

Thursday, January 26th, 2012

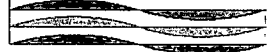
Russell Smith:

Travel from Artesia, NM to Houston, TX.



APPENDIX M

PANSYSTEM© ANALYSIS OUTPUT



Well Test Analysis Report

Company	Navajo Refining Company
Location	Artesia, New Mexico
Well	Gaines Well No. 3
Date	January 21 - 28, 2012
Gauge Type / Serial Number	Spartek / Top No. 77120 & Bottom No. 76404
Gauge Depth	7660 feet
Injection Interval	7660 feet to 8620 feet
Completion Type	Perforated
Top of Fill	8986 feet
Analyst	RLS
Subsurface Project No.	70A6645



HOUSTON, TX • BATON ROUGE, LA • SOUTH BEND, IN

Well Test Analysis Report

Reservoir Description

Fluid type : Water

Well orientation : Vertical

Number of wells : 1

Number of layers : 1

Layer Parameters Data

	Layer 1
Formation thickness	175.0000 ft
Average formation porosity	0.1000
Water saturation	0.0000
Gas saturation	0.0000
Formation compressibility	0.000000 psi-1
Total system compressibility	8.4000e-6 psi-1
Layer pressure	3622.164936 psia
Temperature	0.000000 deg F

Well Parameters Data

	Well 1
Well radius	0.3246 ft
Distance from observation to active well	0.000000 ft
Wellbore storage coefficient	0.11809 bbl/psi
Storage Amplitude	0.000000 psi
Storage Time Constant	0.000000 hr
Second Wellbore Storage	0.000000 bbl/psi
Time Change for Second Storage	0.000000 hr
Well offset - x direction	0.0000 ft
Well offset - y direction	0.0000 ft

Fluid Parameters Data

	Layer 1
Oil gravity	0.000000 API
Gas gravity	0.000000 sp grav
Gas-oil ratio (produced)	0.000000 scf/STB
Water cut	0.000000
Water salinity	0.000000 ppm
Check Pressure	3622.870000 psia
Check Temperature	0.000000 deg F
Gas-oil ratio (solution)	0.000000 scf/STB
Bubble-point pressure	0.000000 psia
Oil density	0.000 lb/ft3
Oil viscosity	0.000 cp
Oil formation volume factor	0.000 RB/STB
Gas density	0.000 lb/ft3
Gas viscosity	0.0 cp
Gas formation volume factor	0.000 ft3/scf
Water density	0.000 lb/ft3
Water viscosity	0.570 cp
Water formation volume factor	1.000 RB/STB
Oil compressibility	0.000000 psi-1
Initial Gas compressibility	0.000000 psi-1
Water compressibility	0.000000 psi-1

**Layer 1 Correlations**

Not Used

Layer 1 Model Data

Layer 1 Model Type : Radial homogeneous

	Layer 1
Permeability	596.528914 md
Skin factor (Well 1)	27.240663

Rate Change Data

Time Hours	Pressure psia	Rate STB/day
-11208.000000	0.000000	-6398.265381
-11184.000000	0.000000	-6398.265381
-11160.000000	0.000000	-6398.265381
-11136.000000	0.000000	-6547.910679
-11112.000000	0.000000	-6398.265381
-11088.000000	0.000000	-6398.265381
-11064.000000	0.000000	-6540.428467
-11040.000000	0.000000	-6398.265381
-11016.000000	0.000000	-6098.977400
-10992.000000	0.000000	-6398.265381
-10968.000000	0.000000	-6547.910679
-10944.000000	0.000000	-6398.265381
-10920.000000	0.000000	-7433.133022
-10896.000000	0.000000	-7141.325160
-10872.000000	0.000000	-6398.265381
-10848.000000	0.000000	-6398.265381
-10824.000000	0.000000	-6256.104911
-10800.000000	0.000000	-6248.622698
-10776.000000	0.000000	-6248.622698
-10752.000000	0.000000	-6547.910679
-10728.000000	0.000000	-6398.265381
-10704.000000	0.000000	-6398.265381
-10680.000000	0.000000	-6398.265381
-10656.000000	0.000000	-6547.910679
-10632.000000	0.000000	-6248.622698
-10608.000000	0.000000	-6540.428467
-10584.000000	0.000000	-6842.037179
-10560.000000	0.000000	0.000000
-10536.000000	0.000000	0.000000
-10512.000000	0.000000	-6540.428467
-10488.000000	0.000000	-6248.622698
-10464.000000	0.000000	-6241.140485
-10440.000000	0.000000	-6398.265381
-10416.000000	0.000000	-6398.265381
-10392.000000	0.000000	-6398.265381
-10368.000000	0.000000	-6547.910679
-10344.000000	0.000000	-6398.265381
-10320.000000	0.000000	-6405.747593
-10296.000000	0.000000	-6248.622698
-10272.000000	0.000000	-6098.977400
-10248.000000	0.000000	-6248.622698

