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PROJECT RIO BLANCO

RESERVOIR REPORT

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I. INTRODUCTION

In August 1969, Equity Oil Company engaged CER Geonuclear Corporation to evaluate the prospects for nuclear stimulation of natural gas production in a portion of the Piceance Basin, Colorado. The study area included a block of about nine townships as shown in Figure 1.

In April 1970 a Feasibility Study⁽¹⁾ was issued for Project Rio Blanco as a result of the work done for Equity Oil Company. The resource evaluation narrowed the study down to a detailed examination of the Fort Union Formation and the Upper portion of the Mesaverde Formation, designated as "Mesaverde I."

As recommended in the Feasibility Study, two wells, Fawn Creek Government Number 1 and Scandard Draw Number 1 were selected for recompletion and testing to obtain more detailed information on the reservoir characteristics. In addition to the testing, several logs were run in the wells. Surface studies of the sand outcrop to determine orientation and extent of sand lenses in the Mesaverde and Fort Union formations were made and seismic surveys were run to determine the location of any geologic discontinuities in the area of interest.

This report covers the well testing and recompletion histories on both wells, the evaluation of net gas sand based on the new logs, a report of the outcrop study performed during the summer of 1970, and the seismic survey report from Seismograph Service Corporation.

Road Map of a Portion of N. W. Colorado Showing the Equity Study Area

Figure No. 1

II. CONCLUSIONS

1. The testing program recommended in the Feasibility Study has been completed.
2. Results of the testing show that the permeability to gas is in the range believed amenable to nuclear stimulation and that water in zones of calculated high water saturation should not be a problem in a nuclear stimulation experiment.
3. It is recommended that the initial experiment be conducted in the Fawn Creek area because of the greater in situ permeability and also because a successful experiment at this location would prove up a larger amount of natural gas reserves.
4. Based on the seismic survey lines run in the vicinity of the Fawn Creek Well there does not appear to be any faulting in the area chosen for the nuclear stimulation experiment.
5. Analysis of both the recent Gamma Ray-Neutron logs and Neutron Lifetime logs indicate that the gas in place figures as presented in the Feasibility Study are conservative.
6. The testing results from the Scandard Draw area are inconclusive. Up to data logs and additional testing are recommended for this area before nuclear stimulation is conducted.
7. The outcrop study indicates that Mesaverde and Fort Union depositional environment should lead to sand lenses large enough to provide an effective drainage radius for nuclear stimulation.

III. SUMMARY

A. PICEANCE BASIN

The Piceance Creek Basin is a large structural downwarp. The basin is asymmetric, generally trending northwest with gentle dips in the west and with relatively steep dips on the north and east. High angle normal faults are present in the central part of the basin and along the western edge of the steeply dipping Grand Hogback. The gas accumulation in the Project Rio Blanco area is associated with a faulted east-west trending nose. The gas seems to be in a combination stratigraphic-structural trap.

A stratigraphic cross-section of the Piceance Basin is shown in Figure 2. The zones of primary interest are the Fort Union and Mesaverde formations. The Wasatch, Fort Union, and upper, middle, and upper portion of the lower Mesaverde are fluvial channel fill and point bar sandstones*. This type of deposit has limited continuity, but appears to be of sufficient size to provide a reasonable drainage area. The basal lower Mesaverde contains marine sandstones that are relatively continuous. Based on the geologic studies presented in the Feasibility Study, a unit has been proposed to the USGS as shown in Figure 3.

1. Fort Union Formation

The average thickness of the Fort Union interval is approximately 800 feet in the proposed unit area. This interval contains gross thicknesses of sandstone on the order of 300 feet based upon analysis of SP logs from wells within the unit boundary. Depth to top of the interval was found to vary between a minimum of approximately 3700 feet in the South Sulphur area to a maximum of approximately 6600 feet in the Black Sulphur Creek area. The Fort Union generally dips at a rate of approximately 500 feet per mile throughout the major portion of the area. Based on log analysis and core data from the wells in the area, a median porosity of 13.5% and water saturation of 60% is believed to be representative of the Fort Union pay sands in this area of the basin.⁽¹⁾

*The stratigraphy of the Fort Union and Mesaverde formations and the geometry of the sandstone bodies are discussed in detail in "The Outcrop Study" presented in Appendix I.

Figure No. 2

PROPOSED RIO BLANCO UNIT
RIO BLANCO COUNTY, COLORADO

Figure No. 3

2. Mesaverde I Formation

This interval averages about 1200 feet in thickness. Gross composite thicknesses of sandstone lenses average about 350 feet in the proposed unit area. Depth to the top of the interval varies between 4400 feet and 7400 feet.

Log analysis and core data from wells in the area indicate that a porosity value of 10.5% and water saturations of 60% are reasonably conservative values for the Mesaverde I pay sands. In general, core data indicated slightly higher values of porosity than was calculated from log data.⁽¹⁾

3. Mesaverde II Formation

Although the Feasibility Study only covered the gas in place for the Fort Union and Mesaverde I, it should be mentioned that the deeper Mesaverde II Formation has considerable gas saturated sand and in future field development would probably be considered for stimulation. While detailed testing and recent log analysis have not been conducted on the deeper Mesaverde, the data from earlier completions, mud log data, and IES logs indicate that the deeper zones are gas saturated and the early production tests indicate good gas permeability. However, because of the greater depth, the longer total vertical section involved, and the additional expense due to the greater depth, inclusion of the Mesaverde II reserves at this time would be premature.

It is anticipated that when successful stimulation of the Fort Union and upper Mesaverde is proven technically feasible, that nuclear stimulation of the entire Fort Union-Mesaverde formations will prove attractive.

4. Net Gas Sand

An apparent discrepancy in the amount of net gas sand exists between that calculated from the old IES and Micrologs and the net sand determined from the more recent logging techniques.

This first became apparent during the Feasibility Study when the more modern* logs from Stuarco Sulphur Creek Number 1 computed a much higher ratio of net pay to gross SP ratio than other wells in the area where only the older IES logs were available. The net pay to gross SP ratio for the 34 wells in the study area average 22.9% while the Stuarco Well averaged 40.3%.

*Dual Induction Laterolog, Borehole Compensated Density Log, Borehole Compensated Sonic Log.

A Neutron Lifetime Log was run on the Fawn Creek Government Number 1 Well during the testing and recompletion work. The well was logged over the entire Fort Union and the top 350 feet of the Mesaverde I. A bridge plug at 6430 prevented deeper logging. Table I shows the reservoir parameters and also the gas in place calculated from the more recent logs run on the Fawn Creek Well. A significant increase in net pay can be seen in both the Fort Union and Mesaverde I intervals. The amount calculated during the earlier feasibility study was 54 BSCF/Section compared to nearly 90 BSCF/Section using the later logging techniques. This suggests that there is considerably more gas in place in the unit than was indicated in the feasibility study using the older IES/Microlog analysis.

B. RIO BLANCO OUTCROP INVESTIGATION

The Fort Union-Mesaverde section that will be stimulated in Project Rio Blanco is a fluvial facies. The reservoir rock consists of a complex of channel fill and point bar sandstone lenses. There appears to be a weak preferential orientation of long axes of sand bodies in a northeasterly/southwesterly direction. The average geometric ratios of the channel fill sands are: length/width/thickness, 140/14/1, and the point bar ratios are: length/width/thickness, 190/80/1.

The channel fill sandstones probably have widths in the order of 350 feet and lengths that generally would be more than 1000 feet. The point bar type sandstones would be expected to have lengths in the order of 3000+ feet and widths in the order of 1200 feet. It is significant that more than 25% of the sand lenses, with a thickness of 10 feet or more, had lengths greater than 1000 feet. This augurs for some optimism on average drainage radius for nuclear stimulation in this area.

The above generalizations are the results of a study of the Fort Union and Mesaverde sandstones in outcrops along the Douglas Creek Arch and the Grand Hogback. The complete outcrop study is given in Appendix 1 of this report.

C. SEISMIC SURVEY REPORT

Because there was some question of possible faulting across the southern portion of Section 14 from earlier seismic surveys, another more detailed seismic survey in the Fawn Creek area was run by Seismic Service Company for CER during the fall of 1970. The improved data recording and data processing now available indicate that this area is clear of faulting. The seismic maps and report by SSC can be found in Appendix II.

TABLE I

FAWN CREEK GOVERNMENT NUMBER 1
SUMMARY OF RESERVOIR PARAMETERS

	<u>Fort Union</u>	<u>Mesaverde I</u>
Depth (KB)	5260' - 6080'	6080' - 7252'
Gross Interval	820 feet	1172 feet
Net Pay	208 feet*	170 feet**
Porosity	12.2 %	11.5 %
Water Saturation	52.6 %	53.2 %
Average Pressure	2400 psia	2750 psia
Z	.93	.90
Formation Temperature	190°F	210°F
B _g	140 scf/ft ³	161 scf/ft ³
Gas in place/Section	47.0 BSCF/Section	41.1 BSCF/Section
Total Gas in place, Fort Union and Mesaverde I*** - 88.1 BSCF/Section		

*From Gamma Ray-Neutron and Neutron Lifetime Log analysis.

**Neutron Lifetime Log only run to 6400 feet - remaining interval estimated from IES Log.

***The Neutron Lifetime Log was run from 5200 feet to 6400 feet. Total pay in the logged interval is 304 feet, which is equivalent to 70.2 BSCF/Section.

D. WELL TESTING

Following the recommendations made in the Project Rio Blanco Feasibility Study, two wells in Equity's Piceance Creek properties were selected, recompleted and tested to determine certain reservoir parameters in the prospective area. The two wells selected were Fawn Creek Government Number 1 (Section 14, Township 3 South, Range 98 West) and Scandard Draw Number 1 (Section 22, Township 3 South, Range 97 West) Rio Blanco County, Colorado. The selected wells are shown on Figure 3.

The primary purpose of the testing was to determine the permeability to gas in the Fort Union and upper Mesaverde sand zones. The secondary purposes of the testing were to determine if mobile water was present in the high water saturated zones as calculated from the logs and also to determine reservoir pressures in this area of the basin.

The technique used for the recompleting and testing of the wells was to kill the wells with 2% KCl water, set a bridge plug above the top of the old perforated section, then run a cement bond log and Gamma Ray-Neutron Log over the interval of interest in the selected wells. The Gamma Ray-Neutron Log of the intervals tested is shown in Figure 4.

If the cement bonding appeared satisfactory around the zone to be tested, the zone was perforated with 10 to 15 jet shots and a dual packer and dual tubing string run in the well. After setting the packer, a small volume sand fracture treatment was performed on the zone. The complete recompletion data for each zone is given in Appendix III.

The dual string completion technique was used in order to insure that the gas zone could be tested without water production killing the well. A 3/4 inch to 5/8 inch tapered rod string and bottom hole pump was run in the 2-1/16 inch O.D. tubing. The 1-1/2 inch string was used for flowing the gas and also running a bottom hole surface recorder pressure gauge. Figures 5 and 6 are schematic drawings of the well test completion and the surface testing hookup. This technique was used for both wells.

Figures 7 through 10 are graphic chronological histories of the recompletion and testing conducted on the two wells. The test data from each well zone analysis is in Appendix III-C and III-D. The drawdown portion of the tests could not be analyzed because of the rapid fluctuations in pressure due to pumping the water off of the formation. However, the buildup portions of the tests were analyzed using several techniques^(2, 3, 4, 5, 6) with good agreement between the different methods of analysis. Because of the excellent agreement, only the pressure versus time method is usually presented. Table II summarizes the zones tested, the number of tests conducted on each zone, and the results of the testing.

FAWN CREEK #1

SCANDARD DRAW #1

The shaded intervals are the zones tested. The depths on this small scale log are in error, the correct depths are given in the text.

TESTED INTERVALS - GAMMA RAY NEUTRON LOG SECTIONS

Figure No. 4

TYPICAL DOWNHOLE COMPLETION USED FOR TESTING

Figure No. 5

TYPICAL FLOW SYSTEM FOR TESTING

TYPICAL WELLHEAD USED FOR TESTING

Figure No. 6

Figure No. 7

Figure No. 8

Figure No. 9

Figure No. 10

TABLE II

SUMMARY OF TESTING RESULTS

<u>Well and Zone</u>	<u>Perforated Interval</u>	<u>Gross Sand (ft)</u>	<u>Net Pay (ft)</u>	<u>Capacity kh (md ft)</u>	<u>Permeability k (md)</u>	<u>Formation Pressure P_i (psig)</u>	<u>Remarks</u>
<u>Fawn Creek Government Number 1</u>							
Zone 1	5747' to 5792'						
Buildup No. 1		47	35	.84	.024		
Buildup No. 2		47	35	.64	.018		
Buildup No. 3		47	35	.69	.020	>2095	
Zone 2	5600' to 5630'						
Buildup No. 1		34	20	1.19	.059		
Buildup No. 2		34	20	.94	.047	>2150	
<u>Scandard Draw Number 1</u>							
Zone 1	7183' to 7210'						
Buildup No. 1		31	15	.24	.016	2986	
Buildup No. 2		31	15	.24	.016	2990	
Zone 2	6810' to 6838'						
Buildup No. 1		28	16	.054	.003	2490	Questionable Test
Zone 3	7454' to 7476'						
Buildup No. 1		23	1	.008	.008	>2470	Extremely Tight

IV. DISCUSSION OF TESTING RESULTS

A. FAWN CREEK GOVERNMENT NUMBER 1 - ZONE 1, 5745 to 5792

1. Buildup Number 1

The initial buildup was conducted after cleanup of the frac job. The well was flowed for thirteen days prior to shut-in for buildup. A Ball Brothers Slim Sentry was run in the 1-1/2 inch tubing prior to shutting in the well. The instrument lodged in the tubing at 5715 feet and could not be retrieved.

A short buildup of approximately 90 hours was obtained before the instrument failed. Figure 11 is a Horner plot of the data obtained from the test. The straight line portion from 30 hours to 90 hours was used to calculate formation permeability. The portion of the slope prior to 30 hours was masked by after-flow and consequently not used in the evaluation. A flow capacity of .84 md feet was calculated as follows:

$$kh = \frac{162.6 \mu q B}{m}$$

where: μ = Viscosity (cp) from Table III-C-1, Appendix III-C
B = Gas volume factor (Bbls/MSCF)
q = Stabilized flow rate at shut in (MCF/D)
m = Slope from Horner plot (psi/cycle) - Figure 11

$$kh = \frac{162.6 \times .0156 \times 73 \times 2.13}{470} = .84 \text{ md ft}$$

The permeability to gas calculated from the net effective pay determined from the logs in the perforated interval is:

$$k = \frac{.84 \text{ md ft}}{35 \text{ ft}} = .024 \text{ md}$$

The preliminary reports assumed all of the perforated interval to be pay and consequently a conservative value of $k = .018 \text{ md}$ was shown.

Figure No. 11

2. Buildup Number 2

In order to retrieve the Ball Brothers instrument, the well was killed with 2% KCl water and the tubing pulled. After retrieving the instrument the well was flowed from June 30 to July 8, 1970 and then shut in for buildup number 2.

Buildup number 2 was conducted from July 8 to August 1, 1970. Failure of the Amerada SPG-3 downhole instrument and leaks in the wire-line control head caused several fluctuations in the buildup data. Figure 12 is a Horner plot of the data from which the calculated permeability is:

$$kh = \frac{162.6 \mu q B}{m} = \frac{162.6 \times .0156 \times 36 \times 2.13}{304} = .64 \text{ md ft}$$

$$k = \frac{.64 \text{ md ft}}{35 \text{ ft}} = .018 \text{ md}$$

It was interesting to note on this buildup that the later data points showed an increasing slope with time. There are several explanations for this type behavior, if in fact, what is being seen is a phenomenon of the formation and not just instrument and leakage problems. The edge of the sand lense, decreasing formation permeability with distance, or faulting, all would cause the upward bending of the buildup curve.

3. Buildup Number 3

In order to confirm the curvature at late buildup times, a third buildup test was run with the following results: (Figure 13)

$$kh = \frac{162.6 \mu q B}{m} = \frac{162.6 \times .0156 \times 35.5 \times 2.13}{280} = .69 \text{ md ft}$$

$$k = \frac{.69 \text{ md ft}}{35 \text{ ft}} = .020 \text{ md}$$

This test was run for 1341 hours. At the conclusion of the test, the buildup was still curving upwards as before, confirming a boundary or boundaries near the well bore.

Because the curve was still increasing, the initial pressure from extrapolation could not be confirmed, one can only say that the formation pressure in this zone was at least as great as 2095 psig. (Figure 13).

Figure No. 12

Figure No. 13

At the conclusion of this buildup, the well was killed with 2% KCl water and zone 1 squeezed with cement. The cement bond log indicated poor bonding in the region of zone 2, consequently the zone was isolated by cement squeezing prior to recompleting for testing.

B. FAWN CREEK GOVERNMENT NUMBER 1 - ZONE 2, 5598 to 5632

1. Buildup Number 1

In order to achieve an early buildup, the well was flowed for two days to clean up after the small sand frac and then shut in for buildup number 1.

From Figure 14, a slope of $m = 1030$ psi/cycle is calculated:

$$kh = \frac{162.6 \mu q B}{m} = \frac{162.6 \times .0168 \times 307 \times 1.47}{1030} = 1.19 \text{ md ft}$$

From the logs it was determined that only 20 feet of the 34 foot total interval can be considered as pay. The gas permeability then is:

$$k = \frac{1.19 \text{ md ft}}{20 \text{ ft}} = .059 \text{ md}$$

Although it is academic for nuclear stimulation, the curve was evaluated at early time for an estimate of the effectiveness of the small volume fracture treatment.

$$\text{Skin } S = 1.151 \left[\frac{P_{1Hr} - P_f}{m} - \text{Log} \left(\frac{k}{\phi \mu c r_w^2} \right) + 3.23 \right] =$$

$$1.151 \left[\frac{335 - 435}{1030} - \text{Log} \frac{.059}{.10 \times .0168 \times 5.13 \times 10^4 \times .3^2} + 3.23 \right] = -3.16$$

The skin value of -3.16 indicates that the small volume fracture treatment was effective in removing a damage near the well bore.

Following the short initial buildup, the well was flowed for 10 days to condition the well for the final buildup.

Figure No. 14

2. Buildup Number 2

This buildup is shown as a conventional Horner plot in Figure 15 and also as a p^2 plot in Figure 16. The upward curvature of the buildup is seen in both of these plots. The same analysis can be applied here as was applied to the zone 1 buildup. The curvature can be a result of decreasing permeability with distance from the well bore; however, it seems more likely because of the lenticularity of the sand zones that we are seeing the edge of a lense. A simple fault would not show a continually increasing slope with time but would straighten out with a slope of twice the original. In addition, the seismic reflection survey* run in the area of Fawn Creek by SSC does not indicate any faulting in the vicinity of the well.

From Figure 15 --

$$kh = \frac{162.6 \mu q B}{m} = \frac{162.6 \times .0164 \times 121.9 \times 1.64}{550} = .940 \text{ md ft}$$

$$k = \frac{.940 \text{ md ft}}{20 \text{ ft}} = .047 \text{ md}$$

Good agreement was noted on the test between the p and p^2 methods of analysis. The calculated permeability from the p^2 analysis is: (Figure 16)

$$kh = \frac{325.2 \mu q BP}{m} = \frac{325.2 \times .0164 \times 121.9 \times 1.64 \times 1800}{2.02 \times 10^6} = .950 \text{ md ft}$$

$$k = \frac{.950 \text{ md ft}}{20 \text{ ft}} = .0475 \text{ md}$$

Zone 2, buildup number 2 is still in progress. Data points are being taken every week to ten days. It is anticipated that the pressure will continue to build back to about 2400 psig (hydrostatic).

*The SSC Study is included in this report as Appendix II.

Figure No. 15

Figure No. 16

C. SCANDARD DRAW NUMBER 1 - ZONE 1, 7181 to 7212

In layered shaly formations such as the Wasatch, Fort Union, and Mesa-verde formations of the Piceance Basin, accurate log analysis is difficult. This is even more true when dealing with older wells, and consequently older logs. Unless a more recent up-to-date logging program is available, there is some question as to the exact amount of net pay and the water saturation in the sandy intervals.

Zone 1, the first interval tested, was selected in order to establish the formation permeability and also to determine if the calculated highly water saturated sands contained mobile water or connate water only.

An attempt was made to reevaluate zone 1 using the Gamma Ray-Neutron Log that was obtained during the recompletion for testing. While this technique is not commonly used, the method did indicate a lower water saturation than was calculated from the IES Log. However, the Gamma Ray-Neutron Log still indicated that slightly over 50% of the 31 foot interval still had a water saturation greater than 70%, compared to the earlier IES calculation that indicated about 90% of the zone had a water saturation in excess of 70%.

1. Buildup Number 1

The 31 foot interval was perforated, sand fractured, and then flowed to the pit to clean up prior to running the initial buildup.

While the entire section had high water saturations, there was about 15 feet that calculated less than 70% S_w and only 2 feet less than 50% S_w .

The initial buildup was run to determine capacity and initial pressure in the interval. Water production was measured during the first drawdown test. Figure 17 is the Horner plot of this initial buildup.

$$kh = \frac{162.6 \times \mu q B}{m} = \frac{162.6 \times .0179 \times 38 \times 1.27}{590} = .24 \text{ md ft}$$

$$\text{for } h = 15 \text{ ft} \quad k = \frac{.24 \text{ md ft}}{15 \text{ ft}} = .016 \text{ md}$$

The reservoir pressure from extrapolation of the buildup curve was 2986 psig.

Figure No. 17

2. Drawdown Number 1

In order to determine if the zone was water productive, the water produced during the drawdown test was carefully measured by both a meter on the separator and also by actual tank gauging. Figure 18 is the water produced during the drawdown test. The water production rate had dropped off to less than two barrels of water per day and was still declining with about 100 barrels of frac load water still remaining to be recovered.

Samples of the frac water were obtained and sent in for chemical analysis along with samples of produced water during the production tests. The analyses are included in Appendix III-E but are not felt to be conclusive because of the effects of dilution with the formation connate water, and also because of the ion exchange phenomenon with the formation shales and clays.

Until a better suite of logs are obtained in the Scandard Draw area, the real values of water saturation can only be estimated with the realization that more data will be required.

It is concluded from this test that even though the zone contains sands with high water saturation, the water appears to be primarily connate and should therefore not create production problems when producing the gas.

3. Buildup Number 2

After the seven-day drawdown test, the well was shut in for 172 hours buildup. Excellent agreement was found between buildup number 1 and number 2. Figure 19 is the Horner plot of buildup number 2.

$$kh = \frac{162.6 \times .0179 \times 33.4 \times 1.27}{505} = .244 \text{ md ft}$$

$$k = \frac{.244 \text{ md ft}}{15 \text{ ft}} = .016 \text{ md}$$

The reservoir pressure from extrapolation of the buildup is 2990 psig. Because of the excellent agreement from the two buildup tests, the well was then recompleted to Zone 2.

Figure No. 18

Figure No. 19

D. SCANDARD DRAW NUMBER 1 - ZONE 2, 6810 to 6838

1. Buildup Number 1

The test results from zone 2 were disappointing. The zone appears to have a good pay section based on the logs; however, the test results indicate that the zone may not have been properly completed for testing. The zone was perforated, given a small volume fracture treatment and then opened up to flow to the pit. The well died and was swabbed for several days without success. A bottom hole pump was run and the well pumped and flowed in order to condition the well for buildup number 1. Sixteen feet of pay were calculated from log data in the perforated interval. However, test results indicate that the capacity (kh) is extremely low. (Figure 20)

$$kh = \frac{162.2 \times .0166 \times 10 \times 1.63}{820} = .054 \text{ md ft}$$

$$\text{if } h = 16 \text{ ft then } k = .003 \text{ md}$$

Comparing this permeability with the core analysis obtained while drilling, this section appears to confirm the fact that the frac treatment may have channelled behind the pipe. The average permeability of 11 core samples taken in this interval was .24 md. This is almost two orders of magnitude greater than that determined from the test data. Normally, core permeability is about one order of magnitude greater than that derived from in situ testing.

In addition, radioactive tracer was injected into the perforated zone and then logged with a Gamma Ray tool. While not conclusive, it did appear from the logs that the tracer was not going into the interval being tested.

For the above reasons it is felt that the test results for the zone from 6810 to 6838 are highly suspect and consequently the test is not considered a valid investigation of the zone in question.

E. SCANDARD DRAW NUMBER 1 - ZONE 3, 7454 to 7476

1. Buildup Number 1

Following the test in zone 2, the well was recompleted to the Mesa-verde and given a small volume frac treatment.

Figure No. 20

The zone was selected from an earlier IES Log analysis which indicated about ten foot of net pay sand. However, when data from the Gamma Ray-Neutron Logs were analyzed in conjunction with the IES logs it indicated that this interval has essentially no pay. The flow rates and subsequent buildup confirmed this fact. A flow rate of 3 MCF/D was the final rate prior to buildup.

A leak in the cable connection to the instrument created erroneous readings during the early buildup period. Only the portion of the buildup that occurs after 200 hours could be used for analysis. Bottom hole pressures were calculated from surface measurements for the early buildup portion. The calculated pressures are also shown on Figure 21. The calculations are based on the following equation:⁽⁷⁾

$$P_{BH} = P_{WH} e^{\frac{.01877 GD}{Z_a T_a}}$$

where:

P_{BH} = Bottom hole pressure (psia)

P_{WH} = Wellhead pressure (psia)

G = Gas gravity (air = 1.0)

D = Depth (ft)

Z_a = Average compressibility factor

T_a = Average gas column temperature (°R)

Figures 21 and 22 both show that a change in slope occurs at about 400 hours. Even though the earlier, more optimistic, slope appears to be the correct slope, the calculated capacity is still very low. The calculated flow capacity (kh) for the zone is:

$$kh = \frac{162.6 \times .0168 \times 3 \times 1.73}{1600} = .008 \text{ md ft}$$

A kh value in this range is still far too low to consider that this zone has any commercial value.

Figure No. 21

Figure No. 22

ABBREVIATIONS

B	Gas volume factor, Bbls/MSCF
Bbl	Barrels
B_g	Gas formation volume factor, scf/ft ³
BOP	Blow out preventer
BSCF/Section	Billion standard cubic feet per section
c	Compressibility, psi ⁻¹
CBL	Cement Bond Log
cp	Centipoise
D	Depth, feet
ft	Feet
G	Gas gravity (air = 1.0)
GR-N	Gamma Ray-Neutron
hr	Hour
IES	Induction Electrical Survey Log
IJ	Integral Joint
k	Permeability, millidarcies
KB	Kelly Bushing
KCl	Potassium Chloride
kh	Flow capacity, permeability times height, millidarcy feet
Lb	Pound

ABBREVIATIONS

m	Slope from Horner plot
MCF/D	Thousand cubic feet per day
md	Millidarcy
OCT	Oil Center Tool Company
OD	Outside diameter
p	Pressure
P _{BH}	Bottom hole pressure, psia
P _f	Flowing Pressure
P _{1 Hr}	Pressure one hour after shut in
P _i	Initial pressure
psi	Pounds per square inch
psia	Pounds per square inch absolute
psig	Pounds per square inch gauge
P _{WH}	Wellhead pressure, psia
q	Stabilized flow rate at shut in
R	Range
r _w	Wellbore radius, feet
S	South
SCF	Standard Cubic Feet

ABBREVIATIONS

Skin S	Skin Factor
SP	Self Potential Log
SSC	Seismograph Service Corporation
S_w	Water saturation, percent
T	Township
T	Temperature, °F
T_a	Average gas column temperature
T_o	Time
Δt	Shut in time, hours
USGS	United States Geological Survey
W	West
Z	Compressibility factor
Z_a	Average compressibility factor
>	More than
μ	Viscosity, centipoise
ϕ	Porosity, fractional

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APPENDIX I

RIO BLANCO OUTCROP INVESTIGATION

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RIO BLANCO OUTCROP INVESTIGATION

I. SUMMARY

The Fort Union-Mesaverde section that will be stimulated in Project Rio Blanco is a fluvial facies. The reservoir rock consists of a complex of channel fill and point bar sandstone lenses.

The average geometric ratios of the channel fill sands are: length/width/thickness, 140/14/1, and the point bar ratios are: length/width/thickness, 190/80/1.

There appears to be a weak preferential orientation of long axes of sand bodies in a northeasterly/southwesterly direction.

The above generalizations are the results of a study of the Fort Union and Mesaverde sandstones in outcrops along the Douglas Creek arch and the Grand Hogback.

Additional work should be done to more accurately define the distribution of orientation of the long axes of the sand bodies.

II. DISCUSSION

A. INTRODUCTION

Gas well test results become useful tools that can be used in evaluating potential nuclear stimulation projects only after the basic data has been processed using a mathematical model of the reservoir. This model must be simple enough to be handled mathematically, yet complex enough and well chosen so that it represents a reasonable match with real life. In the Piceance Basin, the relatively sparse well information and the limited subsurface data make it difficult to select an appropriate model. Hence, surface studies were conducted on the Fort Union and Mesaverde outcrops a few tens of miles to the east and west of the basin center to generate data that should make it easier to select a reasonable model of subsurface reservoir conditions.

The areas selected for this outcrop study were as close to the Project Rio Blanco sites as topography and access would allow. The techniques used were similar to those used in the Project Rulison Feasibility Study. (1, 2)

The Fort Union and Mesaverde outcrops that rim the eastern edge of the Piceance Basin along the Grand Hogback dip steeply to the west (40° to 80°), while on the western edge of the basin in the Douglas Creek Valley and along the Cathedral Bluffs, the beds dip gently to the east ($< 10^{\circ}$). (See Figure 1.)

The different aspects of the outcrops produced different types of basic data. The outcrops on the western margin of the basin yielded a number of length/thickness (L/H) ratios and random cross sections of the sand bodies. The steeply dipping Grand Hogback sections yielded synthetic logs of the total formation plus some partial plan views of scattered sand bodies.

Figure 1. Regional Map and Structural Interpretation Contoured on Top of Lower Cretaceous and Showing Location of Some of the Outcrops Utilized in This Study.

1 Rifle Gap	5 Philadelphia Draw-Rocky Point Gulch
2 Government Creek	6 Cathedral Creek-Little Burma Road
3 East Piceance Creek	7 Douglas Creek
4 Meeker	(after PNE-R-12 ⁽¹⁾ 1966)

B. GENERAL ROCK CHARACTERISTICS

1. Structure

The general Subsurface structural configuration of the Piceance Basin is displayed on the regional structural map, Figure 1. The asymmetric nature of the basin is shown by this map, with steeply dipping beds bounding the basin on the east and gentle dips on the western margin of the basin. The structural contours also show the terracing on the western and southern limbs of the basin and the Piceance Creek Dome to the north of the central basin low.

A schematic east-west cross section (Figure 2) presents the vertical succession of beds and an indication of the near vertical normal faulting.

The lower Fort Union and Mesaverde are considered in greater detail in the stratigraphic summary, since they will be combined as the target interval in the Rio Blanco nuclear stimulation project.⁽³⁾

2. Stratigraphy

The Green River Formation is the surface "bed rock" in the Piceance Basin. This fluvial-lacustrine formation is underlain by the Eocene Wasatch Formation.

a. Wasatch

The Tertiary Wasatch Formation overlies the target Fort Union-Mesaverde formations. The Wasatch is mapped in the field as a variegated predominately shaly sequence that lies between the subdued grayish-greens, grays, and tans, of the Green River Formation and the brown and yellowish gray weathering Fort Union-Mesaverde rocks. A number of geological descriptions of the Wasatch Formation outcrops around periphery of the Piceance Basin are available.⁽⁴⁻¹¹⁾ In general, the Wasatch thickens toward the southeast. It is less than 300 feet thick near Rangely, Colorado, and is more than 5000 feet thick in the Rifle area.

b. Fort Union (including Ohio Creek Conglomerate)

The Paleocene rocks that underlie the Wasatch Formation have been referred to the Fort Union Formation. The basal portion of the Fort Union is generally termed the Ohio Creek Conglomerate.

The basal Ohio Creek is a coarse or conglomeratic sand sandstone 10 to 40 feet thick that grades upward into an interbedded sandstone-shale sequence in the southern portion of the Piceance Basin. (10, 12) The interbedded shales are grayish greens and grade into the main Fort Union sequence of brownish yellow sandstones and shales, containing Paleocene plant and animal fossils. The basal Fort Union (Ohio Creek) ranges from a few feet to 500 feet in thickness. The upper Fort Union displays a thickness variation of from 1500 feet along the eastern basin margin to a pinchout in the southwest. It is difficult to distinguish between the basal Wasatch and upper Fort Union on the logs from the center of the Piceance Basin. Therefore, a log marker is used as the boundary. This marker may not correspond exactly with the outcrop pick, but it is in approximately the same stratigraphic position. The Fort Union rocks are of fluvial coastal swamp, and lacustrine origin.

c. Mesaverde

The Mesaverde Formation of Cretaceous age is a complex assemblage. The basal marine sandstone section is overlain by a coal-bearing fluival coastal swamp sequence called the Neslen facies, which is in turn overlain by fluvial deposits termed the Farrer facies. (12, 13)

A marine transitional sand member called the Trout Creek sandstone is present in the Neslen facies on the north and eastern margin of the basin. (14) (See Figure 3.) This member cannot be traced in the subsurface into the center of the basin. The reddish weathering middle Mesaverde section occurs above the Trout Creek sand. The color is the result of the oxidation of the highly carbonaceous rock. This colored zone is present in the Grand Hogback and Douglas Creek area even when the Trout Creek is not discernable.

A second marine transition zone, termed the Fox Hills sandstone in the Axial Basin, is present in the Farrer facies in the northeastern portion of the basin.⁽¹⁴⁾ The Fox Hills has a distribution that is more limited than the Trout Creek; hence, it is not encountered in the outcrops except in the northeast corner of the basin.

d. Mancos

The Mancos Formation is a dark colored Cretaceous marine shale sequence that underlies the Mesaverde. The Mancos is approximately 3000 feet thick in the central portion of the basin.

3. General

The general stratigraphic framework of the Project Rio Blanco related reservoir rocks can be summarized in a series of isopach maps and cross sections. The Wasatch-Fort Union isopach map is presented as Figure 4. The area of maximum thickness corresponds generally with the present maximum structural basin depth, except for the Grand Hogback area at the basin's eastern margin. The Mesaverde isopach (See Figure 5), shows a configuration in general similar to the Wasatch-Fort Union.⁽¹⁵⁾

The cross section locations are presented as Figure 6. The southwestern cross section A-A', Figure 7, shows the complex intertonguing of the coastal Mesaverde sandstones and the marine Mancos shale. Cross section B-B', Figure 8, shows a simpler Mesaverde-Mancos contact and the Trout Creek sandstone tongue coming in from the north. East-west section C-C' and D-D', Figures 9 and 10, also show the sand wedges in the Neslen facies coming in along the eastern basin margin.

Figure 4. Regional Map and Structural Interpretation Contoured on Top of Lower Cretaceous and Showing Isopachs on Fort Union-Wasatch Formations

(after Millison, (15) 1968)

Figure 5. Regional Map and Structural Interpretation Contoured on Top of Lower Cretaceous and Showing Isopach of the Mesaverde Formation

(after Millison, ⁽¹⁵⁾ 1968)

Figure 6. Regional Map and Structural Interpretation Contoured on Top of Lower Cretaceous and Showing Cross Section Locations

LATE CRETACEOUS DEPOSITS OF BOOK CLIFFS AND GRAND MESA

Figure 7.

(after Quigley, (12) 1968)

C. STATISTICAL STUDY

1. Techniques

A description of the general technique used to construct the photo mosaics follows:

- a. Locations of the outcrops were traced on 1:24000 scale USGS Topographic maps, and each outcrop was given a location designation.
- b. The outcrops were photographed in black/white with either a 4 inch by 5 inch speed graphic or a K24 aerial camera, or in color with a 35 mm Kowa single lens reflex. The camera position was marked on the 1:24000 topo maps and the photo was assigned a reference number number.
- c. When feasible, a six-foot stadia or range rod was included in the outcrop photo for scale.
- d. The prints were marked with the correct identification number and assembled into panoramas.
- e. The scale was marked on each panorama.
- f. The thickness and length of each sand lens in each panorama was measured using the photos and field notes. Figure 11 is a typical example of a photo mosaic of an extensive lens system and Figure 12 is a photo mosaic showing some small lenses.
- g. The length (L), thickness (H), and length/thickness (L/H), ratios were tabulated and form the basis of the statistical analysis. (See Table I.)

