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Hydrogeologic Investigation and Evaluation of Ground Water Dewatering at the Deer Creek Mine

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1.0 Introduction

A hydrogeologic investigation of the Roans Canyon Fault Graben has been conducted in order to develop plans for management of ground water inflow during the construction of three parallel rock tunnels for an underground coal mine. The location of the site is at the Deer Creek Mine near Huntington, Utah in the part of the mine workings called Third North (Figure 1-1). The site is located at an elevation of approximately 7600 feet above sea level and is about 2000 feet below land surface.

The original objective of this project was to confirm and evaluate the zones of relatively high ground water inflow which had been discovered by the original hydrogeologic investigation conducted by Utah Power and Light (Williams and Associates, 1985). After these zones had been confirmed by this investigation with borehole flow rates of up to 250 gallons per minute (gpm), a second objective was to develop a ground water dewatering program for control of the inflow prior to tunnel construction.

In order to conduct the investigation, five test wells were constructed. Selected intervals in the boreholes were tested for hydraulic properties with straddle packers. In addition, three short-term and one long-term constant rate flow tests were performed to measure aquifer parameters.

The definition of the ground water system which has been developed by this investigation has been incorporated into an analysis of tunnel inflow rates and the conceptual design of a ground water dewatering system. The need for dewatering prior to tunneling is necessitated by the high inflow rates which would otherwise be encountered by the tunnels.

This report is organized as follows:

Section 1.0 - Introduction	-	Describes the site location and overall project.
Section 2.0 - Methodology	-	Describes the methods used to install the wells, aquifer test procedures, and data analysis techniques and the methods used to calculate ground water inflow.
Section 3.0 - Results	-	Describes the results of the investigation, including definition of the hydrogeologic system, aquifer characteristics, results of inflow calculations, and dewatering time estimates.
Section 4.0 - Recommendations	-	Presents recommendations for dewatering of the aquifers in advance of the tunneling.

Appropriate field data have been organized into appendices as follows:

Appendix A - *Well geologic logs*
Appendix B - *Aquifer test data*
Appendix C - *Water quality data*
Appendix D - *Ground water modeling input data*

2.0 Methodology

This section describes the methods which were used in the investigation, including:

- Borehole drilling and coring
- Well completion
- Packer testing
- Constant rate flow testing
- Aquifer test data analysis
- Tunnel inflow analysis

2.1 Borehole Drilling and Coring

Five horizontal test wells were installed during this investigation: TW-6, TW-7, TW-8, TW-9 and TW-10 (Figure 1-1). All of the boreholes were drilled with a Diamec 260 drill rig which was operated by Utah Power and Light personnel. Wells TW-6, TW-7, TW-8, and TW-9 were continuously cored with an NX-size wireline setup. Well TW-10 was drilled with a conventional rotary bit without coring. Clear water was used as the circulating fluid with the occasional addition of a synthetic organic polymer to reduce fluid friction.

During drilling, water flow from the borehole was controlled with a control head as shown on Figure 2-1. The control head worked with flow rates of over 300 gpm and 70 pounds per square inch (psi) shut-in pressure. The control head was attached to surface casing which was inserted approximately 80 feet into the borehole and cemented in place (Figure 2-1).

After drilling of the borehole was completed, vertical deviation was measured using a

photographic drift survey instrument. Deviation from the horizontal plane was determined from the survey. Because the borehole conditions of high ground water flow and squeezing clay necessitated that the survey be performed inside the casing, it was not possible to measure the azimuth angle.

2.2 Well Completion

After the borehole for a given well reached the desired horizontal depth or was abandoned because of drilling conditions, the well was completed with a combination of blank casing, slotted casing or wire-wrapped well screen.

Wells TW-6 and TW-7 were completed with 1 1/4 inch Schedule 80 PVC casing. Blank casing was used from 0 to 300 feet and Hydrophilic slotted casing with three rows of 0.100 -inch slots, was used from 300 feet to total depth. A plug was placed in the bottom end of each casing string. Casing blow-out caused by discharge rates of up to 150 gpm necessitated the development of a casing anchor designed by Utah Power and Light personnel.

Wells TW-8, TW-9, and TW-10 were completed with blank BX-size steel casing with wire-wrapped galvanized steel well screen in zones with high hydraulic conductivity. The well screen had an opening size of 0.100-inch with double extra-strength for the rods and the wire. The screen was attached to the BX casing with a fabricated fitting.

The large slot size used for the slotted casing and well screen facilitated well development by allowing fine grained material to pass through the screen and not block the openings. Thus the wells were developed by allowing the well to flow unrestricted until the water became clear.

2.3 Packer Testing

To measure shut-in pressure and flow rate and to locate the zones of high permeability,

a straddle packer testing program was implemented. The tested intervals were determined after review of the geologic data, the borehole flow log, and the pressure response in surrounding completed test wells. The packers used were a pair of Aardvark model 23B-30-.510 sliding-end pneumatic packers.

The general test equipment set-up is presented on Figure 2-2. After locating and inflating the packers within the test interval, water flow from the interval was shut-in with a control valve for approximately 30 minutes. The test interval was then allowed to flow for a period of 30 minutes with the flow rate recorded by either a Stevens chart recorder on a V-notch weir or a 1 gallon bucket and stopwatch. The interval was again shut-in and recovery pressure was monitored with a pressure transducer and gauge for a period of 30 to 100 minutes on a logarithmic frequency. A data logger was used to record the pressure transducer data.

A modification to this basic procedure was used on two tests. Within the interval from 775 to 850 feet on well TW-7, water was allowed to flow through the NX wireline drill rod after the annulus had been sealed by seating the core bit in a squeezing portion of the hole. Otherwise the test procedure was identical to the packer test method. In addition, the interval from 0 to 527 feet on TW-7 was tested by seating a packer at the bottom of a high permeability sandstone, thus blocking flow from the bottom of the well. Water within the test interval was then allowed to flow through the open borehole. Pressure and flow rate were recorded as with the straddle packer tests. These modified procedures were used because it was necessary to have higher flow rates to conduct the tests than could be achieved using the straddle packer equipment, which only allowed a maximum flow rate of approximately 10 gpm because of the size of the openings in the packers and A-rods.

2.4 Constant Rate Flow Testing

Constant discharge flow tests were conducted by the following procedure:

1) Pressure in all wells was allowed to stabilize for a period of 8 to 150 hours prior to the test by closing all discharge valves.
2) Shut-in pressures were measured immediately prior to the test.
3) The ball valve on the test well (Figure 2-1) was opened and the well was allowed to flow at a constant rate. To allow for drawdown in the test well, a well-head pressure of 20 to 30 psi was maintained during the first few minutes of the test. As the test progressed, this pressure was allowed to decline.
4) The flow rate was measured with a V-notch weir and Stevens Type-F chart recorder with a 24 hour clock or a one gallon container and a stopwatch.
5) The flow rate was maintained at a constant rate by gradually opening the ball valve as the pressure in the flowing well decreased.
6) The decrease in pressure in the test and observation wells was monitored with pressure gauges and transducers on a logarithmic time frequency.
7) The ball value was closed at the end of the flow test and the recovery pressure was monitored on a logarithmic frequency.

The duration of the tests ranged from eight hours to over six days.

2.5 Aquifer Test Data Analysis

The packer tests and flow and recovery test data were analyzed to determine static pressures and gradients through the fault system and to determine transmissivity, permeability (hydraulic conductivity), and storage coefficient (storativity) for the zone tested. The flow-period data were analyzed for transmissivity using the constant-discharge method of analysis (Theis, 1935; Cooper and Jacob 1946; Earlougher, 1977). The pressure build-up data were analyzed using Cooper-Jacob recovery plots with consideration for fracture flow (Jenkins and Prentice, 1982; Sen, 1986) to determine transmissivity, permeability and static formation pore pressures. Three basic methods were used to analyze data from the tests:

- Cooper-Jacob drawdown method
- Cooper-Jacob recovery method
- Fracture flow analysis

All of these techniques, except the fracture flow analysis, assume infinite aquifer extent, confined conditions and no borehole storage. Generally, these conditions could be assumed in the pump tests at later times.

All of the above methods, except the fracture flow analysis, are based on the Theis equation (Theis, 1935), which is:

$$ds = \frac{Q}{4\pi T}\left[-0.5772 - \ln(u) + u - \frac{u^2}{2.2!} + \frac{u^3}{3.3!} - \frac{u^4}{4.4!} + \ldots\right] \qquad (2.5.1)$$

where

$$u = r^2S/4Tt \qquad (2.5.2)$$

and where

Q = Discharge from pumping well
T = Transmissivity
s = Drawdown at a well
r = Distance from a pumping well
S = Storage coefficient
t = Elapsed time since pumping started

The infinite series term is often called the well function and is designated W(u), so equation 2.5.1 is written:

$$ds = \frac{Q}{4\pi T} W(u). \tag{2.5.3}$$

This equation is accurate for homogeneous, isotropic, confined aquifers of infinite extent. It may be used in unconfined aquifer situations if the drawdown values are corrected for unconfined conditions.

2.5.1 Cooper-Jacob Method (Drawdown and Recovery)

Cooper and Jacob (1946) observed that at longer pumping times a simplified version of the Theis equation could be used. Therefore, equation 2.5.1 becomes:

$$ds = \frac{2.3Q}{4\pi T} \log_{10}\left(\frac{2.25Tt}{Sr^2}\right). \tag{2.5.4}$$

The conditions necessary to use this simplified equation are:

- Large values of t
- Small values of r

Borehole effects, including borehole storage and skin effects, and hydrogeologic boundaries may effect the drawdown data, and some interpretation may be necessary when using this method. A Horner plot analysis is identical to a Jacob analysis except that well pressure is plotted against time instead of well drawdown.

For this method, a plot is first constructed of drawdown or pressure and $\log_{10}$ time. This plot usually shows a curve which straightens with increasing time. A straight line is drawn through the late-time data after borehole storage effects and early-time effects have diminished. The following equation can then be used to calculate transmissivity:

$$T = 264\ Q/ds \qquad (2.5.5)$$

where

T = Transmissivity (gpd/ft)
Q = Discharge (gpm)
ds = Slope of the straight line over one log cycle of time (ft^{-1})

The storage coefficient then may be calculated by using the following equation with any compatible units:

$$S = 2.25\ Tt_o/r^2 \qquad (2.5.6)$$

where

t_o = Time at intercept of the straight line with the drawdown = 0 axis (days)
r = Distance from the pumping well (feet).

The storage coefficient may not be calculated when drawdown data is from a pumping well.

The recovery data may be used to calculate the transmissivity only. A plot is made of residual drawdown (ds') vs. $\log_{10} t/t'$, where:

ds' = the difference between the static water level and the recovery water level (feet)
t = the time since the pumping began (minutes)
t' = the time since the pumping ended (minutes)

A straight line is drawn through the late-time recovery data and the transmissivity is calculated using the following equation:

$$T = 264\ Q/ds' \qquad (2.5.7)$$

where

T = Transmissivity (gpd/ft)
Q = Discharge (gpm)
ds' = Slope of the straight line over one log cycle of t/t' (ft^{-1})

2.5.2 Fracture Flow Aquifer Analysis

Aquifer test data that form curvilinear patterns on semi-log plots of drawdown versus log time suggest that traditional analytical methods for radial flow may not apply. An arithmetic plot of drawdown versus the square root of time in which the data form a straight line is consistent with linear flow rather than radial flow toward the well (Jenkins and Prentice, 1982). Linear flow can occur in fractured formations where a highly permeable fracture will serve as a hydraulic extension of an intersecting well.

The fracture flow aquifer analysis used in this study is based on the techniques described by Earlougher (1977, pp. 151-155) for artificially, vertically fractured wells. The following assumptions are implicit in the methodology:

- The well intersects a vertical fracture.
- The system can be approximated as being bounded by a closed square with the well at its center.
- Only one vertical fracture intersects the well.
- The fracture has uniform flux; i.e., fluid enters the fracture at a uniform flow rate per unit area.
- Well bore storage is insignificant.

A type-curve matching technique is used in which a log-log plot of drawdown (expressed

as a pressure difference) versus time is fitted to a set of type curves plotted against dimensionless pressure and time (Earlougher, 1977, Figure C.19, p. 218). Permeability, k, in millidarcys, is estimated using the pressure-axis match. The data-plot matchpoint in psi, $(dP)_m$, and the corresponding type-curve match point in dimensionless pressure $(P_D)_m$ are related to permeability by:

$$k = \frac{141.2\ q\ B\ u}{h} \frac{(P_D)_m}{(dP)_m} \tag{2.5.8}$$

where

q = Flow rate (STB/D)

h = Formation thickness (feet)

u = Viscosity (centipoise)

B = Formation volume factor (1.0 for water at low pressure)

The flow behavior of a vertical fracture system includes two phases. Early-time flow from the formation to the fracture is linear and flow lines in the aquifer are parallel rather than converging toward the well. During the linear flow phase, the pressure at the well is a function of the square root of time. Data collected during the linear flow phase will plot as a straight line on a diagram of pressure (or drawdown) versus the square root of time. With continued pumping, a transition toward radial flow occurs.

If all test data are obtained from the linear flow phase, permeability cannot be estimated by the curve-matching technique mentioned above. However, the last linear data point can be used to estimate an upper limit of permeability for a uniform flux fracture system by using the following equation:

$$k \leq \frac{(0.76)\ (141.2)\ q\ B\ u}{h\ \ dP} \tag{2.5.9}$$

Hydraulic conductivity, K, is related to permeability, k, by:

$$K = kpg/u \tag{2.5.10}$$

where

p = Density

g = Gravitational acceleration

u = Viscosity

$$\text{or } K = 18.2k \tag{2.5.11}$$

where

K is in gpd/ft^2

k is in Darcys

2.6 Tunnel Inflow Analysis

To calculate the anticipated rates of inflow into the tunnels and to evaluate the need for dewatering and design additional dewatering systems, it was decided that numerical modeling would be the most appropriate technique. This decision was based primarily on the need to model the geometry of the tunnels in addition to simulating the extent of the aquifer.

2.6.1 Model Selection Criteria

The selection of the ground water numerical model was based on several theoretical and logistical criteria. The final model selection was based on all of the criteria, with logistical considerations secondary to theoretical factors. The selection criteria were:

- Published verification of the basic code should be available.

- The computer code should include verified algorithms for simulation of leakage, recharge, anistropy, confined and unconfined conditions, and heterogeneous hydraulic conductivity.
- The numerical solution should be appropriate for various grid sizes as well as various time steps.
- The code should be non-proprietary and published.
- The code should have a reasonable published case study record.
- The code should support graphical output of results.
- The code should provide for ease of data input and output as well as data output in a format that can be readily checked.
- The code should be implemented on a personal computer.

2.6.2 Model Description

The selected code was the Illinois State Water Survey finite-difference code, also referred to as the Prickett-Lonnquist model. The code meets all of the selection criteria. The flow module of the code has been used to simulate a variety of hydrogeologic systems successfully.

The model consists of two main modules: (1) a flow module (PLASM) and (2) a flow vector module (VECTOR). The flow module is used to solve the ground water flow equation using a finite difference scheme and the vector module is used to determine flow directions and Darcy velocities. The PLASM code is fully documented in Prickett and Lonnquist (1971). The flow module is a node centered finite difference approximation of the ground water flow equation:

$$\frac{\partial}{\partial x}\left(K_x b \frac{\partial h}{\partial x}\right) + \frac{\partial}{\partial y}\left(K_y b \frac{\partial h}{\partial y}\right) = S\frac{\partial h}{\partial t} + Q \qquad (2.6.1)$$

where

$K_x b = T_x$ = Aquifer transmissivity in the x direction

$K_y b = T_y$ =Aquifer transmissivity in the y direction

K_x = Aquifer hydraulic conductivity in the x direction

K_y = Aquifer hydraulic conductivity in the y direction

s = Aquifer storage coefficient

h = head above bottom of aquifer

b = Saturated thickness of aquifer

t = Time

Q = Source or sink functions expressed as net flow rates per unit area.

The numerical scheme used in the model to solve this equation results in a series of equations in which the head at each node is the primary unknown. The equations then are solved for the hydraulic head at each grid node using a modified version of the alternating direction implicit (ADI) method.

2.6.3 Model Implementation, Calibration and Verification

The PLASM and VECTOR modules have been implemented on a personal computer for modeling of the hydrogeologic units. The PLASM code is used to simulate the flow directions and rates of the selected hydrogeologic system, as well as any ground water sources and sinks. The VECTOR module is used to translate the hydraulic head and source/sink strength output from PLASM into the Darcian flow velocities.

Calibration and verification for the model consisted of matching simulated and observed values, such as hydraulic head, through adjustment of the input parameters. Calibration is defined as matching simulated values with one set of observed data and verification is defined as matching a second, unrelated set of simulated and observed data.

Calibration of the flow simulation of the model consisted of matching the steady-state pressures measured during the investigation. Verification of the flow simulation consisted

of comparing simulated and observed head drawdowns obtained from a constant rate flow test.

3.0 Results

This section presents the quantitative and qualitative results of the Roans Canyon Fault Graben hydrogeologic investigation. These results have been used to develop the recommendations in Section 4.0. The results of the investigation include:

- Well completion information
- Definition of significant hydrogeologic units related to tunnel construction
- Hydraulic properties of the aquifers
- Hydrogeologic characterization of the Roans Canyon Fault Graben
- Prediction of dewatering well and tunnel ground water inflow rates

3.1 Well Completion

Five horizontal test wells were completed as described in Section 2.2 (Figure 3-1). The completion data and static wellhead pressures are presented on Table 3.1 The static pressures were measured after all drilling was completed and the wells had been shut-in for approximately seven days.

The original design used on TW-6 and TW-7 was abandoned after completion of TW-7 because the casing size (1 1/4 inches) excessively restricted ground water discharge from the two major sandstone units. For example, the flow test on TW-7 yielded a combined constant rate of 42 gpm from both sandstones even through previous tests had demonstrated that each sandstone was capable of sustained flow rates of approximately 100 gpm. In addition, a strongly squeezing clay zone encountered in the first test wells dictated that steel casing be used to avoid casing collapse because of the high lithostatic pressures.

The new well design incorporated steel well casing and double-strength galvanized steel screen. The casing was capable of allowing flow rates of up to 250 gpm and had sufficient collapse strength to withstand the squeezing zone.

The last factor confirmed during the investigation was the initial design decision to construct the wells using a large slot opening (0.100-inch). The original wells (TW-2 through TW-5) were constructed with relatively small slots and experienced plugging problems during flow tests. Therefore, during test well design it was decided to use a large slot opening and allow fine-grained materials to pass through the well screen and out the well during development, thus creating a natural filter pack around the screens. This method proved to be successful because clear water flowed from all of the wells after four to eight hours of discharge. After a well was developed in this manner, the water became clear after a few minutes of discharge during subsequent flow periods.

3.2 Hydrogeologic Units

The hydrogeologic units of concern to this investigation were primarily zones of high permeability (hydraulic conductivity) which would result in high inflow rates into the tunnels and also cause problems with rock stability. Zones of lower hydraulic conductivity were of minor concern and consequently were not investigated in detail. The hydrogeologic units were defined by the geologic core data (Appendix A), the aquifer test results and the drill pipe discharge rates observed while drilling.

The two major hydrogeologic units defined by the investigation are two fractured, well-sorted, medium-grained, friable, oxidized, fractured channel sandstones. One sandstone is located approximately 350 feet horizontally from the first bounding fault (Figure 3-1) and the other at about 650 feet. These sandstone units are likely of limited vertical thickness but may have more extensive lateral continuity.

These two sandstones are heavily oxidized and iron stained along fractures, and in places

the sandstone is totally oxidized for several feet. This oxidation at a depth below land surface of 2000 feet indicates that oxygenated water is infiltrating rapidly from the surface through the fractures.

The logical conclusion is that there is good hydraulic connection between the channel sandstones at the depth of the rock tunnels and the recharge at the surface primarily through fractures. In essence, the presence of the altered rock indicates that, hydrogeologically, the water producing zones (Figure 3-2) can be assumed to extend from the mine workings adjacent to the graben to near the land surface. In other words, the vertical thickness of the water producing zones can be assumed to be approximately 2000 feet. This thickness is controlled primarily by fracturing as opposed to lithologic continuity. This assumption has been verified by subsequent constant rate flow tests and ground water modeling.

The last important factor concerning the sandstone units is that both have highly sheared zones with almost no strength at one boundary. The first sandstone has a shear zone located on the south side while the second sandstone is bounded with a shear zone associated with the north fault. When these shear zones were penetrated during drilling, invariably a large amount of sediment and water was produced. Typically, when these shear zones were encountered the drill pipe discharge would increase from 5 to 10 gpm to well over 100 gpm and would be accompanied by several cubic feet of sand.

3.3 Hydrogeologic Unit Hydraulic Properties

The hydraulic properties of the two water producing zones were defined with both packer and constant rate flow tests. Specifically, the permeability (hydraulic conductivity), transmissivity, and storage coefficient (storativity) of the units were measured. It should be noted that the storage coefficient could not be determined from the packer test data because observation wells were not monitored during these tests. The data plots for the aquifer tests are presented in Appendix B.

The hydraulic characteristics that were measured are presented on Table 3.2. The hydraulic conductivity measured for the fractured sandstone is in the expected range for this type of aquifer. The storage coefficients measured indicate that the two major sandstone units are confined. For purposes of dewatering design, a hydraulic conductivity of 15 gallons per day per square foot (gpd/ft^2), a thickness of 50 feet, a transmissivity for each sandstone unit of 750 gpd/ft and a storage coefficient of $5x10^{-5}$ (unitless) have been used.

The results of the fracture flow analysis (Section 2.5.2) indicate that although the flow is occurring primarily in fractures, there is no single dominant fracture which controls flow in the units tested. However, it must be stressed that the faults which bound the two major sandstone units have created highly sheared zones which may respond like single fractures. Such a response would result in significantly higher initial inflow rates than those predicted in Section 3.5.4.

3.4 Hydrogeologic Characterization of the Roans Canyon Fault Graben

The overall ground water flow system in the vicinity of the three rock tunnels has been defined by this investigation. This characterization has been incorporated into the design of the ground water control system for the rock tunnels.

As presented on Table 3.1, there are both vertical and horizontal components to the ground water flow directions. The horizontal gradient as measured between TW-9 and TW-8, which are 300 feet apart, is approximately 0.038 psi/ft or 0.089 ft/ft. The vertical gradient measured between TW-9 and TW-10, which are 58 feet apart vertically where they penetrate the first sandstone unit, is approximately 0.069 psi/ft or 0.159 ft/ft, approximately twice the horizontal gradient.

The horizontal flow component is the result of flow in the graben from the west towards the east, where the graben intercepts the canyon walls and presumably the ground water

system discharges. The vertical flow component is controlled by the Starpoint Sandstone which underlies the entire graben (Figure 3-2). This unit is a medium- to coarse- grained marine sandstone with a hydraulic head below the other units in the graben, as evidenced by the loss of circulation water when this unit is drilled. For example, TW-6 made a drill-pipe flow of approximately 100 gpm when the bottom of the borehole was in the second sandstone. After the hole penetrated the major bounding fault on the north side of the graben, between 50% and 75% of the flow from the hole was lost.

The water chemistry data (Appendix C) indicate that there is active circulation of water through the fractures in the two major sandstone units. As presented on Figure 3-3, the ground water is primarily calcium bicarbonate to calcium sulfate water. The presence of over 100 mg/l sulfate indicates that the water is oxygenated because reducing conditions would have reduced the sulfate to sulfide, particularly in the presence of the thin organic carbon stringers in the sandstone and the shales around the sandstone.

The ground water flow in the graben occurs primarily in the fractures of the two major water producing zones with lesser flow quantities in the fractured siltstone units. Virtually no flow occurs in the shales and claystones between the siltstones and sandstones.

The south boundary fault of the graben creates a hydrogeologic barrier to flow into the mine area south of the graben. The two faults within the graben tend to be associated with highly fractured rock, particularly where they are in contact with the first sandstone unit. These zones are associated with relatively high ground water flow and virtually no intact rock. From the TW-6 packer tests, these shear zones have a hydraulic conductivity approximately twice that of the other parts of the fractured sandstone unit. The north boundary fault does not have a thick fault gouge zone like the one associated with the south boundary fault, but from drilling observations it is also a probable barrier to ground water flow.

3.5 Prediction of Dewatering Ground Water Flow Rates

The ground water model developed by Prickett and Lonnquist (PLASM) has been used to predict the following:

- Tunnel inflow without dewatering
- Dewatering effectiveness in dewatering aquifer prior to tunneling
- Tunnel inflow without dewatering

The above predictions were made with the ground water model after it was calibrated and verified. Because of the similarities of the two water producing zones, only the first zone has been simulated. The predictions for the first water zone should be similar to those for the second water zone based on the data available at present. The results of the computer modeling effort are based on the data available at the time this report was prepared and, given the variable hydrogeologic conditions that exist throughout the entire area of interest, should be considered estimates only.

3.5.1 Model Setup

The ground water model was set-up to simulate a vertical cross-section of a sandstone unit which extends from 1000 feet above the tunnel to the Starpoint Sandstone below the tunnels. The model grid is shown on Figure 3-4. The calibrated input data are presented in Appendix D.

3.5.2 Model Boundaries

The boundary conditions of the flow model were set to simulate the hydrogeologic flow system in the Roans Canyon Fault Graben. The western boundary was set at variable constant head to simulate the inflow from the part of the graben not included in the model. The eastern boundary was set to constant head to simulate discharge into the canyon. The

top boundary of the model was set as a constant recharge boundary and the bottom boundary was set as a constant discharge boundary to the Starpoint Sandstone. The model boundaries are presented on Figure 3-5.

3.5.3 Model Verification and Calibration

The model was calibrated by simulating the steady-state pressures measured in the test wells immediately prior to the start of the five-day flow test conducted on well TW-10 (Figure 3-6). The calibration results are presented on Table 3-3. The modeled ground water head distribution in the first sandstone is presented on Figure 3-6.

The model verification consisted of simulating the five-day flow test conducted on well TW-10. The model setup for the flow and observation wells is presented on Figure 3-7. The simulated flow in the first sandstone is presented on Figure 3-8. The comparison of simulated and actual drawdowns is presented on Table 3.4 and Figures 3-9 through 3-12.

3.5.4 Tunnel Inflow Without Dewatering

Upon completion of calibration and verification, the model was used to simulate the flow into three parallel rock tunnels without prior dewatering. Three tunnels were used in the simulation rather than one because the most recent plans available indicate that all three tunnels will be constructed through the graben simultaneously. If the tunnels are constructed one at a time, the only differences will be that the initial inflow rate into the first tunnel will be less than that predicted for all three and the time required to reach the long-term inflow rate will be greater than that predicted for three tunnels.

In addition to predicting ground water inflow, the increase in effective stress as a result of decreasing water pressure in the rock mass with time was predicted. For purposes of ground water inflow, the peak initial flow rate and total quantity produced in 30 days was predicted. The increase in effective stress after 30 days was also calculated over the entire

area modeled.

The model setup for the tunnel simulation is presented on Figure 3-13. The ground water flow is shown on Figure 3-14. The tunnel inflow with time is presented on Figure 3-15. As shown, the initial inflow is relatively high (over 500 gpm), which declines to 160 gpm in a few days. The total quantity produced in 30 days is predicted to be approximately 7,000,000 gallons, with a long-term inflow rate of approximately 160 gpm (230,000 gpd).

The increase in effective stress is around the tunnel presented on Figure 3-16. As shown, there will be an increase of approximately 70 psi in stress immediately around the tunnel, which decreases with distance away from the tunnel. This sudden increase may cause stability problems with the tunnel working face immediately after penetration.

3.5.5 Dewatering Evaluation

From the data presented in the preceding section, it is apparent that the initial flow rates and total quantity produced from one of the water producing zones in the first 30 days are substantial. Therefore, the effect on tunnel inflow of prior dewatering with wells along each tunnel alignment has been evaluated. The primary effects of prior dewatering are:

- The quantity of water to be managed at the working face is reduced.
- The water is handled in areas of the mine away from the working face.
- The increase in effective stress in the rock mass related to a decrease in fluid pressure is accomplished before the working face reaches the area dewatered.

The dewatering was assumed to occur over a period of six months prior to the three tunnel faces reaching the given sandstone unit. The simulated dewatering wells were allowed to flow under gravity drainage without pumping. A comparison of initial tunnel inflow with and without dewatering are presented on Table 3.5 and Figure 3-15. As shown, prior dewatering has a significant impact on the initial flow rate as well as the total volume

discharged in 30 days. As would be expected, prior dewatering has little effect on the long-term flow rate into the tunnel.

The effect of prior dewatering on the increase in effective stress immediately after the tunnels penetrate the water zone is also important. While the overall total increase in effective stress is the same with or without dewatering, the increase caused immediately after the tunnels are opened will be much less with dewatering. The increases in effective stress related to dewatering and the construction of tunnels are presented on Table 3.6 and Figures 3-17 and 3-18. Figure 3-17 shows the rate of effective stress increase at a point 50 feet from the tunnels after penetration if a dewatering system is implemented. The increase shown is the only incremental stress increase resulting from the tunnels penetrating the sandstone. Figure 3-18 presents the effective stress increase in the sandstone after 31 days if no prior dewatering is done. Obviously the 31-day stress increase around the tunnels is decreased by prior dewatering. The influence of the change in effective stress on the construction of the tunnels is beyond the scope of this report and should be evaluated by a qualified engineer.

A final factor which was addressed during the dewatering evaluation was the influence of the tunnels and prior dewatering on the flow in the surface springs located in the vicinity of the Roans Canyon Fault Graben. A maximum drawdown at the surface of the graben of approximately 10 feet was calculated using the ground water model. Given the pre-existing dominant vertical flow direction and the fact that the springs do not appear to be associated with aquifers of concern to this investigation, it is unlikely that the tunnels or the recommended dewatering systems would exert a measurable influence on the springs.

4.0 Recommendations

The recommendations presented in this section are based upon the hydrogeologic field data collected during the course of this investigation. These hydrogeologic data were collected from a portion of the area of interest; specifically, that portion of the Roans Canyon Fault Graben located north of the Third North mine workings.

The results of the analysis presented in Section 3.0 indicate that dewatering of the two major water producing zones using horizontal wells should be conducted prior to penetration by the rock tunnels. This has been initiated in the first water producing zone by using the TW wells. Because of difficult drilling into the second water producing zone from the present mine workings, a recommended dewatering program for each zone is presented separately.

Two other options were considered: no prior dewatering and grouting. The results of the analyses presented in the previous section and the presence of shear zones near the sandstone aquifers in the water zones indicate that the no prior dewatering option cannot be recommended. The pore pressures and high initial flow rates associated with the sandstones could cause a serious delay in the construction of the tunnels. In addition, the possibility of having to increase tunnel support to accept a rapid increase in effective stress (dynamic as opposed to static loading) in the fractured sandstone cannot be ignored if prior dewatering is not conducted.

Grouting of the zones was deemed not to be cost effective because of the high volumes of grout which probably would be required. While grouting may be utilized to control local ground water inflow rates after tunnel construction, it is not recommended as the primary ground water control mechanism.

4.1 Dewatering of First Water Producing Zone

The dewatering program for this unit consists of using the existing test wells to dewater the first zone. Three of the test wells, TW-8, TW-9 and TW-10, were constructed to be used for dewatering. These wells should be allowed to flow until the rock tunnel intercepts the first sandstone. If all of the wells are destroyed by mining prior to the start of tunneling, at least two in the locations of TW-10 and TW-8 should be replaced. TW-8 is especially important because it drains the area in the immediate vicinity of the tunnels. Periodic shut-in pressures on TW-9 should be measured to monitor progress of the dewatering system.

It is recommended that when the tunnels are within approximately 150 feet of this water zone, three test holes be drilled into the zone ahead of the tunnel to verify the effectiveness of the dewatering system. This is particularly important if well TW-8 cannot be used as part of the dewatering system. These test holes would verify whether the hydraulic pressures have been reduced to acceptable levels. In the event that acceptable pressures have not been achieved, the holes should be cased and allowed to flow to finish dewatering the aquifer. This is particularly important because of the shear zone which bounds the sandstone on the south side.

4.2 Dewatering of Second Water Producing Zone

Currently there are no wells completed in the second zone. While two wells, TW-6 and TW-7, were completed into this unit, flow test data indicate that the casing has collapsed, probably at the squeezing clay zone. Therefore, these two wells only obtain water from the first water zone. Consequently, it will be necessary to install two or three new wells into this unit. These wells can be installed from the rock tunnels after the first sandstone has been penetrated. Recommended locations for the wells are shown on Figure 4-1. The well completion techniques should be similar to those used on TW-8 through TW-10. The wells should be allowed to flow until the second water zone is reached by the tunnels.

List of References

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Table 3.1 Roans Canyon Fault Graben, Test Well Completion Data, Utah Power & Light, Deer Creek Mine

Well	Total Depth (ft)	Surface Casing Interval (ft)	Blank Casing Interval (ft)	Blank Casing Type	Blank Casing Size (in. I.D.)	Screened Intervals (ft)	Screen Type	Screen Size (in.I.D.)	Screen Opening (in.)	Static Pressure (psi)
TW - 6	999	0-80	0-300	Sch. 80 PVC	1 1/4	300-850	Machine Slotted	1 1/4	0.100	59.5
TW - 7	850	0-80	0-300	Sch. 80 PVC	1 1/4	300-850	Machine Slotted	1 1/4	0.100	67.5
TW - 8	840	0-80	0-460	BX Steel	2-9/16	460-540	Wire-wrapped Continuous Slot: DS	2	0.100	54.0
TW - 9	650	0-80	0-340	BX Steel	2-9/16	340-400	Wire-wrapped Continuous Slot: DS	2	0.100	65.0
TW - 10	737	0-80	0-340 410-650	BX Steel	2-9/16	340-410 650-700	Wire-wrapped Continuous Slot: DS	2	0.100	68.5

Table 3.2 *Aquifer Test Results*

Test Well	Observation Well	Test Interval (ft)	Transmissivity (gpd/ft)	Flow Rate (gpm)	Aquifer Thickness (ft)	Hydraulic Conductivity (gpd/ft2)	Storage Coefficient
TW-6	TW-6(R)	295 - 306	41	4.5	11	3.7	--
TW-6	TW-6(R)	485 - 496	208	8.5	11	19	--
TW-6	TW-6(R)	495 - 506	293	9.0	11	26.6	--
TW-6	TW-6(R)	505 - 516	900	7.0	11	82 (?)	--
TW-7	TW-6	480 - 525	1200	45	44	27	1.6×10^{-5}
TW-7	TW-7	480 - 525	270	45	50	5.4	--
TW-7	TW-6	800 - 850	816	100	51	16	7×10^{-6}
TW-7	TW-7	800 - 850	816	100	51	16	--
TW-7	TW-6	0 - 850	1320	42	100	13	8×10^{-5}
TW-7	TW-7	0 - 850	738	42	100	7.4	--
TW-7(R)	TW-7	453 - 464	54	3.3	11	4.9	--
TW-9	TW-6	333 - 401	1060	125	70	15	7.4×10^{-6}
TW-9	TW-8	333 - 401	1060	125	70	15	1.1×10^{-5}
TW-9	TW-8(R)	333 - 401	500	125	70	7	--
TW-9	TW-9(R)	333 - 401	484	125	70	9.7	--
TW-2	TW-2	280 - 330	210	15	50	4.2	--
TW-5	TW-5	Unknown	53	10	--	--	--
TW-10	TW-6	340 - 410	711	79	50	14	1.5×10^{-5}
TW-10	TW-7	340 - 410	728	79	50	15	3.0×10^{-5}
TW-10	TW-8	340 - 410	740	79	50	15	2.6×10^{-6}
TW-10	TW-9	340 - 410	695	79	50	14	1.6×10^{-4}
TW-10	TW-10	340 - 410	645	79	50	13	--

NOTES:

1. ft - feet
2. gpd/ft - gallons per day per foot
3. gpm - gallons per minute
4. gpd/ft^2 - gallons per day per squared foot
5. (R) - signifies recovery analysis

Table 3.3 *Simulated and Observed Steady State Water Level Elevations*

Well	Simulated Elevation (feet above MSL)	Observed Elevation (feet above MSL)
TW-6	7739.5	7737.5
TW-7	7752.0	7755.9
TW-8	7733.3	7324.7
TW-9	7751.9	7750.1
TW-10	7764.4	7758.2

Table 3.4 *Comparison of Simulated and Observed Five-Day Flow Test Drawdowns*

		TW-6		TW-7		TW-8		TW-9	
Time (days)	Time (min)	Simulated	Observed	Simulated	Observed	Simulated	Observed	Simulated	Observed
0.06	86	8.0	6.5	9.5	9.0	6.0	2.5	15.6	9.0
0.14	202	12.7	10.5	14.1	13.0	10.0	8.0	21.1	14.0
0.56	806	21.2	18.5	22.6	21.0	18.3	15.5	29.8	22.0
1.06	1526	26.1	22.0	27.5	24.0	23.1	18.5	34.7	25.0
[illegible]	2880	29.8	26.7	31.1	27.5	26.7	22.0	38.4	29.0
5.00	7200	31.9	31.0	33.3	33.0	28.8	27.5	40.5	34.0

NOTE: *All drawdown values are in psi*

Table 3.5 *Predicted Tunnel Inflow Rates*

Time (days)	With Dewatering (gpd)	(gpm)	Without Dewatering (gpd)	(gpm)
.01	342,000	238	780,430	542
.05	286,660	199	487,700	339
.10	272,540	189	413,180	287
.37	267,160	186	325,400	226
.50	267,140	179	298,530	207
.75	250,610	174	278,370	193
1	247,940	172	263,680	183
5	240,560	167	242,190	168
10	239,880	167	239,990	167
16	239,880	167	239,890	166
23	238,810	166	239,820	167
31	239,800	167	239,800	167
100	239,800	167	239,800	167

Table 3.6 *Predicted Effective Stress Increase 50 Feet Above Tunnel*

Time (days)	With Dewatering (WL)	(Del psi)	Without Dewatering (WL)	(Del psi)
.00	7,636	0.0	7,765	0.0
.01	7,615	9.0	7,681	36.4
.05	7,610	11.2	7,648	50.6
.10	7,608	12.1	7,624	61.0
.37	7,606	12.9	7,616	64.5
.50	7,602	14.7	7,610	67.1
.75	7,600	15.5	7,606	68.8
1	7,600	16.0	7,603	71.0
5	7,599	16.0	7,601	71.0
10	7,598	16.4	7,598	72.3
16	7,598	16.4	7,598	72.3
23	7,598	16.4	7,598	72.3
31	7,598	16.4	7,598	72.3
100	7,598	16.4	7,598	72.3

