MONTGOMERY
& ANDREWS
LAW FIRM

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RECEIVED OCD
2013 OCT -8 P 1: 13

October 8, 2013

Daniel Sanchez
Enforcement and Compliance Manager
New Mexico Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, NM 87505

Re: Western Refining Southwest, Inc. Bloomfield Refinery Injection Well (UICI-009)

Dear Mr. Sanchez:

On August 6th, 2013, representatives from the New Mexico Oil Conservation Division ("Division") and Western Refining Southwest, Inc. ("Western") convened a technical discussion regarding the operation of the injection well at the Bloomfield Refinery and the current status of the Injection Well Discharge Permit (GW-130). As requested by the Division, on behalf of Western, we are providing a written summary of the technical presentation given by Mr. Brent W. Hale (William M. Cobb & Associates, Inc.), along with additional surface well-pressure data.

Technical Discussion

The technical presentation summarized the long term performance trends observed and expected for the Bloomfield Refinery injection well. The long term pressure performance is dominated by linear flow systems and by the volume of water injected. Overall, the well has performed in a reliable and predictable manner. Based on what is known about the well, and based on the technical review of data collected over the life of the well, Western is requesting the following recommendations be incorporated into the renewal of the injection well Discharge Permit.

- The parting and fracture pressures from the 1996 hydraulic fracture should be used as needed to manage the Bloomfield Refinery injection well. The step rate test estimates of these parameters are not reliable estimates;

- Additional testing to determine parting and propagation pressures is not recommenced. Such testing would create additional factures and additional injection capacity which are not needed at this time.
- Surface recorded data should be allowed as an alternative to bottom-hole test data. Because this well does not stabilize quickly, the use of surface recorded data will allow for longer term testing when tests are needed.
- There should be no annual requirement for fall-off or similar tests because it is unlikely that these tests will provide new or useful information about the reservoir. Testing should be conducted when performance indicates a departure from expected trends, and thus testing is needed to determine reasons for such changes.
- Maximum surface injection pressure of 1,150 psi be approved for continues use in this well.
- Annual mechanical integrity testing should be conducted to insure the integrity of the well bore.

A detailed discussion of the foregoing matters is presented in the enclosed report dated September 23, 2013 prepared by William M. Cobb & Associates, Inc.

Additional Surface Well-Pressure Data

The existing surface well-pressure gauge is part of the control system which limits the injection pressure to 1,150 psi or below as required by the existing permit. If the surface recorded data alternative is approved, Western will install an additional gauge at the wellhead. As the Division requested, print-outs of the hourly surface-recorded pressure data are enclosed.

Your consideration of these matters is appreciated.

Very truly yours,

J. Scott Hall

J. Scott Hall

cc: Jim Griswold, NMOCD w/enc.
Gabriel Wade, Esq., NMOCD w/enc.

Allen Hains, Western Refining w/o enc.
Randy Schmaltz w/o enc.

WILLIAM M. COBB & ASSOCIATES, INC.
Worldwide Petroleum Consultants

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September 23, 2013

Mr. James (Randy) Schmaltz
Western Refining Southwest, Inc.
50 County Road 4990
Bloomfield, New Mexico 87413

Re: Waste Disposal Well #1
Subsurface Project No. 70G6193

Dear Mr. Schmaltz:

I have reviewed the 1996 hydraulic fracture treatment report and step rate tests conducted in 1994 and 1996 for Water Disposal #1. The purpose of the step-rate tests was to determine fracture initiation pressure and fracture propagation pressures for the well. The 1996 hydraulic fracture of the well was conducted to increase disposal capacity of this well and established the fracture initiation pressure and fracture propagation pressures for this well. I have prepared some notes on how these tests have been interpreted, the dominant fluid flow characteristics for this well, and recommendations for future management of the well.

Water Disposal Well #1 is responding as expected for a fractured well which is injecting water into a low permeability formation. The dominate flow regime for this well is a linear flow regime. The linear flow patterns are seen on both the short term tests and the long term tests. The best analysis of the well's performance will consider these linear flow patterns. It appears that a number of past test interpretations failed to consider linear flow characteristics. Without doing so, the conclusions are not reliable indicators of performance for this well which has low permeability and very long pressure and rate stabilization times. With long stabilization times being normal, short term tests are not useful in determining anything other than performance of the well near the fracture or wellbore. Performance of the entire well and the currently injected volume of water can be best monitored with long term measurements for both flowing periods and for shut-in periods.

After reviewing the data for this well, I recommend that the maximum allowable surface injection pressure remain at 1150 psig. I also recommend that fall-off testing be replaced with longer term well performance data. Western should have the option to provide surface data to document well performance, or at their option to supplement surface data with bottom hole pressure recording when surface pressure becomes unavailable or when the results are inconclusive.

Historical Background

On January 10, 1994, a five hour step rate test was conducted including 2.3 hours of injection beginning at 1.7 hours and ending at 3.99 hours. This test consisted of pumping water into the well at rates ranging from 0.3 to 6 barrels per minute. Treating pressure ranged from 500 psi to 1,300 psi at the surface and from 4156.70 psi to 2092.20 psi at 3,346 feet.

On January 22, 1994, a 3.75 hour step rate test was conducted with the actual injection being about 2.75 hours. Rates ranged from 0.5 to 10 barrels per minute. Treating pressure ranged from 515 psi to 1,910 psi at the surface and from 1445.76 psi to 2053.33 psi at 3,250 feet. With a fluid gradient of 0.43 psi/foot, the 104 feet difference in instrument depth will result in a 45 psi difference in pressure readings. The maximum pressure on this test adjusted to 3346 feet would be 2098.33 psi or almost identical to the maximum pressure of the first test.

On March 1, 1996, the well was fractured with 123,254 gallons slick water injected in 48 minutes and with 153,940 pounds 20/40 Arizona sand injected. The average slurry rate was 65 barrels per minute with ½ to 2 pounds sand per gallon fluid. The observed parting pressure is 2866 psig or a gradient of 0.882 psi/ft. The observed fracture propagation pressure is approximately 2775 psig or a gradient of 0.854 psi/ft.

On March 7, 1996 a third step rate test of 7 hours was conducted with the actual injection being about 3.06 hours. Rates ranged from 0.6 to 5.5 barrels per minute. Treating pressure ranged from 2119.06 psi to 2141.90 psi at 3,400 feet. With a fluid gradient of 0.43 psi/foot, the 56 foot difference in instrument depth will result in a 24 psi difference in pressure readings. The maximum pressure on this test adjusted to 3346 feet would be 2117.9 psi or 25.7 psi more than the maximum pressure of the first test.

General Test Observations

A review of these tests and the fracture treatment shows that pressure data was recorded to four significant digits with associated time recorded to the nearest second. Rates, on the other hand, were generally recorded to one significant digit with associated time being recorded to the nearest minute at the best. Several of the charts to be presented in this review show some of the difficulties resulting from a large difference in the recording quality of the pressure and the rate data.

From these tests, the following are established:

1. Parting pressure of the formation is 2,866 psig.
2. Propagation pressure is 2,775 psig.
3. Reservoir stabilization time was not achieved during these tests.
4. Pressure and rate changes are consistent with those expected from a linear flow system in the well's two injection zones.

In order to visualize the flow patterns which are representative of flow in this reservoir near the Waste Disposal Well #1, Figure 1 was prepared. It shows both a radial flow system where injection flow lines are very close together near the wellbore and a linear flow system where there is no concentration of flow lines as injected water moves from the fracture into the formation. Test data show that performance of this well is best described using the linear flow equations.

Step Rate Test #1

Figures 2, 3 and 4 provide basic statistics for the January 10, 1994 step-rate test. The test lasted from 1.7167 hours to 3.99 hours with injection from 0.3 BPM to 6.0 BPM. The maximum injection pressure is 2092.2 psi measured at 3,446 feet. Figure 4 shows the pressure chart prepared at the time the test was conducted. This data was used to review the well performance during the test. The recorded data is reproduced in Figure 5 which includes the injection rate chart and recorded bottom-hole pressures. The data clearly shows two items: 1) bottom hole pressure changes when the rate changes and 2) the pressure changes are small except for data at the beginning and end of the test when the tool was being lowered into and removed from the wellbore.

Figure 6 expands the pressure scale to better observe the pressure changes during the test. The flowing bottom-hole pressure is not constant during the test. During the first flow period at 0.3 GPM, pressure increased from 1964 psig to 1987 psig. During the second flow, pressure increased from 1987 psig to 2018 psig. The pressure data was recorded with significantly more precision than was the rate data. Pressures were reported to 6 digits with rates being reported two digits with a single rate reported for each step in the test. Data was not recorded to confirm that rates were, in fact, constant during each step of the test. This uncertainty leaves some question as to the exact time of the rate changes and as to whether the pressure changes are reservoir related or related to injection rate changes or to reservoir properties.

The data was analyzed as shown in Figures 7 and 8. Figure 7 plots the surface pressure versus injection rate. Figure 8 does the same for bottom-hole pressures. The two trend lines are extrapolated to show a projected parting pressure of 2055 psig. The extrapolation to 2055 psig shown in Figure 8 is a valid extrapolation if pressures and rates have stabilized and if the reservoir has a radial flow pattern. Figure 9 is the same data re-plotted with a logarithmic rate scale. It shows that, to within the accuracy of the rate data, the test data forms a straight line which relates injection pressure to injection rate. With an established trend between rate and pressure, it is unlikely that the data would also show a reliable parting or fracture propagation pressure.

Figures 10 and 11 analyze the pressure falloff data at the end of the test or approximately from 4.0 hours to 4.2 hours as seen in Figure 6. Figure 10 is a Horner plot of the falloff data which is based on radial flow equations and is useful in analyzing radial flow patterns. Pressure changes are small, but the data do show that the trend line is bending downward as is expected for a system responding to linear flow. Figure 11 shows the same data plotted based on linear flow equations. In this figure, the data are straightened indicating that reservoir response to the step rate test is influenced by linear flow patterns. Figure 12 is the same data with expanded scales to allow extrapolation of trends to the projected formation pressure. The data extrapolate to a pressure of 1962 psig. Actual reservoir pressure will be somewhat more than this value when adjusted for boundary effects.

Step Rate Test #2

Figures 13 to 17 provide basic statistics for the January 22, 1994 step-rate test. The test lasted from 1.00 hour to 3.75 hours with injection from 0.5 BPM to 10.0 BPM. The maximum injection pressure is 2053.33 psi measured at 3,250 feet. Figure 15 and 16 show the analysis of this test data done at the time of the testing. Figure 16 is annotated with a fracture propagation pressure of about 2014 psig or at the intersection of the two trend lines. Figure 17 notes this "fracture extension" pressure of 2,014 psig. Figure 18 is a reproduction of Figure 16 with one important addition: it shows the rate based on cumulative injection volumes in additional to the rate listed on test reports. There is a noticeable variation in the two different rates which shows again the uncertainty introduced into the analysis due to the quality of rate measurements.

The data for Test #2 were re-plotted, Figure 19, to see if they indicate which flow system may be controlling reservoir response during the test. The figure, with pressure versus the logarithm of test rate, shows that the data are straightened significantly and that pressure is directly related to rate throughout the test and does not appear to indicate any other reservoir properties.

Figure 20 is a technically more correct plot of pressure change divided by test rate as a function of time. The figure shows that pressure change divided by rate drops over time during the test or that the rate change is much more significant than the pressure changes during the test. The strong relationship between delta pressure divided by rate versus falloff time shows that there is no change in reservoir properties or performance during the test and that a proper fracture propagation pressure cannot be determined from this test.

March 1996 Hydraulic Fracture

Figure 21 shows the pressure and rate charts recorded for the March 1, 1996 hydraulic fracture of this well. The tabular data supporting this chart was analyzed and shows the formation parting and propagation pressures. Figure 22 is a reproduction of the data in Figure 21. The pressure scale was expanded in Figure 23 to better view the pressure performance during the fracture treatment. The data show that the parting pressure or the peak pressure recorded before fluid started to penetrate the formation is 2,866 psig or 0.882 psi/foot. The data also show that the fracture propagation pressure or the pressure required to inject fluid is 2,775 psig or 0.854 psi/foot. The observed fracture parting pressure of 2,866 psig is significantly higher than the 2,055 psig and 2,014 psig parting pressures estimated from the step-rate tests conducted in 1994.

The surface data were plotted, Figure 24, to give a ready reference to the current maximum injection pressure of 1,150 psig. The fracture propagation pressure is 1730 psig or 580 psi higher than the maximum allowable injection pressure and is 356 psi higher than the formation parting pressure of 1,506 psig measured during the fracture treatment as shown in Figure 26.

Figures 25 and 26 include two charts to show, in detail, pressure response at the beginning and the end of the fracture treatment. Prior to the fracture treatment, reservoir pressure was measured at 2091 psig. Afterward, the measured pressure was 2270 psig. The surface pressures for the same time intervals are shown in Figure 26. The static wellhead pressure prior to the treatment was 770 psig and afterward it was 730 psig. This static wellhead pressure is important in considering allowable maximum wellhead injection pressures. When allowable maximum injection pressures are less than the static wellhead pressures or less than 730 psig, the flow rate will be zero. To allow continued injection into the well, the allowable wellhead injection pressure must be higher than 730 psig as shown in Figure 26.

Step-Rate Test #3

On March 7, 1996 a third step-rate test was conducted. Figures 27 and 28 show the step rate test parameters. Water injection occurred from 2.00 hours to 5.06 hours with rates from 0.6 BPM to 5.0 BPM. Pressures ranged from 2119.23 psig to 2141.90 psig. Prior to the test, the static wellhead pressure was 640 psig and after the test it was 650 psig. The data show that at wellhead pressures of less than 640 psig, the injection rate is zero. Figure 29 shows the pressure and rate data for this test. A single rate was reported for each step in the test. The chart assumes that the rate was constant during the step. A review of the pressure data indicates that this may not have been the case. For example, 2.75 hours, the rate increased from 1.1 BPM to 2.0 BPM with no change in pressure and with a small change in pressure trend. A step rate change is expected to cause a change in pressures as observed at 4.1 hours when the rate changed from 4.4 to 5.5 BPM. On this change, the initial pressure reaction was a reduction in pressure then a rapid increase in pressure.

The test was conducted in two parts with a short shut-in during the test. Figures 30 and 31 show the original and re-plotted pressure versus rate charts for this test. The data have some scatter which is directly related to the quality of the rate measurements and to the accuracy of the timing of the flow rates. The data were re-plotted, Figure 32, as a traditional Horner plot to determine the flow regime controlling reservoir response to the test. The data are bending strongly downward clearly showing that radial flow patterns are not controlling this well's response to the test. The same data re-plotted using linear flow equations is shown in Figure 33. This remarkably straight line shows that reservoir response to the test is strongly influenced by linear flow patterns. In Figure 34, the time scale is expanded to see if the falloff trend is consistent with pre-test pressure data. The extrapolated pressure is slightly lower than the original static bottom-hole pressure. This is consistent with performance of linear flow patterns in the reservoir.

The general shape of Figures 30 and 31 is similar to the shape of Figure 7 taken from the first step rate test. Both are indicating linear flow patterns in the well. The data are trending upward and this is caused by frictional pressure losses in the wellbore as fluid is pumped down the well. When the frictional pressure losses are removed, the data reflect the performance of the reservoir. This same concept is true of the third step rate test. However, in the case of the third test, there is an additional pressure drop not reasonably modeled with radial flow equations. To use radial equations, the pressure recorder would need to be located at the end of the fracture system which is not possible. When the flow system model is changed to a linear model, the bottom-hole pressure charts show well defined trends. The pressure response is consistent with flow dominated by a linear flow system.

CONCLUSIONS

The long term performance trends observed and expected for this well are shown in Figure 35. The long term pressure performance is dominated by linear flow systems and by the volume of water injected. The injection rates are dropping slowly and are expected to continue to decline as the volume of injected water increases. The short term variations or variations measured over 50,000,000 gallons of injection are primarily related to wellbore restrictions. Periodic workovers to keep the wellbore properly operating have been and will be needed. Overall, the well has performed in a reliable and predictable manner as described by linear flow patterns. Based on what is known about this well, the following is recommended:

1) Use parting and fracture pressures from the 1996 hydraulic fracture as needed to manage allowable injection pressures for this well. The step rate test estimates of these parameters are not reliable estimates.

2) Additional testing to determine parting and propagation pressures is not recommended. Such testing would potentially create additional fractures and additional injection capacity which are not needed at this time.

3) Surface recorded data should be accepted as an alternative to bottom-hole test data when available. Because this well does not stabilize quickly, this will generally allow longer testing periods when tests are needed.

4) There should be no annual requirement for fall-off or similar tests because it is unlikely that these tests will provide new or useful information about the reservoir. Testing should be conducted when performance indicates a departure from expected trends and testing is needed to determine reasons for such changes.