2. Statistical Analysis

The data from Table I was classified into thickness interval (see Table II), and the log cumulative frequency of the L/H ratios in the various classes are presented in Figure 13. The median, L/H ratios and the standard deviations vary in the different thickness classes as shown in the following table:

Figure 11. Portion of typical photomosaic showing sandstone lenses with high L/H ratios.

500 Feet

R101W

T
2
S

75°

N

1 Mile

Figure 12. Portion of typical photomosaic showing sandstone lenses with low L/H ratios.

TABLE I

OUTCROP GEOMETRIC DATA

<u>Length/Height</u>	<u>Length (ft)</u>	<u>Height (ft)</u>	<u>Orientation</u>
* 135	* 2700	20	145 Degrees
* 115	* 2300	20	140
* 40	* 800	20	135
* 35	* 700	20	135
* 35	* 700	20	135
44	2200	50	160
* 90	* 1800	20	135
* 75	* 1500	20	135
30	600	20	135
* 75	* 1500	20	135
* 25	* 500	20	120
* 130	* 2600	20	160
* 90	* 1800	20	90
12	360	30	110
20	400	20	110
* 20	* 500	25	110
9	270	30	110
8	120	15	110
* 20	* 400	20	110
* 20	* 400	20	110
* 20	* 500	25	110
* 20	* 300	15	110
* 12	* 24	2	110
* 30	* 120	4	110
5	10	2	110
50	50	1	110
20	20	1	110
20	90	3	110
10	20	2	110
100	400	4	110
40	40	1	110
* 20	* 120	6	110
* 14	42	3	110
8	40	5	110
5	5	1	110
15	15	1	110
12	12	1	110
35	70	2	110
15	300	20	130
37	300	8	130
20	80	4	130

* denotes greater than (>)

TABLE I
OUTCROP GEOMETRIC DATA
Page Two

<u>Length/Height</u>	<u>Length (ft)</u>	<u>Height (ft)</u>	<u>Orientation</u>
167	2000	12	0 Degrees
250	1000	4	0
24	470	24	65
20	510	26	65
16	520	32	65
30	180	6	130
23	230	10	130
40	160	4	130
53	530	10	130
11	90	8	130
10	90	9	130
23	180	8	130
42	210	5	130
17	120	7	130
17	250	15	130
16	130	8	130
20	120	6	130
16	160	10	130
30	300	10	130
21	250	12	130
19	130	7	135
28	280	10	135
15	300	20	135
* 34	* 1200	35	150
17	170	10	145
12	50	4	145
24	120	5	145
20	240	12	145
17	200	12	145
23	680	30	145
23	700	30	145
34	680	20	145
12	360	30	145
20	900	45	140
17	330	20	140
9	170	20	140
* 18	210	12	**
* 29	230	8	**
11	92	8	**
13	170	13	**
* 24	* 480	20	**

* denotes greater than (>)

** not available

TABLE I
OUTCROP GEOMETRIC DATA
Page Three

<u>Length/Height</u>	<u>Length (ft)</u>	<u>Height (ft)</u>	<u>Orientation</u>
28	420	15	** Degrees
24	334	14	**
17	100	6	**
15	60	4	**
20	80	4	**
48	1200	25	145
* 40	* 480	12	145
33	230	7	145
88	350	4	145
48	190	4	145
38	300	8	145
* 50	* 600	12	145
37	220	6	145
* 14	* 280	20	145

* denotes greater than (>)

** not available

TABLE II

L/H RATIOS CLASSIFIED BY THICKNESS INTERVALS

<u>< 5'</u>	<u>5'-10'</u>	<u>10'-20'</u>	<u>20'-30'</u>	<u>> 30'</u>
5				
8	8	13	9	9
10	10	16	15	12
12	11	17	17	16
* 12	11	17	20	20
* 14	17	17	* 20	23
15	17	* 18	* 20	23
20	19	20	* 20	* 34
20	20	20	24	* 44
20	23	* 20	* 24	
* 30	24	* 20	* 25	
35	* 29	21	30	
40	30	23	34	
50	37	24	* 35	
50	42	28	* 35	
60		28	* 38	
80		30	* 40	
100		53	* 65	
160			* 70	
			* 75	
			* 75	
			* 90	
			* 115	
			* 130	
			* 150	
Median				
<u>26</u>	<u>18</u>	<u>21</u>	<u>45</u>	<u>18</u>
16 Percentile				
84 Percentile				
10/66	11/30	16/27	20/100	11/32

* denotes greater than (>)

Figure 13.

<u>Thickness Class</u>	<u>Median L/H Ratio</u>	<u>Standard Deviation (Log Cycles)</u>
< 5'	26	.4
5'-10'	18	.22
10'-20'	21	.1
20'-30'	45	.35
> -30'	18	.24

The hypothesis that the various thickness classes represented different populations was tested using the F distribution test.⁽¹⁶⁾ The F statistic had a value of 1.643 with 4 and 90 degrees of freedom. The F in this situation must have a value of at least 2.47 to be significant at the 0.05 probability level. Therefore, the sandstone lenses must be considered to come from a single population or populations exhibiting statistically insignificant differences in means and standard deviations. For this study, all data will be considered to be representative of one general population.

The data from Table I were processed to evaluate the mean and standard deviation of all the data. These values are:

Mean of L/H ratios 34.4

Standard deviation .74
(in log cycles)

The correlation coefficients between thickness and L/H ratio and between outcrop orientation angle and L/H ratio were determined. They were:

<u>Parameter</u>	<u>Correlation Coefficient</u>
H versus L/H	.01
ϕ versus L/H	-.39

In this case, a correlation coefficient of .20 or greater is significant at the 0.95 probability level. Thus, the lack of correlation between the thickness class and L/H ratio is confirmed. However, a low but statistically significant correlation between L/H ratio and outcrop orientation is indicated. These orientation parameters are cross plotted in Figure 14 and indicate a minimum L/H ratio in outcrops with an orientation of 100° to 160° or 280° to 340°, i.e., a tendency to be

Figure 14. L/H Diagram, showing the relation between the mean L/H ratio and the outcrop orientation. The dotted portions are averages of adjacent sectors.

perpendicular to the long dimensions of the sand bodies in outcrops with this orientation. Thus, the general direction of stream flow may be to the northeast since this was also the orientation of a number of trough cross bedding sets measured in the outcrops. However, the correlation is low and somewhat skewed by the two large L/H ratios in outcrops with an orientation near zero degrees. Since the sandstone orientation is an important consideration in developing reservoir models, additional field work should be done to tie this parameter down more completely.

3. Comparison of Statistical Results and Known Sandstone Body Geometrics

Sandstone bodies can be classified genetically into the following groups:

- bathyal-abyssal
- regressive marine
- transgressive marine
- deltaic
- lacustrine
- fluvial (channel or valley-fill)

Each of these types of deposits has characteristic geometric relationships and sedimentary structures. (17)

The regional studies of the Piceance Basin⁽¹⁸⁾ place the bulk of the Fort Union and Mesaverde formations in the fluvial facies. Thus, it is informative to review some of the geometric features of various types of sand bodies found in this facies, and to compare them with the results of the present outcrop investigation.

Some of the types of fluvial sand bodies recognized in the Cretaceous and adjacent rocks of the Rocky Mountain region are channel fill, (19, 20) point bar, (21, 22, 23) valley fill, (24, 25, 26) and overbank or floodplain deposits. (25) A comparison of the observed geometrics of these depositional types with the Fort Union-Mesaverde outcrop data should provide additional insight into the expected geometrical ranges.

Channel fill sandstones vary widely in size. They are typified by cut and fill structures and frequently form composite sand bodies both in plan and cross section. (27)

Outcrops frequently will display "typical" channel fill structure. This cut and fill sequence, displayed schematically in Figure 15, is termed a fining upward sequence and displays a characteristic pattern on an electric log (see Figure 16 a, b, and c). These figures display an S.P. log response to the composite channel fill sequence displayed in Figure 15. Figure 16a shows a complete channel fill sequence which has cut into a previously deposited channel. Figure 16b and c show a series of partially developed sequences resulting from profile locations that do not intersect the axial region of a single channel fill sequence.

The width of the channel is a function of the stream size, and varies from a few feet in small streams to more than a mile in major streams such as the Mississippi. The width of a channel fill deposit is approximately that of the channel in which it originated. The length of the deposit depends upon the local conditions of burial and subsequent erosion. Hence, there is no simple intrinsic width-length ratio for this type of "sandstone lens" although typical length/width ratios would be from 2.5 to >10. Typical channel width-height ratios are 10 to 14, but this also varies widely. (26)

Some of the Fort Union-Mesaverde sandstone layers in the outcrop study have the characteristics of channel fill deposits. These lenses are frequently in the range of from 20 to 30 feet in thickness.

Based upon the foregoing discussion, the expected "sizes" of channel fill sandstone would be thicknesses from 20 to 30 feet, widths from 200 to 420 feet, and lengths from 500 to >4000 feet.

The fining up channel fill deposit is typical of the deposits found along the majority of stream profiles. However, braided stream deposits frequently produce fining down sequences. The braided stream deposits also have smaller size sand bodies and more irregular sand/shale distributions than the more normal meandering stream deposits. (20, 26) Therefore, a more complex relationship is a possibility when a combination of braided and meandering stream deposits occur together. This possibility has not been ruled out in the course of this study.

Point bars are channel associated deposits. They have rather uniform relationships between channel width, radius of curvature, and meander length, (28) i. e. :

$$L \cong 10.9W$$

$$L \cong 4.7r$$

Figure 15. Highly schematized diagram to illustrate importance of section viewed in controlling apparent type of fining-upward cyclic sequence formed by a complex of cross-cutting, discrete channel fills.

In upper channel fill, complete A-E sequences can be observed only in axial region, as in section X-X'; a marginal section, Y-Y', begins with B₂ sandstone facies, and similar profile at Z-Z' begins with a slide breccia, followed by B₂ sandstone. Lower sequences indicate effects of erosion in truncating upper parts of fining-upward cycles.

(after Kelling, ⁽²⁷⁾ 1968)

Figure 16c. S.P. Log Response to a Series of Partial Channel Fill Sections.

Compare with Section Z-Z' in Figure 15.

where:

L = meander length, feet

W = channel width, feet

r = radius of curvature, feet

This relationship is plotted as Figure 17 for such diverse types of meandering as that exhibited by rivers, melt water streams flowing on ice, meandering of the Gulf Stream, and meanders produced in flume boxes. The width of a meander type sand body is approximately equal to the radius of curvature, and length is approximately equal to one-half the meander length. Thus, simple point bars have length/width ratios of approximately 2.4.

A couple of typical point bar type reservoirs are depicted in Figure 18.⁽²¹⁾ The length-width-thickness ratios for these two fields are:

Coyote Creek, L/W/H = 20,000/7000/75

Miller Creek, L/W/H = 13,000/4000/50

Unfortunately, not many sandstone lenses of this size are known from the alluvial facies of the Fort Union-Mesaverde in the Piceance Basin. However, some point bar type sandstone bodies with lengths greater than 1800 feet were observed along the Grand Hogback. (See Figure 19.) Hence, a few lenses with sizes of the order of length/width/thickness ratios of 2000/800/15 (feet) should be encountered.

Valley fill deposits occur when streams are rather sharply confined to a valley and the ensuing rocks form a genetic unit.

Valley fill deposits usually have dimensions in the range of from one-half to several miles in width and from a few to tens of miles in length. For instance, the dimension of the Cut Bank Sandstone, a Cretaceous valley fill reservoir in north central Montana⁽²⁴⁾ are: average thickness, 60 to 80 feet, width, 7 to 10 miles, length, approximately 35 miles. The Cretaceous "J sand" of eastern Colorado, Wyoming and western Nebraska is approximately 80 feet thick, 0.3 to 0.4 miles wide and more than 20 miles long.⁽²⁶⁾ Thus, the continuities of valley fill deposits are much greater than that exhibited by the Fort Union-Mesaverde sandstones in the Piceance Basin.

Figure 17. Channel Width and Mean Radius of Curvature versus Meander Length⁽²⁵⁾.

(after Leopold and Wolman, ⁽²⁷⁾ 1960)

Figure 18. Two Typical Cretaceous Point Bar Fields.

(after Berg, ⁽²¹⁾ 1968)

Figure 19. Point Bar Type Sandstone Lenses Exposed By Erosion of the Grand Hogback North of Rifle. Colorado.

The overbank and floodplain deposits do not have the cross bedding and other higher energy sedimentary structures found in Fort Union-Mesaverde sandstones lenses. This low energy environment produces thinly bedded silty sandstones, siltstones, and shales that are typical of the "between reservoir rocks." A typical sequence of this type of unit can be seen in Figure 11 underlying the lower (35 feet thick) sandstone body. The overbank rock is not reservoir material unless it possesses an interconnected fracture system. Hence, this type of rock is not of interest in the Fort Union upper Mesaverde section currently under study. (However, it may be the predominate matrix rock in the middle Mesaverde section.)

III. CONCLUSIONS

The Fort Union-Mesaverde sandstone bodies in the central Piceance Basin appear to be predominately fluvial channel fill deposits with some point bar sands. The most common observed thickness was between 20 to 30 feet and the mean length/thickness ratio (L/H) was 35 for all of the observed sand body lenses.

Length/width ratios (shape of body in plan view) are expected to be 2.4/1 or larger based upon an evaluation of the type of sandstone depositional environment that produced the Fort Union-Mesaverde reservoir rocks.

The channel fill sandstones probably have widths in the order of 350 feet and lengths that generally would be more than 1000 feet. The point bar type sandstones would be expected to have lengths in the order of 3000 + feet and widths in the order of 1200 feet. It is significant that more than 25% of the sand lenses, with a thickness of 10 feet or more, had lengths greater than 1000 feet. This augurs for some optimism on average drainage radius for nuclear stimulation in this area.

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APPENDIX II

SEISMIC SURVEY REPORT

REPORT
ON A SEISMOGRAPH SURVEY
CONDUCTED IN
RIO BLANCO COUNTY, COLORADO

PICEANCE CREEK PROSPECT

FOR

CER GEONUCLEAR CORPORATION
LAS VEGAS, NEVADA

Seismograph Service Corporation

A SUBSIDIARY OF RAYTHEON COMPANY
P.O. BOX 1590 TULSA, OKLAHOMA

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INTRODUCTION

A seismograph survey utilizing digital magnetic recording was conducted in Township 3 South, Range 98 West, in south central Rio Blanco County, Colorado, during October 1970, for CER Geonuclear Corporation. The purpose was to determine if subsurface faulting was present over the Piceance Creek Prospect.

DISCUSSION OF RESULTS

General

Two subsurface structural maps are submitted with this report. They are designated as:

Unidentified Tertiary
Unidentified Cretaceous - Near Dakota

The depth values presented on these maps should be considered estimated and were derived by applying an estimated constant average velocity for each horizon to time values obtained from the processed cross sections. The quality of the reflected data is considered poor to fair for the Unidentified Tertiary horizon and questionable to fair for the Unidentified Cretaceous horizon. Good seismic well ties were obtained on Line 2, at the Equity Oil Company No. 1 Government Fawn Creek test in Section 14 and at the Equity Oil Company No. 1 Boies test in Section 22, T 3 S, R 98 W, for the Unidentified Tertiary horizon, but the wells were too shallow to provide a tie for the Unidentified Cretaceous horizon.

An attempt to improve the quality of the stacked data was made on Line 2, by applying fiducialized trim static corrections derived from common depth point trace gather displays. This resulted in improving the Unidentified Tertiary reflection considerably and the Unidentified Cretaceous reflection to where a more reliable interpretation of the data could be presented.

The analog magnetic tapes for Line 27 were digitized and digitally processed for 100% conventional coverage in an attempt to provide better data than the original analog processed data. The results showed no significant improvement, therefore, the original interpretation was used and the depth values adjusted to the present control.

Reduced prints of both structural maps are submitted as pages 5 and 6 of this report.

Detailed Discussion

Unidentified Tertiary

The event associated with the Tertiary appears to originate approximately 200 feet above the Or. Marker zone identified in the tests in Sections 14 and 22.

The contour interpretation shows regional dip to the northeast at the rate of about 300 feet per mile. The possibility of faulting at this level appears to be limited to the southwest portion

SYMBOLS	CLASSIFICATION OF DATA
o Shalepoint	G Good or positive
x Depth Point	F Fair or reliable
• Oil Well	P Poor or possible
o Gas Well	E Estimated
o Dry Hole	7 Questionable
o Drilling Well	Continuity questionable
o Well Location	No continuity
o Abandoned Oil Well	RA Reflection absent in zone being mapped
o Abandoned Gas Well	NR No reflections at any time level
o Direction of Dip	Accuracy not precise
o Two-dimensional displaced depth point with or without third dimension estimated	
o Three-dimensional displaced depth point	
o Contoured depression or interval thickening	
o Established section or survey corner (when designated)	
o Established section or survey line (when designated)	

CER GEONUCLEAR CORPORATION

SEISMIC MAP

PREPARED BY

Geonuclear Service Corporation
Tulsa, Oklahoma, U.S.A.

PICEANCE CREEK PROSPECT
RIO BLANCO COUNTY, COLORADO

UNIDENTIFIED TERTIARY

Contour Interval: 100 Feet
Reference Datum: Sea Level
Elevation Datum: +6900 Feet
Elevation Velocity: 7500 Ft./Sec.
Average Velocity: 8500 Ft./Sec.

Final Report Date: February 8, 1971
Contract Number: 2441-1
Party Chief: J.B. Stout

Supervisor: G.E. Randolph

Checked By: J. S. Jackson

SYMBOLS

- o Shotpoint
- Depth Point
- Oil Well
- Gas Well
- Dry Hole
- Drilling Well
- Well Location
- Abandoned Oil Well
- Abandoned Gas Well
- Direction of Dip
- Two-dimensional displaced depth point with or without third dimension estimated
- Three-dimensional displaced depth point
- Contoured depression or interval thickening
- Established section or survey corner (when designated)
- Established section or survey line (when designated)

CLASSIFICATION OF DATA

- G Good or positive
- F Fair or reliable
- P Poor or possible
- E Estimated
- Q Questionable
- Continuity questionable
- No continuity
- RA Reflection absent in zone being mapped
- NR No reflections at any time level
- Accuracy not precise

CER GEONUCLEAR CORPORATION

SEISMIC MAP

PREPARED BY

Geophysical Service Corporation
Tulsa, Oklahoma 74101

PICEANCE CREEK PROSPECT
RIO BLANCO COUNTY, COLORADO

UNIDENTIFIED CRETACEOUS-NEAR DAKOTA

Contour Interval: 100 Feet
Reference Datum: Sea Level
Elevation Datum: 6900 Feet
Elevation Velocity: 7500 Ft./Sec.
Average Velocity: 12,000 Ft./Sec.

Final Report Date: February 8, 1971

Contract Number: 2441-1

Party Chief: J.B. Stout

Supervisor: G.E. Randolph

Checked By: J.M. Jackson

of Line 3 in Section 20. The other areas of no continuity depicted on this horizon are believed to be caused by weak reflected data and/or poor control for the static corrections used in these areas.

Unidentified Cretaceous - Near Dakota

The Unidentified Cretaceous event is believed to be associated with the Dakota horizon and is of much poorer quality and weaker definition than the shallower horizon mapped; therefore, the interpretation presented is considered to be somewhat questionable.

Regional dip at the rate of about 550 feet per mile to the northeast appears reliably established at this level. Although faulting is a possibility in the areas of no continuity, it is believed that the lack of good static correction control and generally weak reflected data are the dominant reasons for these questionable areas. The presence of faulting is suggested on that portion of Line 3 located in Sections 17 and 20, but is not reliably defined because of the poor seismic data.

CONCLUSIONS AND RECOMMENDATIONS

The presence of regional dip varying from about 300 feet per mile on the Unidentified Tertiary horizon to about 550 feet per mile at the Unidentified Cretaceous level seems reliably established by the seismic data.

An indication of possible faulting is suggested on Line 3 in Sections 17 and 20, T 3 S, R 98 W, at both levels mapped. Further definition of the suspected faulting is questionable with the present control and poor data quality in this immediate area.

It is believed that the other questionable and no continuity areas depicted on both horizons are the result of very weak reflected data, poor control for static corrections, and an abundance of low frequency interference. It is recommended that if additional seismic exploration is undertaken in this area that at least 600% common depth point coverage be obtained, and that use of the "VIBROSEIS"* method be considered in an attempt to reduce the amount of interference generated by shotholes.

/ho
February 8, 1971

Checked by:

Respectfully submitted,

SEISMOGRAPH SERVICE CORPORATION

By: J. B. Stout, Party Chief

By: G. E. Randolph, Supervisor

J. G. Jackson, Senior Geophysicist

2441-1

* Trademark of Continental Oil Company

WYOMING

NEBRASKA

UTAH

KANSAS

NEW MEXICO

OKLAHOMA

SCALE IN MILES

0 5 10 20 30 40 50 60 70 80 90 100

AREA SURVEYED

APPENDIX II

PHYSIOGRAPHY

Topography:	Hilly uplands
Population:	Sparsely populated
Culture:	80% pastureland, 20% timber
Drainage:	Intermittent drainage in a north-easterly direction, furnished by Fawn Creek, a tributary to Piceance Creek
Soil:	Brown, clay, sandy, sandy clay
Weather:	Generally fair, mild
Roads:	75% trails, 25% none
Access to area from headquarters:	Via Colorado Highway No. 64 and Colorado Highway No. 13, an average distance of about 35 miles from headquarters
Traverse difficulties:	Rugged terrain, timber. Bulldozer used to clear trails in timber.

APPENDIX III

GEOLOGY

Near-surface formation:

Green River formation of
Tertiary age

Subsurface log:

Equity Oil Company No. 1 Government
Fawn Creek, SW NW Section 14
T 3 S, R 98 W
Rio Blanco County, Colorado

Dry hole

Elevation: 6629 ft. (K.B.)
Or. Marker +4523
I. Marker +2344
Top of
Cretaceous +549
T.D. 7895 ft.

Major unconformities:

Between Tertiary and
Cretaceous

Regional dip:

Approximately northeasterly

Potential producing horizons:

Sands and limes of
Tertiary age
Sands and limes of
Cretaceous age

Type structures expected:

Folded structures: domes, anti-
clines; fault traps, stratigraphic
traps

Well control:

Tied to: Equity Oil No. 1
Government Fawn Creek

Equity Oil No. 1 Boies

APPENDIX IV

OPERATION METHODS

Method used:	Continuous profiling, common depth point 400% coverage
Spreads used:	Straddle
Normal length:	5280-0-5280 feet
Distance between shotpoints:	1320 feet
Distance from shothole to close geophone stations:	220 feet
Number of geophone stations adjacent to hole:	2
Geophone station spacing:	220 feet
Geophones used:	HS-J, 14 Hz, .7 damping factor
Number per trace:	18
Connection:	Series
Spacing in group:	12 feet
Arrangement in group:	Straddling station, in line
Instrumentation:	
Type amplifiers:	TI DFS III
Number of channels:	48
Filter settings:	
Monitor and tape:	12 to 124 Hz
Field playback:	12 to 124 Hz
Processed sections:	TVBP 0 to 1.6 = 12-18-35-40 Hz 1.4 to 4.0 = 5-10-25-30 Hz
Type mixing:	None
Type camera:	48 trace

APPENDIX IV (Contd.)

OPERATION METHODS (Contd.)

Shothole data:

Type drilling:	Rotary with water and air
Special equipment used:	Portable pits, prefabricated hole plugs

Shothole depths:

Normal:	140 feet
Number of holes used per location:	1
Formations encountered:	Sand, gravel, shale, sandstone
Best shooting depth:	117 feet
Dynamite charges:	
Normal:	75 pounds
Range:	50 to 75 pounds, holes preloaded

Elevation survey:

Based on USGS bench marks. All seismic locations on closed elevation traverses tied within a maximum horizontal error of 200 feet, and a maximum vertical error of 2.3 feet.

Operational difficulties:

Inaccessibility of prospect: had to use bulldozer to open trails in timbered areas.

STATION AND SHOT HOLE ARRANGEMENT

LEGEND

Shot Hole Under Test	⊙
Adjoining Shot Hole	○
Station Number	1-24
Line of Traverse	----
Geophones per Station	18
Geophone Spacing	12'

APPENDIX V

OPERATING STATISTICS

Basic crew:

Crew headquarters:	Meeker, Colorado
Starting date:	October 11, 1970
Completion date:	October 16, 1970
Number of holes shot:	48
Linear miles covered:	10,958
Dynamite used:	3550 pounds
Type:	Hi-velocity
Number of caps used:	50
Normal length leads:	150 feet

Drilling:

Number of drills used:	1
Total drill hours:	Drills on footage basis
Number of holes drilled:	48
Total footage drilled:	6720 feet
Average length water hauls:	1/2 to 1 hour
Number of sets bit blades used:	10
Type:	4-3/4 inserted
Mud used:	1250 pounds
Type:	Quick Gel

Bulldozer time:	25.0 hours
-----------------	------------

APPENDIX VI

CALCULATION AND INTERPRETATION METHODS

Record quality:	Fair to NR, low frequency
Type correction used for final data:	Normal uphole
Other corrections calculated:	Summation
Individual trace corrections used for replay sections:	Summation, adjusted to normal uphole correction
Spread correction:	Used; applied to individual traces on replay sections
Time reference datum:	6900 feet above sea level
Weathering velocity, v_o :	2500 feet per second
Elevation velocity, v_e :	7500 feet per second
Type replay cross sections prepared:	Galvo-area combination
Final data normally obtained from:	400% stacked sections
Horizons mapped:	
Unidentified Tertiary	
Time range:	371 to 677 milliseconds
Depth range:	+5323 to +4022 feet
Velocity, v_a :	8500 E feet per second
Unidentified Cretaceous - Near Dakota	
Time range:	1565 E to 2013 milliseconds
Depth range:	-2490 to -5178 feet
Velocity, v_a :	12,000 E feet per second

DEPTH DETERMINATION FOR CONTINUOUS PROFILING Using Normal Uphole Corrections

LEGEND

S = Shotpoint Location
 G = Geophone Location
 X = Surface Distance
 ds = Depth of Charge
 dw = Thickness of Low Velocity Layer
 ts = Uphole Time
 ED = Elevation or Reference Datum
 Z = Depth below ED
 tr = Recorded Reflection Time
 tc = Corrected Reflection Time
 tx = Normal Moveout Correction
 vo = Average Velocity in Low Velocity Layer
 ve = Elevation Correction Velocity
 va = Average Velocity to Reflecting Horizon

te = de/ve
 tw = dw/vo
 Es = Elevation of Shotpoint
 Eg = Elevation of Geophone
 Em = $\frac{1}{2} (Es + Eg)$
 Em' = $Em - ds = \frac{1}{2} (Es' + Eg')$
 Es' = $Es - ds$
 Eg' = $Eg - ds$
 des = $Es' - ED$
 deg = $Eg' - ED$
 tx = $\frac{x^2}{2va^2tc}$

tc1 = $tr1 - tes1 - teg1 - ts1$
 = $tr1 - 1/ve (Em' - ED) - ts1$
 Z1 = $\frac{1}{2} va tc1$

tcn = $trn - tes1 - tegn - ts2$
 Zn = $\frac{1}{2} va (tcn - txn)$

APPENDIX VII

MATERIAL SUBMITTED SEPARATELY

Base shotpoint tracing
Sepias with data
All records for the survey - monitor and playbacks
Magnetic tapes
Plane table sheets
Surveyor's field notes
Driller's reports
Replay sections:
 Variable area-variable amplitude
 Films from which above sections were taken
Calculation book containing:
 Calculation and interpretation methods
 Time-depth conversion tables
 Weathering graph sheets
 Fiducial correction calculations
 Replay instructions
 Observer's reports
 Shooter's reports

APPENDIX III - A

FAWN CREEK DAILY REPORTS

FAWN CREEK DAILY REPORTS

Friday, May 22, 1970

Moved in Barker rig. Rigged up over hole. Mixed 300 bbls 2% KCl water. Shut-in casing pressure 2400 psig. Blew well down for 20 hours while rigging up and mixing KCl water. Well blew down in approximately 1 hour, making about 300 MCF/D. Pumped KCl water down tubing, circulating up annulus. Circulated with approximately 200 bbls KCl water in hole. Circulated to pit. Making some gas with water.

Saturday, May 23, 1970

Circulated with 2% KCl water holding 750-1000 psig back pressure on annulus for four hours. Pumping at approximately 2 BPM. Small amount of light green oil on water in steel mud tank. Let well bleed down pressure. Removed National 6 inch Series 900 top flange and installed Shaffer hydraulic double gate BOP. Pulled 114 stands 2-3/8 inch tubing. Picked up 4-3/4 inch bit, casing scraper, two 3-3/8 inch drill collars and ran in hole to 2550 feet KB. Circulated for 45 minutes. Ran scraper to 6469 and circulated for 3 hours. Dresser Atlas arrived on location at 6:00 am. Pulled pipe and drill collars. Rigged up Dresser Atlas.

Sunday, May 24, 1970

Ran Baker Model "N" drillable bridge plug on wireline with collar indicator to 6460 and set. Dump bailed 2 sacks neat Class "A" cement using glass bottom bailer. Dumped cement at 10:45 am. - WOC. Ran in 30 stands of 2-3/8 inch tubing, came out laying down. Rigged up for logging. Ran Gamma Ray-Neutron Log with collar indicator and Cement Bond Log with variable amplitude density from bridge plug (6420 feet) to 4500 feet. Cement top at 4660. Good bonding from 6420 to 5050. Fair bonding from 5050 to 4730. Ran in remainder of 2-3/8 inch and came out laying down. Installed dual tubing hanger and BOP's. Tested BOP's, casing and bridge plug to 1500 psig. Held okay. Mixed 350 bbls 2% KCl water for fracing.

Monday, May 25, 1970

Perforated gas sand from 5745 to 5794 with 15 NCF-II jet shots. Perforated zone in two runs as follows: 5792, 87, 82, 79, 77, 75, 73, 71, 67, 64, 61, 58, 54, 50 and 47 (correlated with Dresser Atlas GR-N log). Released Dresser Atlas. Running Brown Oil Tool Husky H-2 dual hydraulic packer on 2-1/16 inch tubing. Nineteen new joints of 2-1/16 inch tubing on bottom. Harbison Fisher seating nipple one joint above packer. Hydrotesting old 2-1/16 tubing going in the hole. Ran a total of 176 joints 2-1/16 inch tubing, seating nipple and double pin sub. Packer sealing element set at 5702 measured from tubing hanger. Seating nipple at 5666.6 feet from hanger. Ran 177 joints 1.900 inch O.D., J and L, JCW-55, IJ tubing with

Monday, May 25, 1970 ---Continued

Brown Oil Tool J-Latch stinger on bottom, one 2 foot tubing sub and 1.900 inch IJ tubing to 2.062 IJ tubing swage to hanger. Latched into packer, landed with 4000 lbs on packer. Moved out substructure and removed BOP.

Tuesday, May 26, 1970

Installed OCT tree on head and tested to 4000 psig - held okay. Circulated down 1.900 inch tubing and up 2-1/16 inch for 30 minutes. Put ball in 2-1/16 inch string, pumped down hole to set packer. Pressured up to 4300 psig when shear ring released. Casing pressure built to approximately 1500 psig during the time that the packer and 2-1/16 inch was pressured to 4300 psig. Bled off casing and left open. A small stream of water came out while pumping at 4300 psig to shear ring. Ring finally sheared. After pressure bled off, the stream coming out the annulus quit. Pressured up annulus to 1500 psig, got small stream of water out 2-1/16 inch and 1.900 inch. Ran several tests with conflicting results. Casing pressure held at 1600 psig for 2 hours, bled off and repressured. Could not get pressure to hold, water would flow out 2-1/16 inch and 1.900 inch. It appears that we may have a small split in the tubing that acts as a check valve if the pressure is on the annulus, but will not hold if the pressure is on the tubing. Rigged up a testing tool with rubber cups opposed. Pumped the tool down the 2-1/16 inch - landed in the seating nipple. Pressured up the 2-1/16 inch to 1500 to 2000 psig. Circulated water back up the annulus but not the 1.900 inch. The leak is in the 2-1/16 inch but must be very small judging from the "leak off" rate. Reversed the tool out of the hole by pumping down the 1.900 inch. Removed Christmas Tree, installed BOP and moved in substructure. Rigged up to pull 1.900 inch. Pulled 1.900 inch tubing, seal nipple looks okay. Rigged up to pull 2-1/16 inch. Released packer and started out of hole.

Wednesday, May 27, 1970

Pulled 2-1/16 inch and packer could not locate leak from visual observation but laid down 7 joints of tubing that looked bad. Box on 2-1/16 inch showed wear. It looks like it had rubbed against another string of tubing. The 2-1/16 inch had been rod pumped before we received it. Apparently the tubing had not been anchored and was "breathing" and wore thin spots from rubbing against the other string. Ordered out a complete new string of 2-1/16 inch IJ tubing to go with the 19 new joints on hand. Going in hole with old 2-1/16 inch to come out laying down. New pipe is coming from Casper. Laid down all of old 2-1/16 inch tubing.

Thursday, May 28, 1970

New tubing arrived on location. Singling in new tubing without packer. Will stand back in derrick in doubles. Waiting on Brown Oil Tool packer. Will hydrotest both strings of tubing going in the hole.

Friday, May 29, 1970

Brown packer arrived in Denver at 10:00 a.m. Called out hydrotesters on location at 4:00 p.m., packer arrived at 5:00 p.m. Ran in hole with new 2-1/16 inch, laid out one bad joint. Ran packer seating element to 5722 feet KB, with 176 joints 2-1/16 inch, one 4 foot sub, and seating nipple, set nipple 4 feet above packer, one 12 foot sub, and double pin sub to hanger. Started testing 1.9 OD tubing, went too slow as tool was hanging up inside of joints, released hydrotesters.

Saturday, May 30, 1970

Finished running 1.9 OD IJ tubing, latched into packer with BOT seal assembly. Removed BOP and substructure, installed OCT tree and tested to 4000 psig. Held okay. Circulated down 1.9 OD tubing and up 2.062 tubing. Dropped ball and waited 33 minutes. Pressured up and set packer at 3000 psig, sheared out ring with ball at 3900 psig. No pressure on annulus. Pressure tested annulus for 15 minutes, held okay. Called out Halliburton. Hooked up Halliburton - pressure tested lines to 6500 psig. Acidized perforations with 200 gallons 15% inhibited HCl. Displaced through perforations at 1/4 to 1/2 BPM. Shut down, let soak 15 minutes. Rigged wellhead for frac. Pumped 3000 gallons pad volume 2% KCl water with 20#/1000 gallons WG-6 gelling agent and 20#/1000 gallons WAC fluid loss additive and 10#/1000 gallons CW-1 breaker, CO₂ concentration approximately 1000 scf/bbl during job. Broke back at 12 BPM at 5000 psig to 14 BPM at 4500 psig. Started sand in at 1/2#/gal. Pumped 3000 gallons, increased concentration to 1# 20-40 mesh sand/gal. Pumped total of 2500 pounds sand, 250 bbls frac fluid. Average rate 13 to 13-1/2 BPM at 4400 psi. ISIP - 1100 psig. Started flowing well to pit immediately. Released Halliburton. Well flowing CO₂ and frac water to pit.

Sunday, May 31, 1970

Released rig at 6:00 a.m. Moved off of location. Well flowing gas and water mist to pit. 3/4 inch choke on 2-1/16 inch string. Estimated rate at 1 BWPH.