NOTE: *WL - Water level elevation in feet above mean sea level.*

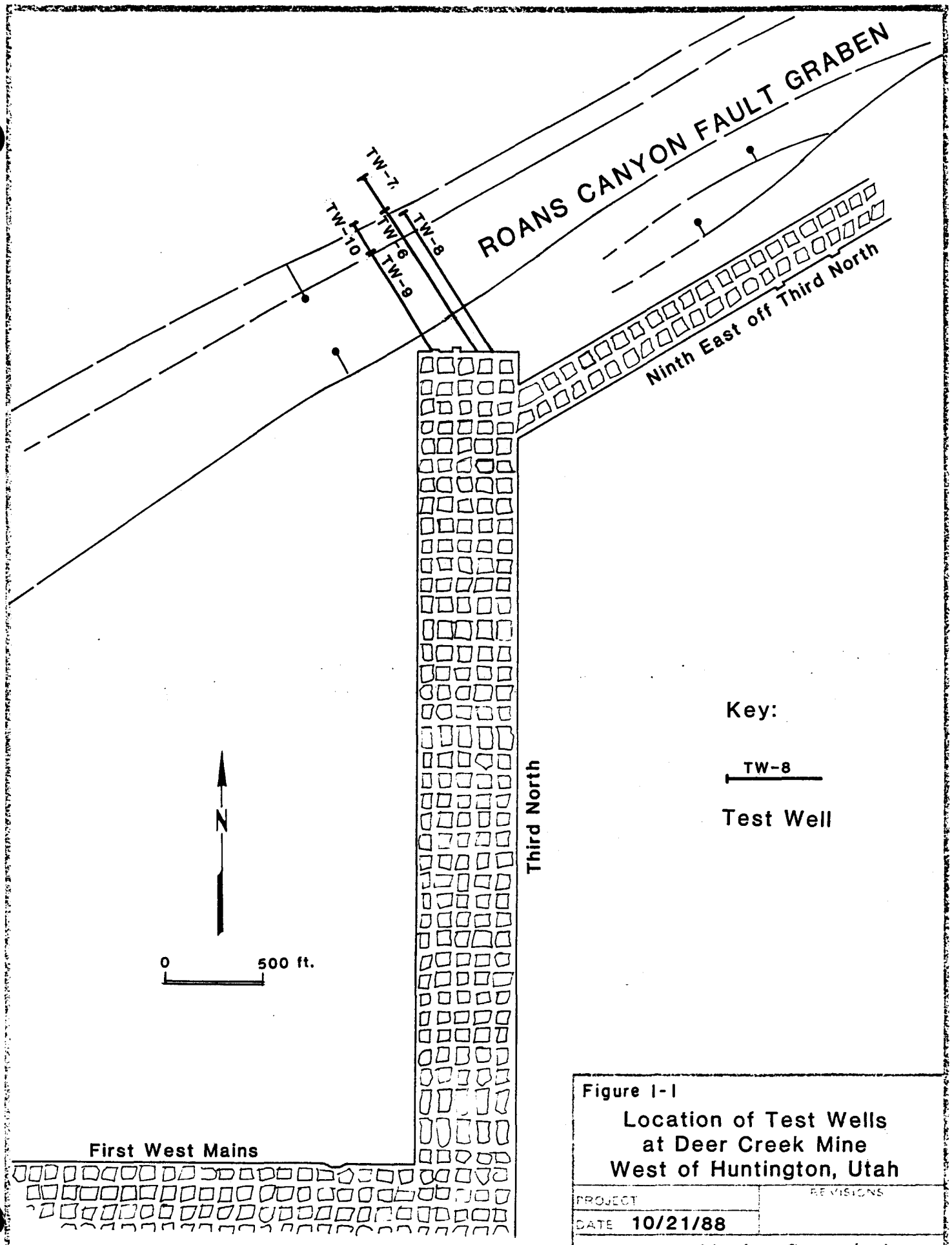

Figure 1-1

Location of Test Wells
at Deer Creek Mine
West of Huntington, Utah

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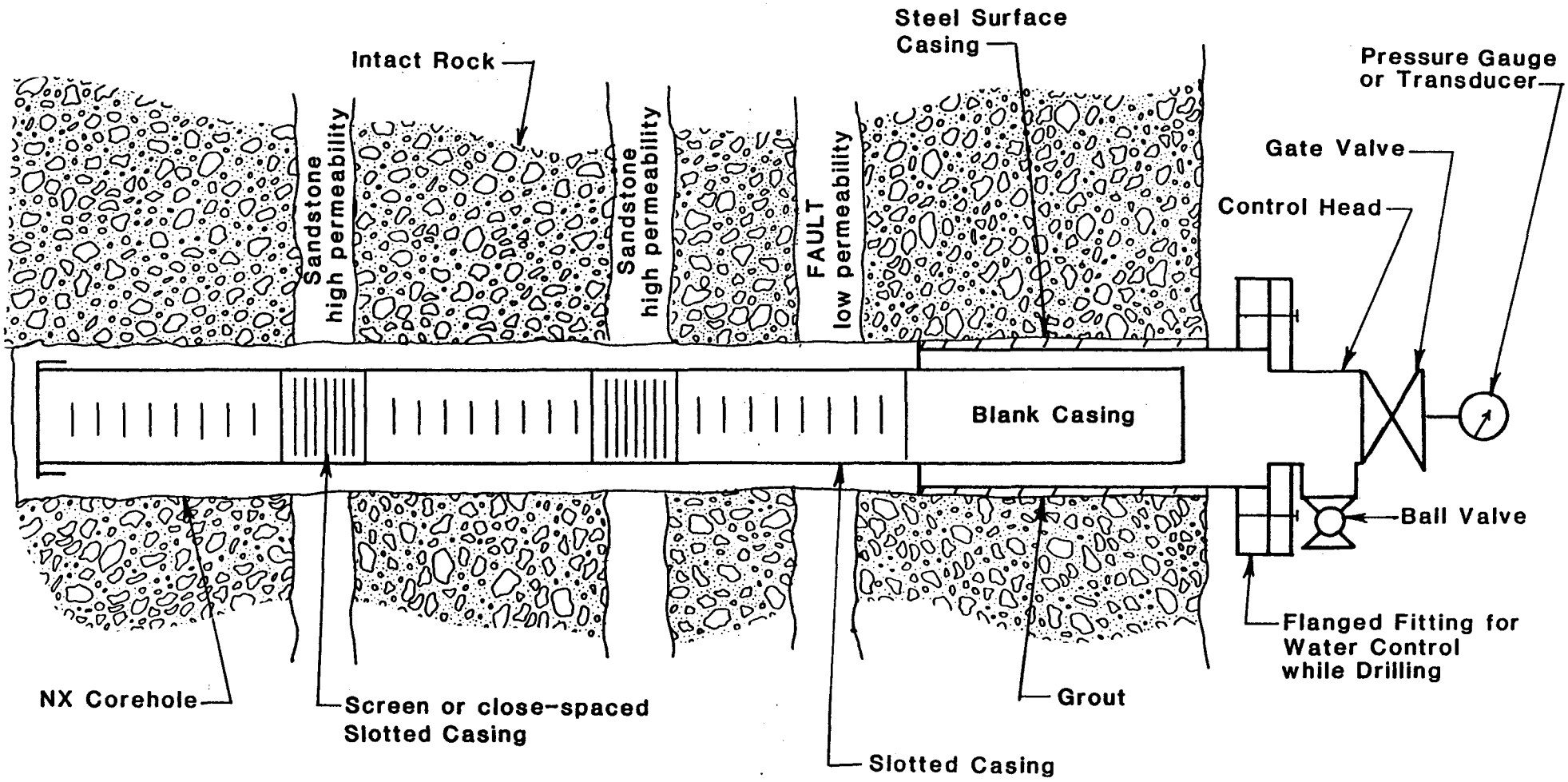

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FIGURE 2-1

Schematic Test Well Construction

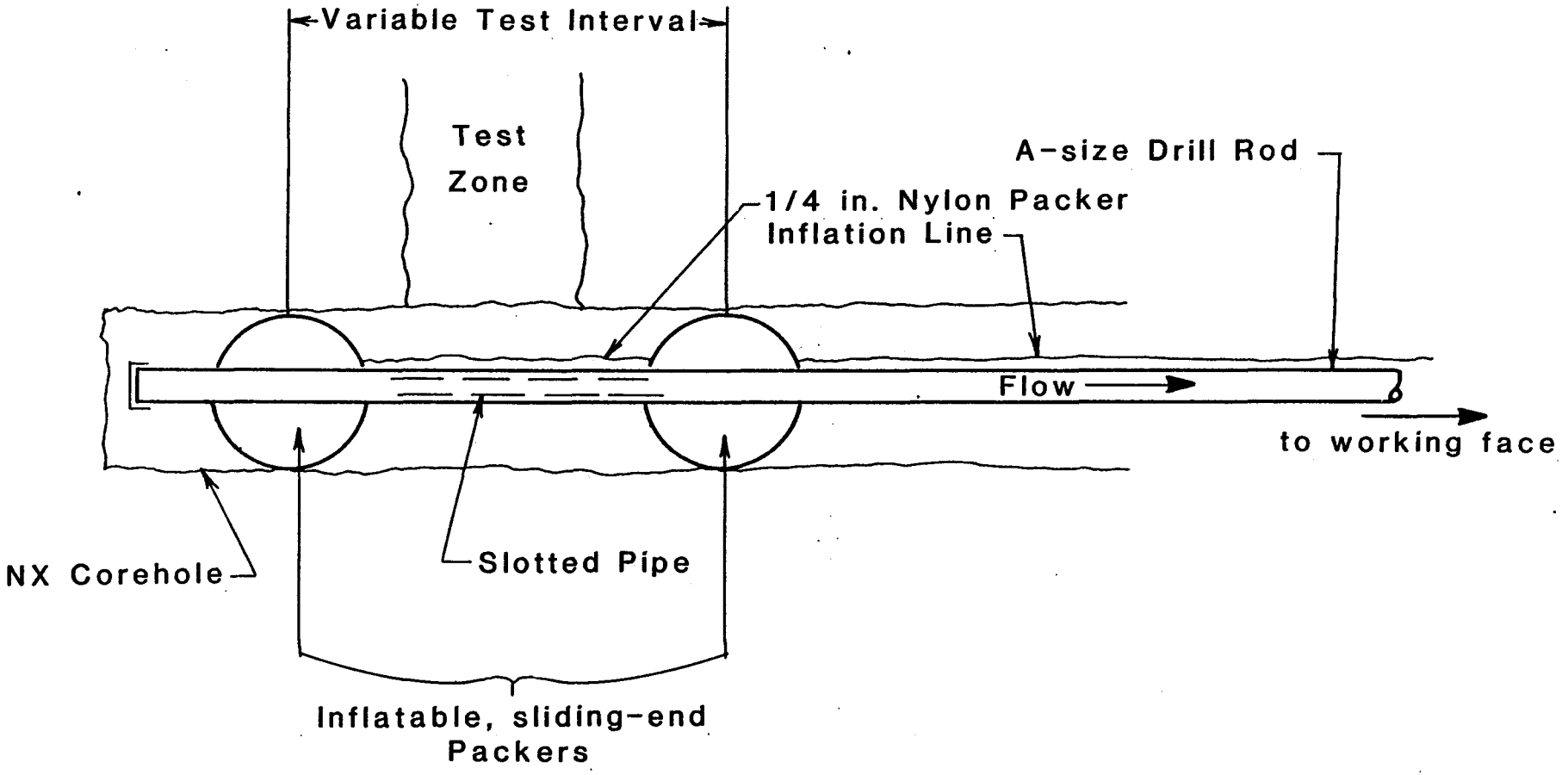

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FIGURE 2-2

Schematic Straddle-Packer Equipment Set-up

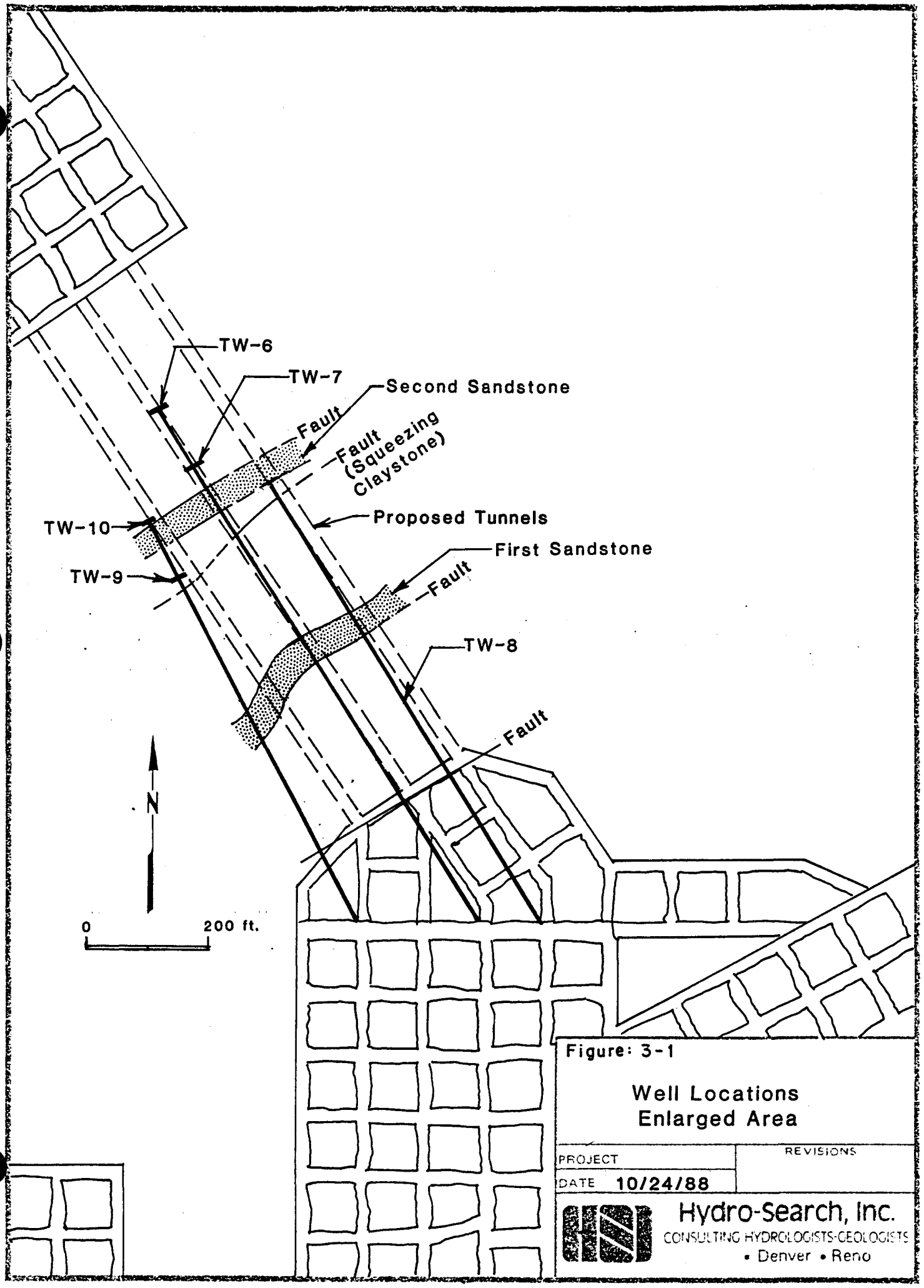

Figure: 3-1

Well Locations
Enlarged Area

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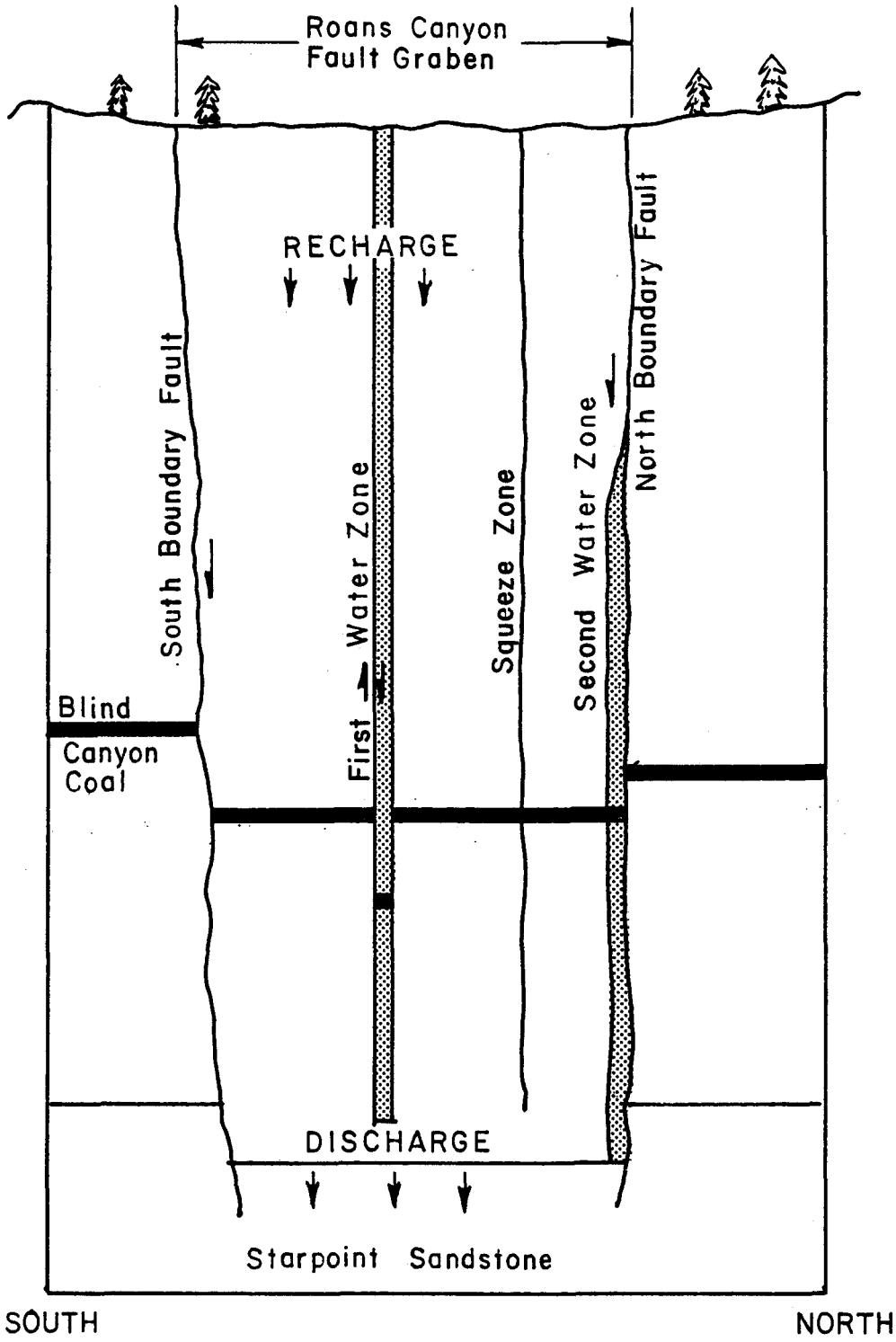

Figure: 3-2

Schematic Cross-Section of

Roans Canyon Fault Graben

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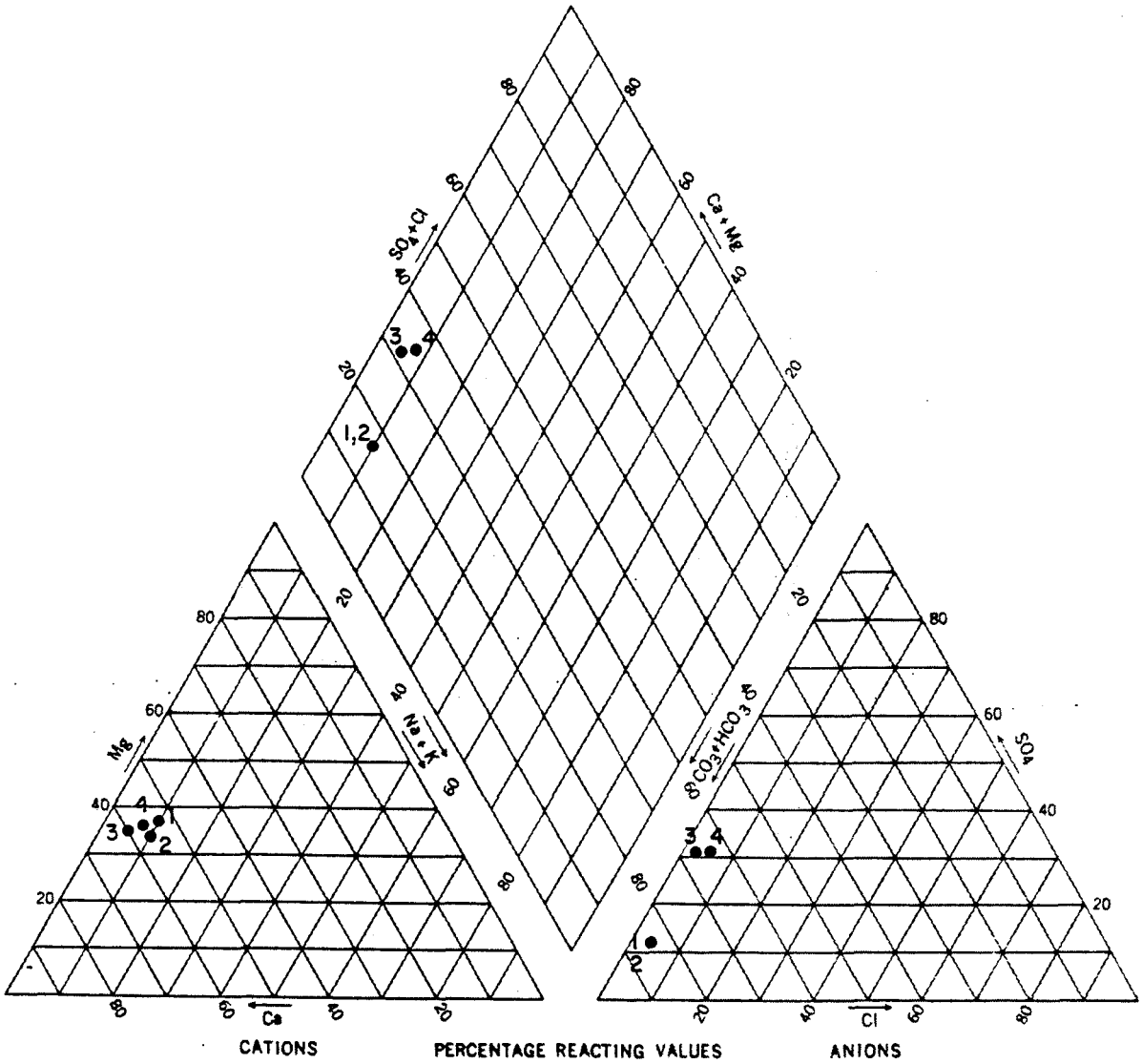

1. TW-10
2. Third North
3. TW-7
4. TW-9

Figure: 3-3

Piper Trilinear Diagram of Test Well Water Quality

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FIGURE

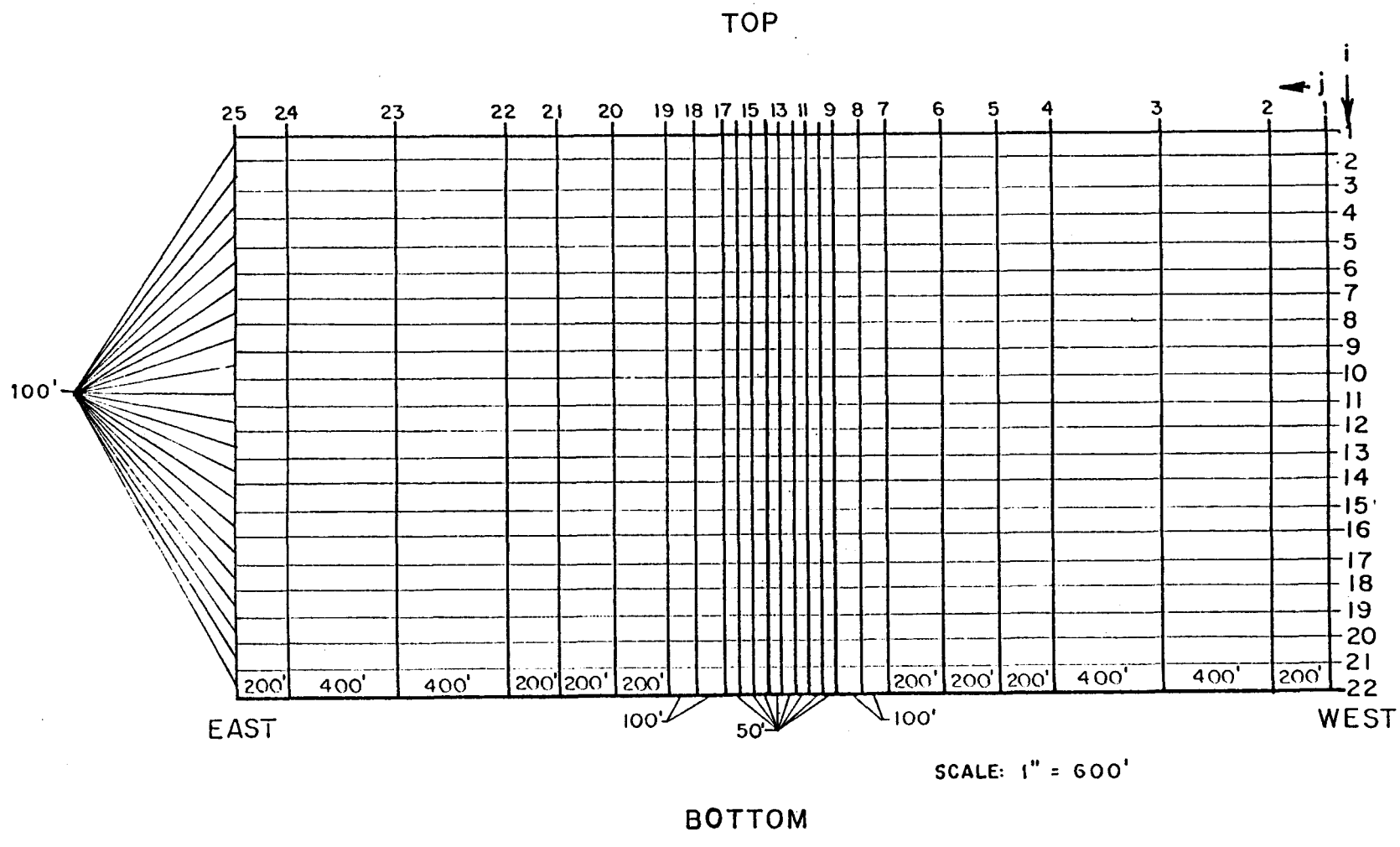

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FIGURE 3-4

Model Grid for Roans Canyon Fault Graben

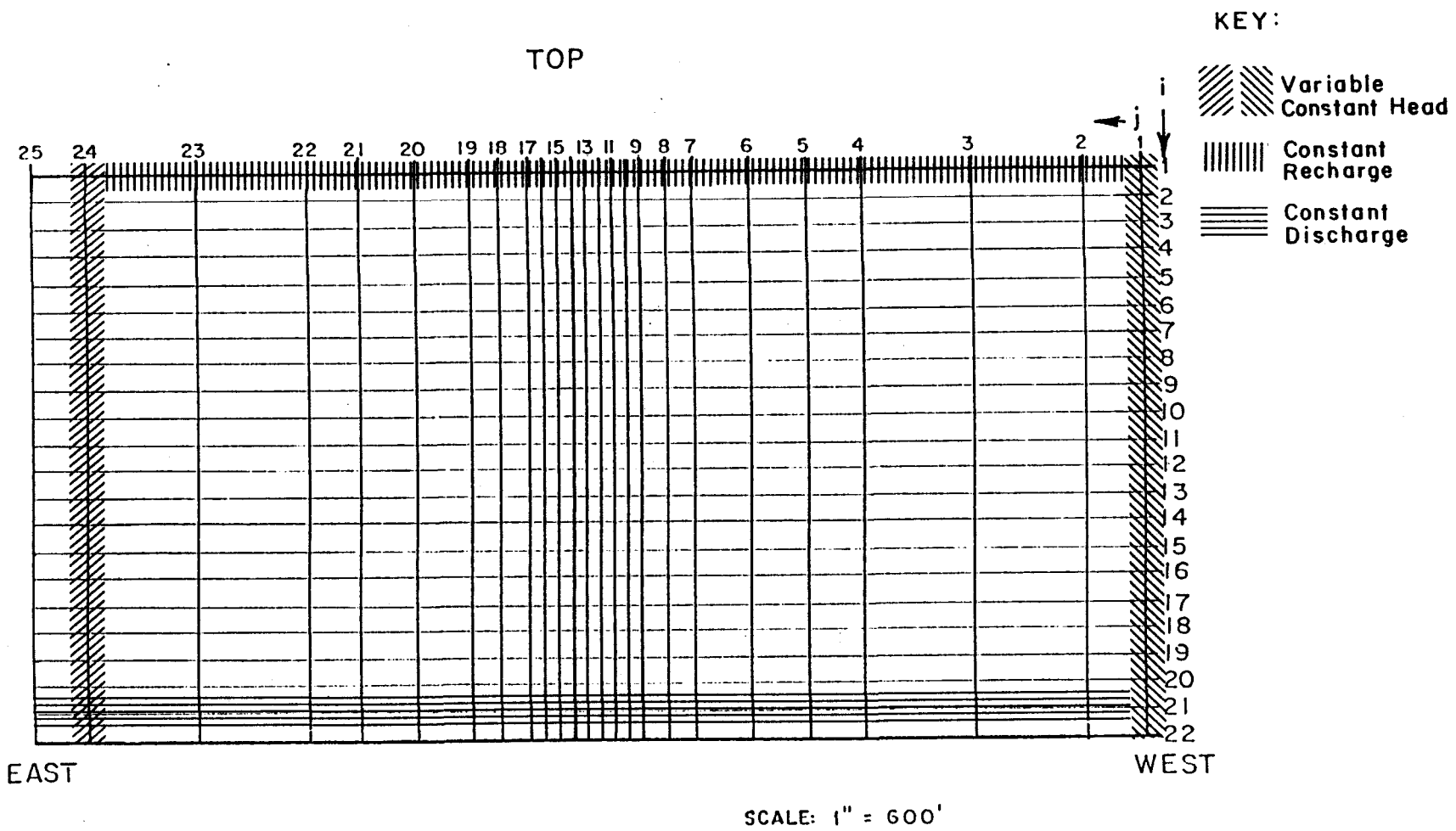

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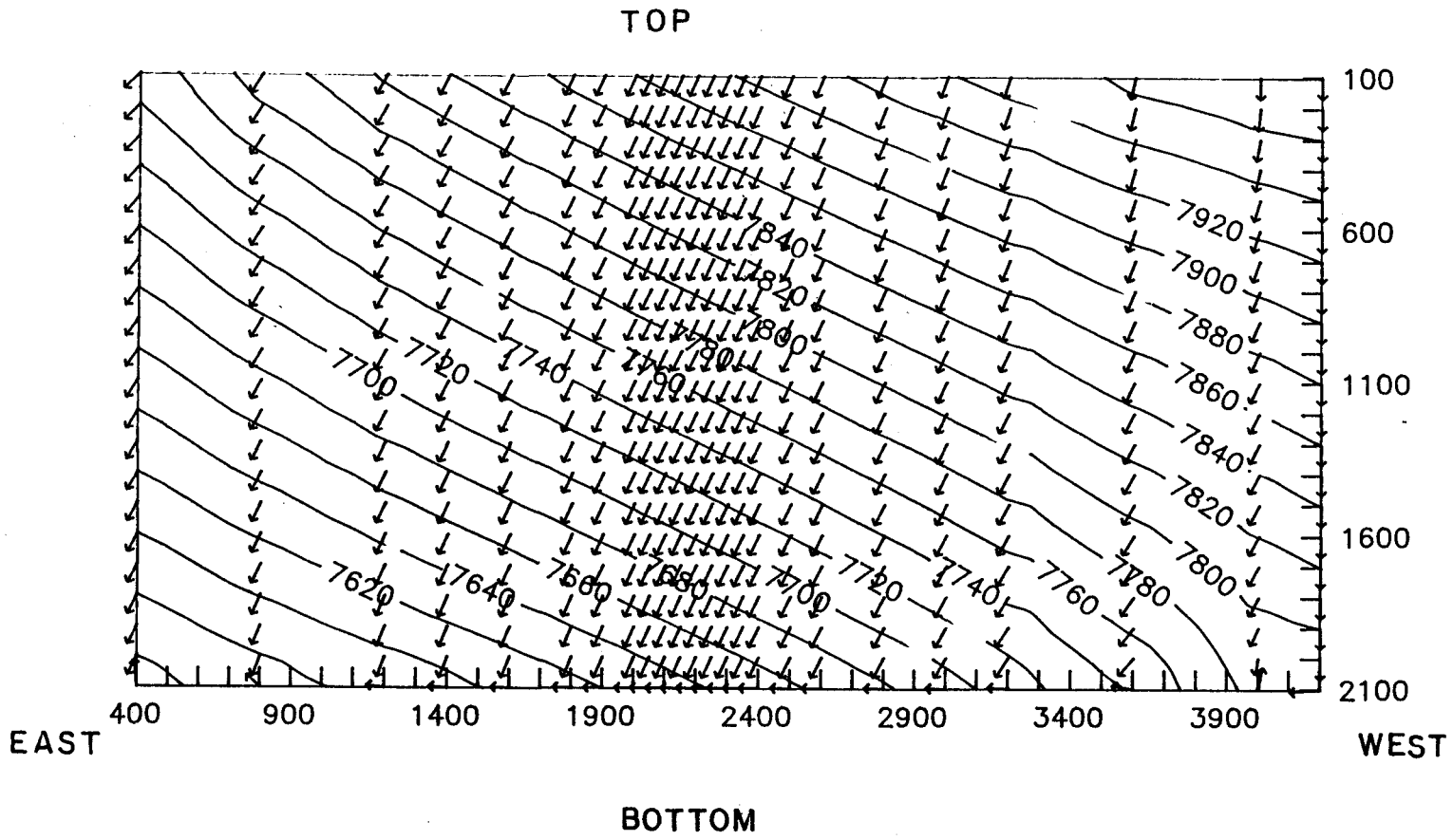
FIGURE 3-5

Model Boundary Conditions for Roans Canyon Fault Graben



KEY:

Contours in feet

Contour Interval 20 feet

SCALE 1:600

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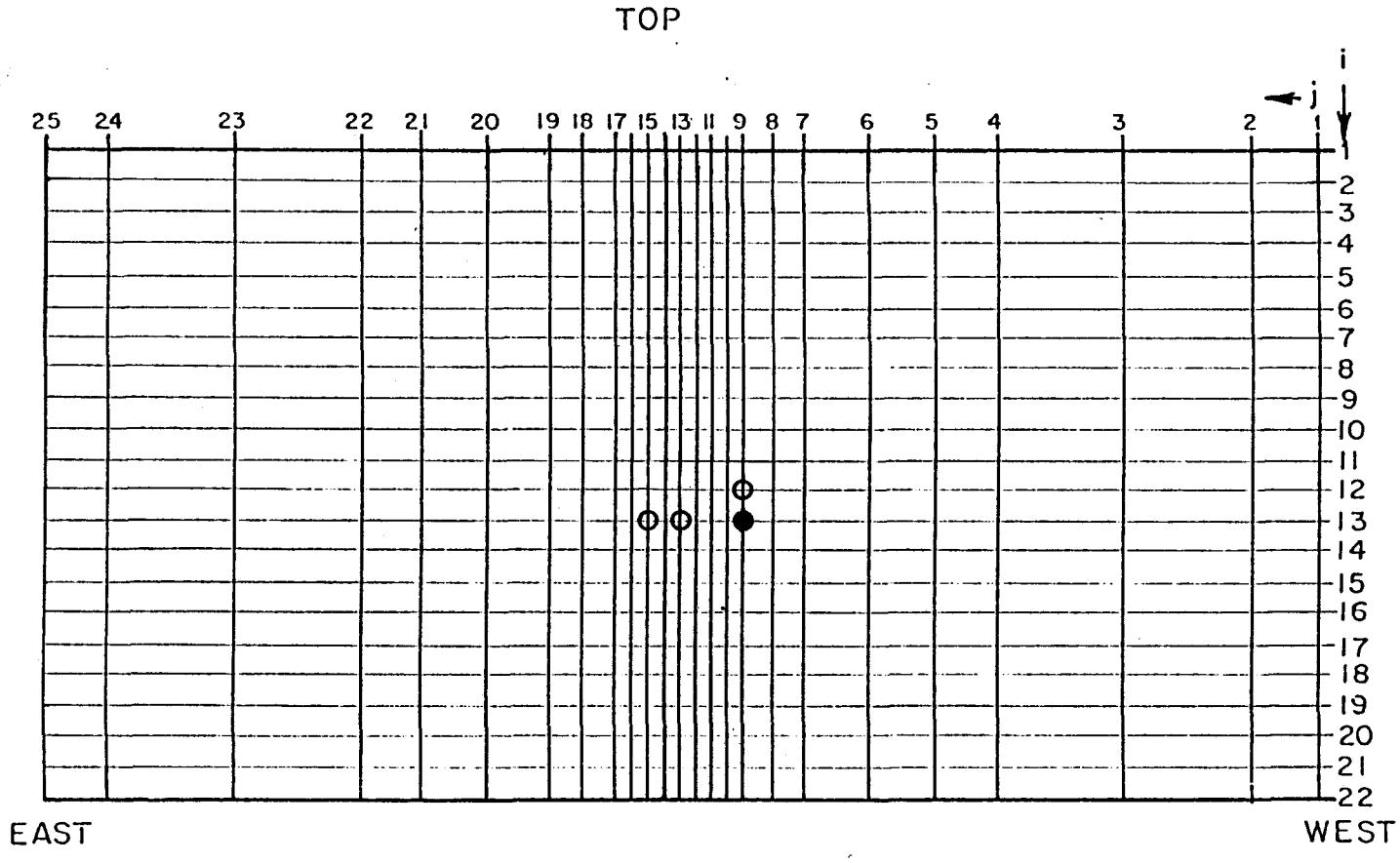
FIGURE 3-6

Fault Graben Base Case



KEY:
● Test Well (TW-10)
O Observation Well

SCALE: 1" = 600'