5) Maximum surface injection pressure of 1,150 psig is reasonable for continued use in this well.

6) Annual mechanical integrity testing should be conducted to insure the integrity of the well bore.

OTHER

In evaluating available information concerning this appraisal, we have excluded from our consideration all matters as to which legal or accounting interpretation, rather than engineering, may be controlling. As in all aspects of oil and gas evaluation, there are uncertainties inherent in the interpretation of engineering data and conclusions necessarily represent only informed professional judgments.

William M. Cobb & Associates, Inc. is an independent consulting firm. Our compensation is not contingent on the results obtained or reported. This report was prepared by a licensed professional engineer with more than 30 years of experience in the estimation, assessment, and evaluation of oil and gas production rates and related reservoir properties.

We appreciate the opportunity to be of service to you. If you have questions regarding this report, please contact us.

Sincerely,

WILLIAM M. COBB & ASSOCIATES, INC.
Texas Registered Engineering Firm F-84

Brent W. Hale

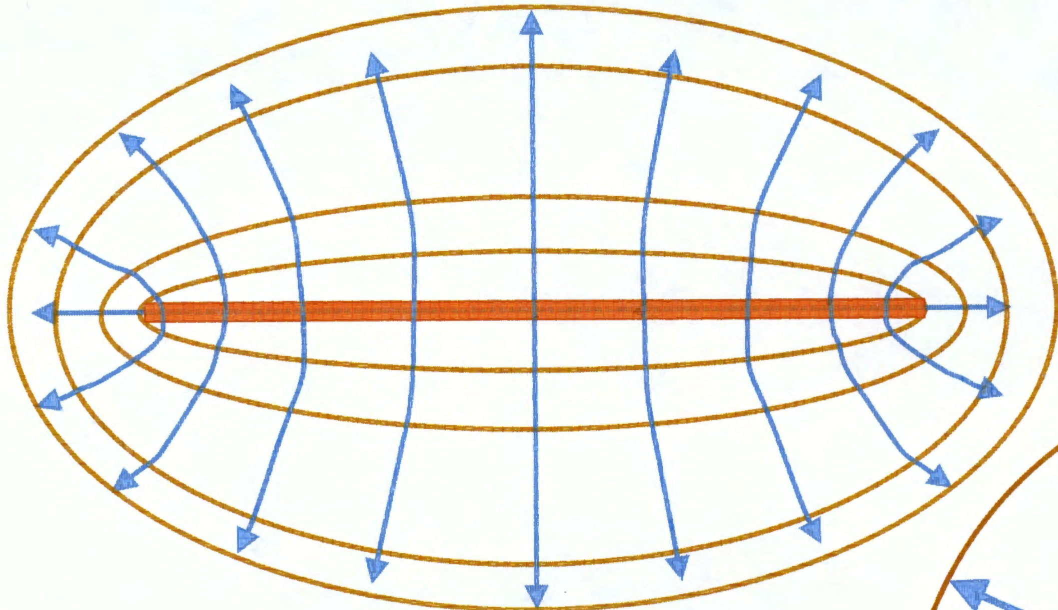
Brent W. Hale, P.E.
Senior Engineering Advisor

BHW:ar
Attachments
M\Western Refining\203\092313

FIGURES

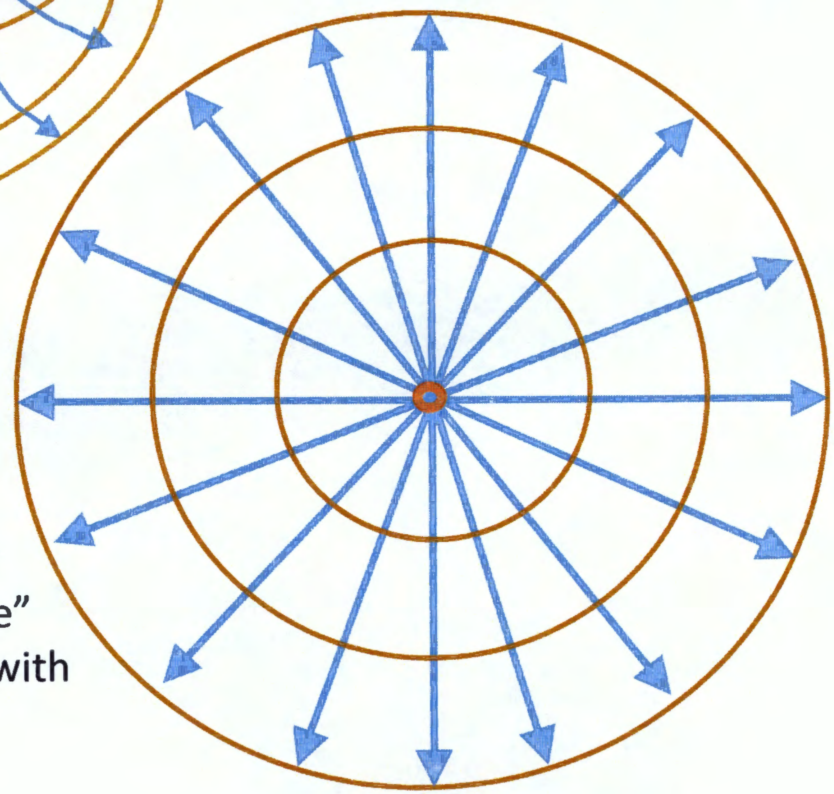
Figure 1

Western Refining Southwest, Inc.
Disposal Well #1



Linear Flow

- Tight reservoir
- Long, un-crowded area for water to leave “wellbore”



Radial Flow

- Small, crowded area for water to leave “wellbore”
- Conventional reservoir with good permeability

Figure 2

Disposal Well #1 – January 10, 1994 Step Rate Test

Test Data Sheets

01/11/94 Page A

File Reference F113111.DAT

Customer .... BLOOMFIELD REFINING COMPANY
Street .... P.O. BOX 159
City/State....................... BLOOMFIELD, NM 87413
Country .... U.S.A.
Service Company .... TEFTELLER, INC.

Well Name .... BLOOMFIELD REFINING WD NO. 1
Well Location .... SAN JUAN COUNTY, NM
Field / Pool ....
Status (Oil, Gas, Other) .... WATER DISPOSAL

Test Type .... STEP RATE TEST
Date of Test 1-10-94
Producing Interval ....
Recorder Depth .... 3346'
Recorder Position ....
Shut In Date .... Start: 1-10-94
Stop: 1-10-94
Duration: 5 HOURS
Bottom Hole Temperature .... 116 DEGREES - INJECTING WATER

Gauge Identification

Gauge Manufacturer .... MICRO-SMART SYSTEMS
Serial Number 113
Model Number SP2000
Pressure Range ....
Battery Type ....
Calibration I.D. ....
Last Calibration 9/15/93

Gauge Setup Parameters

Probe Set Up Time 1/10/94 10:55: 0
Time Delay to First Reading ....
Test Type Selection .... STEP RATE TEST
Test Duration Selection .... 5 HOURS

Figure 3

Disposal Well #1 – January 10, 1994 Step Rate Test
Test Data Sheets

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*                              *
*E V E N T   S U M M A R Y*
*                              *
********************************
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COMPANY : BLOOMFIELD REFINING COMPANY

PAGE : B

WELL NAME : BLOOMFIELD REFINING WD NO. 1

DATE : 01/11/94

WELL LOCATION : SAN JUAN COUNTY, NM

FILE REF: F113111.DAT

Date MM/DD	Time hh:mm:ss	Test Time hhhh.hhhh	Key Event	Pressure Psig	Temp Deg F
01/10	11:27:00	.5333	INSTRUMENT @ 3346'	336.71	86.30
01/10	12:38:00	1.7167	START PUMP RATE #1 - SURFACE 500 PSI	415.70	115.61
01/10	12:53:00	1.9667	RATE #1/.3 BPM - SURFACE 500 PSI	1985.61	116.00
01/10	13:08:00	2.2167	RATE #2/.9 BPM - SURFACE 590 PSI	2018.37	115.96
01/10	13:23:00	2.4667	RATE #3/2.0 BPM - SURFACE 700 PSI	2058.49	115.91
01/10	13:38:00	2.7167	RATE #4/2.9 BPM - SURFACE 790 PSI	2072.51	115.86
01/10	13:53:00	2.9667	RATE #5/3.6 BPM - SURFACE 880 PSI	2076.02	115.82
01/10	14:08:00	3.2167	RATE #6/4.3 BPM - SURFACE 990 PSI	2080.83	115.77
01/10	14:23:00	3.4667	RATE #7/5.0 BPM - SURFACE 1100 PSI	2085.20	115.74
01/10	14:38:00	3.7167	RATE #8/5.4 BPM - SURFACE 1200 PSI	2088.79	115.72
01/10	14:53:00	3.9667	RATE #9/6.0 BPM - SURFACE 1300 PSI	2092.20	115.72