Monday, June 1, 1970

Flowing gas and water mist to pit, 3/4 inch choke, estimated at 1/2 to 1 BWPH.

Tuesday, June 2, 1970

Flowing gas and water mist to pit, 3/4 inch choke, estimate at 1/2 BWPH.

Wednesday, June 3, 1970

Flowing gas and water drip to pit, 3/4 inch choke, estimate at 1/4 BWPH. Rigged up gin pole to run pressure sentry.

Thursday, June 4, 1970

Flowing gas and water drip to pit, 3/4 inch choke, estimate at 2 BWPD.

Friday, June 5, 1970

Flowing gas and water drip to pit, 3/4 inch choke, estimate at 1 BWPD.

Saturday, June 6, 1970

Flowing gas and water drip to pit, 3/4 inch choke, estimate at 1 BWPD.

Sunday, June 7, 1970

Flowing gas and water drip to pit. 3/4 inch choke. Installed 2 inch Merla flow prover with 3/8 inch plate. Gas rate calculates at 90 MCF/D.

Monday, June 8, 1970

Gas rate 85 MCF/D. 3/8 inch Orifice approximately 28 psia. 2-3 BWPD.

Tuesday, June 9, 1970

Flowing to clean up. 3/8 inch Orifice, 14 psig. Gas rate approximately 79 MCF/D. Water rate estimated at 5-6 BWPD.

Wednesday, June 10, 1970

Flowing to pit. 3/8 inch Orifice, 12 psig. Gas rate 73 MCF/D. Water picking up approximately 6-7 BWPD, estimated.

Thursday, June 11, 1970

Flowing to pit, 3/8 inch Orifice - 10-12 psig. Gas rate approximately 70 MCF/D. Water estimated at 10 BWPD. Removed Merla prover to install at Scandard Draw.

Friday, June 12, 1970

Flowing to pit. Gas rate estimated at about the same, approximately 70 MCF/D. Water rate gauged at 1 qt/27 secs = 19 BWPD. Running Ball Brothers sentry to determine liquid level in 1-1/2 inch tubing. Gas gradient to bottom. Well flowing during run in stations at 1000, 2000, 3000, 4000, 5000, 5500 and 5720 feet. Ball Brothers instrument stuck either in packer or coming up into packer. Will leave alone until weight indicator installed gauge at 5715 feet KB. Shut well in at 5:00 p.m. for buildup. Recorder and sentry operating okay. Taking readings on hourly schedule.

Saturday, June 13, 1970

Shut in for buildup, Ball Brothers instrument at 5715 feet KB.

Sunday, June 14, 1970

Shut in for buildup.

Monday, June 15, 1970

Ball Brothers instrument stopped working. There appears to be a short in the system. May be a leak in electrical connection in the instrument.

Tuesday, June 16, 1970

Well shut in - rigging line to blow well down, instrument not working and stuck at 5715 feet KB.

Wednesday, June 17, 1970

Blew down Fawn Creek. Ball Brothers instrument stopped working. Instrument stuck in or near packer.

Thursday, June 18, 1970

Worked on Fawn Creek trying to pull instrument free. No luck.

Friday, June 19, 1970

Rigging up to kill well with 2% KCl water. Mixing water and rigging lines. Will kill well tomorrow morning. C. A. White fishing service will be here in the A.M. If we can't pull free we will cut line at instrument and go in with wire line overshot and jars to jar free. Don Smith with C. A. White will be here from Casper. Full crew from Barker on location. Ball Brothers making up new instrument. Shipped drawings and fishing neck air freight to Grand Junction yesterday, Owen Coats will pick up.

Saturday, June 20, 1970

Fishing neck and drawings did not arrive. Pumped down 2-1/16 inch and up 1-1/2 inch. Worked on fish, pulled fish free from tight spot at 5715 feet, hung up tight about 5580 feet. Worked to free tools, pulled 1/8 inch line free of rope socket. Rigged up pulling unit, making rope socket connection to 9/16 inch sand line.

Sunday, June 21, 1970

Rigged up, going in hole with overshot hydraulic jars, mechanical jars on 9/16 inch sand line. Caught fish at approximately 5540 feet. Sand line measurement - worked and jarred on fish, very tight, came out of hole with tools, appeared to be on fishing neck but pulled free. Removed tree, put on orbit valve. Went in with sand line, caught hold of fish. Picked up 4 feet on 1-1/2 inch tubing and worked on fish. Came out of hole with 9/16 inch line and tools. Did not indicate that we had hold of fishing neck but we could sit down on fish. Went back in with tools to try again, no luck. Came out of hole, released C. A. White hand, rigging up to pull 1-1/2 inch. Pumped total of 160 barrels 2% KCl water into formation.

Monday, June 22, 1970

Rigging up to pull 1-1/2 inch, circulated tubing to remove gas, well dead. Brown Oil tool hand should be on location at 5:00 p.m. tonight with new "J" latch sub and packer. Sub-structure moved in. Tree removed and orbit valve installed. Will come out of hole with offset spool and stripper head on orbit valve. Came out of hole, found fish in third stand off bottom. Had to cut joint in several places to get instrument out. 50 to 75 feet of 1/8 inch line "bird nested" on top of instrument and line had doubled back below instrument and wedged it in pipe. This must have happened while pulling on instrument and pumping from below. When instrument came loose it pumped up past wire line and wedged. BOT arrived on location, put on new "J" latch and ran 1-1/2 inch back in hole. Tried drifting packer with sinker bar and found it would not go through packer. BOT will rebores packer and drift with 6 foot x 1-1/4 inch rabbit before bringing out packer to next job. Landed 1-1/2 inch tubing with 3000 pounds on packer. 88 stands and 22 feet of subs (12 feet, 8 feet and 2 feet), put on wellhead and pressure tested flanges to 4200 psi. Held okay. Released crew for the day.

Tuesday, June 23, 1970

Barker rig on location. Moved on 3/4 inch rods - pressure tested annulus to 600 psig. Held okay. Ran 1-1/2 x 1-1/4 x 10 x 16 Harbison Fisher "Lock-No" B.H. pump with 52 feet of 3/4 inch pipe stinger on bottom - pump is bottom hold down type. Ran in hole with 225 3/4 inch rods, 1-8 feet, 2-6 feet, 3/4 inch pony rods and 1-1/8 inch x 22 feet polish rod - 3/4 inch stinger pipe has beveled collars top and bottom, 2 joints x 21 feet each, one joint by 10 feet perforated and orange-peeled on bottom, total 52 feet. Tagged SN and spaced out pump. Did not seat pump, waiting until pumping unit is set.

Wednesday, June 24, 1970

Moved out floor and pad, dug holes for tie downs for pumping unit. Pumping unit at Scandard Draw to be moved to Fawn Creek. Installed anchors. Waiting on pumping unit.

Thursday, June 25, 1970

Well shut in - waiting on pumping unit. Did not use rig, set boards for base for pump unit. Set pump unit substructure and separator. Tied in line to propane tank to near pump unit location. Received new Ball Brothers BH sentry. Made up rope socket, checked out okay. Waiting on pumping unit. Equity moved off their 2-3/8 inch tubing except for 10 joints we were using.

Friday, June 26, 1970

Well shut in. Barker moved on pumping unit. Casada started to set on sub base and one 9 inch pole collapsed. Called out Bob Jones truck from Vernal, set unit on base. Had welder make revisions to separator unit. Connected line to tank from separator. Had Casada haul junk pipe from Fawn Creek (85 stands) and Scandard Draw (30 joints) to Equity yard and set on trailer - 2-1/16 inch junks. Did not start up pump unit - too late at night, 8:30 when set. Had welder make barrel stand for gasoline for generator engine out of bad joint of 1-1/2 inch tubing cut off to retrieve Ball Brothers instrument.

Saturday, June 27, 1970

Made up flow and test lines, wellhead to separator and pit and tank. Spaced out pump. Seated and hung off rods - pumped up well - rigged down unit - put up gin pole. Made up lubricator, put Ball Brothers instrument in lubricator. Took several pressure readings, some near 250 pounds, some near 2900 psig. Actual pressure was near 1050 psig at start. Blew well and pumped to separator. Most of Ball readings after flowing awhile were near 2800 psig. Actual was from 1050 to 100 psig. Cannot use Ball instrument. Plan to pull Amerada at Scandard Draw and run in Fawn Creek after retrieving from Scandard Draw well. Pumped and flowed well overnight. Gas flow to 1/8 inch plate on Merla prover. Pumping water at approximately 4 BWPH - left pumping and flowing overnight.

Sunday, June 28, 1970

Well shut in. Waiting to run Amerada sentry from Scandard Draw well.

Monday, June 29, 1970

Well shut in - waiting to run Amerada sentry from Scandard Draw well.

Tuesday, June 30, 1970

Ran Amerada sentry - made stops at surface, 1000, 2000, 3000 feet - reading obtained at 3000 feet indicates problem in sentry or connection. Left sentry at 3000 feet - started pumping and flowing well. Pumping H₂O at rate of 2 BWPH. (Loyd Snow watching 24 hours per day.) Making approximately 40 MCF/D of gas with 200 to 400 pounds back pressure on well.

Wednesday, July 1, 1970

Purchased Amerada sentry (by CER), arrived with other equipment, recorder, etc. Checked out with new recorder, still indicates problem down hole. Pulled sentry, made new rope socket and let sealing compound set overnight. Pumped and flowed well, making approximately 2 BWPH, approximately 40 MCF/D gas with 200 to 400 psig back pressure.

Thursday, July 2, 1970

Pumping and flowing well, checked out operation of rental pressure element, would not function. Installed CER pressure element with rental temperature element. Ran to 5700 feet KB with gradient stops at 1000, 2000, 3000, 4000, 4500, 5000, 5500 and 5700 feet. Well pumping and flowing gas to pit through separator, making approximately 1-1/2 BWPH and approximately 40 MCF/D gas. Pressure sentry working okay. Owen Coats sent rental pressure to Tulsa for repair.

Friday, July 3, 1970

Pumping and flowing at approximately 1 to 1-1/2 BWPH and approximately 40 MCF/D gas. Pressure sentry working okay.

Saturday, July 4, 1970

Pumping and flowing Fawn Creek. Water rate dropped to 8-10 BWPD, gas rate constant at 40 MCF/D. Repacked rubbers on stuffing box. Pumping well intermittently, both surface recorders sent back to Indel for repair. New recorder had a bad transformer. Old recorder not working right. Indel sending out manual recorder. Will shut well in for initial buildup when recorder arrives.

Sunday, July 5, 1970

Pump and flow well, rate at approximately 36 MCF/D. Liquid produced at approximately 10 BPD. Cumulative water reading at 386 = 223 barrels.

Monday, July 6, 1970

Pump and flow well, pump morning and night only. Rate at approximately 36 MCF/D. Liquid rate at approximately 10 BWPD. Cumulative water reading at 394 bbls = 231 bbls.

Tuesday, July 7, 1970

Pump and flow well. Rate at approximately 36 MCF/D. Liquid rate at approximately 10 BWPD. Pumping morning and night only -- pumps off in approximately 2 hours, will pump approximately 4 to 5 barrels and pump off. Wellhead pressure is rising at rate of 36 MCF/D. Indel SPR-4 arrived, checked on instrument, no reading, pulled instrument from hole - took off temperature element, reinstalled pressure element only in lubricator. Got pressure okay, left well flow overnight with sentry in lubricator.

Wednesday, July 8, 1970

Flowing well 8:00 a.m. to 1:00 p.m. Ran GRC-SPE-3, SN 30362, to 5700 feet KB. Range 0 to 4200 psig, checked sentry against surface before run to T.D., checked out okay. Flowed well until 1:00 p.m., shut in for buildup. Cumulative gas produced since recompletion is 1619 MCF. Total liquid produced this pump test = 243 barrels. Cumulative meter reading = 406 barrels on separator.

Thursday, July 9, 1970

Shut in for bottom hole pressure buildup.

Friday, July 10, 1970

Shut in for bottom hole pressure buildup.

Saturday, July 11, 1970

Shut in for bottom hole pressure buildup.

Sunday, July 12, 1970

Shut in for bottom hole pressure buildup. (Small leak in stuff box during day.)

Monday, July 13, 1970

Shut in for bottom hole pressure buildup. (Small leak in stuff box during day.)

Tuesday, July 14, 1970

Shut in for bottom hole pressure buildup. Small leak also short in cable at surface while clamping off cable, cut cable - 5700 feet left in hole - lost 3300 feet.

Wednesday, July 15, 1970

Shut in for bottom hole pressure buildup. Small leak - recorder stopped.

Thursday, July 16, 1970

Shut in for bottom hole pressure buildup. Small leak in stuffing box. Manual recorder will not balance out - problems downhole or in cable or in surface instrument.

Friday, July 17, 1970

Shut in for bottom hole pressure buildup - pulled bottom hole pressure sentry into lubricator. Some gas leak from Bowen head while removing sentry. Blowdown lubricator, master valve shut in.

Saturday, July 18, 1970

Shut in for bottom hole pressure buildup - gauge in lubricator, master valve shut.

Sunday, July 19, 1970

Laid down Amerada (CER) gauge. Ran Marshall wireline service 3500 psig pressure element to 5650 feet GL. Deadweighted gauge in lubricator and wellhead pressure tested at 1335 psig. Ran with 72 hour clock - on bottom at 1:15 p.m. Plan to pull gauge July 22, 1970.

Monday, July 20, 1970

Well shut in for bottom hole pressure buildup.

Tuesday, July 21, 1970

Well shut in for BHP buildup.

Wednesday, July 22, 1970

Pulled Amerada pressure element - 72 hour clock had stopped after approximately 2 hours. No data, ran same sentry in with 3 hour clock, obtained the following information.

<u>Depth - GL</u>	<u>Pressure psig</u>	<u>Gradient #/ft</u>
Surface	1364.8	
1000 ft	1405.6	.041
1000	1439.3	.034
3000	1472.9	.033
4000	1505.3	.033
4500	1521.3	.032
5000	1537.2	.032
5500	1553.2	.032
5650	1558.5	.033

The maximum recorded temperature was 192°F at 5650 feet GL. The pressure element was on bottom (5650 feet) at 1:30 p.m. The pressure element was run back in the hole with a 120 hour clock to 5650 feet GL for a three-day buildup. Pressure element at 5650 feet at 2:30 p.m.

Thursday, July 23, 1970

Well shut in for BHP buildup.

Friday, July 24, 1970

Well shut in for BHP buildup.

Saturday, July 25, 1970

Pulled pressure element with 120 hour clock. Installed 3 hour clock. Deadweight tested pressure element in lubricator. Deadweight pressure was 1397.0 psig. Pressure element was 1394.5 psig. Pressure element pulled from bottom at 1:30 p.m. Due to the high costs of the pressure surveys by Marshall it was decided to obtain an RPG-3 for CER. The well was left shut in for further BHP buildup.

Sunday, July 26, 1970

Well shut in for BHP buildup. Arranged to borrow wireline unit from Dowell, Vernal, Utah.

Monday, July 27, 1970

Well shut in for BHP buildup. Ordered Amerada RPG-3 4000 psig element from Indel - air freight.

Tuesday, July 28, 1970

Well shut in for BHP buildup. Waiting for pressure sentry.

Wednesday, July 29, 1970

Well shut in for BHP buildup. Ran Amerada RPG-3 SN 30167N w/3 hr clock, 4000 psig element - calibrated 7/16/70. Deadweighted pressure element in lubricator at surface prior to running in hole. The deadweight pressure was 1430 psig. Pressure element indicated 1425.6 psig. Following is the data obtained on the first run with the three hour clock.

<u>Depth KB</u>	<u>Time</u>	<u>Ext.</u>	<u>Pressure psig</u>	<u>Gradient</u>
Surface	2:40 pm	.662	1425.6	
1000 ft	2:52	.682	1468.6	.0430
2000	3:02	.698	1503.1	.0345
3000	3:10	.715	1539.7	.0366
4000	3:18	.731	1574.1	.0344
5000	3:26	.747	1608.6	.0345
5650	3:35	.757	1630.1	.0330

Total depth that the instrument was run was 5650 feet KB. The pressure element was rerun to TD of 5650 feet with a 72 hour clock. The element was on bottom at 4:30 p.m.

Thursday, July 30, 1970

Well shut in for BHP buildup.

Friday, July 31, 1970

Well shut in for BHP buildup.

Saturday, August 1, 1970

Pulled Amerada RPG-3 at 12:00 noon, chart readings as follows:

<u>Date</u>	<u>Time</u>	<u>Hours</u>	<u>Extension</u>	<u>BHP psig</u>
7/29	4:30 p.m.	0	.754	1623.6
7/30	4:30 p.m.	24	.759	1634.4
7/31	4:30 p.m.	48	.762	1640.9
8/01	12:00 noon	67.5	.766	1649.5

Ran RPG-3 to 5650 feet KB with 72 hour clock, on bottom at 3:00 p.m. Started well to flowing at 4:35 p.m. 1/8 inch plate 2 inch critical flow prover, flowing gas only, not pumping well, rate at approximately 36 MCF/D.

Sunday, August 2, 1970

Flowing well at approximately 36 MCF/D. Surface pressure declining slowly.

Monday, August 3, 1970

Flowing well at approximately 36 MCF/D

Tuesday, August 4, 1970

Flowing well at approximately 36 MCF/D. Pulled pressure element at 1:53 p.m. Installed new chart, element back on bottom at 2:45 p.m. 8/4/70. Shut down well for approximately 30 minutes.

Wednesday, August 5, 1970

Well flowing at approximately 36 MCF/D.

Thursday, August 6, 1970

Well flowing at approximately 36 MCF/D.

Friday, August 7, 1970

Well flowing at approximately 36 MCF/D. Pulled Amerada RPG-3, back on bottom at 11:30 a.m. Started up pumping unit at 12:30 p.m.

Saturday, August 8, 1970

Pumping and flowing well at approximately 36 MCF/D.

Sunday, August 9, 1970

Pumping and flowing well at approximately 36 MCF/D.

Monday, August 10, 1970

Pumping and flowing well at approximately 36 MCF/D.

Tuesday, August 11, 1970

Pumping and flowing well at approximately 36 MCF/D. Pulled Amerada RPG-3 at 6:00 p.m. Made up lubricator for Amerade SPG-3. Installed in lubricator and checked out SPG-3. Left overnight in lubricator and running.

Wednesday, August 12, 1970

Pumping and flowing well at approximately 36 MCF/D. Ran Amerada SPG-3 to 5650 feet KB.

Thursday, August 13, 1970

Pumping and flowing well at approximately 36 MCF/D.

Friday, August 14, 1970

Pumped and flowed well at approximately 36 MCF/D. Having problems with well pumping off and ruining stuffing box rubbers.

Saturday, August 15, 1970

Pumped and flowed well at approximately 36 MCF/D until 12:00 noon. Caught two gas samples from 1-1/2 inch string. Sample pressure 450 psig, temperature 70°F, deadweight tested Barton recorder on 1-1/2 inch string.

DWT pressure psig

Barton Recorder psig

250	255
500	505
1000	1005
1500	1505
2000	2005

Saturday, August 15, 1970 (Continued)

Shut in well at 12:00 noon for BHP buildup. Left pumping string open to separator to bleed off gas to replace packing in stuffing box. Bled off. Pulled brass follower and well started flowing water and gas. Waited for well to blow down again. Would not, opened up 1-1/2 inch string to separator to get well to stop blowing through 2-1/16 inch string. Also, bled off small amount of gas to atmosphere from 1-1/2 inch string. (Estimated at 2 MCF). Replaced packing at 4:00 p.m. Let well flow gas only from 4:00 p.m. to 7:30 p.m. Started up pumping unit, aborted buildup test #3, will stabilize well and shut in for buildup test.

Sunday, August 16, 1970

Pumped and flowed well until 6:00 p.m. Shut in for BHP buildup.

Monday, August 17, 1970

Shut in for BHP buildup.

Tuesday, August 18, 1970

Shut in for BHP buildup.

Wednesday, August 19, 1970

Shut in for BHP buildup.

Thursday, August 20, 1970

Shut in for BHP buildup.

Friday, August 21, 1970

Shut in for BHP buildup.

Saturday, August 22, 1970

Shut in for BHP buildup.

Sunday, August 23, 1970

Shut in for BHP buildup.

Monday, August 24, 1970

Shut in for BHP buildup.

Tuesday, August 25, 1970

Shut in for BHP buildup.

Wednesday, August 26, 1970

Shut in for BHP buildup.

Thursday, August 27, 1970

Shut in for BHP buildup.

Friday, August 28, 1970

Shut in for BHP buildup.

Saturday, August 29, 1970

Shut in for BHP buildup.

Sunday, August 30, 1970

Shut in for BHP buildup.

Monday, August 31, 1970

Shut in for BHP buildup.

Tuesday, September 1, 1970

Shut in for BHP buildup.

Wednesday, September 2, 1970

Shut in for BHP buildup.

Thursday, September 3, 1970

Shut in for BHP buildup.

Friday, September 4, 1970

Shut in for BHP buildup.

Saturday, September 5, 1970

Shut in for BHP buildup.

Sunday, September 6, 1970

Shut in for BHP buildup.

Monday, September 7, 1970

Shut in for BHP buildup.

Tuesday, September 8, 1970

Well shut in for bottom hole pressure buildup.

Wednesday, September 9, 1970

Well shut in for bottom hole pressure buildup.

Thursday, September 10, 1970

Well shut in for bottom hole pressure buildup.

Friday, September 11, 1970

Well shut in for bottom hole pressure buildup.

Saturday, September 12, 1970

Well shut in for bottom hole pressure buildup.

Sunday, September 13, 1970

Well shut in for bottom hole pressure buildup.

Monday, September 14, 1970

Well shut in for bottom hole pressure buildup.

Tuesday, September 15, 1970

Well shut in for bottom hole pressure buildup.

Wednesday, September 16, 1970

Well shut in for bottom hole pressure buildup.

Thursday, September 17, 1970

Well shut in for bottom hole pressure buildup. A very very small leak was noted around the line coming out of the stuffing box.

Friday, September 18, 1970

Well shut in for BHP buildup

Saturday, September 19, 1970

Well shut in for BHP buildup

Sunday, September 20, 1970

Well shut in for BHP buildup

Monday, September 21, 1970

Well shut in for BHP buildup

Tuesday, September 22, 1970

Well shut in for BHP buildup

Wednesday, September 23, 1970

Well shut in for BHP buildup

Thursday, September 24, 1970

Well shut in for BHP buildup

Friday, September 25, 1970

Well shut in for BHP buildup

Saturday, September 26, 1970

Well shut in for BHP buildup

Sunday, September 27, 1970

Well shut in for BHP buildup

Monday, September 28, 1970

Well shut in for BHP buildup

Tuesday, September 29, 1970

Well shut in for BHP buildup

Wednesday, September 30, 1970

Well shut in for BHP buildup

Thursday, October 1, 1970

Well shut in for BHP buildup

Friday, October 2, 1970

Well shut in for BHP buildup

Saturday, October 3, 1970

Well shut in for BHP buildup

Sunday, October 4, 1970

Well shut in for BHP buildup

Monday, October 5, 1970

Well shut in for BHP buildup

Tuesday, October 6, 1970

Well shut in for BHP buildup

Wednesday, October 7, 1970

Well shut in for BHP buildup.

Thursday, October 8, 1970

Well shut in for BHP buildup.

Friday, October 9, 1970

Well shut in for BHP buildup.

Saturday, October 10, 1970

Well shut in for BHP buildup.

Sunday, October 11, 1970

Well shut in for BHP buildup.

Monday, October 12, 1970

Well shut in for BHP buildup.

Tuesday, October 13, 1970

Ended BHP buildup. Started spooling line on wireline unit, started moving on equipment for workover. Well shut in.

Wednesday, October 14, 1970

Well shut in. Pulled Amerada SPG-3 from hole. Laid down lubricator and gin pole. Moving on equipment for workover.

Thursday, October 15, 1970

Well shut in, moving on equipment for workover.

Friday, October 16, 1970

Well shut in, moving on equipment for workover.

Saturday, October 17, 1970

Rigged up Barker rig, mixed 200 gallons 2% KCl water. Flowed well to pit for four hours. Killed well with 100 barrels 2% KCl water. Pulled and laid down rods and pump. Installed hydraulic double gate BOP on head.

Sunday, October 18, 1970

Pulled 1.90 O.D. IJ tubing. Released packer and pulled 2.062 O.D. IJ tubing and packer. Rigged up to log with Dresser Atlas. Ran Dresser Atlas Neutron Lifetime Log from 6421 feet to 4421 feet KB and Gamma Ray Neutron from 6425 feet to 4425 feet KB.

Monday, October 19, 1970

Laid down Dresser Atlas tools, ran Halliburton RTTS packer on 174 joints 2-3/8 inch EUE tubing, landed packer at 5494 feet KB. Set packer, filled annulus and pressured to 800 psig. Pumped down tubing at 5 BPM at 1900 psig with 20 barrels water. Mixed and pumped in 50 sacks class G cement, followed with 150 sacks class G with 1-1/4% CFR-2. Displaced cement with 23 barrels of water. Staged and squeezed in 2-1/2 barrels cement over 2-1/2 hours. Final pressure 3500 psig. Released packer, reversed out cement to 5700 feet KB. Pulled out of hole, WOC.

Tuesday, October 20, 1970

WOC 14 hours. Perforated with Dresser Atlas at following intervals with jet shots: 5565, 5570, 5585, and 5590 feet KB. Ran Halliburton RTTS packer to 5630 feet. Tested bottom squeeze to 3500 psig, okay. Pulled packer to 5583 feet KB. Spotted 200 gallon 15% MCA at 5583 feet, pulled packer up hole to 5304 feet and set. Pressured annulus to 600 psig. Pumped in acid at 2 BPM. Formation broke down at 2100 psig. Displaced acid with 5 barrels water. Let acid set for 15 minutes. Pumped in 10 barrels H₂O. Mixed and pumped in 100 sacks class G cement with 1-1/4% CFR-2. Displaced with 22 barrels H₂O. Staged and squeezed in 2-1/2 barrels over 4 hours. Final pressure 3500 psig. Pulled out of hole, WOC.

Wednesday, October 21, 1970

WOC 14 hours. Rigged up to drill out cement. Ran 4-3/4 inch bit, four 3-3/8 inch D.C. on 2-3/8 inch EUE tubing. Tagged top of plug at 5410 feet KB, drilled and cleaned out hole to 5682 feet K.B. Circulated hole with 2% KCl water. Pulled out of hole. Pressure tested to 1000 psig for 15 minutes. Held okay. Perforated with Dresser Atlas NCF II jet shots from 5600 to 5630 feet KB, 3 foot intervals, total of 11 holes. Ran in hole with 4-3/4 inch bit and casing scraper, tagged TD at 5682 feet KB. Started out of hole with 2-3/8 inch, laying down.

Thursday, October 22, 1970

Finished laying down 2-3/8 inch tubing, drill collars and kelly. Ran Brown Oil tool dual hydraulic husky packer in hole with 171 joints 2.062 O.D. IJ tubing. Packer element landed at 5553 feet KB. Seated nipple at 5545 feet KB. Ran 172 joints 1.90 OD IJ tubing and 1-10 foot sub. Latched into packer with 3000 pounds down. Removed BOP. Installed dual head valve flange. Pressure tested head flange to 4000 psig. Held okay. Set packer with 3800 psig. Tested annulus to 1000 psig for 15 minutes, held okay. Started mixing 2% KCl water for frac and tearing down rig.

Friday, October 23, 1970

Mixing 2% KCl water and tearing down and moving out rig.

Saturday, October 24, 1970

Well shut in. Finished moving out rig. Unable to move on CO₂ transport storage, transport stuck in mud at Red Wash, Utah; waiting on CO₂.

Sunday, October 25, 1970

Well shut in - waiting on CO₂.

Monday, October 26, 1970

Moved on CO₂ storage, started hauling CO₂. Well shut in.

Tuesday, October 27, 1970

Well shut in. Hauling CO₂ for fracture treatment.

Wednesday, October 28, 1970

Fraced with Dowell. Pressured annulus to 1000 psig, spot 1000 gallon 15% HCl down 1.90 O.D. tubing and up 2.062 tubing and balanced levels. Pressure tested to 6000 psig. Pumped down both strings of tubing. Displaced acid with 24 barrels 2% KCl water mixed with 20#/1000 gallon J-133, pumped in at 12.5 BPM at 5400 psig. Shut down, let acid set for 15 minutes. Surface pressure at end of 15 minutes was 800 psig. Started frac, pumped in 80 barrel pad of 2% KCl water mixed with 20#/1000 gal J-133 and 16#/1000 gal J-84 and 1200 scf/bbl CO₂, followed with 60 barrels at 1/2#/gal of 20/40 sand, followed with 90 barrels at 1#/gal of 20/40, pumped in 36 barrels with 1#/gal of 10/20 sand, flushed with 30 barrels 2% KCl water.

Started in RA sand (iridium 192) at 186 barrels cum (approximately 1/2 way through 1#/gal of 20/40). Continued RA sand throughout 1#/gal 10/20, CO₂ throughout job at 1200 scf/bbl. Used 25 tons total CO₂. Frac liquid 2% KCl water mixed with 20#/1000 gal J-133 and 16#/1000 gal J-84. Flushed with only J-133 additive in 2% KCl water. Used total of 5000 pounds 20/40 sand and 1500 pounds 10/20 sand. Cum H₂O including acid job was 326 barrels. Average pressure 5800 psig, average rate 12.5 BPM (Sand and water), HHP 1777, instant shut in 1500 psig. Started flowing well back to pit in 5 minutes after end of frac.

Thursday, October 29, 1970

Well flowing gas and water, good constant blow. Estimated rate 150 + MCF/D, estimated water recovered at 100 barrels.

Friday, October 30, 1970

Well flowing gas and water mist to pit, connected 2 inch Merla critical flow prover, 1/4 inch plate; let well flow for two hours through prover. Rate last 1-1/2 hours at 301 MCF/D. Estimated cum H₂O recovered at 125 barrels. Ran RPG-3 pressure sentry to 5300 feet KB, unable to get below 5369 feet KB due to restriction in 1.90 tubing. Let well flow for 1/2 hour with pressure sentry at 5300 feet KB and shut in flow at 2:00 p.m., October 30, 1970. Estimated cum natural gas flowed at 400 MCF. Caught water sample 2-2 at 125 barrels recovered water. Sample 2-1 is 2% KCl water used for frac. 72 hour clock is in RPG-3. Well shut in for BHP buildup. A slight brown oil scum or film was noted on the water in the pit.

Saturday, October 31, 1970

Well shut in for BHP buildup (very small leak in union on lubricator).

Sunday, November 1, 1970

Well shut in for BHP buildup (very small leak in union on lubricator).

Monday, November 2, 1970

Well shut in for BHP buildup. Pulled RPG-3 off bottom at 11:00 a.m., out of hole at 11:30 a.m. Reran sentry to 5300 feet KB with 72 hour clock. Sentry on bottom at 1:30 p.m., November 2, 1970. Well shut in for BHP buildup.

Tuesday, November 3, 1970

Well shut in for BHP buildup.

Wednesday, November 4, 1970

Well shut in for BHP buildup.

Thursday, November 5, 1970

Pulled RPG-3 off bottom at 10:00 a.m. Run #2 with 72 hour clock at 5300 feet KB. Well left shut in. Spotted CER wireline unit - made up rope socket for SPG-3.

Friday, November 6, 1970

Well shut in for BHP buildup. Checked operation of pressure and temperature elements and surface recording instrument, checks okay. Ran pressure and temperature sentry to 1000 feet KB. Bled some gas to get down hole. Pressure at 1000 feet is 1836.9, temperature not on scale. Ran sentry to 2000 feet KB, pressure 1872.6. Temperature not on scale. Line froze up in stuffing box - let set for one hour. Ran sentry to 5300 feet KB and closed in head on stuffing box and wireline BOP and packed off with grease. No leaks. Pressure at 5:00 p.m. at 5300 feet is 2038.0 psig, temperature at 5:00 p.m. at 5300 feet is 189.8°F. Left instrument recording, well shut in. Pressure at 10:00 p.m. is 2042.5 psig.

Saturday, November 7, 1970

Well shut in, monitoring BHP buildup and operation of pressure equipment.

Sunday, November 8, 1970

Well shut in, monitoring BHP buildup and operation of pressure equipment.

Monday, November 9, 1970

Well shut in until 3:40 p.m., monitoring BHP buildup and operation of pressure equipment. Pressure tested flow lines from 3:40 p.m. to 4:00 p.m. with wellhead gas. Started flow test number 1, zone 2 at 4:00 p.m.

Tuesday, November 10, 1970

Flow test number 1, zone 2.

Wednesday, November 11, 1970

Flow test number 1, zone 2.

Thursday, November 12, 1970

Flow Test number 1, zone 2.

Friday, November 13, 1970

Flow Test number 1, zone 2.

Saturday, November 14, 1970

Conducting flow test number 1, zone 2.

Sunday, November 15, 1970

Conducting flow test number 1, zone 2.

Monday, November 16, 1970

Conducting flow test number 1, zone 2.

Tuesday, November 17, 1970

Conducting flow test number 1, zone 2.

Wednesday, November 18, 1970

Conducting flow test number 1, zone 2.

Thursday, November 19, 1970

End flow test number 1, zone 2, well shut in at 0500 11/19/70 for BHP buildup number 2.

Friday, November 20, 1970

Well shut in for BHP buildup number 2.

Saturday, November 21, 1970

Well shut in for BHP buildup number 2.

Sunday, November 22, 1970

Well shut in for BHP buildup number 2.

Monday, November 23, 1970

Well shut in for BHP buildup number 2.

Tuesday, November 24, 1970

Well shut in for BHP buildup number 2.

Wednesday, November 25, 1970

Well shut in for BHP buildup number 2.

Thursday, November 26, 1970

Well shut in for BHP buildup number 2.

Friday, November 27, 1970

Well shut in for BHP buildup number 2.

Saturday, November 28, 1970

Well shut in for BHP buildup number 2.

Sunday, November 29, 1970

Well shut in for BHP buildup number 2.

Monday, November 30, 1970

Well shut in for BHP buildup number 2.

Tuesday, December 1, 1970

Well shut in for BHP buildup number 2.

Wednesday, December 2, 1970

Well shut in for BHP buildup number 2.

Thursday, December 3, 1970

Well shut in for BHP buildup number 2.

Friday, December 4, 1970

Well shut in for BHP buildup number 2.

Saturday, December 5, 1970

Well shut in for BHP buildup number 2.

Sunday, December 6, 1970

Well shut in for BHP buildup number 2.

Monday, December 7, 1970

Well shut in for BHP buildup number 2.

Tuesday, December 8, 1970

Well shut in for BHP buildup number 2.

Wednesday, December 9, 1970

Well shut in for BHP buildup number 2.

Thursday, December 10, 1970

Well shut in for BHP buildup number 2.

Friday, December 11, 1970

Well shut in for BHP buildup number 2.

Saturday, December 12, 1970

Well shut in for BHP buildup number 2.

Sunday, December 13, 1970

Well shut in for BHP buildup number 2.

Monday, December 14, 1970

Well shut in for BHP buildup number 2.

Tuesday, December 15, 1970

Well shut in for BHP buildup number 2.

Wednesday, December 16, 1970

Well shut in for BHP buildup number 2.

Thursday, December 17, 1970

Well shut in for BHP buildup number 2.

Friday, December 18, 1970

Well shut in for BHP buildup number 2.

Saturday, December 19, 1970

Well shut in for BHP buildup number 2.

Sunday, December 20, 1970

Well shut in for BHP buildup number 2.

Monday, December 21, 1970

Well shut in for BHP buildup number 2.

Tuesday, December 22, 1970

Well shut in for BHP buildup number 2.

Wednesday, December 23, 1970

Well shut in for BHP buildup number 2.

Thursday, December 24, 1970

Well shut in for BHP buildup number 2.

Friday, December 25, 1970

Well shut in for BHP buildup number 2.

Saturday, December 26, 1970

Well shut in for BHP buildup number 2.

Sunday, December 27, 1970

Well shut in for BHP buildup number 2.