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-10224.000000	0.000000	-6098.977400
-10200.000000	0.000000	-6098.977400
-10176.000000	0.000000	-6248.622698
-10152.000000	0.000000	-6098.977400
-10128.000000	0.000000	-6248.622698
-10104.000000	0.000000	-5949.334717
-10080.000000	0.000000	-6106.459612
-10056.000000	0.000000	-6098.977400
-10032.000000	0.000000	0.000000
-10008.000000	0.000000	-6547.910679
-9984.000000	0.000000	-6398.265381
-9960.000000	0.000000	-6547.910679
-9936.000000	0.000000	-6398.265381
-9912.000000	0.000000	-6540.428467
-9888.000000	0.000000	-6547.910679
-9864.000000	0.000000	-6248.622698
-9840.000000	0.000000	-6248.622698
-9816.000000	0.000000	-6098.977400
-9792.000000	0.000000	-6398.265381
-9768.000000	0.000000	-6398.265381
-9744.000000	0.000000	-6248.622698
-9720.000000	0.000000	-5804.850900
-9696.000000	0.000000	-5949.334717
-9672.000000	0.000000	0.000000
-9648.000000	0.000000	0.000000
-9624.000000	0.000000	0.000000
-9600.000000	0.000000	-6690.071150
-9576.000000	0.000000	-6398.265381
-9552.000000	0.000000	-6547.910679
-9528.000000	0.000000	-6405.747593
-9504.000000	0.000000	-6547.910679
-9480.000000	0.000000	-6547.910679
-9456.000000	0.000000	-6405.747593
-9432.000000	0.000000	-6540.428467
-9408.000000	0.000000	-6697.553362
-9384.000000	0.000000	-6547.910679
-9360.000000	0.000000	-6547.910679
-9336.000000	0.000000	-6248.622698
-9312.000000	0.000000	-6248.622698
-9288.000000	0.000000	-6398.265381
-9264.000000	0.000000	-6547.910679



Well Test Analysis Report

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-9240.000000	0.000000	-6547.910679
-9216.000000	0.000000	-6547.910679
-9192.000000	0.000000	-6697.553362
-9168.000000	0.000000	-6248.622698
-9144.000000	0.000000	-6697.553362
-9120.000000	0.000000	-6697.553362
-9096.000000	0.000000	-6690.071150
-9072.000000	0.000000	-6547.910679
-9048.000000	0.000000	-6398.265381
-9024.000000	0.000000	-6547.910679
-9000.000000	0.000000	-6547.910679
-8976.000000	0.000000	-6540.428467
-8952.000000	0.000000	-6398.265381
-8928.000000	0.000000	-6547.910679
-8904.000000	0.000000	-6547.910679
-8880.000000	0.000000	-6547.910679
-8856.000000	0.000000	-6398.265381
-8832.000000	0.000000	-6547.910679
-8808.000000	0.000000	-6398.265381
-8784.000000	0.000000	-6547.910679
-8760.000000	0.000000	-6398.265381
-8736.000000	0.000000	0.000000
-8712.000000	0.000000	-5949.334717
-8688.000000	0.000000	-6547.910679
-8664.000000	0.000000	-6398.265381
-8640.000000	0.000000	-6697.553362
-8616.000000	0.000000	-6547.910679
-8592.000000	0.000000	0.000000
-8568.000000	0.000000	-3.0346e4
-8544.000000	0.000000	-575.822689
-8520.000000	0.000000	-6091.495187
-8496.000000	0.000000	0.000000
-8472.000000	0.000000	0.000000
-8448.000000	0.000000	-6697.553362
-8424.000000	0.000000	-6909.119176
-8400.000000	0.000000	-4919.370117
-8376.000000	0.000000	0.000000
-8352.000000	0.000000	-4019.441267
-8328.000000	0.000000	-3420.865566
-8304.000000	0.000000	-4455.730852
-8280.000000	0.000000	-4612.858364
-8256.000000	0.000000	-5206.272845
-8232.000000	0.000000	-5505.560826
-8208.000000	0.000000	-5655.205601
-8184.000000	0.000000	-5056.630162
-8160.000000	0.000000	-5942.110421
-8136.000000	0.000000	-5206.272845
-8112.000000	0.000000	-5505.560826
-8088.000000	0.000000	0.000000