Figure 4

Disposal Well #1 – January 10, 1994 Step Rate Test

Original Chart of Pressure and Temperature with Color Added

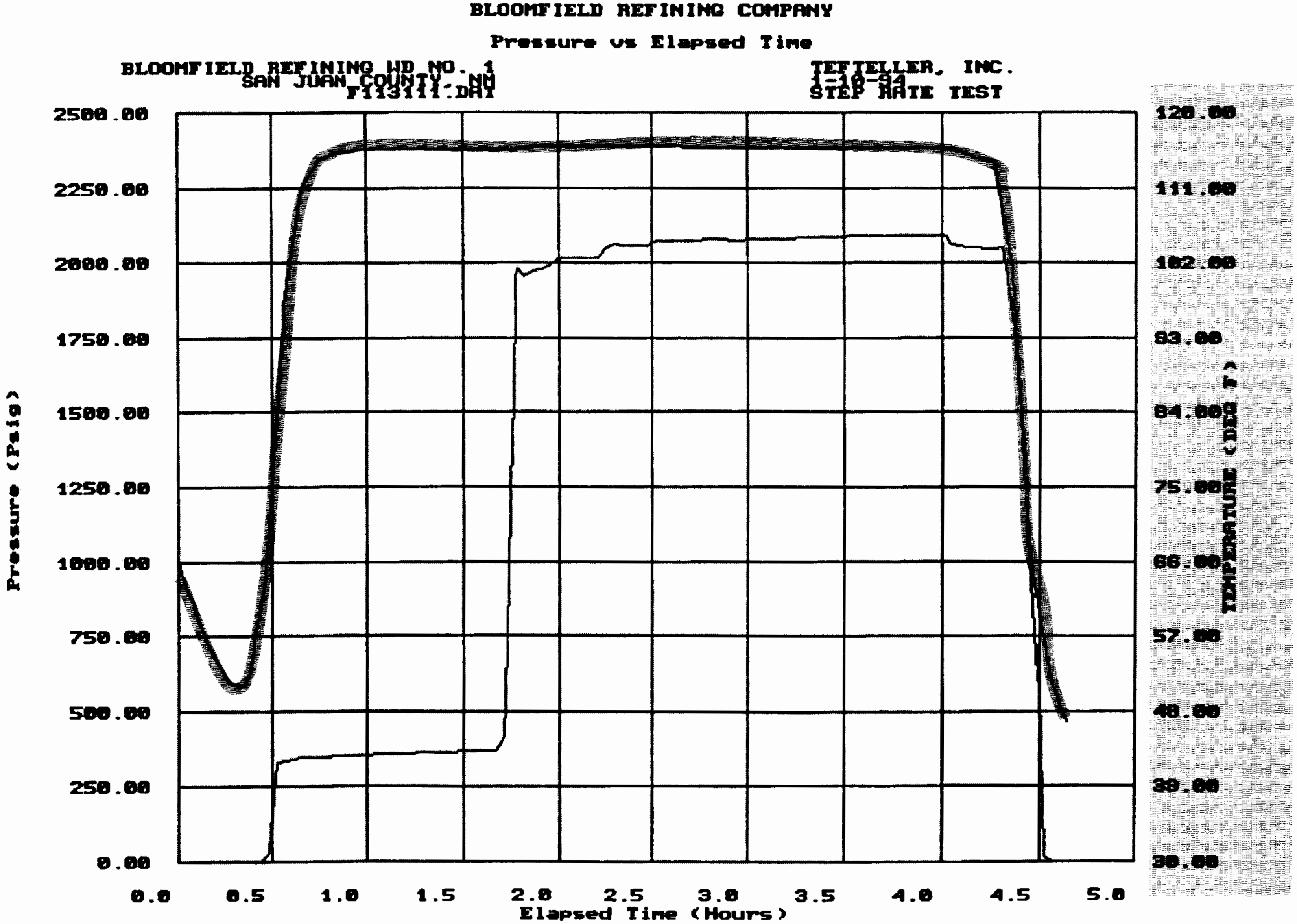


Figure 5

Disposal Well #1 January 10, 1994 Step Rate Test

Pressure and Rate Chart

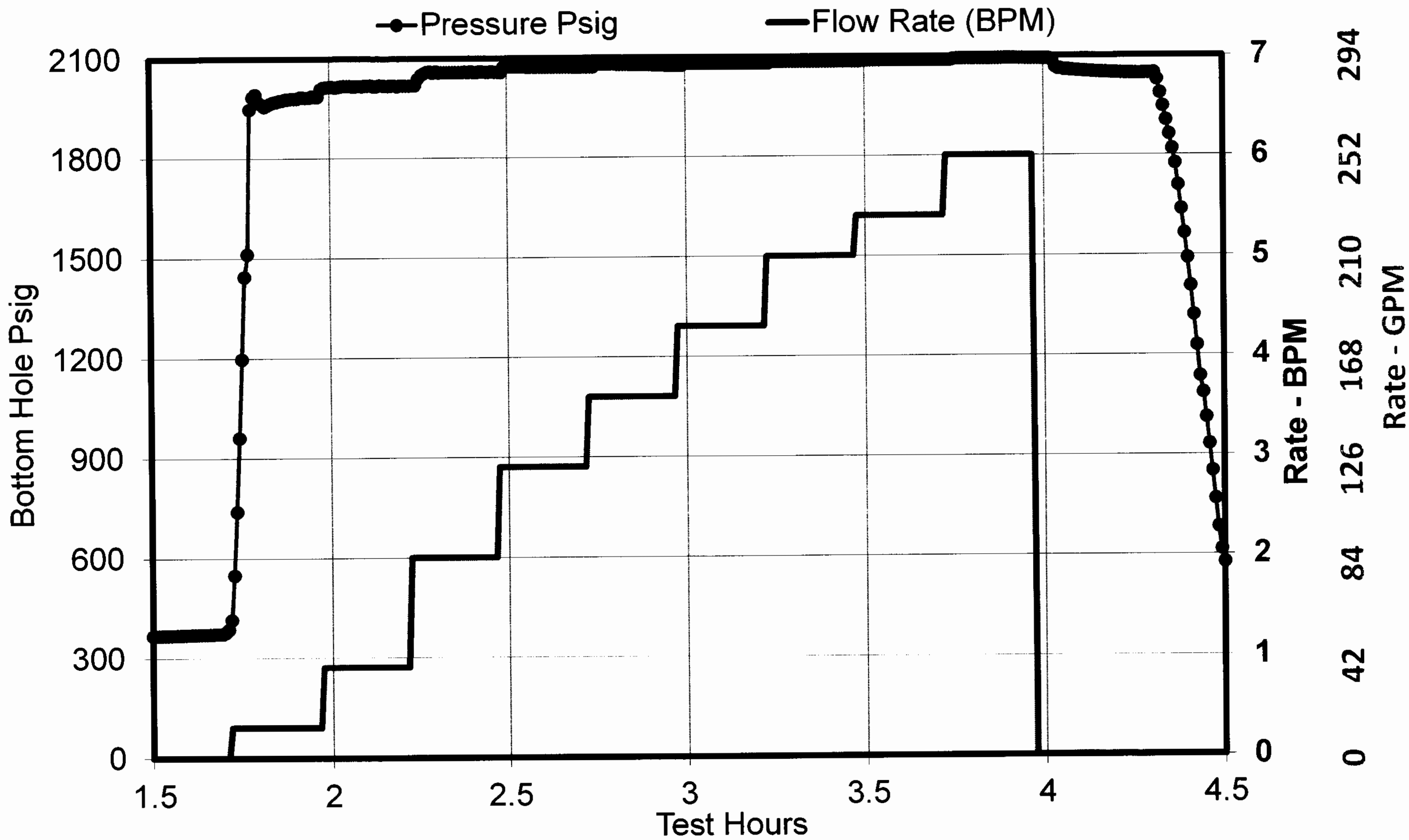


Figure 6

Disposal Well #1 January 10, 1994 Step Rate Test

Expanded Pressure and Rate Chart

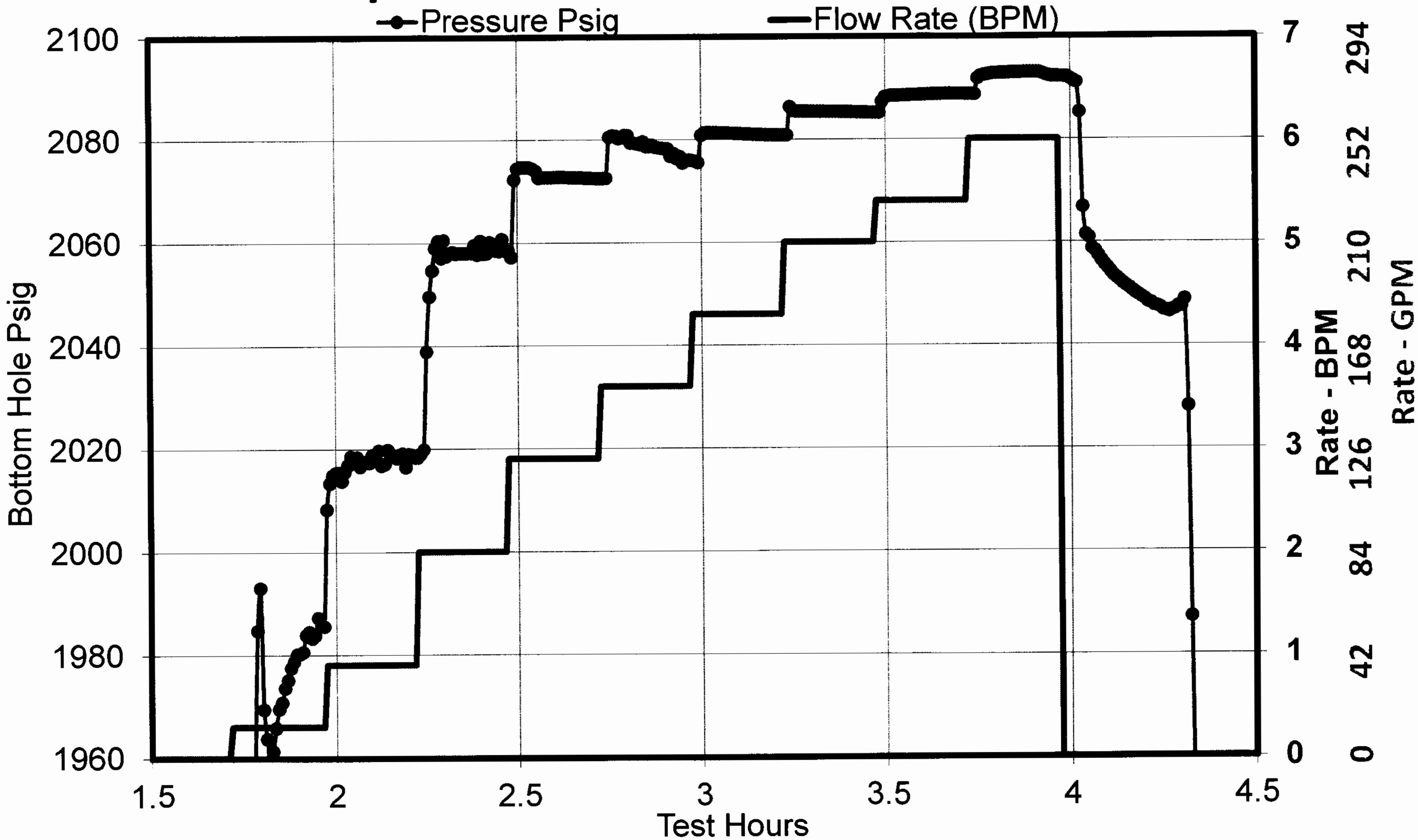


Figure 7

Disposal Well #1 January 10, 1994 Step Rate Test

Original Wellhead Pressure vs Rate (BPM) Chart

Test #1 Surface

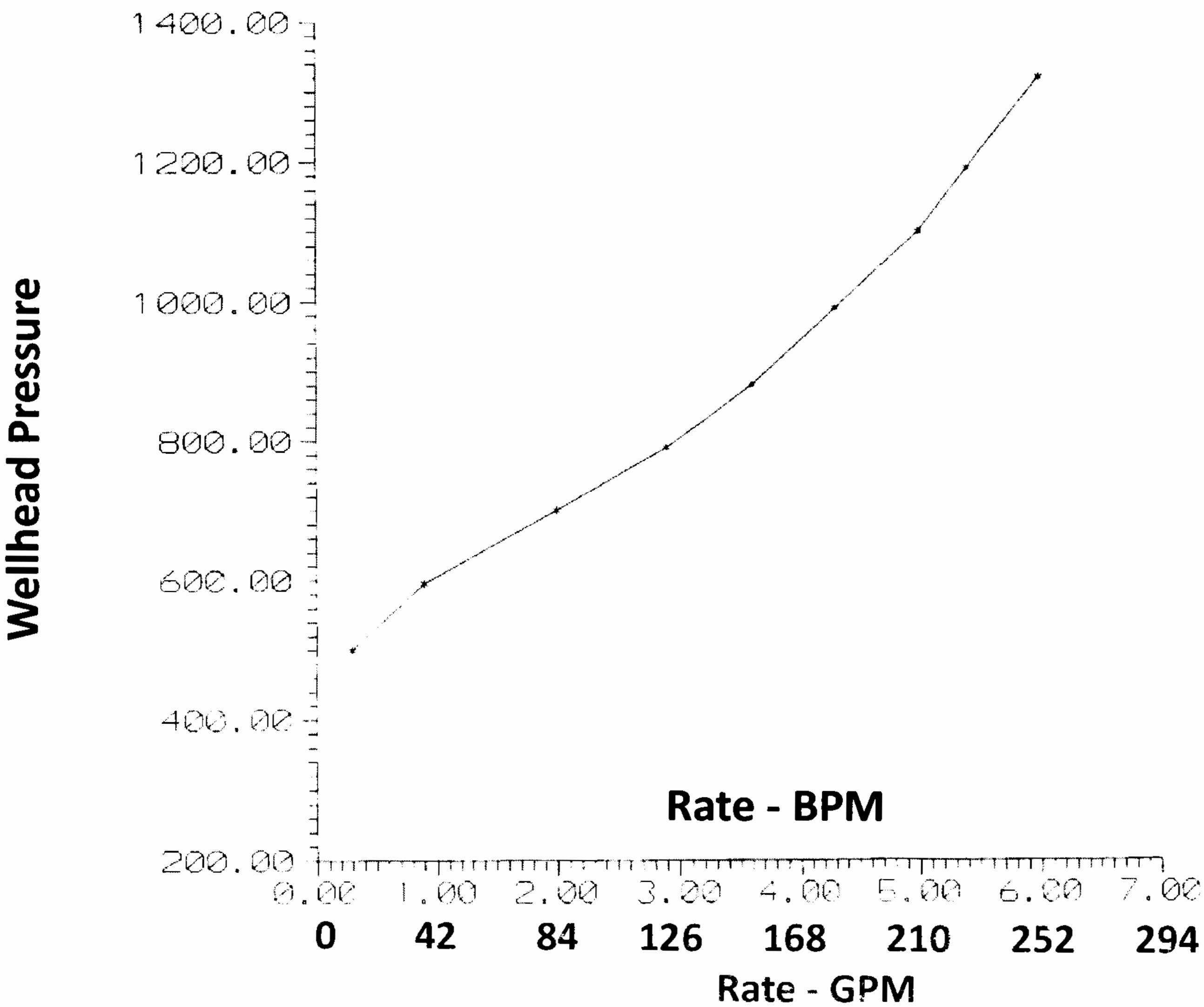


Figure 8

Disposal Well #1 January 10, 1994 Step Rate Test

Bottomhole Pressure vs Rate (BPM)