Monday, December 28, 1970

Well shut in for BHP buildup number 2.

Tuesday, December 29, 1970

Well shut in for BHP buildup number 2.

Wednesday, December 30, 1970

Well shut in for BHP buildup number 2.

Thursday, December 31, 1970

Well shut in for BHP buildup number 2.

Friday, January 1, 1971

Well shut in for BHP buildup number 2.

Saturday, January 2, 1971

Well shut in for BHP buildup number 2.

Sunday, January 3, 1971

Well shut in for BHP buildup number 2.

Monday, January 4, 1971

Well shut in for BHP buildup number 2.

Tuesday, January 5, 1971

Well shut in for BHP buildup number 2.

Wednesday, January 6, 1971

Well shut in for BHP buildup number 2.

Thursday, January 7, 1971

Well shut in for BHP buildup number 2.

Friday, January 8, 1971

Well shut in for BHP buildup number 2.

Saturday, January 9, 1971

Well shut in for BHP buildup number 2.

Sunday, January 10, 1971

Well shut in for BHP buildup number 2.

Monday, January 11, 1971

Well shut in for BHP buildup number 2.

Tuesday, January 12, 1971

Well shut in for BHP buildup number 2.

Wednesday, January 13, 1971

Well shut in for BHP buildup number 2.

Thursday, January 14, 1971

Well shut in for BHP buildup number 2.

Friday, January 15, 1971

Well shut in for BHP buildup number 2.

Saturday, January 16, 1971

Well shut in for BHP buildup number 2.

Sunday, January 17, 1971

Well shut in for BHP buildup number 2.

Monday, January 18, 1971

Well shut in for BHP buildup number 2.

Tuesday, January 19, 1971

Well shut in for BHP buildup number 2.

Wednesday, January 20, 1971

Well shut in for BHP buildup number 2.

Thursday, January 21, 1971

Well shut in for BHP buildup number 2.

Friday, January 22, 1971

Well shut in for BHP buildup number 2.

Saturday, January 23, 1971

Well shut in for BHP buildup number 2.

Sunday, January 24, 1971

Well shut in for BHP buildup number 2.

Monday, January 25, 1971

Well shut in for BHP buildup number 2.

Tuesday, January 26, 1971

Well shut in for BHP buildup number 2.

Wednesday, January 27, 1971

Well shut in for BHP buildup number 2.

Thursday, January 28, 1971

Well shut in for BHP buildup number 2.

Friday, January 29, 1971

Well shut in for BHP buildup number 2.

Saturday, January 30, 1971

Well shut in for BHP buildup number 2.

Sunday, January 31, 1971

Well shut in for BHP buildup number 2.

Monday, February 1, 1971

Well shut in for BHP buildup number 2.

Tuesday, February 2, 1971

Well shut in for BHP buildup number 2.

Wednesday, February 3, 1971

Well shut in for BHP buildup number 2.

Thursday, February 4, 1971

Well shut in for BHP buildup number 2.

Friday, February 5, 1971

Well shut in for BHP buildup number 2.

Saturday, February 6, 1971

Well shut in for BHP buildup number 2.

Sunday, February 7, 1971

Well shut in for BHP buildup number 2.

Monday, February 8, 1971

Well shut in for BHP buildup number 2.

Tuesday, February 9, 1971

Well shut in for BHP buildup number 2.

APPENDIX III-B

SCANDARD DRAW DAILY REPORTS

SCANDARD DRAW DAILY REPORTS

Friday, May 8, 1970

Rigged up to blow well down. One choke on casing; one choke on tubing. Put gauge on each. Tubing pressure 4100 psig, casing pressure 4200 psig. Unable to open stuck wing valve on casing. Opened tubing valve to pit. Lighted flare. Pressure in both tubing and casing going down by blowing tubing with maximum of 100 to 150 psi differential throughout blowdown. Started blowing well at 2:00 pm. Most of rig on location. 2-1/16 inch tubing arrived at Equity Yard. Two Barker construction crews, one piping Scandard Draw and one unloading pipe at Fawn Creek. One Rippy Backhoe to dig through dikes at Scandard Draw and Fawn Creek to put tubing through the dike and then backfill. Olman Heath delivered separator to well.

Saturday, May 9, 1970

8:00 am. -- Blowing tubing, pressure 100 psig, casing pressure 250 psig. 3/4 inch choke wide open. Choke sanded up at 3:00 am. Shut-in approximately 15 minutes to clean out choke. Pressure built to 1000 psig. Calculated flow rate 1620 MCF per day. Making a fine condensate spray. Barker watching well 24 hours per day.

Sunday, May 10, 1970

Flowing tubing pressure 75 psig, casing pressure 125 psig. 3/4 inch choke wide open. Some fine spray water and condensate. Flow rate calculated at 1260 MCF per day. Barker watching well 24 hours per day.

Monday, May 11, 1970

Rigged up. Laid lines. Moved in 400 bbl tank. Barker 10 inch Series 900 BOP did not fit under substructure. Will use Acme 6 inch Series 1500 BOP. Smith Chemical delivered 10,000 pound KCl. Mixed and circulated 500 bbls of KCl water at 12 lb KCl per bbl. Raised rig substructure in order to install BOP and stripper head. Rods and 1.9 inch OD tubing arrived Equity Yard.

Tuesday, May 12, 1970

Finished mixing KCl water. Rigged up lines to kill well down tubing. Acme BOP arrived early A.M. No hand wheels. Barker closing unit did not operate correctly. Ordered Acme closing unit and repairman for the Barker unit. Have two 3-5/8 inch drill collars, casing scraper, float and 4-3/4 inch bit on location. Killed and

Tuesday, May 12, 1970 ---continued

circulated well with approximately 200 bbls KCl water. Pumped approximately 40 bbls into formation. Maximum pressure 400 psig. Circulated hole slowly, losing water. Waited on Barker 1-1/2 hours for wrench to take off 6 inch series 1500 flange. Took off flange, installed BOP. Screwed into donut, pulled loose at 55,000 pounds. Halliburton Tool hand released packer. Keeping hole full. Laid down donut joint. Acme hand corrected malfunction of Barker closing unit. Sent in Acme closing unit. Have 350 bbls water in hole at 9:00 pm. Slowly circulating through annulus to keep hole full. Losing some KCl water. Pulled tubing and laid down packer. The rubbers were gone, drag strip broken off. Pipe pulled wet. Laid down joint above and below packer. Total joints in hole 299, Equity well inventory showed 306.

Wednesday, May 13, 1970

Tallied tubing back in hole. Ran in with 4-3/4 inch bit, casing scraper, 3-3/8 inch casing collars, and 136 stands of 2-3/8 inch tubing. 12 stands left in the rack plus 3 single laid down. Broke circulation at 5038 feet, 6860 and 8624. Ran scraper to T.D. of 8624 KB. Circulated at 8624 to get gas and air out of water. Waited on Dresser Atlas to get on location, approximately one hour. Pulled out of hole, rigged up Dresser Atlas. Ran Baker Model "N" cast iron Mercury series wireline bridge plug set at 8608 KB (McCullough Collar Log). Pressure tested casing and bridge plug to 1000 psig with water using rig pump. Pressure held okay. Mixed and circulated 300 bbl 2% KCl water for frac job at 7 pound per bbl. Ran Gamma Ray-Neutron Log from bridge plug to 4600 feet KB. Ran Cement Bond Log with variable density from bridge plug to 5000 feet. Bonding looks good from bridge plug (8608) to 6900 feet. Cement top at approximately 5750 with bonding fair to poor from 6900 to 5750.

Thursday, May 14, 1970

Ran wireline bridge plug set at 7550 KB (Dresser Atlas GR-N) Dump bailed two sacks Class "A" neat cement on top of bridge plug with glass bottom bailer. Plug is a Baker Model "N" cast iron bridge plug. Rigged down Dresser Atlas while WOC. Ran 2-3/8 inch tubing in hole. Came out laying down. Laid down two 3-3/8 inch drill collars. 2-3/8 inch tubing collars were very tight. Mashed some joints breaking connections to lay down. Removed BOP, installed tubing head. Reinstalled BOP, pressure testing BOP, casing, and bridge plug with water using rig pump. Pressure tested at 1500 psig, held okay. Moved in 2.062 O.D. integral joint tubing and 1.900 inch O.D. integral joint tubing while laying down 2-3/8 inch tubing. Perforated with Dresser Atlas NCF-2 jets on 3 foot spacing. Bottom shot 7210 at KB, top shot at 7183, ten 3/8 inch holes. On trip out of hole with gun, pulled into something at 900 feet, gun pulled loose from rope socket. Going in hole to locate gun.

Friday, May 15, 1970

Ran gauge ring on wireline to 2000 feet. Gun apparently went to bottom. Pulled out of hole, put on overshot, went in, caught fish at 7099. Gun was on bottom. Pulled out of hole. Released Dresser Atlas, rigged up to run 2-1/16 inch tubing J and L JCW-55 IJ ten round tubing. Picked up Brown Oil Tool dual hydraulic H-2 husky packer with USI seating nipple on top of packer. Ran in hole on 220 joints of 2-1/16 inch IJ tubing. Landed tubing in OCT dual head. Packer element at 7143 KB. Seating nipple at 7138 KB, rigged up to run 1-1/2 Nominal, 1.900 O.D., JCW-55, IJ tubing. Rigged up offset spool and stripper head. Ran Brown Oil Tool J-Latch stinger seal assembly on bottom with 211 joints of 1.9 inch IJ tubing. One 4 foot sub and one changeover sub 1.9 IJ x 2.062 into hanger. CO₂ truck arrived on location.

Saturday, May 16, 1970

Landed tubing in head and J-Latched into packer with tubing in hanger. Removed BOP, stripper head, and offset spool, flanged up head, tested flange to 4000 psig. Moved out substructure, rigged up to set packer and frac. Dropped ball down 2-1/16 inch tubing to set packer. Pumped down 2-1/16 inch at 5 BPM at 3000 pound. Ball did not seat to set packer. Reversed out to recover ball and clean out 2-1/16 inch tubing. Ball did not return. Water was gas cut on return. Waited 30 minutes, pumped down 2-1/16 inch again. Ball did not seat to set packer. Ran 1-1/4 inch O.D. 10# sinker bar on wireline to push ball into seat. Pulled sinker bar. The bar was covered with heavy paraffin. Pumped down 2-1/16. Pumped up to 3500 psig and water communicated to annulus. No pressure on 1-1/2 IJ tubing, indicating packer had set and a hole was in the 2-1/16 inch tubing. Released Dowell, CO₂ truck left on location. Started circulating down 1-1/2 inch and up 2-1/16 inch to remove gas. Circulated out gas. Removed OCT tree, installed BOP, rigged up substructure.

Sunday, May 17, 1970

Rigged up to pull 1-1/2 inch IJ tubing. Released 1-1/2 inch from packer, pulled out of hole, rigged up to pull 2-1/16 inch. Could not release packer. Removed BOP to pull dual head to work with less weight on packer.

Monday, May 18, 1970

Continued working on 2-1/16 inch. After working 22-1/2 hours, packer apparently came loose. Coming out of hole with 2-1/16 inch and packer. Pulled 2-1/16 inch IJ tubing and Brown packer. Several joints of tubing were mashed by slips. There was one noticeable leak in the tubing. Ordered out hydrotesters to pressure test

Monday, May 18, 1970

tubing and another dual hydraulic packer. Tested 30 stands of tubing, found several damaged joints, no leaks other than one visually located. Tester ran out of cups for their tool. Waiting on new cups and packer.

Tuesday, May 19, 1970

Barker crew rigged up lines to flow Fawn Creek Well, blew well down. Moved additional 2-1/16 inch tubing from Equity Yard to Scandard Well. Fenced pit. Testers cups arrived, started testing 2-1/16 inch - waiting on Brown Packer.

Wednesday, May 20, 1970

Brown Oil Tool Packer arrived, finished hydrotesting tubing. Laid out 32 bad joints with leaks and mashed sections where slips had set. Picked up Brown Oil Tool DS9-2H packer, ran in hole with 54 stands and packer set, pulled out of hole, shear ring had sheared, apparently from accumulation of paraffin on packer. Picked up Brown H-2 husky ran in hole with 2-1/16 inch IJ tubing, total of 220 joints. Seating nipple one joint above packer. Seating nipple is a Harbison Fisher 495E81. Packer is set at 7142 feet KB. Seating nipple at 7107 feet KB.

Thursday, May 21, 1970

Ran Brown Oil Tool Latch in seal assembly on bottom of 221 joints of 1.9 OD, IJ tubing, one 1 foot sub and one 1.90 OD by 2.062 OD IJ tubing swage to hanger. Latched into packer and landed donut. Installed OCT head and pressure tested to 4500 psig. Held okay. Set packer. Dowell spotted 200 gallons 15% HCl on perfs, displaced acid into perfs at 1/2 BPM, 1200 psig. Waited on acid 45 minutes. Fraced with 3000# 20/40 sand, liquid CO₂ at 1000 scf/bbl of treating liquid. Treating liquid 2% KCl water mixed, 16#/1000 gal J-84 and 20#/1000 gal J-133, total liquid 250 bbls. Pumped in 100 bbls of pad with 1000 scf/bbl CO₂, tubing pressure 6,000 psig, backed up casing at 1000 psig with rig pump. Pumped in 60 bbls with 1/2#/gal 20/40 and 350 scf/bbl, pumped 40 bbls with 1#/gal 20/40 and no CO₂, pumped in flush of 4700 bbls with 1000 scf/bbl CO₂. Average pressure 5600 psi, maximum pressure 6300 psig, average rate 12.5 BPM (sand and water). Instant shut-in pressure 1400 psig - rigged down Dowell, connected line to pit, well flowed back good for approximately 3 hours and died. Estimate flowback at 150 bbls water. Released Barker rig at 6:00 am, May 22, 1970 moving to Fawn Creek Number 1.

Friday, May 22, 1970

Moved off Barker rig.

Saturday, May 23, 1970

Casada Construction started laying lines to separator and tank, installing tie downs for pumping unit and gin pole. Set base for pumping unit. Casada attempted to set pumping unit - truck too small to handle. Barker set 400 bbl tank and separator.

Sunday, May 24, 1970

No action.

Monday, May 25, 1970

Casada set pumping unit, finished hold downs for pumping unit and gin pole. Some piping done.

Tuesday, May 26, 1970

Set propane tank, generator, and some piping done. Moved on R & R pulling unit, connected well to pit, let flow overnight.

Wednesday, May 27, 1970

Well kicking some gas and H₂O circulated well with 60 bbls 2% KCl water. Ran pump and rods and spaced out. Structurally braced pumping unit base, fixed horses head for slim hole pumping.

Thursday, May 28, 1970

Finished bracing on base for pumping unit, hung off rods, adjusted beam and horses head, let well pump up, released R & R pulling unit. Let well pump to separator, liquid level dump did not function correctly. Water in fuel and instrument supply lines. Had problems starting pumping unit engine.

Friday, May 29, 1970

Lengthened gin pole, stood in air, tied and adjusted guy lines. Made up lubricator and BOP, fabricated stand for oil, Pamco mechanic repaired engine to unit. Finished piping to wellhead.

Saturday, May 30, 1970

Finished gin pole for Fawn Creek Well. Spool wireline through Bowen equipment, ready to make up Amerada pressure and temperature sentry and run in hole.

Sunday, May 31, 1970

Connected Amerada pressure-temperature sentry to 1/8 inch cable, made up lubricator assembly. Put sentry in lubricator and pressured up. Pressure element works okay. Temperature element does not respond. Had to overhaul wireline BOP. Had some leaks. Shutdown to call Indel about temperature sentry before running in hole.

Monday, June 1, 1970

Corrected function of temperature element. Finished overhaul of wireline BOP. Ran pressure element to 7142 feet KB, unable to get out packer. Suspect heavy tar in tubing. Took pressure and temperature readings at various points while running to TD. Landed element at 7100 feet KB. Attempted to pump and flow well through separator. Problems with separator include - water meter does not register, level control does not respond, ordered out parts and serviceman. Left sentry recording pressure.

Tuesday, June 2, 1970

Installed bypass on pumping string to bypass separator as required. BHP at 11:30 a.m. was 2896.1 psig. Temperature was 215.7°F. Pressure buildup from 6:15 p.m., June 1, 1970 to 11:30 a.m., June 2, 1970, was from 1914.6 psig to 2896.1 psig in 17 hours 15 minutes. BHP at 2:45 p.m. was 2909.5 psig.

Wednesday, June 3, 1970

BHP at 8:15 a.m. was 2927.4 psig, BHT was 214.6°F at 8:20 a.m. Changed out separator dump valve trim from 1/8 inch to 3/8 inch, repaired level controller. Installed new water meter, installed filters and drip pots ahead of instrument supply gas. Started well pumping and flowing at 10:00 a.m. Pumping unit at 10 SPM x 54 inches stroke. Pump has 1-1/4 inch plunger. Well rapidly declined from 2927.4 psig to 675 psig at 1:30 p.m. Gas flow rate started at 126 MCF/D, declined to approximately 38 MCF/D after 14 hours and appeared to stabilize at that rate. Gas flow being measured by Merla 2 inch critical flow prover, 1/8 inch (.125 inch) plate. H₂O samples taken at 25 bbls produced at 12:30 p.m. and at 50 bbls produced at 1:00 a.m., June 4, 1970.

Thursday, June 4, 1970

Well appears stabilized at 100 psig on prover. 125 psig BHP and 209°F BHT. Pumping unit changed to 12 SPM x 54 inch stroke at 2:00 p.m.

Friday, June 5, 1970

BHP remaining at 120 to 125 psig, flow rate at approximately 38 MCF/D. Produced H₂O at approximately 3/4 BWPH.

Saturday, June 6, 1970

BHP remaining at 120 to 125 psig. Flow rate at approximately 38 MCF/D. Produced H₂O at approximately 1/2 BWPH. Water samples caught at 87 bbls indicate small cut of heavy black oil (estimated 10%). Shut-in well at 1:00 p.m. June 6, 1970. F BHP at SI was 115.6 psig. Separator pressure was 100 psig and pressure on prover plate was 97 psig. Water samples were caught as follows:

<u>Date</u>	<u>Time</u>	<u>Bbls Produced</u>	<u>Estimated Oil Cut</u>
6/3/70	12:30 p.m.	25	1%
6/4/70	1:00 a.m.	50	2%
6/5/70	11:30 a.m.	74.5	4%
6/6/70	1:00 p.m.	87	10%

Following are some of the pressures observed on the buildup.

<u>Date</u>	<u>Time</u>	<u>BHP psig at 7100 feet KB</u>
6/6/70	1:00 pm	116
6/6/70	1:04	120
6/6/70	1:10	147
6/6/70	1:30	231
6/6/70	2:00	351
6/6/70	3:00	596
6/6/70	4:00	800
6/6/70	6:00	1240 ?
6/6/70	7:00	1377
6/6/70	8:00	1555
6/6/70	9:00	1698
6/6/70	10:00	1838
6/6/70	12:00 Midnight	2117

Some problems were encountered between 4:00 p.m. and 6:00 p.m. with the surface recorder.

Sunday, June 7, 1970

Well shut-in - readings as follows:

<u>Date</u>	<u>Time</u>	<u>BHP psig at 7100 feet KB</u>
6/7/70	3:00 a.m.	2288
6/7/70	6:00 a.m.	2413
6/7/70	10:00 a.m.	2520
6/7/70	2:00 p.m.	2583
6/7/70	4:00 p.m.	2601

Shortly after 4:00 p.m. generator engine went down.

Monday, June 8, 1970

Well SI for buildup to static - started up generator engine.

<u>Date</u>	<u>Time</u>	<u>BHP, psig at 7100 feet KB</u>
6/8/70	12:00 Noon	2726
6/8/70	5:00 p.m.	2740
6/8/70	10:00 p.m.	2753

Tuesday, June 9, 1970

Well shut-in.

<u>Date</u>	<u>Time</u>	<u>BHP, psig at 7100 feet KB</u>
6/9/70	8:00 a.m.	2775
6/9/70	2:00 p.m.	2789

Wednesday, June 10, 1970

Well shut in for buildup. 10:00 a.m. - 2824 psig. Raining, roads in bad shape.

Thursday, June 11, 1970

Well shut in for buildup. 10:00 a.m. - 2849 psig. Started flowing well at 1415. Choke on separator acting up. Could not control pressure on separator so shut well in to repair choke at 2200.

Friday, June 12, 1970

Well shut in, getting new choke equipment for separator.

Saturday, June 13, 1970

Commenced drawdown test #1 at 1700 hours, BHP at 1700 - 2867 psig. Separator operating pressure had to be controlled manually using manual choke ahead of separator. Automatic choke could not control with the high wellhead pressure. Bottom hole pressure erratic because of manual adjustments to separator. Gas flow rate 36.2 MCF/D.

Sunday, June 14, 1970

Drawdown test #1.

Monday, June 15, 1970

Started pumping unit at 1530. Bottom hole pressure dropped from 2045 psig to approximately 150 psig in 24 hours. Produced 40 barrels of water, gas rate constant at 36.2 MCF/D.

Tuesday, June 16, 1970

Gas rate dropped to 33 MCF/D for short period but back up to 36.2 MCF/D. Bottom hole pressure dropped to 107 psig, dropped gas rate to 33 MCF/D.

Wednesday, June 17, 1970

Bottom hole pressure 130 psig, gas rate 33 MCF/D. Total produced fluids at 1700 hours 52 barrels H₂O - 3 barrels condensate.

Thursday, June 18, 1970

Pumping well intermittently.

Friday, June 19, 1970

Dropped separator pressure to install new packing rubbers in stuffing box. Down 2 hours.

Saturday, June 20, 1970

Shut in well for buildup at 1600 hours. Total produced liquids, 72.5 barrels water, 3 barrels condensate. Bottom hole pressure at 1600 hours - 120 psig. Water production rate gradually decreasing. Averaging 2.5 BWPD during final 30 hours of test. Obtained water samples every ten barrels for chemical analysis. Average gas production rate during drawdown was 33.4 MCF/D.

Sunday, June 21, 1970

Shut in for buildup #2. BHP at 1600 hours - 2436 psig.

Monday, June 22, 1970

Shut in for buildup. BHP at 1600 hours - 2579 psig.

Tuesday, June 23, 1970

Well shut in for buildup. Some problems with packoff leaking small volume of gas, got stopped for awhile, started again next morning, June 24.

Wednesday, June 24, 1970

Well shut in for buildup. Wellhead stuffing box leaking, changed out rubbers in control head. Held for approximately 1 hour and started leaking again. Old rubbers looked okay, attempted several times to bleed off between BOP and control head and packoff again to stop leak. Would only hold for short intervals and start leaking again. Had Barker crew take up flow lines, prepare pumping unit for moving to Fawn Creek. Separator ready also. Waiting on trucks to move equipment. Drained 400-barrel water tank to pit, gauged at 7 feet 10 inches before draining to pit. Drained down to zero feet 6 inches and started getting some dark oil and condensate. Separator water gauge indicates 164 barrels liquid. Tank gauge indicates 156.7 barrels.

Thursday, June 25, 1970

Well shut in for buildup. Moved off pump unit from base. Moved unit substructure, separator, fittings, propane tank to Fawn Creek. Would not let Casada move unit. Truck had high fifth wheel, Casada hand hurt putting up poles - sent into town with Barkers driller (Theo), 6 hours Theo's time charged to Casada plus mileage in and out. Had some problems with packing leak again, appeared to start approximately 4:00 p.m. Tried to repackoff at 6:00 p.m. Will move pump unit with Barker truck.

Friday, June 26, 1970

Well shut in for buildup. Had leak on stuffing box again in afternoon. Barker truck moved pump unit to Fawn Creek. Returned to well approximately 9:00 p.m., found that as sun went down that stuffing box quit leaking, about 8:30 p.m., could be temperature problem. Barker moved on some pieces of rig. Casada moved 15 joints 2-3/8 inch tubing and 2 joints that were cut off previously to Fawn Creek well for flow lines. Casada moved off 30 joints 2-1/16 inch junk to Equity yard. Plotted data using Horner technique. Buildup data prior to start of leaks sufficient for extrapolation. Corrected data during leak period and corrected plot also extrapolates to the same point. Buildup No. 1 and No. 2 both extrapolate to within 5 psig. No. 1 - 3000 psig, No. 2 - 2995 psig.

Saturday, June 27, 1970

Well shut in for buildup, small leak on stuffing box. Also, small leak on control head. Barker generator engine quit, cannot start. Barker moved on most of rig. Completed buildup test No. 2 on zone #1 from 7181 to 7212 at 8:00 p.m. Barker moving in rig and rigging up. Mixing KCl water (2%). Rigging lines to blow well down.

Sunday, June 28, 1970

Blew well down to pit. Pulled sentry and moved it to Fawn Creek. Killed well with KCl water after unseating pump. Well not kicking or presenting problems.

Monday, June 29, 1970

Pulled rods and pump. Opened annulus valve before unlatching 1-1/2 inch tubing. Gas pressure on annulus, blew to atmosphere for 15 minutes, shut in and rigged line to pit. Pressure on annulus 1100 psi - bleed off to pit - filled annulus with KCl water, estimated 40-50 barrels for filling. Pressure tested to 500 psi, would bleed off in 10-12 minutes. Tested several times, same result. Tubing valves open, no flow from tubing.

Tuesday, June 30, 1970

Pulled 1-1/2 tubing and 2-1/16 inch tubing with packer, no problems. Ran McCullough casing inspection and casing gauge from 7100 feet to surface. No apparent holes detected from log. Ran Baker Model N castiron bridge plug and set at 7110 feet. Dump bailed 2 sacks class A cement on bridge plug. Pressure tested BP and casing to 1000 psig. Pressure held okay for 1 hour. Rigging up to perforate.

Wednesday, July 1, 1970

Perforated gas zone from 6810 to 6838 (GR-N) with 12 jet shots. Used McCullough 19 gram charges in 4 inch steel carrier. Ran in BOT H-2 husky packer on 2-1/16 inch tubing. Ran in 209 joints with 1 double pin sub and seating nipple. KB depth to packer sealing element - 6773.43. Seating nipple at 6740.95 feet. Ran total of 210 joints of 1.9 inch IJ tubing plus one 4 foot 1-1/2 inch sub and one 1 foot 1-1/2 inch sub and change over swage from 1-1/2 inch tubing to 2-1/16 inch tubing thread to hanger. Landed 1-1/2 inch string with 4000 pounds on packer and latched in. Moved out substructure, installed dual head and pressure tested to 4000 psig for 30 minutes, held okay. Circulated down 1-1/2 inch and up 2-1/16 inch for 45 minutes, dropped ball down 2-1/16 inch to set packer. Pressured up 2-1/16 inch to 3800 psig. Set packer and sheared out ring. Pressure tested annulus to 1000 psig. Started leaking small stream out both tubing.

Thursday, July 2, 1970

Continued testing with 1000 to 1200 psig on annulus. 2-1/16 inch quit leaking and 1-1/2 inch kept bleeding small stream. Pressure on annulus would not bleed fast, indicating small leak in 1-1/2 inch. 2-1/16 inch string would leak small amount when 1-1/2 inch valve was closed. Pumped 1-7/16 inch ball (Bakelite) down 1-1/2 inch string to seat on top of latch-in assembly, pressured to 1500 psig, small leak indicated. Rigged up to pull 1-1/2 inch string. Pulled 1-1/2 inch tubing and checked. Could find no splits or breaks. Checked latch assembly, okay. Ran in tubing, made up every joint going in hole. Found few loose in middle of stands.

Friday, July 3, 1970

Finished running 1-1/2 inch IJ tubing back in hole (210 joints) latched into packer, set with 6000 pounds on packer. Made up head, tested head to 4600 psig, held okay. Pressured annulus to 1500 psig, held okay for 1 hour. No leaks out 2-1/16 inch or 1-1/2 inch. Waiting on Dowell to frac. Rigged up Dowell, acidized formation with 200 gallons 15% inhibited HCl at 1/2 barrel per minute. Pressure 1000 psig. No noticeable break-back in pressure. Shut down and let acid soak for 15 minutes. Rigged wellhead for frac job. Pumped 70 barrels spearhead at 13 to 13-1/2 BPM frac fluid plus 1000 SCF CO₂ per barrel. Initial pressure was 5500 psi. Pressure broke back to 4900-5000 psi. Started sand in at 1/2# per gallon - CO₂ 1000 SCF per barrel frac fluid, pump rate 13 to 13-1/2 BPM at 4900-5000 psi. Pumped 60 barrels at 1/2# per gallon, increased concentration of 20-40 sand to 1# per gallon, pump rate 13-1/2 BPM at 4900 psi. Pumped total of 2500 pounds 20-40 sand in total of 220 barrels frac fluid, including overflush. Increased CO₂ concentration to 1200-1300 SCF per barrel at tail end. Released Dowell, opened up 1-1/2 inch string to pit to flow back through choke. Flowed to pit until 4:00 a.m., then died. Rigged up 2-1/16 inch string and flowed to pit. Died at 6:00 a.m. Rigging up to swab 2-1/16 inch string.

Saturday, July 4, 1970

Swabbed 2-1/16 inch to 5:00 p.m. Estimated swabbed 20-25 barrels fluid and some gas in 21 swab runs, flowed back 70 barrels during previous night, still have 100-150 barrels to recover. Ran swab from 6650 feet several times with very little recovery of water or gas. Pressure on 1-1/2 inch string, rigged up and flowed to pit. Died in 15 minutes but the presence of pressure on 1-1/2 inch and swabbed dry 2-1/16 inch string looks suspicious. Rigged up to circulate both strings. Circulated down 1-1/2 inch and up 2-1/16 inch. Very gassy at first, quit after 20 minutes at 1 BPM. Circulated 45 minutes, then rigged up to swab 2-1/16 inch. Did not see any pressure breaks that would indicate plugging. Circulated at 800 psi.

Sunday, July 5, 1970

Swabbed well down, began unloading after run to bottom. Flowed from 5:00 a.m. to 8:00 a.m. then died. Swabbing from 6650.

Monday, July 6, 1970

Released rig at 7:00 a.m. Rigged down - stacked on location. Left well with 1-1/2 inch shut in and 2-1/16 inch open to pit. Very small gas well, estimated 10 MCF/D.

Tuesday, July 7, 1970

Well open to pit from 2-1/16 inch. 1-1/2 inch shut in.

Wednesday, July 8, 1970

Well open to pit from 2-1/16 inch. 1-1/2 inch shut in.

Thursday, July 9, 1970

Well open to pit from 2-1/16 inch. 1-1/2 inch shut in. 1-1/2 inch pressure at 1700 psig. Very small gas blow estimated at 1 MCF/D. Dropped 3 Dowell foamer sticks down 2-1/16 inch. Left 2-1/16 inch shut in for four hours, built up to 150 psig - opened to pit for 1 hour. Would not unload, shut in overnight.

Friday, July 10, 1970

Opened up well to pit from 2-1/16 inch, would not unload - 1800 psig on 1-1/2 inch string.

Saturday, July 11, 1970

Well open to pit - will not unload.

Sunday, July 12, 1970

Well open to pit through 2-1/16 inch - will not unload.

Monday, July 13, 1970

Well open to pit through 2-1/16 inch - will not unload. Moved on Barker rig - ran 1-1/2 inch x 1-1/4 inch x 16 foot H & F bottom hold down pump. Moved on pumping unit and set, landed and spaced out pump. Well tried to flow while running rods.

Tuesday, July 14, 1970

Rigged up flow lines, trailer, wireline trailer, seated pump, aligned unit, tied in propane to unit engine and rigged down Barker.

Wednesday, July 15, 1970

Continued rigging up flow lines.

Thursday, July 16, 1970

Started up pump unit - well did not pump up in four hours. Started flowing gas out 1-1/2 inch string through Merla critical flow prover - 3/32 inch plate - well heads up and flows some water out 1-1/2 inch string. Did not pump up.

Friday, July 17, 1970

Pumped well approximately 6 hours - did not pump up. Well flows by heads out 1-1/2 inch string - brings some water out prover plate.

Saturday, July 18, 1970

Pumped well approximately 6 hours - did not pump up. Flows by heads up 1-1/2 inch string.

Sunday, July 19, 1970

Pumped well approximately 2 hours - did not pump up. Well continues to blow by heads up 1-1/2 inch string. Rigged up to run Amerada pressure element - found partial short in instrument head - repaired - pump started blowing and sucking while stroking.

Monday, July 20, 1970

Pumped well after bumping bottom with pump. Well pumped or flowed small stream of gas cut water after respacing pump. Does not appear to be pump displacement on strokes - appears to be continuous flow of small stream of water - may still have to pull pump.

Pumped well after bumping bottom with pump - well pumped up in approximately 2 hours after respacing pump. Pumping or flowing small stream of water. Let well pump for approximately three hours. Put Amerada (CER) pressure sentry in lubricator at 4:00 p.m. Read .030 = 82.3 psig. Deadweighted at 85.0 psig. Shut pumping unit down, well flowing gas to pit when ready to start in hole with sentry. Following are pressures obtained while going in hole.

<u>Time</u>	<u>Depth</u>	<u>Flowing Pressure</u>
4:15 p.m.	Surface	73.1 psig
4:30	1000 ft	73.1
4:37	2000 ft	64.0
4:43	3000 ft	64.0
4:50	4000 ft	64.0
4:57	5000 ft	64.0
5:05	6000 ft	123.4
5:15	6650 ft KB	196.6 psig

Pressure sentry landed at 6650 feet KB. Started up pumping unit at 5:15 p.m. Left well flowing gas to pit, let well pump for 20 minutes, bottom hole pressure increased to 224 psig at 5:45 p.m. No liquid to surface through pumping string. Appears to blow and suck each stroke of pump. Shut down pumping unit, left gas flowing to pit overnight. Sentry at 6650 feet KB.

Tuesday, July 21, 1970

Gas flow had stabilized at 9 to 10 MCF/D overnight for a period of 12 hours. Surface gas pressure at 35 psig DWT. Started up pumping unit at 11:40 a.m. Pumped water in 10 minutes. Bottom hole pressure declined. Surface pressure remained at 35 psig until 2:00 p.m., then started to increase. A manual choke was used to control flow rate at approximately 9 to 10 MCF/D. At 3:00 p.m. DWT surface pressure had increased to 177 psig. BHP was at 644.6 psig. Following are some data points taken during the pump down and flow.

<u>Date & Time</u>		<u>Wellhead DW Surface Pressure</u>	<u>BHP</u>
7/21	3:00 p.m.	177 psig	644.6 psig
	3:15	189	608.0
	3:30	214	598.9
	3:45	227	598.9
	4:00	242	589.7
	4:30	268	557.7
	5:00	292	493.7
	5:30	308	411.4
	6:00	310	361.1
	7:00	333	384.0
	8:00	347	400.0
	10:00	345	400.0
7/22	6:00 a.m.	360	420.6

Water samples were caught at 1:40 p.m. and at 5:00 p.m. on July 21. It should be noted that in the previous pumping data that water production initially was at approximately 1 BWPH at 11:40 a.m., July 21, and had declined to approximately 1/2 BWPH at 10:00 p.m. July 21. At 6:00 a.m. July 22, no water was being pumped. The well was shut in at 6:30 a.m. July 22, 1970.

Wednesday, July 22, 1970

Shut in well for BHP buildup on July 22 at 6:30 a.m. The flow rate had been relatively constant at 9 to 10 MCF/D for a period of 36 hours prior to shut in. Cumulative produced gas since the frac was calculated at 83 MCF. T hours calculated by slide rule is at 200. Following are some of the data points observed on the buildup.