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-8064.000000	0.000000	-5655.205601
-8040.000000	0.000000	0.000000
-8016.000000	0.000000	-6842.037179
-7992.000000	0.000000	0.000000
-7968.000000	0.000000	-6697.553362
-7944.000000	0.000000	-6547.910679
-7920.000000	0.000000	-6398.265381
-7896.000000	0.000000	-6697.553362
-7872.000000	0.000000	-7290.970459
-7848.000000	0.000000	-4463.213065
-7824.000000	0.000000	0.000000
-7800.000000	0.000000	-5949.334717
-7776.000000	0.000000	0.000000
-7752.000000	0.000000	-149.336406
-7728.000000	0.000000	-4612.858364
-7704.000000	0.000000	-4762.501046
-7680.000000	0.000000	-3570.508248
-7656.000000	0.000000	0.000000
-7632.000000	0.000000	-4463.213065
-7608.000000	0.000000	-4762.501046
-7584.000000	0.000000	-4313.570382
-7560.000000	0.000000	-5949.334717
-7536.000000	0.000000	-5520.525251
-7512.000000	0.000000	-6547.910679
-7488.000000	0.000000	-4612.858364
-7464.000000	0.000000	0.000000
-7440.000000	0.000000	-5206.272845
-7416.000000	0.000000	-6697.553362
-7392.000000	0.000000	-5505.560826
-7368.000000	0.000000	0.000000
-7344.000000	0.000000	-6398.265381
-7320.000000	0.000000	-5804.850900
-7296.000000	0.000000	-6098.977400
-7272.000000	0.000000	0.000000
-7248.000000	0.000000	-6398.265381
-7224.000000	0.000000	-5855.419922
-7200.000000	0.000000	-5804.850900
-7176.000000	0.000000	-6398.265381
-7152.000000	0.000000	-6098.977400
-7128.000000	0.000000	0.000000
-7104.000000	0.000000	-5949.334717
-7080.000000	0.000000	-4612.858364
-7056.000000	0.000000	0.000000
-7032.000000	0.000000	-1490.971854
-7008.000000	0.000000	-4422.857143
-6984.000000	0.000000	-5385.714111
-6960.000000	0.000000	-4902.857143
-6936.000000	0.000000	-5179.999826
-6912.000000	0.000000	-5074.285714



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Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-6888.000000	0.000000	-5131.428746
-6864.000000	0.000000	-4797.143032
-6840.000000	0.000000	-4694.285889
-6816.000000	0.000000	-2602.857056
-6792.000000	0.000000	-4800.000000
-6768.000000	0.000000	-4800.000000
-6744.000000	0.000000	0.000000
-6720.000000	0.000000	-7502.856968
-6696.000000	0.000000	0.000000
-6672.000000	0.000000	-4662.857143
-6648.000000	0.000000	-4425.714111
-6624.000000	0.000000	-5074.285714
-6600.000000	0.000000	-3500.000087
-6576.000000	0.000000	-4974.285540
-6552.000000	0.000000	-5177.142857
-6528.000000	0.000000	-5214.285540
-6504.000000	0.000000	-5080.000174
-6480.000000	0.000000	-5314.285714
-6456.000000	0.000000	0.000000
-6432.000000	0.000000	-5177.142857
-6408.000000	0.000000	-5177.142857
-6384.000000	0.000000	-5348.571429
-6360.000000	0.000000	0.000000
-6336.000000	0.000000	-5108.571429
-6312.000000	0.000000	-4971.428571
-6288.000000	0.000000	-5214.285540
-6264.000000	0.000000	-5108.571429
-6240.000000	0.000000	-4800.000000
-6216.000000	0.000000	-5102.856968
-6192.000000	0.000000	-5214.285540
-6168.000000	0.000000	-4865.714460
-6144.000000	0.000000	-5382.857143
-6120.000000	0.000000	-5145.714111
-6096.000000	0.000000	-5042.856968
-6072.000000	0.000000	-5239.999826
-6048.000000	0.000000	-5217.143032
-6024.000000	0.000000	-5280.000000
-6000.000000	0.000000	-5214.285540
-5976.000000	0.000000	-5179.999826
-5952.000000	0.000000	-5211.428571
-5928.000000	0.000000	-5208.571603
-5904.000000	0.000000	-5179.999826
-5880.000000	0.000000	-5248.571254
-5856.000000	0.000000	-5140.000174
-5832.000000	0.000000	-4968.571603
-5808.000000	0.000000	-5080.000174
-5784.000000	0.000000	-5114.285889
-5760.000000	0.000000	-5074.285714
-5736.000000	0.000000	-5111.428397

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-5712.000000	0.000000	-5071.428746
-5688.000000	0.000000	-5211.428571
-5664.000000	0.000000	-5591.428397
-5640.000000	0.000000	-5588.571429
-5616.000000	0.000000	-5588.571429
-5592.000000	0.000000	-5591.428397
-5568.000000	0.000000	-5237.142857
-5544.000000	0.000000	-5754.285540
-5520.000000	0.000000	-5242.857317
-5496.000000	0.000000	-4731.428571
-5472.000000	0.000000	-5242.857317
-5448.000000	0.000000	-5011.428746
-5424.000000	0.000000	-5242.857317
-5400.000000	0.000000	-5108.571429
-5376.000000	0.000000	-5242.857317
-5352.000000	0.000000	-5042.856968
-5328.000000	0.000000	-5071.428746
-5304.000000	0.000000	-5142.857143
-5280.000000	0.000000	-5145.714111
-5256.000000	0.000000	-5140.000174
-5232.000000	0.000000	-5174.285889
-5208.000000	0.000000	-5143.661237
-5184.000000	0.000000	-5137.054269
-5160.000000	0.000000	-5142.857143
-5136.000000	0.000000	-5174.285889
-5112.000000	0.000000	-5074.285714
-5088.000000	0.000000	0.000000
-5064.000000	0.000000	-5042.856968
-5040.000000	0.000000	0.000000
-5016.000000	0.000000	-5345.714460
-4992.000000	0.000000	-5102.856968
-4968.000000	0.000000	0.000000
-4944.000000	0.000000	-5108.571429
-4920.000000	0.000000	-5074.285714
-4896.000000	0.000000	0.000000
-4872.000000	0.000000	-4114.285714
-4848.000000	0.000000	-5105.714460
-4824.000000	0.000000	-5074.285714
-4800.000000	0.000000	-5040.000000
-4776.000000	0.000000	-5042.856968
-4752.000000	0.000000	-5008.571254
-4728.000000	0.000000	-5077.142683
-4704.000000	0.000000	-5080.000174
-4680.000000	0.000000	0.000000
-4656.000000	0.000000	-4974.285540
-4632.000000	0.000000	-4688.571429
-4608.000000	0.000000	-4834.285714
-4584.000000	0.000000	0.000000
-4560.000000	0.000000	-5005.714286