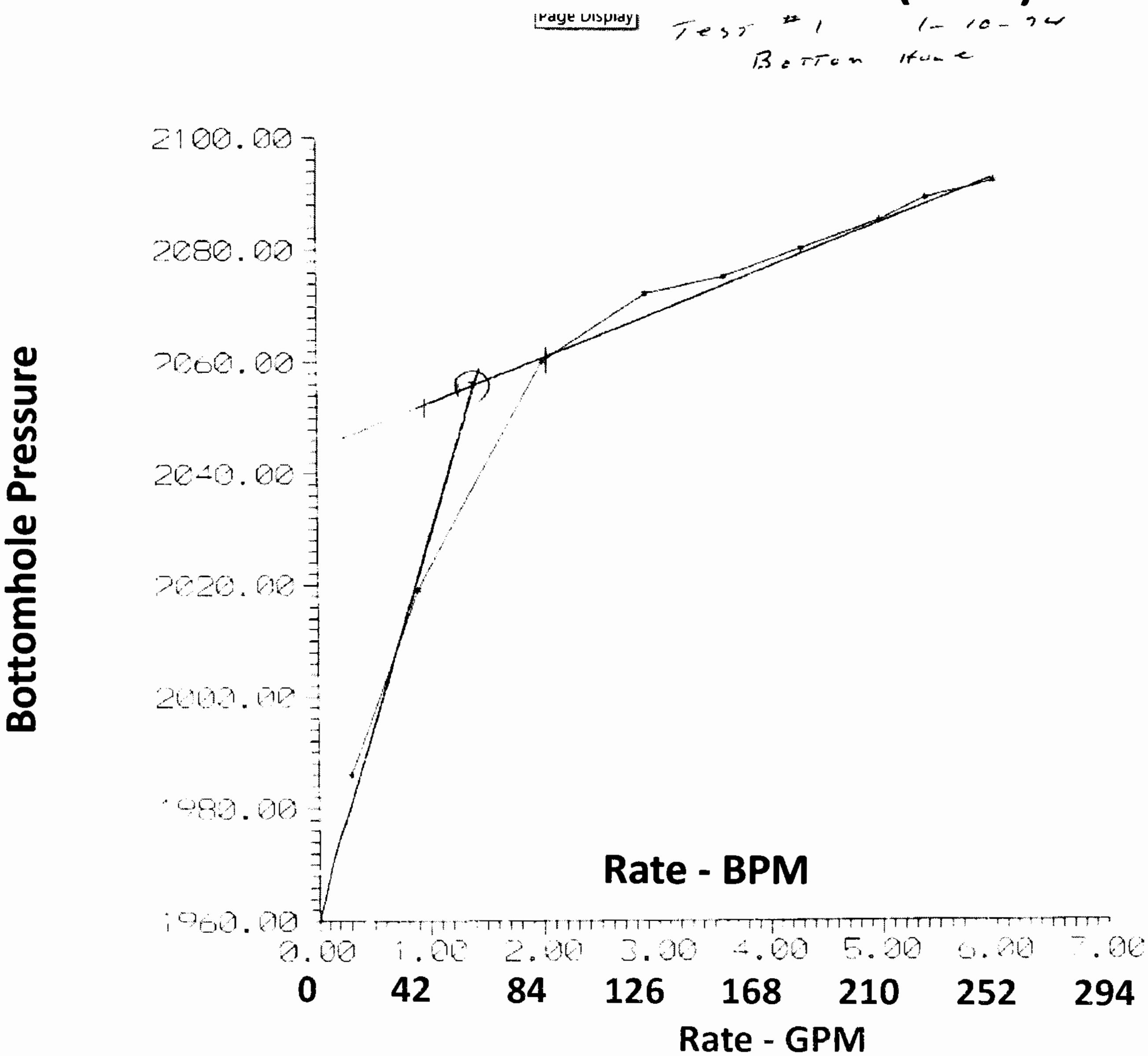


Figure 9

Disposal Well #1 January 10, 1994 Step Rate Test

Bottomhole Pressure vs. Time

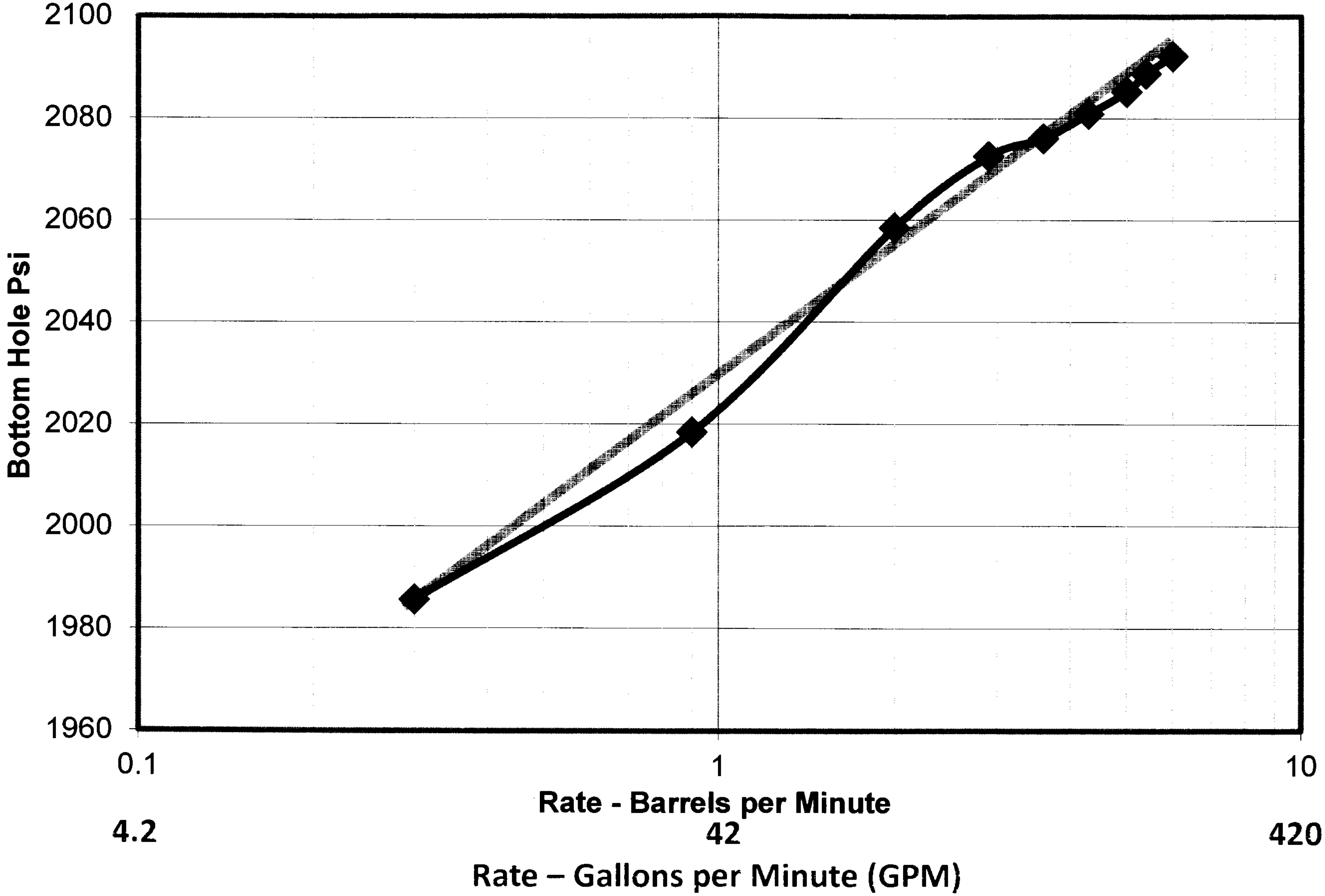


Figure 10

Disposal Well #1 January 10, 1994 Step Rate Test

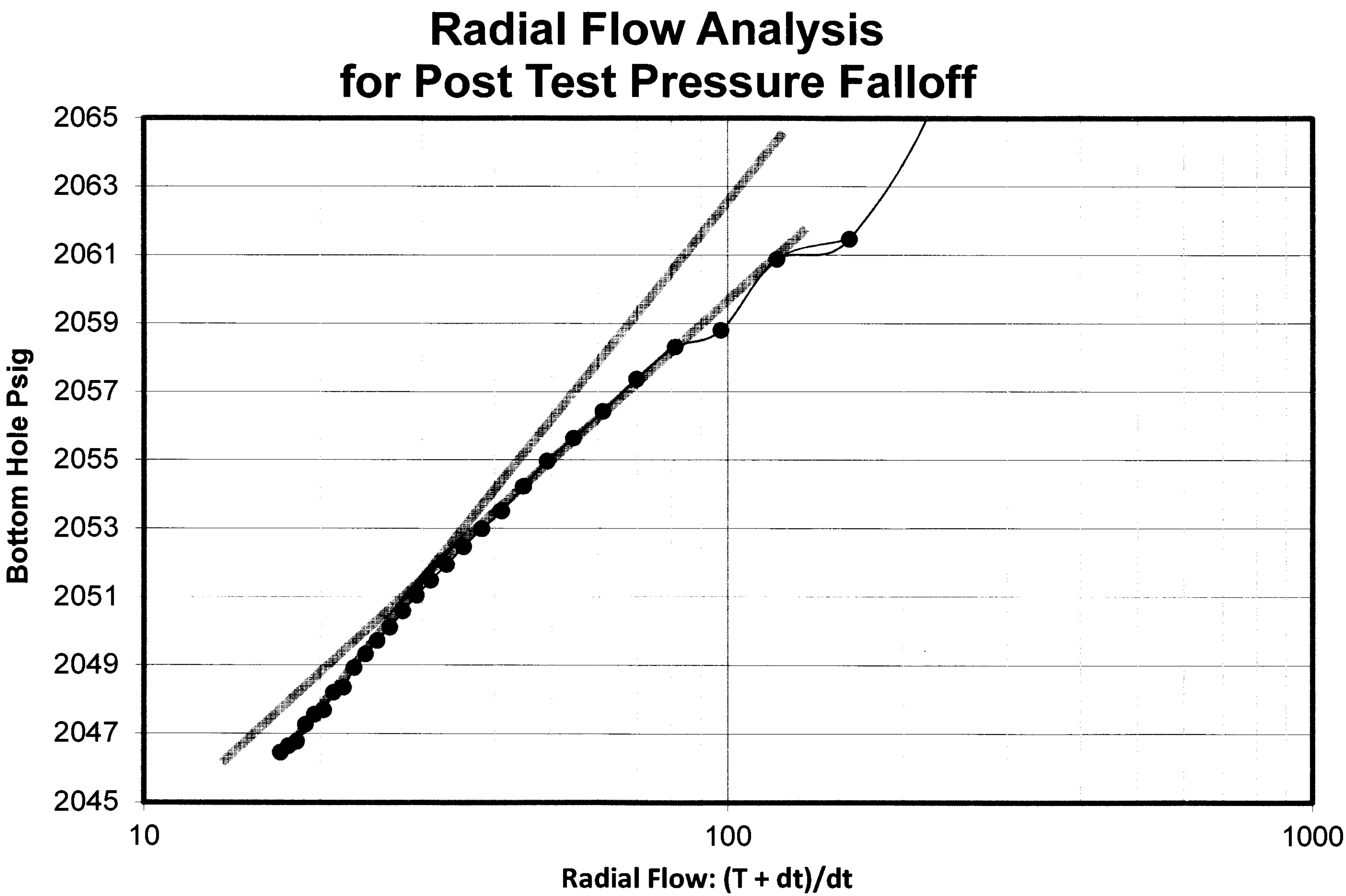


Figure 11

Disposal Well #1 January 10, 1994 Step Rate Test

Linear Flow Analysis for Post Test Pressure Falloff

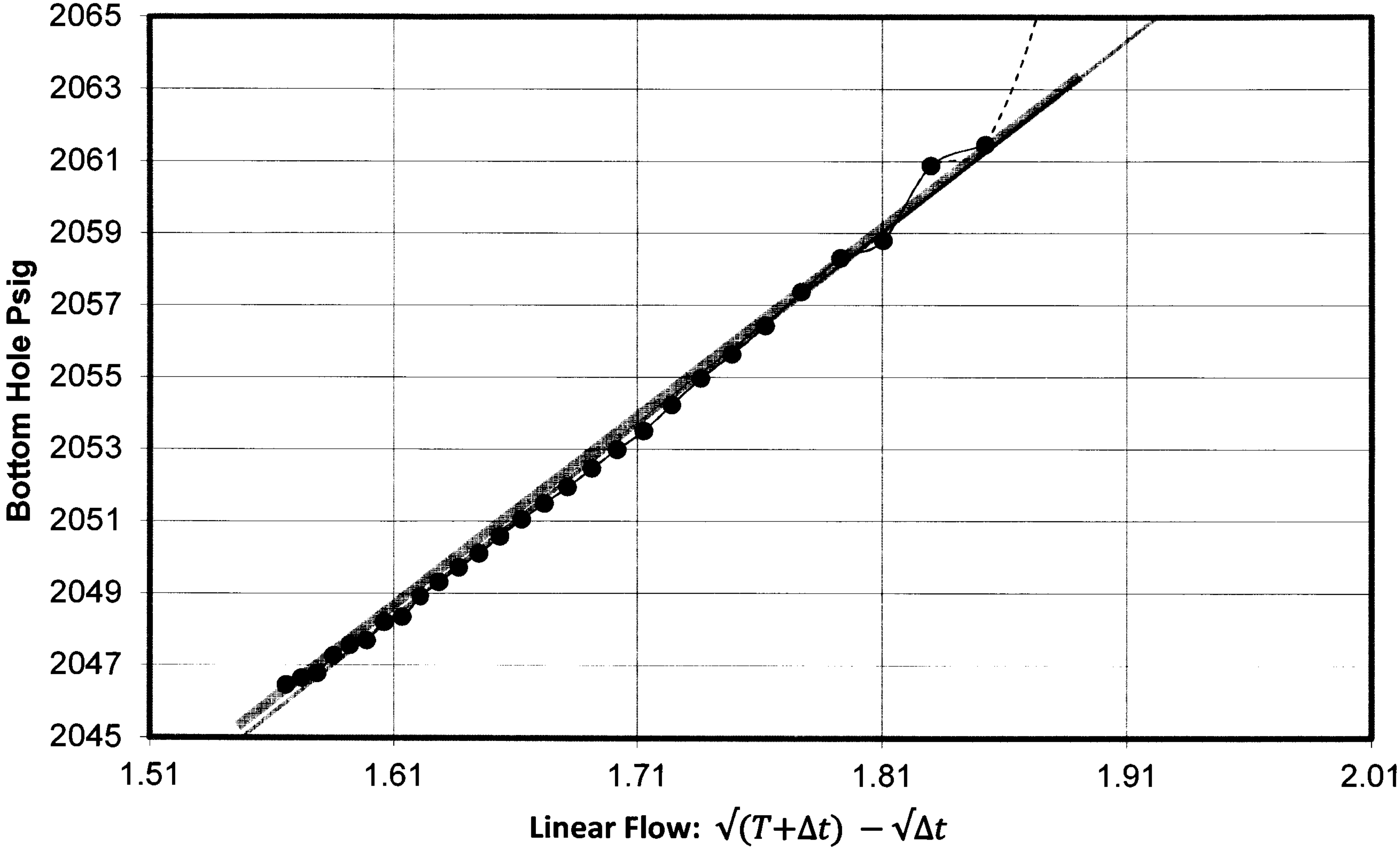


Figure 12

Disposal Well #1 January 10, 1994 Step Rate Test

Linear Flow Analysis
Post Test Pressure Falloff

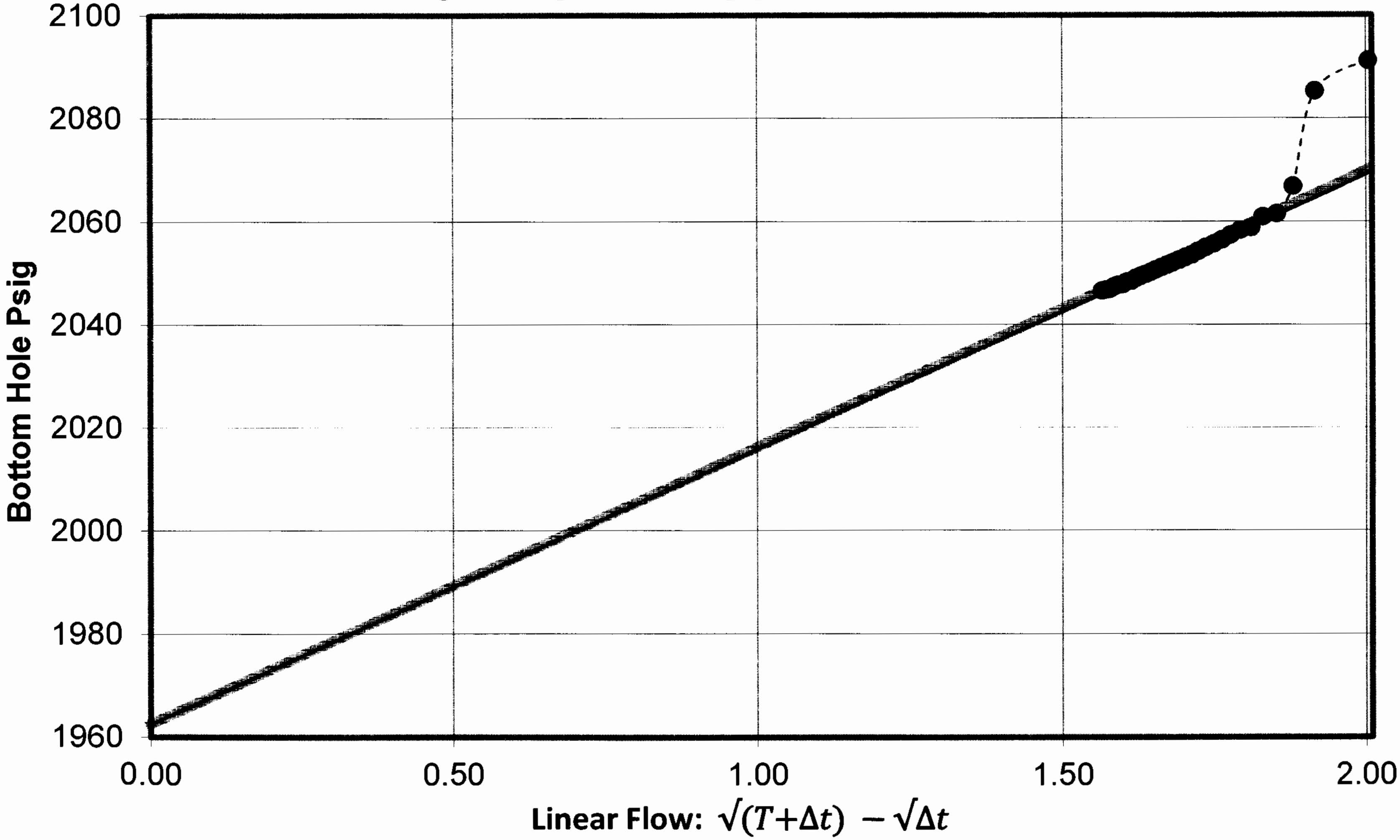


Figure 13

Disposal Well #1 – January 22, 1994 Step Rate Test

Original Test Notes

BLOOMFIELD REFINING DISPOSAL #1 1-22-94

TEST #2

	TIME	RATE	PSI
START	12,50 PM	.5 BPM	515
1	1.05	1 BPM	580
2	1.20	2.1 BPM	645
3	1.35	3 BPM	733
4	1.50	4.1 BPM	860
5	2.05	5 BPM	1005
6	220	6 BPM	1170
7	235	7 BPM	1372
8	250	8 BPM	1612
9	3.05	9.1 BPM	1910
10	2.20	10 BPM	2185

ISIP 600 15 MIN 590

Figure 14

Disposal Well #1 – January 22, 1994 Step Rate Test

Test Data Sheets

E V E N T   S U M M A R Y

COMPANY : BLOOMFIELD REFINING COMPANY

PAGE : 8

WELL NAME : BLOOMFIELD REFINGING WD NO. 1

DATE : 01/22/94

WELL LOCATION : SAN JUAN COUNTY, NM

FILE REF: F142122.DAT

Date MM/DD	Time hh:mm:ss	Test Time hhhh.hhhh	Key Event	Pressure Psig	Temp Deg F
01/22	12:20:00	.5000	INSTRUMENT @ 3250'	1445.76	100.76
01/22	12:50:00	1.0000	START RATE #1	1454.03	113.26
01/22	13:05:00	1.2500	RATE #1/.5 BPM - SURFACE 515 PSI	1920.09	112.93
01/22	13:20:00	1.5000	RATE #2/1.1 BPM - SURFACE 580 PSI	1970.65	110.05
01/22	13:35:00	1.7500	RATE #3/2.1 BPM - SURFACE 645 PSI	1995.34	99.02
01/22	13:50:00	2.0000	RATE #4/3.0 BPM - SURFACE 733 PSI	2009.50	76.98
01/22	14:05:00	2.2500	RATE #5/4.1 BPM - SURFACE 860 PSI	2020.32	61.11
01/22	14:20:00	2.5000	RATE #6/5.0 BPM - SURFACE 1005 PSI	2029.79	54.52
01/22	14:35:00	2.7500	RATE #7/6.0 BPM - SURFACE 1170 PSI	2034.17	51.77
01/22	14:50:00	3.0000	RATE #8/7.0 BPM - SURFACE 1372 PSI	2038.64	50.93
01/22	15:05:00	3.2500	RATE #9/8.0 BPM - SURFACE 1612 PSI	2044.07	50.99
01/22	15:20:00	3.5000	RATE #10/9.1 BPM - SURFACE 1910 PSI	2048.46	51.38
01/22	15:35:00	3.7500	RATE #11/10.0 BPM	2053.33	52.03

Pressure break at Rate #7.

Figure 15

Disposal Well #1 – January 22, 1994 Step Rate Test

Original Chart – Bottomhole Pressure vs Rate (BPM)