(Attached sheet shows Zone 2, Drawdown Number 1 - 6810 feet to 6828 feet GR-N
Log for 7/21/70 to 7/22/70)

STANDARD DRAW NUMBER 1

SECOND ZONE DRAWDOWN NUMBER 1

BHP Gauge Set at 6650 feet

6810 - 6838 (GR-N)

Date & Time

7/21	11:30 a.m.	Found BHP at 196.6 psig - Gas rate had leveled off to 9 MCF/D for approximately 12 previous hours. Surface pressure and pressure on 3/32 inch plate was 35 psig. Started up pumping unit at 11:40 a.m. Let well continue to flow at 35 psig on plate. Well pumped up in 10 minutes - BHP started declining. Surface pressure remained at 35 psig until 2:00 p.m. then started to increase. Well had previously pumped for short periods then quit for short periods. When wellhead (1-1/2 inch) started to increase it was attempted to control flow rate at 9 MCF/D by a manual adjustable choke to maintain 35 psig on the 3/32 inch plate.
	3:00 p.m.	Deadweight surface pressure up stream of choke was 177 psig. 3/32 inch plate pressure was at 40 psig. BHP was 644.6 psig. Closed choke, very small amount.
	3:15 p.m.	Deadweight surface pressure at 189 psig. BHP at 608.0. Well pumping water.
	3:30 p.m.	Deadweight surface pressure at 214 psig. BHP at 598.9 psig. Rate at 39 psig on 3/32 inch plate. Well pumping small stream of water. Adjusted choke back - very small amount.
	3:45 p.m.	Deadweight surface pressure at 227 psig. BHP at 598.9 psig. Rate at 39 psig on 3/32 inch plate. Well pumping small stream water. Adjusted back choke - very small amount.
	4:00 p.m.	Deadweight surface pressure at 242 psig. BHP at 589.7 psig. Rate at 39 psig on 3/32 inch plate. Well pumping small stream of water. Adjusted choke back - very small amount. Pump rate over last hour estimated at 1/2 to 1 BWPH.
	4:15 p.m.	Deadweight surface pressure at 256 psig. BHP at 576.0. Rate at 36 psig on 3/32 inch plate. Did not adjust choke. Pumping small stream of water.
	4:30 p.m.	Deadweight surface pressure at 268 psig. BHP at 557.7. Rate at 36 psig on 3/32 inch plate. Well pumping small stream of water. Did not adjust choke.
	4:45 p.m.	Deadweight surface pressure at 282 psig. BHP at 530.3. Rate at 36 psig on 3/32 inch plate. Well pumping small stream of water. Did not adjust choke.

Standard Draw Number 1
Second Zone Drawdown Number 1

Date & Time

7/21	5:00 p.m.	Deadweight surface pressure at 292. BHP at 493.7. Rate at 36 psig on 3/32 inch plate. Pumping small stream of water. No adjustment to choke. Took water sample.
	5:15 p.m.	Deadweight surface pressure at 299. BHP at 457.1. Rate at 36 psig on 3/32 inch plate. Pumping small stream of water. No adjustment made.
	5:30 p.m.	Deadweight surface pressure at 308 psig. BHP at 411.4 psig. Rate at 38 psig on 3/32 inch plate. Pumping small stream of water. Adjusted choke small amount.
	5:45 p.m.	Deadweight surface pressure at 314 psig. BHP at 384.0. Rate at 38 psig on 3/32 inch plate. Pumping water - very foamy. No adjustment.
	6:00 p.m.	Deadweight surface pressure at 310 psig. BHP at 361.1. Rate at 38 psig on plate. No adjustment. Pumping very very small stream foamy water. Shutdown generator to add oil at 6:02. Start up generator at 6:04.
	6:15 p.m.	Deadweight surface pressure at 320 psig. BHP at 370.3. Rate at 37 psig on plate. Approximate water being pumped is 1/4 BWPH - very foamy with soap.
	6:30 p.m.	Deadweight surface pressure at 323 psig. BHP at 374.9 psig. Rate at 36 psig on 3/32 inch plate. Very very small amount foamy water being pumped approximately 1/4 BWPH.
	6:35 p.m.	Deadweight surface pressure at 329 psig. BHP at 384.0. Rate at 35 psig on 3/32 inch plate. Approximately 1/4 BWPH. Changed chart drive to 3"/hr from 15"/hr.
	7:00 p.m.	Deadweight surface pressure at 333. BHP at 384.0. Rate at 37 psig on 3/32 inch plate. Approximately 1/4 (less) BWPH.
	7:15 p.m.	Deadweight surface pressure at 335 psig. BHP at 386.3. Rate at 33 psig on 3/32 inch plate. Less than 1/4 BWPH.
	7:30 p.m.	Deadweight surface pressure at 342 psig. BHP at 393.1. Rate at 32 psig on 3/32 inch plate. Water increased to approximately 1/2 BWPH.

Standard Draw Number 1
Second Zone Drawdown Number 1

Date & Time

7/21	8:00 p.m.	Deadweight surface pressure at 347. BHP at 400.0. Rate at 31 psig on 3/32 inch plate. Water at approximately 1/2 BWPH. Adjusted rate up with choke.
	8:15 p.m.	Deadweight surface pressure at 348. BHP at 400.0. Rate at 38 on 3/32 inch plate. Water at approximately 1/2 BWPH. Gauged water at this rate - very foamy.
	10:00 p.m.	Deadweight surface pressure at 345. BHP at 402.3. Rate at 40 psig on 3/32 inch plate. Water at approximately 1/2 to 3/4 BWPH. Decided to let pump overnight to see if well will clean up and flow improve.
7/22	6:00 a.m.	Deadweight surface pressure at 360. BHP at 420.6. Rate at 50 psig on 3/32 inch plate. Not pumping any water at surface at time of check.
	6:30 a.m.	Well shut in.

Wednesday, July 22, 1970 (Continued)

<u>Date & Time</u>	<u>DW Surface Pressure</u>	<u>BHP psig</u>	<u>Δt</u>
7/22 6:30 a.m.	360 psig	416.0 psig - shut in	
7:00	388	448.0	0.5
7:30	420	484.6	1.0
8:00	450	521.1	1.5
8:30	486	571.4	2.0
9:00	513	621.7	2.5
9:30	545	672.0	3.0
10:00	574	717.7	3.5
10:30	600	758.9	4.0
11:00	629	804.5	4.5
11:30	655	849.2	5.0
12:00 Noon	-	889.4	5.5
1:00 p.m.	-	960.9	6.5
2:00	-	1027.9	7.5
3:00	825	1095.0	8.5
4:00 p.m.	855 psig	1153.1 psig	9.5
5:30	-	1229.1	11.0
6:30	935	1273.7	12.0
7:30	970	1322.9	13
8:30	1000	1358.7	14
10:30	1050	1434.6	16
7/23 12:30 a.m.	-	1492.7	18
2:30	-	1537.4	20
4:30	-	1573.2	22
6:30	-	1608.9	24
8:30	1218	1635.8	26
10:30	1238	1662.6	28
12:30 p.m.	1255	1680.4	30
*3:30	1279	1707.3	33
*6:30	1286	1716.2	36
9:30	1305	1738.5	39
7/24 1:30 a.m.	-	1765.4	43
5:30	1370	1796.6	47
**9:30	1393	1823.5	51
**1:30 p.m.	1395	1832.4	55
**7:30	1390	1845.8	61

*Note: A small leak around the cable existed during these readings. After the sun went down the leak was a very very small blow of gas.

**Note: A small leak started at approximately 12:00 Noon and existed until approximately 8:00 p.m. at which time it receded to a very very small blow.

Saturday, July 25, 1970

<u>Date & Time</u>	<u>DW Surface Pressure</u>	<u>BHP psig</u>	<u>Δt</u>
7/25 1:30 a.m.	1420 psig	1872.6 psig	67
7:30	1447	1899.4	73
7:30 p.m.	-	1926.3	85

Approximately 1 gallon of Marfak II grease was pumped into the control head to seal off small leak. Helped but did not completely seal off. Very small leak remains - decreases after sun goes down.

Sunday, July 26, 1970

<u>Date & Time</u>	<u>DW Surface Pressure</u>	<u>BHP psig</u>	<u>Δt</u>
7/26 7:30 a.m.	-	1970.9 psig	97
11:30	1518 psig	1979.9	101

Install CER SPR-1 in place of rental surface recorder. Worked okay - reads .002 less than rental instrument. Pumped in approximately 1 quart of grease into control head.

Monday, July 27, 1970

<u>Date & Time</u>	<u>DW Surface Pressure</u>	<u>BHP psig</u>	<u>Δt</u>
7/27 2:30 p.m.	1610 psig	2033.5 psig	128

Found CER SPR-1 had functioned okay for approximately 3 hours and then went "Kaput" - noted were the following:

- (1) At 3"/hr on selector chart runs at 6"/hr.
- (2) Auto chart full scale indicator sweeps during indications.
- (3) Jumped from expanded scale to full scale and remained there for approximately 4 hours.
- (4) Reads .002 less than rental recorder.
- (5) Electronics package loose in case.
- (6) Door will not latch correctly.

The rental instrument was reinstalled and CER's recorder sent back for repair.

Tuesday, July 28, 1970

Well shut in for BHP buildup - mixed graphite with grease. Pumped into control head. Still very very small leak.

Wednesday, July 29, 1970

Well shut in for BHP buildup.

Thursday, July 30, 1970

Well shut in for BHP buildup.

Friday, July 31, 1970

Well shut in for BHP Buildup.

Saturday, August 1, 1970

Well shut in for BHP buildup.

Sunday, August 2, 1970

Well shut in for BHP buildup. Still very very small leak around 1/8 inch cable in control head.

Monday, August 3, 1970

Ended BHP buildup at 10:30 a.m. Deadweight tested surface pressure at 1776 psig. Pulled pressure sentry. Rigged up Barker rig. Mixed 200 bbls 2% KCl water. Unseated pump - pumped down 1-1/2 inch string up 2-1/16 inch, circulated for 1-1/2 hours. Rigged up to pull rods. Pulled and laid down rods and pump. Took off dual valves. Installed BOP and tested. Moved on substructure. Rigged up to pull 1-1/2 inch tubing string.

Tuesday, August 4, 1970

Released 1-1/2 inch from packer. Pulled 1-1/2 inch, released packer, pulled 2-1/16 inch and packer. Mixed 200 bbls 2% KCl water. Moved 2-3/8 inch onto pipe racks. Rigged up McCullough to run tracer survey. Started in hole with tools.

Wednesday, August 5, 1970

Had problems with McCullough Gamma tools. Three defective tools. Ran log and tracer survey with Colbalt 60. Appears that hole is taking liquid throughout 6810 - 6838 perforated interval. Injected tracer at 6797 feet. Checked location of R.A. material. Ran tool to 6840 feet. Pumped in water at 1/2 BPM. Ran profile surveys to check entry of R.A. material into perfs. Repeated this interval and also injected at 6828 feet and ran profile from 6870 feet up. Indicates apparent entry of R.A. material into lower perfs also. Pumped into formation with 2% KCl water to clean up zone. Ran Base Gamma log after cleaned up. Appears to correlate with initial log except for minor differences and a peak at 6830 feet. Rigged down McCullough. Picked up Dowell Model 6 - 5-1/2 inch packer ran in hole on 2-3/8 inch EUE tubing. Hydrotested tubing into hole. Found one bad joint. Set packer at 6620 feet KB. Tested to 1000 psig on annulus, held okay. Top perf at 6810 feet. Pumped in 10 bbls fresh water at 3 BPM at 2400 psig. Followed with 50 sacks Class G cement, followed by 100 sacks Class G with 3/10 of 1% D-13 and 1.3% Flak D-60. Well started taking cement on vacuum, then slowly started to build pressure when top of cement was near bottom of tubing. Pumped to clear tubing at 1/2 BPM, when tubing cleared shut down pump.

Thursday, August 6, 1970

Staged in 3 bbls over 3 hours. Pressured to 3000 # max., held okay. Ended squeeze. Rigged down Dowell - WOC 12 hours. Pulled packer and tubing while WOC. While coming out of hole small allen bolt dropped out of power tongs. Packer pulled by bolt. Laid down packer, nipples up to drill out cement. Picked up ten 3-5/8 inch drill collars, 4-3/4 inch bit, ran in hole on 2-3/8 inch tubing. Tagged top of soft cement at 6680 feet. After 12 hours WOC started drilling out cement. Small bolt gave very little problems. Cement became hard at 6750 feet. Drilled and cleaned out to 6900 feet. Circulated 45 minutes. Pressure tested squeeze to 1500 psig, surface pressure for 15 minutes, held okay.

Friday, August 7, 1970

Drilled and cleaned out to bridge plug at 7110 feet. Started drilling on bridge plug at 2:30 p.m. Worked on plug until 9:00 p.m. Pulled bit, found several teeth broken, probably from small bolt in hole. Ran bit #2 (Williams W-2) 4-3/4 inch. Drilled on plug for 1 hour and plug dropped out. Closed rams on BOP - Pumped 30 bbls 2% KCl water into perfs below at 1/2 BPM at 1100 psig. Opened back to tank. Flowed back 10 bbls in 10 minutes. Circulated gas to pit for 2 hours at 1/2 BPM - Pumped 10 bbls at 1/2 BPM and 1100psig into perfs at 7210 to 7183 feet. Did not flow back. Ran bit to 7520 feet.

Saturday, August 8, 1970

Pulled bit, collars out of hole. Picked up Dowell Model 6 packer. Ran in hole on 2-3/8 inch tubing to 6998 feet KB. Set and tested to 1500 psig, held okay. Pumped in 10 bbls fresh water, followed with 50 sacks Class G cement followed by 100 sacks Class G mixed with 3/10 of 1% D-13 and 1.3% Flak D-60. Displaced and cleared packer - staged in 3-1/4 bbls over 4-1/2 hours. Maximum squeeze pressure 3100 psig, held okay. Pulled packer - WOC 12 hours. Picked up 4-3/4 inch bit, 10 drill collars ran in hole with 2-3/8 inch tubing. Waited on cement 12 hours before drilling out.

Sunday, August 9, 1970

Drilled out cement with fresh water, ran bit to 7520 feet KB. Tested squeeze with 1500 psig surface pressure for 15 minutes, held okay. Pulled bit, ran bit, casing scraper, 10 collars to 7520 feet, found fillup from 7505 feet to 7520 feet. Cleaned out to 7520 feet. Pulled out of hole, cone lost from bit on top of bridge plug at 7520 feet KB (will have to be fished out of hole before going deeper). Before pulling out of hole, circulated out fresh water from 7520 feet to surface with 2% KCl water. Laid down 2-3/8 inch and drill collars on way out of hole.

Monday, August 10, 1970

Installed OCT dual tubing hangers under BOP and tested to 1000 psig, held okay. Rigged up Dresser Atlas, perforated with one NCF II shot at following KB points; 7454, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, and 76, total of 12 holes. Laid down D. A. tools. Picked up Brown Oil tools Husky dual hydraulic packer, ran in hole on 228 joints 2.062 IJ tubing, packer landed at 7403 feet KB, seating nipple at 7399 feet KB hydrotested 2-1/16 inch into hole at 5500 psig. Installed offset spool, started in hole with 1.90 OD IJ tubing.

Tuesday, August 11, 1970

Finished running 1.9 OD tubing, total of 229 joints, one 6 foot sub and change over 1.9 OD IJ x 2.062 OD IJ to hanger. Spaced out and latched into packer, landed with 4000# down on packer. Moved out substructure, installed dual head valves and tested to 4000#, mixed 600 bbls 2% KCl water. CO₂ transport delivered at 2:00 a.m., 8/12/70. Other 20 tons CO₂ to be on location at approximately 12:00 noon 8/12/70. Suspect approximately 1/2 of load was lost when one transport fell over.

Standard Draw Number 1

Zone 3 - 7454 feet to 7476 feet (GR-N Log)

SUMMARY OF FLOW PERIODS PRIOR TO BUILDUP TEST NUMBER 1

8/12/70 - Well fractured, flowing back to pit, CO₂, gas and water.

8/13/70 - Estimated 100 barrels water recovered, well flowing in heads.

8/14/70 - Well flowing 1 hour, dead 3 hours.

8/15/70 - Well still heading as before, estimated recovery - 150 barrels water.

8/16/70 - Well dead.

8/17/70 - Well dead.

8/18/70 - Well dead.

8/19/70 - Well dead.

8/20/70 - Moved in pumping unit.

8/21/70 - Killed well - running rods and pump

Date/Time	Wellhead Pressure psig	Bottom Hole Pressure psig	Water Meter Reading barrels	Flow Rate MCF/D	Remarks
8/22 0900	0	-	Direct to tank	0	Started pumping & flowing
1630	0	-	-	0	Started pumping & flowing
1930	500	-	510	20	
2200	625	-	-	20	
2245	700	-	-	30	
8/23 0330	550	-	-	30	
0730	400	-	592	30	
1030	350	-	610	26	Changed rate
1100	200	-	-		Reducing rate to
8/24 0800	200	-	-	10	Tank gauge recovered 117 barrels
1630	200	Shut in Well - changed meter			
1745	250	-	-	5.5	Opened well
8/25 0730	200	-	037	5.5	
1200	140	-	44.5	5.5	Shut well in

Standard Draw Number 1

Zone 3 - 7454 feet to 7476 feet (GR-N Log)

Summary of Flow Periods Prior to Buildup Test Number 1

Page Two

Date/Time	Wellhead Pressure psig	Bottom Hole Pressure psig	Water Meter Reading barrels	Flow Rate MCF/D	Remarks
8/26 1800	300	672	44	16	Opened well - Pumping
2030	180	315	50	5.5	
8/27 0900	125	329	80	5.5	
1600	100	142	92	5.5	
8/28 0400	10	450	100	0	Well shut in
1250	125	620	100	5.5	Started flowing
1915	100	370	112.5	5.5	
8/29 0730	0	822	112.5	0	Well dead
0815	125	822	113	5.5	
1500	72	599	127	5.5	Shut in
Tank gauge indicates only 3" water produced - gas breakout through meter is giving erroneous meter reading gas flowing to water tank - no measurement of rate					
8/30	Well shut in				
8/31 1150	515	1144	127	5.5	Pumping
1750	310	921	142.5	10	Changed rate
2250	200	768	142.5	10	Flowing only
9/01 0530					Rate declining
0715					Well dead
1645	150	-	155.5	5.5	
9/02 0600		(Pulled SPG-3)			Gas flow died
1530	150	-	157.5	4	
9/03		(Running SPG-3)			Well dead
9/04 1005	300	393	164.5	3	
2200	-	146	176.2	3	
9/05 1000	-	169	180	3	
1600	65	187	185	3	Shut in at 1600
1715	87	338	185	3	Opened well
2400	55	247	186.5	3	
9/06 0600	33	242	188.5	3	
Shut in at 0600 for buildup					

Standard Draw Number 1
 Zone 3 - 7454 to 7476 feet (GR-N Log)

GAS PRODUCED DURING PRODUCTION DRAWDOWN NUMBER 1

Date/Time	Hours 3/32"	Hours 1/8"	Pressure 3/32" psig	Pressure 1/8" psig	°F Temperature	Total Daily Produced MCF	MCF Cum.
8/22 0930	3.75	10	90	78	62	16.0	16.0
8/23 0930	-	24	-	33	62	15.5	31.5
8/24 0930	17.5	5.5	18	12	68	5.9	37.4
8/25 0930	6.5	-	50	-	68	3.0	40.4
8/26 1815	18	-	25.5	-	68	5.2	45.6
8/27 1300	15	-	18	-	68	3.4	49.0
8/28 1015	15.5	-	18	-	69	3.6	52.6
8/29 1030	5	-	18	-	89	1.4	54.0
8/30 1145	1.5	-	18	-	89	0.2	54.2
8/31 0030	18.5	-	36	-	60	6.5	60.7
9/01 2215	13.0	1/16"	18	1/16"	60	3.0	63.7
9/02 1200	-	16	-	36	64	2.7	66.4
9/03 0045	-	7	-	24	64	0.9	67.3
9/04 1145	-	24	-	24	63	3.0	70.3
9/05 1845	-	11.5	-	24	54	1.5	71.8

Well was shut in for buildup at 0600 9/06/70

Cum gas used for T hours is 72 MCF - Last 36 hours rate = 3 MCF/D

$$T_o = \frac{72 \text{ MSCF}}{3 \text{ MSCF/D}} \times 24 = 576 \text{ Hours}$$

Wednesday, August 12, 1970

Raised CO₂ transport. Had lost only (approximately) 5 tons of 20 tons total. Second transport arrived at 4:30 p.m. Dowell tested lines to 3000 psig for spotting acid. Pumped 200 gal 15% HCl down 1.9 OD tubing, spotted on bottom. Pumped into perfs at 1/2 BPM at 1400 psig. No apparent breakback in pressure. Let acid set for 27 minutes. Pressure tested to 7300 psig. All frac liquid 2% KCl water, mixed with 20#/1000 gal J-133 and 16#/1000 gal J-84, injected CO₂ at 1000 scf/bbl throughout job. Pumped in 80 bbl pad and got CO₂ into line during first part of pad. Pad at 5700# at 11 BPM, followed with 60 bbls at 1/2# 20/40 sand per gal. Got approximately 200# increase to 5900# when sand hit formation. Went to 3/4#/gal 20/40 and pressure gradually increased after sand hit formation to 6200 psig. Started in R.A. iridium 191 sand tracer at start of 3/4#/gal and throughout remainder of job. Changed sand concentration back to 1/2#/gal as pressure kept increasing. Got in 71 bbls at 3/4#/gal. Pressure started to decline when 1/2#/gal hit formation. Pumped in 157 bbls at 1/2#/gal at 5800 psig. Flushed with 47 bbls, total water 419 bbls, total CO₂ 30 tons, total sand 6800# 20/40 sand. Maximum pressure 6200 psig, average pressure 5600 psig. Average rate, sand and water, 11.5 BPM. Immediate shut in 2200 psig. Disconnected Dowell, connected 2-1/16 inch to line to pit. Flowing back water and CO₂ to pit. Ended frac at 6:25 p.m. 8/12/70.

Thursday, August 13, 1970

Well flowing back at 8:00 a.m. Estimated recovery 100 bbls H₂O. Well started declining from steady flow back at 10:00 a.m. to heading and flowing. At 6:00 p.m. well flowing approximately 30 minutes and dead approximately 1 hour. Gas will burn.

Friday, August 14, 1970

Well flaring gas and water to pit by heads. Estimated cumulative recovery 125 bbls. Well flows approximately 45 minutes to 1 hour then dies for 2 to 3 hours. Moved off Barker rig. Left well flowing to pit through 2-1/16 inch. Put 3 Dowell foaming sticks into 1.9 OD string. Pushed down hole with Amerada RPG-3 to 7350 feet KB, on bottom with pressure element at 5:00 p.m. Left well open to pit.

Saturday, August 15, 1970

Well flowing gas and water by heads. Flows approximately 45 minutes to 1 hour and dies for 2 to 3 hours. Estimated recovery since frac at 150 BW - flowed back some of soap at 7:00 p.m. Good blow.

Sunday, August 16, 1970

Well dead.

Monday, August 17, 1970

Well dead.

Tuesday, August 18, 1970

Well dead.

Wednesday, August 19, 1970

Pulled Amerada RPG-3, reran to 7350 feet KB with 72 hour clock - on bottom at 1:05 p.m. Found master valve closed on 2-1/16 inch string.

Thursday, August 20, 1970

Well did not unload after opening master valve on 2-1/16 inch. Blowing small volume of gas, too small to measure on Merla. Moved on R & R pulling unit to run rods. Rigged up unit only, connected Barker pump and tank ready to circulate well prior to running pump and rods in hole.

Friday, August 21, 1970

Circulated well with 60 bbls 2% KCl water, down 2-1/16 inch and up 1-1/2 inch to pit. Ran 2 joints 3/4 inch pipe and one 10 foot sub with perforations below pump, total of 52 feet ran H & F 1-1/2 x 1-1/4 x 16 foot "Lock-No" bottom hold down pump with double standing valve. Ran in hole with 87 5/8 inch rods and 208 3/4 inch rods, no pony rods. Set pump unit and base, spaced out pump and seated. Rigged down R & R well service. Installed gin pole, connected propane to engine and flow lines from wellhead to separator. Started up unit before releasing R & R. Pump action okay, released R & R.

Saturday, August 22, 1970

Started up pumping unit at 9:00 a.m. Pumped up at 9:30 a.m. Pumping direct to 400 bbl tank. Pressure on 1-1/2 inch string is 0# at surface, pumped well to 400 bbl tank until 7:30 p.m. Wellhead pressure on 1-1/2 inch string increased from 0# at 4:30 p.m. to 500 psig at 7:30 p.m. At 7:30 p.m. put well to pumping into separator and gas flow from 1-1/2 inch string to separator. 3/32 inch plate in Merla prover. Flowing at rate of 20 MCF/D - 100 psig on prover. Wellhead pressure increased from 500 psig at 8:00 p.m. to 625 psig at 10:00 p.m. and to 700 psig at 10:45 p.m. Installed 1/8 inch plate in prover - pressure at 78 psig, rate = 30 MCF/D, wellhead pressure decreased to 550 psig at 3:30 a.m., at 7:30 a.m. wellhead pressure was 400 psig. Separator water meter indicates H₂O production from 510 bbls at 7:30 p.m., 8/22, to 592 bbls at 7:30 a.m., 8/23/70.

Sunday, August 23, 1970

Pumping and flowing well. Flowed well on 1/8 inch plate at 78 psig until 10:30 a.m. Rate of approximately 30 MCF/D. Wellhead pressure had dropped to 350 psig. Changed rate to 66 psig on plate - approximately 26 MCF/D at 10:30 a.m. Water meter reading at 610 bbls on meter. Kept reducing gas flow rate to maintain approximately 200# on wellhead.

Monday, August 24, 1970

Pumping and flowing well. 1/8 inch plate, 18 psig, gas rate at 8:00 a.m. down to 10 MCF/D. Gauged 400 bbl tank at 4:00 p.m. Tank gauge at 5 ft, 10 in. = 117 bbls - meter on separator indicates 248 bbls produced. Some gas bubbling through water in tank. Shut in well at 4:30 p.m. Pulled dump valve, checked seat and nipple, looks okay. Pulled level control, looks okay. Changed out water meter, old one read 758 bbls, new one installed read 0000 bbls. Installed 3/32 inch plate in Merla. Started pumping and flowing at 5:45 p.m. Gas rate of 5.5 MCF/D, 18 psia on plate. H₂O to recover based on tank gauge is as follows. 484 bbls, total load H₂O in well minus 267 bbls recovered = 217 bbls yet to recover as of 5:45 p.m. 8/24/70.

Tuesday, August 25, 1970

Pumping and flowing well. Gas flow rate is 5.5 MCF/D, wellhead pressure decreased from 250 psig at 5:45 p.m. 8/24 to 200 psig at 7:30 a.m. 8/25/70, water meter reading at 037 bbls at 7:30 a.m. Gauged tank at 11:00 a.m. at 6 ft, 10 in. Made 20 bbls since 5:45 p.m. 8/24/70. Water meter indicates 43.5 bbls. Well is pumping off. Made only 1 bbl on meter from 9:30 a.m. to 12:00 noon. Wellhead pressure down to 140 psig. Shut in well at 12:00 noon. Plan to leave shut in overnight and run Amerada SPG-3 with SRT-2 in hole on 8/26 to see what bottom hole conditions are. Water to recover as of 12:00 noon 8/25 = 484 - 287 recovered = 197 bbls to recover. At shut in wellhead pressure was 140 psig.

Wednesday, August 26, 1970

Wellhead pressure at 12:00 noon was 550 psig. Rigged up to run Amerada pressure and temperature tools (CER equipment). Took gradient stops on way into hole. Well flowing small amount of gas through flow tube on way into hole. Started gas flow at 6:00 p.m. at 16 MCF/D. Started pumping unit at 6:15 p.m. H₂O meter at 44 at start of pumping. Wellhead pressure started to decline fast. Reduced gas flow rate at 8:30 p.m. to 5.5 MCF/D. Shut down pump unit at 3:30 a.m. 8/27. Well pumped off, left well flowing gas at 5.5 MCF/D.

Thursday, August 27, 1970

Well flowing gas at 5.5 MCF/D, balanced pumping unit. Gauged tank at 11:00 a.m. at 7 ft, 7 in. = 152 bbls - started up pumping unit at 10:30 a.m. Meter reading at 11:30 a.m. was 081 bbls. Load water to recover at 11:00 a.m. was 182 bbls. Total recovered from pumping 6:15 p.m. 8/26 to 3:30 a.m. 8/27 was 15 bbls. Shut down pumping unit at 7:20 p.m., well pumped off. Left well flowing at 5.5 MCF/D. Well died at 4:00 a.m. 8/28/70 - separator shut in.

Friday, August 28, 1970

Well buildup BHP to 745 psig at 12:45 p.m. Started gas flow at 5.5 MCF/D at 12:50 p.m. Started up pumping unit at 12:55 p.m. Gauged tank at 8 feet 0 inches - made 5 inches from 11:00 a.m. 8/27/70 to 7:20 p.m. 8/27/70 - total of 8.5 barrels. Cumulative recovery now 310.5 barrels, total to recover at 12:45 p.m. 8/18/70 is 173.5 barrels. Pumped well until 7:15 p.m., water meter reading 112.5. Shut down pumping unit - 370 psig BHP when well was shut in. Left well flowing through gas string.

Saturday, August 29, 1970

At 7:30 a.m. well dead on gas string. BHP at 822.3 psig, separator shut in. Opened gas string, pressure was 95 psig est. (wellhead gauge does not read less than 100 psig). Opened up H₂O string to separator, wellhead pressure on H₂O string was 350 psig. Started up pump unit at 8:30 a.m. Gas flow at 5.5 MCF/D since 8:15 a.m. Pumped and flowed until 5:15 p.m. Shut down pumping unit and gas string. Well is flowing gas through H₂O string, no H₂O. At 5:30 p.m. BHP was at 649 psig.

Sunday, August 30, 1970

Did not flow or pump well. Problems with separator. BHP at 8:00 a.m. was 884.9 psig. Both H₂O and gas strings had 350 psig at surface. Well shut in all day.

Monday, August 31, 1970

At 10:30 a.m. BHP was at 1144 psig. Surface pressure was 515 psig. Started pumping and flowing gas at 5.5 MCF/D at 10:50 a.m. Gauged tank at 9 feet 0 inches, made 20 barrels 8/28/70 to 8/29/70, load H₂O to recover is now 153.5 barrels. Water meter reading at start of pumping was 127 barrels. At 4:50 p.m. well was flowing gas through H₂O string. No H₂O. Shut down pumping unit. Surface pressure was 285 pounds on gas string and 300 on H₂O string (different gauge). At 5:50 p.m. changed gas flow rate to 10 MCF/D, at 7:50 p.m. gas string surface pressure was at 325 psig and H₂O string was at 135 psig. Started up pumping unit at 7:50 p.m. Well did not pump up in 3 hours. Shut down unit at 10:50 p.m., no H₂O. Left both strings open to the separator and gas flow at 10 MCF/D. Questionable if BHP measurements are correct.

Tuesday, September 1, 1970

At 5:30 a.m. gas rate started to decline from 10 MCF/D. At 7:15 a.m. well was dead and separator shut in, no H₂O produced. Meter still at 142.5 barrels. Surface pressure recorder SPR-1 very erratic. Does not appear to correlate with what should be going on down hole. Checked out SPR-1 and SPG-3, problems appear to be down hole. Started pumping well at 11:30 a.m., 1-1/2 inch gas string has less than 100 psig. Gauged tank at 11:25 a.m. at 9 feet 6 inches = 190 barrels recovered in 400 barrel tank. Total load recovered now at 340.5 barrels. Total to recover is 143 barrels. Well pumped up at 1:00 p.m. Shut in at 1:15 p.m. to go to Fawn Creek well. Started up flow and pumping at 4:45 p.m. Caught H₂O sample 3-9 at 0143 barrels on meter at 5:00 p.m. Cumulative recovery at this sample is 341 barrels. Much gas or CO₂ still in water being dumped from separator to 400 barrel tank. Shut down pumping unit at 10:00 p.m. Left well open through both strings to separator overnight at 5.5 MCF/D.

Wednesday, September 2, 1970

Well flowed until 6:00 a.m. and died. Separator shut in, started to pumping to 400 barrel tank (separator by-passed) at 7:30 a.m. Did not open up gas flow. Pumped until 10:30 a.m. Shut down unit. Pulled Amerada SPG-3 from hole. Started pump unit again at 11:30 a.m., pumped until 12:45 p.m. and shut down to go to Fawn Creek. Started up pump unit at 3:30 p.m. Installed 1/16 inch plate in 2 inch Merla Prover. Started up gas flow at 4 MCF/D through separator. Gauged 400 barrel tank, recovery now 352.5 barrels of 484 barrels total load H₂O. 131.5 barrels to recover. Found SPG-3 problem apparently in rope socket terminal connection. Shut down pump unit at 8:40 p.m., well had pumped off. Left both strings open to separator and controls set for 4 MCF/D.

Thursday, September 3, 1970

Started pumping well at 8:30 a.m. to 400 barrel tank, no gas flow. Pumped until 11:00 a.m. and shut down to install lubricator and pressure element in lubricator. DWT pressure element at surface in lubricator. DWT pressure = 130 psig, SPG-3 = 128 psig. Left instrument in lubricator at surface until 1:00 p.m. and ran to 7350 feet KB. Pumped well from 4:30 p.m. until 7:45 p.m. Did not flow gas. Pumped direct to 400 barrel tank. Shut down pump unit at 7:45 p.m. Left H₂O string open to 400 barrel tank.

Friday, September 4, 1970

At 10:00 a.m. wellhead pressure at approximately 300 psig on 1-1/2 inch string. 2-1/16 inch string dead to 400 barrel tank. Started up gas flow at 3 MCF/D at 10:05 a.m. Separator water meter reading at 164.5 barrels. Started up pumping unit at 10:20 a.m. to separator. Caught water sample 3-10 at 3:00 p.m. Separator reading at 168.5. Pumped and flowed well for rate to shut in well for BHP buildup. Surface and BHP gradually declined.

Saturday, September 5, 1970

Pumping and flowing well. Gas rate at 3 MCF/D. Surface pressure and BHP gradually declining. At 3:30 p.m. BHP was 125.7 psig. Surface pressure was 55 psig. Shut in well for buildup at 3:30 p.m. Pressure built up rapidly after approximately 30 minutes. Shut in at 338 psig. Appears that either instrument is bad or H₂O is leaking through pump and has u-tubed to 1-1/2 inch string. At 5:00 p.m. started up pump unit, watched BHP for 15 minutes. It did not change, well did not pump H₂O. Started up gas flow at 5:15 p.m. at 3 MCF/D, no H₂O at 9:00 p.m. Pumping and flowing at 3 MCF/D. Very small amount of H₂O between 9:00 p.m. and midnight. BHP is gradually declining. Let well pump and flow until 6:00 a.m., 9/6/70. Appears that SPG-3 instrument is okay and that water has u-tubed to 1-1/2 inch.

Sunday, September 6, 1970

Shut in well at 6:00 a.m. for BHP buildup. Surface pressure down to 33 psig. BHP at 242.3. After shut in for approximately 3 minutes BHP again rapidly increased. Caught H₂O sample 3-11 at 6:00 a.m. Separator water meter reading at 188.5 barrels. Gauged 400 barrel tank at 11.6 feet = 232 barrels. Total load water recovered = 150 barrels from flow back after frac plus 232 barrels pumped back = 382 barrels recovered of 484 barrels load H₂O in well. Total yet to recover - 102 barrels. Total gas produced = 72 MCF. Rate for last 36 hours before shut in was 3 MCF/D.

Monday, September 7, 1970

Well shut in for BHP buildup.

Tuesday, September 8, 1970

Well shut in for bottom hole pressure buildup.

Wednesday, September 9, 1970

Well shut in for bottom hole pressure buildup.

Thursday, September 10, 1970

Well shut in for bottom hole pressure buildup.

Friday, September 11, 1970

Pulled SPG-3 from hole, found pin in instrument broken where cable head attaches. Sent instrument to Indel, Tulsa, for repair. Well shut in, had to bleed small amount of gas to get instrument out of hole.

Saturday, September 12, 1970

Waiting on instrument - well shut in for bottom hole pressure buildup.

Sunday, September 13, 1970

Waiting on instrument - well shut in for bottom hole pressure buildup.

Monday, September 14, 1970

Received instrument from Indel - ran in hole to 7350 feet KB. Well shut in. Had to bleed small amount of gas to get instrument in hole.