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Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-4536.000000	0.000000	-4834.285714
-4512.000000	0.000000	-4771.428746
-4488.000000	0.000000	-4971.428571
-4464.000000	0.000000	-5008.571254
-4440.000000	0.000000	-4902.857143
-4416.000000	0.000000	-4797.143032
-4392.000000	0.000000	-4937.142857
-4368.000000	0.000000	-5002.857317
-4344.000000	0.000000	-4597.142683
-4320.000000	0.000000	0.000000
-4296.000000	0.000000	-4900.000174
-4272.000000	0.000000	-4934.285889
-4248.000000	0.000000	0.000000
-4224.000000	0.000000	-4937.142857
-4200.000000	0.000000	-4902.857143
-4176.000000	0.000000	-5002.857317
-4152.000000	0.000000	-5011.428746
-4128.000000	0.000000	-4468.571254
-4104.000000	0.000000	-4997.142857
-4080.000000	0.000000	-4968.571603
-4056.000000	0.000000	-4999.999826
-4032.000000	0.000000	-5002.857317
-4008.000000	0.000000	-4974.285540
-3984.000000	0.000000	-4965.714111
-3960.000000	0.000000	-4874.285889
-3936.000000	0.000000	0.000000
-3912.000000	0.000000	-4865.714460
-3888.000000	0.000000	-4934.285889
-3864.000000	0.000000	-4905.714111
-3840.000000	0.000000	-4902.857143
-3816.000000	0.000000	-5002.857317
-3792.000000	0.000000	-4942.857317
-3768.000000	0.000000	-4939.999826
-3744.000000	0.000000	-4934.285889
-3720.000000	0.000000	0.000000
-3696.000000	0.000000	-4765.714286
-3672.000000	0.000000	-4931.428397
-3648.000000	0.000000	-4937.142857
-3624.000000	0.000000	-4868.571429
-3600.000000	0.000000	-4905.714111
-3576.000000	0.000000	-5002.857317
-3552.000000	0.000000	-4937.142857
-3528.000000	0.000000	-4937.142857
-3504.000000	0.000000	-4931.428397
-3480.000000	0.000000	-4871.428397
-3456.000000	0.000000	-5037.143032
-3432.000000	0.000000	-4837.142683
-3408.000000	0.000000	-4939.999826
-3384.000000	0.000000	-4931.428397

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-3360.000000	0.000000	-4937.142857
-3336.000000	0.000000	-4837.142683
-3312.000000	0.000000	-4974.285540
-3288.000000	0.000000	-5037.143032
-3264.000000	0.000000	-4942.857317
-3240.000000	0.000000	-4937.142857
-3216.000000	0.000000	-4868.571429
-3192.000000	0.000000	-4971.428571
-3168.000000	0.000000	-4937.142857
-3144.000000	0.000000	0.000000
-3120.000000	0.000000	-5419.999826
-3096.000000	0.000000	-5239.999826
-3072.000000	0.000000	-5208.571603
-3048.000000	0.000000	-4668.571603
-3024.000000	0.000000	-4871.428397
-3000.000000	0.000000	-4900.000174
-2976.000000	0.000000	-4934.285889
-2952.000000	0.000000	-4697.142857
-2928.000000	0.000000	-4868.571429
-2904.000000	0.000000	-4771.428746
-2880.000000	0.000000	-4928.571429
-2856.000000	0.000000	0.000000
-2832.000000	0.000000	-4871.428397
-2808.000000	0.000000	-4731.428571
-2784.000000	0.000000	-4834.285714
-2760.000000	0.000000	-4831.428746
-2736.000000	0.000000	-1948.571385
-2712.000000	0.000000	-4771.428746
-2688.000000	0.000000	-2022.857143
-2664.000000	0.000000	-4902.857143
-2640.000000	0.000000	-1242.857143
-2616.000000	0.000000	-4182.857143
-2592.000000	0.000000	-4802.856968
-2568.000000	0.000000	-4837.142683
-2544.000000	0.000000	-4634.285889
-2520.000000	0.000000	-4668.571603
-2496.000000	0.000000	-4731.428571
-2472.000000	0.000000	-4699.999826
-2448.000000	0.000000	-4597.142683
-2424.000000	0.000000	-4625.714460
-2400.000000	0.000000	-4797.143032
-2376.000000	0.000000	-4597.142683
-2352.000000	0.000000	0.000000
-2328.000000	0.000000	0.000000
-2304.000000	0.000000	-36.357143
-2280.000000	0.000000	-4483.702381
-2256.000000	0.000000	-4683.331018
-2232.000000	0.000000	-4498.543981
-2208.000000	0.000000	-4739.353257