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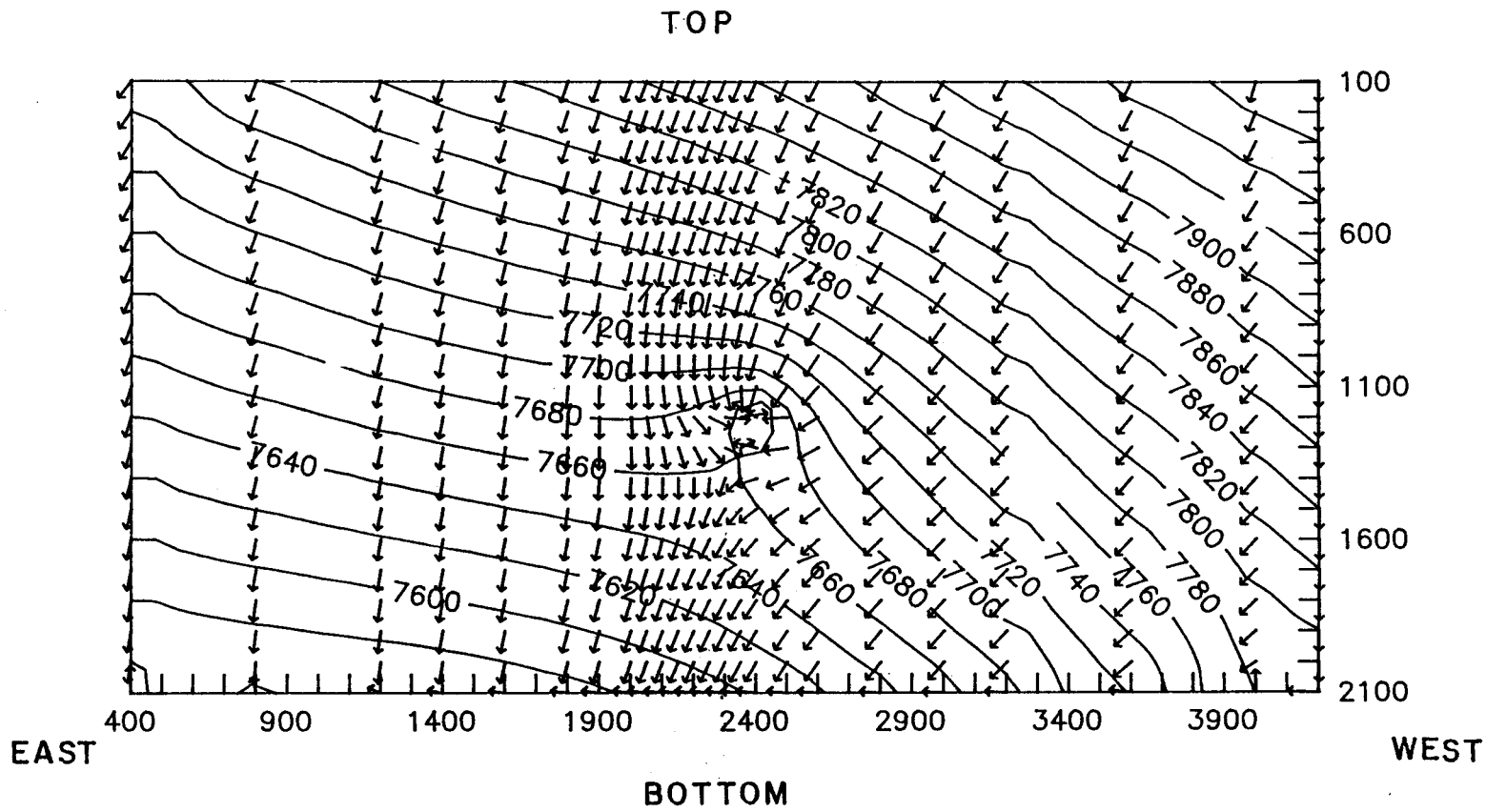
FIGURE 3-7

Well Locations for TW-10 Flow Test Simulation



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Contours in feet

Contour Interval 20 feet

SCALE 1:600

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FIGURE 3-8

Simulated Flow Test

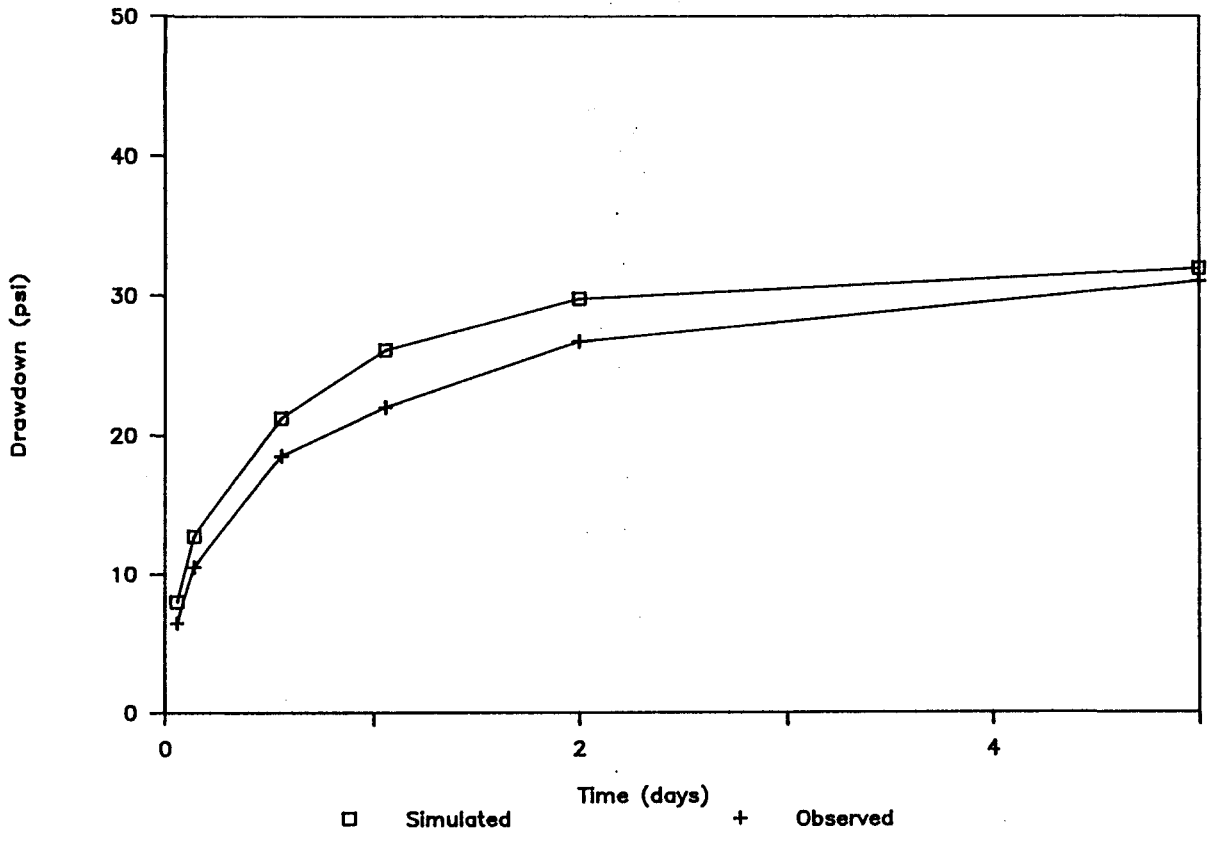

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FIGURE 3-9

Model Verification
Well TW-6

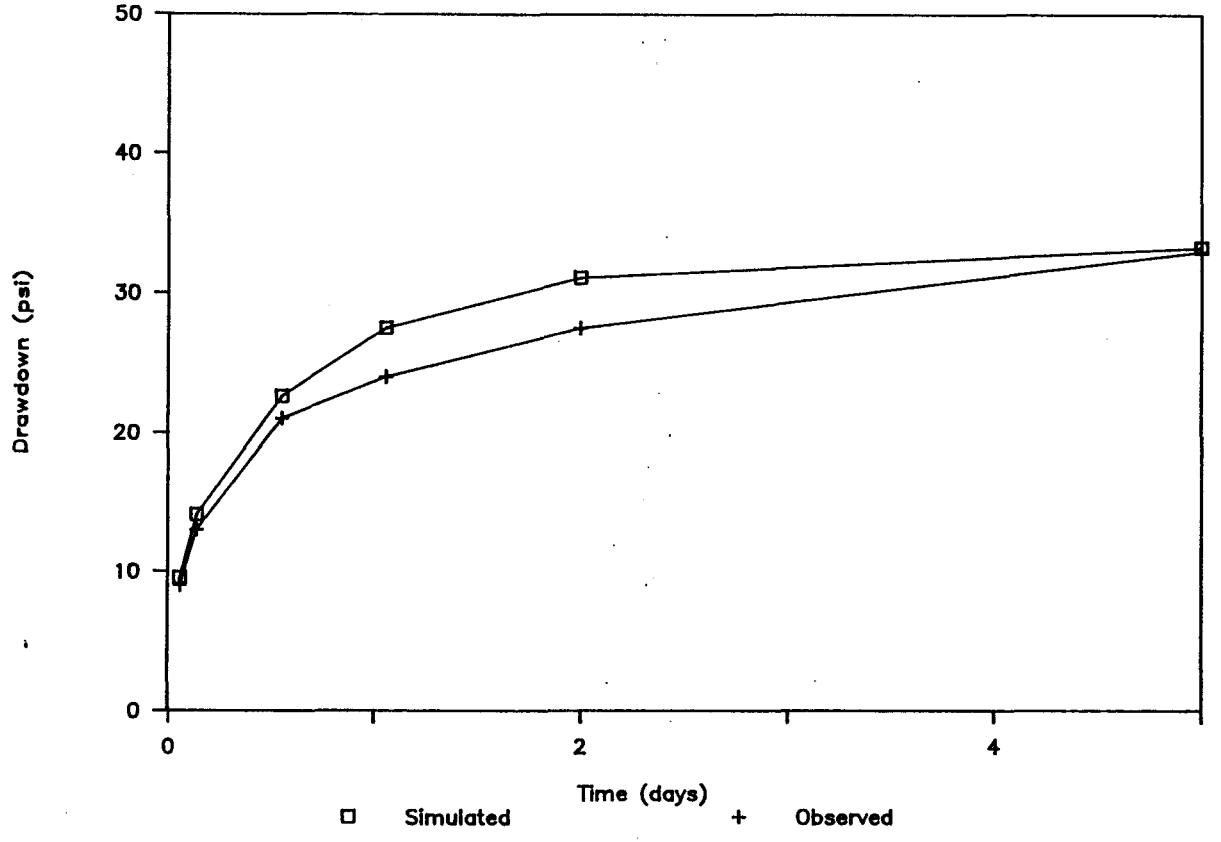

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FIGURE 3-10

Model Verification
Well TW-7

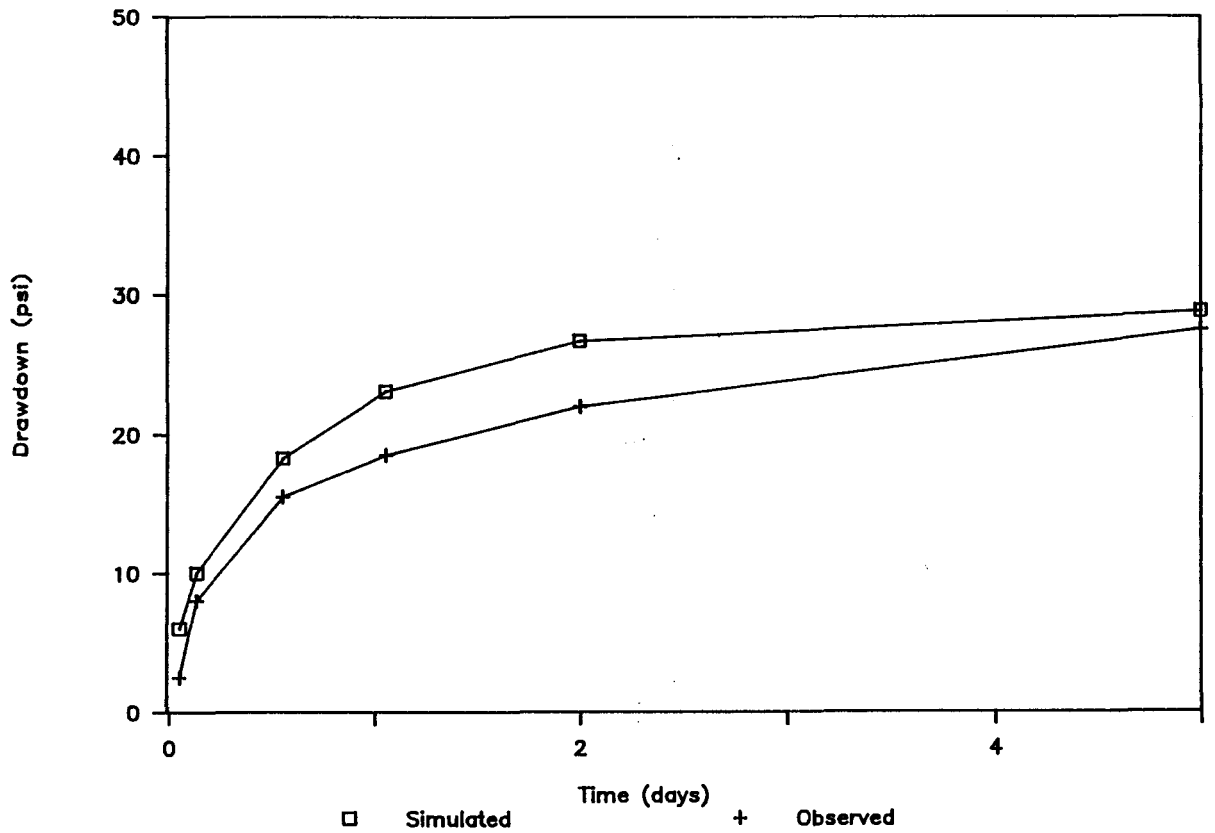

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FIGURE 3-11

Model Verification
Well TW-8

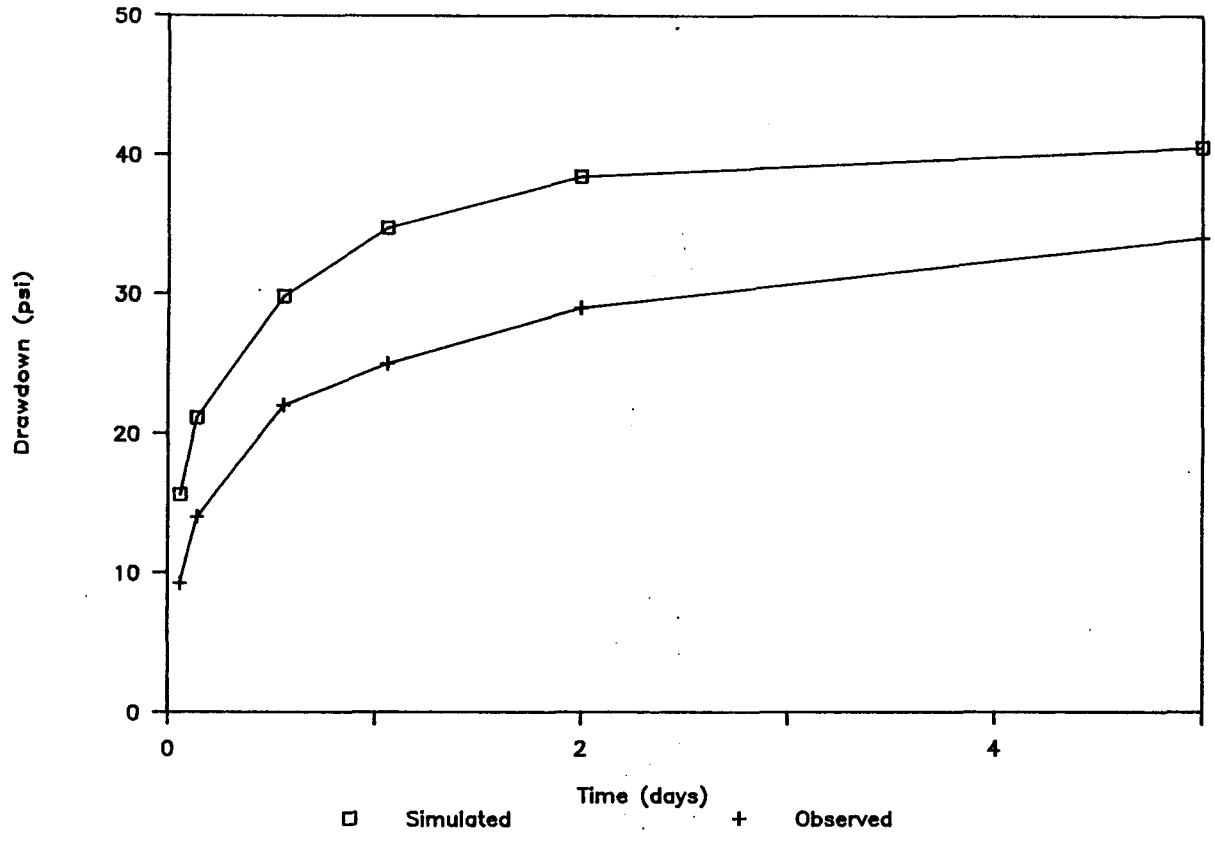

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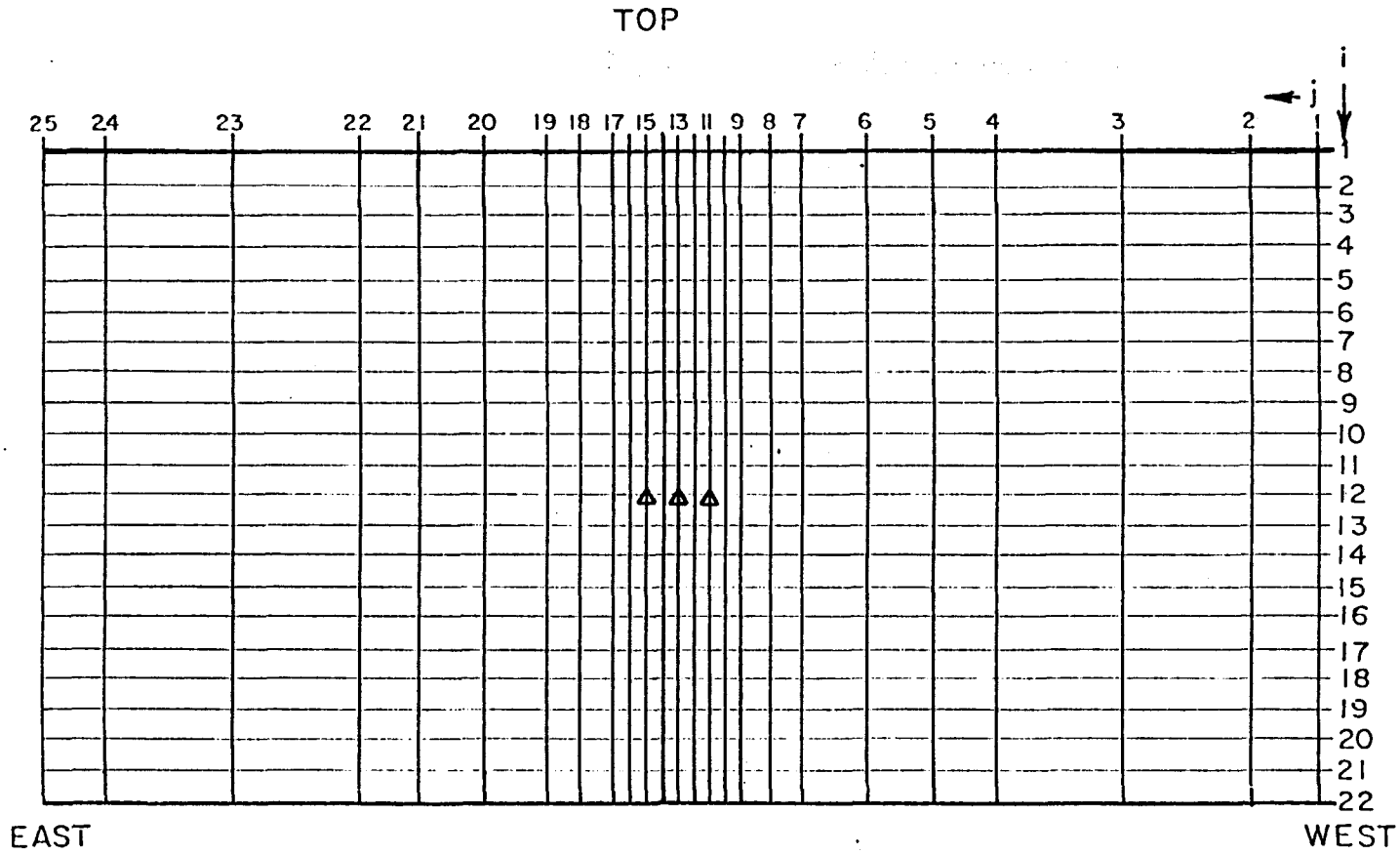
FIGURE 3-12

Model Verification
Well TW-9



KEY:

△ Simulated Tunnel Location

SCALE: 1" = 600'

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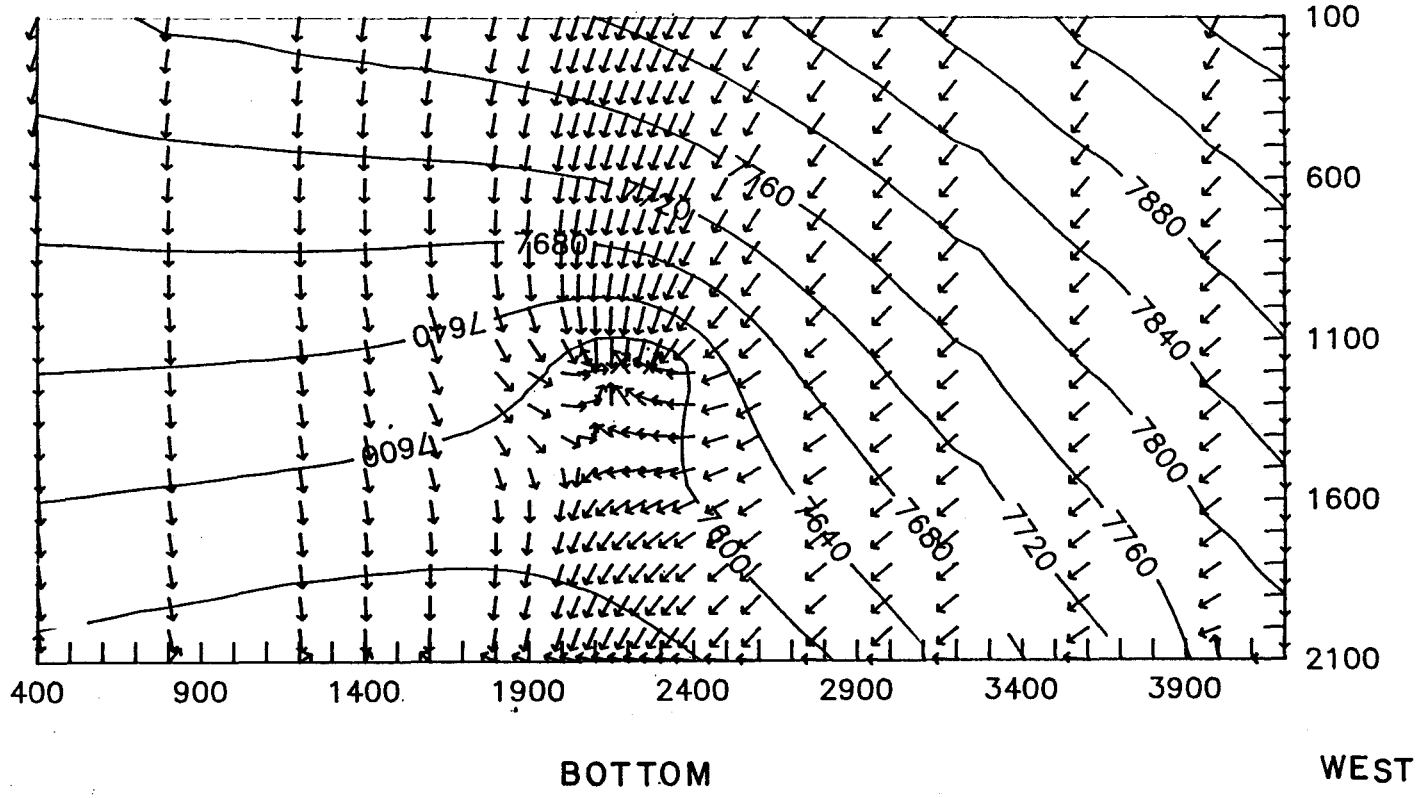
FIGURE 3-13

Tunnel Locations for Inflow Simulations



KEY:
Contours in feet
Contour Interval 20 feet

SCALE 1:600

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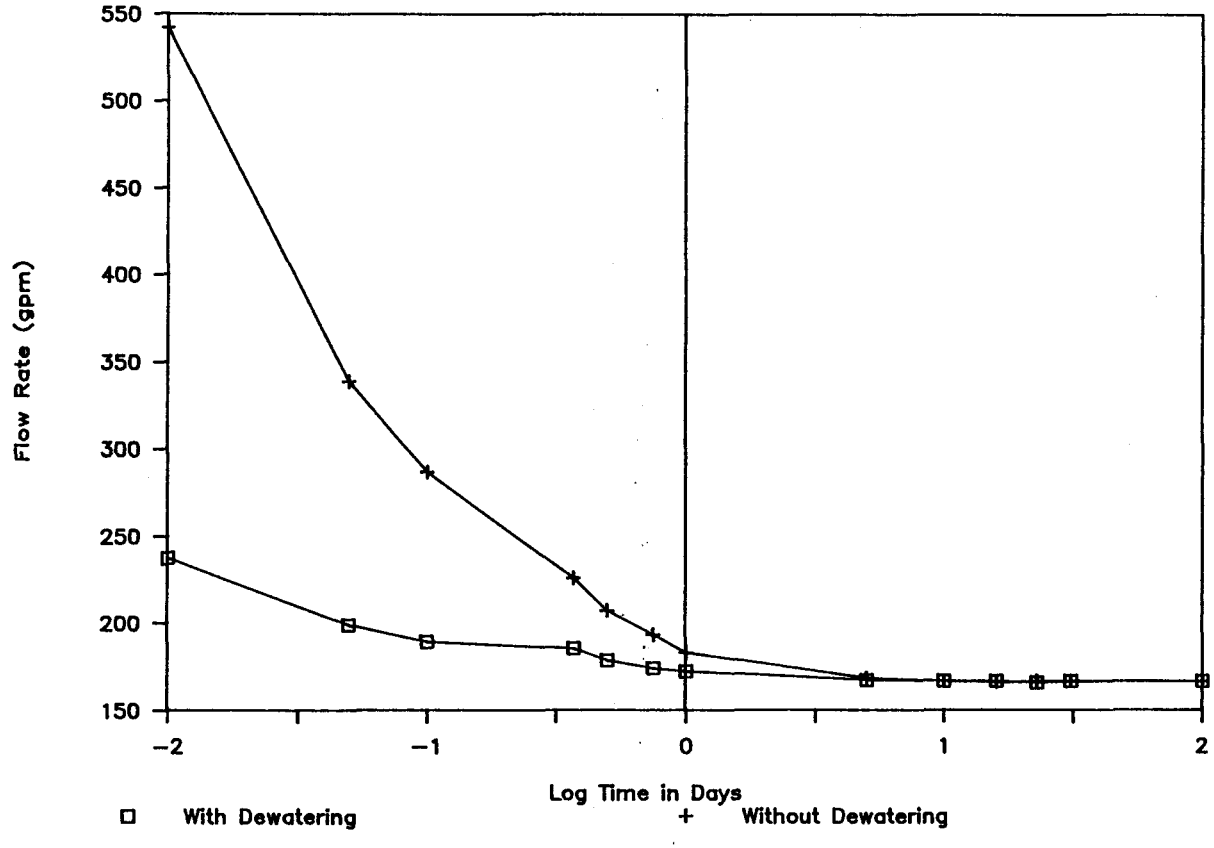
FIGURE 3-14

Simulated Tunnel Inflow



PROJECT	REVISIONS
DATE	

Hydro-Search, Inc.
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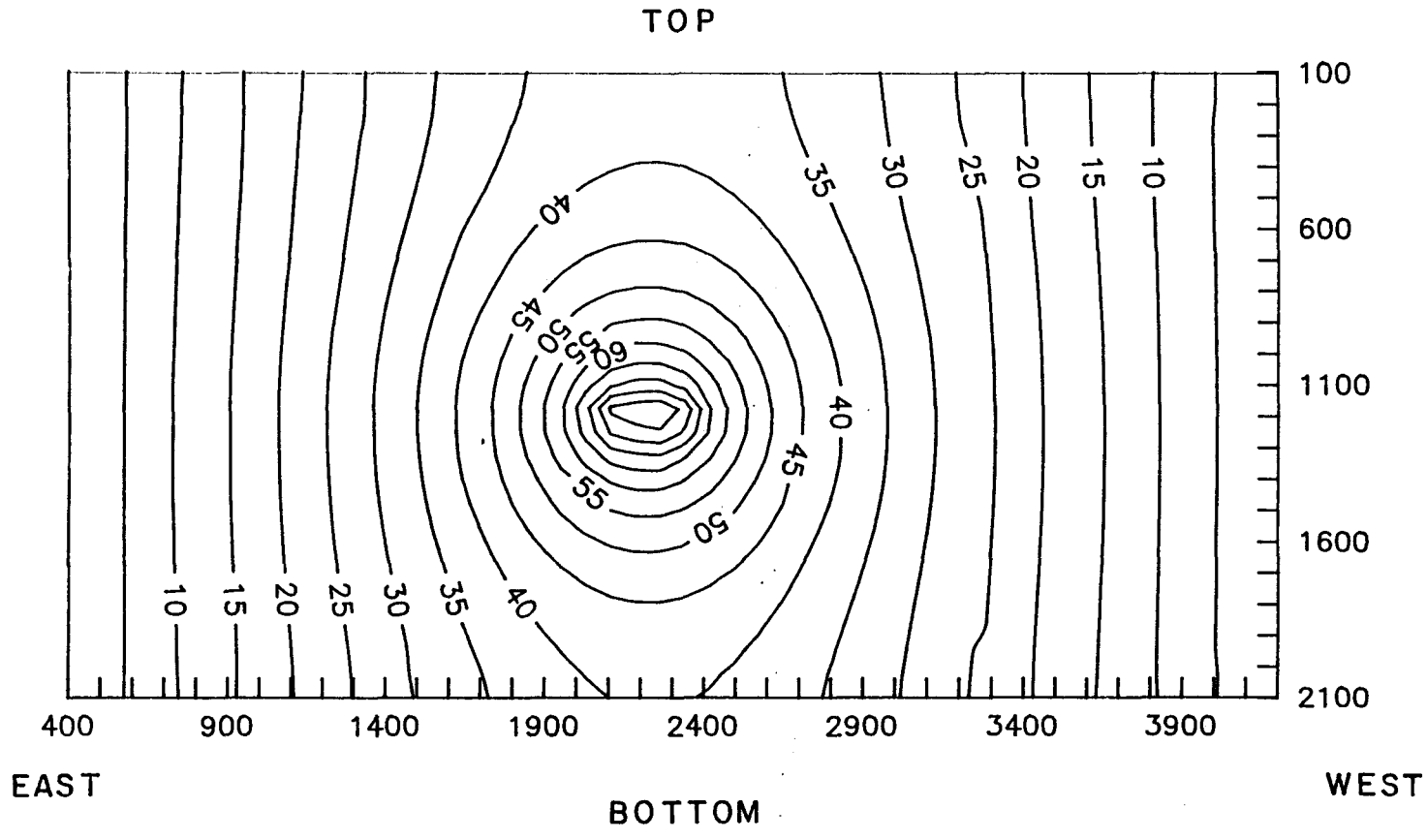
Milwaukee • Denver • Reno

FIGURE 3-15

Tunnel Inflow Rate Comparison
First Sandstone Aquifer



KEY:
Contours in psi
Contour Interval 5 psi

SCALE 1:600

PROJECT	REVISIONS
DATE	

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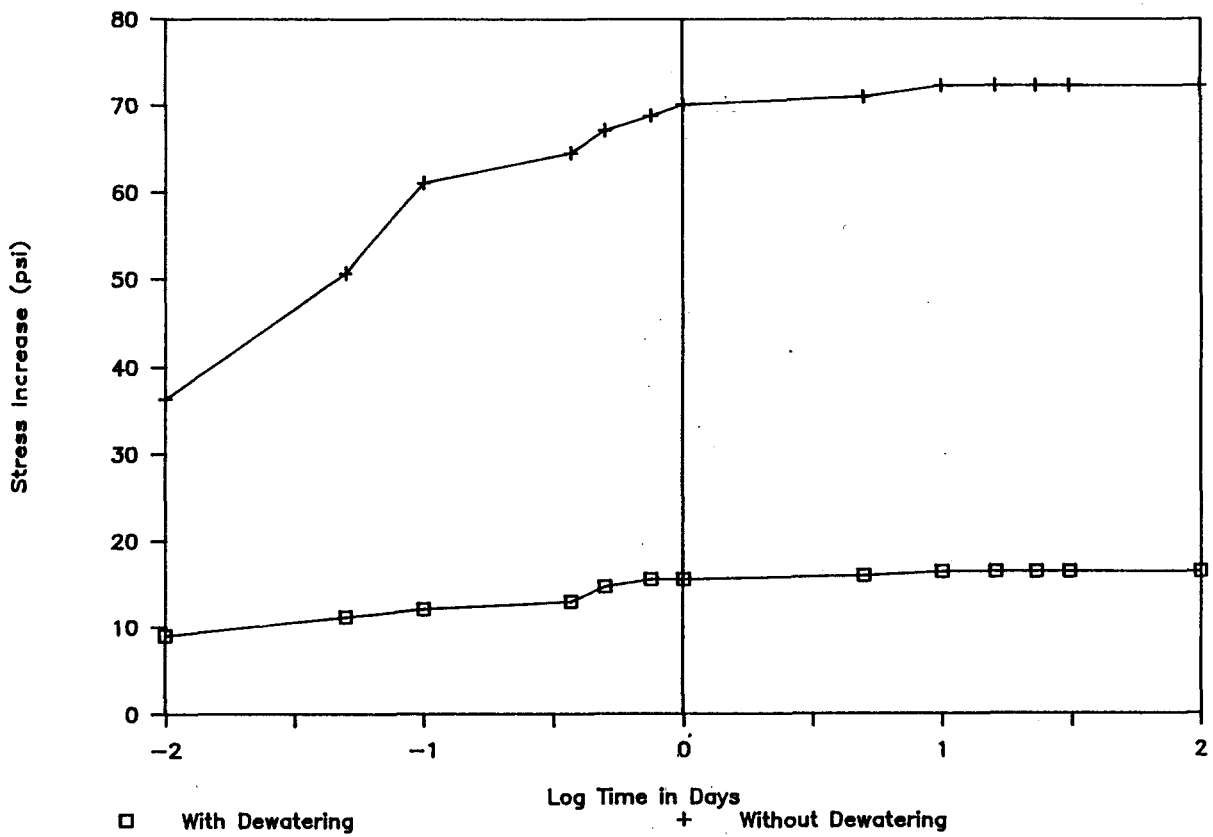
FIGURE 3-16

Simulated Effective Stress Increase Without Dewatering
31 Days After Tunnel Penetration



PROJECT	REVISIONS
DATE	

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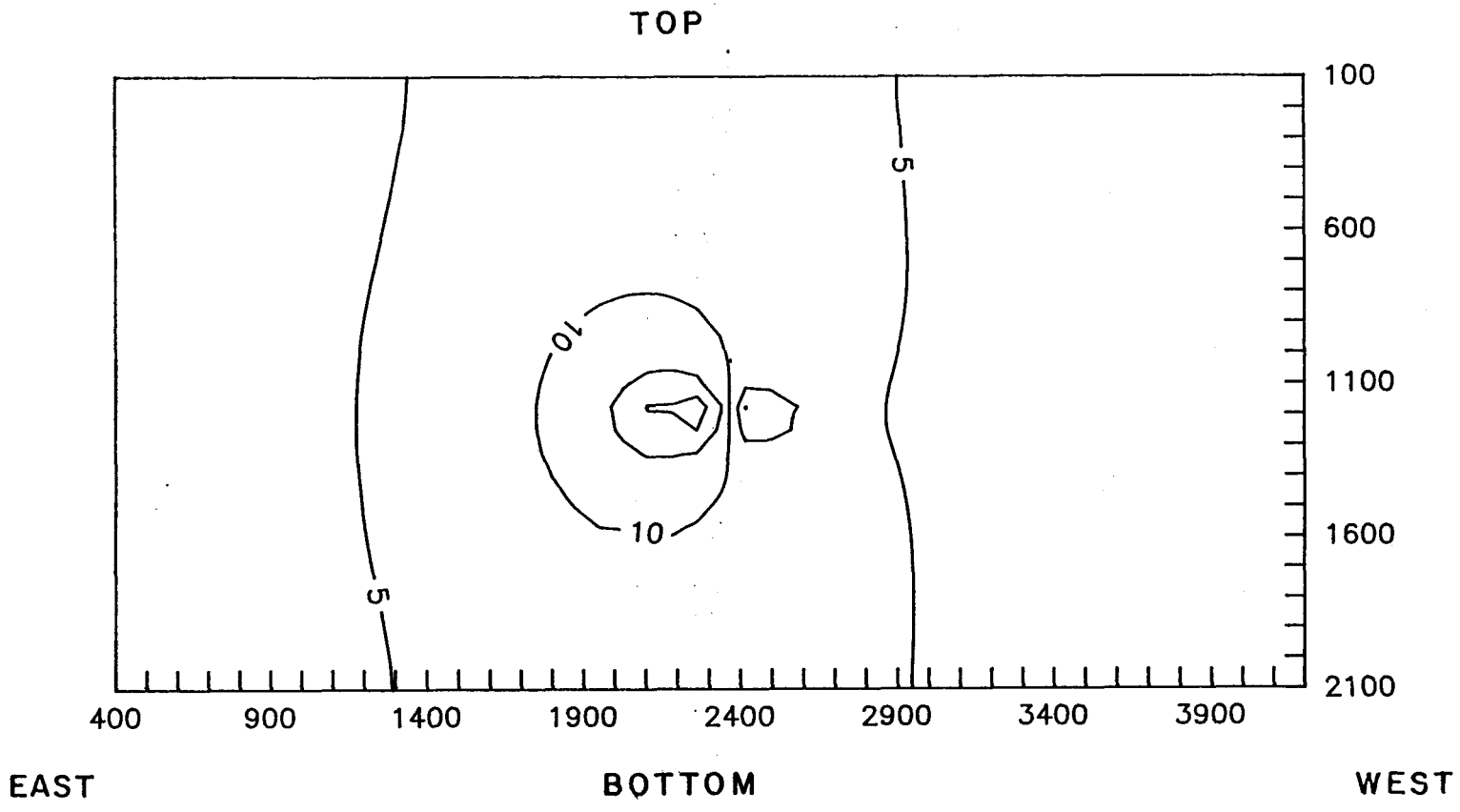
FIGURE 3-17

Tunnel Effective Stress Comparison
First Sandstone Aquifer



KEY:
Contours in psi
Contour Interval 5 psi

SCALE 1:600

PROJECT	REVISIONS
DATE	

Hydro-Search, Inc.
CONSULTING HYDROLOGISTS-GEOLOGISTS
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FIGURE 3-18

Simulated Effective Stress Increase With Dewatering
31 Days After Tunnel Penetration