Tuesday, September 15, 1970

Well shut in for bottom hole pressure buildup.

Wednesday, September 16, 1970

Well shut in for bottom hole pressure buildup.

Thursday, September 17, 1970

Well shut in for bottom hole pressure buildup.

Friday, September 18, 1970

Well shut in for BHP buildup

Saturday, September 19, 1970

Well shut in for BHP buildup

Sunday, September 20, 1970

Well shut in for BHP buildup

Monday, September 21, 1970

Well shut in for BHP buildup

Tuesday, September 22, 1970

Well shut in for BHP buildup

Wednesday, September 23, 1970

Well shut in for BHP buildup

Thursday, September 24, 1970

Well shut in for BHP buildup

Friday, September 25, 1970

Well shut in for BHP buildup

Saturday, September 26, 1970

Well shut in for BHP buildup

Sunday, September 27, 1970

Well shut in for BHP buildup

Monday, September 28, 1970

Well shut in for BHP buildup

Tuesday, September 29, 1970

Well shut in for BHP buildup

Wednesday, September 30, 1970

Well shut in for BHP buildup

Thursday, October 1, 1970

Well shut in for BHP buildup

Friday, October 2, 1970

Well shut in for BHP buildup

Saturday, October 3, 1970

Well shut in for BHP buildup

Sunday, October 4, 1970

Well shut in for BHP buildup

Monday, October 5, 1970

Well shut in for BHP buildup

Tuesday, October 6, 1970

Well shut in for BHP buildup

Wednesday, October 7, 1970

Well shut in for BHP buildup.

Thursday, October 8, 1970

Well shut in for BHP buildup.

Friday, October 9, 1970

Well shut in for BHP buildup.

Saturday, October 10, 1970

Well shut in for BHP buildup.

Sunday, October 11, 1970

Well shut in for BHP buildup.

Monday, October 12, 1970

Well shut in for BHP buildup.

Tuesday, October 13, 1970

Pulled Amerada SPG-3, spooled off 1/8 inch line from wireline unit, rigged down lubricator, gin pole and pumping unit. Disconnected flow lines, moved equipment to Fawn Creek. Barker rig moved onto location. Rigged up pump to kill well.

Wednesday, October 14, 1970

Moved equipment from Scandard to Fawn Creek. Set up pipe racks, moved in 2-3/8 inch tubing, rigged up Barker rig, ready to pull rods. Blew well down, cleaned up location, working days only.

Thursday, October 15, 1970

Circulated hole with 2% KCl water. Pulled and laid down 3/4 inch, 5/8 inch rods and pump. Rigged to pull tubing. Laid down 1.90 O.D. tubing, shut in for night.

Friday, October 16, 1970

Filled hole with 2% KCl water, released packer, pulled and laid down 2.062 O.D. tubing. Ran 224 joints 2-3/8 inch EUE tubing. Landed open ended at 6964 feet (tubing tally attached). Made up wellhead. Shut in well.

Saturday, October 17, 1970

Rigged down Barker rig - moving to Fawn Creek. Final Report for this well, left completed as gas well.

APPENDIX III-C

FAWN CREEK TEST DATA

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Fawn Creek Government Number 1
Zone Open - Mesaverde II

Tefteller Inc.
Instrument

PRESSURE AND TEMPERATURE SURVEY
BEFORE RECOMPLETION

Survey Run on May 2, 1970

<u>Depth (KB)</u> <u>feet</u>	<u>Temperature</u> <u>°F</u>	<u>Pressure</u> <u>psig</u>
50	-	2575
1000	-	2665
2000	113	2751
3000	141	2828
3500	154	2869
4000	170	2910
4500	179	2950
5000	187	2991
5500	194	3032
6000	201	3073
6500	207	3114
7000	214	3155

Fawn Creek Government Number 1
Zone 1 - 5747 feet to 5792 feet

TABLE III-C-1

GAS PROPERTIES

Pressure psia	Z	Viscosity cp	Compressibility psi ⁻¹	B Bbls/MCF	M(p) psi ² /cp
500	.962	.0143	2.08×10^{-3}	6.34	1.81×10^7
600	.955	.0144	1.74 "	5.25	2.61 "
700	.948	.0145	1.50 "	4.46	3.56 "
800	.942	.0147	1.32 "	3.88	4.64 "
900	.936	.0148	1.17 "	3.43	5.87 "
1000	.930	.0149	1.06 "	3.07	7.24 "
1100	.925	.0151	9.61×10^{-4}	2.77	8.75 "
1200	.921	.0153	8.81 "	2.53	10.39 "
1300	.916	.0154	8.13 "	2.32	12.17 "
1400	.913	.0156	7.53 "	2.15	14.07 "
1500	.909	.0158	7.01 "	2.00	16.10 "
1600	.906	.0160	6.55 "	1.87	18.25 "
1700	.904	.0162	6.14 "	1.75	20.51 "
1800	.902	.0164	5.76 "	1.65	22.89 "
1900	.900	.0166	5.43 "	1.56	25.38 "
2000	.899	.0168	5.12 "	1.48	27.97 "
2100	.898	.0170	4.84 "	1.41	30.66 "
2200	.897	.0173	4.58 "	1.34	33.45 "
2300	.897	.0175	4.34 "	1.29	36.33 "
2400	.897	.0178	4.12 "	1.23	39.30 "
2500	.898	.0180	3.92 "	1.18	42.35 "
2600	.899	.0183	3.72 "	1.14	45.48 "
2700	.900	.0185		1.10	48.68 "

Gas Gravity = .605
Crit. Temp. = 361.2 R
Bottom Hole Temp. = 195°F
Crit. Pres. = 672.2 psia
Barometric Pres. = 11 psia

Molecular Weight = 17.45
Reduced Temp. = 1.813
Base Temp. = 520 R
Initial Pres. = 2500 psig
Base Pres. = 14.7 psia

CHEMICAL & GEOLOGICAL LABORATORIES

C3

P. O. Box 279
Casper, Wyoming

GAS ANALYSIS REPORT

Company CER Geonuclear Date September 9, 1970 Lab. No. 4310
Well No. Unit No. 1 Location
Field Fawn Creek Formation Fort Union 5745 to 5792 - Zone 1
County Rio Blanco Depth
State Colorado Sampling point Wellhead
Line pressure 450 psig; Sample pressure 450 psig; Temperature 72 ° F; Container number
Remarks Wellhead sample

Component	Mole % or Volume %	
Oxygen	0	
Nitrogen	0.18	
Carbon dioxide	0.91	
Hydrogen sulfide	0	
Helium	0	
Methane	94.03	
Ethane	3.45	Gallons per MCF
Propane	0.69	0.189
Iso-butane	0.18	0.059
N-butane	0.15	0.047
Iso-pentane	0.07	0.026
N-pentane	0.05	0.018
Hexanes & higher	0.29	0.134
Total	100.00	0.473

GPM of pentanes & higher fraction 0.178

Gross btu/cu. ft. @60° F. & 14.7 psia (dry basis) 1,061

Specific gravity (calculated from analysis) 0.602

Specific gravity (measured) 0.605

Remarks:

Fawn Creek Government Number 1
Zone 2 - 5600 feet to 5630 feet

TABLE III-C-2
GAS PROPERTIES

Pressure psia	Z	Viscosity cp	Compressibility psi^{-1}	B Bbls/MCF	M(p) psi^2/cp
100	.996	.0139	1.01×10^{-2}	32.59	$.72 \times 10^6$
200	.987	.0140	5.09×10^{-3}	16.14	2.89 "
300	.978	.0141	3.42 "	10.66	6.52 "
400	.970	.0141	2.58 "	7.93	1.16×10^7
500	.962	.0142	2.08 "	6.29	1.82 "
600	.954	.0144	1.74 "	5.20	2.62 "
700	.947	.0145	1.50 "	4.43	3.57 "
800	.941	.0146	1.32 "	3.85	4.66 "
900	.935	.0148	1.17 "	3.40	5.90 "
1000	.929	.0149	1.06 "	3.04	7.27 "
1100	.924	.0151	9.63×10^{-4}	2.75	8.79 "
1200	.919	.0152	8.82 "	2.51	10.43 "
1300	.915	.0154	8.14 "	2.30	12.22 "
1400	.911	.0156	7.54 "	2.13	14.13 "
1500	.908	.0158	7.02 "	1.98	16.16 "
1600	.905	.0160	6.56 "	1.85	18.32 "
1700	.902	.0162	6.14 "	1.74	20.59 "
1800	.900	.0164	5.77 "	1.64	22.98 "
1900	.898	.0166	5.44 "	1.55	25.48 "
2000	.897	.0168	5.13 "	1.47	28.08 "
2100	.896	.0170	4.85 "	1.40	30.79 "
2200	.895	.0173	4.59 "	1.33	33.59 "
2300	.895	.0175	4.35 "	1.27	36.48 "
2400	.895	.0177	4.13 "	1.22	39.46 "
2500	.896	.0180	3.92 "	1.17	42.52 "
2600	.897	.0182	3.73 "	1.13	45.66 "
2700	.898	.0185	3.55 "	1.09	48.87 "
2800	.900	.0188	3.38 "	1.05	52.16 "
2900	.901	.0190	3.22 "	1.02	55.51 "
3000	.904	.0193	3.07 "	.99	58.92 "
3100	.906	.0196	2.93 "	.96	62.39 "
3200	.909	.0198		.93	65.92 "

Gas Gravity = .62
Crit. Temp. = 360 R
Bottom Hole Temp. = 190°F
Crit. Pres. = 672.5 psia
Barometric Pres. = 11 psia

Molecular Weight = 17.31
Reduced Temp. = 1.81
Base Temp. = 520 R
Initial Pres. = 3000 psig
Base Pres. = 14.7 psia

CHEMICAL & GEOLOGICAL LABORATORIES

C5

P. O. Box 2794

Casper, Wyoming

GAS ANALYSIS REPORT

Company C.E.R. Geonuclear Date November 30, 1970 Lab. No. 4764
 Well No. Unit #1 Location _____
 Field Fawn Creek Formation Fort Union (Zone 2) 5598 to 5632
 County Rio Blanco Depth _____
 State Colorado Sampling point Separator
 Line pressure 270 psig; Sample pressure 110 psig; Temperature 80 ° F; Container number 40M
 Remarks _____

Component	Mole % or Volume %	
Oxygen	0	
Nitrogen	0.20	
Carbon dioxide	0.93	
Hydrogen sulfide	0	
Methane	93.40	
Ethane	3.47	Gallons per MCF
Propane	0.70	0.192
Iso-butane	0.17	0.055
N-butane	0.19	0.060
Iso-pentane	0.08	0.029
N-pentane	0.07	0.025
Hexanes & higher	0.79	0.364
Total	100.00	0.725

GPM of pentanes & higher fraction 0.418
 Gross btu/cu. ft. @ 60° F. & 14.7 psia (dry basis) 1085
 Specific gravity (calculated from analysis) 0.618
 Specific gravity (measured) 0.621

Remarks: _____

Fawn Creek Government Number 1
 Zone 1 - 5747 feet to 5792 feet (GR-N Log)
 BHP Buildup Number 1

Buildup Test From 6/12/70 to 6/16/70
 Ball Bros. MK-9P SS
 Element at 5715 feet KB

$$T_o = \frac{1150 \text{ MSCF}}{73 \text{ MSCF/D}} \times 24 = 378 \text{ Hours}$$

Date & Time		Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_o + \Delta t}{\Delta t}$	Remarks
6/12/70	1700	0	372				
	1707	0.11	376			3333.	
	1715	0.25	390			1493.	
	1730	0.50	456			756.	
	1745	0.75	522			505.	
	1800	1.0	570			378.	
	1830	1.5	642			252.	
	1900	2.0	708			189.	
	2000	3.0	-			126.	
	2100	4.0	876			95.	
	2200	5.0	876			77.	
	2300	6.0	882			63.7	
	2400	7.0	894			55.0	
6/13	0100	8.0	906			48.3	
	0200	9.0	924			43.0	
	0300	10.0	936			38.8	
	0400	11.0	954			35.3	
	0500	12.0	966			32.4	
	0600	13.0	978			30.0	
	0700	14.0	990			27.9	

Fawn Creek Government Number 1
 Zone 1 - 5747 feet to 5792 feet (GR-N Log)
 BHP Buildup Number 1
 Page Two

Date & Time		Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	To+ Δt Δt	Remarks
6/13/70	0800	15.0	1002			26.2	
	0900	16.0	1008			24.6	
	1000	17.0	1026			23.2	Hard to Read
	1100	18.0	1032			22.0	
	1200	19.0	1038			20.9	
	1315	20.25	1038			19.65	
	1330	20.50	1044			19.42	
	1400	21.0	1050			19.01	
	1600	23.0	-			17.4	
	1800	25.0	1092			16.12	
	2000	27.0	1104			15.0	
	2200	29.0	1122			14.2	
	2400	31.0	1080 ?			13.2	
6/14	0200	33.0	-			12.45	
	0400	35.0	1146			11.78	
	0600	37.0	-			11.21	
	0800	39.0	-			10.7	
	1000	41.0	1170			10.2	
	1200	43.0	1176			9.8	
	1400	45	1182			9.43	
	1800	49	1194			8.77	
	2200	53	1212			8.13	
	2400	55	1218			7.87	
6/15	0200	57	1224			7.64	
	0400	59	1236			7.41	
	0800	63	1242			7.00	
	1000	65	1248			6.80	
	1120	66.3	1254			6.71	
	1135	66.6	1254			6.66	

Fawn Creek Government Number 1
 Zone 1 - 5747 feet to 5792 feet (GR-N Log)
 BHP Buildup Number 1
 Page Three

Date & Time		Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{\text{To+ } \Delta t}{\Delta t}$	Remarks
6/15/70	1200	67	1254			6.64	
	1400	69	1260			6.48	
	1600	71	1266			6.32	
	2000	75	1272			6.05	
	2200		1278				
	2400	79	1284			5.78	
6/16	0200		1290				
	0400	83	1290			5.55	
	0800	87	1302			5.35	
	1000		1308				
	1045	89.75	1308			5.20	

From 6/16 to 6/30/70 the well was worked on to recover instrument and then cleaned up for drawdown test 1 and buildup number 2 -- details are furnished in daily reports.

Fawn Creek Government Number 1
Drawdown Number 1

The Fawn Creek Well was flowed at a constant gas flow rate of 36 MCF/D from 1530 on 6/30/70 to 1300 on 7/08/70. No downhole pressure data is available due to failure of downhole recorders. Cumulative production to 7/08/70 is estimated at 1619 MSCF. Water produced this test was 157 barrels from meter reading on separator. Water production at end of test averaging less than 6 barrels per day.

Fawn Creek Government Number 1
 Zone 1 - 5747 feet to 5792 feet (GR-N Log)
 BHP Buildup Number 2

Buildup Test From 7/8/70 to 8/1/70
 Instrument GRC-SPG-3, #30362
 Element at 5700 feet KB

$$T_o = \frac{1619 \text{ MSCF}}{36 \text{ MSCF/D}} \times 24 = 1160 \text{ Hours}$$

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_o + \Delta t}{\Delta t}$	Remarks
7/08/70 1300	0	653.7	425	229		Shut well in. SPG-3 pressure element at 5700 feet KB.
1330	.5	772.6	535	238	2321	
1400	1.0	822.3	580	242	1161	
1430	1.5	858.1	640	218	774	
1500	2.0	884.9	675	210	581	
1600	3	925.1	740	185	388	
1700	4	956.4	785	171	291	
1800	5	983.2	825	158	233	
1900	6	1010.1	865	145	194	
2000	7	1036.9	905	132	167	
2100	8	1063.7	940	124	146	
2200	9	1086.0	955	131	130	
2400	11	1117.3	980	137	106.5	
7/09/70 0200	13	1144.1	1005	139	90.2	
0400	15	1166.5	1025	141	78.3	
0800	19	1197.8	1055	143	62.0	
1200	23	1220.1	1080	140	51.4	
1600	27	1242.5	1110	132	44.0	
2000	31	1264.8	1130	135	38.4	
2400	35	1282.7	1145	138	34.1	

Fawn Creek Government Number 1
 Zone 1 - 5747 feet to 5792 feet (GR-N Log)
 BHP Buildup Number 2
 Page Two

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T + \Delta t}{\Delta t}$	Remarks
7/10/70 0400	39	1296.1	1155	141	30.7	
0800	43	1309.5	1165	144	28.0	
1200	47	1322.9	1170	153	25.7	
1600	51	1331.8	1180	152	23.7	Leaking
2000	55	1340.8	1190	150	22.1	Leaking
2400	59	1349.7	1195	155	20.7	Okay
7/11/70 0400	63	1358.7	1200	159	19.4	
0800	67	1367.6	1205	163	18.3	
1400	73	1374.0	1210	164	16.9	
2200	81	1385.5	1215	170	15.3	
7/12/70 0600	89	1398.9	1220	179	14.0	
1400	97	1412.3	1230	182	12.9	
2200	105	1413	1235	178	12.0	Leaking
7/13/70 1700	124	1425.7			10.4	Worked on control head -
1900	126	1439.1	1250	189	10.2	still leaking
Rubbers in control head leaking since 2200 hours 7/12/70, leak stopped at 2030 hours 7/13/70						
7/13/70 2200	129	1439.1			10.0	No Leak
7/14/70 0200	133	1461.5			9.72	No Leak
0700	138	1470.4	1265	205	9.41	No Leak
1200	143	1479.3	1270	209	9.11	No Leak
1400	145	1483.8			9.00	Leak - short in cable at
1600	147	1501.7			8.89	wellhead where safety
1800	149	1497.2			8.79	clamped off
2000	151	1492.7			8.68	
2100	152	1497.2			8.63	Leak stopped
2400	155	1501.7			8.48	

Short in cable from safety clamp - cut cable at wellhead and repaired short. Lost 3300 feet 1/8 inch cable.
 Leaking gas at wellhead all afternoon - stopped when cooled off at 9:00 p.m.

Fawn Creek Government Number 1
 Zone 1 - 5747 feet to 5792 feet (GR-N Log)
 BHP Buildup Number 2
 Page Three

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	To+ Δt Δt	Remarks
7/15/70 0600	161	1515.1			8.20	
1000	165	1524.0			8.03	
1600	171	1533.0			7.78	
7/16/70 1000	189	1649.2			7.14	recorder stopped - 18 hours
1400	193	1658.1			7.01	Another fault?
1700						Small gas leak
						Suspect instrument error - both manual and recording
(Manual recorder pressure fall off at wellhead)						
7/17/70 1000						
1100 - Packoff loosened to pull wireline out. Blowdown some gas.						
7/18/70	Gage in wellhead all day, master valve shut in - well building up.					
7/19/70	Recovered SPG-3 gage. Surface recorder not functioning. Deadweighted the Marshall 3500 psi RPG-3 in the lubricator - 72 hour clock pressure gage at 12:35. DWT pressure 1335 psig. Waited 10 minutes, DWT same at 1335 psig. On bottom with Marshall gage at 1315, 5650 feet G.L.					
7/20/70	Well shut in					
7/21/70	Well shut in					
7/22/70 1330	336.5	1558.5			4.45	No fluid level to 5650 feet GL
						Marshall survey
1430	337.5	1559.9			4.44	Marshall pressure element
						using 175°F, 1800 psig
						calibration curve. 5650 ft GL
1930	342.5	1561.7			4.39	
7/23/70 0030	347.5	1565.3			4.34	
0530	352.5	1567.0			4.29	
1030	357.5	1568.8			4.24	
1530	362.5	1570.6			4.20	
2030	367.5	1572.4			4.16	

Fawn Creek Government Number 1
 Zone 1 - 5747 feet to 5792 feet (GR-N Log)
 BHP Buildup Number 2
 Page Four

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	To+ Δt Δt	Remarks
7/24/70 0130	372.5	1574.1			4.11	
0630	377.5	1575.9			4.07	
1130	382.5	1577.7			4.03	
1630	387.5	1579.5			3.99	
2130	392.5	1583.0			3.96	
7/25/70 0230	397.5	1584.8			3.92	
0730	402.5	1586.6			3.88	
1230	407.5	1588.4			3.85	Deadweight test of Marshall gauge in lubricator. DWT = 1397 psig Marshall gauge = 1394.5 psig
7/26/70	Well shut in					
7/27/70	Well shut in					
7/28/70	Well shut in					
7/29/70 1440						Deadweight test of CER RPG-3 in lubricator. DWT = 1430 psig CER gauge = 1425.6
1535	506.5	1630.1			3.29	CER wellbore survey to 5650 ft KB, no fluid level.
1630	507.5	1624.0			3.29	CER gauge rerun with 72 hr clock 5650 ft KB
7/30/70 1630	531.5	1634.0			3.18	
7/31/70 1630	555.5	1641.0			3.09	
8/01/70 1200	575.0	1650.0			3.02	CER gauge pulled to read
1630	579.5	1653.0			3.00	CER gauge rerun for start of flow period 72 hour clock.

Well open to flow at 1635 on 8/01/70

Fawn Creek Government Number 1
 Zone 1 - 5747 feet to 5792 feet (GR-N Log)
 Drawdown Test Number 2

Test From 8/1/70 to 8/16/70

RPG-3 #30167N, bottom hole pressure gauge
 used from 8/01/70 to 8/11/70 then changed
 out and SPG-3 #30362 used from 8/12/70 to
 end of test.

All instruments landed at 5650 feet KB.

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
8/1/70									
1635	0	1653	1460	193	95	34.1	406	0	
1700	.5	1632	1460	172	97	34.7	"	"	
1800	1.5	1627	1445	182	97	34.7	"	"	
1900	2.5	1617	1435	182	97	35.2	"	"	
2000	3.5	1608	1420	188	96	35.5	"	"	
2100	4.5	1600	1410	190	96	35.7	"	"	
2200	5.5	1594	1400	194	96	35.7	"	"	
2300	6.5	1587	1390	197	96	35.7	"	"	
2400	7.5	1581	1385	196	97	35.8	"	"	
8/2/70									
0100	8.5	1574	1380	194	97	35.9	406	0	
0200	9.5	1569	1375	194	97	35.9	"	"	
0400	11.5	1559	1370	189	97	35.8	"	"	
0600	13.5	1553	1360	193	97	35.9	"	"	
0800	15.5	1543	1360	183	97	35.6	"	"	
1000	17.5	1538	1360	178	97	35.7	"	"	
1200	19.5	1531	1360	171	98	35.4	"	"	

Fawn Creek Government Number 1
Zone 1 - 5747 feet to 5792 feet (GR-N Log)
Drawdown Test Number 2
Page Two

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
8/2/70									
1400	21.5	1525	1355	170	98	35.4	406	0	
1600	23.5	1518	1350	168	98	35.2	"	"	
1800	25.5	1510	1330	180	97	35.6	"	"	
2000	27.5	1501	1320	181	96	35.8	"	"	
2200	29.5	1496	1310	186	96	35.7	"	"	
2400	31.5	1488	1305	183	96	35.7	"	"	
8/3/70									
0200	33.5	1482	1295	187	96	35.7	406	0	
0400	35.5	1475	1280	195	96	35.7	"	"	
0600	37.5	1470	1275	195	96	35.6	"	"	
0800	39.5	1463	1270	193	96	35.4	"	"	
1000	41.5	1459	1280	179	97.5	35.6	"	"	
1200	43.5	1452	1295	157	98	35.4	"	"	
1400	45.5	1447	1285	162	97.5	35.4	"	"	
1600	47.5	1442	1280	162	97	35.3	"	"	
1800	49.5	1435	1280	155	97.5	35.3	"	"	
2000	51.5	1426	1260	166	97	35.6	"	"	
2200	53.5	1418	1250	168	97	35.5	"	"	
2400	55.5	1410	1245	165	97	35.7	"	"	
8/4/70									
0200	57.5	1405	1240	165	97	35.8	406	0	
0400	59.5	1400	1230	170	97	35.6	"	"	
0600	61.5	1393	1225	168	97.5	35.4	"	"	
0800	63.5	1387	1220	167	97	35.6	"	"	
1000	65.5	1382	1230	152	97	35.6	"	"	
1200	67.5	1376	1220	156	97.5	35.6	"	"	
1400	69.5	1374	1220	154	97.5	35.5	"	"	

Fawn Creek Government Number 1
 Zone 1 - 5747 feet to 5792 feet (GR-N Log)
 Drawdown Test Number 2
 Page Three

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
RPG-3 bottom hole gauge with 72 hour clock off bottom at 1:53 p.m. Back on bottom at 2:45 p.m. with new chart. Well shut in approximately 20 minutes. Pressure in lines and lubricator kept flow prover constant except for 5 minutes. Flow prover decreased from 97.5 to 30 psig and increased to 102.5 over 5 minute period. Remained at 102.5 psig for 22 minutes with separator corrected. Prover pressure went to 97.5 psig again. Similar response shown on separator chart, eg., 96 to 29.5 to 102.6 in 5 minutes and 102.6 psig for 23 minutes.									
8/4/70									
1425	70.25	1365							
1600	71.5	1367	1215	152	97.5	35.4	406	0	
2000	75.5	1352	1190	162	97.5	35.6	"	"	
2400	79.5	1337	1180	157	97.0	35.5	"	"	
8/5/70									
0400	83.5	1322	1160	162	97.5	35.5	406	0	
0800	87.5	1305	1140	165	97.5	35.4	"	"	
1200	91.5	1288	1135	153	97.0	35.5	"	"	
1600	95.5	1286	1090	196	97.0	35.3	"	"	
2000	99.5	1271	1020	251	96.0	35.5	"	"	
2400	103.5	1260	940	320	96.0	35.6	"	"	
8/6/70									
0400	107.5	1245	860	385	96.0	35.6	406	0	
0800	111.5	1230	780	450	97.5	35.8	"	"	
1200	115.5	1206	700	506	97.5	35.4	411	5	
1600	119.5	1195	570	625	96.0	35.2	"	"	
2000	123.5	1159	370*	789	96.0	35.9	"	"	
2400	127.5	1122	350	772	96.0	35.8	"	"	

*BHP chart shows water by small pulses in pressure

Fawn Creek Government Number 1
 Zone 1 - 5747 feet to 5792 feet (GR-N Log)
 Drawdown Test Number 2
 Page Four

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
8/7/70									
0400	131.5	1096	350	746	96.0	35.9			
0800	135.5	1072	335	737	97.5	36.4			
1015*	137.75	1070							
*Amerada RPG off bottom at 1010 8/7/70 with 72 hour clock from 8/4/70. Well shut in at 1055. Amerada back on bottom at 1130 hours.									
1200	139.5	1199	475	724	95	35.5	414.5	7.5	Started pumping at 1230 8/07/70
1600	143.5	866	625	241	95	35.5	419.0	13	
2000	147.5	967	850	117	95	35.5	425.0	19	
8/08/70									
0000	151.5	1042	840	202	95	35.5	-		
0400	155.5	1053	775	278	95	35.5	-		
0800	159.5	1053	675	378	95	35.5	-		
1200	163.5	926	700	226	95	35.5	425.1	19.1	
1600	167.5	825	750	75	95	35.5	432.3	26.3	
2000	171.5	978	760	218	95	35.5	-		
8/09/70									
0000	175.5	997	710	287	95	35.5	-		
0400	179.5	988	610	378	95	35.5	-		
0800	183.5	978	475	503	95	35.5	-		
1200	187.5	1042	580	462	95	35.5	432.5	26.5	
1600	191.5	734	675	59	95	35.5	438.0	32.0	
2000	195.5	881	725	156	95	35.5	441.8	35.8	

Fawn Creek Government Number 1
Zone 1 - 5747 feet to 5792 feet (GR-N Log)
Drawdown Test Number 2
Page Five

Date & Time	Δ t hours	Bottom Hole Pressure psig	Wellhead Pressure psig	Δ P Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
8/10/70									
0000	199.5	930	675	255	95	35.5	-	-	
0400	203.5	941	610	331	95	35.5	-	-	
0800	207.5	937	500	437	95	35.5	-	-	
1200	211.5		480		95	35.5	441.9	35.9	Pumping
1600	215.5		600		95	35.5	449.5	43.5	Pumping
2000	219.5		670		95	35.5	-	-	
8/11/70									
0000	223.5		625		95	35.5	-	-	Pulled RPG-3
0400	227.5		540		95	35.5			Changed Lubricator
0800	231.5		425		95	35.5			to run SPG-3 on
1200	235.5		340		95	35.5			1/8" cable
1600	239.5		260		95	35.5			
2000	243.5		375		95	35.5			
8/12/70									
0000	247.5		540		95	35.5	451.5	45.5	Running SPG-3
0400	251.5		420		95	35.5			
0800	255.5		350		95	35.5			
1200	259.5		240		95	35.5			
1600	263.5	791.1	175	616	95	35.5	452.0	46.0	Bottom hole gauge in
2000	267.5	511.1	350	161	95	35.5	-	-	operation
8/13/70									
0000	271.5	688.9	475	214	95	35.5	460.6	54.6	
0400	275.5	764.4	450	314	95	35.5	-	-	
0800	279.5	786.7	425	362	95	35.5	-	-	
1200	283.5	520.0	460	60	95	35.5	462.1	56.1	
1600	287.5	697.8	510	188	95	35.5	-	-	
2000	291.5	760.0	480	280	95	35.5	-	-	

Fawn Creek Government Number 1
Zone 1 - 5747 feet to 5792 feet (GR-N Log)
Drawdown Test Number 2
Page Six

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
8/14/70									
0000	295.5	777.8	425	353	95	39.5	-	-	
0400	299.5	768.9	325	444	95	39.5			
0800	303.5	764.4	250	514	95	39.5	468.6	162.6	
1200	307.5	511.1	200	311	95	39.5			
1600	311.5	391.1			95	39.5	478.0	72.0	Pumping
2000	315.5	471.1			95	39.5			
8/15/70									
0000	319.5	493.3			95	39.5			
0400	323.5	537.8			95	39.5			
0800	327.5	537.8			95	39.5	497.0	91.0	Installed new packing
1200	331.5	524.4	450	74	95	39.5			
Well shut in @ 1200 for 6 hours - reopened to flow at 1800 8/15/70									
2000		520.0			95	35.5	500.0	94.0	
8/16/70									
0000	335.5	324.4			95	35.5			
0400	339.5	364.4			95	35.5			
0800	343.5	413.3			95	35.5	501.5	95.5	
1200	347.5	488.9			95	35.5	504.5	98.5	
1600	351.5	546.7			95	35.5			
1800	353.5	577.8	500	78	95	35.5	510.0	104.0	Shut in for buildup at 1800 8/16/70 End of Test

Fawn Creek Government Number 1
 Zone 1 - 5747 feet to 5792 feet (GR-N Log)
 BHP Buildup Number 3

Buildup Test From 8/16/70 to 10/13/70
 Rental SPG-3 at 5650 feet KB

$$T_o = \frac{2153 \text{ MSCF}}{35.5 \text{ MSCF/D}} \times 24 = 1457 \text{ Hours (Horner)}$$

$$T^* = 1236 \text{ Hours (ODEH)}$$

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_o + \Delta t}{\Delta t}$	Remarks
8/16/70 1800	0	578	500	78		
1830	.5	680.0	600	80	2473	
1900	1	728.9	650	79	1237	
2000	2	813.3	720	93	619	
2100	3	866.7	760	107	413	
2200	4	911.1	800	111	310	
2300	5	946.7	840	107	248	
2400	6	973.3	860	113	207	
8/17/70 0100	7	1000.0	880	120	177.6	
0200	8	1022.2	900	122	155.5	
0300	9	1035.6	915	121	138.3	
0400	10	1053.3	925	128	124.6	
0500	11	1066.7	940	127	113.4	
0600	12	1080.0	950	130	104.0	
0700	13	1093.3	960	133	96.08	
0800	14	1102.3	965	137	89.29	
0900	15	1111.1	975	136	83.40	
1000	16	1120.0	985	135	78.25	
1100	17	1128.9	1000	129	73.71	
1200	18	1133.3	1010	123	69.67	Power Off
1700	23	1164.4	1025		54.74	
1800	24	1168.9			52.50	Power Off

Fawn Creek Government Number 1
 Zone 1 - 5747 feet to 5792 feet (GR-N Log)
 BHP Buildup Number 3
 Page Two

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_b + \Delta t}{\Delta t}$	Remarks
8/18/70 0900	39	1226.7	1075	152	32.69	
1000	40	1235.6	1080	156	31.90	
1200	42	1240.0			30.43	
1400	44	1244.4	1100	144	29.09	
1600	46	1248.9			27.87	
1800	48	1253.3	1105	148	26.75	
2200	52	1262.2	1105	157	24.77	
8/19/70 0200	56	1269.0	1110	159	23.07	
0600	60	1275.6	1115	160	21.60	
1000	64	1284.4	1125	160	20.31	
1500	69	1297.8	1140	158	18.9	Generator Out
8/20/70 1300	91	1324.4	1160	164	14.58	
1530	93.5	1328.9	1170	159	14.22	Standby Generator Out
8/21/70 1130	113.5	1346.4	1185	162	11.89	
1800	120	1355.6	1190	166	11.30	
2200	124	1360.0	1190	160	10.97	
8/22/70 0200	128	1364.4	1190	164	10.66	
0600	132	1366.6	1190	166	10.36	
1000	136	1368.9	1200	169	10.09	
1400	140	1373.3	1210	163	9.83	
2000	146	1382.2	1210	172	9.47	
8/23/70 0200	152	1386.7	1215	172	9.13	
0800	158	1391.1	1215	171	8.82	
1400	164	1393.4	1225	168	8.54	
2200	172	1397.8	1225	173	8.19	
8/24/70 0600	180	1404.4	1225	179	7.86	
1400	188	1410.1	1245	165	7.57	
2200	196	1417.8	1245	177	7.31	

Fawn Creek Government Number 1
 Zone 1 - 5747 feet to 5792 feet (GR-N Log)
 BHP Buildup Number 3
 Page Three

Date & Time		Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{\text{Tot } \Delta t}{\Delta t}$	Remarks
8/25/70	0600	204	1422.2	1245	177	7.06	
	1300	211	1426.7	1255	172	6.86	
	2200	220	1431.1	1255	176	6.62	
8/26/70	0600	228	1435.6	1255	181	6.42	
	1400	236	1437.8	1265	173	6.24	
	2200	244	1442.2	1265	177	6.07	
8/27/70	0600	252	1446.6	1265	182	5.90	
	1400	260	1453.3	1290	163	5.75	
8/28/70	0200	272	1457.8	1295	183	5.54	
	1400	284	1466.7	1300	167	5.35	
8/29/70	1400	308	1480.0	1310	170	5.01	
8/30/70	1400	332	1488.9	1320	169	4.72	
8/31/70	1400	356	1497.8	1325	173	4.47	
9/01/70	1400	380	1506.7	1325	183	4.25	
9/02/70	1400	404	1515.6	1340	176	4.05	
9/03/70	1130	425.5	1529.0	1350	179	3.90	
9/04/70	1400	452	1537.8	1350	188	3.73	
9/06/70	1400	500	1548.9	1355	194	3.47	
9/07/70	1230	522.5	1557.8	1370	188	3.36	
9/08/70	1300	547	1564.4	1380	184	3.26	
9/09/70	1400	572	1671.1	1390	281	3.16	
9/11/70	1200	618	1584.5	1405	180	3.00	
9/13/70	1600	670	1595.6	1410	186	2.84	
9/14/70	1330	691.5	1602.3	1410	192	2.78	
9/16/70	1200	738	1615.7	1425	191	2.67	
9/17/70	1645	766.75	1624.7	1440	185	2.61	
9/18/70	1545	789.75	1631.5	1450	182	2.57	
9/19/70	1530	813.5	1634.2	1450	184	2.52	
9/20/70	1530	837.5	1640.4	1450	190	2.48	
9/21/70	1430	860.5	1642.7	1450	193	2.44	

Fawn Creek Government Number 1
 Zone 1 - 5747 Feet to 5797 Feet (GR-N Log)
 BHP Buildup Number 3
 Page Four

Date & Time	Δt hours	Bottom	Wellhead	ΔP	$\frac{To+ \Delta t}{\Delta t}$	Remarks
		Pressure psig	Pressure psig	Difference psi		
9/22/70 1500	885.0	1649.4	1450	199	2.40	
9/23/70 1500	909.0	1653.9	1450	204	2.36	
9/24/70 1530	933.5	1658.4	1450	208	2.32	
9/25/70 1500	957.0	1658.4	1450	208	2.29	
9/26/70 1500	981.0	1662.9	1460	203	2.26	
9/27/70 1930	1005.5	1671.9	1470	202	2.23	
9/28/70 1700	1031.0	1676.4	1470	206	2.20	
9/30/70 1500	1077.0	1683.2	1480	203	2.15	
10/01/70 1600	1102.0	1685.4	1485	200	2.12	
10/02/70 1500	1125.0	1689.9	1490	200	2.10	
10/03/70 1630	1150.5	1694.4	1490	204	2.07	
10/05/70 1500	1173.0	1701.1	1500	201	2.05	
10/07/70 1300	1195.0	1707.9	1500	208	2.03	
10/09/70 1400	1244.0	1716.9	1500	217	1.99	
10/13/70 1500	1341.0	1732.5	1525	208	1.92	

End of Test -
 ReCompleting to Zone II

Fawn Creek Government Number 1
 Zone 2 - 5600 feet to 5630 feet (GR-N Log)
 BHP Buildup Number 1

Buildup Test From 10/30/70 to 11/09/70
 Amerada Pressure Sentry #30167N at 5300 feet KB

$$T_o = \frac{750 \text{ MSCF}}{307 \text{ MSCF/D}} \times 24 = 58.6 \text{ Hours}$$

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_o + \Delta t}{\Delta t}$	Remarks
10/30/70 1330	-	435	NOT RECORDED		-	Flowing BHP @ 307 MCF/D
1400	0	435			-	Well shut in
1500	1	900			59.63	Well shut in
1600	2	1042			30.32	Well shut in
1800	4	1232			15.66	Well shut in
2000	6	1354			10.77	Well shut in
2200	8	1445			8.33	Well shut in
2400	10	1510			6.86	Well shut in
10/31/70 0200	12	1559			5.89	Well shut in
0600	16	1641			4.66	Well shut in
1000	20	1705			3.93	Well shut in
1400	24	1751			3.44	Well shut in
1800	28	1787			3.09	Well shut in
2200	32	1813			2.83	Well shut in
11/01/70 0200	36	1837			2.63	Well shut in
0800	42	1867			2.40	Well shut in
1400	48	1889			2.22	Well shut in
2200	56	1914			2.05	Well shut in
11/02/70 0600	64	1934			1.92	Well shut in
1100	69	1942			1.85	Pulled Sentry
1900	77	1966			1.76	Ran SPG-3 #30362, landed

Fawn Creek Government Number 1
 Zone 2 - 5600 feet to 5630 feet (GR-N Log)
 BHP Buildup Number 1
 Page Two

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_o + \Delta t}{\Delta t}$	Remarks
11/03/70 0300	85	1977	NOT RECORDED		1.69	at 5300'
1100	93	1988			1.63	Continued buildup
1900	101	1996			1.58	
11/04/70 0300	109	2005			1.54	
1100	117	2013			1.50	
1900	125	2020			1.47	
11/05/70 0300	133	2024			1.44	
1000	140	2029			1.42	
11/06/70 1700	171	2038			1.34	
2200	176	2042.5			1.33	
11/07/70 0600	184	2046.9			1.32	
1400	192	2051.4			1.31	
2200	200	2055.9			1.29	
11/08/70 0600	208	2060.3			1.28	
1400	216	2064.8			1.27	
2200	224	2067.0			1.26	
11/09/70 0600	232	2069.3			1.25	
1100	237	2069.3			1.25	
1500	241	2073.7			1.24	
						End of initial buildup - 1600 11/09/70

Fawn Creek Government Number 1
 Zone 2 - 5600 feet to 5630 feet (GR-N Log)
 Drawdown Number 1

Test From 11/09/70 to 11/19/70
 Amerada SPG-3, #30362
 SRT-2, #30363
 Pressure Element at 5600 feet KB
 Water Tank Capacity 20 barrels/ft.