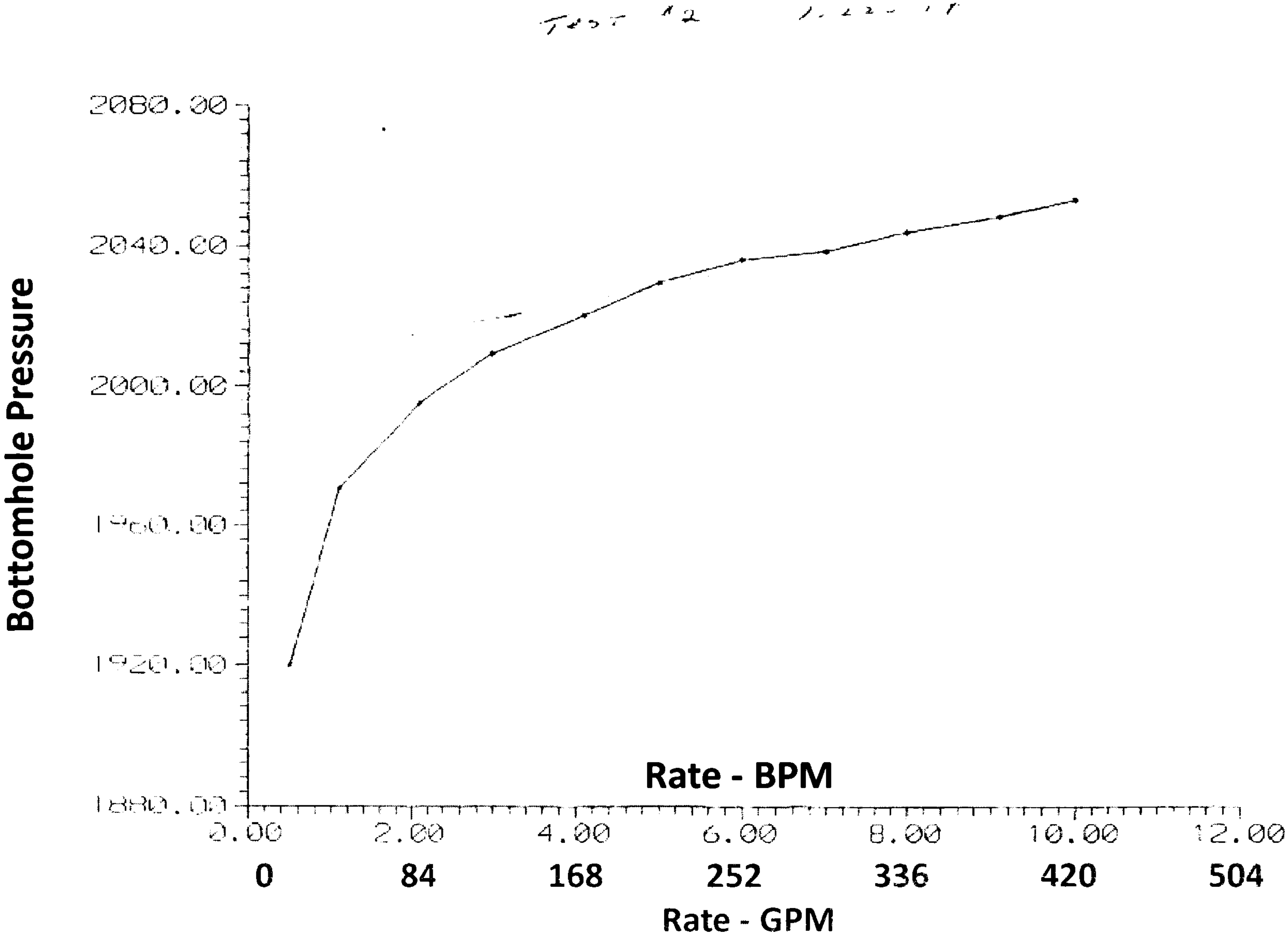


Figure 16

Disposal Well #1 – January 22, 1994 Step Rate Test

Original Fracture Pressure Analysis

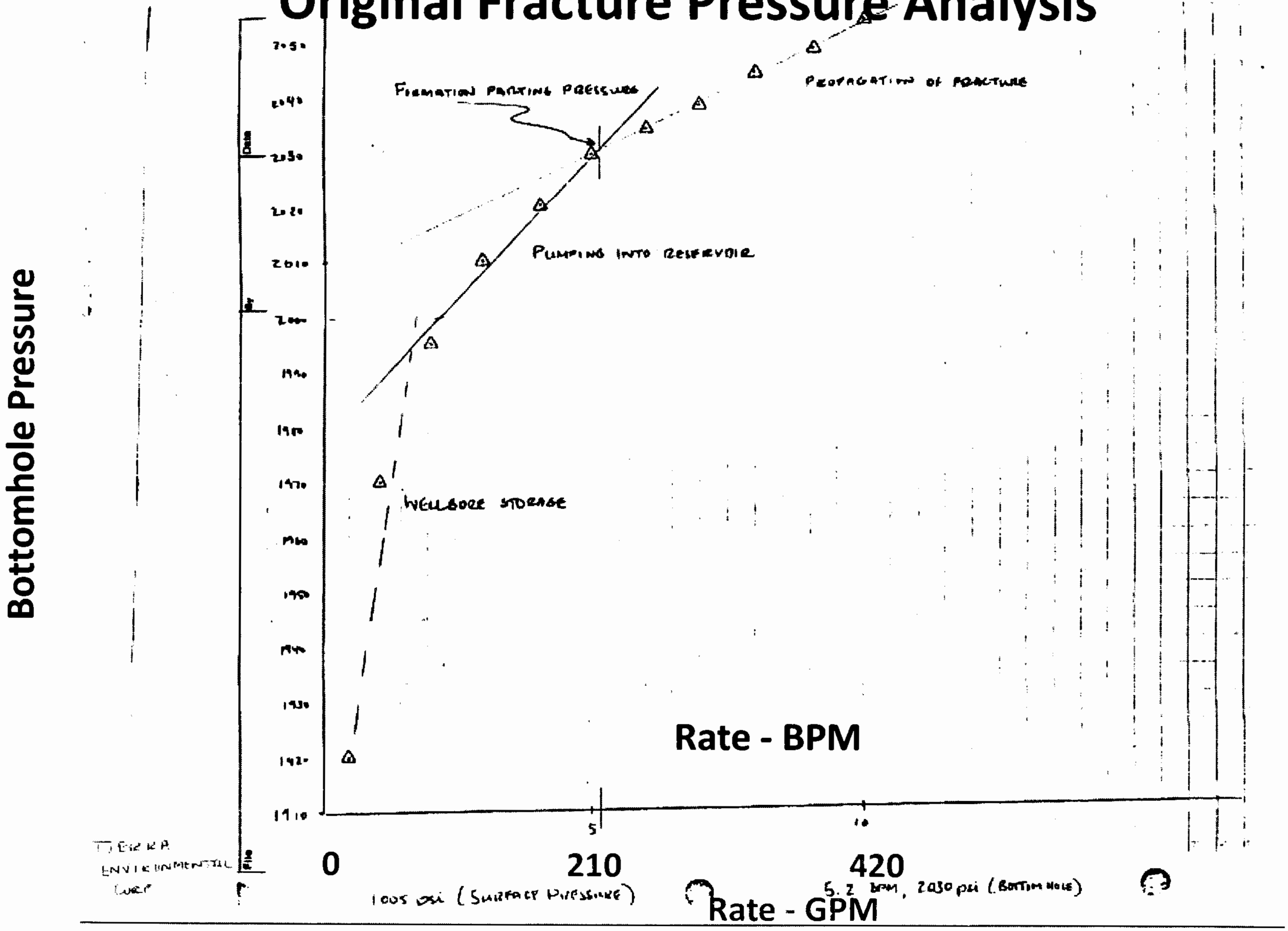


Figure 17

Disposal Well #1 – January 22, 1994 Step Rate Test

Test Data Sheets

«««««««««« THE WESTERN COMPANY OF NORTH AMERICA -- STEP RATE ANALYSIS »»»»»»»»»»

ELAPSED TIME = 182.00 min. AVE. STP. = 1213 psi. AVE. RATE = 5.9 bpm.

POINT #	RATE bpm.	PRESSURE psi.
1	1.0	2023
2	3.0	2016
3	6.0	2016
4	7.0	2027
5	10.0	2147
6	9.1	2102

ESTIMATED BOTTOMHOLE CLOSURE PRESSURE = 1746 psi.
BOTTOMHOLE FRACTURE EXTENSION PRESSURE = 2014 psi.
FRACTURE EXTENSION RATE = 6.6 bpm.

Figure 18

Disposal Well #1 – January 22, 1994 Step Rate Test

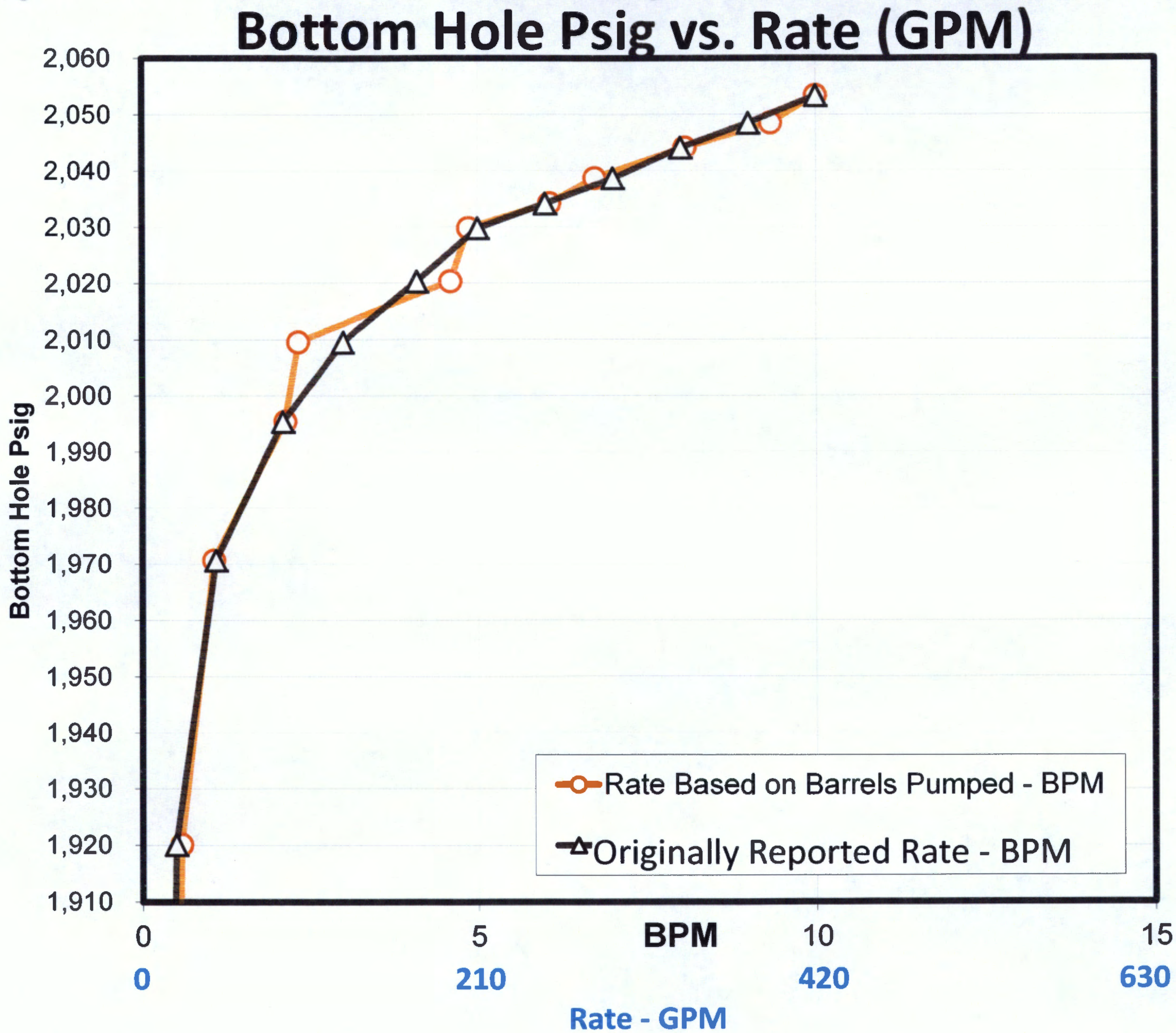


Figure 19

Disposal Well #1 – January 22, 1994 Step Rate Test

Bottom Hole Psig vs. Log(Rate) (GPM)