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Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-2184.000000	0.000000	-4498.311508
-2160.000000	0.000000	-4739.888558
-2136.000000	0.000000	-4293.713624
-2112.000000	0.000000	-4625.099950
-2088.000000	0.000000	-4324.223628
-2064.000000	0.000000	-4827.789104
-2040.000000	0.000000	-4792.579034
-2016.000000	0.000000	-4881.841105
-1992.000000	0.000000	-4815.456267
-1968.000000	0.000000	-7234.171048
-1944.000000	0.000000	-6065.735284
-1920.000000	0.000000	-4486.401207
-1896.000000	0.000000	-4603.563244
-1872.000000	0.000000	-4207.539683
-1848.000000	0.000000	-3875.855076
-1824.000000	0.000000	-2134.996280
-1800.000000	0.000000	0.000000
-1776.000000	0.000000	0.000000
-1752.000000	0.000000	-3960.563740
-1728.000000	0.000000	-4768.571254
-1704.000000	0.000000	-5025.714111
-1680.000000	0.000000	-4831.428746
-1656.000000	0.000000	-5974.285714
-1632.000000	0.000000	-5991.428571
-1608.000000	0.000000	-8548.571254
-1584.000000	0.000000	-2231.428659
-1560.000000	0.000000	-5217.143032
-1536.000000	0.000000	-2905.714286
-1512.000000	0.000000	-5002.857317
-1488.000000	0.000000	-1.6786e4
-1464.000000	0.000000	-1314.285671
-1440.000000	0.000000	-4494.285540
-1416.000000	0.000000	-3597.142770
-1392.000000	0.000000	-4488.571603
-1368.000000	0.000000	-2294.285627
-1344.000000	0.000000	-5065.714286
-1320.000000	0.000000	-3974.285627
-1296.000000	0.000000	-4457.142857
-1272.000000	0.000000	-4971.428571
-1248.000000	0.000000	-4077.142770
-1224.000000	0.000000	-4428.571603
-1200.000000	0.000000	-4425.714111
-1176.000000	0.000000	0.000000
-1152.000000	0.000000	-4557.143032
-1128.000000	0.000000	-19.999999
-1104.000000	0.000000	-4971.428571
-1080.000000	0.000000	-4734.285540
-1056.000000	0.000000	-5008.571254
-1032.000000	0.000000	-4560.000000