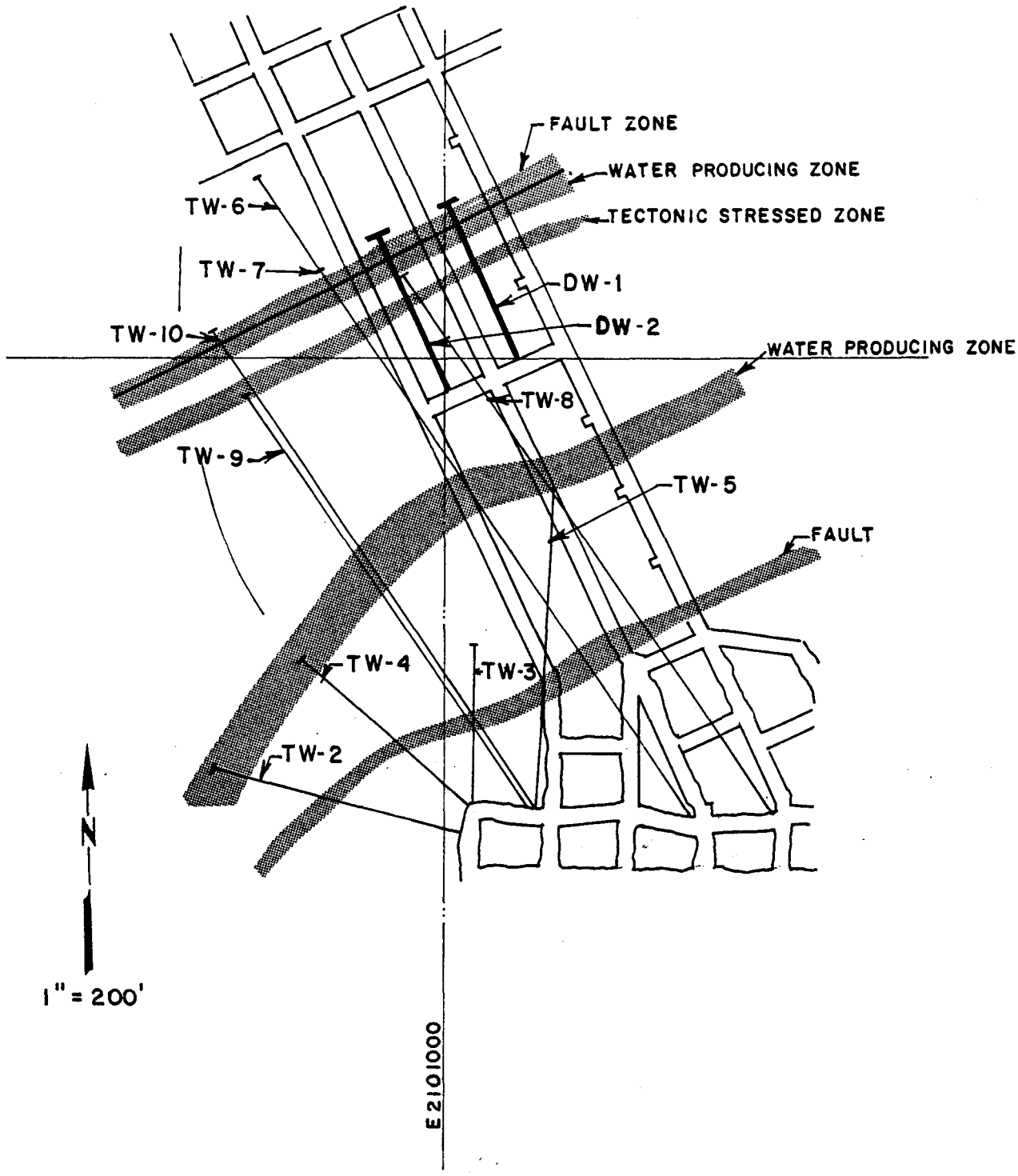

Figure: 4-1

Locations of Proposed Additional Dewatering Wells

PROJECT	REVISIONS
DATE	

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FIGURE

COAL LITHOLOGIC LOG
UTAH POWER & LIGHT COMPANY
DEPT. OF MINING & EXPLORATION

PROJECT: ROANS CANYON FAULT CROSSING - 3RD NORTH DRILL HOLE: 88-1 (TW-6)

LOCATION: 3RD N XC-65, #4
COLLAR ELEV.:
HOLE TYPE: PLUG/CORE
PLUG INTERVAL: 0-101
CORE INTERVAL: 101-999.7
TOTAL DEPTH: 999.7'
DATE: 4/19 - 5/3/88
SCALE: 1" - 10'
GEOLOGIST: FAY/SNIDER/LIOYD/SEMBERSKI

GEOPHYSICAL DATA

LOG	FROM	TO
DENSITY:	/	
H.R.D.:	NO	
E. LOG:	✓	
GAMMA:	NO	
CALIPER:		
S.P.:	/	

COAL SUMMARY:

SEAM	THICKNESS	INT.
N/A		

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
0					0-101' PLUGGED INTERVAL. 0'-80' CASED ZONE (4" STEEL)					
100					101'-126' COAL; BLIND CANYON SEAM, RESINOUS - HIGHLY FRACTURED - 101.0'-102.8' 108.6-110.8' 118.6'-120.0'	57	1	1	100	
110							2	2	100	
120				FORMATION			3	3	100	
					126.0-128.0' MUDSTONE, DARK GRAY-BROWN	100				
130					128.0'-134.2' INTERBEDS. SILTSTONE/MUDSTONE ROOTED, FRACTURED FROM 125.2'-126.2'	95	4	4	96	
					134.2'-137.2' MUDSTONE DARK GRAY-BROWN	97				
140				BLACKHAWK	137.2-143.0 INTERBEDS SANDSTONE/MUDSTONE LIGHT GRAY-BROWN HIGHLY FRACTURED FROM 140.0'-143.0'	24	5	5	91	
150					143.0'-234.0' SANDSTONE LIGHT GRAY, VERY FINE GRAIN YELLOW-BROWN STAINING ALONG FRACTURES.	96	6	6	100	
							7	7	100	

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: ROANS CANYON
DRILL HOLE: 88-1 (TW-6)
PAGE 2 OF 11

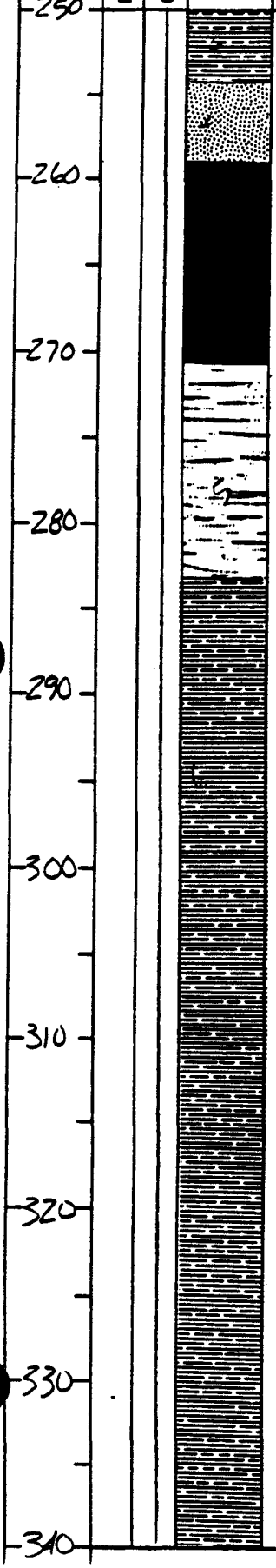
DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
160				BLACKHAWK FORMATION			7	9		
							8			
170					POSSIBLE FAULTS		9	10		
180							10	11		
190						96	11	12		
200							12	13		
210							13	14		
220							14 A			
230					SANDSTONE AS ABOVE W/ ZONES OF MUDDY YELLOW-GRAY FAULT GOUGE 222'-234'			15 A	63	
240					234.0'-244.0' FAULT GOUGE. HIGHLY FRACTURED - ONLY YELLOW-GRAY CLAY RECOVERED.	0	14 B	15 B	30	
250					244.0'-249.0' INTERBEDS MS/SILTSTONE YELLOW-BROWN (OXIDIZED)	88	15		84	

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: Roans Canyon
DRILL HOLE: 88-1 (TW-6)



LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
249.0 - 254.0' MUDSTONE. YELLOW-BROWN, ROOTED, CLAYEY - POOR RECOVERY.	0	15	16	44	
254.0 - 259.0' SANDSTONE, LIGHT GRAY, FINE GRAIN	100		17	64	
259.0' - 271.3' COAL; SLIGHTLY RESINOUS, CARB. MUDSTONE @ UPPER & LOWER CONTACTS.	0	16	18	89	
271.3' - 283.1' INTERBEDS; MUDSTONE/SILTSTONE MEDIUM GRAY, VERY HARD, COAL STREAKS.	91	17	19	92	
		18	20	89	
283.1' - 340.0 MUDSTONE - SILTSTONE LIGHT-MEDIUM GRAY BUFF STAINING (OXIDIZED) ON SEVERAL FRACTURES.	76	19	21	87	
		20	22	98	
		21	23	99	
		22	24	99	
		23	25	100	
		24	26	100	

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: Roans Canyon
DRILL HOLE: 88-1 (TW-6)
PAGE 4 OF 11

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
340				BLACKHAWK FORMATION	340.0' - 379.9' INTERBEDS; MUDSTONE / SILTSTONE LIGHT GRAY — OXIDATION FRACTURES (BUFF) — 345.3' 351.3' 363.2' 345.8' 354.5' 367.1' 346.0' 355.2' 372.3' 347.7' 255.3' 373.0' 349.7' 361.5' 373.7'	96	24	26	100	
350							25	27	100	
360							26	28	100	
370							27	29	100	
380					379.9' - 383.9' MUDSTONE; DARK GRAY - BROWN	80	28	30	100	
					383.9' - 385.6' COAL; NON-RESINOUS	36				
390					385.6' - 391.4' MUDSTONE; DARK GRAY, ROOTED FRACTURES ALONG UPPER CONTACT.	85	29	31	100	
					391.4' - 396.6' SILTSTONE. LIGHT GRAY, LAMINATED MICRO SLUMP STRUCTURES, ROOTED.	77				
400					396.6' - 419.8' MUDSTONE. LIGHT - MEDIUM GRAY, FRACTURING ALONG BEDDING PLANES.	63	30	32	100	
410							31	33	100	
							32	34	100	
420					419.8' - 426.8' CARBONACEOUS MUDSTONE DARK GRAY - BLACK, SOME GRAY, ROUND MUDBALLS	30	33	35	97	
430					426.8' - 453.0' INTERBEDS; MUDSTONE / SILTSTONE, LIGHT GRAY	93.1				

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: Roans Canyon
DRILL HOLE: 83-1 (TW-6)
PAGE 5 OF 11

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
430				BLACKHAWK FORMATION	426.8'-453.0' INTERBEDS; MUDSTONE/SILTSTONE LIGHT GRAY.	93.1	34	35	97	
								36	98	
440							35	37	100	
450										
					453.0'-494.0' MUDSTONE; LIGHT-MEDIUM GRAY, ROOTED, SLICKENSIDED FRACTURING, CHANNEL MARGIN DEPOSIT.	93.6	36	38	100	
460								39	90	
							37	40	100	
470							38	41	100	
480							39	42	90	
490							40			
					494.0'-540.0' SANDSTONE; LIGHT GRAY, YELLOW-BROWN ON FRACTURES FINE TO MEDIUM GRAIN, MASSIVE. FRACTURE - FAST PENETRATION 497.0-498.5' @ END OF RUN 41 FLOW ~50 GPM PRESSURE 50 PSI	92.8		43	100	
500							41			
								44	100	
510							42			
								45	100	
520							43			

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: ROANS CANYON
DRILL HOLE: 88-1 (TW-6)
PAGE 6 OF 11

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
520				BLACKHAWK FORMATION	494.0'-540.0' SANDSTONE; LIGHT GRAY, YELLOW-BROWN ON FRACTURES, FINE TO MEDIUM GRAIN, MASSIVE A FEW MINOR CARB. LAMINAE, MASSIVE.	92.8	43, 44	45, 46, 47	100, 93, 100	
530										
540					540.0'-541.5' CARB. MUDSTONE; BIOTURBATED.	83	45			
					541.5'-543.8' COAL; HIGHLY FRACTURED	0				
550					543.8'-566.9' MUDSTONE LIGHT-MEDIUM GRAY SOFT CLAYEY FROM 543.8'-545.0', SILTY FROM 545.0'-566.9'.	76.2	46, 47	48, 49, 50	93, 100, 91	
560										
570					566.9-570.2 CARB. MUDSTONE; DARK GRAY/BLACK, BIOTURBATED.	84	48	51	92	
					570.2'-573.5' SILTSTONE; LIGHT GRAY	83.4				
580					578.5'-584.0' MUDSTONE; MEDIUM GRAY, ROOTED.	86.6	49	52	100	
					584.0'-587.6' CARB. MUDSTONE DK. GRAY-BROWN; MS/SILT. BALLS, ROOTED.	66.7				
					587.6'-589.7 COAL; RESINOUS	21.4		53	100	
590					589.7-591.4' CARB. MUDSTONE; DARK GRAY	100				
					591.4'-606.4' MUDSTONE; MEDIUM-DARK GRAY, 0.1' OF COAL @ LOWER CONTACT.	96.4	50, 51	54, 55	86, 100	
600										
					606.4'-627.9' INTERBEDS, MUDSTONE/SILTSTONE LIGHT GRAY.	83.3	52			
(611)										

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: Roans Canyon
DRILL HOLE: 88-1 (TN-6)
PAGE 7 OF 11

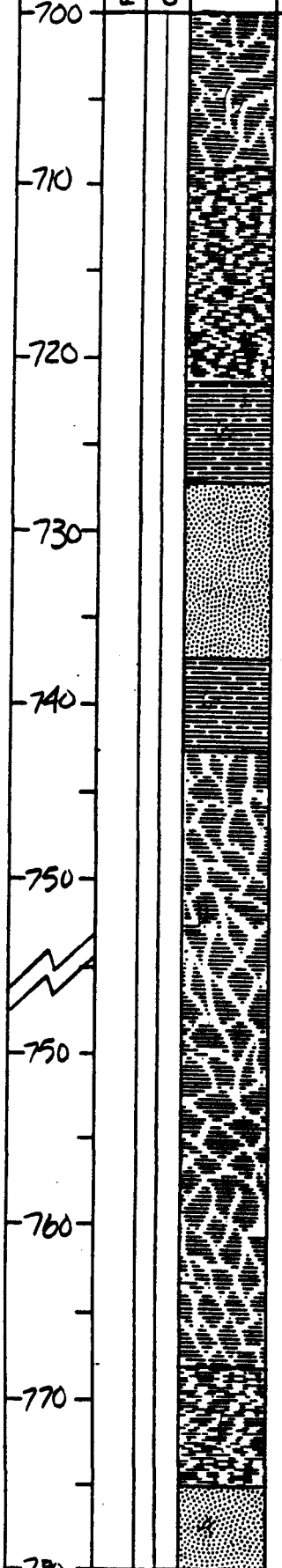
DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
610				BLACKHAWK FORMATION	606.4'-627.9 INTERBEDS. MUDSTONE/SILTSTONE, LIGHT GRAY	88.3	52, 53	56, 57	100, 100	
620										
630					627.9'-637.9' SANDSTONE. LIGHT GRAY, FINE GRAIN, BUFF COLOR STAINING ON FRACTURES. FRACTURES	82.2	54	58	100	
640					637.9'-680.0' INTERBEDS MUDSTONE/SILTSTONE	83.8	55, 56, 57, 58, 59	59, 60, 61, 62	100, 99, 100, 96	
650					BUFF COLOR STAINED FRACTURES					
660										
670										
680					680.0'-709.0' CARBONACEOUS. MUDSTONE DARK GRAY - BLACK	98.3	60, 61	63, 64, 65	100, 100, 100	
690										
700										

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: Roans Canyon
DRILL HOLE: RR-1 (TW-6)



DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
700				BLACKHAWK FORMATION	680.0 - 709.0' CARBACEOUS MUDSTONE, DARK GRAY - BLACK, GRADING TO MUDSTONE @ 700'	98.3	62	65 66	100 100	
710					709.0' - 721.6' SILTSTONE LIGHT GRAY - GRAY, COARSENS INWARD, SOME INTERBEDS MS AND ROOTS NEAR BASE, ANGULAR LOWER CONTACT.	98.8	63	67	100	
720					721.6' - 727.6' MUDSTONE; DARK GRAY, SOME SILTY LAMINAE NEAR BASE, SHARP ANGULAR LOWER CONTACT.	93.4	64	68	100	
730					727.6' - 737.6' SANDSTONE; LIGHT GRAY, FINE GRAIN, SILTY, ANGULAR LOWER CONTACT.	100	65	69	100	
740					737.6' - 742.7' MUDSTONE; DARK GRAY SOME CARBONACEOUS IN PLACES, SLICKENSIDED FRACTURES, ROOTED	97.9				
750					742.7' - 768.0' CARBONACEOUS MUDSTONE DARK GRAY - BLACK SLICKENSIDED FRACTURING, SOFT-STICKY. - SQUEEZE ZONE - 742.0' - 755.0' (FAULTED) - DEPTH CORRECTION ON RUN 72 (ERROR + 2.5')	97.6	66 67 68	70 71 72 A 72 B	100 99 100 100	
770					768.0 - 775.0' SILTSTONE; GRAY COMPETENT, GRADITIONAL LOWER CONTACT.	100	69	73	100	
780					775.0' - 787.1 SANDSTONE LIGHT GRAY FINE GRAIN CARB. LAYERS ON BEDDING PLANES.	96.8	70	74	100	

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY
DEPT. OF MINING & EXPLORATION

PROJECT: Roans Canyon
DRILL HOLE: 89-1 (TW-6)

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
780				BLACKHAWK FORMATION	775.0' - 787.1' SANDSTONE (DESCRIBED ON PREVIOUS PAGE)	96.8	70	74	100	
							71	75	100	
790					787.1' - 807.7' SILTSTONE MEDIUM-DARK GRAY (THIN ZONES OF MS THOUGHOUT - THICKNESS ±2')	96.8	72	76	99	
800								77	87	
810					807.7' - 831.7 SANDSTONE; LIGHT GRAY, VERY FINE - FINE GRAIN SHALE LAMINAE.	72.7	73			
					- OXIDATION FRACTURES @ 809.4' 814.9' 809.9' 815.4' 810.1' 815.6' 810.3' 815.9' 810.4' 817.9' 811.9' 819.9'		74	78	99	
820					VOID @ 809.0' WIDTH 0.5' FLOW 63.8 GPM, PRESSURE 52 PSI			79	73	
830					FAULT ZONE SANDY GOUGE CORE LOSS →		75			
				STARPOINT SANDSTONE	831.7 - 999.7' SANDSTONE · LIGHT GRAY, MEDIUM GRAIN. REWORKED MUDSTONE @ 842.8' - 844.8'			80	96	
840							76	81	100	
850					OXIDIZED FRACTURE →	95.3	77	82	100	
860							78	83	100	
870							79	84	90	

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: Rocky Canyon
DRILL HOLE: 88-1 (TW-6)

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
870				STAREPOINT SANDSTONE	REWORKED MUDSTONE →		79	84	90	
880							80	85	100	
890							81	86	100	
900							82	87	100	
910						95.3	83	88	100	
920							84	89	100	
930					OXIDIZED FRACTURE @ 934.8'		85	90	100	
940							86	91	100	
950					ROOTED →		87	92	100	
960										

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: Ruans Canyons
DRILL HOLE: 89-1 (TW-6)
PAGE 11 OF 11

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
960				STARPOINT SANDSTONE	SHALE STREAKED @ 970'-973' ROOTED REWORKED MUDSTONE SLIGHT OXIDATION @ 972.0'	95.3	88	93	100	
970							89	94	100	
980							90	95	100	
990							91	96	100	
1000					T.D. 999.7' - CASED ZONES: - 0' - 80' 4" STEEL 0' - 850' 1 1/4" PVC					

IN-MINE DRILL HOLE DATA SHEET

MINE ========) DEER CREEK 3RD NORTH
SECTION ========) ROANS CANYON FAULT DRILLING
HOLE NUMBER ========) 88-1
LOCATION ========)
DATE ========) MAY 5, 1988

Interval			Horizontal Angle From Magnetic North			True Horizontal Depth		Vertical Angle From Horizontal		
from	to	length	bearing	degrees	interval	accumulation	interval	accumulation	Angle	interval	accumulation
5	15	10	NW	1	0.17	0.17	9.99	9.99	2	0.35	0.35
15	35	20	NW	1	0.35	0.52	19.99	29.98	2	0.70	1.05
35	55	20	NW	0	0.00	0.52	19.97	49.95	3	1.05	2.09
55	75	20	NW	1	0.35	0.35	19.95	69.91	4	1.40	3.49
75	95	20	NW	1	0.35	0.35	19.96	89.87	3.5	1.22	4.71
95	115	20	NW	1	0.35	0.35	19.94	109.81	4.5	1.57	6.28
115	135	20	NW	1	0.35	0.35	19.95	129.76	4	1.40	7.67
135	155	20	NW	1	0.35	0.35	19.95	149.71	4	1.40	9.07
155	175	20	NW	1	0.35	0.35	19.83	169.54	7.5	2.61	11.68
175	195	20	NW	1	0.35	0.35	19.94	189.48	4.5	1.57	13.25
195	215	20	NW	1	0.35	0.35	19.83	209.31	7.5	2.61	15.86
215	235	20	NW	1	0.35	0.35	19.83	229.13	7.5	2.61	18.47
235	255	20	NW	1	0.35	0.35	19.91	249.04	5.5	1.92	20.39
255	275	20	NW	1	0.35	0.35	19.83	268.87	7.5	2.61	23.00
275	295	20	NW	1	0.35	0.35	19.83	288.70	7.5	2.61	25.61
295	315	20	NW	1	0.35	0.35	19.78	308.48	8.5	2.96	28.56
315	335	20	NW	1	0.35	0.35	19.75	328.23	9	3.13	31.69
335	355	20	NW	1	0.35	0.35	19.85	348.08	7	2.44	34.13
355	375	20	NW	1	0.35	0.35	19.87	367.96	6.5	2.26	36.39
375	395	20	NW	1	0.35	0.35	19.83	387.79	7.5	2.61	39.00
395	415	20	NW	1	0.35	0.35	19.83	407.61	7.5	2.61	41.62
415	435	20	NW	1	0.35	0.35	19.75	427.37	9	3.13	44.74
435	455	20	NW	1	0.35	0.35	19.73	447.09	9.5	3.30	48.04
455	475	20	NW	1	0.35	0.35	19.78	466.87	8.5	2.96	51.00
475	495	20	NW	1	0.35	0.35	19.73	486.60	9.5	3.30	54.30
495	515	20	NW	1	0.35	0.35	19.81	506.41	8	2.78	57.09
515	535	20	NW	1	0.35	0.35	19.78	526.19	8.5	2.96	60.04
535	555	20	NW	1	0.35	0.35	19.67	545.85	10.5	3.64	63.69
555	575	20	NW	1	0.35	0.35	19.70	565.55	10	3.47	67.16
575	595	20	NW	1	0.35	0.35	19.63	585.18	11	3.82	70.98
595	615	20	NW	1	0.35	0.35	19.63	604.81	11	3.82	74.79
615	635	20	NW	1	0.35	0.35	19.67	624.48	10.5	3.64	78.44
635	655	20	NW	1	0.35	0.35	19.70	644.17	10	3.47	81.91
655	675	20	NW	1	0.35	0.35	19.70	663.87	10	3.47	85.38
675	695	20	NW	1	0.35	0.35	19.49	683.36	13	4.50	89.88
695	715	20	NW	1	0.35	0.35	19.70	703.05	10	3.47	93.35
715	735	20	NW	1	0.35	0.35	19.56	722.62	12	4.16	97.51

735	755	20	I	NW	1	0.35	0.35	19.45	742.06	I	13.5	4.67	102.16
755	775	20	I	NW	1	0.35	0.35	19.45	761.51	I	13.5	4.67	106.85
775	795	20	I	NW	1	0.35	0.35	19.49	781.00	I	13	4.50	111.35
795	815	20	I	NW	1	0.35	0.35	19.41	800.40	I	14	4.84	116.19
815	835	20	I	NW	1	0.35	0.35	19.53	819.93	I	12.5	4.33	120.52
835	855	20	I	NW	1	0.35	0.35	19.36	839.29	I	14.5	5.01	125.52
855	875	20	I	NW	1	0.35	0.35	19.32	858.61	I	15	5.18	130.70
875	895	20	I	NW	1	0.35	0.35	19.27	877.88	I	15.5	5.34	136.05
895	915	20	I	NW	1	0.35	0.35	19.18	897.06	I	16.5	5.68	141.73
915	935	20	I	NW	1	0.35	0.35	19.23	916.29	I	16	5.51	147.24
935	955	20	I	NW	1	0.35	0.35	19.60	935.86	I	11.5	3.99	151.23
955	975	20	I	NW	1	0.35	0.35	19.41	955.29	I	14	4.84	156.06
975	1000	25		NW				24.26'	979.6'				

3rd North, Deer Creek Mine
Flow Data Report

Hole # 88-1 Date: [illegible] Shift: _____

Drill Interval	Time:	Injection Rate:	Discharge Rate:
101 - 111	630AM 4-19-88	20GPM	0.2" 19GPM
111 - 121	9:15AM "	12.5	0.17 13.0GPM
121 - 125	10:45AM "	11.5	0.15 [illegible] 9.5GPM
125 - 135	11:30	12.5	0.15 9.5 GPM
135 - 145	12:00	17.0	0.18 15.04 GPM
135 - 145	2.00	16	0.18 15.04 GPM
145 - 150	6:00	21	0.19 17.2 GPM
150 - 160	7:00	22	0.19 17.2 GPM
160 - 170	8:00	18	0.19 17.2 GPM
170 - 180	10:00	19	0.19
180 - 190	11:00	18	0.19
190 - 200	Hole making about 0.3 GPM/between shift change 130 Am (4/20/88)	18	0.19
200 - 210	3:30	20	.19
210 - 220	5:30	20	.19
226.5 - 234.0'	12:00 Noon 4-25-88	8	.17 13.0 gpm
234.0 - 244.0	2.00 PM	12	.15 9.5
244 - 249	7:15 P	20	.21 22 [illegible]
249 - 254	7:30 PM	20-22	.20 19.6
254 - 259	8:05 P	20-22 GPM	.20 19.6 gpm
259 - 268	9.00	20-22	.2
268 - 269	10:00	20-22	0.2
269 - 279	11 00	20-22	0.2
	4/26/88 12:00 Am		4-5 [illegible] 2-3 GPM through [illegible]

3rd North, Deer Creek Mine

Flow Data Report

Hole # 88-1 Date: Apr 28, 2[illegible] Shift: 6 4 - Days

Drill Interval	Time:	Injection Rate:	Discharge Rate:
317-328	1:30	(Line Pressure 25 GPM	.19?
3[illegible]2-337	3:00	22.5 GPM	20
338- 348	4:30	22.5 GPM	20 GPM
348- 358	5:15	20 PSI 24 GPM	16 GPM
358- 368	?		15.04 GPM
[illegible] 378	9:30 AM	24	17.2 GPM
378- 388	10:40 AM	20	17.2 GPM
388- 398	12:50 PM	25	19.6 GPM
398- 406	1:20 PM	22	15.0 GPM
406- 413	2:00 PM	24	17.2 GPM
413- 423	3:00 PM	21 GPM	17.2 GPM
423- 433	7:00 PM	20	.19
433- 443	9:00 PM	20	.19
443- 453	10:00 PM	20	.19
453- 463	3:00 AM	20	17.0 GPM
463- 473 RUN 40	10:00 AM	20-22	15 GPM
473- 483 RUN 41	11:30 AM	17	17 GPM
483- 493 RUN 42	5:30 P	20	15
493 - 503 Run 43	6:00	17	13 50 GPM out of pipe
503 - (RUN 43)	6:00 5 Gal in 4 Sec out of Pipe	6:15 50 PSI 6:30 60 PSI 6:34 60 PSI	13 GPM Flume
"	8:10 no [illegible]	pipe	
503- 513	[illegible] P	12 again [illegible] gpm out of pipe	10
513 - 523	9:35 P	[illegible]	
523 - 533	10:45 P	15	13
533- 541.7	9:30A 4:30	15	10 RUN 47
541.7 - 551.7	10:30A	15	10 RUN 48

3rd North, Deer Creek Mine
Flow Data Report

Hole # 88-1 Date: 4-30-88 Shift: GRAVEYARD - DAY

Drill Interval	Time:	Injection Rate:	Discharge Rate:
551.7-561.9	11:00 AM	10 GPM	15 RUN# 49
561.9-568.4	11:00AM-2:30PM	10 GPM	15 RUN# 50
568.4-578.4	2:40 PM - 3:10	10 GPM	13 RUN# 51
578.4-588.4	6:10 PM - 7:00	12 GPM	13 RUN# 52
588.4-591.4	7:00 - 7:19	10 GPM PLUGGED	13 BARREL RUN# 53
591.4-598.4	8:10 - 9.00	10 GPM	13 RUN# 54
598.4-608.4	9:10 - 10:25	15 GPM	13 RUN# 55
608.4-618.4	10:25 - 11:00	15	16 Run 56
618.4-628.1	1:00AM - 2:00	15	13 Run 57
628.1-638.1	2:00 Am - [illegible]	15	[illegible]
648.1-648.1	3:00 - 400	15	15 Run 59
Took Pressure	at 4:00 to 445	Results: 65 PSI	
648.1-658.1	5:00 to 550	16	17 Run 60
658.1-668.1	6:00 to 650	15 to 17	17 Run 61
668.1-678.1	7:00 to 730	12 to 15	17 RUN 62
678.1-686.9	9:30A to 10:30A	12 GPM	17 RUN 63
686.9-693.9	10:30A to 11:30A	12 GPM	17 RUN 64
693.9 702.7	11:30 to 12:30	12 GPM	17 RUN 65
702.7 - 709.4	1:45 to 2:05	10 Gpm	13 Run 66

Wet Paper

87
701590
560/400

3rd North, Deer Creek Mine

Flow Data Report

Hole # 88-1 Date: 5-1-88 Shift: Day

Drill Interval	Time:	Injection Rate:	Discharge Rate:
702.7 - 709.4	1:45 - 2:05	10	13
709.4 - 719.1	2:05 - 3:00	12	15
719.1 - 729.1	4:45 - 5:20	13	14
729.1 - 739.2	5:35 - 5:55	13	14
739.2 - 749.2	6:20 - 6:20	15	15
749.2 - 759.2	7:41 - 8:55	10 gpm (high pressure when drilling)	(clean pump mixed) 15
	10:30 - 11:20	Reaming from	729
5/2/88	12:30 - 2:30	Reaming from	730 to 759
759.2 - 769.3	2:30 - 3:15	13-15	17
TRIPING	3:15 - 8:00a	766.8	END RUN # 72
766.8 to 771.7	10:00 to 11:00	10	18 RUN 73
(740 to 755 squeeze zone)			
RUN 74 771.7 to 781.9	11:00 to 11:30	10	17.22
~~Run 75~~ 781.9	25 GPM out of Drill Pipe	52 PSI	
RUN 75			

3rd North, Deer Creek Mine

Flow Data Report

Hole # 88-1 Date: 5/02/88 Shift: Day - Aft. - Grave

Drill Interval	Time:	Injection Rate:	Discharge Rate:
781.9 - 791.9	1:00 PM	10 GPM	17 GPM RUN #75
791.9 - 801.9	1:30 PM	10 GPM	15 RUN #76
801.9 - 811.9	2:30 PM	12 GPM	13 RUN #77
PIPE	FLOW @ 811.9'	63-8 GPM	52 psi
811.9 - 821.9	5:30 PM	10-15 GPM	13 RUN #78
PIPE	FLOW @ 821.9'	24.49 GPM	43 psi
821.9 - 830.4	6:30	10-15 GPM	15 GPM RUN #79
RUN #79 CUT SHORT BY 0.5', POSSIBLE FAULT ZONE @			
826.7 - 829.2 ⇒ FRACTURE ZONE, FAULT @ 829.2?			
830.4 - 835.9	7:30 - 8:00	10 - 15 GPM	15 RUN #80
835.9 - 845.9	8:50 - 9:45	12 - 15	15 RUN #81
845.9 - 859.5	9:45 - 10:15	12 - 15	15 RUN #82
859.5 - 869.5	10:30 11:20	12 - 15	17 # 83
5-3-88 869.5 - 879.5	5/3/88 1:30 - 2:00	12 - 15	17 # 84
879.5 - 889.5	2:00 - 2:45	12 - 15	17 # 85
889.5 - 899.5	3:20 - 3:50	12 - 15	17 # 86
899.5 - 909.5	4:45 - 5:00	8 - 10	15 # 87
909.5 - 919.5	5:35 - 5:46	8 - 10	15 # 88
919.5 - 929.5	6:10 - 6:20	8 - 10	15 # 89
929.5 - 937.5	6:52 -	8 - 10	15 # 90
run lack 2'	lost water pressure	at 7:01 AM	due to leak
repair	down the line		
937.5 - 939.6'	10:11 9:05 - 9:10 A	finished run	
939.6 - 949.6	9:40 - 9:49	15	~14
949.6 - 959.6	10:22 -	15	15

9 min to pump

3rd North, Deer Creek Mine

Flow Data Report

Hole # 88-1 Date: 5-3-88 Shift: Graveyard/Day/

Drill Interval	Time:	Injection Rate:	Discharge Rate:
959.6 - 969.7	11:05 - 11:22	13	13
11:40 Finnegan	arrived, shut down	for odds & ends	
969.7 - 979.7	12:58 - 1:11	15	13
979.7 - 989.7	1:35 - 1:47	15	13
989.7 - 999.7	2:09 - 2:22	15	13
	T.D		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-1
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
427.088	0.00	0.00	INTERBEDS; MUDSTONE/SILTSTONE	
33.951	6.86	6.86		
36.352	2.40	2.40		
438.204	1.85	1.85		
38.354	0.15	0.00		
38.554	0.20	0.00		
438.654	0.10	0.00		
438.804	0.15	0.00		
39.004	0.20	0.00		
439.404	0.40	0.00		
440.404	1.00	1.00		
40.604	0.20	0.00		
41.305	0.70	0.70		
443.508	2.20	2.20		
445.108	1.60	1.60		
45.658	0.55	0.55		
446.657	1.00	1.00		
446.857	0.20	0.00		
[illegible].457	0.60	0.60		
[illegible].907	0.45	0.45		
448.106	0.20	0.00		
48.507	0.40	0.40		
49.408	0.90	0.90		
450.059	0.65	0.65		
450.61	0.55	0.55		
51.211	0.60	0.60		
452.461	1.25	1.25		
452.961	0.50	0.50	93.05%----------	
53.161	0.20	0.00	MUDSTONE; CHANNEL MARGIN;	
53.761	0.60	0.60	SLICKENSIDDED FRACTURES;	
453.961	0.20	0.00	LIGHT TO MED. GRAY; ROOTED	
54.161	0.20	0.00		
54.911	0.75	0.75		
455.361	0.45	0.45		
455.611	0.25	0.00		
456.21	0.60	0.60		
457.413	1.20	1.20		
457.714	0.30	0.00		
57.864	0.15	0.00		
58.264	0.40	0.40		
458.964	0.70	0.70		
59.214	0.25	0.00		
59.715	0.50	0.50		
460.566	0.85	0.85		
[illegible]016	0.45	0.45		
[illegible].066	0.05	0.00		
461.166	0.10	0.00		
461.266	0.10	0.00		
63.166	1.90	1.90		
63.666	0.50	0.50		
464.216	0.55	0.55		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-1
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
465.166	0.95	0.95		
466.418	1.25	1.25		
466.969	0.55	0.55		
467.719	0.75	0.75		
468.269	0.55	0.55		
468.719	0.45	0.45		
469.466	0.75	0.75		
470.568	1.10	1.10		
471.52	0.95	0.95		
473.721	2.20	2.20		
475.172	1.45	1.45		
475.572	0.40	0.00		
475.622	0.05	0.00		
476.122	0.50	0.50		
476.522	0.40	0.00		
477.723	1.20	1.20		
479.174	1.45	1.45		
481.624	2.45	2.45		
[illegible].126	0.50	0.50		
[illegible].476	1.35	1.35		
484.527	1.05	1.05		
486.026	1.50	1.50		
486.477	0.45	0.45		
487.028	0.55	0.55		
487.628	0.60	0.60		
488.078	0.45	0.45		
489.228	1.15	1.15		
490.078	0.85	0.85		
490.629	0.55	0.55		
491.48	0.85	0.85		
492.679	1.20	1.20		
494.281	1.60	1.60	93.58%	
495.231	0.95	0.95		SANDSTONE; GRAY TO YELLOW BROWN
495.581	0.35	0.00		ON FRACTURES; FINE TO MED. GRAINED
495.78	0.20	0.00		WATER 50 GPM FROM PIPE 50 PSI
496.829	1.05	1.05		
502.234	5.40	5.40		
503.935	1.70	1.70		
504.335	0.40	0.00		
504.735	0.40	0.40		
508.038	3.30	3.30		
508.389	0.35	0.00		
509.539	1.15	1.15		
510.339	0.80	0.80		
5[illegible]639	0.30	0.00		
[illegible]989	0.35	0.00		
510.989	0.00	0.00		
512.64	1.65	1.65		
513.638	1.00	1.00		
515.491	1.85	1.85		
516.091	0.60	0.60		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-1
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
523.613	7.52	7.52		
24.466	0.85	0.85		
26.171	1.71	1.71		
526.422	0.25	0.00		
526.622	0.20	0.00		
27.175	0.55	0.55		
527.526	0.35	0.00		
528.077	0.55	0.55		
531.84	3.76	3.76		
33.445	1.61	1.61		
534.9	1.45	1.45		
35.352	0.45	0.45		
36.205	0.85	0.85		
536.908	0.70	0.70		
537.259	0.35	0.00		
537.46	0.20	0.00		
538.463	1.00	1.00		
539.065	0.60	0.60		
[illegible]119	1.05	1.05	92.79%----------	
[illegible]423	1.30	1.30		CARBMUDSTONE; BIOTURBATED
541.473	0.05	0.00		
41.874	0.40	0.40		
41.824	-0.05	0.00		
541.874	0.05	0.00		
541.975	0.10	0.00		
42.175	0.20	0.00	82.93%----------	
542.376	0.20	0.00		COAL;
542.476	0.10	0.00		HIGHLY FRACTURED
42.626	0.15	0.00		
42.677	0.05	0.00		
542.878	0.20	0.00		
43.028	0.15	0.00		
43.179	0.15	0.00		
543.43	0.25	0.00		
543.63	0.20	0.00		
543.63	0.00	0.00		
43.881	0.25	0.00		
543.981	0.10	0.00	0.00%----------	
44.482	0.50	0.50		MUDSTONE; SOFT CLAYEY
44.533	0.05	0.00		
545.285	0.75	0.75		
546.088	0.80	0.80		
546.59	0.50	0.50		
547.092	0.50	0.50		
5[illegible]195	1.10	1.10		
[illegible]546	0.35	0.00		
48.847	0.30	0.00		
549.75	0.90	0.90		
51.809	2.06	2.06		
51.914	0.11	0.00		
552.111	0.20	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-1
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
552.264	0.15	0.00		
553.765	1.50	1.50		
553.966	0.20	0.00		
554.267	0.30	0.00		
555.169	0.90	0.90		
555.373	0.20	0.00		
555.471	0.10	0.00		
555.971	0.50	0.50		
556.724	0.75	0.75		
557.225	0.50	0.50		
558.982	1.76	1.76		
559.232	0.25	0.00		
559.333	0.10	0.00		
559.433	0.10	0.00		
559.584	0.15	0.00		
559.684	0.10	0.00		
561.289	1.61	1.61		
561.44	0.15	0.00		
561.59	0.15	0.00		
[illegible].891	0.30	0.00		
562.142	0.25	0.00		
562.745	0.60	0.60		
562.945	0.20	0.00		
563.347	0.40	0.40		
563.699	0.35	0.00		
563.949	0.25	0.00		
564.25	0.30	0.00		
564.4	0.15	0.00		
564.952	0.55	0.55		
565.052	0.10	0.00		
565.303	0.25	0.00		
565.856	0.55	0.55		
566.107	0.25	0.00		
566.558	0.45	0.45	76.21%----------	
566.859	0.30	0.00		CARBMUDSTONE; DARK GRAY-BROWN/BLACK;
567.862	1.00	1.00		BIOTURBATED
569.317	1.46	1.46		
570.019	0.70	0.70		
570.32	0.30	0.00	84.00%----------	
570.621	0.30	0.00		SILTSTONE; LIGHT GRAY
571.022	0.40	0.40		
571.424	0.40	0.40		
571.725	0.30	0.00		
571.975	0.25	0.00		
5[illegible].179	1.20	1.20		
[illegible].38	0.20	0.00		
573.681	0.30	0.00		
574.134	0.45	0.45		
574.987	0.85	0.85		
575.991	1.00	1.00		
576.794	0.80	0.80		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-1
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
578.497	1.70	1.70	83.44%----------	
578.648	0.15	0.00	MUDSTONE; MEDIUM GRAY; ROOTED	
579.801	1.15	1.15		
581.106	1.30	1.30		
581.557	0.45	0.45		
582.109	0.55	0.55		
582.26	0.15	0.00		
582.46	0.20	0.00		
583.012	0.55	0.55		
583.864	0.85	0.85		
584.115	0.25	0.00	86.60%----------	
585.32	1.21	1.21	CARBMUDSTONE; DARK GRAY-BROWN; W/MS SILT BALL	
585.621	0.30	0.00		
586.624	1.00	1.00		
586.875	0.25	0.00		
587.076	0.20	0.00		
587.227	0.15	0.00		
587.377	0.15	0.00		
[illegible].427	0.05	0.00	66.67%----------	
[illegible]578	0.15	0.00	COAL; RESINOUS	
587.728	0.15	0.00		
587.979	0.25	0.00		
588.18	0.20	0.00		
588.28	0.10	0.00		
588.731	0.45	0.45		
588.982	0.25	0.00		
589.233	0.25	0.00		
589.534	0.30	0.00	21.40%----------	
591.400	1.87	1.87	100.00%----------CMS; DARK GRAY	
592.042	0.64	0.64	MUDSTONE; MED-DK GRAY	
593.297	1.25	1.25		
593.799	0.50	0.50		
594.453	0.65	0.65		
595.005	0.55	0.55		
596.109	1.10	1.10		
599.267	3.16	3.16		
599.768	0.50	0.50		
600.42	0.65	0.65		
600.972	0.55	0.55		
601.223	0.25	0.00		
601.223	0.00	0.00		
602.779	1.56	1.56		
603.431	0.65	0.65		
604.233	0.80	0.80		
6[illegible]036	0.80	0.80		
[illegible].337	0.30	0.00		
606.19	0.85	0.85		
606.64	0.45	0.45	96.38%----------	
607.142	0.50	0.50	INTERBEDS; MUDSTONE/SILTSTONE	
607.544	0.40	0.40		
607.745	0.20	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-1
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
609.451	1.71	1.71		
10.501	1.05	1.05		
10.601	0.10	0.00		
610.952	0.35	0.00		
612.105	1.15	1.15		
12.305	0.20	0.00		
612.606	0.30	0.00		
612.606	0.00	0.00		
12.906	0.30	0.00		
613.909	1.00	1.00		
614.66	0.75	0.75		
16.364	1.70	1.70		
17.116	0.75	0.75		
618.318	1.20	1.20		
619.271	0.95	0.95		
19.872	0.60	0.60		
620.122	0.25	0.00		
620.273	0.15	0.00		
[illegible]523	0.25	0.00		
[illegible]774	0.25	0.00		
620.924	0.15	0.00		
21.425	0.50	0.50		
24.482	3.06	3.06		
625.535	1.05	1.05		
627.489	1.95	1.95		
628.09	0.60	0.60	88.32%----------	
628.441	0.35	0.00		SANDSTONE; FINE GRAINED; LT GRAY;
628.842	0.40	0.40		STAINED ON FRACTURES
29.243	0.40	0.40		
30.295	1.05	1.05		
630.496	0.20	0.00		
30.696	0.20	0.00		
30.846	0.15	0.00		
630.896	0.05	0.00		
631.548	0.65	0.65		
32.851	1.30	1.30		
634.104	1.25	1.25		
634.705	0.60	0.60		
35.056	0.35	0.00		
35.206	0.15	0.00		
635.306	0.10	0.00		
636.759	1.45	1.45		
37.261	0.50	0.50		
637.762	0.50	0.50		
[illegible]962	0.20	0.00	82.24%----------	
[illegible].814	0.85	0.85		INTERBEDS; MUDSTONE/SILTSTONE
639.465	0.65	0.65		
640.468	1.00	1.00		
40.869	0.40	0.40		
42.372	1.50	1.50		
643.424	1.05	1.05		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-1
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
644.376	0.95	0.95		
44.878	0.50	0.50		
645.83	0.95	0.95		
645.98	0.15	0.00		
646.732	0.75	0.75		
47.533	0.80	0.80		
648.335	0.80	0.80		
649.287	0.95	0.95		
50.239	0.95	0.95	STAINING ON FRACTURES 650 TO 655	
650.49	0.25	0.00		
650.64	0.15	0.00		
51.091	0.45	0.45		
51.192	0.10	0.00		
651.643	0.45	0.45		
652.043	0.40	0.00		
52.294	0.25	0.00		
652.695	0.40	0.40		
653.096	0.40	0.40		
[illegible]246	0.15	0.00		
[illegible]346	0.10	0.00		
653.547	0.20	0.00		
653.597	0.05	0.00		
54.098	0.50	0.50		
654.549	0.45	0.45		
654.699	0.15	0.00		
655.2	0.50	0.50		
655.752	0.55	0.55		
656.453	0.70	0.70		
56.854	0.40	0.40		
57.205	0.35	0.00		
657.756	0.55	0.55		
58.157	0.40	0.40		
59.009	0.85	0.85		
659.36	0.35	0.00		
659.61	0.25	0.00		
61.063	1.45	1.45		
662.066	1.00	1.00		
662.767	0.70	0.70		
664.17	1.40	1.40		
64.822	0.65	0.65		
665.022	0.20	0.00		
65.573	0.55	0.55		
65.974	0.40	0.40		
666.476	0.50	0.50		
[illegible]678	1.20	1.20		
[illegible].079	0.40	0.40		
668.33	0.25	0.00		
668.831	0.50	0.50		
69.232	0.40	0.40		
69.582	0.35	0.00		
669.733	0.15	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-1
FRACTURE ANALYSIS