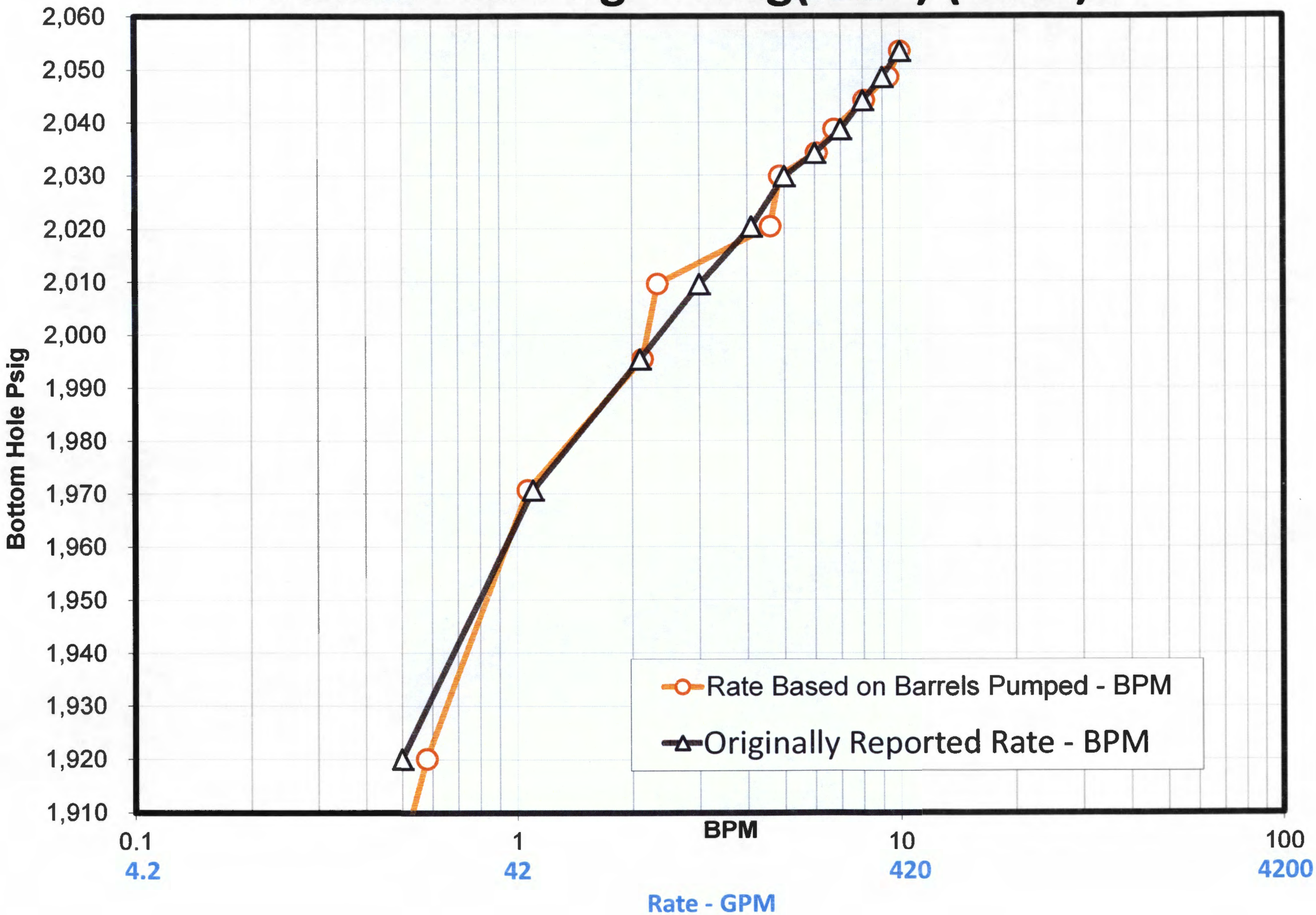


Figure 20

Disposal Well #1 – January 22, 1994 Step Rate Test

Log Delta Pressure/Rate vs Log Delta Time

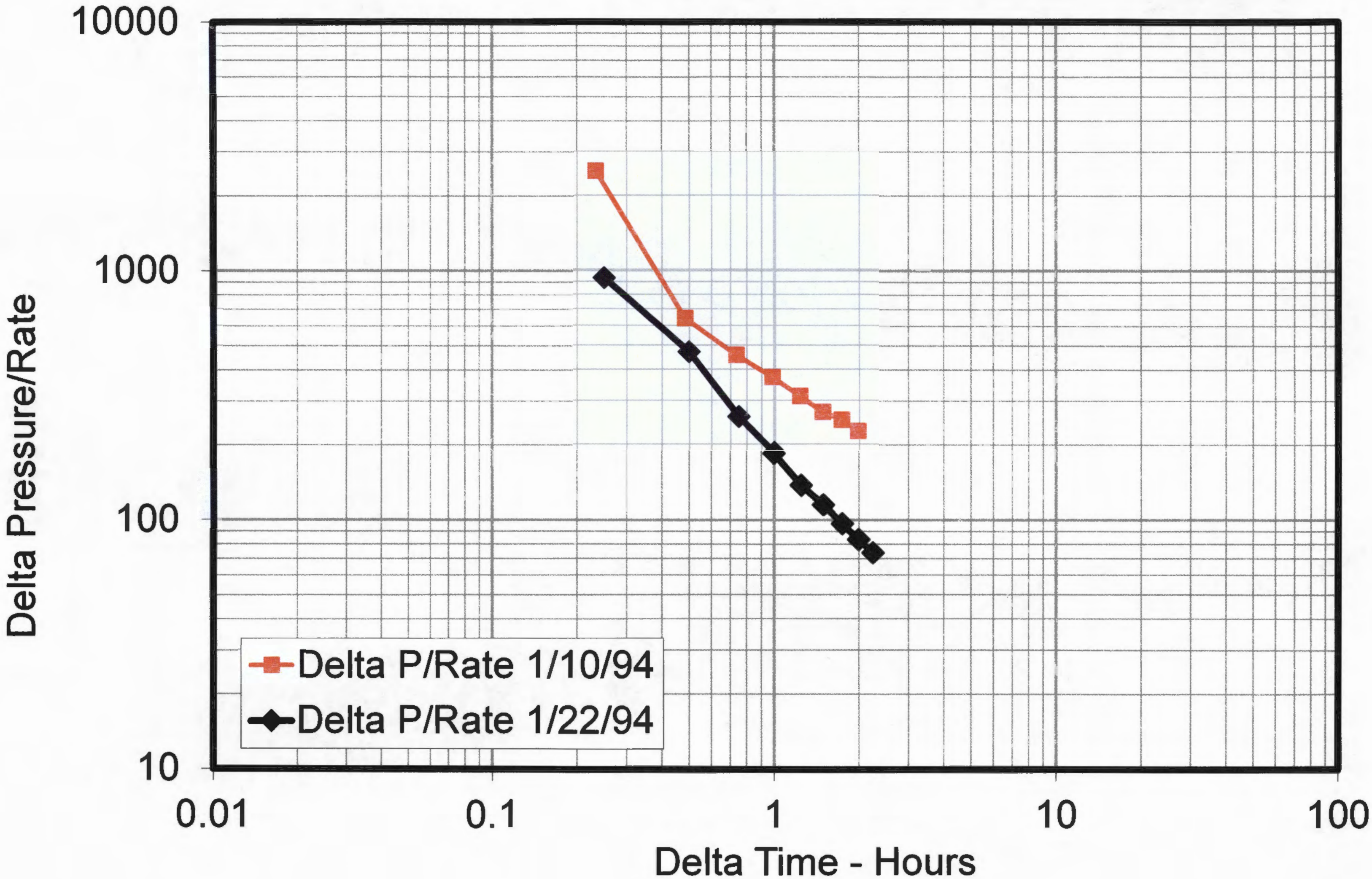


Figure 21

Disposal Well #1 – Frac March 1, 1996
Original Chart

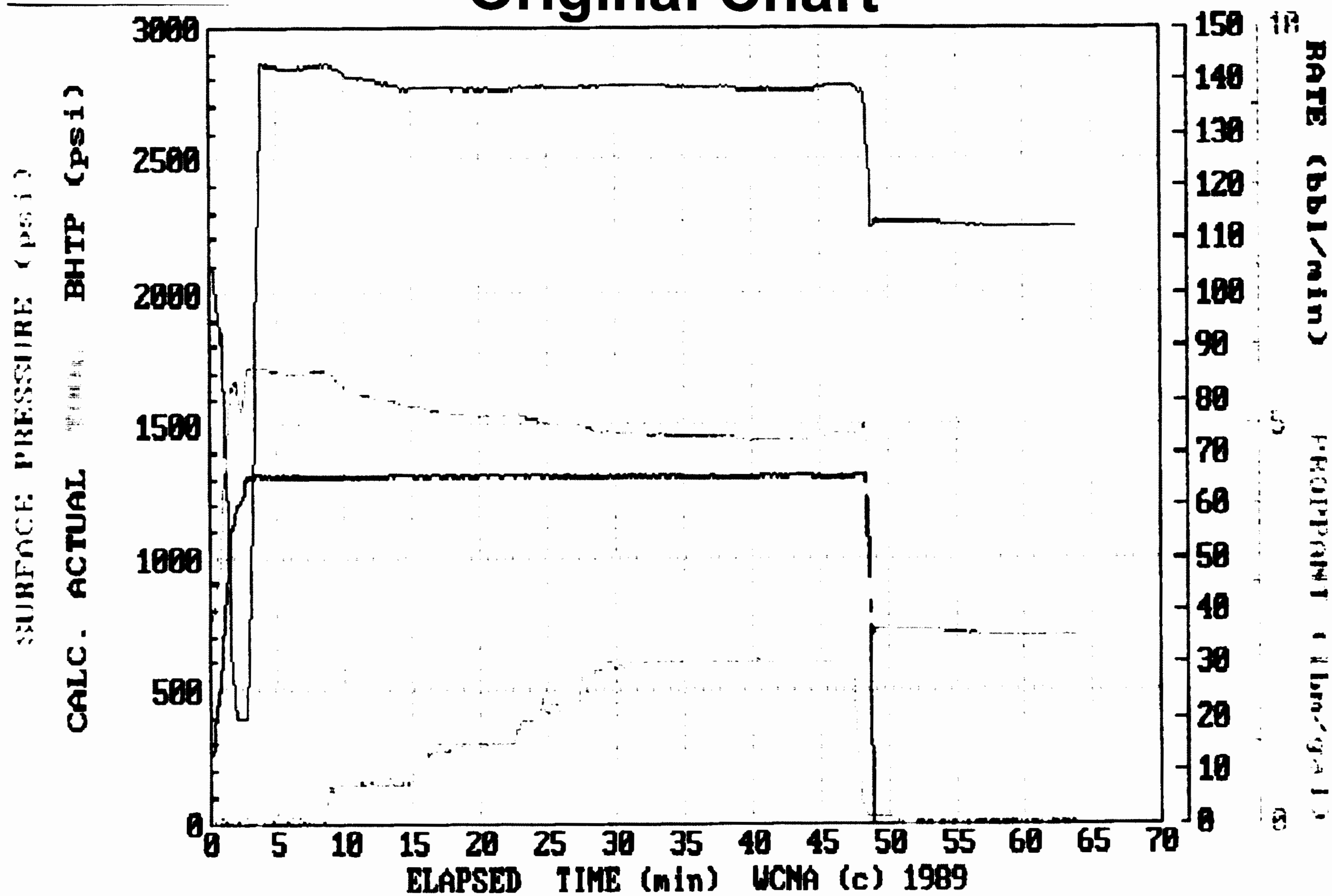
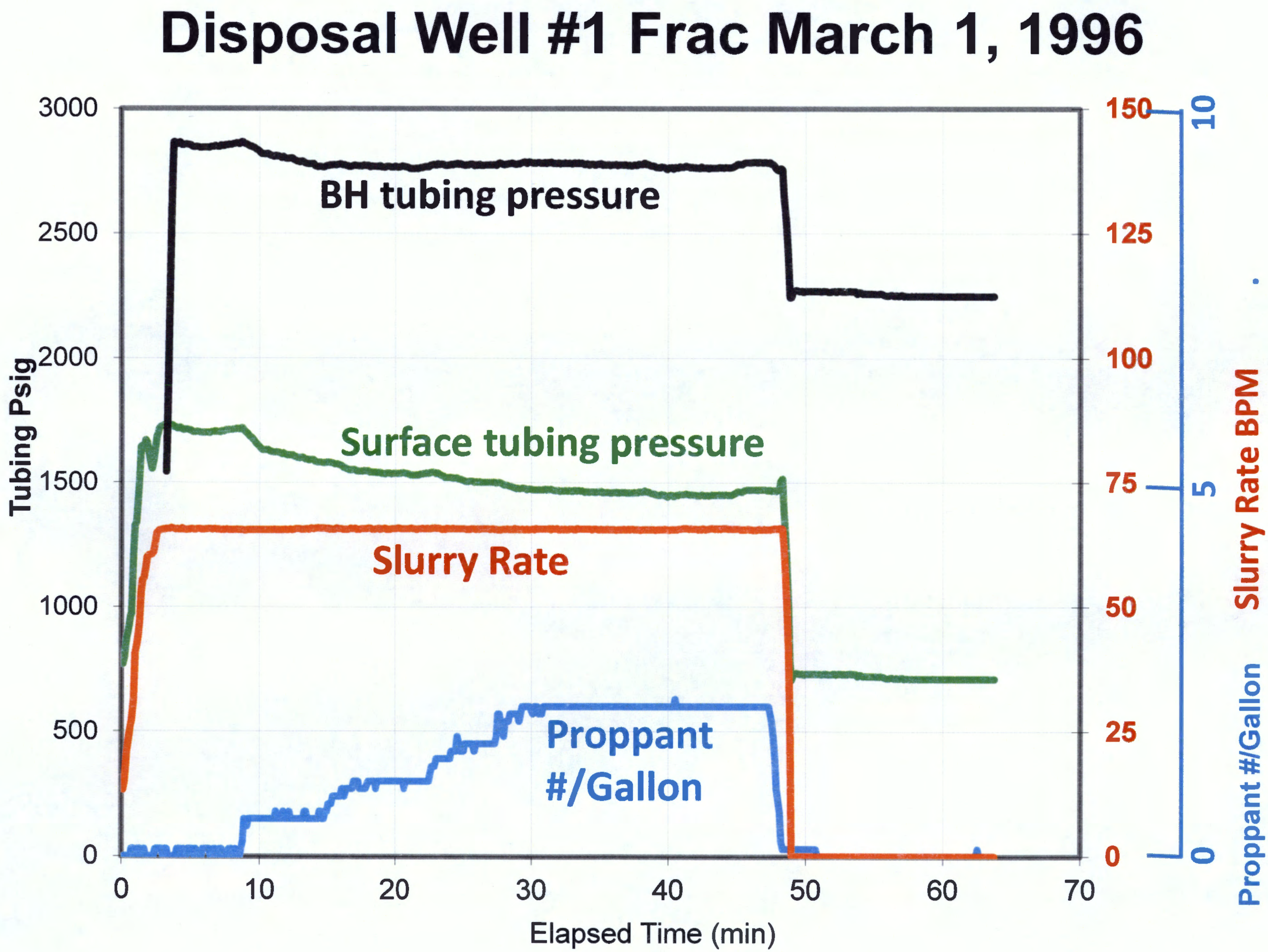


Figure 22



Disposal Well #1 Frac March 1, 1996
3000
2500
2000
1500
1000
500
0
Tubing Psig
BH tubing pressure
Surface tubing pressure
Slurry Rate
Proppant
#/Gallon
0
10
20
30
40
50
60
70
Elapsed Time (min)
150
125
100
75
50
25
0
Slurry Rate BPM
10
5
0
Proppant #/Gallon

Figure 23

Disposal Well #1 Frac March 1, 1996

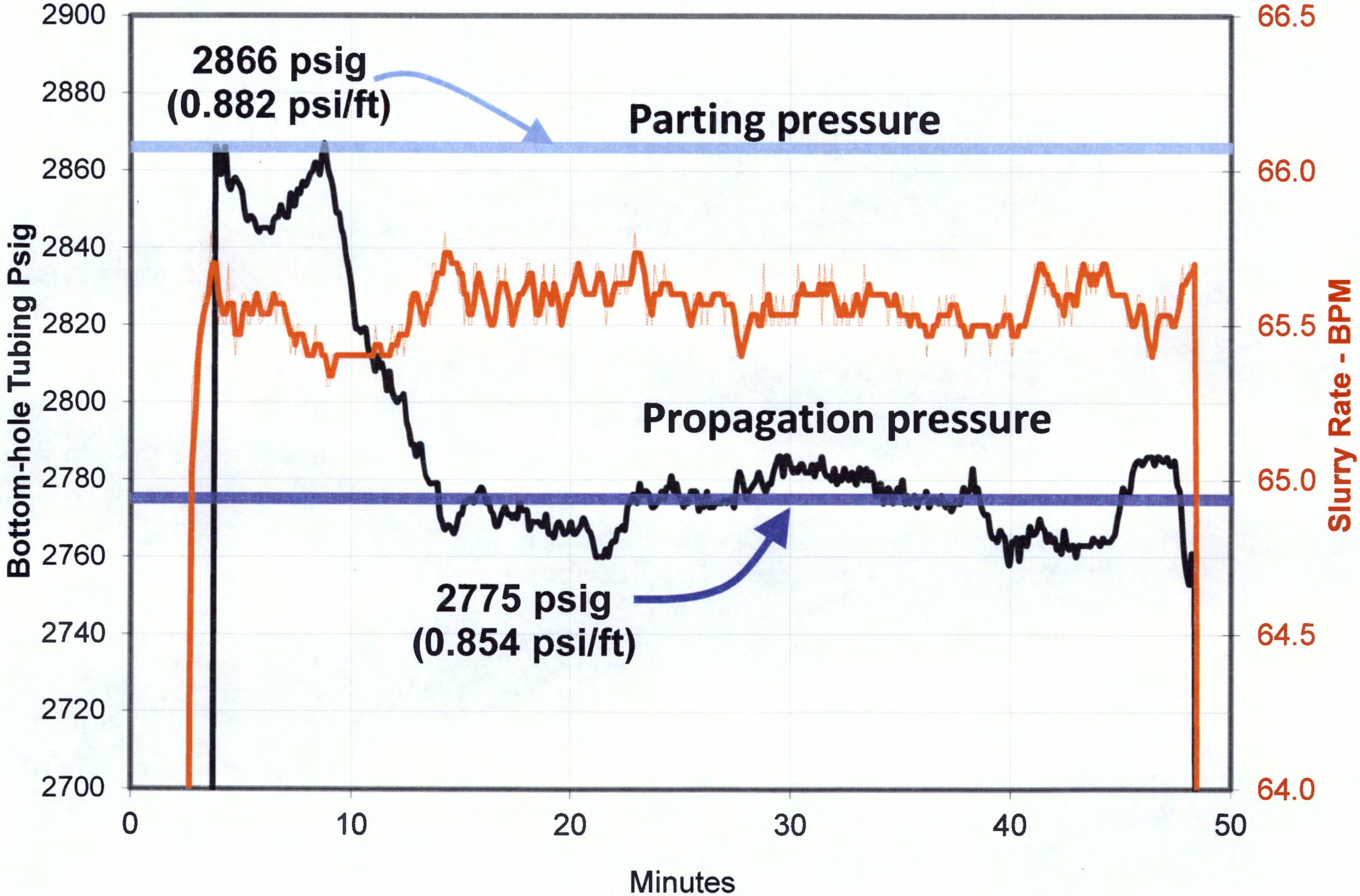


Figure 24

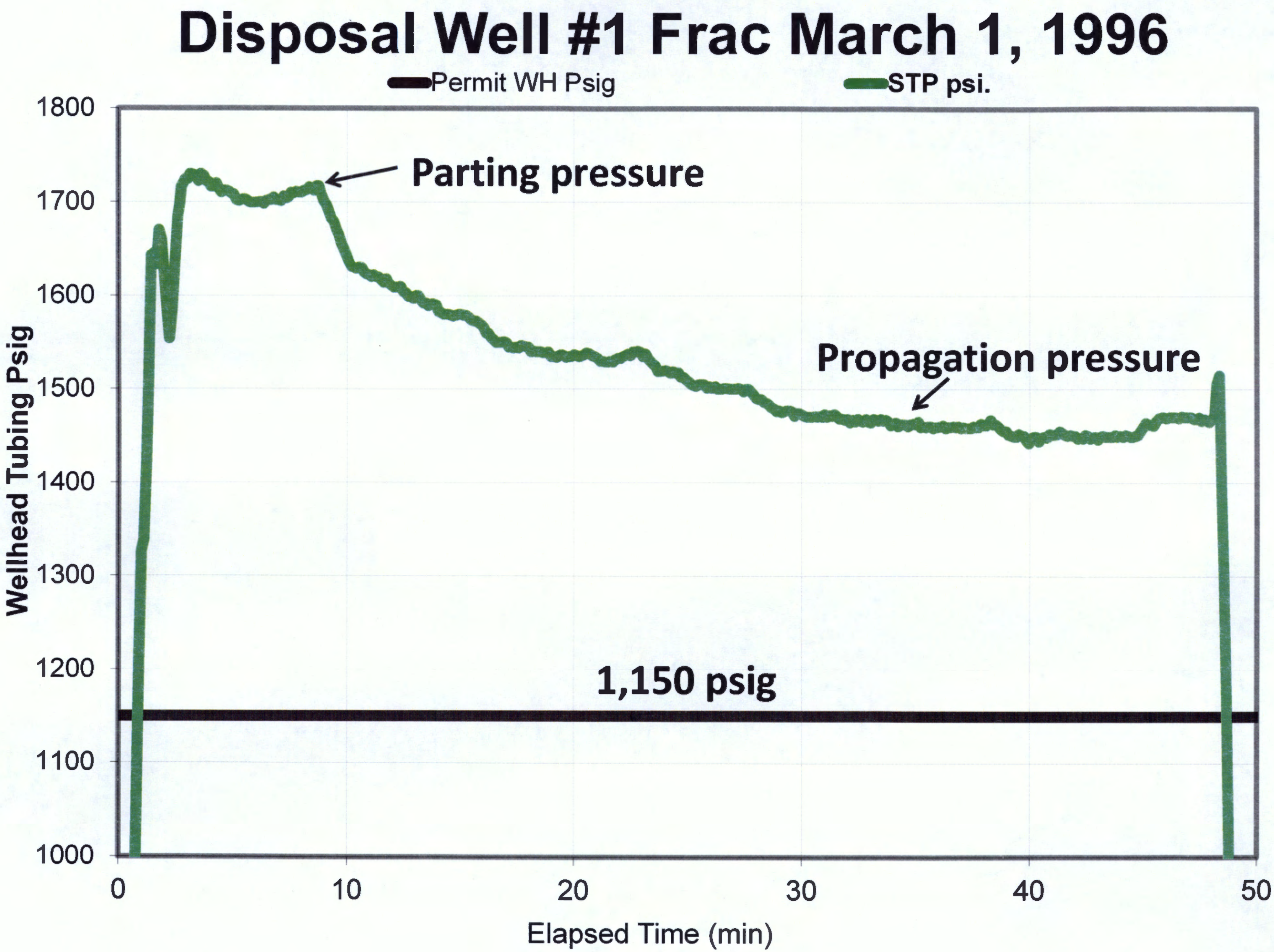

Disposal Well #1 Frac March 1, 1996
Permit WH Psig
STP psi.
Wellhead Tubing Psig
1800
1700
1600
1500
1400
1300
1200
1100
1000
Parting pressure
Propagation pressure
1,150 psig
0
10
20
30
40
50
Elapsed Time (min)