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-1008.000000	0.000000	-3331.428484
-984.000000	0.000000	-5111.428397
-960.000000	0.000000	-5008.571254
-936.000000	0.000000	-4865.714460
-912.000000	0.000000	-5242.857317
-888.000000	0.000000	-5182.857317
-864.000000	0.000000	-4179.999913
-840.000000	0.000000	-5042.856968
-816.000000	0.000000	-3791.428659
-792.000000	0.000000	-3871.428484
-768.000000	0.000000	-3057.142770
-744.000000	0.000000	-4768.571254
-720.000000	0.000000	-4348.571516
-696.000000	0.000000	0.000000
-672.000000	0.000000	-5202.857143
-648.000000	0.000000	-3871.428484
-624.000000	0.000000	-2097.142901
-600.000000	0.000000	-3608.571429
-576.000000	0.000000	-2514.285801
-552.000000	0.000000	-5034.285540
-528.000000	0.000000	-4865.714460
-504.000000	0.000000	-4968.571603
-480.000000	0.000000	-5040.000000
-456.000000	0.000000	-3088.571516
-432.000000	0.000000	-4217.142857
-408.000000	0.000000	-4699.999826
-384.000000	0.000000	-437.142857
-360.000000	0.000000	0.000000
-336.000000	0.000000	-3502.857056
-312.000000	0.000000	-4362.857143
-288.000000	0.000000	-3085.714286
-264.000000	0.000000	-4417.142683
-240.000000	0.000000	-3231.428571
-216.000000	0.000000	-3660.000000
-192.000000	0.000000	-4634.285889
-168.000000	0.000000	-4491.428571
-144.000000	0.000000	-5322.857143
-120.000000	0.000000	-4588.571254
-96.000000	0.000000	-1414.285714
-76.289593	3841.764422	-3960.000000
-55.927602	3842.748942	-4611.428571
-30.569832	3852.797833	-7262.856968
0.000000	3853.883527	-1808.571429
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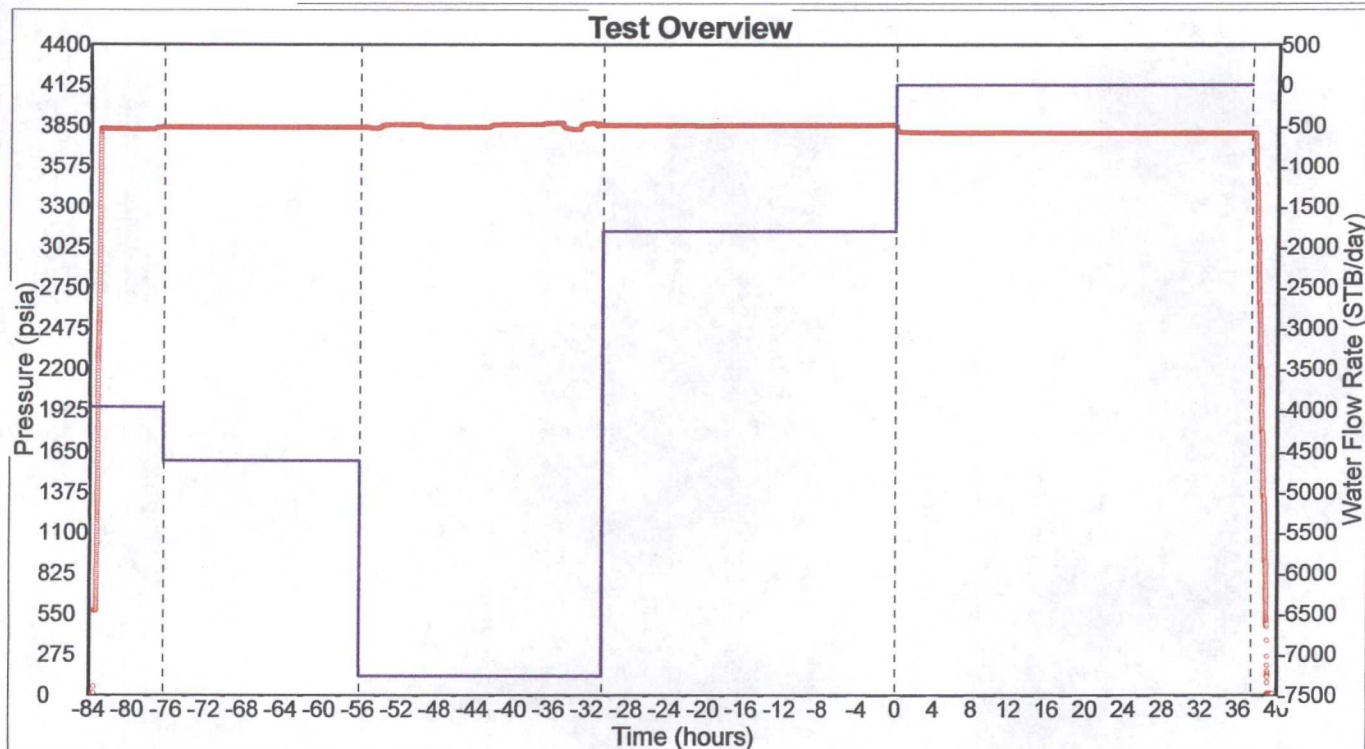
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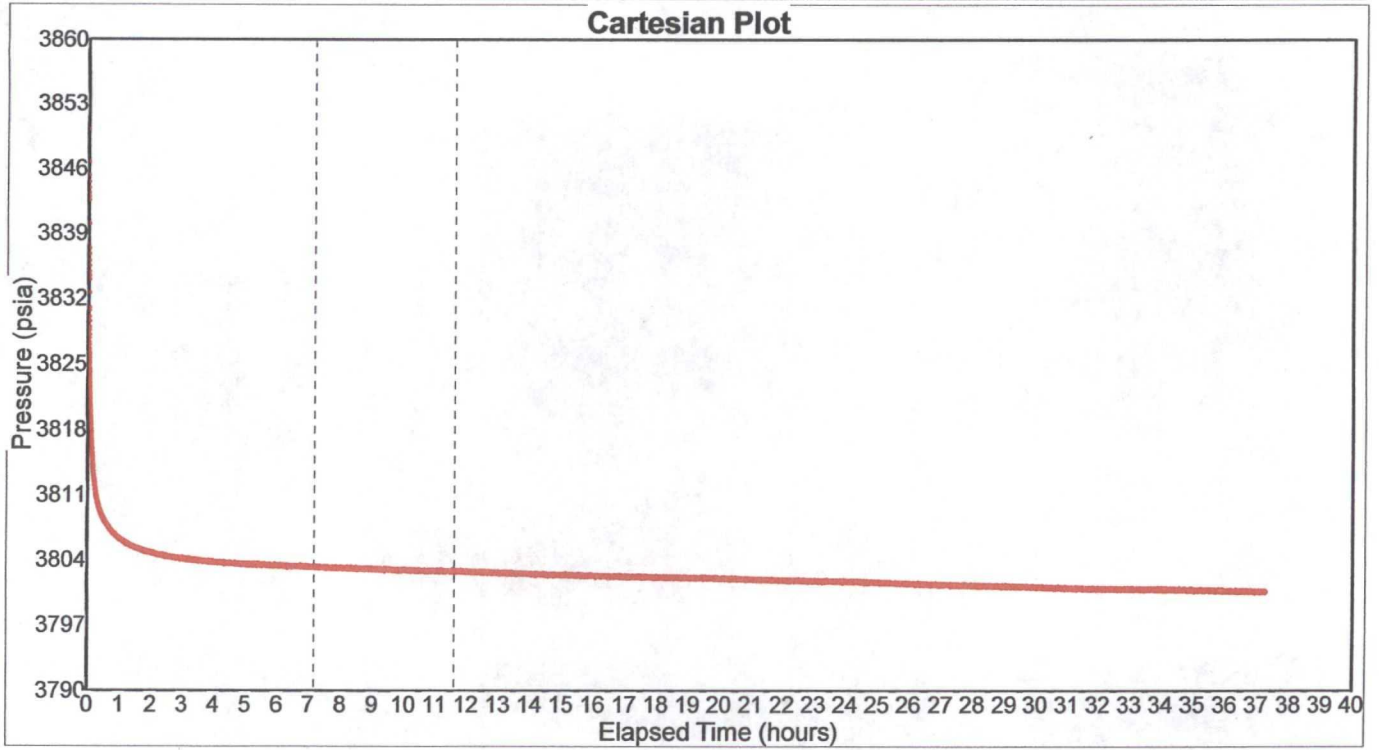
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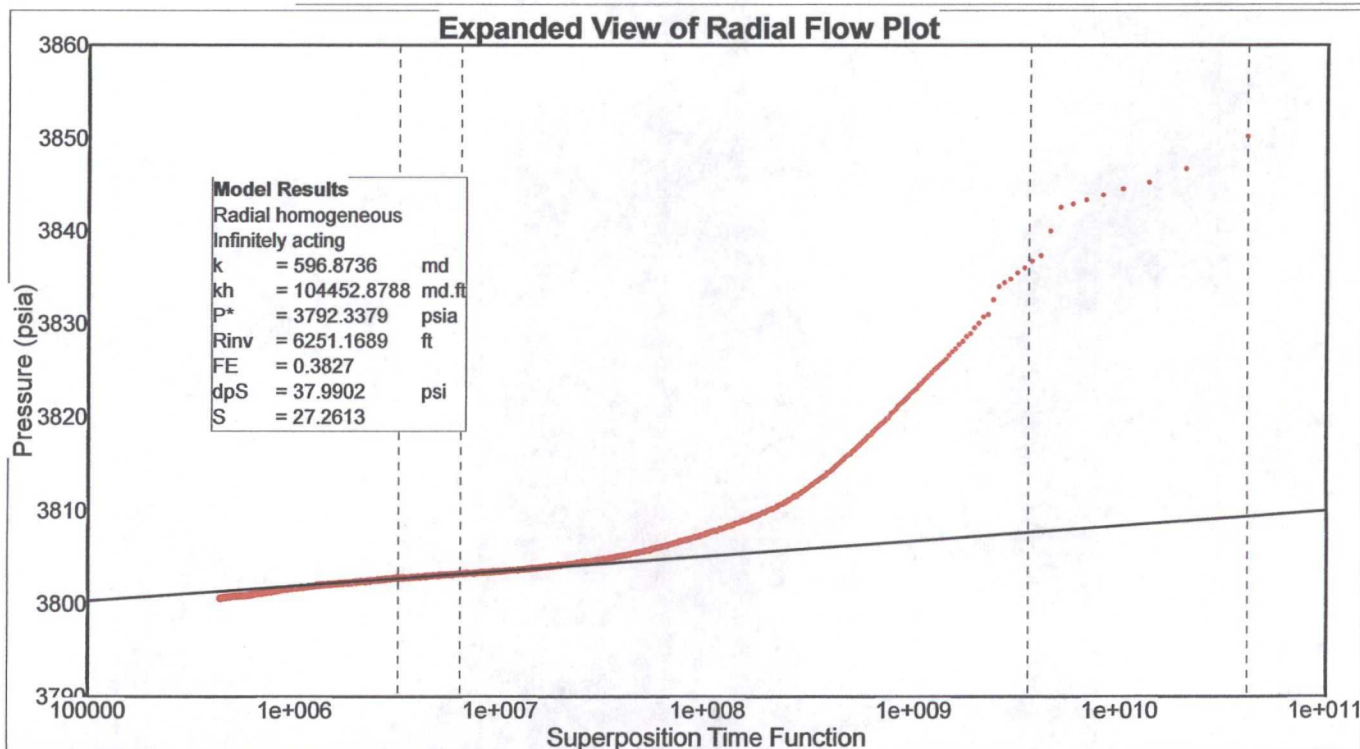
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Well Test Analysis Report