Date & Time	Δ t hours	Bottom Hole Pressure psig	Wellhead Pressure psig	Δ P Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
11/09/70									
1600	0	2060.3	1800	260	50	195.7	188.5	0	0.6' Tank Gauge
1700	1	2006.7	1735	272	50	195.7	188.5		
1800	2	1970.9	1700	271	50	195.7	188.5		
1900	3	1944.1	1680	264	50	195.7	188.5		
2000	4	1921.8	1665	257	50	195.7	188.5		
2200	6	1886.0	1640	246	50	195.7	188.5		
2400	8	1854.7	1615	240	50	195.7	188.5		
11/10/70									
0200	10	1827.9	1590	238	50	195.7	188.5		
0400	12	1805.6	1560	246	50	195.7	188.5		
0600	14	1778.8	1545	234	50	195.7	188.5		
0800	16	1756.4	1525	231	50	195.7	188.5		
1000	18	1738.5	1505	234	50	195.7	188.5		
1200	20	1716.2	1490	226	50	195.7	188.5		
1400	22	1693.9	1475	219	50	195.7	188.5		

At 1500 hours separator dumped small amount of liquid (methanol and condensate) to tank, dump valve did not completely close. Bleeding very small amount of gas through water meter. Liquid production should be determined from tank gauging.

Fawn Creek Government Number 1
 Zone 2 - 5600 feet to 5630 feet (GR-N Log)
 Drawdown Test Number 1
 Page Two

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
1600	24	1671.5	1450	222	50	195.7	188.5	0	0.6' Tank Gauge
2000	28	1604.5	1375	230	50	195.7	188.5		
2400	32	1564.2	1100	464	50	195.7	188.5		
At 0100 hours flow rate dropped immediately from 195.7 MCF/D to 109 MCF/D and remained there until 0350 hours. Liquid carry over into gas line, probably heavy oil - and set up. Raised pressure on gas line and corrected level control problem at 0350 hours. Atms. temp. at 0330 hours 14°F - @ 0730 12°F.									
11/11/70									
0100	33	1546.4	1075	471	23	109	188.5		Rate declined
0200	34	1600.0	1120	480	23	109	188.5		Rate declined
0300	35	1617.9	1140	478	23	109	188.5		Rate declined
0400	36	1622.3	1125	497	50	195.7	188.5		
0500	37	1564.2	980	584	50	195.7	188.5		
0530	37.5	-	-	-	-	-	200		
0600	38	1524.0	1010	514	50	195.7	203		
0800	40	1492.7	1030	463	50	195.7	206		
1000	42	1474.9	970	505	50	195.7	209		
1200	44	1448.0	1025	423	50	195.7	212		
1400	46	1430.2	950	480	50	195.7	215	14	1.3' Tank Gauge
1600	48	1403.4	920	483	50	195.7	219		
1800	50	1381.0	900	481	50	195.7	221		
2000	52	1354.2	915	439	50	195.7	224		
2400	56	1322.9	870	453	50	195.7	230		
11/12/70									
0400	60	1269.3	825	444	50	195.7	236		
0800	64	1233.5	835	399	50	195.7	243		
1000	66	1220.1	850	370	50	195.7	245		
1200	68	1202.2	810	392	50	195.7	248		
1400	70	1184.4	790	394	50	195.7	250	28	2.0' Tank Gauge
1600	72	1166.5	765	402	50	195.7	254		

Fawn Creek Government Number 1
 Zone 2 - 5600 feet to 5630 feet (GR-N Log)
 Drawdown Test Number 1
 Page Three

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
1800	74	1139.7	760 ?	380	50	195.7	256		
2000	76	1117.3	760 ?	357	50	195.7	259		
2400	80	1068.2	755 ?	313	50	195.7	264		
11/13/70									
0400	84	1027.9	750 ?	278	50	195.7	270		
0800	88	992.2	740 ?	252	50	195.7	276		
1000	90	965.4	740 ?	225	50	195.7	279		
? Found tubing line to Barton frozen up - found pressure (Surface) to be 640 psig at 1030 hours after thawing out line, as a result ? symbols have been placed by pressures that may be in doubt.									
1200	92	947.5	625	323	50	195.7	282		
1400	94	929.6	610	320	50	195.7	284		
1600	96	911.7	590	322	50	195.7	287		
1800	98	880.4	550	330	50	195.7	290		
2000	100	867.0	530	337	50	195.7	293		
2400	104	804.5	520*	285	50	195.7	299		
11/14/70									
0400	108	768.0	520*	248	50	195.7	304		*Surface recorder line probably froze up
0800	112	726.9	500*	227	50	195.7	308		
1000	114	704.0	420	284	50	195.7	312		
1200	116	681.1	410	271	50	195.7	315		
1400	118	662.9	375	288	50	195.7	318	66	3.9' Tank Gauge
1600	120	635.4	350	285	50	195.7	321		
1800	122	617.1	340	277	50	195.7	324		
2000	124	576.0	300	276	50	195.7	327		
2400	128	512.0	275	237	50	195.7	333		
11/15/70									
0400	132	461.7	200	262	50	195.7	338		
0600	134	425.1	180	245	50	195.7	339		
0800	136	420.6	175	246	50	195.7	340		

Well inadvertently shut in for $4\frac{1}{2}$ hours

Fawn Creek Government Number 1
 Zone 2 - 5600 feet to 5630 feet (GR-N Log)
 Drawdown Test Number 1
 Page Four

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
0900	137	740.6	500	241					Shut in
1000	138	858.1	625	233					Shut in
1100	139	925.1	750	175					Shut in
1200	140	978.8	850	129					Shut in
1230	140.5	992.2	890	102			340		Shut in
Started flowing again at 195.7 MCF/D @ 1230 hours									
1300	141	925.1	825	100	50	195.7	340		
1400	142	844.7	750	95	50	195.7	340	84	4. 8' Tank Gauge
1500	143	795.4	700	95	50	195.7	340		
1600	144	758.9	600	159	50	195.7	340		
1700	145	717.7	450	268	50	195.7	340		Started making H ₂ O
1800	146	667.4	400	267	50	195.7	342		at 1715 hours
1900	147	630.9	350	281	50	195.7	344		
2000	148	589.7	310	280	50	195.7	345		
2200	150	516.6	260	257	50	195.7	349		
2300	151	493.7	220	274	50	195.7	351		
2400	152	461.7	190	272	50	195.7	352		
11/16/70									
0100	153	429.7	175	255	50	195.7	353		
0200	154	411.4	160	251	50	195.7	355		
0300	155	402.3	160	242	50	195.7	356		
0500	157	393.1	160	233	45	180	358		Rate falling off
0700	159	384.0	150	234	40	165	360		Rate falling off
0800	160	384.0	145	239	39	161	361		Rate falling off
0900	161	379.4	145	234	39	161	362		Rate falling off
Shut in from 0900 to 0930 to change orifice plate and work on pressure controller - installed 1/4" plate									
0930	161.5	544.0	350	194	72	121.9	362		New rate 121.9
1000	162	525.7	325	201	72	121.9	362		
1100	163	548.6	330	219	72	121.9	362		

Fawn Creek Government Number 1
 Zone 2 - 5600 feet to 5630 feet (GR-N Log)
 Drawdown Test Number 1
 Page Five

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
1200	164	566.9	340	227	72	121.9	362		
1400	166	589.7	340	250	72	121.9	363	94	5.3' Tank Gauge
1600	168	603.4	370	233	72	121.9	364		
Two drums of methanol pumped in to this point									
1800	170	612.6	370	243	72	121.9	365		
2000	172	617.1	370	247	72	121.9	366		
2400	176	621.7	375	247	72	121.9	369		
11/17/70									
0400	180	612.6	370	243	72	121.9	372		
0800	184	598.9	360	239	72	121.9	375		
1000	186	598.9	355	244	72	121.9	377		
1200	188	598.9	365	234	72	121.9	378		
1400	190	594.3	375	219	72	121.9	380	104	5.8' Tank Gauge
1600	192	589.7	355	235	72	121.9	382		
1800	194	580.6	350	231	72	121.9	383		
2000	196	576.0	340	236	72	121.9	384		
2400	200	557.7	330	228	72	121.9	387		
11/18/70									
0400	204	539.4	315	224	72	121.9	391		
0800	208	521.1	300	221	72	121.9	395		
1000	210	512.0	290	222	72	121.9	396		
1200	212	507.4	285	222	72	121.9	397		
1400	214	498.3	275	223	72	121.9	398	112	6.2' Tank Gauge
1600	216	484.6	260	225	72	121.9	400		
1800	218	470.9	250	221	72	121.9	403		
2000	220	461.7	240	222	72	121.9	405		
2400	224	429.7	220	210	72	121.9	407		

Fawn Creek Government Number 1
 Zone 2 - 5600 feet to 5630 feet (GR-N Log)
 Drawdown Test Number 1
 Page Six

<u>Date & Time</u>	<u>Δt hours</u>	<u>Bottom Hole Pressure psig</u>	<u>Wellhead Pressure psig</u>	<u>ΔP Difference psi</u>	<u>Flow Prover Pressure psig</u>	<u>Rate MCF/D</u>	<u>Water Meter Reading bbls</u>	<u>Cum. Water bbls</u>	<u>Remarks</u>
11/19/70									
0400	228	393.1	170	223	70	119	410		
0500	229	361.1	145	216	70	119	411	117	6.45' Tank Gauge
Shut in well at 0500 11/19 for BHP buildup Number 2 - Two barrels of methanol pumped into cum water.									

Fawn Creek Government Number 1
 Zone 2 - 5600 feet to 5630 feet (GR-N Log)
 BHP Buildup Number 2

Buildup Test From 11/19/70 to
 Amerada SPG-3 #30362
 SRT-2 #30363 at 5300 feet KB

$$T_o = \frac{2230 \text{ MSCF}}{121.9 \text{ MSCF/D}} \times 24 = 439 \text{ Hours}$$

FBHT @ 0445 hours = 191.4°F

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_o + \Delta t}{\Delta t}$	Remarks
11/19/70 0500	0	361.1	145	216	-	Shut in
0515	.25	457.1	155	302	1757	
0530	.50	516.6	200	317	879	
0545	.75	557.7	260	298	586	
0600	1.0	589.7	325	265	440	
0630	1.5	644.6	440	205	294	
0700	2.0	685.7	475	211	220.5	
0730	2.5	731.4	500	231	176.6	
0800	3.0	763.4	515	248	147.3	
0900	4	817.9	600	218	110.8	
1000	5	853.6	675	179	88.80	
1100	6	889.4	755	134	74.17	
1200	7	916.2	790	126	63.71	
1300	8	943.0	775 *	-	55.88	
						*Found 1/8" line partially frozen, cut, made shorter, refilled with methanol - now okay

Fawn Creek Government Number 1
 Zone 2 - 5600 feet to 5630 feet (GR-N Log)
 BHP Buildup Number 2
 Page Two

Date & Time		Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{To+ \Delta t}{\Delta t}$	Remarks
11/19/70	1400	9	965.4	875	90	49.78	
	1500	10	992.2	890	102	44.90	
	1600	11	1010.1	905	105	40.91	
	1700	12	1032.4	920	112	37.58	
	1800	13	1045.8	935	111	34.77	
	1900	14	1063.7	945	119	32.36	
	2000	15	1081.6	955	127	30.27	
	2200	17	1108.4	980	128	26.82	
	2400	19	1130.7	1005	126	24.11	
11/20/70	0200	21	1153.1	1020	133	21.90	
	0400	23	1175.4	1040	135	20.09	
	0600	25	1197.8	1055	143	18.56	
	0800	27	1215.6	1070	146	17.26	
	1000	29	1233.5	1090	144	16.14	
	1200	31	1246.9	1110	137	15.16	
	1600	35	1273.7	1135	139	13.54	
	2000	39	1300.6	1155	146	12.26	
	2400	43	1322.9	1175	148	11.21	
11/21/70	0400	47	1345.3	1190	155	10.34	
	0800	51	1367.6	1205	163	9.61	
	1200	55	1385.5	1225	161	8.98	
	1600	59	1398.9	1240	159	8.44	
	2000	63	1412.3	1250	162	7.97	
	2400	67	1425.7	1260	166	7.55	
11/22/70	0600	73	1448.0	1280	168	7.01	
	1200	79	1465.9	1295	171	6.56	

Fawn Creek Government Number 1
 Zone 2 - 5600 feet to 5630 feet (GR-N Log)
 BHP Buildup Number 2
 Page Three

Date & Time	Δt hours	Bottom Hole Pressure	Wellhead Pressure	ΔP Difference	$\frac{To + \Delta t}{\Delta t}$	Remarks
		psig	psig	psi		
11/22/70	1800	1479.3	1305	174	6.16	
	2400	1492.7	1320	173	5.82	
11/23/70	0600	1506.1	1335	171	5.53	
	1300	1524.0	1350	174	5.22	
	2200	1541.9	1360	182	4.88	
11/24/70	0600	1555.3	1370	185	4.63	
	1600	1568.7	1390	179	4.35	
11/25/70	0200	1586.6	1405	182	4.11	
	1200	1604.5	1420	185	3.91	
	2400	1622.3	1430	192	3.69	
11/26/70	1200	1631.3	1435	196	3.51	
	2400	1644.7	1440	205	3.35	
11/27/70	1100	1658.1	1450	208	3.22	
	2400	1671.5	1460	212	3.08	
11/28/70	1200	1680.4	1470	210	2.97	
11/29/70	1200	1698.3	1480	218	2.78	
11/30/70	1100	1711.7	1490	222	2.63	
12/01/70	1100	1720.7	1515	206	2.49	
12/02/70	1000	1734.1	1525	209	2.38	
12/03/70	1100	1747.5	1545	203	2.28	
12/04/70	1100	1760.9	1555	206	2.20	
12/05/60	1100	1772.0	1570	202	2.13	
12/06/70	1100	1783.2	1575	208	2.06	
12/07/70	1100	1794.4	1580	214	2.00	
12/08/70	1800	1807.8	1585	223	1.94	
12/09/70	2300	1819.0	1595	224	1.88	
12/11/70	1300	1830.1	1610	220	1.82	
12/13/70	1300	1841.3	1635	206	1.75	
12/15/70	1300	1850.3	1645	205	1.69	

Fawn Creek Government Number 1
 Zone 2 - 5600 feet to 5630 feet (GR-N Log)
 BHP Buildup Number 2
 Page Four

Date & Time	Δt hours	Bottom Hole Pressure	Wellhead Pressure	ΔP Difference	$T_b + \Delta t$	Remarks
		psig	psig	psi	Δt	
12/16/70 1500	658	1856.9	1650	207	1.67	
12/18/70 1200	703	1863.7	1655	209	1.62	
12/21/70 1200	775	1877.1	1670	207	1.57	
12/24/70 1100	846	1888.2	1680	208	1.52	
12/30/70 1200	991	1912.8	1695	217	1.44	
1/07/71 1700	1188	1930.7	1700	231	1.37	
1/11/71 1500	1282	1944.1	1700	244	1.34	
1/17/71 1800	1429	1953.1	1725	228	1.31	

APPENDIX III-D

SCANDARD DRAW TEST DATA

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Standard Draw Number 1
Zone 3 - 7454 feet to 7476 feet

SPG-3, #30362
SRT-2, #30363

PRESSURE AND TEMPERATURE SURVEY

Survey Run on August 26, 1970

<u>Depth (KB)</u> <u>feet</u>	<u>Temperature</u> <u>°F</u>	<u>Pressure</u> <u>psig</u>
0	-	429.7
1000	-	425.1
2000	-	420.6
3000	137.6	416.0
4000	159.2	411.4
5000	177.0	416.0
6000	199.6	429.7
6500	208.8	512.0
7000	214.4	608.0
7350	216.1	658.3

SRT-2 Temperature range 111 to 300°F

Standard Draw Number 1

TABLE III-D-1

GAS PROPERTIES

Pressure psia	Z	Viscosity cp	Compressibility psi ⁻¹	B Bbls/MCF	M(p) psi ² /cp
100	.996	.0139	1.01×10^{-2}	33.89	0.72×10^6
200	.987	.0140	5.09×10^{-3}	16.79	2.89 "
300	.978	.0140	3.42 "	11.09	6.52 "
400	.970	.0141	2.58 "	8.25	1.16×10^7
500	.962	.0142	2.08 "	6.55	1.82 "
600	.955	.0144	1.74 "	5.42	2.62 "
700	.948	.0145	1.50 "	4.61	3.57 "
800	.942	.0146	1.32 "	4.01	4.66 "
900	.936	.0148	1.17 "	3.54	5.89 "
1000	.931	.0149	1.06 "	3.17	7.27 "
1100	.926	.0151	9.61×10^{-4}	2.86	8.78 "
1200	.921	.0152	8.80 "	2.61	10.42 "
1300	.917	.0154	8.12 "	2.40	12.20 "
1400	.913	.0156	7.52 "	2.22	14.10 "
1500	.910	.0158	7.00 "	2.06	16.13 "
1600	.907	.0160	6.54 "	1.93	18.27 "
1700	.905	.0162	6.13 "	1.81	20.54 "
1800	.903	.0164	5.76 "	1.71	22.91 "
1900	.901	.0166	5.42 "	1.61	25.39 "
2000	.900	.0169	5.12 "	1.53	27.98 "
2100	.899	.0171	4.83 "	1.46	30.67 "
2200	.898	.0173	4.58 "	1.39	33.44 "
2300	.898	.0176	4.36 "	1.33	36.31 "
2400	.899	.0178	4.12 "	1.27	39.27 "
2500	.899	.0181	3.91 "	1.22	42.30 "
2600	.900	.0183	3.72 "	1.18	45.41 "
2700	.901	.0186	3.54 "	1.14	48.60 "
2800	.903	.0189	3.37 "	1.10	51.85 "
2900	.905	.0192	3.21 "	1.06	55.16 "
3000	.908	.0194	3.06 "	1.03	58.54 "
3100	.910	.0197	2.92 "	1.00	61.97 "

Gas Gravity = .65

Crit. Temp. = 371.9 R

Bottom Hole Temp. = 216°F

Crit. Press. = 669.3 psia

Barometric Pres. = 11 psia

Molecular Weight = 18.75

Reduced Temp. = 1.82

Base Temp. = 520 R

Initial Pres. = 3000 psig

Base Pres. = 14.7 psia

Standard Draw Number 1
 Zone 1 - 7181 feet to 7212 feet (GR-N Log)
 Buildup Test Number 1

Tested From 6/06/70 to 6/13/70
 Cumulative gas produced = 130 MCF, Average
 rate = 38 MCF/D

Rental SPG-3 Pressure and Temperature
 Element at 7100 feet KB

$$T_o = \frac{130 \text{ MSCF}}{38 \text{ MSCF/D}} \times 24 = 82 \text{ Hours}$$

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_o + \Delta t}{\Delta t}$	Remarks
6/06/70 1300	0	115.6	NOT RECORDED			Well shut in after this FBHP reading 6/06/70
1304	.07	120.0			1172	
1310	.17	146.7			483	
1330	.5	231.1			165	
1400	1	351.1			83	
1500	2	595.6			42	
1600	3	800.0			28.33	
1800	5	1240?			17.40	
1900	6	1377			14.67	
2000	7	1555			12.71	
2100	8	1698			11.25	
2200	9	1838			10.11	
2400	11	2117			8.45	
6/07/70 0300	14	2288			6.86	
0600	17	2413			5.82	
1000	21	2520			4.90	
1400	25	2583			4.28	
1600	27	2601	2110	491	4.04	

Standard Draw Number 1
 Zone 1 - 7181 feet to 7212 feet (GR-N Log)
 Buildup Test Number 1
 Page Two

Page Two

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_b + \Delta t}{\Delta t}$	Remarks
6/08/70	1200	2726	NOT RECORDED		2.74	Chart drive stopped. Gen. engine stopped.
	1700	2740			2.58	
	2200	2753			2.44	
6/09/70	0800	2775			2.22	
	1400	2789			2.12	
6/10/70	1000	2824			1.88	
6/11/70	1000	2849			1.70	T = 216°F
	1415	121.25 2851.4			1.68	
Started flowing well - could not control pressure						
	1420	Shut in - rate ~ 150 MCF/D during blowdown at separator (1415-1420) installing manual choke				
	1532	Started drawdown at 25 MCF/D				
	1840	Shut in briefly to rig bypass around manual choke				
	1932	Opened well up to flow again at 25 MCF/D, could not keep choke on bypass from freezing off.				
	2140	Shut well in, terminated first flow test, froze off at 2140, total gas this test = 6.7 MCF				
	2140	0 2686	NOT RECORDED			Cum gas prod 136.7
	2200	.33 2704				This buildup not analyzed
	2300	1.33 2753.1				because flow rate not stable
	2400	2.33 2775.4				at shut in.
6/12/70	0100	3.33 2793.3				
	0300	5.33 2806.7				
	0500	7.33 2820.1				
	0800	10.33 2829.1				
	0900	11.33 2833.5				
	1100	13.33 2835				
	1300	15.33 2842.5				
	1500	17.33 2846.9				
	1700	19.33 2851.4				
	2200	24.33 2851.4				

Standard Draw Number 1
 Zone 1 - 7181 feet to 7212 feet (GR-N Log)
 Buildup Test Number 1
 Page Three

<u>Date & Time</u>	<u>Δt hours</u>	Bottom	Wellhead	ΔP	<u>$\frac{Tot \Delta t}{\Delta t}$</u>	<u>Remarks</u>
		Pressure <u>psig</u>	Pressure <u>psig</u>	Difference <u>psi</u>		
6/13/70	0700	33.33	2880.3	NOT RECORDED		Temp 215.2 ^o F
	0900	35.33	2880.3			
	1200	38.33	2864.8			
	1530	41.83	2867			
	1700		2867			
	1702	Started drawdown test, flow rate ~ 35 MCF/D. Meter reading (Sep liquids) start at 87 barrels.				

Standard Draw Number 1
 Zone 1 - 7181 feet to 7212 feet (GR-N Log)
 Drawdown Test Number 1

Tested From 6/13/70 to 6/20/70
 Rental SPG-3 and SRT-2 instruments
 at 7100 feet KB

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
6/13/70									
1700	0	2864.8	2400	465	100	37.2	88.0		
		Separator operating pressure had to be controlled manually using manual choke ahead of separator. Bottom hole pressure erratic because of manual adjustments to separator.							
1730	0.5	2784.4			100	37.2			
1800	1	2762.0	2385	377	100	37.2			
1900	2	2721.8			100	37.2			
2000	3	2690.5	2350	341	100	37.2			
2100	4	2668.2			100	37.2			
2200	5	2645.8	2300	346	100	37.2	88.5		
2300	6	2632.4			100	37.2			
2400	7	2619.0	2275	344	100	37.2			
6/14/70									
0100	8	2601.1			100	37.2			
0200	9	2587.7	2215	373	100	37.2			
0300	10	2578.8			100	37.2			
0400	11	2569.8	2185	385	100	37.2			
0500	12	2560.9			100	37.2			
0600	13	2552.0	2115	437	100	37.2			

Standard Draw Number 1
 Zone 1 - 7181 feet to 7212 feet (GR-N Log)
 Drawdown Test Number 1
 Page Two

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
6/14/70									
0700	14	2538.5			100	37.2			
0800	15	2534.1	2100	434	100	37.2			
0900	16	2529.6			100	37.2			
1000	17	2525.1	2065	460	100	37.2			
1100	18	2511.7			100	37.2			
1200	19	2502.8	2050	453	100	37.2			
1300	20	2498.3			100	37.2			
1400	21	2489.4	2000	489	100	37.2	89.0		
1500	22	2480.4			100	37.2			
1600	23	2476.0	1975	501	100	37.2			
1700	24	2467.0			100	37.2	90.0		
1800	25	2458.1	1935	523	100	37.2			
1900	26	2440.2			100	37.2	91.0	3.0	
2000	27	2422.3	1875	547	100	37.2			
2100	28	2408.9			100	37.2			
2200	29	2391.0	1835	556	100	37.2			
2300	30	2373.0			100	37.2			
2400	31	2355.1	1750	605	100	37.2			
6/15/70									
0100	32	2337.1			100	37.2			
0200	33	2319.1	1675	644	100	37.2			
0300	34	2292.1			100	37.2			
0400	35	2274.2	1600	674	100	37.2			
0500	36	2251.7			100	37.2			
0600	37	2229.2	1500	729	100	37.2			
0700	38	2206.7			100	37.2			
0800	39	2184.3	1400	784	100	37.2			BHT - 214.6°F

Standard Draw Number 1
Zone 1 - 7181 feet to 7212 feet (GR-N Log)
Drawdown Test Number 1
Page Three

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
6/15/70									
0900	40	2170.8			100	37.2			
1000	41	2152.8	1300	853	100	37.2			
1100	42	2134.8			100	37.2			
1200	43	2116.9	1200	917	100	37.2			Automatic choke on
1300	44	2098.4			100	37.2			sepatator now
1400	45	2071.9	1015	1057	100	37.2			controlling OK.
1500	46	2044.9			100	37.2	91.0		
Started pumping unit at 1530, 6/15/70.									
1600	47	1878.7	900	979	100	37.2	94.1	3.1	*#10
1700	48	1627.0			100	37.2	98.2	7.2	
1730					100	37.2	100.0		*#11
1800	49	1413.3	600	813	100	37.2	102.1	11.1	Obtaining water
1900	50	1288.9			100	37.2	105.0		samples every 10
2000	51	1213.3	550	663	100	37.2	106.0		barrels.
2100	52	1124.4			100	37.2	107.2		
2200	53	1035.6	340	696	100	37.2	108.5		
2300	54	960.0			100	37.2	110.0	19.0	*#12
2400	55	888.9	320	569	100	37.2	111.5		
6/16/70									
0100	56	813.3			100	37.2			
0200	57	737.8	290	448	100	37.2	113.5		
0300	58	675.6			100	37.2	117.0	26.0	
0400	59	608.9	275	334	100	37.2			
0500	60	537.8			100	37.2	119.5		*#13
0600	61	471.1	245	226	100	37.2			

Standard Draw Number 1
 Zone 1 - 7181 feet to 7212 feet (GR-N Log)
 Drawdown Test Number 1
 Page Four

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
6/16/70									
0700	62	413.3			100	37.2	122.4		
0800	63	373.3	220	153	100	37.2	123.5		
0900	64	346.7			100	37.2	124.2	33.2	
1000	65	315.6	205	111	100	37.2	125.0		
1100	66	284.4			100	37.2	125.9		
1200	67	253.3	195	58	100	37.2	126.5		
1300	68	235.6			100	37.2	127.3		
1400	69	200.0	180	20	100	37.2	129.0	38.0	
1500	70	191.1			100	37.2	129.6		*#14
1600	71	182.2	165	17	100	37.2	130.0		
1700	72	168.9			100	37.2	130.5	39.5	
1800	73	155.6	140	16	100	37.2	131.3	40.3	
1900	74	142.2			100	37.2	132.0		
2000	75	124.4	110	14	100	37.2	132.4		
2100	76	111.1			96	36.2	133.1		
2200	77	106.7	95	12	90	34.1	134.5		
2300	78	106.7			84	34.1	135.3	44.3	
2400	79	106.7	90	17	84	34.1			
6/17/70									
0100	80	111.1			84	34.1	136.3	45.3	
0200	81	118.0	90	28	80	32.1			
0300	82	124.4			80	32.1			
0400	83	128.9	85	44	80	32.1	137.6	46.6	
0500	84								Recorder Out
0600	85	133.3	85	48	80	32.1	138.6		
0700	86	137.8			80	32.1	139.1		

Standard Draw Number 1
 Zone 1 - 7181 feet to 7212 feet (GR-N Log)
 Drawdown Test Number 1
 Page Five

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
6/17/70									
0800	87	137.8	85	53	80	32.1	139.8		*#15
0900	88	142.2			84	34.1	140.1	49.1	
1000	89	137.8	90	48	84	34.1	140.4		
1100	90	137.8			84	34.1	141.0	50.0	
1200	91								No readings on recorder
1300	92								
1400	93	120.0	90	30	84	34.1	142.0	51.0	
1500	94	133.3			84	34.1	142.5		
1600	95	137.8	90	48	84	34.1	142.9	51.9	
1700	96	142.2			84	34.1			
1800	97	137.8	90	48	84	34.1			
1900	98	137.8			84	34.1	144.0	53.0	
2000	99	142.2	90	52	80	32.1			
2100	100	142.2			80	32.1	144.6		
2200	101	142.2	85	57	80	32.1	145.0	54.0	
2300	102	146.7			80	32.1			
2400	103	146.7	85	62	80	32.1			
6/18/70									
0100	104	146.7			80	32.1	146.0	55.0	
0200	105	151.1	80	71	80	32.1			
0300	106	151.1			80	32.1	146.9		
0400	107	155.6	80	76	80	32.1		56.0	
0500	108	160.0			80	32.1			
0600	109	160.0	80	80	80	32.1	147.5		
0700	110	164.4			80	32.1			
0800	111	168.9	80	89	80	32.1	148.0	57.0	
0900	112	182.2			80	32.1	148.1		
1000	113	182.2	85	97	80	32.1			Pump gas locked

Standard Draw Number 1
Zone 1 - 7181 feet to 7212 feet (GR-N Log)
Drawdown Test Number 1
Page Six

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
6/18/70									
1100	114	155.6			80	32.1	149.9	58.5	*#16 Broke gas lock
1200	115	111.1	85	26	80	32.1			
1300	116	102.2			80	32.1			
1400	117	102.2	85	17	80	32.1			
1500	118	102.2			80	32.1			
1600	119	100.0	85	15	80	32.1	151.5	60.5	
1630	Packing on pumping tee stuffing box leaking, will only pump off when BHP starts up.								
1700	120	102.2			80	32.1	151.7	60.7	
1800	121	111.1	80	31	80	32.1	151.9		
1900	122	128.9			80	32.1	152.0	61.0	
2000	123	137.8	80	58	80	32.1			
2100	124	124.4			80	32.1	152.2		
2200	125	137.8	80	58	72	30.1	152.5	61.5	
2300	126	142.2			72	30.1			
2400	127								No readings on recorder
6/19/70									"
0100	128								
0200	129	146.7	80	67	72	30.1	153.0	62.0	
0300	130	151.1			72	30.1			
0400	131	173.3	75	98	72	30.1			
0500	132	177.8			72	30.1			
0600	133	177.8	75	103	72	30.1	154.0	63.0	
0700	134	204.4			72	30.1			
0800	135	137.8	80	58	80	32.1	155.5	64.5	
0900	136	111.1			80	32.1			
1000	137	120.0	85	35	80	32.1			
1040	Dropped separator pressure and installed 1/2" plate so we could install new packing in stuffing box, repacked stuffing box.								

Standard Draw Number 1
 Zone 1 - 7181 feet to 7212 feet (GR-N Log)
 Drawdown Test Number 1
 Page Seven

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
6/19/70									
1100	138	102.2			22	31.0	156.0	65.0	
1150	Installed 1/4" orifice plate in prover, operating separator at ≈ 20 psig. Coefficient of 1/4" orifice = 25.86 at 22 psia Q = 31 MCF/D.								
1200	139	111.1	30	81	22	31.0			
1300	140	115.6			22	31.0	156.2	65.2	
1400	141	120.0	60	60	22	31.0			
1500	142	128.9			22	31.0	156.7	65.7	
1600	143	120.0	35	85	22	31.0	157.0	66.0	
1700	144	66.7			22	31.0	157.9	66.9	
1800	145	66.7	35	32	22	31.9	158.0	67.0	
1900	146	84.4			22	31.9	158.2		
2000	147	71.1	30	41	22	31.9	158.5	67.5	
2100	148	80.0			22	31.9	158.9	67.9	
2200	149	84.4	30	54	22	31.9			
2300	150	84.4			22	31.9			
2400	151	84.4	25	59	22	31.9	159.6	68.6	*#17
6/20/70									
0100	152	128.9			24	33.3			
0200	153	151.1	70	81	24	33.3			
0300	154	173.3			24	33.3	159.9	68.9	
0400	155	151.1	30	121	24	33.3			
0500	156	182.2			24	33.3			
0600	157	240.0	40	200	24	33.3			
0700	158	275.6			24	33.3	160.0	69.0	

Standard Draw Number 1
 Zone 1 - 7181 feet to 7212 feet (GR-N Log)
 Drawdown Test Number 1
 Page Eight

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	Flow Prover Pressure psig	Rate MCF/D	Water Meter Reading bbls	Cum. Water bbls	Remarks
6/20/70									
0800	159	177.8	55	123	24	33.3			
0900	160	204.4			24	33.3			
1000	161	244.4	60	184	24	33.3			
1100	162	280.0			24	33.3			
1200	163	315.6	65	251	24	33.3	161.0	70.0	
1300	164	262.2			24	33.3			
1400	165	111.1	30	81	24	33.3	163.1	72.1	
1500	166	106.7			24	33.3			
1600	167	120.0	25	95	24	33.3	163.5	72.5	Well shut in for buildup

Total liquids produced - 156 barrels water (Tank Gauge), 3 barrels condensate

*Numbers 10 to 17 indicate water samples obtained for chemical analysis.