FRACTURE D PTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
669.883	0.15	0.00		
670.184	0.30	0.00		
70.234	0.05	0.00		
670.434	0.20	0.00		
671.086	0.65	0.65		
71.487	0.40	0.40		
71.687	0.20	0.00		
671.938	0.25	0.00		
72.188	0.25	0.00		
72.288	0.10	0.00		
672.689	0.40	0.40		
672.89	0.20	0.00		
73.641	0.75	0.75		
673.892	0.25	0.00		
674.243	0.35	0.00		
74.644	0.40	0.40		
75.145	0.50	0.50		
675.395	0.25	0.00		
[illegible]352	2.96	2.96		
[illegible]905	1.55	1.55		
680.156	0.25	0.00		
680.356	0.20	0.00	83.81%	----------
81.359	1.00	1.00	CARBMUDSTONE; DK GRAY	
683.914	2.55	2.55		
685.367	1.45	1.45		
87.021	1.65	1.65		
688.575	1.55	1.55		
690.178	1.60	1.60		
91.531	1.35	1.35		
91.982	0.45	0.45		
692.183	0.20	0.00		
692.834	0.65	0.65		
93.135	0.30	0.00		
695.891	2.76	2.76		
697.043	1.15	1.15		
97.494	0.45	0.45		
97.996	0.50	0.50		
699.549	1.55	1.55		
00.838	1.29	1.29		
01.695	0.86	0.86		
702.247	0.55	0.55		
703.749	1.50	1.50		
08.961	5.21	5.21	98.25%	----------
09.562	0.60	0.60	SILTSTONE; GRAY TO LT GRAY;	
7[illegible]816	3.75	3.75	UPWARD COARSENING	
[illegible]817	1.00	1.00	SOME INTERBEDS MS;	
17.471	3.15	3.15	ROOTED	
718.167	0.70	0.70		
719.07	0.90	0.90		
19.769	0.70	0.70		
721.467	1.70	1.70		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-1
FRACTURE ANALYSIS

FRACTURE D PTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
721.619	0.15	0.00	98.80%	
23.063	1.44	1.44		MUDSTONE; DK. GRAY;
723.71	0.65	0.65		SILTY LAMINAE
726.666	2.96	2.96		
727.066	0.40	0.00		
27.721	0.65	0.65	93.44%	
29.226	1.50	1.50		SANDSTONE; LT GRAY; FINE GRAINED; SILTY
732.28	3.05	3.05		
36.428	4.15	4.15		
37.878	1.45	1.45	100.00%	
737.978	0.10	0.00		MUDSTONE; DK. GRAY; CARBONACEOUS
39.331	1.35	1.35		
42.700	3.37	3.37	97.93%	
743.084	0.38	0.00		CMS; SQUEEZE ZONE 742 TO 755
744.23	1.15	1.15		
46.082	1.85	1.85		
48.481	2.40	2.40		
748.732	0.25	0.00		
[illegible]186	0.45	0.45		
[illegible]629	2.44	2.44		
760.629	9.00	9.00		
61.695	1.07	1.07		
63.729	2.03	2.03		
764.239	0.51	0.51		
765.51	1.27	1.27		
66.324	0.81	0.81		
67.941	1.02	1.02		
768.918	1.58	1.58	97.58%	
770.9	1.98	1.98		SILTSTONE; GRAY;GRADATIONAL LOWER CONTACT
71.561	0.66	0.66		
772.832	1.27	1.27		
773.696	0.86	0.86		
75.019	1.32	1.32	100.00%	
775.274	0.25	0.00		SANDSTONE; FINE GRAINED; CARB LAMINAE
775.884	0.61	0.61		
77.612	1.73	1.73		
78.323	0.71	0.71		
778.476	0.15	0.00		
32.006	3.53	3.53		
32.507	0.50	0.50		
784.864	2.36	2.36		
785.565	0.70	0.70		
35.616	0.05	0.00		
787.32	1.70	1.70		
7[illegible]826	2.01	2.01	96.79%	
[illegible]627	0.30	0.00		SILTSTONE; MED-DK GRAY;
95.994	6.37	6.37		THIM MS ZONES THROUGHOUT
799.554	3.56	3.56		
99.955	0.40	0.40		
01.409	1.45	1.45		
801.71	0.30	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-1
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
802.212	0.50	0.50		
804.067	1.86	1.86		
805.22	1.15	1.15		
807.928	2.71	2.71	96.76%----------	
809.983	2.05	2.05		SANDSTONE; LT GRAY; VERY FINE-FINE GRAINED;
810.635	0.65	0.65		
811.187	0.55	0.55		
811.487	0.30	0.00		
811.989	0.50	0.50		
812.691	0.70	0.70		
814.797	2.11	2.11		
815.198	0.40	0.40		
815.499	0.30	0.00		WATER ZONE
815.749	0.25	0.00		|
816.251	0.50	0.50		|
816.602	0.35	0.00		|
816.802	0.20	0.00		|
816.953	0.15	0.00		WATER ZONE
818.808	1.86	1.86		
[illegible].46	0.65	0.65		
8[illegible]663	1.20	1.20		
821.114	0.45	0.45		
821.766	0.65	0.65		
823.571	1.81	1.81		
824.022	0.45	0.45		
824.975	0.95	0.95		
826.128	1.15	1.15		
826.68	0.55	0.55		
831.593	4.91	0.00		
831.593	0.00	0.00	72.68%----------	
832.145	0.55	0.55		SANDSTONE; FIEN TO MED GRAINED; LT. GRAY
832.446	0.30	0.00		
833.85	1.40	1.40		
834	0.15	0.00		
834.1	0.10	0.00		
834.1	0.00	0.00		
834.552	0.45	0.45		
834.702	0.15	0.00		
834.752	0.05	0.00		
835.053	0.30	0.00		
835.955	0.90	0.90		
836.958	1.00	1.00		
837.259	0.30	0.00		
838.011	0.75	0.75		
838.262	0.25	0.00		
8[illegible]21	3.26	3.26		
8[illegible]524	1.00	1.00		
842.825	0.30	0.00		REWORKED MUDSTONE
847.136	4.31	4.31		
848.189	1.05	1.05		
851.198	3.01	3.01		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-1
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
854.758	3.56	3.56		
854.908	0.15	0.00		
855.309	0.40	0.40		
859.37	4.06	4.06		
860.072	0.70	0.70		
862.178	2.11	2.11		
864.986	2.81	2.81		
865.889	0.90	0.90		
871.12	5.23	5.23		
871.465	0.35	0.00		
872.014	0.55	0.55		
873.715	1.70	1.70		
874.413	0.70	0.70		
874.915	0.50	0.50		
876.217	1.30	1.30		
882.256	6.04	6.04		
882.963	0.71	0.71		
883.415	0.45	0.45		
888.53	5.12	5.12		
[illegible]422	5.89	5.89		
[illegible]5.93	1.51	1.51		
898.775	2.85	2.85		
899.473	0.70	0.70		
900.882	1.41	1.41		
902.583	1.70	1.70		
903.783	1.20	1.20		
904.235	0.45	0.45		
904.932	0.70	0.70		
905.634	0.70	0.70		
908.884	3.25	3.25		
909.788	0.90	0.90		
909.887	0.10	0.00		
909.987	0.10	0.00		
910.239	0.25	0.00		
910.439	0.20	0.00		
911.585	1.15	1.15		
911.941	0.36	0.00		
911.941	0.00	0.00		
912.24	0.30	0.00		
913.24	1.00	1.00		
914.187	0.95	0.95		
917.291	3.10	3.10		
918.637	1.35	1.35		
924.103	5.47	5.47		
92[illegible].054	1.95	1.95		
[illegible]844	2.29	2.29		
928.696	0.35	0.00		
934.246	5.55	5.55		
935	0.75	0.75		
937.09	2.09	2.09		
937.898	0.81	0.81		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-1
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
944.006	6.11	6.11		
945.654	1.65	1.65		
946.255	0.60	0.60		
947.159	0.90	0.90		
947.86	0.70	0.70		
949.854	1.99	1.99		
950.203	0.35	0.00		
950.805	0.60	0.60		
953.613	2.81	2.81		
955.261	1.65	1.65		
956.361	1.10	1.10		
957.411	1.05	1.05		
958.062	0.65	0.65		
958.461	0.40	0.00		
959.315	0.85	0.85		
959.614	0.30	0.00		
959.614	0.00	0.00		
959.714	0.10	0.00		
[illegible]403	1.69	1.69		
[illegible]804	0.40	0.40		
962.354	0.55	0.55		
962.754	0.40	0.00		
963.602	0.85	0.85		
965.305	1.70	1.70		
966.106	0.80	0.80		
967.405	1.30	1.30		
969.356	1.95	1.95		
969.904	0.55	0.55		
970.654	0.75	0.75		
971.005	0.35	0.00		
971.105	0.10	0.00		
971.305	0.20	0.00		
971.553	0.25	0.00		
971.753	0.20	0.00		
973.153	1.40	1.40		
973.953	0.80	0.80		
974.253	0.30	0.00		
975.553	1.30	1.30		
975.803	0.25	0.00		
976.203	0.40	0.00		
976.353	0.15	0.00		
977.906	1.55	1.55		
978.755	0.85	0.85		
979.455	0.70	0.70		
9[illegible]704	9.25	9.25		
[illegible]555	0.85	0.85		
98.104	8.55	8.55	95.31%	

COAL LITHOLOGIC LOG
UTAH POWER & LIGHT COMPANY
DEPT. OF MINING & EXPLORATION

PROJECT: ROANS CANYON FAULT CROSSING - 3RD NORTH DRILL HOLE: 88-2 (TW-7)

LOCATION: 3RD N XC-65, #5
COLLAR ELEV.:
HOLE TYPE: PLUG / CORE
PLUG INTERVAL: 0 - 215.7'
CORE INTERVAL: 215.7' - 850.2'
TOTAL DEPTH: 850.2'
DATE: 5/12 - 5/17/88
SCALE: 1" - 10'
GEOLOGIST: FRY/SNIDER/LLOYD/SEMBOSKI

GEOPHYSICAL DATA

LOG	FROM	TO
DENSITY:		
H.R.D.:	/	
E. LOG:	G	
GAMMA:	O	
CALIPER:	V	
S.P.:	NO	
	/	

COAL SUMMARY:

SEAM	THICKNESS	INT.
N/A		

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
0					0' - 80' CASED ZONE (4" STEEL) NO LITHOLOGIC INFORMATION					
					- PLUGGED INTERVAL - 0' - 215.7'					
80					80.0' - 110.0' MUDSTONE					
90										
100										
110					110.0' - 215.7' INTERBEDS, SILTSTONE / MUDSTONE					
120					FRACTURE @ 130' (0.1')					
130										
140										

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

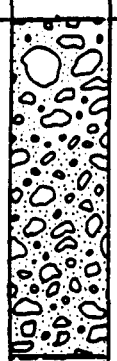
PROJECT: Roans Canyon
DRILL HOLE: 88-2 (TW-7)
PAGE 2 OF 9

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
140										
150										
160					SMALL VOIDS @ 168' AND 176'					
170										
180										
190										
200										
210					PLUGGED TO 215.7'					
					215.7'-218.8 SILTSTONE, MEDIUM GRAY	100		1	66	
220					218.8'-247.0' FAULT GOUGE SILTSTONE AND CLAY, ALTERED YELLOW-BROWN TO GRAY, ROOTED IN CLAY ZONES -REDUCED RUN LENGTH TO 5' TO IMPROVE RECOVERY.	>10	1	2	65	
								3	92	
230										

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY
DEPT. OF MINING & EXPLORATION

PROJECT: Roans Canyon
DRILL HOLE: 88-2 (TW-7)
PAGE 3 OF 9

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
230					218.8 - 247.0' FAULT GOUGE	>10	1	3	92	
							2	4	70	
240								5	44	
								6	78	
250					247.0' - 264.7' MUDSTONE, ALTERED YELLOW-BROWN TO GRAY, VERY SOFT.	41.2	3	7	80	
								8	98	
260							4	9	82	
					264.7' - 282.0' SILTSTONE, LIGHT GRAY, HARD, STAINED (BUFF) ALONG FRACTURES OXIDATION FRACTURES: 266.5, 268.2, 268.7 - 269.1, 272.9, 274.3, 275.0, 276.4 - 276.9, 278.8, 281.4, 294.8 UPWARD FINING: SILTSTONE → MUDSTONE 282.0' - 292.0'	92.8		10	100	
270							5	11	89	
280							6	12	100	
					282.0' - 319.5' MUDSTONE, LIGHT-MEDIUM-GRAY, SILTY THIN ROOTED ZONES.	91.8		13	100	
290							7	14	100	
300							8	15	100	
310							9	16	100	
320							10			

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: ROANS CANYON
DRILL HOLE: 88-2 (TW-7)
PAGE 4 OF 9

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
320					319.5'- 373.5' MUDSTONE; GRAY TO DARK GRAY, STAINED YELLOW-BROWN ON SOME FRACTURES, UPPER 10' ONLY, LITTLE TO NO STAINING BELOW, HARD OCCASIONALLY SILTY.	91.8	10	16	100	
330							11	17	100	
340							12	18	100	
350							13	19	100	
360							14	20	100	
370					SLICKENSIDE →		15	21	100	
380					373.5'- 394.0' SILTSTONE; GRAY, VERY HARD.	99.8	16	22	100	
390							17	23	100	
400					394.0'- 422.0' SANDSTONE, LIGHT GRAY FINE GRAIN WITH YELLOW-BROWN STAINS ON FRACTURES, WATER INCREASED IN THIS ZONE.	89.2	18	24	98	
410							19	25	83	

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY
DEPT. OF MINING & EXPLORATION

PROJECT: Roans Canyon
DRILL HOLE: 88-2 (TW-7)
PAGE 5 OF 9

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
410					394.0 - 422.0 SANDSTONE (DESCRIBED ON PREVIOUS PAGE).	89.2	19, 20	25, 26	98	
420					422.0' - 439.3' SILTSTONE, GRAY TO GRAY-BROWN, SANDY TOWARD BASE.	94.6	21, 22	27, 28	100, 100	
430										
440					439.3' - 471.6' SANDSTONE, LIGHT GRAY, FINE TO MEDIUM GRAIN. OXIDATION ALONG FRACTURES @ THE FOLLOWING: 440.9' 451.0', 443.4' 455.2', 444.5' 457.2', 446.0' 458.9', 447.3' 459.7', 448.7' 460.0'. WATER PRODUCER 452.2' - 452.9' (VOID) 45 GPM	98.0	23, 24, 25	29, 30, 31	99, 91, 100	
450										
460										
470					471.6' - 472.1' FAULT GOUGE: GRAY CLAY	0				
					472.1' - 478.2' SANDSTONE, LIGHT GRAY CARB. LAMINAE INTERBEDDED W/ MS, DK GRAY	100	26	32	94	
480					478.2 - 480.6' SANDSTONE, BUFF OXIDIZED	73.2				
					480.6' - 520.0' SANDSTONE, LIGHT GRAY, FINE GRAIN CARB LAMINAE. OXIDIZED TO BUFF LOCALLY @ 483.2' - 483.7', 485.0' - 489.3', 491.7' - 493.5', 494.7' - 495.9', 496.2' - 498.8', 5000 - 510.0'. VOID 496.4' - 497.5	88.8	27, 28	33, 34	98, 89	
490										

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: Roans Canyon
DRILL HOLE: 88-2 (TW-7)
PAGE 6 OF 9

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
500							28			
							29	35	93	
510					80% YELLOW-BROWN SANDSTONE, MG, ABUNDANT LOOSE SAND IN BARREL	88.8				
							30	36	82	
520					520.0' - 584.5' MUDSTONE; DARK GRAY, A FEW ROOTS, HARD COMPETENT					
								37	100	
530							31			
								38	90	
540					~1.0' VOID NEAR 539' WITH SOME CLAY MATERIAL & YELLOW STAINS ON JOINTS AND FRACTURES. LIGHT BROWN CLAY @ 540.8' - 541.1'		32			
								39	98	
550							33			
					SOME BROWN MINERALIZATION (1/8" THICK) ON SOME FRACTURES & JOINTS.	90.7		40	100	
560							34			
								41	100	
570					WATER VOLUME & PRESSURE INCREASED IN THIS ZONE. TW-6 ALSO INCREASED PRESSURE. VOID NEAR 577.4'		35	42	98	
580							36	43	100	
					584.5' - 655.4' SILTSTONE GRAY MUDDY IN PARTS BIOTURBATED YELLOW BROWN MINERALIZATION ON FRACTURES.	93.1	37	44	100	

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY
DEPT. OF MINING & EXPLORATION

PROJECT: Roans Canyon
DRILL HOLE: 88-2 (TW-7)
PAGE 7 OF 9

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
590					SILTSTONE; GRAY, MUDDY, BIOTURBATED, SOME ROOTS		37	44	100	
							38			
600								45	96	
							39			
610					← SANDY ZONE ← MUDDY ZONE	93.1		46	97	
620					VOID →		40	47	80	
630							41	48	81	
640							42	49	100	
650					652.5'-695.4' SANDSTONE LIGHT GRAY FINE GRAIN, CARB. LAMINAE MEDIUM GRAIN 671.0'-695.4		43	50	98	
660						93.9	44	51	100	
670					670.5'-671.0' COAL W/ SANDSTONE (CONTACT)		45	52	96	
680							46	53	100	

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: ROANS CANYON
DRILL HOLE: 89-2 (TW-7)
PAGE 8 OF 9

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
680					689.0'-691.0' REWORKED MUDSTONE IN SANDSTONE 691.0'-691.4' COAL W/ SANDSTONE (CONTACT) 691.4'-694.7' ABUNDANT REWORKED MS FRAGMENTS 694.7'-695.4' COAL W/ SANDSTONE (CONTACT)	93.9	46 47	53 54	100 100	
690										
700					695.4'-723.0' SILTSTONE; LIGHT GRAY, DENSE, FINING DOWNWARDS	95.4	48 49 50	55 56 57	100 100 100	
710										
720										
					723.0'-729.8' MUDSTONE; MEDIUM-DARK GRAY, SILTY	84.2	51	58	100	
730					729.8'-731.8' SILTSTONE; LIGHT GRAY	100				
					731.8'-748.2' MUDSTONE; MED GRAY SILTY	98.2	52 53	59 60	100 100	
740										
750					748.2'-753.2' SANDSTONE, LIGHT GRAY, FINE-GRAIN	94.3	54	61	100	
					753.2'-769.4' MUDSTONE, DARK GRAY, THIN COAL LAYERS, SLICKENSIDED. - SQUEEZE AREA -	95.6	55	62	100	
760										
770										

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: ROANS CANYON
DRILL HOLE: 88-2 (TW-7)
PAGE 9 OF 9

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
770					769.4 - 792.2 SILTSTONE, - VERY FINE SANDSTONE, LIGHT GRAY YELLOW - BROWN STAINING ON FRACTURES.	85.7	56	63	100	
780							57	64	98	
790					792.2' - 839.7' SANDSTONE, LIGHT GRAY, FINE - MEDIUM GRAIN (BUFF COLOR IN OXIDATION ZONE). - TOTAL OXIDATION - 802.2' - 836.9'	78.6	58	65	95	
800							59	66	72	
810					VOID →		60	67	83	
820					VOID →		61	68	74	
830					FLOW @ 830.2 120 GPM 840.2 + 100 GPM		62	69	70	
840					FAULT ZONE (VOID) 836.9' - 839.7' → POSSIBLE GOUGE - POOR RECOVERY					
					839.7' - 841.8 INTERBEDS. SILT./MS MEDIUM GRAY	67.9				
					841.8' - 850.2' MUDSTONE, DARK GRAY (2.0' OF CORE LOSS DUE TO REAMING - TIGHT STEEL, NO CHANGE H_2O PSI.)	87.9	63	70	80	
850					T.D. 850.2' - CASED ZONES - 0' - 80' 4" STEEL 0 - 850 1 1/4" PVC 0 - 300 1 1/4" SOLID 300 - 850' 1 1/4" SLOTTED (0.10")					
860										

3rd North, Deer Creek Mine

Flow Data Report

Hole # 88-2 Date: 5-12-88 / 5-13-88 Shift: Afternoon/graveyard/Da

Drill Interval	Time:	Injection Rate:	Discharge Rate:		
~~195~~ - ~~205~~	5:15 begin last plug run				
~~206~~ - 215.7	5:38 at 215.7'	pulling rod	Afternoon drillers had depth 10' off were at 205' not 195'		
215.7 - 220.7 (5')	6:20 - 6:30 hit	plugged, void at 219'			
220.7 - 225.8 (5.1)	6:45 - 7:00		no flow after open pipe drained		
225.8 - 232.0 (6.2)	7:15 - 7:28		"		
232.0 - 237.0 (5)	8:30 - 9:00		about 1. GPM		
237.0 - 242.0 (5)	9:00 - 9:30		" "		
242.0 - 247.0 (5)	9:30 - 10:00		about 2 GPM		
247.0 - 252.0 (5)	10:00 10:40		about 5 GPM		
252.0 - 257.0	10:40 - 1115				
257.0 - 262.0	1:00 - 130		6 GPM		
262.0 - 266.4	1:30 - 300	Slowed penetration			RUN 10
266.4 - 272.0	3:00 - 400	10GPM	est 20GPM	Tw-6 66PSI	RUN 11
272.0 - 282.0	4:40 - 5:50			66PSI	RUN 12
282.0 - 292.0	5:50 - 6:30	10GPM	20 GPM	64PSI	RUN 13
292.0 - 302.0	9:30A - 10:30 A	10GPM	20GPM	63PSI	RUN 14
302.0 - 312.0	10:30A 11:15A	10 GPM	20GPM	63PSI	RUN 15
312.0 - 322.0	11:15A 11:45A	10GPM	20GPM	63PSI	RUN 16
~~312.0~~ 322.2	11:45A	0	10 GPM annular 20GPM in pipe	63	RUN 16
322.2 - 332.2	1:00				RUN 17
332.2 - 342.2 10.0	1:07 - 150				18
342.2 - 352.3 10.1	? outside				19
352.3 - 362.0 9.7	2:15	30 gpm			20
362.0 - 372.0 10	2:53 - 3:22	30 gpm	22 weir	64	21
372.0 - 382.1 10.1	4:48 - 5:30 slow	30	25 "	64	22

3rd North, Deer Creek Mine
Flow Data Report

Hole # 88-2 Date: 5-13-88 / 5-14-88 Shift: Afternoon/→

Drill Interval	Time:	Injection Rate:	Discharge Rate: Weir	TW-6	RUN#
382.1 - 392.0	5:50 - [illegible]:25	30 gpm	25	64	23
392.0 - 402.0	6:40 - 7:00	30 gpm	20	64	24
402.0 - 412.0	7:34 - [illegible]	30	15	64	25
	8:00 lunch 30 gpm through open drill pipe				
412.0 - 420.1	9:00 - [illegible]	30	14	61	26
420.1 - 430.3	9:55 - 10:25	30	15	62	27
430.3 - 440.4	10:45 - [illegible]	30	15 weir 10 pipe	64	28
	11:30 shut down, water [illegible] but no steel added black paint mark [illegible] steel is 440.4 at stuffing box				
	to [illegible] next run, add 10' and insert core				
	barrel. All core is logged core barrels empty				
440.4 - 450.4	5-16-88 [illegible] 12:30A - 1:30A	30	15	63	29
450.4 - 460.4	1:30A - 2:30P	30	15 GPM	63 PSI	30
water out of NY pipe after pulling barrel 115 GPM					
460.4 - 470.4	2:30 - 3:45	30	15 GPM	63 PSI	31
	3:45 - 4:15	Lunch			
470.4 - 480.4	4:15 - 5:15	30 GPM	15 GPM	62 PSI	32
480.4 - 490.4	5:15 - 6:15	30 GPM	15 GPM	62 PSI	33
490.4 - 500.4	6:15 - 7:15	30 GPM	15 GPM	61.5 PSI	34
500.4 - 510.4	7:15 - ?	30 GPM	15 GPM	61.5 PSI	35
510.4 - 520.1 (9.7')	9:50 - 10:30	30	15	61	36
520.1 - 530.1	11:00 - 11:50	22	15	61.5	37
	12:00 - 12:30	lunch, cleaned weir			
530.1 - 540.1	12:30 - 1:15	22	15	60.5	38
540.1 - 550.1	1:30 - 2:05	22	15	60.5	39
550.1 - 560.1	2:30 - 3:[illegible]	22	15	62.0	40

3:11 shut down drillers had to repair water line leak down 3H
need to pump down [illegible] & retrieve next (aft) shift

3rd North, Deer Creek Mine

Flow Data Report

Hole # 98-2 Date: 5-16-89 Shift: Day →

Drill Interval	Time:	Injection Rate:	Discharge Rate:		
			Weir	IN-6	Run
between shifts	3:30 - 4:30	0	15 gpm	58 psi	—
560.1 - 567.6 (7.5')	5:05 - 5:25	25	13	59	41
567.6 - 577.6	5:50 - 6:15	20	15	60.5	42
577.6 - 587.6	6:35 - 7:00	20	14	60.0	43
587.6 - 597.6	7:25 - [illegible]	20	12	60.5	44
Dinner	8:00 - 8:40	20		59.0	-
597.6 - 607.6	9:40 - [illegible]	20	17	59.5	45
607.6 - 617.6	9:40 10:40	20	17	60.0	46
617.6 - 626.7	[illegible] 11:10	20	17	60	47
[illegible] change	[illegible] - [illegible]				
[illegible]	5-17-88 [illegible] - [illegible]	20	17	59	48
625.4 - 645.4	2:00 - 3:00	20	17	60	49
[illegible] - 655.4	[illegible] 1:00	20	17	60	50
655.4 - 665.4	4:45 - 5:35	20	15GPM	60PSI	51
665.4 - 675.4	5:35 - 6:20	20	15GPM	60PSI	52
675.4 - 685.4	6:25 - 7:20	20	15GPM	60PSI	53
685.4 - 695.4	9:00 - 9:45	20	15GPM	60PSI	54
695.4 - 705.4	9:45 - 11:15	20	15GPM	60PSI	55
705.4 - 715.4	11:15 - 12:20	11	11	60PSI	56
715.4 - 724.8	12:20 - 1:40	11	11	60PSI	57
724.8 - 734.8	1:40 - 3:00	20	15GPM	60PSI	58
734.8 - 744.8	3:00 - 5:00	20	15	60P	59
744.8 - 752.2	5:00 - [illegible]	20	15	60P	60
752.2 - 762.2	[illegible] - 8:00	20	15	60P	61
[illegible] Pipe	[illegible] 10:00			5A	

3rd North, Deer Creek Mine

Flow Data Report

Hole # _____ Date: _____ Shift: _____

Drill Interval	Time:	Injection Rate:	Discharge Rate:		
			Weir		Run
Getting into Hole	10:30-11:00				
762.2 - 772.2	11:30 - 11:30 12:30 - 130	20	15	58	62
772.2 - 782.2	1:30 - 3:00	20	15	59	63
782.2 - 792.2	3:00 - 4:00	20	15	59	64
792.2 - 802.2	4:00 - 5:[illegible]	20	15	59	65
802.2 - 810.2	5:00 - [illegible]		15	59	66
810.2 - 820.2	6:30 - 7:[illegible]	[illegible]	15	59	67
820.2 - 830.2	8:30 - 9:30	20	15		68
830.2 - 840.2	10.00 - 10.20	20	15	53.5	69
840.2	SHUT PSI AFTER 15 MIN 64				
840.2 - 850.2	11:00 - 12:00	20	15	54.5	70

IN-MINE DRILL HOLE DATA SHEET

MINE ========) DEER CREEK 3RD NORTH
SECTION ========) ROANS CANYON FAULT DRILLING
HOLE NUMBER ========) 88-2
LOCATION ========)
DATE ========) MAY 18, 1988

Interval			Horizontal Angle From Magnetic North				True Horizontal Depth		Vertical Angle From Horizontal		
from	to	length	bearing	degrees	interval	accumulation	interval	accumulation	Angle	interval	accumulation
0	5	5	NW	1	0.09	0.09	4.98	4.98	5.5	0.48	0.48
5	10	5	NW	1	0.09	0.17	4.97	9.94	6.5	0.57	1.05
10	20	10	NW	1	0.17	0.35	9.95	19.90	5.5	0.96	2.00
20	40	20	NW	1	0.35	0.35	19.92	39.82	5	1.74	3.75
40	60	20	NW	1	0.35	0.35	19.95	59.77	4	1.40	5.14
60	80	20	NW	1	0.35	0.35	19.97	79.75	3	1.05	6.19
[illegible]	100	20	NW	1	0.35	0.35	19.98	99.73	2.5	0.87	7.06
[illegible]	120	20	NW	1	0.35	0.35	19.99	119.72	1.5	0.52	7.58
120	140	20	NW	1	0.35	0.35	19.99	139.71	2	0.70	8.28
140	160	20	NW	1	0.35	0.35	20.00	159.71	0.5	0.17	8.46
160	180	20	NW	1	0.35	0.35	19.99	179.70	2	0.70	9.16
180	200	20	NW	1	0.35	0.35	20.00	199.69	0.5	0.17	9.33
200	220	20	NW	1	0.35	0.35	20.00	219.69	0	0.00	9.33
220	240	20	NW	1	0.35	0.35	20.00	239.69	0	0.00	9.33
240	260	20	NW	1	0.35	0.35	20.00	259.69	0.5	0.17	9.50
260	280	20	NW	1	0.35	0.35	20.00	279.69	0	0.00	9.50
280	300	20	NW	1	0.35	0.35	20.00	299.69	0	0.00	9.50
300	320	20	NW	1	0.35	0.35	20.00	319.69	0	0.00	9.50
320	340	20	NW	1	0.35	0.35	20.00	339.69	-1	-0.35	9.16
340	360	20	NW	1	0.35	0.35	19.99	359.68	-1.5	-0.52	8.63
360	380	20	NW	1	0.35	0.35	19.99	379.68	-1.5	-0.52	8.11
380	400	20	NW	1	0.35	0.35	19.98	399.66	-2.5	-0.87	7.24
400	420	20	NW	1	0.35	0.35	19.98	419.64	-2.5	-0.87	6.36
420	440	20	NW	1	0.35	0.35	19.98	439.62	-2.5	-0.87	5.49
440	460	20	NW	1	0.35	0.35	19.98	459.60	-2.5	-0.87	4.62
460	480	20	NW	1	0.35	0.35	19.98	479.58	-2.5	-0.87	3.75
480	500	20	NW	1	0.35	0.35	19.97	499.55	-3	-1.05	2.70
500	520	20	NW	1	0.35	0.35	19.98	519.54	-2.5	-0.87	1.83
520	540	20	NW	1	0.35	0.35	19.96	539.50	-3.5	-1.22	0.61
540	560	20	NW	1	0.35	0.35	19.95	559.45	-4	-1.40	-0.79
560	580	20	NW	1	0.35	0.35	19.96	579.41	-3.5	-1.22	-2.01
580	600	20	NW	1	0.35	0.35	19.97	599.38	-3	-1.05	-3.06
[illegible]	620	20	NW	1	0.35	0.35	19.94	619.32	-4.5	-1.57	-4.63
620	640	20	NW	1	0.35	0.35	19.96	639.29	-3.5	-1.22	-5.85
640	660	20	NW	1	0.35	0.35	19.95	659.24	-4	-1.40	-7.24
660	680	20	NW	1	0.35	0.35	19.96	679.20	-3.5	-1.22	-8.46
680	700	20	NW	1	0.35	0.35	19.91	699.11	-5.5	-1.92	-10.38

IN-MINE DRILL HOLE DATA SHEET

MINE ========) DEER CREEK 3RD NORTH
SECTION ========) ROANS CANYON FAULT DRILLING
HOLE NUMBER ========) 88-2
LOCATION ========)
DATE ========) MAY 18, 1988

Interval			Horizontal Angle From Magnetic North				True Horizontal Depth		Vertical Angle From Horizontal		
from	to	length	bearing	degrees	interval	accumulation	interval	accumulation	Angle	interval	accumulation
700	720	20	NW	1	0.35	0.35	19.91	719.02	-5.5	-1.92	-12.30
720	740	20	NW	1	0.35	0.35	19.94	738.95	-4.5	-1.57	-13.87
740	760	20	NW	1	0.35	0.35	19.91	758.86	-5.5	-1.92	-15.78
760	780	20	NW	1	0.35	0.35	19.92	778.79	-5	-1.74	-17.53
780	800	20	NW	1	0.35	0.35	19.92	798.71	-5	-1.74	-19.27
800	820	20	NW	1	0.35	0.35	19.94	818.65	-4.5	-1.57	-20.84
[illegible]	840	20	NW	1	0.35	0.35	19.92	838.57	-5	-1.74	-22.58