Figure 25

Bottomhole Pressure at Beginning and End of Test

Disposal Well #1 Frac March 1, 1996

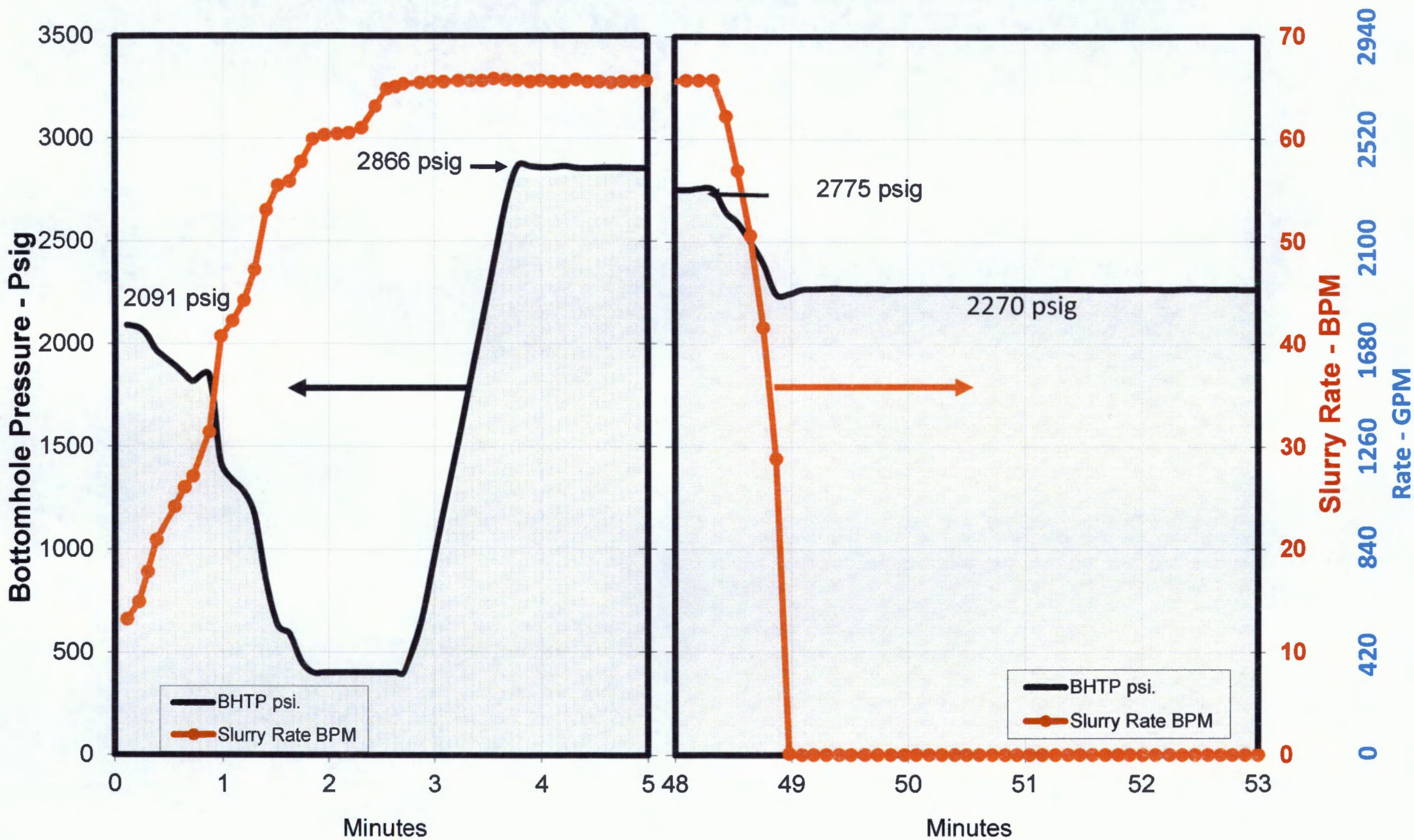


Figure 26

Wellhead Pressure at Beginning and End of Test

Disposal Well #1 Frac March 1, 1996

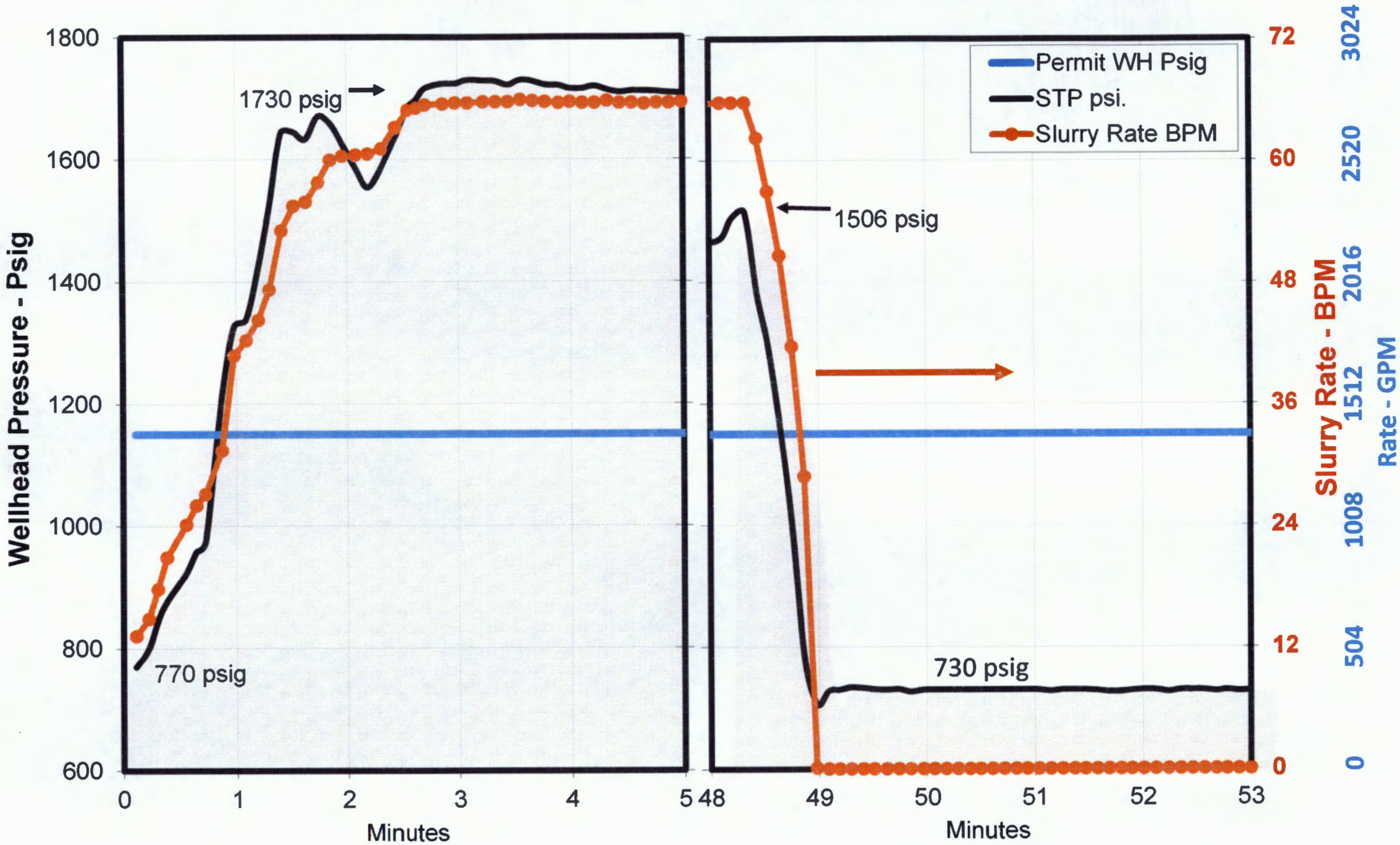


Figure 27

Disposal Well #1 – March 7, 1996 Step Rate Test

03/08/96 Page A

File Reference F224307.RED

Customer	GIANT REFINING
Street	7415 E. MAIN
City/State.......................	FARMINGTON, NM 87402
Country	U.S.A.
Service Company	TEFTELLER, INC.
Well Name	SWD (CLASS I) NO. WD-1
Well Location	SAN JUAN COUNTY, NM
Field / Pool	MESA VERDE FORMATION
Status (Oil, Gas, Other)	WATER DISPOSAL
Test Type	STEP RATE TEST
Date of Test	3-7-96
Producing Interval	3276' - 3514'
Recorder Depth	3400'
Recorder Position	
Shut In Date .... Start:	3-7-96
Stop:	3-7-96
Duration:	7 HOURS
Bottom Hole Temperature	

Gauge Identification

Gauge Manufacturer	MICRO-SMART SYSTEMS
Serial Number	224
Model Number	SP2000
Pressure Range	
Battery Type	
Calibration I.D.	
Last Calibration	10/ 3/95

Gauge Setup Parameters

Probe Set Up Time	3/ 7/96 7:46: 0
Time Delay to First Reading	
Test Type Selection	STEP RATE TEST
Test Duration Selection	7 HOURS