This completes drawdown test number 1.

Standard Draw Number 1
 Zone 1 - 7181 feet to 7212 feet (GR-N Log)
 Buildup Test Number 2

Tested From 6/20/70 to 6/27/70
 Instrument at 7100 feet KB

$$T_o = \frac{371 \text{ MSCF}}{33.4 \text{ MSCF/D}} \times 24 = 267 \text{ Hours}$$

Date & Time		Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_o + \Delta t}{\Delta t}$	Remarks
6/20/70	1600	0	120.0	25	95		
	1700	1	377.8	240	138	268	
	1800	2	617.8	425	193	134.5	
	1900	3	817.8	590	228	90	
	2000	4	986.7	735	252	68	
	2100	5	1160.0	880	280	54.4	
	2200	6	1328.9	1020	309	45.5	
	2300	7	1515.6			39.1	
6/21/70	2400	8	1653.9			34.4	
	0100	9	1779.8			30.7	
	0200	10	1883.1			27.7	
	0300	11	1973.0			25.3	
	0400	12	2049.4			23.2	
	0500	13	2121.3			21.5	
	0600	14	2179.8			20.1	
	0700	15	2229.2			18.8	
	0800	16	2265.2	1700	565	17.7	

Scandard Draw Number 1
 Zone 1 - 7181 feet to 7212 feet (GR-N Log)
 Buildup Test Number 2
 Page Two

Date & Time		Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$T_o + \frac{\Delta t}{\Delta t}$	Remarks
6/21/70	0900	17	2305.6			16.7	
	1000	18	2332.6	1775	558	15.8	
	1100	19	2355.1			15.1	
	1200	20	2373.0	1825	448	14.4	
	1300	21	2391.0			13.7	
	1400	22	2404.5	1875	530	13.1	
	1500	23	2419.0			12.6	
	1600	24	2435.8	1890	546	12.1	
	1700	25	2447			11.7	
	1800	26	2453.6	1905	549	11.3	
	1900	27	2462.6			10.9	
	2000	28	2471.5	1950	522	10.5	
	2100	29	2480.4			10.2	
	2200	30	2489.4	1950	539	9.90	
	2300	31	2498.3			9.61	
	2400	32	2502.8	1960	543	9.34	
6/22/70	0100	33	2511.7			9.09	
	0200	34	2516.2	1980	536	8.85	
	0300	35	2520.7			8.63	
	0400	36	2525.1	1995	530	8.42	
	0500	37	2532			8.22	
	0600	38	2538.5	2000	539	8.03	
	0700	39	2543.0			7.85	
	0800	40	2547.5	2015	533	7.68	
	0900	41	2552.0			7.51	
	1000	42	2560.9	2090	471	7.36	
	1100	43	2565.4			7.21	
	1200	44	2569.8	2105	465	7.07	

Standard Draw Number 1

Zone 1 - 7181 feet to 7212 feet (GR-N Log)

Buildup Test Number 2

Page Three

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_o + \Delta t}{\Delta t}$	Remarks
6/22/70	1300	2569.8			6.93	
	1400	2574.3	2110	464	6.80	
	1500	2578.8			6.68	
	1600	2578.8	2110	469	6.56	
	1700	2583.2			6.45	
	1800	2583.2	2110	473	6.34	
	1900	2587.7			6.24	
	2000	2592.2	2110	482	6.13	
	2100	2596.6			6.04	
	2200	2596.6	2110	487	5.94	
	2300	2601.1			5.85	
	2400	2603.4			5.77	
6/23/70	0100	2610.1			5.68	
	0200	2614.5			5.60	
	0300	2616.8			5.53	
	0400	2619.0	2120	499	5.45	
	0500	2619.0			5.38	
	0600	2627.9			5.31	
	0700	2627.9			5.24	
	0800	2632.4	2130	502	5.17	
	0900	2632.4			5.11	
	1000	2636.9			5.05	
	1100	2636.9			4.99	
	1200	2641.3	2200	441	4.93	
	1300	2641.3			4.87	
	1400	2636.9			4.81	Leak
	1500	2614.5			4.76	"
	1600	2605.6	2180	426	4.71	"
	Control head started leaking at 1350 6/23/70, stopped leak at 1730					
	1700	2592.2			4.66	Leak

Standard Draw Number 1
 Zone 1 - 7181 feet to 7212 feet (GR-N Log)
 Buildup Test Number 2
 Page Four

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$T_o + \Delta t$ Δt	Remarks
6/23/70	1800	2592.2			4.61	
	1900	2614.5			4.56	
	2000	2623.5	2180	444	4.51	
	2100	2632.4			4.47	
	2200	2641.3			4.42	
	2300	2641.3			4.38	
	2400	2645.8			4.34	
6/24/70	0100	2650.3			4.29	
	0200	2654.7	2180	475	4.26	
	0300	2659.2			4.22	
	0400	2659.2			4.18	
	0500	2663.7			4.14	
	0600	2663.7	2190	474	4.10	
	0700	2668.2			4.07	
	0800	2668.2			4.03	
	0900	2672.6			4.00	
	1000	2672.6	2200	473	3.97	
	1100	2672.6			3.93	Leak
	1200	2650.3			3.90	"
	1300	2637.4			3.87	"
	1400	2614.5	2200	415	3.84	"
	1500	2565.4			3.81	"
	1600	2596.6	2180	417	3.78	"
	1700	2592.2			3.75	"
	1800	2569.2			3.72	"
	1900	2601.1			3.70	"
	2000	2610.1			2.67	"
	2100	2614.5			3.64	Leak

Scandard Draw Number 1
Zone 1 - 7181 feet to 7212 feet (GR-N Log)
Buildup Test Number 2
Page Five

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_o + \Delta t}{\Delta t}$	Remarks
6/24/70	2200	2632.4	2180	452	3.62	
	2300	2641.3			3.59	
	2400	2650.3			3.57	
6/25/70	0100	2654.7	2190	469	3.54	
	0200	2659.2			3.52	
	0300	2663.7			3.50	
	0400	2663.7			3.47	
	0500	2668.2	2180	488	3.45	
	0600	2668.2			3.43	
	0700	2672.6			3.41	
	0800	2677.1			3.38	
	0900	2677.1			3.36	
	1000	2677.1			3.34	
	1100	2681			3.32	
	1200	2681			3.30	
	1300	2681			3.28	
	1400	2681			3.26	Small Leak
	1500	2681			3.24	" "
	1600	2681			3.22	" "
	1700	2654.7			3.21	" "
	1800	2641.3			3.19	" "
	1900	2632.4			3.17	Small Leak
	2000	2654.7			3.15	
	2100	2663.7			3.14	
	2200	2668.2			3.12	
	2300	2677.1			3.10	
	2400	2681.6			3.09	

Standard Draw Number 1
 Zone 1 - 7181 feet to 7212 feet (GR-N Log)
 Buildup Test Number 2
 Page Six

Date & Time	Δt hours	Bottom Hole Pressure	Wellhead Pressure	ΔP Difference	$\frac{T_o + \Delta t}{\Delta t}$	Remarks
		psig	psig	psi		
6/26/70	0100	129	2686.0		3.07	
	0200	130	2690.5		3.05	
	0300	131	2690.5		3.04	
	0400	132	2695.0		3.02	
	0500	133	2695.0		3.01	
	0600	134	2695.0		2.99	
	0700	135	2695.0		2.98	
	0800	136	2699		2.96	
	0900	137	2699		2.95	
	1000	138	2699		2.93	
	1100	139	2699		2.92	
	1200	140	2699		2.91	
	1300	141	2699		2.89	
	1400	142	2681.6		2.88	
	1500	143	2663.7		2.87	Leak
	1600	144	2680.3		2.85	Leak
	1700	145	2641.3		2.84	
	1800	146	2632.4		2.83	
	1900	147	2627.9		2.82	
	2000	148	2627.9		2.80	
	2100	149	2641.3		2.79	
	2200	150	2659.2		2.78	
	2300	151	2668.2		2.77	
	2400	152	2677.1		2.76	

Standard Draw Number 1
 Zone 1 - 7181 feet to 7212 feet (GR-N Log)
 Buildup Test Number 2
 Page Seven

Date & Time		Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_o + \Delta t}{\Delta t}$	Remarks
6/27/70	0100	153	2686.0			2.75	
	0200	154	2690.5			2.73	
	0300	155	2690.5			2.72	
	0400	156	2695.0			2.71	
	0500	157	2695.0			2.70	
	0600	158	2699.4			2.69	
	0700	159	2699.4			2.68	
	0800	160	2699.4			2.67	
	0900	161	2703.9			2.66	
	1000	162	2703.9			2.65	
	1100	163	2703.9			2.64	
	1200	164	2703.9			2.63	
	1300	165	2703.9			2.62	Leak
	1400	166	2677.1			2.61	
	1500	167	2663.7			2.60	
	1600	168	2654.7			2.59	
	1700	169	2645.8			2.58	
	1800	170	2645.8			2.57	
	1900	171	2641.3			2.56	
	2000	172	2636.9			2.55	End of buildup test number 2

Scandard Draw Number 1
 Zone 2 - 6810 feet to 6838 feet (GR-N Log)
 Buildup Test Number 1

Tested From 7/22/70 to 8/03/70
 SPG-3, #30362 landed at 6650 feet KB

$$T_o = \frac{83 \text{ MSCF}}{10 \text{ MSCF/D}} \times 24 = 199 \text{ Hours}$$

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_o + \Delta t}{\Delta t}$	Remarks
7/22/70 0630	0	416.0	360	56	-	
0700	.5	448.0	388	60	399	
0730	1.0	484.6	420	65	200	
0800	1.5	521.1	450	71	133.7	
0830	2.0	571.4	486	85	100.5	
0900	2.5	621.7	513	109	80.6	
0930	3.0	672.0	545	127	67.3	
1000	3.5	717.7	574	144	57.9	
1030	4.0	758.9	600	159	50.8	
1100	4.5	804.5	629	176	45.2	
1130	5.0	849.2	655	194	40.8	
1200	5.5	889.4			37.2	
1300	6.5	960.9			31.6	
1400	7.5	1027.9			27.5	
1500	8.5	1095.0	825	270	24.4	
1600	9.5	1153.1	855	298	21.9	
1730	11.0	1229.1			19.09	
1830	12.0	1273.7	935	348	17.58	
1930	13.0	1322.9	970	353	16.31	

Standard Draw Number 1

Zone 2 - 6810 feet to 6838 feet (GR-N Log)

Build Test Number 1

Page Two

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_o + \Delta t}{\Delta t}$	Remarks	
7/22/70	2030	14.0	1358.7	1000	359	15.21	
	2230	16.0	1434.6	1050	385	13.44	
7/23/70	0030	18.0	1492.7			12.06	
	0230	20.0	1537.4			10.95	
	0430	22.0	1573.2			10.05	
	0630	24	1608.9			9.29	
	0830	26	1635.8	1218	418	8.65	
	1030	28	1662.5	1238	425	8.11	
	1230	30	1680.4	1255	426	7.63	
	1530	33	1707.3	1279	429	7.03	
	1830	36	1716.2	1286	430	6.53	
	2130	39	1738.5	1305	433	6.10	
7/24/70	0130	43	1765.4			5.63	
	0530	47	1796.6	1370	426	5.23	
	0930	51	1823.5	1393	430	4.90	
	1330	55	1832.4	1395	437	4.62	
	1930	61	1845.8	1390	456	4.26	
7/25/70	0130	67	1872.6	1420	453	3.97	
	0730	73	1899.4	1447	452	3.73	
	1930	85	1926.3			3.34	
7/26/70	0730	97	1970.9			3.05	
	1130	101	1979.9	1518	462	2.97	
7/27/70	1430	128	2033.5	1610	424	2.55	
7/28/70	1100	148.5	2064.8	1620	445	2.34	
7/29/70	1030	172	2091.6	1650	442	2.16	
7/31/70	1100	220.5	2145.3			1.90	
8/01/70	1100	244.5	2172.1			1.81	
8/02/70	0930	267	2194.4			1.75	
	2200	279.5	2196.5			1.71	
8/03/70	0930	291	2203.4			1.68	
	1030	292	2203.4	1776	427	1.68	

NOTE TO READER:

Data taken during flow periods prior to Buildup Test Number 1 (Zone 3 - 7454 feet to 7476 feet)

is given on pages S24 through S26 of Appendix III-B - Scandard Draw Daily Reports

Standard Draw Number 1
 Zone 3 - 7454 feet to 7476 feet (GR-N Log)
 Buildup Test Number 1

Tested From 9/06/70 to 10/13/70
 SPG-3, #30362 and SRT-2, #30363 instruments
 at 7350 feet

$$T_o = \frac{72 \text{ MSCF}}{3 \text{ MSCF/D}} \times 24 = 576 \text{ Hours}$$

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_o + \Delta t}{\Delta t}$	Remarks
9/06/70 0600	0	242.3	33	209		
0630	.5	530.3			1151	
0700	1.0	608.0			576	
0730	1.5	608.0			385	
0800	2.0	630.9			288.5	
0830	2.5	649.1			231	
0900	3.0	644.6			192.7	
1000	4	667.4	105	562	144.8	
1100	5	676.6	120	557	116.0	
1200	6	688.0	134	554	96.8	
1300	7	694.9	145	550	83.1	
1430	8.5	722.3	167	555	68.7	
1600	10	754.3	184	570	58.5	
1700	11	749.7	193	557	53.3	
1800	12	754.3	205	549	48.9	
1900	13	763.4	215	548	45.2	
2000	14	772.6			42.1	
2100	15	768.0	232	536	39.3	
2200	16	758.9			36.9	
2400	18	763.4			32.9	

Scandard Draw Number 1
 Zone 3 - 7454 feet to 7476 feet (GR-N Log)
 Buildup Test Number 1
 Page Two

Date & Time		Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{To+ \Delta t}{\Delta t}$	Remarks
9/07/70	0200	20	786.3			29.8	
	0400	22	786.3			27.1	
	0600	24	790.9			24.96	
	0800	26	797.7	330	468	23.11	
	1000	28	811.2	342	469	21.53	
	1200	30	822.3	356	466	20.17	
	1400	32	840.2			18.97	
	1600	34	826.8			17.91	
	2200	40	911.7			15.38	
	2400	42	929.6			14.69	
9/08/70	0200	44	943.0			14.07	
	0400	46	947.5			13.50	
	0600	48	960.9			12.98	
	0800	50	965.4			12.50	
	1000	52	978.8	496	483	12.06	
	1200	54	992.2	504	488	11.65	
	1400	56	1001.1			11.27	
	0200	68	1063.7			9.46	
9/09/70	0600	72	1068.2			8.99	
	1000	76	1081.6			8.57	
	1100	77	1086.0	604	482	8.47	
	1300	79	1095.0	612	483	8.29	
	1800	84	1099.4			7.85	
	2200	88	1108.4			7.53	
	0200	92	1117.3			7.25	
9/10/70	0600	96	1130.7			6.99	
	1000	100	1153.1			6.75	
	1200	102	1162.0	686	476	6.64	
	1400	104	1166.5	691	476	6.53	

Standard Draw Number 1
 Zone 3 - 7454 feet to 7476 feet (GR-N Log)
 Buildup Test Number 1
 Page Three

Date & Time	Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{T_o + \Delta t}{\Delta t}$	Remarks
9/11/70 1400	128	1211.2	753	458	5.49	
9/12/70 1130	149.5		781		4.85	Pull instru. sent in for repair
9/13/70 1000	172.0		843		4.34	
1500	177.0		852		4.25	
9/14/70 1000	196.0		889		3.93	
1300	199.0	1045.8	850	196	3.89	Reran instru.
1430	200.5	1054.7	861	194	3.87	
2400	210	1095.0			3.74	
9/15/70 0400	214	1106.1			3.69	
0800	218	1112.8			3.64	
1000	220	1117.3	908	109	3.61	
1400	224	1124.0	916	208	3.57	
2000	230	1135.2			3.50	
9/16/70 0200	236	1153.1			3.44	
0800	242	1162.0			3.38	
1100	245	1170.9	951	220	3.35	
2400	258	1197.8			3.23	
9/17/70 1200	270	1220.1			3.13	
1530	273.5	1224.6	992	233	3.10	
9/18/70 0000	282	1238.0			3.04	
1200	290	1260.0			2.98	
1330	295.5	1262.5	1023	240	2.95	
9/19/70 0000	306.0	1282.7			2.88	
1230	318.5	1300.6	1052	249	2.81	
9/20/70 0000	330.0	1318.4			2.74	
1100	341.0	1336.3	1078	258	2.69	
9/21/70 0000	354.0	1352			2.62	
1200	366.0	1372.1	1108	264	2.57	

Standard Draw Number 1
 Zone 3 - 7454 feet to 7476 feet (GR-N Log)
 Buildup Test Number 1
 Page Four

Date & Time		Δt hours	Bottom Hole Pressure psig	Wellhead Pressure psig	ΔP Difference psi	$\frac{\text{Tot } \Delta t}{\Delta t}$	Remarks
9/22/70	1300	391.0	1398.9	1133	266	2.47	
9/23/70	1300	415.0	1442.4	1159	283	2.38	
9/24/70	1330	439.5	1461.5	1182	280	2.31	
9/25/70	1400	464.0	1490.5	1203	288	2.24	
9/26/70	1230	486.5	1517.4	1220	297	2.18	
9/27/70	1430	512.5	1537.4	1240	297	2.12	
9/28/70	1600	538.0	1568.7	1260	309	2.07	
9/30/70	1400	584.0	1613.4	1291	322	1.98	
10/01/70	1430	608.5	1633.6	1312	322	1.94	
10/02/70	1400	632.0	1653.6	1322	332	1.91	
10/03/70	1530	657.5	1667.0	1337	330	1.87	
10/05/70	1400	680.0	1702.8	1370	331	1.85	
10/07/70	1200	702.0	1743.0	1400	343	1.82	
10/09/70	1200	750.0	1769.8	1420	350	1.77	
10/13/70	1000	844.0	1823.5	1465	359	1.68	End of Test - Well Shut in.

APPENDIX III-E

WATER ANALYSIS

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SCANDAR DRAW NUMBER 1
WATER ANALYSIS
Zone 1 - 7181 feet to 7212 feet

Sample No.	1	2	3	4
Date Sampled	5/21/70	5/21/70	6/03/70	6/04/70
Remarks	Frac Water	Frac Fluid	25 bbls produced water	50 bbls produced water
Potassium (K) ppm	10,400	10,400	3,200	1,560
Sodium (Na) ppm	1,755	1,820	435	3,670
Calcium (Ca) ppm	168	103	99	398
Magnesium (Mg) ppm	72	95	67	244
Chloride (Cl) ppm	12,225	12,320	3,680	8,452
Carbonate (CO ₃) ppm	0	0	245	0
Bicarbonate (HCO ₃) ppm	403	313	0	33
Iron (Fe) ppm	2.0	14.0	3.0	40.0
Total Solids ppm	26,516	27,356	7,536	15,940
Conductivity (mmhos)	45,000	43,000	13,800	13,800
ph	7.5	5.4	6.7	6.9

SCANDARD DRAW NUMBER 1
WATER ANALYSIS
Zone 1 - 7181 feet to 7212 feet

Sample No.	5	6	10	11
Date Sampled	6/05/70	6/06/70	6/15/70	6/15/70
Remarks	75 bbls produced water	87 bbls produced water	94 bbls produced water	100 bbls produced water
Potassium (K) ppm	1,500	1,230	1,180	1,150
Sodium (Na) ppm	4,424	4,444	4,728	4,746
Calcium (Ca) ppm	187	286	262	225
Magnesium (mg) ppm	105	85	159	118
Chloride (Cl) ppm	8,477	8,428	8,836	8,836
Sulfate (SO ₄) ppm			50	20
Carbonate (CO ₃) ppm	0	0	0	0
Bicarbonate (HCO ₃) ppm	554	484	644	436
Iron (Fe) ppm	43.0	50.0	40	7.5
Total Solids ppm	15,212	15,300	16,140	16,050
Conductivity (mmhos)	23,500	23,600	17,800	18,800
ph	6.8	6.6	6.6	6.7

SCANDARD DRAW NUMBER 1
WATER ANALYSIS
Zone 1 - 7181 feet to 7212 feet

Sample No.	12	13	14	15
Date Sampled	6/15/70	6/16/70	6/16/70	6/17/70
Remarks	110 bbls produced water	120 bbls produced water	130 bbls produced water	130 bbls produced water
Potassium (K) ppm	1, 180	1, 130	1, 440	2, 000
Sodium (Na) ppm	4, 581	4, 635	4, 345	3, 821
Calcium (Ca) ppm	234	206	309	262
Magnesium (mg) ppm	205	149	118	143
Chloride (Cl) ppm	8, 836	8, 688	8, 492	8, 099
Sulfate (SO ₄) ppm	20	24	29	150
Carbonate (CO ₃) ppm	0	0	0	0
Bicarbonate (HCO ₃) ppm	507	455	659	649
Iron (Fe) ppm	8.0	30	14	25
Total Solids ppm	16, 920	16, 016	15, 986	15, 820
Conductivity (mmhos)	18, 800	18, 000	18, 200	18, 500
ph	6.7	6.7	6.8	6.8

SCANDARD DRAW NUMBER 1
 WATER ANALYSIS
 Zone 1 - 7181 feet to 7212 feet

Sample No.	16	17
Date Sampled	6/18/70	6/19/70
Remarks	150 bbls produced water	160 bbls produced water
Potassium (K) ppm	1,060	1,260
Sodium (Na) ppm	3,896	4,497
Calcium (Ca) ppm	234	215
Magnesium (mg) ppm	138	133
Chloride (Cl) ppm	8,198	8,295
Sulfate (SO ₄) ppm	125	30
Carbonate (CO ₃) ppm	0	0
Bicarbonate (HCO ₃) ppm	649	739
Iron (Fe) ppm	14	24
Total Solids ppm	16,160	15,374
Conductivity (mmhos)	18,400	17,800
ph	6.8	6.75

SCANDARD DRAW NUMBER 1
WATER ANALYSIS

Zone 2 - 6810 feet to 6838 feet

Sample No.	SD2-1	SD2-2
Date Sampled	7/21/70	7/21/70
Remarks	Produced Water	Produced Water
Potassium (K) ppm	1,000	1,000
Sodium (Na) ppm	2,175	1,125
Calcium (Ca) ppm	345	345
Magnesium (mg) ppm	100	90
Chloride (Cl) ppm	7,498	7,341
Sulfate (SO ₄) ppm	15.6	15.0
Carbonate (CO ₃) ppm	0	0
Bicarbonate (HCO ₃) ppm	956	956
Iron (Fe) ppm	74	65
Total Solids ppm	14,188	14,016
Conductivity (mmhos)	19,500	19,000
ph	6.9	6.85

SCANDAR DRAW NUMBER 1
WATER ANALYSIS
Zone 3 - 7454 feet to 7476 feet

Sample No.	3-1	3-2	3-3	3-4
Date Sampled	8/12/70	8/14/70	8/23/70	8/23/70
Remarks	Frac water	150 bbls produced water	207 bbls produced water	224 bbls produced water
Potassium (K) ppm	8,138	1,008	2,490	1,357
Sodium (Na) ppm	420	6,620	3,453	6,287
Calcium (Ca) ppm	125	302	232	211
Magnesium (mg) ppm	78	98	114	89
Chloride (Cl) ppm	7,739	7,546	7,498	6,970
Sulfate (SO ₄) ppm	660	27	62	28
Carbonate (CO ₃) ppm	29	0	0	0
Bicarbonate (HCO ₃) ppm	425	1,557	1,341	1,505
Iron (Fe) ppm	72	36	36	20
Total Solids ppm	17,700	12,656	13,786	12,140
Conductivity (mmhos)	22,000	22,400	24,600	22,000
ph	7.4	6.7	6.5	6.7

SCANDARD DRAW NUMBER 1
 WATER ANALYSIS
 Zone 3 - 7454 feet to 7476 feet

Sample No.	3-5	3-6	3-7	3-8
Date Sampled	8/24/70	8/24/70	8/25/70	8/27/70
Remarks	245 bbls produced water	267 bbls produced water	287 bbls produced water	302 bbls produced water
Potassium (K) ppm	1,033	1,705	821	792
Sodium (Na) ppm	3,870	3,429	3,618	3,390
Calcium (Ca) ppm	172	168	148	142
Magnesium (mg) ppm	107	107	107	74
Chloride (Cl) ppm	6,729	6,825	6,297	6,249
Sulfate (SO ₄) ppm	18	45	22	23
Carbonate (CO ₃) ppm	0	0	0	0
Bicarbonate (HCO ₃) ppm	1,336	1,001	1,001	1,242
Iron (Fe) ppm	16	12	18	64
Total Solids ppm	11,986	13,154	10,860	10,900
Conductivity (mmhos)	19,800	19,600	19,500	17,900
ph	6.8	6.7	7.8	

SCANDARD DRAW NUMBER 1
 WATER ANALYSIS
 Zone 3 - 7454 feet to 7476 feet

Sample No.	3-9	3-10	3-11
Date Sampled	9/01/70	9/04/70	9/06/70
Remarks	341 bbls produced water	365 bbls produced water	382 bbls produced water
Potassium (K) ppm	805	1,000	655
Sodium (Na) ppm	3,300	3,500	3,400
Calcium (Ca) ppm	137.9	155	137.9
Magnesium (mg) ppm	62.7	64.9	67.2
Chloride (Cl) ppm	5,912	6,297	5,287
Sulfate (SO ₄) ppm	40	42	27
Carbonate (CO ₃) ppm	0	0	0
Bicarbonate (HCO ₃) ppm	1,116	1,158	1,256
Iron (Fe) ppm	60	95	110
Total Solids ppm	10,920	11,192	11,210
Conductivity (mmhos)	16,000	16,100	16,000
ph	6.8	6.75	6.8

FAWN CREEK GOVERNMENT NUMBER 1
WATER ANALYSIS
Zone 1 - 5745 feet to 5792 feet

Sample No.	FC-1	FC-2	FC-3	FC-4
Date Sampled	5/30/70	5/30/70	6/12/70	6/20/70
Remarks	Frac water	Frac water	Est. 100 bbls produced water after frac	Water used to kill well
Potassium (K) ppm	9,140	9,140	750	11,525
Sodium (Na) ppm	1,565	718	4,600	750
Calcium (Ca) ppm	136	126	167	141
Magnesium (mg) ppm	77	83	87	57
Chloride (Cl) ppm	10,695	9,480	8,280	11,468
Sulfate (SO ₄) ppm				180
Carbonate (CO ₃) ppm	0	0	0	0
Bicarbonate (HCO ₃) ppm	357	261	640	375
Iron (Fe) ppm	1.0	8.0	40.5	0.9
Total Solids ppm	22,330	21,950	12,880	24,678
Conductivity (mmhos)	30,200	29,000	21,100	37,000
ph	7.3	6.2	6.4	7.3

FAWN CREEK GOVERNMENT NUMBER 1
WATER ANALYSIS
Zone 1 - 5745 feet to 5792 feet

Sample No.	FC-5	FC-6	FC-7	FC-8
Date Sampled	6/28/70	6/28/70	6/30/70	7/01/70
Remarks	216 bbls produced water	228 bbls produced water	250 bbls produced water	300 bbls produced water
Potassium (K) ppm	5,250	5,000	4,375	2,180
Sodium (Na) ppm	3,300	3,500	3,875	4,589
Calcium (Ca) ppm	150	145	168	281
Magnesium (mg) ppm	90	88	81	77
Chloride (Cl) ppm	9,900	9,900	10,000	9,507
Sulfate (SO ₄) ppm	192	196	128	95
Carbonate (CO ₃) ppm	0	0	0	0
Bicarbonate (HCO ₃) ppm	586	633	633	398
Iron (Fe) ppm	25	47	16	1.3
Total Solids ppm	19,498	19,428	15,700	16,450
Conductivity (mmhos)	30,000	33,500	35,000	28,000
ph	6.5	6.4	6.6	6.8

FAWN CREEK GOVERNMENT NUMBER 1
WATER ANALYSIS
Zone 1 - 5745 feet to 5792 feet

Sample No.	FC-9	FC-10	FC-11	FC-12
Date Sampled	7/02/70	8/07/70	8/08/70	8/09/70
Remarks	325 bbls produced water	416 bbls produced water	426 bbls produced water	436 bbls produced water
Potassium (K) ppm	2,000	2,789	2,017	1,880
Sodium (Na) ppm	4,726	4,585	4,342	4,449
Calcium (Ca) ppm	281	120	163	193
Magnesium (mg) ppm	77	56	89	81
Chloride (Cl) ppm	9,556	9,806	8,796	8,796
Sulfate (SO ₄) ppm	95	150	85	78
Carbonate (CO ₃) ppm	0	0	0	0
Bicarbonate (HCO ₃) ppm	398	94	361	492
Iron (Fe) ppm	1.7	200	80	36
Total Solids ppm	16,800	17,140	15,930	15,898
Conductivity (mmhos)	29,000	25,500	25,000	24,500
ph	7.1	6.2	6.8	6.9

FAWN CREEK GOVERNMENT NUMBER 1
WATER ANALYSIS
Zone 1 - 5745 feet to 5792 feet

Sample No.	FC-13	FC-14	FC-15	FC-16
Date Sampled	8/10/70	8/12/70	8/13/70	8/14/70
Remarks	446 bbls produced water	456 bbls produced water	466 bbls produced water	476 bbls produced water
Potassium (K) ppm	1,929	1,920	1,880	1,979
Sodium (Na) ppm	4,386	4,366	4,160	4,233
Calcium (Ca) ppm	224	176	189	198
Magnesium (mg) ppm	63	78	71	94
Chloride (Cl) ppm	8,748	8,652	8,652	8,316
Sulfate (SO ₄) ppm	65	88	62	58
Carbonate (CO ₃) ppm	0	0	0	0
Bicarbonate (HCO ₃) ppm	506	516	516	431
Iron (Fe) ppm	14	72	30	30
Total Solids ppm	15,450	15,060	13,986	15,228
Conductivity (mmhos)	26,000	25,500	25,000	26,000
ph	6.7	6.9	6.85	6.9

FAWN CREEK GOVERNMENT NUMBER 1
 WATER ANALYSIS
 Zone 1 - 5745 feet to 5792 feet

Sample No.	FC-17	FC-18	FC-19
Date Sampled	8/15/70	8/16/70	8/17/70
Remarks	496 bbls produced water	506 bbls produced water	510 bbls produced water
Potassium (K) ppm	1,929	1.842	1,794
Sodium (Na) ppm	4,405	4,461	4,186
Calcium (Ca) ppm	215	232	198
Magnesium (mg) ppm	36	54	65
Chloride (Cl) ppm	8,650	8,700	8,796
Sulfate (SO ₄) ppm	67	68	68
Carbonate (CO ₃) ppm	0	0	0
Bicarbonate (HCO ₃) ppm	473	460	431
Iron (Fe) ppm	32	50	72
Total Solids ppm	15,258	14,650	14,260
Conductivity (mmhos)	24,250	25,800	23,000
ph	6.5	6.8	6.65

FAWN CREEK GOVERNMENT NUMBER 1
WATER ANALYSIS
Zone 2 - 5598 feet to 5632 feet

Sample No.	2-1	2-2	2-3	2-4
Date Sampled	10/28/70	10/30/70	11/11/70	11/12/70
Remarks	Frac water	Est. 125 bbls produced water after frac	139 bbls produced water	153 bbls produced water
Potassium (K) ppm	10,550	1,500	735	685
Sodium (Na) ppm	395	4,900	5,890	5,700
Calcium (Ca) ppm	95	762	284	284
Magnesium (mg) ppm	27	146	67	58
Chloride (Cl) ppm	13,300	10,500	9,133	9,133
Sulfate (SO ₄) ppm	750	375	130	127
Carbonate (CO ₃) ppm	23	0.	0	0
Bicarbonate (HCO ₃) ppm	23	800	1,180	919
Iron (Fe) ppm	0.1	26.5	5.7	5.7
Total Solids ppm	28,720	20,430	17,630	17,000
Conductivity (mmhos)	37,500	26,500	23,000	20,500
ph	9.0	7.0	7.4	7.1

FAWN CREEK GOVERNMENT NUMBER 1
WATER ANALYSIS
Zone 2 - 5598 feet to 5632 feet

Sample No.	2-5	2-6	2-7	2-8
Date Sampled	11/13/70	11/14/70	11/15/70	11/16/70
Remarks	173 bbls produced water	191 bbls produced water	209 bbls produced water	222 bbls produced water
Potassium (K) ppm	660	625	610	565
Sodium (Na) ppm	5,890	5,800	5,410	5,590
Calcium (Ca) ppm	293	310	301	284
Magnesium (mg) ppm	67	45	40	98
Chloride (Cl) ppm	9,469	9,325	8,700	8,870
Sulfate (SO ₄) ppm	115	145	220	175
Carbonate (CO ₃) ppm	0	0	0	0
Bicarbonate (HCO ₃) ppm	782	665	695	533
Iron (Fe) ppm	5.7	4.9	6.0	7.0
Total Solids ppm	17,360	17,570	16,180	15,990
Conductivity (mmhos)	21,700	23,500	20,200	21,500
ph	7.25	7.3	7.2	7.3

FAWN CREEK GOVERNMENT NUMBER 1
WATER ANALYSIS
Zone 2 - 5598 feet to 5632 feet

Sample No.	2-9	2-10	2-11
Date Sampled	11/17/70	11/18/70	11/19/70
Remarks	229 bbls produced water	237 bbls produced water	242 bbls produced water
Potassium (K) ppm	530	530	530
Sodium (Na) ppm	5,350	5,650	5,700
Calcium (Ca) ppm	232	275	267
Magnesium (mg) ppm	85	76	67
Chloride (Cl) ppm	8,460	8,941	8,989
Sulfate (SO ₄) ppm	120	163	160
Carbonate (CO ₃) ppm	0	0	0
Bicarbonate (HCO ₃) ppm	523	533	502
Iron (Fe) ppm	7.5	7.5	7.0
Total Solids ppm	15,400	15,590	16,400
Conductivity (mmhos)	22,100	21,500	22,100
ph	7.4	7.2	7.3

SULFUR CREEK NUMBER 4
WATER ANALYSIS
Wasatch-Fort Union Zone "I" - 4118 feet to 4128 feet

Sample No.	1-1	1-2
Date Sampled	11/20/70	11/20/70
Remarks	Formation water	Formation water
Potassium (K) ppm	59	59
Sodium (Na) ppm	4,620	4,550
Calcium (Ca) ppm	146	137
Magnesium (mg) ppm	81	67
Chloride (Cl) ppm	6,825	6,970
Sulfate (SO ₄) ppm	145	145
Carbonate (CO ₃) ppm	0	0
Bicarbonate (HCO ₃) ppm	543	528
Iron (Fe) ppm	5.2	4.2
Total Solids ppm	12,070	12,100
Conductivity (mmhos)	17,400	17,600
ph	7.7	7.8