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-2
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
263.14				SILTSONE; HARD; STAINED ON FRACTURES
263.64	0.50	0.50		
264.24	0.60	0.60		
264.99	0.75	0.75		
265.64	0.65	0.65		
266.04	0.40	0.40		
266.34	0.30	0.00		
266.59	0.25	0.00		STAINED
268.04	1.45	1.45		STAINED
268.59	0.55	0.55		
268.99	0.40	0.40		STAINED
270.15	1.15	1.15		
270.50	0.35	0.00		
270.65	0.15	0.00		
271.35	0.70	0.70		
272.55	1.20	1.20		
272.85	0.30	0.00		STAINED
273.55	0.70	0.70		
[illegible]4.40	0.85	0.85		STAINED
[illegible]5.00	0.60	0.60		STAINED
275.60	0.60	0.60		
276.55	0.95	0.95		STAINED
277.16	0.60	0.60		
277.66	0.50	0.50		
278.26	0.60	0.60		
278.91	0.65	0.65		STAINED
281.11	2.20	2.20		STAINED
282.00	0.89	0.89	92.84%	————————
282.26	1.15	1.15		MUDSTONE; GRAY; SILTY;
283.41	1.15	1.15		SOME ROOT ZONES
283.66	0.25	0.00		
283.81	0.15	0.00		
285.06	1.25	1.25		
285.41	0.35	0.00		
285.76	0.35	0.00		
288.47	2.70	2.70		
291.42	2.95	2.95		
292.72	1.30	1.30		
293.27	0.55	0.55		
293.37	0.10	0.00		
293.47	0.10	0.00		
293.72	0.25	0.00		
294.32	0.60	0.60		
294.73	0.40	0.40		STAINED
[illegible].13	1.40	1.40		
297.43	1.30	1.30		
299.63	2.20	2.20		
302.18	2.55	2.55		
302.73	0.55	0.55		
304.09	1.35	1.35		
310.59	6.51	6.51		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-2
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
312.00	1.40	1.40		
314.20	2.20	2.20		
315.80	1.60	1.60		
316.60	0.80	0.80		
316.90	0.30	0.00		
319.25	2.35	2.35		
319.86	0.60	0.60		
320.30	0.45	0.45		
321.15	0.85	0.85		
321.65	0.50	0.50		
322.45	0.80	0.80		
323.45	1.00	1.00		
325.56	2.10	2.10		
325.76	0.20	0.00		
326.06	0.30	0.00		
326.31	0.25	0.00		
326.71	0.40	0.00		
326.91	0.20	0.00		
[illegible].36	0.45	0.45		
[illegible].76	0.40	0.00		
328.01	0.25	0.00		
328.26	0.25	0.00		
328.51	0.25	0.00		
330.66	2.15	2.15		
331.11	0.45	0.45		
332.57	1.45	1.45		
332.82	0.25	0.00		
336.62	3.80	3.80		
338.62	2.00	2.00		
338.77	0.15	0.00		
339.12	0.35	0.00		
339.47	0.35	0.00		
340.07	0.60	0.60		
343.33	3.25	3.25		
343.68	0.35	0.00		
344.28	0.60	0.60		
344.58	0.30	0.00		
345.33	0.75	0.75		
345.58	0.25	0.00		
346.13	0.55	0.55		
346.58	0.45	0.45		
346.93	0.35	0.00		
348.48	1.55	1.55		
349.38	0.90	0.90		
3[illegible]84	1.45	1.45		
[illegible].44	0.60	0.60		
351.74	0.30	0.00		
353.24	1.50	1.50		
354.59	1.35	1.35		
355.24	0.65	0.65		
357.19	1.95	1.95		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-2
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
358.30	1.10	1.10		
359.25	0.95	0.95		
360.45	1.20	1.20		
363.15	2.70	2.70		
363.65	0.50	0.50		
363.90	0.25	0.00		
365.40	1.50	1.50		
365.70	0.30	0.00		
370.16	4.46	4.46		
370.91	0.75	0.75		
371.66	0.75	0.75		
372.66	1.00	1.00		
373.61	0.95	0.95	91.83%----------	
373.66	0.05	0.00		SILTSTONE; GRAY; VERY HARD
376.17	2.50	2.50		
378.32	2.15	2.15		
379.72	1.40	1.40		
390.33	10.61	10.61		
[illegible].23	3.90	3.90	99.76%----------	
[illegible].59	0.35	0.00		SANDSTONE; FINE GRAINED; GRAY
395.69	1.10	1.10		OXIDATION STAINING ON FRACTURES
395.94	0.25	0.00		WATER INCREASE ON PULLING CORE
396.04	0.10	0.00		
396.14	0.10	0.00		
396.19	0.05	0.00		
396.29	0.10	0.00		
398.54	2.25	2.25		
398.89	0.35	0.00		
399.84	0.95	0.95		
399.99	0.15	0.00		
400.24	0.25	0.00		
400.34	0.10	0.00		
400.39	0.05	0.00		
401.70	1.30	1.30		
401.89	0.20	0.00		
402.10	0.20	0.00		
403.70	1.60	1.60		
405.20	1.50	1.50		
406.15	0.95	0.95		
407.15	1.00	1.00		
407.60	0.45	0.45		
409.20	1.60	1.60		
409.30	0.10	0.00		
409.50	0.20	0.00		
[illegible].60	0.10	0.00		
[illegible].25	0.65	0.65		
411.65	1.40	1.40		
412.00	0.35	0.00		
413.26	1.25	1.25		
414.96	1.70	1.70		
416.06	1.10	1.10		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-2
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
416.46	0.40	0.40		
418.16	1.70	1.70		
421.07	2.90	2.90		
421.47	0.40	0.40		
421.92	0.45	0.45	89.15%	
422.27	0.35	0.00		SILTSTONE; GRAY
425.43	3.16	3.16		TO GRAY BROWN
425.73	0.30	0.00		
428.88	3.15	3.15		
429.43	0.55	0.55		
430.58	1.15	1.15		
430.89	0.30	0.00		
431.29	0.40	0.40		SANDY NEAR BASE
432.79	1.50	1.50		
435.44	2.65	2.65		
438.40	2.95	2.95		
439.60	1.20	1.20	94.62%	
440.70	1.10	1.10		SANDSTONE; LT GRAY;
441.10	0.40	0.40		MED TO FINE GRAINED
[illegible].56	2.45	2.45		
[illegible]4.36	0.80	0.80		
445.91	1.55	1.55		
447.21	1.30	1.30		
448.51	1.30	1.30		
451.22	2.70	2.70		
452.07	0.85	0.85		
452.32	0.25	0.00		
453.62	1.30	1.30		
454.88	1.25	1.25		
455.23	0.35	0.00		
457.18	1.95	1.95		
458.98	1.80	1.80		
459.78	0.80	0.80		
460.18	0.40	0.40		
462.79	2.60	2.60		
463.39	0.60	0.60		
464.44	1.05	1.05		
466.75	2.30	2.30		
467.60	0.85	0.85		
469.20	1.60	1.60		
471.55	2.35	2.35		
471.60	0.05	0.00	97.98%	
472.15	0.60	0.00	0.00%	FAULT GAUGE; GRAY CLAY
472.76	0.60	0.60		
[illegible].71	0.95	0.95		
[illegible].96	0.65	0.65		
474.81	0.45	0.45		
475.36	0.55	0.55		
476.71	1.35	1.35		
477.11	0.40	0.40		
478.20	1.09	1.09	100.00%	

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-2
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
478.41	1.30	1.30		SANDSTONE; MED GRAINED
478.61	0.20	0.00		CARB LAMINAE
478.72	0.10	0.00		INTERBEDDED W/ MUDSTONE GRAY
478.87	0.15	0.00		
479.22	0.35	0.00		
479.37	0.15	0.00		
480.67	1.30	1.30	73.23%----------	
481.87	1.20	1.20		SANDSTONE; BUFF; OXIDIZED
482.12	0.25	0.00		
482.17	0.05	0.00		
483.32	1.15	1.15		
485.43	2.10	2.10		
485.73	0.30	0.00		
486.13	0.40	0.40		
486.98	0.85	0.85		
487.58	0.60	0.60		
488.13	0.55	0.55		
488.98	0.85	0.85		
489.18	0.20	0.00		
[illegible].63	0.45	0.45		
490.74	1.10	1.10		
492.69	1.95	1.95		
493.49	0.80	0.80		
494.89	1.40	1.40		
495.64	0.75	0.75		
496.09	0.45	0.45		
496.39	0.30	0.00		
497.50	1.10	1.10		
498.20	0.70	0.70		
499.50	1.30	1.30		
501.35	1.85	1.85		
501.40	0.05	0.00		
501.45	0.05	0.00		
502.65	1.20	1.20		
502.70	0.05	0.00		
502.80	0.10	0.00		
503.00	0.20	0.00		
503.15	0.15	0.00		
503.30	0.15	0.00		
503.45	0.15	0.00		
504.25	0.80	0.80		
504.65	0.40	0.40		
505.10	0.45	0.45		
505.55	0.45	0.45		
5[illegible]05	0.50	0.50		
[illegible].10	0.05	0.00		
506.30	0.20	0.00		
506.30	0.00	0.00		
506.50	0.20	0.00		
506.65	0.15	0.00		
506.90	0.25	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-2
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
506.90	0.00	0.00		
508.66	1.75	1.75		
509.01	0.35	0.00		
510.51	1.50	1.50		
510.96	0.45	0.45		
510.96	0.00	0.00		
511.01	0.05	0.00		
511.01	0.00	0.00		
511.16	0.15	0.00		
511.41	0.25	0.00		
512.06	0.65	0.65		
512.66	0.60	0.60		
513.81	1.15	1.15		
514.31	0.50	0.50		
514.71	0.40	0.40		
516.36	1.65	1.65		
516.66	0.30	0.00		
517.11	0.45	0.45		
517.16	0.05	0.00		
517.21	0.05	0.00		
517.36	0.15	0.00		
517.51	0.15	0.00		
517.56	0.05	0.00		
518.56	1.00	1.00		
519.97	1.40	1.40	88.78%----------	
520.42	0.45	0.45	MUDSTONE; DK. GRAY; HARD	
520.82	0.40	0.00		
521.27	0.45	0.45		
521.77	0.50	0.50		
521.82	0.05	0.00		
523.27	1.45	1.45		
523.77	0.50	0.50		
531.38	7.61	7.61		
531.88	0.50	0.50		
533.53	1.65	1.65		
535.89	2.35	2.35		
536.69	0.80	0.80		
538.18	1.50	1.50		
538.23	0.05	0.00		
538.48	0.25	0.00		
538.63	0.15	0.00	VOID	
539.99	1.35	1.35		
540.39	0.40	0.00		
540.44	0.05	0.00		
[illegible].59	0.15	0.00		
[illegible]0.79	0.20	0.00		
540.89	0.10	0.00		
542.24	1.35	1.35		
542.54	0.30	0.00		
543.84	1.30	1.30		
544.64	0.80	0.80		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-2
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
545.49	0.85	0.85		
546.75	1.25	1.25		
547.24	0.50	0.50		
547.80	0.55	0.55		
547.80	0.00	0.00		
547.90	0.10	0.00		
548.05	0.15	0.00		
548.20	0.15	0.00		
550.50	2.30	2.30		
550.70	0.20	0.00		
551.30	0.60	0.60		
551.45	0.15	0.00		
552.95	1.50	1.50		
553.65	0.70	0.70		
554.35	0.70	0.70		
554.95	0.60	0.60		BROWN MINERALIZATION ON FRACTURES
555.95	1.00	1.00		
556.45	0.50	0.50		
[illegible]8.41	1.95	1.95		
[illegible].76	0.35	0.00		
559.21	0.45	0.45		
559.56	0.35	0.00		
562.41	2.85	2.85		
565.11	2.70	2.70		
565.36	0.25	0.00		
567.42	2.06	2.06		
567.62	0.20	0.00		
568.07	0.45	0.45		
570.07	2.00	2.00		WATER VOLUME & PRESSURE INCREASE
570.17	0.10	0.00		
570.22	0.05	0.00		
570.27	0.05	0.00		
570.42	0.15	0.00		
571.67	1.25	1.25		
571.87	0.20	0.00		
572.37	0.50	0.50		
573.97	1.60	1.60		
574.97	1.00	1.00		
576.88	1.90	1.90		
576.98	0.10	0.00		
577.53	0.55	0.55		
577.93	0.40	0.00		
577.98	0.05	0.00		
577.98	0.00	0.00		
[illegible].13	0.15	0.00		
[illegible].43	0.30	0.00		
578.93	0.50	0.50		
579.53	0.60	0.60		
579.93	0.40	0.40		
580.23	0.30	0.00		
580.43	0.20	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-2
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
582.28	1.85	1.85		
584.94	2.66	2.66	90.68%	
585.99	1.05	1.05		SILTSTONE; GRAY; MUDDY
587.14	1.15	1.15		BIOTURBATED; YELLOW MINERALIZATION
587.84	0.70	0.70		ON FRACTURES
588.69	0.85	0.85		
590.81	2.12	2.12		
591.01	0.20	0.00		
591.76	0.75	0.75		
591.80	0.05	0.00		
593.16	1.35	1.35		
600.47	7.31	7.31		
602.32	1.85	1.85		
603.17	0.85	0.85		
604.12	0.95	0.95		
605.22	1.10	1.10		
606.03	0.80	0.80		
606.98	0.95	0.95		
[illegible]8.38	1.40	1.40		
[illegible]9.38	1.00	1.00		
611.08	1.70	1.70		
614.93	3.86	3.86		
615.28	0.35	0.00		
615.48	0.20	0.00		
615.78	0.30	0.00		
615.93	0.15	0.00		
616.38	0.45	0.45		
617.69	1.30	1.30		
618.64	0.95	0.00		
619.94	1.30	0.00		
620.24	0.30	0.00		
620.94	0.70	0.70		
621.69	0.75	0.75		
621.99	0.30	0.00		
622.44	0.45	0.45		
623.20	0.75	0.75		
624.30	1.10	1.10		
625.25	0.95	0.95		
630.60	5.35	5.35		
630.95	0.35	0.00		
631.20	0.25	0.00		
631.65	0.45	0.45		
632.35	0.70	0.70		
632.90	0.55	0.55		
[illegible].50	0.60	0.60		
[illegible].06	0.55	0.55		
634.71	0.65	0.65		
635.16	0.45	0.45		
637.46	2.30	2.30		
637.46	0.00	0.00		
638.51	1.05	1.05		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-2
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
640.71	2.20	2.20		
642.57	1.85	1.85		
643.52	0.95	0.95		
644.37	0.85	0.85		
644.92	0.55	0.55		
646.77	1.85	1.85		
649.72	2.95	2.95		
652.42	2.70	2.70	93.03%----------	
654.72	2.30	2.30		SANDSTONE; LT GRAY; FINE GRAINED
655.18	0.45	0.45		CONTAINES CARBONACEOUS
655.33	0.15	0.00		LAMINAE
656.53	1.20	1.20		
657.88	1.35	1.35		
659.63	1.75	1.75		
660.53	0.90	0.90		
665.59	5.06	5.06		
666.24	0.65	0.65		
667.99	1.75	1.75		
668.84	0.85	0.85		
[illegible].99	1.15	1.15		
670.20	0.21	0.00		
670.75	0.55	0.55		ABUNDANT REWORKED MUDSTONE
670.85	0.10	0.00		691.4 TO 694.7
671.06	0.21	0.00		SANDSTONE; LT GRAY MED GRAINED;
671.22	0.16	0.00		CARB LAMINAE PRESENT
672.80	1.58	1.58		
676.45	3.65	3.65		670.5 TO 671.0 SANDSTONE IN
677.50	1.05	1.05		CONTACT W/COAL
678.40	0.90	0.90		
681.45	3.05	3.05		
682.21	0.75	0.75		
682.66	0.46	0.46		
684.38	1.71	1.71		
684.73	0.35	0.00		
684.88	0.15	0.00		
685.84	0.96	0.96		
686.69	0.86	0.86		
686.94	0.25	0.00		
689.92	2.97	2.97		
690.67	0.75	0.75		
691.02	0.35	0.00		
691.16	0.14	0.00		
691.32	0.16	0.00		
694.39	3.08	3.08		
[illegible].54	0.15	0.00		IN CONTACT WITH COAL AT
[illegible].78	0.24	0.00		694.7 TO 695.4
695.40	0.62	0.62	93.91%----------	
696.61	1.83	1.83		SILTSTONE; LT GRAY; DENSE
698.47	1.86	1.86		BECOMING INCREASINGLY MUDDY
701.24	2.77	2.77		W/DEPTH
703.20	1.96	1.96		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-2
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
705.42	2.22	2.22		
707.54	2.12	2.12		
707.64	0.10	0.00		
710.41	2.77	2.77		
712.02	1.61	1.61		
712.62	0.61	0.61		
713.13	0.50	0.50		
713.48	0.35	0.00		
714.53	1.06	1.06		
714.58	0.05	0.00		
715.19	0.60	0.60		
715.33	0.15	0.00		
715.48	0.14	0.00		
715.67	0.19	0.00		
716.74	1.07	1.07		
717.30	0.55	0.55		
718.16	0.86	0.86		
718.86	0.71	0.71		
[illegible]9.16	0.30	0.00		
[illegible]0.57	1.41	1.41		
721.83	1.26	1.26		
722.74	0.91	0.91	95.40%----------	
723.09	0.35	0.00		MUDSTONE; DARK GRAY; SILTY
723.45	0.36	0.00		
723.60	0.15	0.00		
724.10	0.50	0.50		
724.21	0.10	0.00		
724.46	0.25	0.00		
724.96	0.50	0.50		
725.11	0.15	0.00		
725.36	0.25	0.00		
725.97	0.61	0.61		
726.72	0.76	0.76		
728.14	1.41	1.41		
728.69	0.55	0.55		
729.75	1.06	1.06	84.23%----------	
731.00	1.26	1.26		SILTSTONE; LT. GRAY; MUDDY
731.76	0.76	0.76	100.00%----------	
732.06	0.30	0.00		MUDSTONE; MED. GRAY; SILTY
733.78	1.71	1.71		
735.08	1.31	1.31		
735.63	0.55	0.55		
736.44	0.80	0.80		
736.44	0.00	0.00		
[illegible].60	1.16	1.16		
[illegible]8.96	1.36	1.36		
739.86	0.91	0.91		
741.27	1.41	1.41		
742.23	0.96	0.96		
743.69	1.46	1.46		
746.01	2.32	2.32		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-2
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
747.07	1.06	1.06		
747.67	0.60	0.60		
748.53	0.86	0.86	98.21%----------	
748.83	0.30	0.00	SANDSTONE; LT. GRAY; FINE GRAINED	
753.37	4.54	4.54		
753.78	0.41	0.41	94.29%----------	
753.83	0.05	0.00	MUDSTONE; DK. GRAY; THIN COAL LAYERS;	
754.78	0.96	0.96	SLICKENSIDED; -SQUEEZE AREA-	
755.84	1.06	1.06		
756.70	0.85	0.85		
760.36	3.66	3.66		
761.22	0.86	0.86		
761.93	0.71	0.71		
762.39	0.46	0.46		
762.99	0.60	0.60		
763.29	0.30	0.00		
763.79	0.50	0.50		
764.40	0.61	0.61		
[illegible].50	1.11	1.11		
[illegible].86	1.36	1.36		
768.42	1.56	1.56		
769.68	1.26	1.26		
769.99	0.30	0.00	95.96%----------	
770.33	0.35	0.00	SILTSTONE; LT. GRAY; LBROWN STAINING	
770.59	0.25	0.00	ON FRACTURES	
770.74	0.15	0.00		
771.19	0.46	0.46		
771.90	0.70	0.70		
772.85	0.96	0.96		
773.50	0.65	0.65		
774.97	1.47	1.47		
775.32	0.35	0.00		
777.49	2.16	2.16		
777.94	0.45	0.45		
778.19	0.25	0.00		
778.55	0.35	0.00		
779.20	0.65	0.65		
780.05	0.86	0.86		
780.21	0.15	0.00		
780.56	0.35	0.00		
781.67	1.11	1.11		
782.52	0.86	0.86		
783.38	0.86	0.86		
785.64	2.26	2.26		
[illegible].20	1.56	1.56		
[illegible].41	0.20	0.00		
789.87	2.47	2.47		
790.03	0.15	0.00		
790.28	0.25	0.00		
790.43	0.15	0.00		
792.34	1.91	1.91		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-2
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
792.60	0.25	0.00	85.74%----------	
793.50	0.90	0.90	SANDSTONE; LIGHT GRAY; FINE TO MED.	
794.36	0.86	0.86	GRAINED;	
794.96	0.60	0.60		
795.67	0.71	0.71		
797.78	2.11	2.11		
799.14	1.36	1.36		
799.84	0.70	0.70		
801.15	1.31	1.31		
802.92	1.77	1.77	802.2 TO 836.9 TOTAL OXIDATION	
803.37	0.45	0.45		
803.87	0.50	0.50		
803.87	0.00	0.00		
804.02	0.15	0.00		
804.28	0.25	0.00		
804.78	0.50	0.50		
805.08	0.30	0.00		
805.84	0.75	0.75		
[illegible]6.90	1.06	1.06		
[illegible]8.25	1.36	1.36		
809.81	1.56	1.56		
810.37	0.55	0.55		
810.37	0.00	0.00		
813.18	2.82	0.00		
813.90	0.71	0.71		
814.20	0.30	0.00		
815.10	0.90	0.90		
817.32	2.22	2.22		
818.23	0.90	0.90		
818.58	0.35	0.00		
819.33	0.75	0.75		
820.83	1.50	1.50		
821.03	0.20	0.00		
821.08	0.05	0.00		
821.43	0.35	0.00		
822.64	1.21	1.21		
822.84	0.20	0.00		
822.94	0.10	0.00		
823.34	0.40	0.00		
826.76	3.41	0.00		
827.56	0.80	0.80		
828.36	0.80	0.80		
829.37	1.00	1.00		
832.48	3.11	3.11		
[illegible].28	0.80	0.80		
[illegible]6.30	3.01	3.01		
836.90	0.60	0.00	78.56%----------	
839.36	2.46	0.00	FAULT ZONE	
839.76	0.40	0.00	73.80%----------	
840.57	0.81	0.81	INTERBEDS; SILTSTONE/MUDSTONE;	
840.77	0.20	0.00	GRAY	

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-2
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
841.02	0.25	0.00		
841.37	0.35	0.00		
841.67	0.30	0.00		
841.92	0.25	0.00	67.94%----------	
842.07	0.15	0.00		MUDSTONE; DARK GRAY
842.47	0.40	0.40		
842.72	0.25	0.00		
842.87	0.15	0.00		
843.13	0.25	0.00		
843.38	0.25	0.00		
843.93	0.55	0.55		
844.33	0.40	0.40		
845.18	0.85	0.85		
845.89	0.70	0.70		
846.49	0.60	0.60		
847.09	0.60	0.60		
848.10	1.00	1.00		
848.70	0.60	0.60		
[illegible]0.61	1.91	1.91	87.88%----------	

COAL LITHOLOGIC LOG
UTAH POWER & LIGHT COMPANY
DEPT. OF MINING & EXPLORATION

PROJECT: ROANS CANYON FAULT CROSSING - 3RD NORTH DRILL HOLE: 88-3 (TW-8)

LOCATION: 3RD N X C 65 #5
COLLAR ELEV.:
HOLE TYPE: PLUG / CORE
PLUG INTERVAL: 0' - 238.4'
CORE INTERVAL: 238.4' - 840.0'
TOTAL DEPTH: 840.0'
DATE: 5/31 - 6/15/88
SCALE: 1" - 10'
GEOLOGIST: FRY/SNIDER/LLOYD/SEMBORSKI

GEOPHYSICAL DATA

LOG	FROM	TO
DENSITY:		
H.R.D.:	✓	
E. LOG:	LOG	
GAMMA:		
CALIPER:	NO	
S.P.:	✓	

COAL SUMMARY:

SEAM	THICKNESS	INT.
N/A		

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
0				BLACKHAWK FORMATION	0' - 80' CASED ZONE (4" STEEL)					
80					80.0' - 238.4' PLUGGED INTERVAL					
90										
100										
220										
230										
240					238.4' - 251.2' MUDSTONE: GRAY - DARK GRAY, UPPER 5' SILTY, BUFF STAINED FRACTURES.	100	1	1	99	

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY
DEPT. OF MINING & EXPLORATION

PROJECT: ROANS CANYON
DRILL HOLE: 88-3 (TW-8)
PAGE 2 OF 8

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
250				BLACKHAWK FORMATION	POSSIBLE FAULT ↓					
					251.2 - 262.7 CARBONACEOUS MUDSTONE; DARK GRAY - BLACK HIGHLY FRACTURED, SLICKENSIDED.	66.8	2	2	86	
260					GOUGE					
					262.7' - 268.7 COAL / CMS	100	3	3	81	
					268.7' - 271.3' SILTSTONE; MEDIUM GRAY, SANDY NEAR BASE.	42		4	79	
270					271.3' - 286.8' FAULT GOUGE SOFT CLAYEY WITH ISOLATED ZONES OF MUDSTONE / SILTSTONE / SANDSTONE, YELLOW-BROWN → GRAY.	0	4	5	42	
280								6	74	
								7	82	
290					286.8 - 295.7' MUDSTONE; MEDIUM - DARK GRAY. SILTY	28.1	5	8	98	
					FAULT ↓					
					295.7 - 337.0' SANDSTONE; LIGHT GRAY (OXIDIZED YELLOW-BROWN NEAR FAULT CONTACT & ALONG FRACTURES). FINE GRAIN THIN AREAS OF GOUGE (SOFT MS) IN UPPER 12'.	HIGHLY FRACTURED		9	70	
300								10	50	
					GOUGE 2.0' CLAYEY, MINOR CMS/COAL		6	11	80	
310								12	96	
						79.3	7	13	100	
320					WATER INCREASED SLIGHTLY →					
330							8	14	95	
					337.0' - 341' MUDSTONE. DARK GRAY, SOME CMS/COAL LAYERS	100	9	15	90	
340										

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: ROANS CANYON
DRILL HOLE: 88-3 (TW-8)

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
340				BLACKHAWK FORMATION	337.0' - 341.0' MUDSTONE; DARK GRAY	100				
					341.0' - 360.4' SILTSTONE; GRAY, A FEW ROOTS, UPPER 2' BROKEN.		9	16	100	
350					SOME STAINING FRACTURES →	83.3	10	17	100	
360							11	18	100	
					360.4' - 368.0' MUDSTONE; DARK GRAY, ROOTED, EASILY FRACTURED DRILLING.	79.2				
370					368.0' - 382.7' SILTSTONE; LIGHT GRAY, ROOTED, THIN COAL @ 381.7' - 382.7'		12	19	94	
						80.3		20	89	
380					THIN COAL (CRUSHED) →		13	21	98	
					382.7' - 387.9' SANDSTONE; LIGHT GRAY, VERY FINE GRAIN, COAL-SHALE LAMINAE.	81.7				
390					387.9' - 393.0' MUDSTONE; MEDIUM GRAY, DIFFICULT DRILLING - STICKY, ROOTED	71.1	14	22	100	
					393.0' - 410.7' SILTSTONE; LIGHT GRAY, MASSIVE.			23	100	
400					THIN MS ZONE @ 397.2' - 399.7'	71.3	15			
								24	82	
410							16	25	100	
					410.7' - 436.0' MUDSTONE; LIGHT GRAY (THIN ZONES OF SILT/MS INTERBEDS IN UPPER SECTION), ROOTED					
420						33.3	17	26	100	
							18	27	100	
430										

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: ROANS CANYON
DRILL HOLE: 83-3 (TW-8)
PAGE 4 OF 8

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
430					410.0' - 436.0' MUDSTONE; LIGHT GRAY	33.3	18	28	100	
440					436.0' - 452.0' INTERBEDS; SANDSTONE, LIGHT GRAY VERY FINE GRAIN / MUDSTONE, MEDIUM GRAY.	92	19, 20	29, 30	100, 100	
450					452.0' - 457.0' CARBONACEOUS MUDSTONE; DARK GRAY - BLACK, COAL STREAKS.	74.2				
460					457.0' - 472.5' MUDSTONE; LIGHT - MEDIUM GRAY, SILTY.	79.3	21, 22	31, 32	100, 100	
470					472.5' - 485.8' SILTSTONE; LIGHT - MEDIUM GRAY MASSIVE. OXIDATION FRACTURE @ 484.8' - 485.1'	91.6	23	33	100	
480					485.8' - 546.6' INTERBEDS; SANDSTONE, LIGHT GRAY, VERY FINE GRAIN / MUDSTONE, MEDIUM GRAY. POSSIBLE FAULT (0.6' CLAY/MUD) → — OXIDATION FRACTURES — 486.1' - 486.3', 493.9' - 494.3', 494.6' - 495.3', 499.6' - 503.2', 508.0' - 509.0' > W/ GOUGE — FLOW @ 505' 85 GPM —	93.4	24, 25, 26, 27	34, 35, 36, 37, 38	100, 100, 100, 98, 100	
490										
500										
510										
520										

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: ROANS CANYON
DRILL HOLE: 88-3 (TW-8)
PAGE 5 OF 8

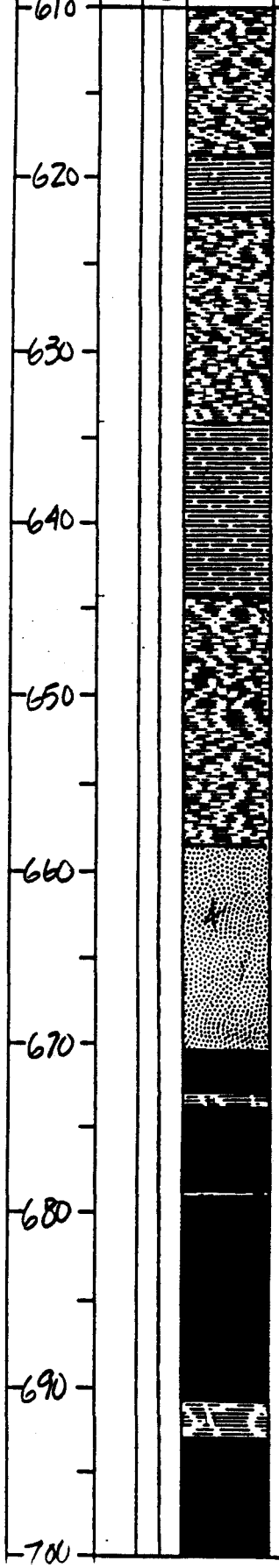
DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
520					OXIDATION FRACTURE @ 536.2', 538.5', 541.0', 543.0'	93.4	27, 28, 29, 30	38, 39, 40	100, 100, 100	
530, 540										
550					546.6' - 551.6' SANDSTONE, LIGHT GRAY, FINE GRAIN, MS/COAL LAMINAE. OXIDATION FRACTURES @ 547.6'-547.9' & 549.6'-551.6' THIN GOUGE ZONE (0.3')	97.8	30, 31	41, 42	99, 80	
					551.6' - 558.3 INTERBEDS; SANDSTONE, LIGHT GRAY, VERY FING GRAIN / MUDSTONE MED. GRAY. SOFT MS 551.6'-551.9'					
560					558.3' - 561.9' FAULT GOUGE; MUDSTONE, GRAY, SOFT, CORE LOSS (1.7')	40.7				
570					561.9' - 573.4' MUDSTONE; DARK GRAY - BLACK, SOFT, POKER CHIP FRACTURING, UPWARD FINING SEQUENCE.	64.5	32	43, 44	85, 80	
580					573.4' - 618.5' SILTSTONE; LIGHT - MEDIUM GRAY, MASSIVE. - OXIDATION FRACTURES - 573.4', 578.2' - 578.3', 583.8' - 583.9'; THIN SS W/SHALE STREAKS @ 583.5'-587.6'	95.4	33, 34	45, 46	100, 100	
590										
600					- VOID (1.2') @ 601.0 - 602.2' (FAULT?) - OXIDATION FRACTURES - 602.2' - 602.3', 602.7' - 602.8', 603.0 - 603.1', 604.9 - 605.0', 606.2' - 606.3', 608.1' - 608.3', 610.0' - 610.1', 611.0 611.1'		35, 36	47, 48	88, 94	
610										

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: Roans Canyon
DRILL HOLE: 88-3 (TW-3)
PAGE 6 OF 8



DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
610				BLACKHAWK FORMATION	573.4' - 618.5 SILTSTONE; DESCRIBED ON PREVIOUS PAGE.	95.4	37	48	96	
								49	100	
620					618.5' - 622.0' MUDSTONE; DARK GRAY, SILTY, DENSE, ROOTED.	100				
					622.0' - 634.0' SILTSTONE; LIGHT GRAY SANDY LAMINATED W/ SANDSTONE, MOTTLED.	95	38	50	100	
630							39			
					634.0' - 644.2' MUDSTONE; GRAY, SILTY DENSE, SLIGHT OXIDATION @ 634.2'	95.7	40	51	99	
640										
					644.2' - 658.4 SILTSTONE; LIGHT GRAY, SANDSTONE LAMINAE MOTTLED, SLIGHT OXIDATION @ 647.5	96.5	41	52	92	
650								53	100	
660					658.4' - 670.2' SANDSTONE; GRAY, MEDIUM GRAIN, UPPER 2.0' HIGHLY FRACTURED & OXIDIZED YELLOW-BROWN. - OXIDIZED FRACTURES - 666.0' - 666.1', 668.4' - 668.6'	96.6	42	54	96	
670					670.2' - 672.6' COAL	26.7	43	55	72	
					672.6' - 673.3 CARB. MUDSTONE	0				
					673.3' - 691.0' COAL	60.1				
					678.6' - 679.8 CARB. MUDSTONE; BLACK - DK GRAY	61.2	56			
680						16.3	44	57	88	
								58	98	
690					691.0' - 693.0' CMS; HIGHLY FRACTURED - STICKY	37.5				
					693.0' - 719.9' COAL; VERY BROKEN - PULVERIZED, RESINOUS	41.6	45	59	95	
700										

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: ROANS CANYON
DRILL HOLE: 88-3
PAGE 7 OF 8

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
700				BLACKHAWK FORMATION	693.0 - 719.9' COAL; MOSTLY BROKEN	41.6	45, 46, 47	60, 61	100, 100	
710										
720					719.9' - 721.2' MUDSTONE, GRAY, CLAYEY (FIRECLAY)	0		62	100	
					721.2' - 736.2' COAL; HIGHLY FRACTURED	24.2	48	63, 64	100, 100	
730										
					736.2' - 740.6' MUDSTONE, GRAY, DENSE, CLAYEY	34	49			
740					740.6' - 770.3' SILTSTONE LIGHT GRAY SANDY NEAR UPPER CONTACT.	90.6	50	65	100	
					748.4' - 748.6' MUDSTONE; DK GRAY	83.1	51, 52	66, 67, 68	100, 97, 100	
750										
760					OXIDIZED FRACTURES @ 762.0', 764.2' - 765.0', 766.0 - 767.0					
770					770.3' - 779.0' INTERBEDS. SILTSTONE LIGHT GRAY/MUDSTONE, MEDIUM GRAY. OXIDIZED FRACTURE @ 773.9' - 774.2'	85.6	53	69	100	
780					779.0' - 786.8' SANDSTONE; LIGHT GRAY, FINE GRAIN. BOTTOM 0.4' SHALE LAMINATED. OXIDIZED FRACTURE @ 778.5 - 778.6'	100	54	70	100	
					786.8' - 817.3 MUDSTONE; MEDIUM GRAY, MASSIVE - VERY HARD	91.6	55			
790										

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY
DEPT. OF MINING & EXPLORATION

PROJECT: Rans Canyon
DRILL HOLE: 88-3 (TW-8)
PAGE 8 OF 8

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
790				BLACKHAWK FORMATION	786.8 - 817.3 MUDSTONE MEDIUM GRAY VERY HARD SLIGHTLY SILTY THIN SANDSTONE @ 793.7' - 794.7' - OXIDIZED FRACTURES - 792.6' - 792.8' 794.5' - 794.7'	91.6	55	71	100	
800							56	72	100	
810							57	73	100	
820					817.3' - 818.7 CARB. MUDSTONE; DK GRAY, DENSE	0	58			
					818.7 - 822.8 COAL; SANDSTONE SPAR @ 821.0'	24.3				
					822.8' - 823.4' CARB. MUDSTONE; DK GRAY-BROWN	0		74	100	
					823.4' - 827.4 SILTSTONE; LIGHT GRAY, SANDY	88.6				
830					827.4 - 828.9 SANDSTONE; LT. GRAY, FINE GRAIN	83.7				
					828.9' - 835.5' COAL / CMS, 5.2' OF CORE LOSS	15.2	59	75	20	
					835.5' - 837.5' MUDSTONE DK GRAY - CLAYSTONE	0		76	72	
840			?		UNABLE TO COMPLETE HOLE DUE TO SQUEEZE ZONE @ 825' - 835'	0				
					T.D. 840'					
850					- CASED INTERVAL - 0' - 80' 4" STEEL 0' - 460' BX STEEL CASING 460' - 540' 2" STEEL SCREEN					

IN-MINE DRILL HOLE DATA SHEET

MINE ========) DEER CREEK 3RD NORTH
SECTION ========) ROANS CANYON FAULT DRILLING
HOLE NUMBER ========) 88-3
LOCATION ========)
DATE ========) JUNE 17, 1988

Interval				Horizontal Angle From Magnetic North			True Horizontal Depth		Vertical Angle From Horizontal		
from	to	length	bearing	degrees	interval	accumulation	interval	accumulation	Angle	interval	accumulation
0	15	15	NW	1	0.26	0.26	14.99	14.99	2	0.52	0.52
15	35	20	NW	1	0.35	0.61	20.00	34.99	-1	-0.35	0.17
35	55	20	NW	0	0.00	0.61	20.00	54.98	-1	-0.35	-0.17
55	75	20	NW	1	0.35	0.35	19.95	74.94	-4	-1.40	-1.57
75	95	20	NW	1	0.35	0.35	19.89	94.83	-6	-2.09	-3.66
95	115	20	NW	1	0.35	0.35	19.92	114.75	-5	-1.74	-5.40
115	135	20	NW	1	0.35	0.35	19.85	134.60	-7	-2.44	-7.84
[illegible]	155	20	NW	1	0.35	0.35	19.83	154.43	-7.5	-2.61	-10.45
155	175	20	NW	1	0.35	0.35	19.89	174.32	-6	-2.09	-12.54
175	195	20	NW	1	0.35	0.35	19.89	194.21	-6	-2.09	-14.63
195	215	20	NW	1	0.35	0.35	19.78	213.99	-8.5	-2.96	-17.59
215	235	20	NW	1	0.35	0.35	19.83	233.82	-7.5	-2.61	-20.20
235	255	20	NW	1	0.35	0.35	19.78	253.60	-8.5	-2.96	-23.16
255	275	20	NW	1	0.35	0.35	19.75	273.35	-9	-3.13	-26.28
275	295	20	NW	1	0.35	0.35	19.73	293.08	-9.5	-3.30	-29.59
295	315	20	NW	1	0.35	0.35	19.73	312.81	-9.5	-3.30	-32.89
315	335	20	NW	1	0.35	0.35	19.73	332.53	-9.5	-3.30	-36.19
335	355	20	NW	1	0.35	0.35	19.73	352.26	-9.5	-3.30	-39.49
355	375	20	NW	1	0.35	0.35	19.60	371.86	-11.5	-3.99	-43.48
375	395	20	NW	1	0.35	0.35	19.67	391.52	-10.5	-3.64	-47.12
395	415	20	NW	1	0.35	0.35	19.56	411.08	-12	-4.16	-51.28
415	435	20	NW	1	0.35	0.35	19.70	430.78	-10	-3.47	-54.75
435	455	20	NW	1	0.35	0.35	19.60	450.38	-11.5	-3.99	-58.74
455	475	20	NW	1	0.35	0.35	19.32	469.70	-15	-5.18	-63.91
475	495	20	NW	1	0.35	0.35	19.70	489.39	-10	-3.47	-67.39
495	515	20	NW	1	0.35	0.35	19.60	508.99	-11.5	-3.99	-71.38
515	535	20	NW	1	0.35	0.35	19.32	528.31	-15	-5.18	-76.55
535	555	20	NW	1	0.35	0.35	19.36	547.67	-14.5	-5.01	-81.56
555	575	20	NW	1	0.35	0.35	19.32	566.99	-15	-5.18	-86.74
575	595	20	NW	1	0.35	0.35	19.53	586.52	-12.5	-4.33	-91.06
595	615	20	NW	1	0.35	0.35	19.36	605.88	-14.5	-5.01	-96.07
615	635	20	NW	1	0.35	0.35	19.23	625.11	-16	-5.51	-101.58
[illegible]	655	20	NW	1	0.35	0.35	19.02	644.13	-18	-6.18	-107.77
[illegible]	675	20	NW	1	0.35	0.35	18.97	663.09	-18.5	-6.35	-114.11
675	695	20	NW	1	0.35	0.35	19.13	682.22	-17	-5.85	-119.96
695	715	20	NW	1	0.35	0.35	19.02	701.24	-18	-6.18	-126.14
715	735	20	NW	1	0.35	0.35	19.02	720.26	-18	-6.18	-132.32
735	755	20	NW	1	0.35	0.35	18.97	739.23	-18.5	-6.35	-138.67