Figure 28

Disposal Well #1 – March 7, 1996 Step Rate Test

```
******************************
*                            *
*E V E N T   S U M M A R Y*
*                            *
******************************
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COMPANY : GIANT REFINING

PAGE : B

WELL NAME : SWD (CLASS I) NO. WD-1

DATE : 03/08/96

WELL LOCATION : SAN JUAN COUNTY, NM

FILE REF: F224307.RED

Date MM/DD	Time hh:mm:ss	Test Time hhhh.hhhh	Key Event	Pressure Psig	Temp Deg F
03/07	08:51:22	1.0896	INSTRUMENT @ 3400'	2118.23	78.56
03/07	09:46:30	2.0083	RATE #1 - 0.Ø6 BPM	2119.06	107.55
03/07	10:01:30	2.2583	RATE #2 - 1.1 BPM	2119.69	107.57
03/07	10:31:30	2.7583	RATE #3 - 2.0 BPM	2121.88	107.61
03/07	10:46:00	3.0000	RATE #4 - 2.5 BPM	2123.96	107.51
03/07	11:00:45	3.2458	RATE #5 - 3.0 BPM	2126.00	107.44
03/07	11:16:00	3.5000	RATE #6 - 3.6 BPM	2128.51	107.32
03/07	11:31:15	3.7542	RATE #7 - 4.4 BPM	2131.53	107.37
03/07	11:49:15	4.0542	RATE #8 - 5.5 BPM	2134.65	107.32
03/07	12:13:45	4.4625	RECALIBRATE FLOW METER	2131.18	107.29
03/07	12:18:45	4.5458	RATE #1-A - 2.0 BPM	2131.60	107.24
03/07	12:24:00	4.6333	RATE #2-A - 3.0 BPM	2133.07	107.24
03/07	12:28:45	4.7125	RATE #3-A - 4.0 BPM	2135.74	107.28
03/07	12:34:30	4.8083	RATE #4-A - 5.0 BPM	2136.74	107.36
03/07	12:38:30	4.8750	RATE #5-A - 5.0 BPM	2140.01	107.39
03/07	12:44:30	4.9750	RATE #6-A - 5.0 BPM	2141.03	107.40
03/07	12:49:45	5.0625	SHUT PUMPING DOWN	2141.90	107.37
03/07	13:19:45	5.5625	INSTRUMENT OFF BOTTOM	2130.64	107.37

Figure 29

Disposal Well #1 – March 7, 1996 Step Rate Test

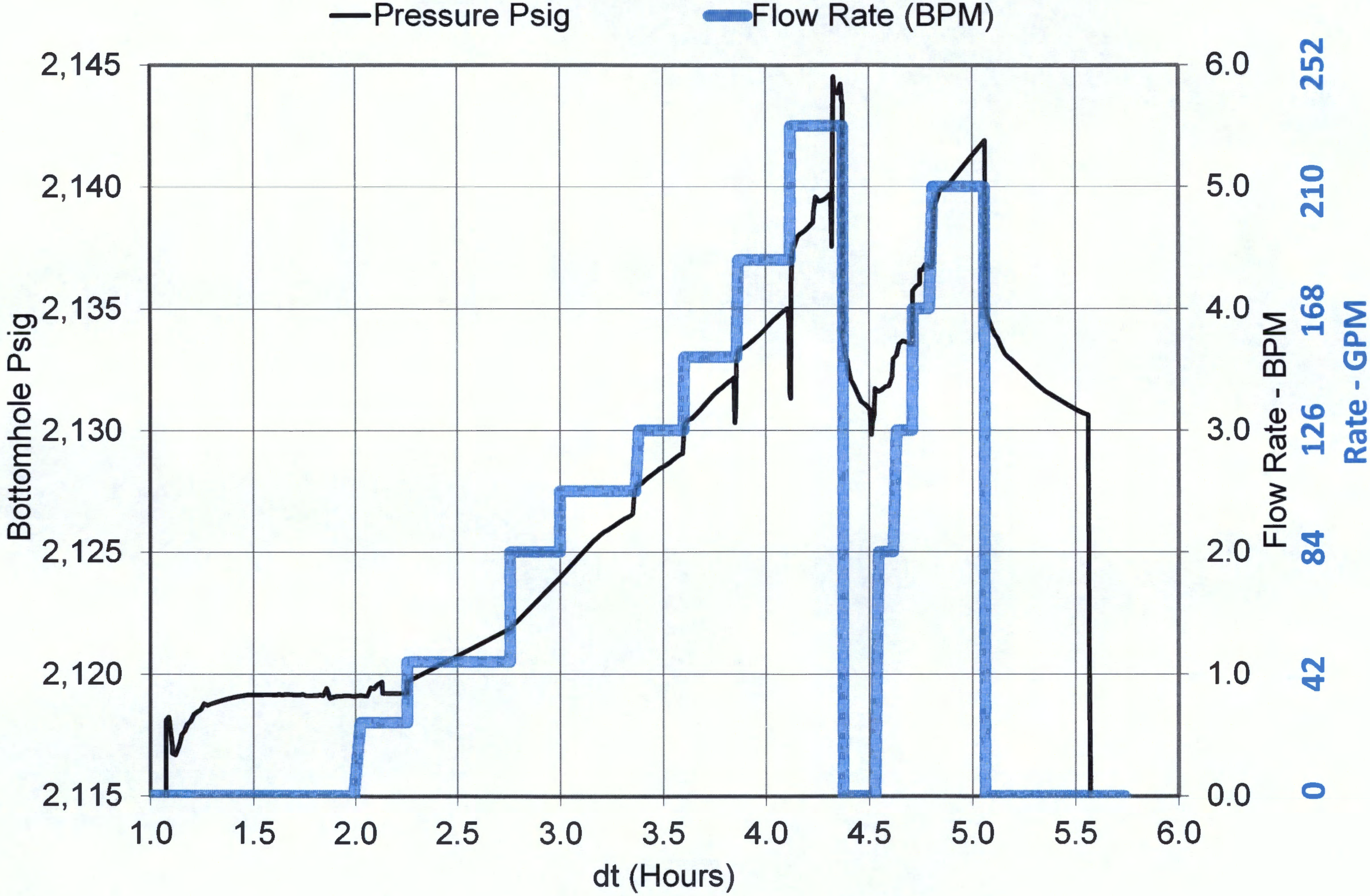

Figure 30

Disposal Well #1 – March 7, 1996 Step Rate Test
Original Wellhead Pressure vs Rate Chart

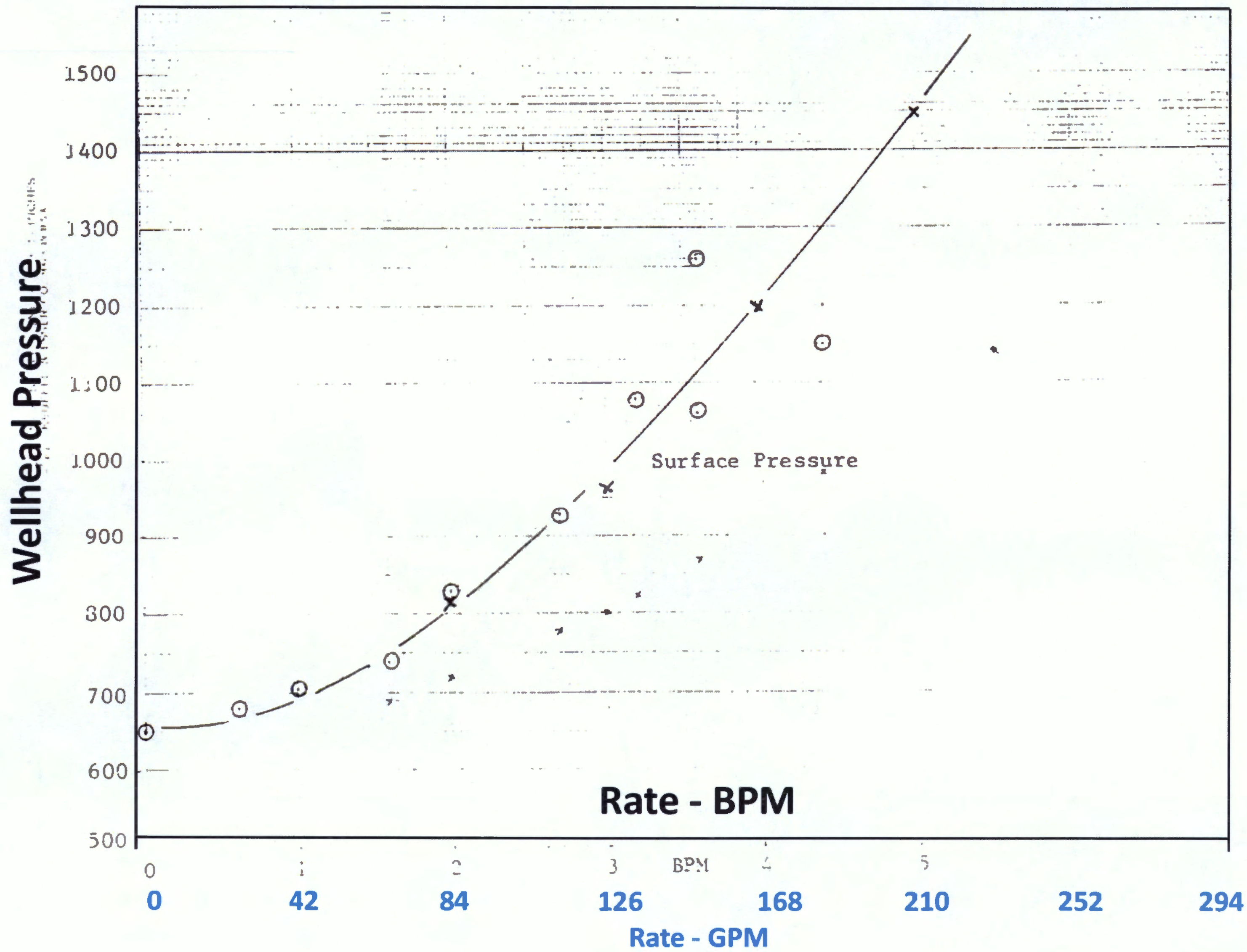

Figure 31

Disposal Well #1 – March 7, 1996 Step Rate Test Original Chart with re-Posted Results

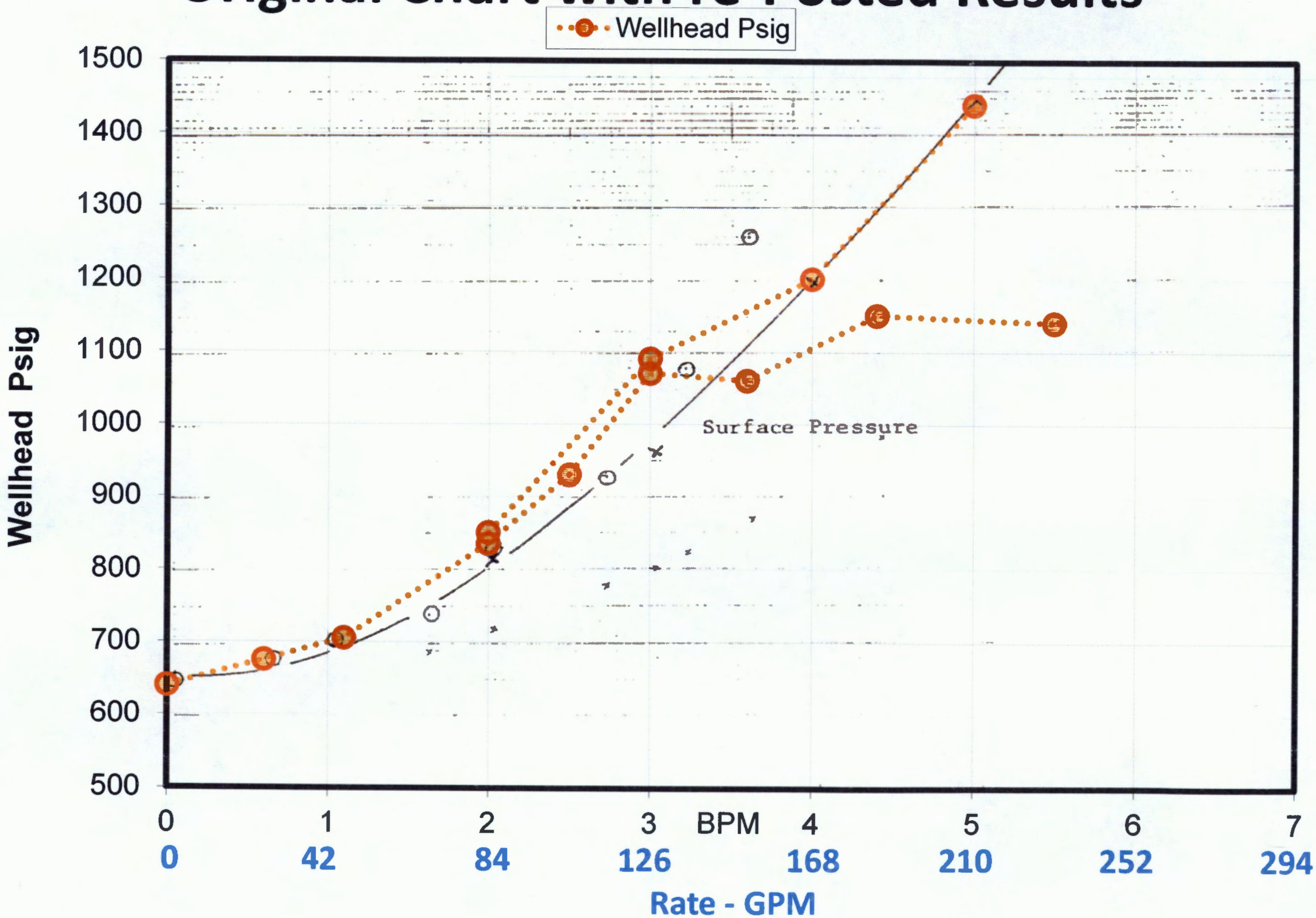

Figure 32

Disposal Well #1 – March 7, 1996 Step Rate Test

Radial Flow Analysis

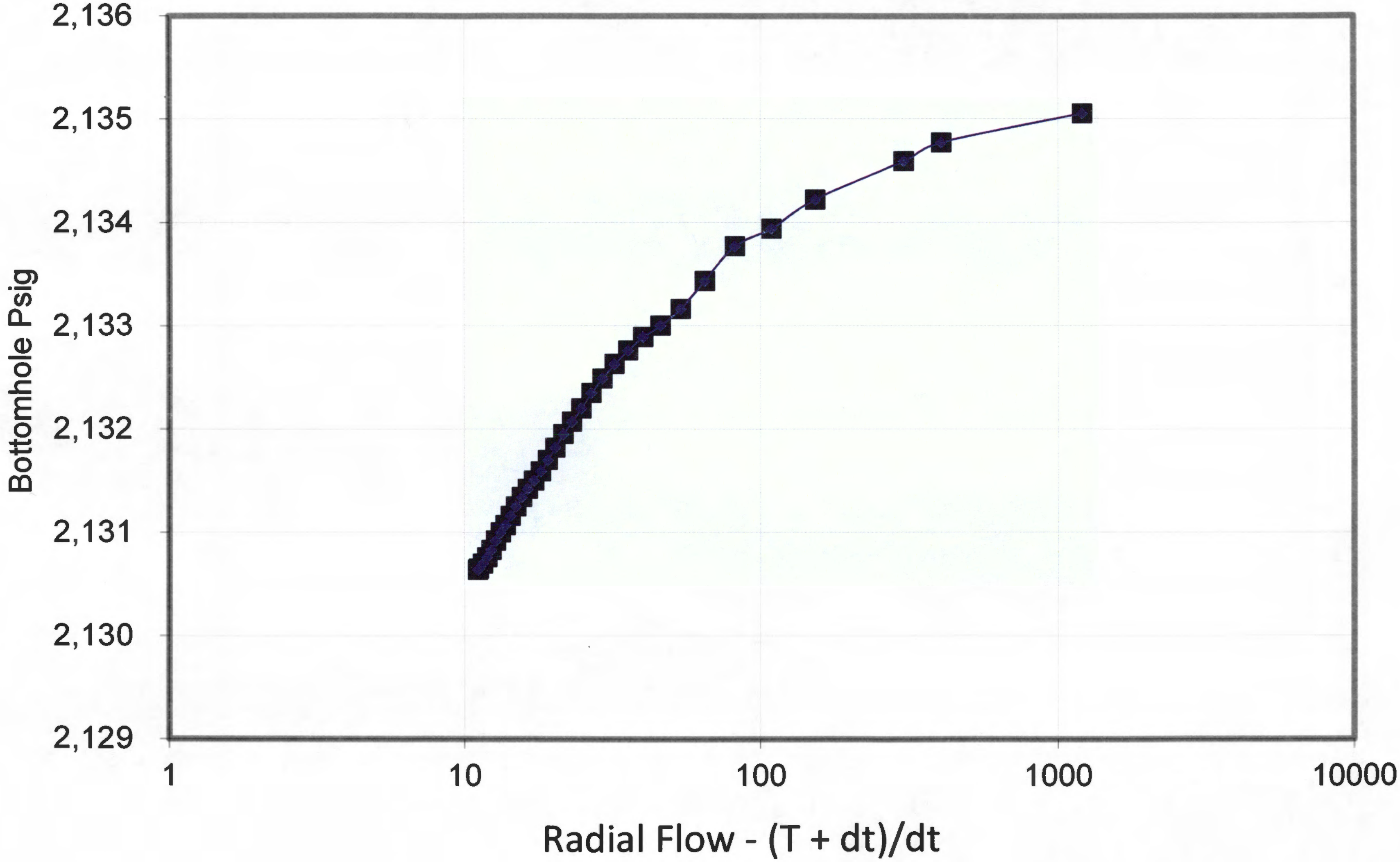

Figure 33

Disposal Well #1 – March 7, 1996 Step Rate Test

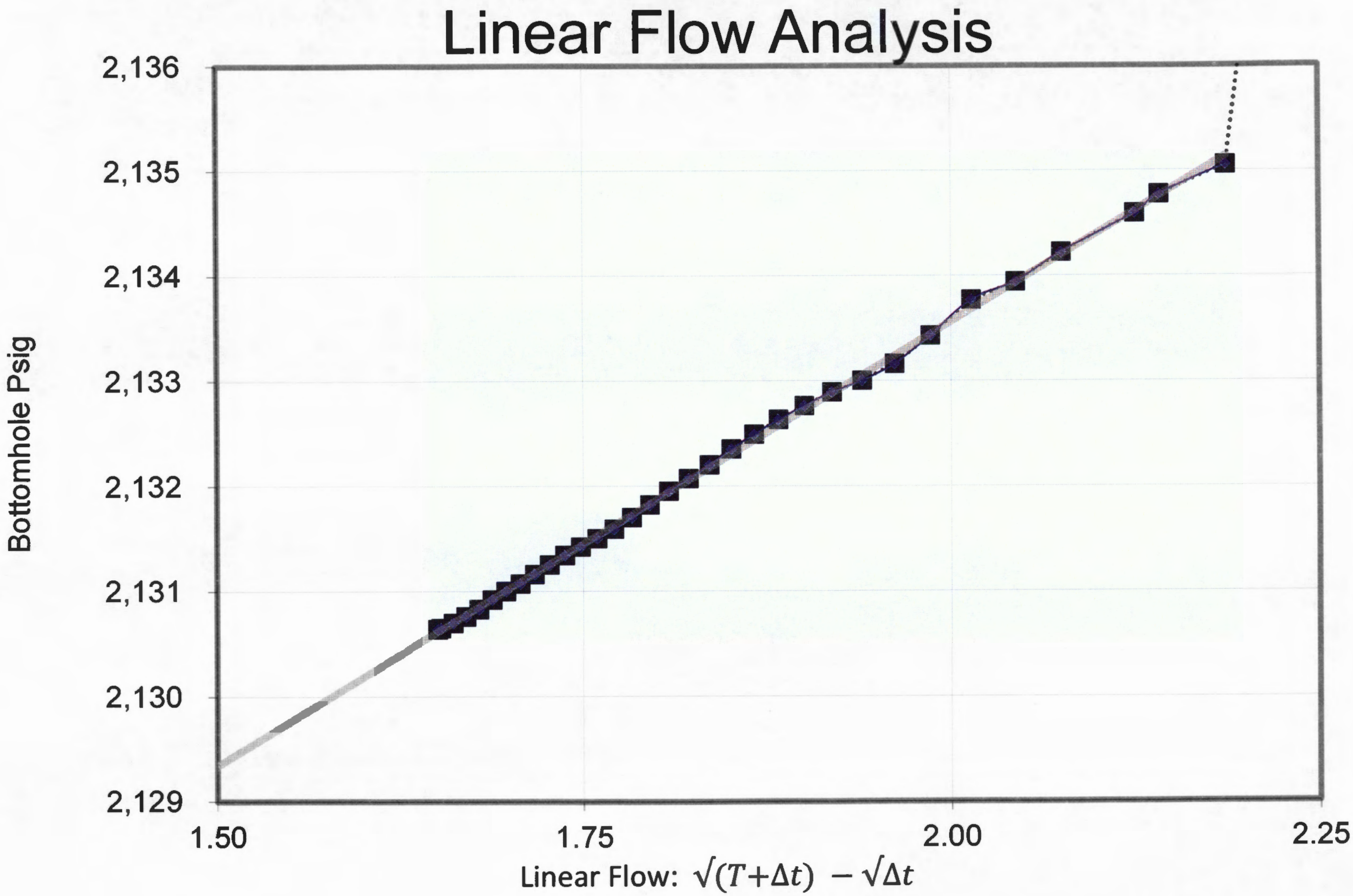

Figure 34

Disposal Well #1 – March 7, 1996 Step Rate Test

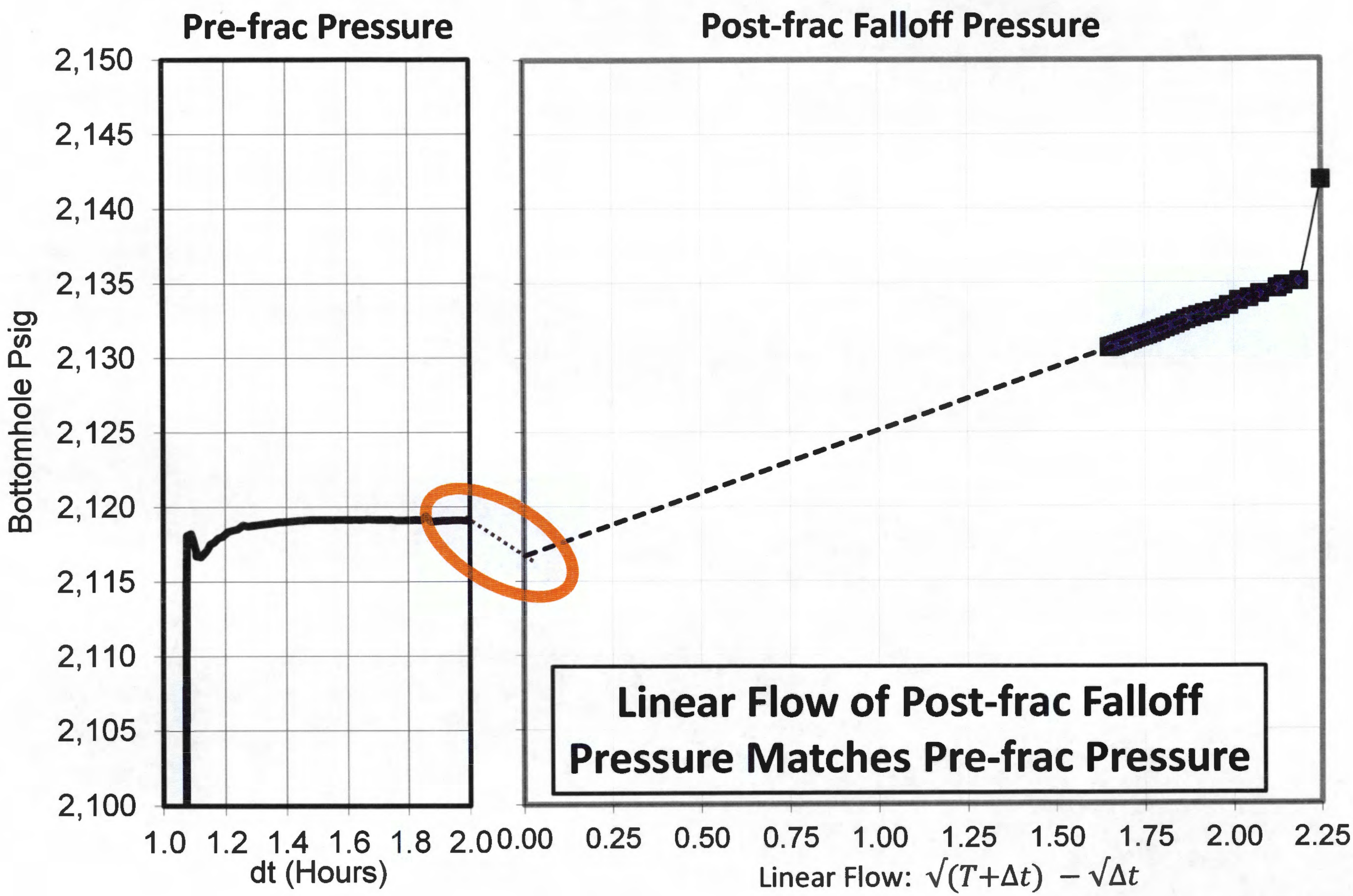

Figure 35

Disposal Well #1 Pressure History