Expanded View of Radial Flow Plot Model Results

Radial homogeneous - Infinitely acting

Fair Wellbore Storage

	Value
Permeability	596.873593 md
Permeability-thickness	1.0445e5 md.ft
Extrapolated pressure	3792.337923 psia
Radius of investigation	6251.168856 ft
Flow efficiency	0.382731
dP skin (constant rate)	37.990201 psi
Skin factor	27.261314

Expanded View of Radial Flow Plot Line Details

Line type : Radial flow

Slope : 1.60439

Intercept : 3792.34

Coefficient of Determination : 0.899916

	Radial flow
Extrapolated pressure	3792.337923 psia
Pressure at dt = 1 hour	3804.910506 psia

Number of Intersections = 0



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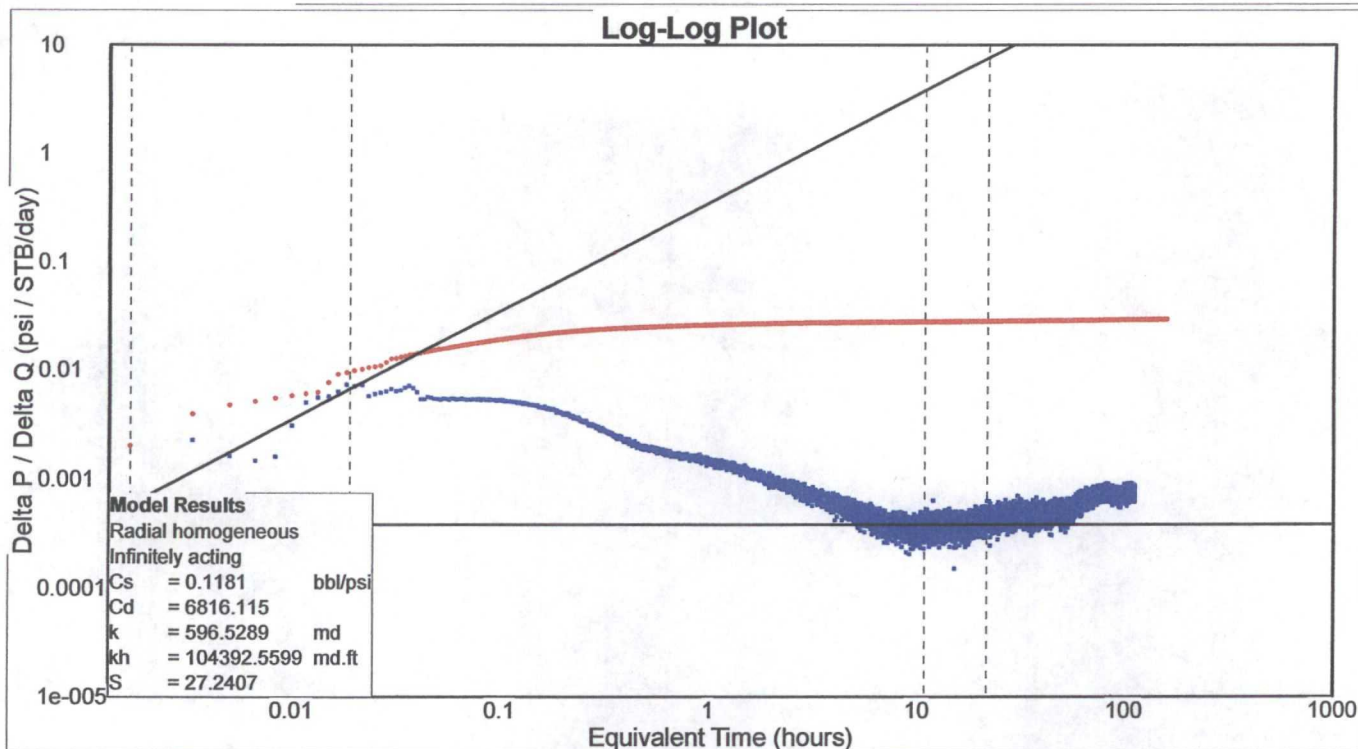
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Well Test Analysis Report



Log-Log Plot Model Results

Radial homogeneous - Infinitely acting

Fair Wellbore Storage

	Value
Wellbore storage coefficient	0.11809 bbl/psi
Dimensionless wellbore storage	6816.114987
Permeability	596.528914 md
Permeability-thickness	1.0439e5 md.ft
Skin factor	27.240663

Log-Log Plot Line Details

Line type : Wellbore storage

Slope : 1

Intercept : 0.352838

Coefficient of Determination : Not Used

Line type : Radial flow

Slope : 0

Intercept : 0.000385487

Coefficient of Determination : Not Used

Number of Intersections = 0

APPENDIX N

TEMPERATURE SURVEY, DATED JANUARY 27, 2012