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
238.53	0.00	0.00		MUDSTONE; GRAY TO DK GRAY;
239.14	0.61	0.61		SILTY IN UPPER 5';
243.40	4.26	4.26		SOME YELLOW STAINING ON FRACS.
246.14	2.74	2.74		
249.14	3.00	3.00		
249.85	0.71	0.71		
251.50	1.65	1.65	100.00%----------	
253.86	2.35	2.35		MUDSTONE; DK GRAY; SLICKENSIDED;
254.06	0.20	0.00		HIGHLY FRACTURED
254.16	0.10	0.00		
254.21	0.05	0.00		
254.61	0.40	0.40		
254.81	0.20	0.00		
254.96	0.15	0.00		
255.21	0.25	0.00		
255.46	0.25	0.00		
255.66	0.20	0.00		
256.11	0.45	0.45		
256.26	0.15	0.00		
256.51	0.25	0.00		
256.76	0.25	0.00		
256.96	0.20	0.00		
257.26	0.30	0.00		
257.41	0.15	0.00		
257.66	0.25	0.00		
257.76	0.10	0.00		
257.86	0.10	0.00		
259.21	1.35	1.35		
259.71	0.50	0.50		
260.92	1.20	1.20		
261.02	0.10	0.00		
261.17	0.15	0.00		
261.22	0.05	0.00		
261.37	0.15	0.00		
261.42	0.05	0.00		
261.57	0.15	0.00		
262.96	1.40	1.40	66.82%----------	
263.92	0.96	0.96		COAL
264.02	0.10	0.00	90.80%----------	
264.42	0.40	0.40		MUDSTONE; SANDY AT BASE
264.57	0.15	0.00		
264.62	0.05	0.00		
265.02	0.40	0.40		
265.22	0.20	0.00		
265.37	0.15	0.00		
265.67	0.30	0.00		
265.82	0.15	0.00		
265.92	0.10	0.00		
266.32	0.40	0.40		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

F ACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
266.47	0.15	0.00		
266.72	0.25	0.00		
267.07	0.35	0.00		
267.32	0.25	0.00		
267.72	0.40	0.00		
267.92	0.20	0.00		
268.27	0.35	0.00		
268.47	0.20	0.00		
268.77	0.30	0.00		
268.92	0.15	0.00		
269.12	0.20	0.00		
269.22	0.10	0.00		
269.37	0.15	0.00		
270.62	1.25	1.25		
271.17	0.55	0.55	42.01%----------	
271.27	0.10	0.00		FAULT GAUGE; MUDSTONE; SOFT; JUNK
295.43	24.16	0.00		
[illegible].58	0.16	0.00	0.00%----------	
295.93	0.35	0.00		SANDSTONE; LT. GRAY TO GRAY; FINE GRAINED;
296.69	0.75	0.75		FRACTURE STAINING
297.54	0.85	0.85		
297.89	0.35	0.00		
298.09	0.20	0.00		
298.19	0.10	0.00		
298.59	0.40	0.40		
298.69	0.10	0.00		
298.79	0.10	0.00		
299.24	0.45	0.45		
299.24	0.00	0.00		
299.39	0.15	0.00		
299.54	0.15	0.00		
299.84	0.30	0.00		
300.29	0.45	0.45		
300.49	0.20	0.00		
300.89	0.40	0.40		
301.19	0.30	0.00		
301.64	0.45	0.45		
301.99	0.35	0.00		
302.29	0.30	0.00		
302.59	0.30	0.00		
302.69	0.10	0.00		
302.89	0.20	0.00		
[illegible].04	0.15	0.00		
[illegible].19	0.15	0.00		
303.34	0.15	0.00		
303.79	0.45	0.45		
303.99	0.20	0.00		
304.19	0.20	0.00		
304.55	0.35	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
304.60	0.05	0.00		
304.90	0.30	0.00		
305.05	0.15	0.00		
305.20	0.15	0.00		
305.45	0.25	0.00		
305.65	0.20	0.00		
305.90	0.25	0.00		
306.40	0.50	0.50		
306.70	0.30	0.00		
307.05	0.35	0.00		
307.65	0.60	0.60		
307.85	0.20	0.00		
308.00	0.15	0.00		
308.30	0.30	0.00		
308.50	0.20	0.00		
308.75	0.25	0.00		
[illegible].00	0.25	0.00		
[illegible].10	0.10	0.00		
309.50	0.40	0.40		
309.90	0.40	0.00		
311.05	1.15	1.15		
312.10	1.05	1.05		
313.40	1.30	1.30		
314.35	0.95	0.95		
315.05	0.70	0.70		
324.57	9.52	9.52		
325.47	0.90	0.90		SLIGHT INCREASE IN WATER
327.22	1.75	1.75		
328.41	1.20	1.20		
329.42	1.00	1.00		
334.12	4.70	4.70		
337.16	3.04	3.04	79.29%	----------
337.66	0.51	0.51		MUDSTONE; DK GRAY; SOME CMS
341.06	3.40	3.40	100.00%	----------
341.17	0.11	0.00		SILTSTONE; GRAY; MUDDY;
341.27	0.10	0.00		SOME STAINING ON FRACS.
341.57	0.30	0.00		
341.62	0.05	0.00		
341.88	0.26	0.00		
341.98	0.10	0.00		
342.53	0.55	0.55		
342.88	0.35	0.00		
[illegible].98	0.10	0.00		
343.08	0.10	0.00		
343.33	0.25	0.00		
344.43	1.10	1.10		
344.93	0.50	0.50		
345.77	0.84	0.84		
346.77	1.00	1.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
347.38	0.61	0.61		
347.79	0.40	0.40		
349.34	1.55	1.55		
351.24	1.90	1.90		
352.30	1.06	1.06		
353.30	0.99	0.99		
353.34	0.05	0.00		
353.44	0.10	0.00		
353.65	0.20	0.00		
353.70	0.05	0.00		
354.70	1.00	1.00		
354.75	0.05	0.00		
355.80	1.05	1.05		
356.95	1.15	1.15		
357.10	0.15	0.00		
357.10	0.00	0.00		
[illegible]7.25	0.15	0.00		
[illegible].40	0.15	0.00		
357.70	0.30	0.00		
357.75	0.05	0.00		
358.86	1.11	1.11		
359.46	0.60	0.60		
359.51	0.05	0.00		
359.56	0.05	0.00		
359.71	0.15	0.00		
360.32	0.61	0.61	83.27%----------	
360.42	0.10	0.00		MUDSTONE; DARK GRAY; EASILY FRACTURED
361.32	0.90	0.90		IN DRILLING
361.52	0.20	0.00		
361.77	0.25	0.00		
362.02	0.25	0.00		
362.43	0.40	0.40		
362.77	0.35	0.00		
364.28	1.50	1.50		
364.99	0.71	0.71		
367.03	2.04	2.04		
367.99	0.96	0.96		
368.19	0.20	0.00		
368.19	0.00	0.00		
368.29	0.10	0.00		
368.55	0.26	0.00	79.21%----------	
370.94	2.40	2.40		SILTSTONE; LIGHT GRAY; ROOTED
[illegible].40	0.45	0.45		
[illegible]1.75	0.36	0.00		
373.41	1.66	1.66		
374.92	1.51	1.51		
375.32	0.40	0.40		
375.67	0.35	0.00		
376.07	0.40	0.40		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
376.92	0.84	0.84		
378.43	1.52	1.52		
380.49	2.06	2.06		
380.74	0.25	0.00		
381.04	0.30	0.00		
381.09	0.05	0.00		
381.19	0.10	0.00		
381.24	0.05	0.00		
381.29	0.05	0.00		
381.44	0.15	0.00		
381.54	0.10	0.00		
381.84	0.30	0.00		
381.94	0.10	0.00		
382.23	0.30	0.00		
382.23	0.00	0.00		
382.33	0.10	0.00		
[illegible]2.53	0.20	0.00	80.33%	----------
[illegible].13	0.60	0.60		SANDSTONE; LIGHT GRAY; VERY FINE GRAINED
384.90	1.77	1.77		
385.25	0.34	0.00		
386.26	1.01	1.01		
386.95	0.70	0.70		
387.80	0.85	0.85		
387.90	0.10	0.00		
388.05	0.15	0.00		
388.31	0.25	0.00		
388.36	0.05	0.00		
388.56	0.20	0.00		
388.56	0.00	0.00	81.73%	----------
388.81	0.25	0.00		MUDSTONE; MEDIUM GRAY; HARD
388.86	0.05	0.00		
389.77	0.91	0.91		
390.22	0.45	0.45		
390.42	0.20	0.00		
390.67	0.25	0.00		
390.92	0.25	0.00		
391.02	0.10	0.00		
391.84	0.81	0.81		
392.22	0.38	0.00		
392.77	0.54	0.54		
393.73	0.96	0.96	71.12%	----------
394.82	1.10	1.10		SILTSTONE; LIGHT GRAY; MASSIVE
[illegible].43	0.61	0.61		
[illegible].38	1.95	1.95		
397.78	0.40	0.00		
398.03	0.25	0.00		
398.43	0.40	0.40		
398.98	0.55	0.55		
399.39	0.40	0.40		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
400.25	0.86	0.86		
400.44	0.20	0.00		
400.70	0.25	0.00		
400.80	0.10	0.00		
401.00	0.20	0.00		
401.10	0.10	0.00		
401.15	0.05	0.00		
401.45	0.30	0.00		
401.55	0.10	0.00		
401.55	0.00	0.00		
401.70	0.15	0.00		
401.90	0.20	0.00		
402.00	0.10	0.00		
402.25	0.25	0.00		
402.65	0.40	0.40		
403.00	0.35	0.00		
403.60	0.61	0.61		
404.05	0.45	0.45		
404.80	0.75	0.75		
405.46	0.66	0.66		
405.96	0.50	0.50		
406.06	0.10	0.00		
406.46	0.40	0.00		
406.61	0.15	0.00		
406.86	0.25	0.00		
407.31	0.45	0.45		
407.47	0.15	0.00		
407.61	0.15	0.00		
407.76	0.15	0.00		
408.61	0.85	0.85		
409.16	0.55	0.55		
410.12	0.95	0.95		
410.32	0.20	0.00		
410.42	0.10	0.00		
410.57	0.15	0.00		
410.62	0.05	0.00	71.28%----------	
411.67	1.05	1.05		MUDSTONE; LT GRAY; SILTY
411.92	0.25	0.00		
412.02	0.10	0.00		
412.28	0.25	0.00		
412.63	0.35	0.00		
412.78	0.15	0.00		
[illegible].38	0.60	0.60		
[illegible].48	0.10	0.00		
413.83	0.35	0.00		
414.19	0.35	0.00		
414.59	0.40	0.40		
414.89	0.30	0.00		
415.14	0.25	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
415.3[illegible]	0.25	0.00		
415.59	0.20	0.00		
415.69	0.10	0.00		
416.08	0.40	0.00		
416.23	0.15	0.00		
416.63	0.40	0.00		
416.99	0.35	0.00		
417.23	0.25	0.00		
417.49	0.25	0.00		
417.99	0.51	0.51		
418.19	0.20	0.00		
418.54	0.35	0.00		
419.09	0.55	0.55		
419.19	0.10	0.00		
420.20	1.01	1.01		
420.45	0.25	0.00		
[illegible].85	0.40	0.00		
[illegible].90	0.05	0.00		
421.00	0.10	0.00		
421.15	0.15	0.00		
421.45	0.30	0.00		
421.65	0.20	0.00		
421.80	0.15	0.00		
422.10	0.31	0.00		
422.25	0.15	0.00		
422.56	0.31	0.00		
422.71	0.15	0.00		
423.06	0.35	0.00		
423.21	0.15	0.00		
424.11	0.90	0.90		
424.32	0.20	0.00		
424.67	0.35	0.00		
424.92	0.25	0.00		
425.42	0.50	0.50		
425.82	0.40	0.00		
425.87	0.05	0.00		
426.07	0.20	0.00		
426.32	0.25	0.00		
426.52	0.20	0.00		
426.77	0.25	0.00		
427.07	0.30	0.00		
427.17	0.10	0.00		
[illegible].32	0.15	0.00		
[illegible].62	0.30	0.00		
427.87	0.25	0.00		
428.02	0.15	0.00		
428.27	0.25	0.00		
428.52	0.25	0.00		
428.57	0.05	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
428.88	0.30	0.00		
428.98	0.10	0.00		
429.08	0.10	0.00		
429.18	0.10	0.00		
429.42	0.25	0.00		
429.57	0.15	0.00		
430.21	0.63	0.63		
430.36	0.15	0.00		
430.46	0.10	0.00		
430.81	0.35	0.00		
431.41	0.60	0.60		
431.56	0.15	0.00		
431.66	0.10	0.00		
432.11	0.45	0.45		
432.41	0.30	0.00		
432.67	0.25	0.00		
[illegible]3.07	0.40	0.40		
[illegible]3.62	0.55	0.55		
433.97	0.35	0.00		
434.32	0.35	0.00		
434.37	0.05	0.00		
434.47	0.10	0.00		
434.77	0.30	0.00		
435.13	0.35	0.00	33.30%----------	
435.93	0.80	0.80		INTERBEDS; SANDSTONE; LT GRAY; VFG;
436.94	1.01	1.01		MUDSTONE; MED. GRAY
437.64	0.70	0.70		
438.44	0.80	0.80		
439.25	0.80	0.80		
440.40	1.15	1.15		
440.65	0.25	0.00		
440.85	0.20	0.00		
442.76	1.91	1.91		
443.56	0.80	0.80		
443.92	0.35	0.00		
445.37	1.46	1.46		
446.68	1.31	1.31		
446.83	0.15	0.00		
448.89	2.06	2.06		
449.44	0.55	0.55		
450.19	0.75	0.75		
451.25	1.05	1.05		
[illegible].60	0.35	0.00	92.04%----------	
[illegible]2.05	0.45	0.45		CARBMUDSTONE; COAL STREAKS
452.41	0.35	0.00		
452.81	0.40	0.40		
453.01	0.20	0.00		
453.21	0.20	0.00		
454.52	1.31	1.31		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
454.82	0.30	0.00		
454.92	0.10	0.00		
455.02	0.10	0.00		
455.72	0.70	0.70		
456.47	0.75	0.75	74.18%----------	
457.38	0.90	0.90		MUDSTONE; LIGHT-MEDIUM GRAY; SILTY
458.08	0.70	0.70		
458.53	0.45	0.45		
458.68	0.15	0.00		
458.83	0.15	0.00		
459.19	0.35	0.00		
459.49	0.30	0.00		
459.84	0.35	0.00		
460.09	0.25	0.00		
461.65	1.56	1.56		
462.50	0.85	0.85		
[illegible]2.60	0.10	0.00		
[illegible]2.90	0.30	0.00		
462.95	0.05	0.00		
463.15	0.20	0.00		
463.30	0.15	0.00		
463.30	0.00	0.00		
463.71	0.40	0.40		
464.06	0.35	0.00		
464.16	0.10	0.00		
464.86	0.70	0.70		
465.57	0.70	0.70		
467.07	1.51	1.51		
467.52	0.45	0.45		
467.52	0.00	0.00		
467.67	0.15	0.00		
468.38	0.70	0.70		
470.13	1.76	1.76		
470.74	0.60	0.60		
471.09	0.35	0.00		
472.50	1.41	1.41	79.30%----------	
473.80	1.31	1.31		SILTSTONE; LIGHT TO MED. GRAY; MASSIVE
474.86	1.05	1.05		
478.37	3.51	3.51		
479.03	0.65	0.65		
481.18	2.16	2.16		
482.04	0.86	0.86		
[illegible]4.55	2.51	2.51		
[illegible]4.80	0.25	0.00		
485.10	0.30	0.00		
485.20	0.10	0.00		
485.50	0.30	0.00		
485.66	0.15	0.00	91.60%----------	
485.91	0.25	0.00		INTERBEDS; SANDSTONE; LIGHT GRAY; VFG;

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
488.51	2.61	2.61	MUDSTONE; MED. GRAY	
490.57	2.06	2.06		
490.62	0.05	0.00		
490.78	0.15	0.00		
490.88	0.10	0.00		
490.98	0.10	0.00		
491.03	0.05	0.00		
491.18	0.15	0.00		
493.39	2.21	2.21	OXIDATION	
493.54	0.15	0.00		
494.89	1.35	1.35	OXIDATION	
498.66	3.77	3.77		
499.06	0.40	0.40		
499.11	0.05	0.00		
499.41	0.30	0.00		
499.62	0.20	0.00	OXIDATION	
[illegible]99.72	0.10	0.00		
[illegible]9.92	0.20	0.00		
500.02	0.10	0.00		
500.12	0.10	0.00		
500.17	0.05	0.00		
501.48	1.31	1.31		
501.53	0.05	0.00		
501.78	0.25	0.00	OXIDATION	
502.03	0.25	0.00		
502.18	0.15	0.00		
502.28	0.10	0.00		
502.33	0.05	0.00		
502.48	0.15	0.00		
502.78	0.30	0.00		
505.34	2.56	2.56	OXIDATION	
508.36	3.01	3.01		
508.71	0.35	0.00	OXIDATION	
508.86	0.15	0.00	OXIDATION	
508.96	0.10	0.00	OXIDATION	
513.63	4.67	4.67		
514.13	0.50	0.50		
514.78	0.65	0.65		
515.79	1.00	1.00		
518.40	2.61	2.61		
520.45	2.05	2.05		
521.25	0.80	0.80		
[illegible]2.25	1.00	1.00		
[illegible]4.76	2.50	2.50		
525.61	0.85	0.85		
526.36	0.75	0.75		
530.86	4.50	4.50		
532.51	1.65	1.65		
536.37	3.85	3.85	OXIDATION	

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
538.22	1.85	1.85	OXIDATION	
540.92	2.70	2.70	OXIDATION	
543.18	2.25	2.25	OXIDATION	
545.43	2.25	2.25		
546.48	1.05	1.05	93.39%----------	
549.98	3.50	3.50	SANDSTONE; LIGHT GRAY; FG;	
551.09	1.10	1.10		
551.79	0.70	0.70		
551.94	0.15	0.00		
553.79	1.85	1.85		
553.89	0.10	0.00		
558.04	4.15	4.15	97.84%----------	
558.39	0.35	0.00	GOUGE; SOFT MUDSTONE;	
558.44	0.05	0.00		
558.64	0.20	0.00		
558.79	0.15	0.00		
[illegible]9.04	0.25	0.00		
[illegible]9.44	0.40	0.40		
559.69	0.25	0.00		
560.15	0.45	0.45		
560.45	0.30	0.00		
560.55	0.10	0.00		
561.05	0.50	0.50		
561.40	0.35	0.00		
561.80	0.40	0.40		
561.95	0.15	0.00		
562.10	0.15	0.00		
562.35	0.25	0.00	40.72%----------	
562.45	0.10	0.00	MUDSTONE; DK. GRAY-BLACK; SOFT;	
562.60	0.15	0.00	POKER CHIP FRACTURING	
562.70	0.10	0.00	FINING UPWARD SEQUENCE	
562.80	0.10	0.00		
562.80	0.00	0.00		
562.95	0.15	0.00		
563.35	0.40	0.00		
563.40	0.05	0.00		
563.70	0.30	0.00		
564.00	0.30	0.00		
564.10	0.10	0.00		
564.40	0.30	0.00		
564.65	0.25	0.00		
564.70	0.05	0.00		
[illegible]4.75	0.05	0.00		
[illegible]5.00	0.25	0.00		
565.20	0.20	0.00		
565.20	0.00	0.00		
565.50	0.30	0.00		
565.65	0.15	0.00		
566.00	0.35	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
566.50	0.50	0.50		
566.50	0.00	0.00		
566.55	0.05	0.00		
566.95	0.40	0.00		
566.95	0.00	0.00		
566.95	0.00	0.00		
567.60	0.65	0.65		
568.00	0.40	0.40		
568.50	0.50	0.50		
569.16	0.65	0.65		
569.71	0.55	0.55		
570.16	0.45	0.45		
572.81	2.65	2.65		
573.91	1.10	1.10	64.51%----------	
575.91	2.00	2.00		SILTSTONE; LIGHT TO MED GRAY; MASSIVE
578.97	3.05	3.05		
[illegible].02	1.05	1.05		
[illegible].12	1.10	1.10		
583.62	2.50	2.50		OXIDATION
584.12	0.50	0.50		
589.83	5.71	5.71		
590.83	1.00	1.00		
591.08	0.25	0.00		
591.88	0.80	0.80		
593.78	1.90	1.90		
596.09	2.30	2.30		
601.39	5.30	5.30		
602.44	1.05	0.00	95.44%----------	
603.84	1.40	1.40		SILTSTONE; LIGHT GRAY; SANDY
605.10	1.25	1.25		
606.05	0.95	0.95		OXIDATION
608.05	2.00	2.00		OXIDATION
610.00	1.95	1.95		OXIDATION
610.61	0.61	0.61		OXIDATION
614.92	4.31	4.31		
616.02	1.10	1.10		
617.37	1.35	1.35		
618.57	1.20	1.20	100.00%----------	
619.22	0.65	0.65		MUDSTONE; DK. GRAY; SILTY; DENSE
620.47	1.25	1.25		
620.98	0.50	0.50		
621.38	0.40	0.40		
[illegible].29	1.91	1.91	100.00%----------	
[illegible].43	0.15	0.00		SILTSTONE; LT. GRAY; SANDY
626.14	2.71	2.71		
626.54	0.40	0.00		
627.34	0.80	0.80		
628.85	1.50	1.50		
633.31	4.46	4.46		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
634.21	0.90	0.90	94.98%----------	
634.46	0.25	0.00		MUDSTONE; GRAY; SILTY
634.61	0.15	0.00		
636.61	2.00	2.00		
643.58	6.97	6.97	95.72%----------	
647.49	3.91	3.91		SILTSTONE; LT. GRAY; SANDY
648.14	0.65	0.65		
648.34	0.20	0.00		
649.84	1.50	1.50		
651.25	1.40	1.40		
651.80	0.55	0.55		
653.70	1.90	1.90		
656.10	2.41	2.41		
657.36	1.25	1.25		
657.91	0.55	0.55		
658.67	0.75	0.75		
[illegible]9.01	0.34	0.00	96.45%----------	
[illegible]9.11	0.10	0.00		SANDSTONE; GRAY; MED. GRAINED
660.57	1.46	1.46		
661.67	1.11	1.11		
663.02	1.35	1.35		
666.33	3.31	3.31		OXIDATION
666.78	0.45	0.45		
668.84	2.06	2.06		OXIDATION
669.74	0.90	0.90		
670.49	0.75	0.75		
670.79	0.30	0.00	96.59%----------	
670.84	0.05	0.00		COAL
670.94	0.10	0.00		
671.04	0.10	0.00		
671.34	0.30	0.00		
671.44	0.10	0.00		
671.74	0.30	0.00		
671.89	0.15	0.00		
671.94	0.05	0.00		
672.54	0.60	0.60		
672.59	0.05	0.00		
672.64	0.05	0.00		
673.04	0.40	0.00	26.69%----------	
673.29	0.25	0.00		CARBMUDSTONE
673.39	0.10	0.00		
673.39	0.00	0.00		
[illegible].69	0.30	0.00		
[illegible]3.69	0.00	0.00		
673.89	0.20	0.00		
673.94	0.05	0.00		
674.30	0.35	0.00		
674.30	0.00	0.00		
674.40	0.10	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

F ACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
674.50	0.10	0.00		
674.55	0.05	0.00		
674.65	0.10	0.00		
674.65	0.00	0.00	0.00%----------	
674.95	0.30	0.00	COAL	
675.00	0.05	0.00		
675.10	0.10	0.00		
675.25	0.15	0.00		
675.30	0.05	0.00		
675.35	0.05	0.00		
675.80	0.45	0.45		
676.30	0.50	0.50		
676.45	0.15	0.00		
676.45	0.00	0.00		
676.60	0.15	0.00		
676.80	0.20	0.00		
676.85	0.05	0.00		
[illegible].00	0.15	0.00		
677.10	0.10	0.00		
677.30	0.20	0.00		
678.91	1.60	1.60	60.07%----------	
679.06	0.15	0.00	CARBMUDSTONE; BLACK TO DK. GRAY	
679.11	0.05	0.00		
679.26	0.15	0.00		
679.81	0.55	0.55	61.17%----------	
679.91	0.10	0.00	COAL; HIGHLY FRACTURED	
680.92	1.01	1.01		
680.92	0.00	0.00		
681.02	0.10	0.00		
681.12	0.10	0.00		
681.22	0.10	0.00		
681.32	0.10	0.00		
681.42	0.10	0.00		
681.51	0.10	0.00		
681.61	0.10	0.00		
681.76	0.15	0.00		
681.96	0.20	0.00		
682.21	0.25	0.00		
682.46	0.25	0.00		
682.66	0.20	0.00		
682.76	0.10	0.00		
682.96	0.20	0.00		
[illegible].17	0.20	0.00		
[illegible].57	0.40	0.40		
683.67	0.10	0.00		
683.82	0.15	0.00		
684.17	0.35	0.00		
684.27	0.10	0.00		
684.42	0.15	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
684.52	0.10	0.00		
684.92	0.40	0.40		
685.02	0.10	0.00		
685.22	0.20	0.00		
685.37	0.15	0.00		
685.37	0.00	0.00		
685.42	0.05	0.00		
685.57	0.15	0.00		
685.67	0.10	0.00		
686.02	0.35	0.00		
686.02	0.00	0.00		
686.32	0.30	0.00		
686.47	0.15	0.00		
686.67	0.20	0.00		
686.82	0.15	0.00		
687.02	0.20	0.00		
687.12	0.10	0.00		
[illegible].17	0.05	0.00		
687.37	0.20	0.00		
687.77	0.40	0.00		
687.82	0.05	0.00		
688.02	0.20	0.00		
688.12	0.10	0.00		
688.37	0.25	0.00		
688.43	0.05	0.00		
688.58	0.15	0.00		
688.88	0.30	0.00		
688.88	0.00	0.00		
688.98	0.10	0.00		
689.13	0.15	0.00		
689.23	0.10	0.00		
689.38	0.15	0.00		
689.58	0.20	0.00		
689.73	0.15	0.00		
689.83	0.10	0.00		
689.93	0.10	0.00		
690.08	0.15	0.00		
690.13	0.05	0.00		
690.28	0.15	0.00		
690.53	0.25	0.00		
690.53	0.00	0.00		
690.63	0.10	0.00		
[illegible].68	0.05	0.00		
[illegible].73	0.05	0.00		
690.78	0.05	0.00		
691.08	0.30	0.00		
690.88	-0.20	0.00	16.33%	
691.79	0.90	0.90		CARBMUDSTONE; HIGHLY FRACTURED
691.89	0.10	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
691.99	0.10	0.00		
691.99	0.00	0.00		
692.09	0.10	0.00		
692.39	0.30	0.00		
692.39	0.00	0.00		
692.69	0.30	0.00		
692.74	0.05	0.00		
692.79	0.05	0.00		
692.89	0.10	0.00		
692.89	0.00	0.00		
692.99	0.10	0.00		
693.04	0.05	0.00		
693.29	0.25	0.00	37.49%	----------
693.99	0.70	0.70	COAL; PULVERIZED	
694.04	0.05	0.00		
694.04	0.00	0.00		
[illegible].14	0.10	0.00		
[illegible].19	0.05	0.00		
694.29	0.10	0.00		
694.34	0.05	0.00		
694.39	0.05	0.00		
695.24	0.85	0.85		
695.49	0.25	0.00		
695.69	0.20	0.00		
695.84	0.15	0.00		
696.20	0.35	0.00		
696.40	0.20	0.00		
696.65	0.25	0.00		
696.90	0.25	0.00		
697.30	0.40	0.40		
697.35	0.05	0.00		
697.65	0.30	0.00		
697.90	0.25	0.00		
698.05	0.15	0.00		
698.10	0.05	0.00		
698.15	0.05	0.00		
698.25	0.10	0.00		
698.35	0.10	0.00		
698.35	0.00	0.00		
699.15	0.80	0.80		
699.20	0.05	0.00		
699.45	0.25	0.00		
[illegible].50	0.05	0.00		
[illegible].55	0.05	0.00		
699.60	0.05	0.00		
699.65	0.05	0.00		
699.75	0.10	0.00		
700.31	0.55	0.55		
700.31	0.00	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
700.31	0.00	0.00		
700.36	0.05	0.00		
700.46	0.10	0.00		
700.46	0.00	0.00		
700.51	0.05	0.00		
700.86	0.35	0.00		
701.11	0.25	0.00		
701.11	0.00	0.00		
701.16	0.05	0.00		
701.46	0.30	0.00		
701.46	0.00	0.00		
701.61	0.15	0.00		
701.76	0.15	0.00		
702.01	0.25	0.00		
702.16	0.15	0.00		
702.26	0.10	0.00		
[illegible].41	0.15	0.00		
[illegible].51	0.10	0.00		
702.66	0.15	0.00		
702.91	0.25	0.00		
703.01	0.10	0.00		
703.11	0.10	0.00		
703.31	0.20	0.00		
703.36	0.05	0.00		
703.46	0.10	0.00		
703.51	0.05	0.00		
703.56	0.05	0.00		
703.61	0.05	0.00		
703.66	0.05	0.00		
704.32	0.66	0.66		
704.47	0.15	0.00		
705.06	0.60	0.60		
705.11	0.05	0.00		
705.77	0.65	0.65		
706.02	0.25	0.00		
706.17	0.15	0.00		
706.37	0.20	0.00		
706.67	0.31	0.00		
706.67	0.00	0.00		
706.82	0.15	0.00		
707.17	0.35	0.00		
708.02	0.85	0.85		
[illegible]32	0.30	0.00		
[illegible].32	0.00	0.00		
708.42	0.10	0.00		
708.57	0.15	0.00		
708.57	0.00	0.00		
708.77	0.20	0.00		
708.87	0.10	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
708.92	0.05	0.00		
708.92	0.00	0.00		
709.23	0.30	0.00		
709.23	0.00	0.00		
709.48	0.25	0.00		
709.73	0.25	0.00		
709.73	0.00	0.00		
709.93	0.20	0.00		
711.43	1.50	1.50		
711.98	0.55	0.55		
712.58	0.60	0.60		
714.13	1.55	1.55		
714.13	0.00	0.00		
714.49	0.36	0.00		
714.59	0.10	0.00		
714.74	0.15	0.00		
[illegible].09	0.35	0.00		
[illegible].29	0.20	0.00		
715.39	0.10	0.00		
715.69	0.30	0.00		
715.99	0.30	0.00		
716.19	0.20	0.00		
716.59	0.40	0.00		
716.69	0.10	0.00		
716.79	0.10	0.00		
717.19	0.40	0.00		
717.34	0.15	0.00		
717.49	0.15	0.00		
717.64	0.15	0.00		
717.69	0.05	0.00		
717.89	0.20	0.00		
718.29	0.40	0.40		
718.74	0.45	0.45		
718.89	0.15	0.00		
719.09	0.20	0.00		
719.14	0.05	0.00		
719.19	0.05	0.00		
719.29	0.10	0.00		
719.34	0.05	0.00		
719.49	0.15	0.00		
719.64	0.15	0.00		
719.74	0.10	0.00		
[illegible].74	0.00	0.00		
[illegible]9.99	0.25	0.00	41.64%----------	
720.24	0.25	0.00		MUDSTONE; CLAYEY; GRAY
720.35	0.10	0.00		
720.40	0.05	0.00		
720.45	0.05	0.00		
720.45	0.00	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
720.80	0.35	0.00		
720.85	0.05	0.00		
720.95	0.10	0.00		
721.10	0.15	0.00		
721.30	0.20	0.00		
721.35	0.05	0.00		
721.35	0.00	0.00		
721.45	0.10	0.00		
721.55	0.10	0.00		
721.75	0.20	0.00		
721.85	0.10	0.00		
721.95	0.10	0.00	0.00%----------	
722.35	0.40	0.00		COAL; HIGHLY FRACTURED
722.35	0.00	0.00		
722.40	0.05	0.00		
722.55	0.15	0.00		
[illegible].70	0.15	0.00		
[illegible].75	0.05	0.00		
722.80	0.05	0.00		
723.05	0.25	0.00		
723.25	0.20	0.00		
723.35	0.10	0.00		
723.81	0.45	0.45		
723.86	0.05	0.00		
723.96	0.10	0.00		
724.01	0.05	0.00		
724.26	0.25	0.00		
724.31	0.05	0.00		
724.56	0.25	0.00		
724.61	0.05	0.00		
724.85	0.25	0.00		
725.05	0.20	0.00		
725.20	0.15	0.00		
725.30	0.10	0.00		
725.40	0.10	0.00		
725.70	0.30	0.00		
725.75	0.05	0.00		
725.90	0.15	0.00		
726.05	0.15	0.00		
726.20	0.15	0.00		
726.30	0.10	0.00		
726.55	0.25	0.00		
[illegible].86	0.30	0.00		
[illegible].91	0.05	0.00		
727.01	0.10	0.00		
727.31	0.30	0.00		
727.31	0.00	0.00		
727.61	0.30	0.00		
727.76	0.15	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
727.81	0.05	0.00		
727.81	0.00	0.00		
727.96	0.15	0.00		
728.66	0.71	0.71		
728.86	0.20	0.00		
730.32	1.46	1.46		
730.67	0.35	0.00		
730.72	0.05	0.00		
730.77	0.05	0.00		
731.02	0.25	0.00		
731.27	0.25	0.00		
731.78	0.50	0.50		
731.83	0.05	0.00		
731.88	0.05	0.00		
731.93	0.05	0.00		
732.28	0.35	0.00		
[illegible].33	0.05	0.00		
[illegible].53	0.20	0.00		
732.93	0.40	0.00		
733.07	0.15	0.00		
733.07	0.00	0.00		
733.37	0.30	0.00		
733.42	0.05	0.00		
733.42	0.00	0.00		
733.77	0.35	0.00		
733.77	0.00	0.00		
733.77	0.00	0.00		
733.97	0.20	0.00		
733.97	0.00	0.00		
734.02	0.05	0.00		
734.27	0.25	0.00		
734.27	0.00	0.00		
734.43	0.15	0.00		
734.43	0.00	0.00		
734.53	0.10	0.00		
734.53	0.00	0.00		
734.82	0.30	0.00	24.24%----------	
734.99	0.17	0.00	MUDSTONE; GRAY; DENSE	
735.00	0.00	0.00		
735.05	0.05	0.00		
735.30	0.25	0.00		
735.30	0.00	0.00		
[illegible].40	0.10	0.00		
[illegible].54	0.15	0.00		
735.69	0.15	0.00		
735.79	0.10	0.00		
736.09	0.30	0.00		
736.34	0.25	0.00		
736.49	0.15	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
736.59	0.10	0.00		
736.59	0.00	0.00		
736.74	0.15	0.00		
736.79	0.05	0.00		
736.84	0.05	0.00		
737.09	0.25	0.00		
737.34	0.25	0.00		
737.59	0.25	0.00		
738.15	0.55	0.55		
738.20	0.05	0.00		
738.20	0.00	0.00		
738.25	0.05	0.00		
738.50	0.25	0.00		
738.50	0.00	0.00		
738.80	0.31	0.00		
738.86	0.05	0.00		
739.45	0.59	0.59		
[illegible].09	0.65	0.65	34.00%	----------
[illegible]0.30	0.21	0.00		SILTSTONE; LT GRAY; SANDY
740.30	0.00	0.00		
740.46	0.16	0.00		
740.73	0.26	0.00		
740.74	0.01	0.00		
740.91	0.17	0.00		
743.06	2.14	2.14		
743.96	0.90	0.90		
744.76	0.81	0.81		
745.62	0.86	0.86		
748.82	3.20	3.20	90.60%	----------
749.12	0.30	0.00		MUDSTONE; DK GRAY
749.78	0.66	0.66		
750.02	0.24	0.00		
750.73	0.71	0.71		
751.08	0.35	0.00		
751.53	0.45	0.45		
751.83	0.30	0.00		
752.23	0.40	0.00		
752.83	0.60	0.60		
753.33	0.50	0.50		
753.78	0.45	0.45		
754.18	0.40	0.00		
754.88	0.70	0.70		
[illegible].89	2.00	2.00		
[illegible].54	0.65	0.65		
758.19	0.65	0.65		
761.94	3.75	3.75		
762.95	1.01	1.01		
763.21	0.25	0.00		
764.56	1.35	1.35		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
764.56	0.00	0.00		
764.66	0.10	0.00		
764.86	0.20	0.00		
765.06	0.20	0.00		
766.21	1.14	1.14		
766.26	0.05	0.00		
766.31	0.05	0.00		
766.46	0.15	0.00		
766.72	0.26	0.00		
766.82	0.10	0.00		
766.97	0.15	0.00		
767.07	0.10	0.00		
767.12	0.05	0.00		
768.01	0.90	0.90		
768.77	0.75	0.75		
770.51	1.75	1.75	83.13%----------	
771.72	1.20	1.20		INTERBEDS; SILTSTONE; LT. GRAY
[illegible].92	0.20	0.00		MUDSTONE; MED. GRAY
773.13	1.21	1.21		
774.28	1.15	1.15		
774.38	0.10	0.00		
774.53	0.15	0.00		
774.63	0.10	0.00		
774.93	0.30	0.00		
775.03	0.10	0.00		
775.58	0.55	0.55		
777.90	2.31	2.31		
778.20	0.30	0.00		
779.25	1.05	1.05	85.64%----------	
779.70	0.45	0.45		SANDSTONE; LIGHT GRAY; FINE GRAINED
782.86	3.16	3.16		
783.36	0.50	0.50		
783.97	0.60	0.60		
784.57	0.60	0.60		
786.62	2.05	2.05	100.00%----------	
786.67	0.05	0.00		MUDSTONE; MED. GRAY; VERY HARD; MASSIVE
788.38	1.71	1.71		
788.68	0.30	0.00		
788.99	0.30	0.00		
789.24	0.25	0.00		
789.53	0.29	0.00		
791.70	2.17	2.17		
[illegible].56	0.86	0.86		
[illegible].41	1.85	1.85		
795.47	1.05	1.05		
795.57	0.10	0.00		
795.67	0.10	0.00		
797.77	2.10	2.10		
804.64	6.87	6.87		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
808.80	4.16	4.16		
808.85	0.05	0.00		
809.05	0.20	0.00		
810.45	1.40	1.40		
812.61	2.15	2.15		
812.96	0.35	0.00		
813.26	0.30	0.00		
814.11	0.85	0.85		
814.56	0.45	0.45		
816.27	1.70	1.70		
816.82	0.55	0.55		
817.12	0.30	0.00		
817.52	0.40	0.40	91.57%----------	
817.52	0.00	0.00		CARBMUDSTONE; DK GRAY; HIGHLY FRACTURED
817.63	0.11	0.00		
817.73	0.10	0.00		
817.94	0.21	0.00		
[illegible].99	0.05	0.00		
818.29	0.30	0.00		
818.34	0.05	0.00		
818.54	0.20	0.00		
818.68	0.15	0.00	0.00%----------	
818.68	-0.00	0.00		COAL; BLACK
818.78	0.10	0.00		
818.88	0.10	0.00		
818.98	0.10	0.00		
819.08	0.10	0.00		
819.13	0.05	0.00		
819.33	0.20	0.00		
819.43	0.10	0.00		
819.43	0.00	0.00		
819.88	0.45	0.45		
819.88	0.00	0.00		
820.03	0.15	0.00		
820.23	0.20	0.00		
820.28	0.05	0.00		
820.63	0.35	0.00		
820.78	0.15	0.00		
820.94	0.15	0.00		
821.19	0.25	0.00		
821.34	0.15	0.00		
821.88	0.54	0.54		
[illegible].28	0.40	0.00		
[illegible].38	0.10	0.00		
822.78	0.40	0.00	24.32%----------	
823.08	0.30	0.00		CARBMUDSTONE; DK GRAY TO BROWN; CLAYEY
823.40	0.32	0.00	0.00%----------	
825.44	2.04	2.04		SILTSTONE; LT GRAY; SANDY
826.19	0.75	0.75		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

F ACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
826.94	0.75	0.75		
827.04	0.10	0.00		
827.30	0.25	0.00		
327.40	0.10	0.00	88.57%----------	
327.55	0.15	0.00		SANDSTONE; LT. GRAY; FINE GRAINED; SILTY
827.70	0.15	0.00		
328.14	0.44	0.44		
328.90	0.76	0.76	88.66%----------	
829.85	0.95	0.95		COAL; TIGHT SQUEEZE ZONE
329.90	0.05	0.00		
329.95	0.05	0.00		
830.10	0.15	0.00		
830.20	0.10	0.00		
330.40	0.20	0.00		
330.45	0.05	0.00		
830.75	0.30	0.00		
[illegible].85	0.10	0.00		
[illegible].90	0.05	0.00		
831.15	0.25	0.00		
831.20	0.05	0.00		
331.35	0.15	0.00		
831.45	0.10	0.00		
831.80	0.35	0.00		
332.05	0.25	0.00		
332.25	0.20	0.00		
832.60	0.35	0.00		
332.75	0.15	0.00		
333.00	0.25	0.00		
833.20	0.20	0.00		
833.41	0.20	0.00		
333.56	0.15	0.00		
333.66	0.10	0.00		
833.91	0.25	0.00		
333.96	0.05	0.00		
334.06	0.10	0.00		
834.26	0.20	0.00		
334.36	0.10	0.00		
334.51	0.15	0.00		
834.56	0.05	0.00		
834.61	0.05	0.00		
334.81	0.20	0.00		
834.86	0.05	0.00		
[illegible].11	0.25	0.00	15.22%----------	
[illegible].21	0.10	0.00		MUDSTONE; DK. GRAY; CLAYSTONE BUT NOT SOFT
335.21	0.00	0.00		
835.41	0.20	0.00		
335.41	0.00	0.00		
335.51	0.10	0.00		
835.56	0.05	0.00		

ROANS CANYON FAULT DRILLING
DRILL HOLE 88-3
FRACTURE ANALYSIS

FRACTURE DEPTH	FRACTURE INTERVAL	RQD INTERVAL	RQD	LITHOLOGY
835.66	0.10	0.00		
835.91	0.25	0.00		
835.91	0.00	0.00		
836.11	0.20	0.00		
836.16	0.05	0.00		
836.26	0.10	0.00		
836.41	0.15	0.00		
836.41	0.00	0.00		
836.46	0.05	0.00		
836.61	0.15	0.00		
836.61	0.00	0.00		
836.86	0.25	0.00		
836.86	0.00	0.00		
836.86	0.00	0.00		
836.91	0.05	0.00		
836.91	0.00	0.00		
836.96	0.05	0.00		
836.96	0.00	0.00		
837.11	0.15	0.00		
837.11	0.00	0.00		
837.21	0.10	0.00		
837.56	0.35	0.00		
837.81	0.25	0.00		
837.86	0.05	0.00		
837.96	0.10	0.00		
838.01	0.05	0.00		
838.06	0.05	0.00		
838.36	0.30	0.00		
838.41	0.05	0.00		
838.51	0.10	0.00		
838.56	0.05	0.00		
838.66	0.10	0.00		
838.71	0.05	0.00		
838.76	0.05	0.00		
838.91	0.15	0.00		
839.01	0.10	0.00		
839.26	0.25	0.00		
839.46	0.20	0.00		
839.46	0.00	0.00		
839.66	0.20	0.00		
839.71	0.05	0.00		
839.91	0.20	0.00		
[illegible].06	0.15	0.00	0.00%	----------

COAL LITHOLOGIC LOG
UTAH POWER & LIGHT COMPANY
DEPT. OF MINING & EXPLORATION

PAGE 1 OF ____

PROJECT: ROANS CANYON HYDRO PROJECT DRILL HOLE: 88-4 (TW-9)

LOCATION: 3RD N XC-65 1 3/4
COLLAR ELEV.: ____
HOLE TYPE: PLUG/CORE
PLUG INTERVAL: 0 - 120.8'
CORE INTERVAL: 120.8'-
TOTAL DEPTH: ____
DATE: 7/25 -
SCALE: 1" - 10'
GEOLOGIST: ____

GEOPHYSICAL DATA

LOG	FROM	TO
DENSITY:		
H.R.D.:		
E. LOG:		
GAMMA:		
CALIPER:		
S.P.:		

LOG

COAL SUMMARY:

SEAM	THICKNESS	INT.
N/A		

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
0					0 - 120.8' PLUGGED INTERVAL 0'-100' COAL 100-101 CMS 101-115 COAL 115-120.8 CMS/MS					
110										
120			SS		120.8'-123.2' SANDSTONE; LT. GRAY, FINE GRAIN, SHALE LAMINAE	100		1	69	
			FAULT GOUGE		123.2'-130.6' FAULT ZONE, SANDSTONE; LIGHT GRAY FINE GRAIN W/ SOFT MS/SS FAULT GOUGE @125.5 - 127.8' CORE LOSS 123.2'-125.5'	0	1	2	89	
130					130.6' - 131.9 MUDSTONE, DK GRAY, SOFT, silty					
					131.9 - 163.0 Interbedded. Fine Grnd SS, SLts		2	3	97	
140										
150							3	4	100	
160							4	5	100	
					163.0-248.2 Sandstone fine Grnd Laminae, some muddy Layers		5	6	100	

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: Deer Creek
DRILL HOLE: 88-4 Tw 9
PAGE 2 OF ____

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
170							5	6	100	
180							6	7	100	
190							7	8	100	
200							3	9	100	
210							9	10	100	
220					Some Stain		10	11	100	
230							11	12	99	
240							12	13	100	
250					248.2-257.0 Coal Fractured some cms Poor recovery		13	14	78	
								15	52	
					257.0-263.2' Interbedded ms/slts					

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY
DEPT. OF MINING & EXPLORATION

PROJECT: _____
DRILL HOLE: 83-4
PAGE 3 OF _____

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
260					-263.2' Int. MS/SLts			16	100	
					263.2'-270.2' MUDSTONE, DK GRAY-BLACK, SLOW DRILLING FROM 267.0 - 270.2'		14	17	100	
270					270.2'-274.8' SILTSTONE; LIGHT-MEDIUM GRAY, ROOTED.		15			
					274.8'-297.5 INTERBDS. SS. LIGHT GRAY, VERY FING GRAIN, MS; MEDIUM GRAY. OXIDATION FRACTURES 277.7 - 277.9' 280.5 - 280.7' 282.8 - 283.1 286.3 - 286.5 288.2 - 288.9 > H_2O INCREASED 290.2 - 290.3 FINING DOWNWARD SEQUENCE		16	18	100	
280								19	100	
290							17			
					297.5-332.0' MUDSTONE, LIGHT GRAY, ROOTED, VERY HARD, SL. SILTY		18	20	100	
300								21	100	
310							19			
								22	100	
320							20			
								23	91	
330					FAULT H_2O #1 VOID → FLOW 80 GPM. (OPEN HOLE) VERY HIGH SEDIMENT LOAD - SAND 332.0 - 346.3 Sandstone weathered Poor recovery		21	24	35	
340								25	85	
					346.3 - 352.5 Sandstone fine Grnd Lt Gray, weathered on Fractures		22	26	99	
350										

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: Bears Canyon
DRILL HOLE:
PAGE 4 OF

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
350					352.5 261.2 Weathered Sandstone		23	26	99	
								27	95	
360					361.2'-380.7' Sandstone Lt Gray Fractures weathered		24	28	100	
370					MS Ripups from 368.2-380.7'					
							25	29	100	
380					380.7-401.6 Sandstone weathered TOTAL OXIDATION		26			
390								30	98	
400					1.6' OF CORE LOSS SMALL VOIDS GRADITIONAL CONTACT		27	31	82	
					401.6'-403.8' IB's SS/MS LIGHT GRAY					
					403.8-408.7 COAL LOWER 1.4' CMS/MS		28	32	80	
410					408.7'-411.0 FAULT GOUGE & CORE LOSS SOFT GRAY MUD					
					411.0'-418.4 IB's; SANDSTONE; LT GRAY, VFG, MUDSTONE/SILTSTONE MEDIUM GRAY. OXIDIZED FRACTURES @ 412.1-412.2 413.6-413.7 412.4-412.5 414.1-414.2			33	100	
420					418.4'-424.5 SILTSTONE, MEDIUM GRAY VERY HARD		29			
								34	100	
					424.5'-427.7 MUDSTONE, DARK GRAY-BROWN (VERY SLOW DRILLING)					
430					427.7'-438.3 SILTSTONE; LIGHT GRAY OXIDIZED FRACTURE @ 435.3'-435.7'		30	35	97	
							31	36	100	
440					438.3'- IB's SILTSTONE/SS/MS LT GRAY					

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY
DEPT. OF MINING & EXPLORATION

PROJECT: Rolls Canyon
DRILL HOLE: 83-4
PAGE 5 OF ____

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
440					438.3'-449.0 INTERBEDS SILTSTONE/SANDSTONE/MUDSTONE LIGHT GRAY OXIDATION FRACTURES 443.2 - 443.5 451.3' - 451.6' 447.3 - 447.5		31	36	100	
450					449.0' 476.3 SANDSTONE LT. GRAY VFG, SINGLE LAMINAE. OXIDATION FRACTURES 453.1 - 453.4 458.7 - 458.9 463.3 - 464.0 467.3 - 469.4 471.4 - 473.0		32	37	100	
460							33	38	100	
470							34	39	100	
480					476.3 - 497.2 Mudstone, Med Gray 1' coally interval 480.3 very Dense [illegible]		35	40	80	
490							36	41	100	
500					497.2 - 518.6 [illegible] lt to med gray [illegible] fractures 510.6 511.3 513.6' 514.7' 515.6 518.3		37	42	100	
510							38	43	100	
520					518.6' - IBS. SANDSTONE LT GRAY UFG, MUDSTONE/SILTSTONE MEDIUM GRAY. OXIDATION FRACTURES 518.6 521.9 525.0 - 525.2' FAULT GOUGE ORANGE MUD 525.8 - 526.2 528.6 - 529.0 530.6 - 531.6 ← H2O' PRODUCER		39	44	100	
530							40	45	92	

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY
DEPT. OF MINING & EXPLORATION

PROJECT: Roans Canyon
DRILL HOLE: 88-4
PAGE 6 OF ____

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
530					518.6'-546.7 IBs; SANDSTONE LT VFG-FG MUDSTONE SILTSTONE MEDIUM GRAY.		40	45	92	
540					OXIDATION FRACTURES 533.3 - 533.8 536.1 - 536.6' 534.4 - 534.6 537.5 - 537.6 541.2' - 541.3'			46	97	
					546.7'-550.0 COAL/CMS CRUSHED/BROKEN → POOR RECOVERY	0		47	91	
550					550.0'-558.7 SILTSTONE; MEDIUM GRAY			48	97	
560					558.7'-562.1 MUDSTONE DK GRAY-BROWN					
					562.1'-574.5 SILTSTONE LT.-MEDIUM GRAY Oxidation Fractures 564.3 567.3 571.3 564.8 568.4 571.6 566.3 569.6 572.9		43	49	100	
570					574.5-580.3 MS DK Gray Dense poor Recovery		44	50	96	
580					580.3-582.6 Siltstone Lt Gray					
					582.6 592.3 Interbedded MS-SLts Med to Lt Gray		45	51	93	
590					592.3-624.2 Mudstone Med to DK Gray, Dense		46	52	100	
600							47	53	100	
610							48	54	100	
620										

COAL LITHOLOGIC LOG

UTAH POWER & LIGHT COMPANY

DEPT. OF MINING & EXPLORATION

PROJECT: _____

DRILL HOLE: 88-A

PAGE 7 OF _____

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX NO.	RUN NO.	% REC.	SAMPLE
620					592.3-624.2 MS Med to DK Gray			54	100	
					624.2 631.6 Int. MS/SLts (Core loss)		49	55	95	
630					631.6-635.3 Sandstone fine Grnd Lt Gray					
					635.3-641.3 Int. MS/SLts Lt to Med Gray		50	56	94	
640					641.3- MS Very soft, DK Gray to Black, slickensided,			57	100	
650										
670										
680										
690										
700										

IN-MINE DRILL HOLE DATA SHEET

MINE ========> DEER CREEK 3RD NORTH
SECTION ========> ROANS CANYON FAULT DRILLING
HOLE NUMBER ========> 88-4
LOCATION ========>
DATE ========> JULY 30, 1988

Interval			Horizontal Angle From Magnetic North				True Horizontal Depth		Vertical Angle From Horizontal		
rrom	to	length	bearing	degrees	interval	accumulation	interval	accumulation	Angle	interval	accumulation
0	10	10	NW	1	0.17	0.17	9.98	9.98	3.5	0.61	0.61
10	30	20	NW	1	0.35	0.52	20.00	29.98	0.5	0.17	0.79
30	50	20	NW	0	0.00	0.52	19.97	49.95	-3	-1.05	-0.26
50	70	20	NW	1	0.35	0.35	19.94	69.89	-4.5	-1.57	-1.83
[illegible]	90	20	NW	1	0.35	0.35	19.89	89.78	-6	-2.09	-3.92
90	110	20	NW	1	0.35	0.35	19.87	109.65	-6.5	-2.26	-6.19
110	130	20	NW	1	0.35	0.35	19.87	129.52	-6.5	-2.26	-8.45
130	150	20	NW	1	0.35	0.35	19.85	149.38	-7	-2.44	-10.89
150	170	20	NW	1	0.35	0.35	19.83	169.20	-7.5	-2.61	-13.50
170	190	20	NW	1	0.35	0.35	19.81	189.01	-8	-2.78	-16.28
190	210	20	NW	1	0.35	0.35	19.70	208.71	-10	-3.47	-19.75
210	230	20	NW	1	0.35	0.35	19.73	228.43	-9.5	-3.30	-23.05
230	250	20	NW	1	0.35	0.35	19.60	248.03	-11.5	-3.99	-27.04
250	270	20	NW	1	0.35	0.35	19.56	267.59	-12	-4.16	-31.20
270	290	20	NW	1	0.35	0.35	19.60	287.19	-11.5	-3.99	-35.19
290	310	20	NW	1	0.35	0.35	19.60	306.79	-11.5	-3.99	-39.18
310	330	20	NW	1	0.35	0.35	19.53	326.32	-12.5	-4.33	-43.50
330	350	20	NW	1	0.35	0.35	19.70	346.01	-10	-3.47	-46.98
350	370	20	NW	1	0.35	0.35	19.67	365.68	-10.5	-3.64	-50.62
370	390	20	NW	1	0.35	0.35	19.60	385.28	-11.5	-3.99	-54.61
390	410	20	NW	1	0.35	0.35	19.32	404.59	-15	-5.18	-59.79
410	430	20	NW	1	0.35	0.35	19.36	423.96	-14.5	-5.01	-64.79
430	450	20	NW	1	0.35	0.35	19.32	443.28	-15	-5.18	-69.97
450	470	20	NW	1	0.35	0.35	19.27	462.55	-15.5	-5.34	-75.31
470	490	20	NW	1	0.35	0.35	19.41	481.95	-14	-4.84	-80.15
490	510	20	NW	1	0.35	0.35	19.36	501.32	-14.5	-5.01	-85.16
510	530	20	NW	1	0.35	0.35	19.36	520.68	-14.5	-5.01	-90.17
530	550	20	NW	1	0.35	0.35	19.23	539.91	-16	-5.51	-95.68
550	570	20	NW	1	0.35	0.35	19.07	558.98	-17.5	-6.01	-101.69
[illegible]	590	20	NW	1	0.35	0.35	19.07	578.05	-17.5	-6.01	-107.71
[illegible]	610	20	NW	1	0.35	0.35	19.02	597.08	-18	-6.18	-113.89

3rd North, Deer Creek Mine

Flow Data Report

Hole # 88-4 Date: 7/25-26 Shift: _____

Drill Interval	Run #	Time:	Injection Rate:	Discharge Rate:	Run
120.8-124.3	1	4:10-4:20	20 GPM	20 GPM	1
124.3-132.3	2	5:00-5:30	30 GPM	30 GPM	2
132.2-143.2		530-730	30 GPM	30 GPM	3
143.2-153.2		7:30-755	10 GPM	10 GPM	4
153.2-163.2		7:55-8:15	10	.2 100 H_2O Between Runs	5
163.2-173.2		8:15 8:40	10	.2 " " "	6
173.2-183.2		8:40-9:05	10	.2 " "	7
Break				.02	
183.2-193.2		10:00-10:15	10	.2	8
193.2-203.2		10:15 10:35	10	.2	9
203.2 213.2		10:35-11:00	10	.2	10
213.2-223.2		11:00-11:30	10	.2 .14 Between Runs	11
223.2-233.2		11:30-12:00	10	.2 " "	12
233.2-243.2		12:00-12:30	10	.2	13
243.2-253.2		12:30-12 50	10	.22	14
253.2-258.2		12:50-1:15	10	.22	15
258.2 263.5		1:15-1:45	10	.22	16
7-26-88		FLOW 12 GPM			
88-1 63.5 PSI		88-2 72.5 PSI	88-3 59 PSI	85-5 71.5 PSI	
263.5-273.0		9:40-10:20	10	.23	17
273.0-283.0'		10:40-11:10	FLOW @ OF RUN 10 21.5 + .18 =	.21	18
283.0-293.0		11:30-12:00	10-12 85-5 68 PSI	.22	19
293.0-303.0		FLOW @ END OF RUN 20 1:10-1:50 17+.21	12-14 85-2 100.5 4 43 5 68.5	.22 88-1 62 2 71 3 58.5	20
303.0-313.0		2:05-2:45	12-14	.22	21
313.0-323.0		255-3:28	12-14	.22	22

3rd North, Deer Creek Mine
Flow Data Report

Hole # 88-4 Date: 7/26-27 Shift: _____

Drill Interval	Time:	Injection Rate:	Discharge Rate:	RUN #
323.0-333.0	3:50-4:30	12-14	.23	23
OPEN HOLE FLOW @ 333'		80 GPM		
333.0-336.4	630-820	12	.24	24
336.4-343.2	920 9:20	12 GPM	.24	25
343.3-353.2	1045 11:30	12	.24	26
353.2-363.2	11:30-12:00	12	.24	27
363.2-373.2	12:00-12:40	12	.24	28
373.2-383.2	12:40-1:15	13	.24	29
383.2-393.2	1:15 2:00	13	.24	30
open hole	Flow at 393'	[illegible] GPM		
7-27-88 85-2 = 98 85-4 = 41.5	85-5 = 65 88-1 = 56	88-2 = 65.5 88-3 = 52.5		
393.2-402.0	9:00AM-9:11 DRILLING INNER BARREL PREMATURE!	PRESSURE INCREASE PULLED 15	.21	31
	FLOW @ 402'	PIPE 120 GPM + WEIR .18		
402.0'-412.0'	9:35-10:05	12-14	.20	32
	FLOW @ 412'	PIPE 60 GPM + WEIR .20		
412.0'-422.0'	10:20-11:04	12-14	.23	33
422.0-426.0	SHORT RUN - VERY SLOW CUTTING 11:30-12:00	12-14	FLOW @ 422 60 GPM + .20 WEIR .23	34
426.0-433.3'	1:10-1:40	12-14	.23	35
433.3'-443.3'	2:00-2:47	12-14	.23	36
443.3'-453.3'	3:00-3:47	12-14	.23	37
85-2: 98.5 85-4: 40	85-5 = 63 88-1 = 58.5	88-2 = 66.5 88-3 = 54.5		
	FLOW @ 453.3	44 GPM @ 60 PSI		
453.3'-463.3'	4:15-5:15	10-12	.22	38

3rd North, Deer Creek Mine
Flow Data Report

Hole # 88-4 Date: 7/27- Shift: _____

Drill Interval	Time:	Injection Rate:	Discharge Rate:	RUN #
463.3'- [illegible]	[illegible] - 7:10	[illegible]	[illegible]	39
[illegible]	[illegible] - 8:10	12	.24	40
[illegible]	8:10 - 9:20	12	.24	41
[illegible]	11:45 - 1:00	12	.24	42
[illegible] 513.3	1:00 [illegible]	12	.24	43
513.3 - 523.3	9:40 - 10.27	15	.23	44
523.3 - 533.3	10:50 - 11:40	15 FLOW @ 533' 53 GPM HIGH SEDIMENT GOOD	.23	45
533.3' - 543.3'	12:00 - 1:30	15 FLOW @ 543 60 GPM	.23	46
543.3' - 553.3'	1:50 - 2:40	12-14 FLOW @ 553 25 GPM	.22	47
553.3 - 563.3'	3.04 - 4:00	12-14	.23	48
563.3 - [illegible]	4:00 5:15	12-14	.24	49
573.3 - 583.3	5.15 - 630	12-14	.24	50
583.3 - 593.3	630 - 720	12-14	.24	51
593.3 - 603.3	7:20 - 825	12-14	.23	52
603.3 - 613.3	8:25 - 925	12-14	.23	53
613.3 - 623.3	10:20 - 11:20	12-14	.23	54
623.3 - 633.3	11:20 - 12:10	12-14	.23	55
633.3 - 642.9	12:10 - 1:05 AM	12-14	.23	56
642.9 648.3	105 - 230	12-14	.23	57

Currant Depth
648.3.

Lots of mud,
May need to ream

TW-10 88-S

DATE 8/29 - 9/2

FAULT INFO: 1ST FAULT = 118 - 128

2ND FAULT = 723-729 & 735-737

FLOW INFO: 0' - 200 GPM

180' - 100 GPM

380' - 75 GPM

550 - 75 GPM

640 - 50 GPM

720 - 38 GPM

CASING INFO: 0' - 80' 4" STEEL

0' - 340' BX CASING

340' - 410 2" STEEL SCREEN

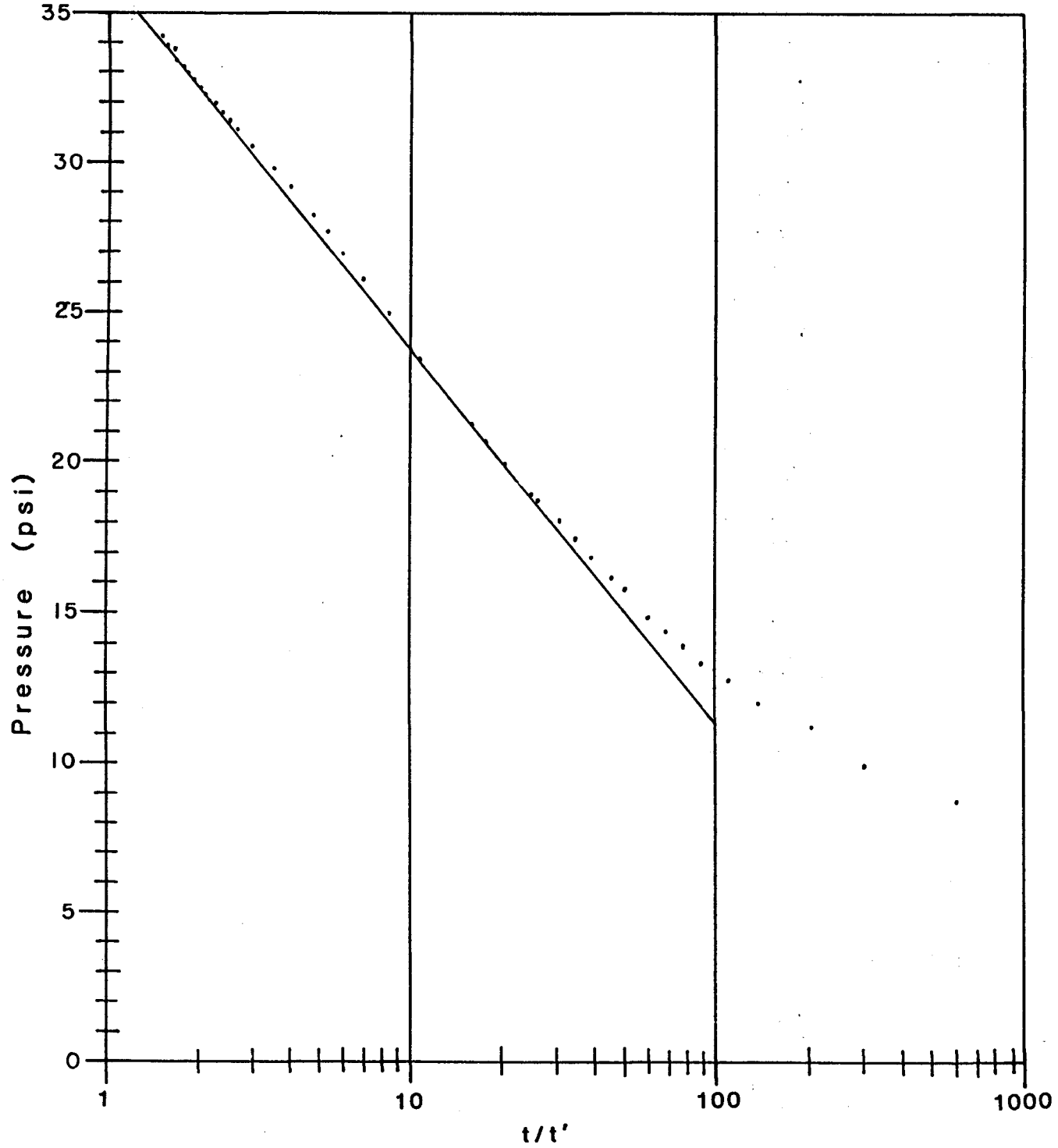
410' - 650' BX CASING

650' - 700' 2" STEEL SCREEN

IN-MINE DRILL HOLE DATA SHEET

MINE ========) DEER CREEK 3RD NORTH
SECTION ========) ROANS CANYON FAULT DRILLING
HOLE NUMBER ========) 88-5
LOCATION ========)
DATE ========) SEPT. 01, 1988

Interval				Horizontal Angle From Magnetic North			True Horizontal Depth		Vertical Angle From Horizontal		
on	to	length	bearing	degrees	interval	accumulation	interval	accumulation	Angle	interval	accumulat
0	10	10	NW	1	0.17	0.17	9.98	9.98	3.5	0.61	0.61
10	30	20	NW	1	0.35	0.52	19.96	29.94	3.5	1.22	1.83
30	50	20	NW	0	0.00	0.52	19.94	49.88	4.5	1.57	3.40
50	70	20	NW	1	0.35	0.35	19.96	69.85	3.5	1.22	4.62
[illegible]	90	20	NW	1	0.35	0.35	19.97	89.82	3	1.05	5.67
[illegible]	110	20	NW	1	0.35	0.35	19.97	109.79	3	1.05	6.72
110	130	20	NW	1	0.35	0.35	20.00	129.79	0.5	0.17	6.89
130	150	20	NW	1	0.35	0.35	20.00	149.79	0	0.00	6.89
150	170	20	NW	1	0.35	0.35	19.99	169.78	-2	-0.70	6.19
170	190	20	NW	1	0.35	0.35	20.00	189.78	0.5	0.17	6.37
190	210	20	NW	1	0.35	0.35	19.99	209.76	2	0.70	7.06
210	230	20	NW	1	0.35	0.35	19.99	229.75	2	0.70	7.76
230	250	20	NW	1	0.35	0.35	19.99	249.75	1.5	0.52	8.29
250	270	20	NW	1	0.35	0.35	19.99	269.74	1.5	0.52	8.81
270	290	20	NW	1	0.35	0.35	20.00	289.74	0	0.00	8.81
290	310	20	NW	1	0.35	0.35	19.99	309.73	1.5	0.52	9.33
310	330	20	NW	1	0.35	0.35	20.00	329.73	0.5	0.17	9.51
330	350	20	NW	1	0.35	0.35	19.99	349.72	1.5	0.52	10.03
350	370	20	NW	1	0.35	0.35	19.98	369.70	2.5	0.87	10.90
370	390	20	NW	1	0.35	0.35	19.99	389.70	1.5	0.52	11.43
390	410	20	NW	1	0.35	0.35	19.98	409.68	2.5	0.87	12.30
410	430	20	NW	1	0.35	0.35	20.00	429.68	0.5	0.17	12.47
430	450	20	NW	1	0.35	0.35	19.99	449.67	1.5	0.52	13.00
450	470	20	NW	1	0.35	0.35	19.97	469.64	3	1.05	14.04
470	490	20	NW	1	0.35	0.35	19.99	489.64	1.5	0.52	14.57
490	510	20	NW	1	0.35	0.35	19.94	509.58	4.5	1.57	16.14
510	530	20	NW	1	0.35	0.35	19.98	529.56	2.5	0.87	17.01
530	550	20	NW	1	0.35	0.35	19.98	549.54	2.5	0.87	17.88
550	570	20	NW	1	0.35	0.35	19.98	569.52	2.5	0.87	18.75
570	590	20	NW	1	0.35	0.35	19.96	589.48	3.5	1.22	19.97
[illegible]	610	20	NW	1	0.35	0.35	20.00	609.48	1	0.35	20.32
[illegible]	630	20	NW	1	0.35	0.35	20.00	629.48	1	0.35	20.67
630	650	20	NW	1	0.35	0.35	20.00	649.48	0	0.00	20.67
650	670	20	NW	1	0.35	0.35	19.98	669.46	2.5	0.87	21.55
670	690	20	NW	1	0.35	0.35	19.97	689.43	3	1.05	22.59



$$T = \frac{264\ Q}{\Delta s}$$

$$T = \frac{264\,(4.5)}{(23.75 - 11.25)\ 2.31}$$

$$T = 41\ \text{gpd / ft}$$

$$K = \frac{41}{11} = 3.7\ \text{gpd/ft}^2$$

$$K = 1.7 \times 10^{-4}\ \text{cm/sec}$$

Figure: B-1
HORNER PLOT
Well: TW-6
Interval: 295'-306'

PROJECT	REVISIONS
DATE	

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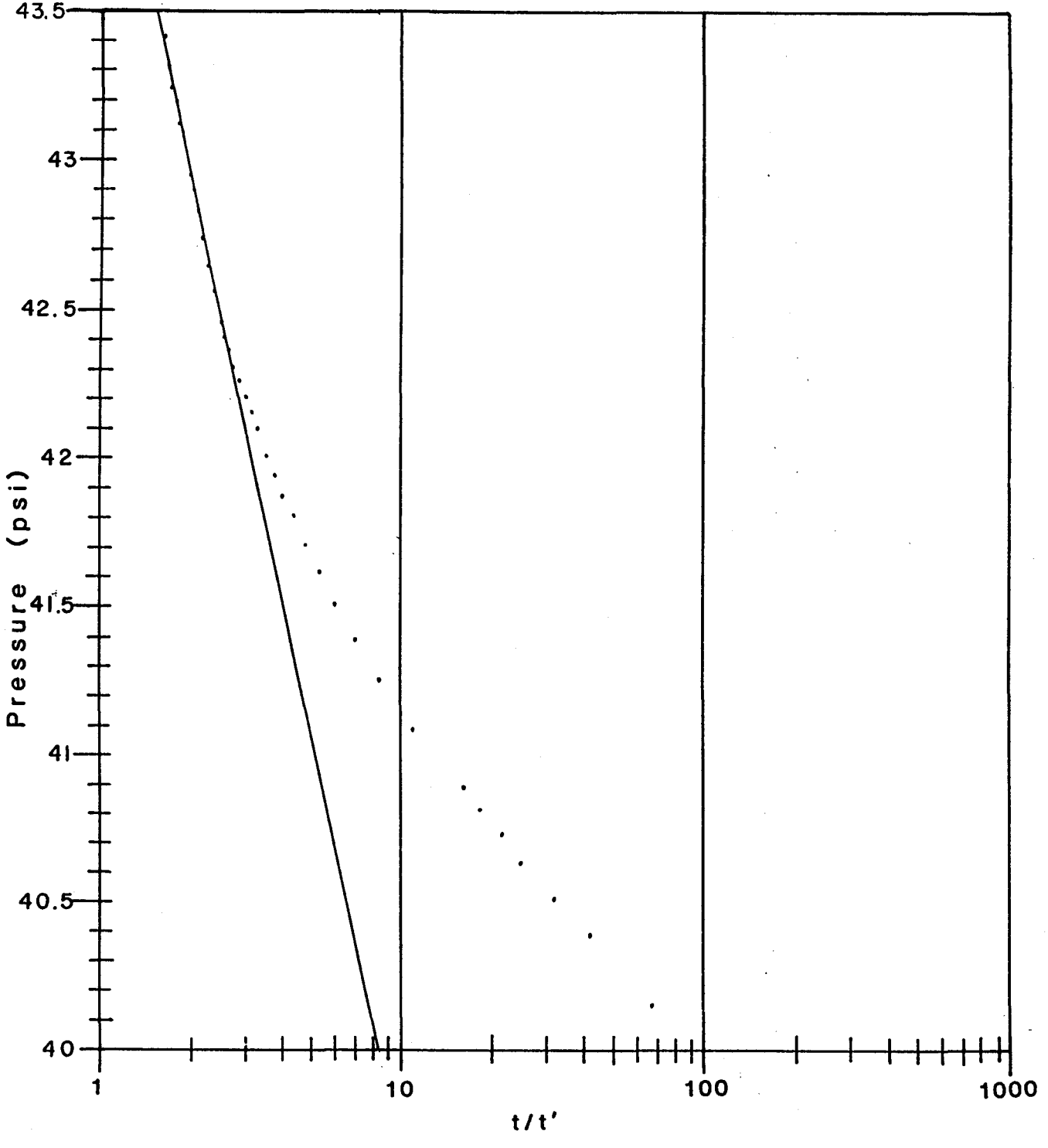
FIGURE



$$T = \frac{264\,Q}{\Delta s}$$

$$T = \frac{264\,(8.5)}{(43.5 - 38.85)(2.31)}$$

$$T = 208 \text{ gpd/ft}$$

$$K = \frac{208}{11} = 19 \text{ gpd/ft}^2$$

$$K = 9 \times 10^{-4} \text{ cm/sec}$$

Figure: B-2
HORNER PLOT
Well: TW-6
Interval: 485'- 496'

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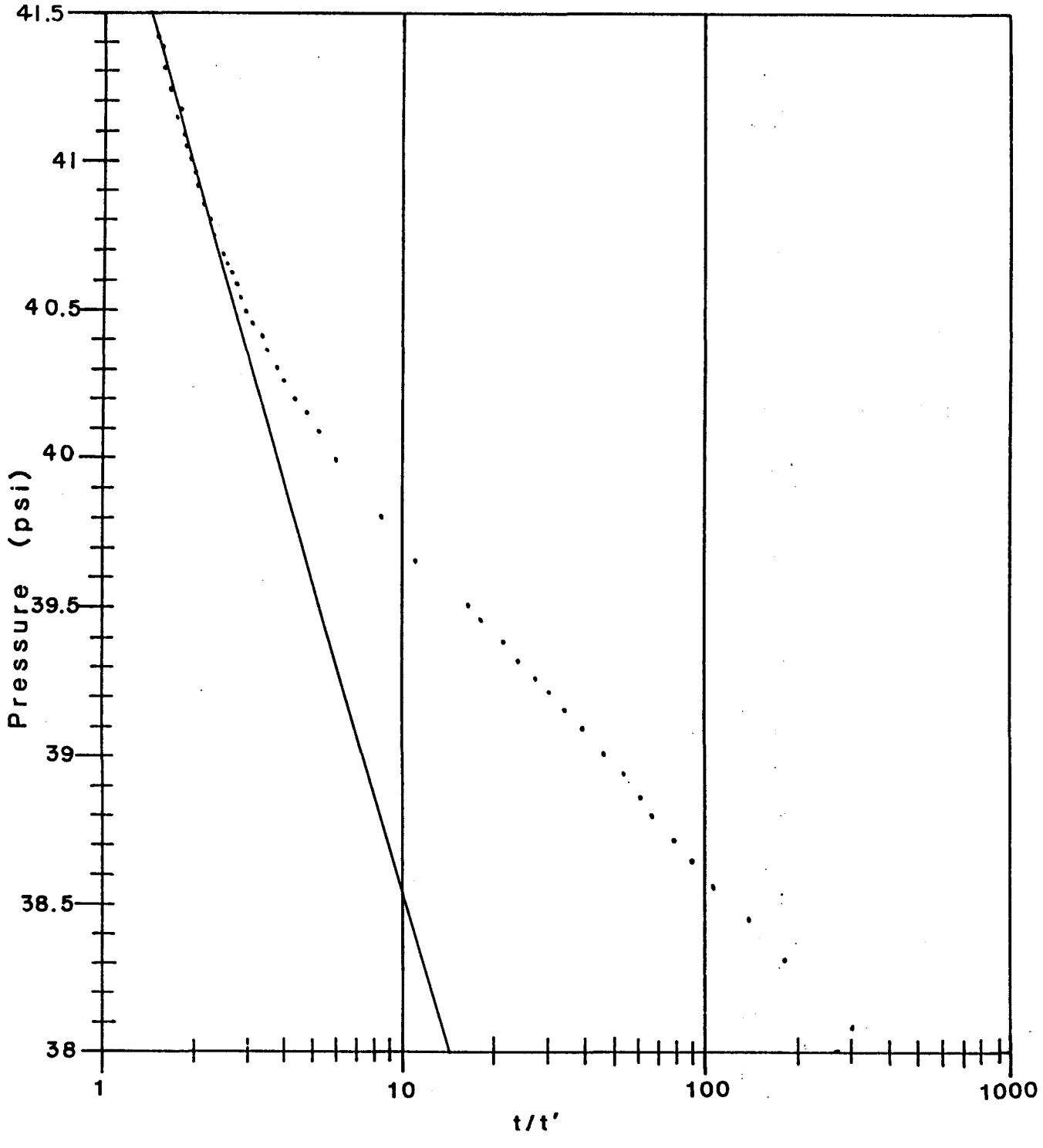

$$T = \frac{264\,Q}{\Delta s}$$

$$T = \frac{264\,(9)}{(41.5-38)\,2.31}$$

$$T = 293 \text{ gpd/ft}$$

$$K = \frac{293}{11} = 26.6 \text{ gpd/ft}^2$$

$$K = 1.2 \times 10^{-3} \text{ cm/sec}$$

Figure: B-3
HORNER PLOT
Well: TW-6
Interval: 495' - 506'

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DATE	

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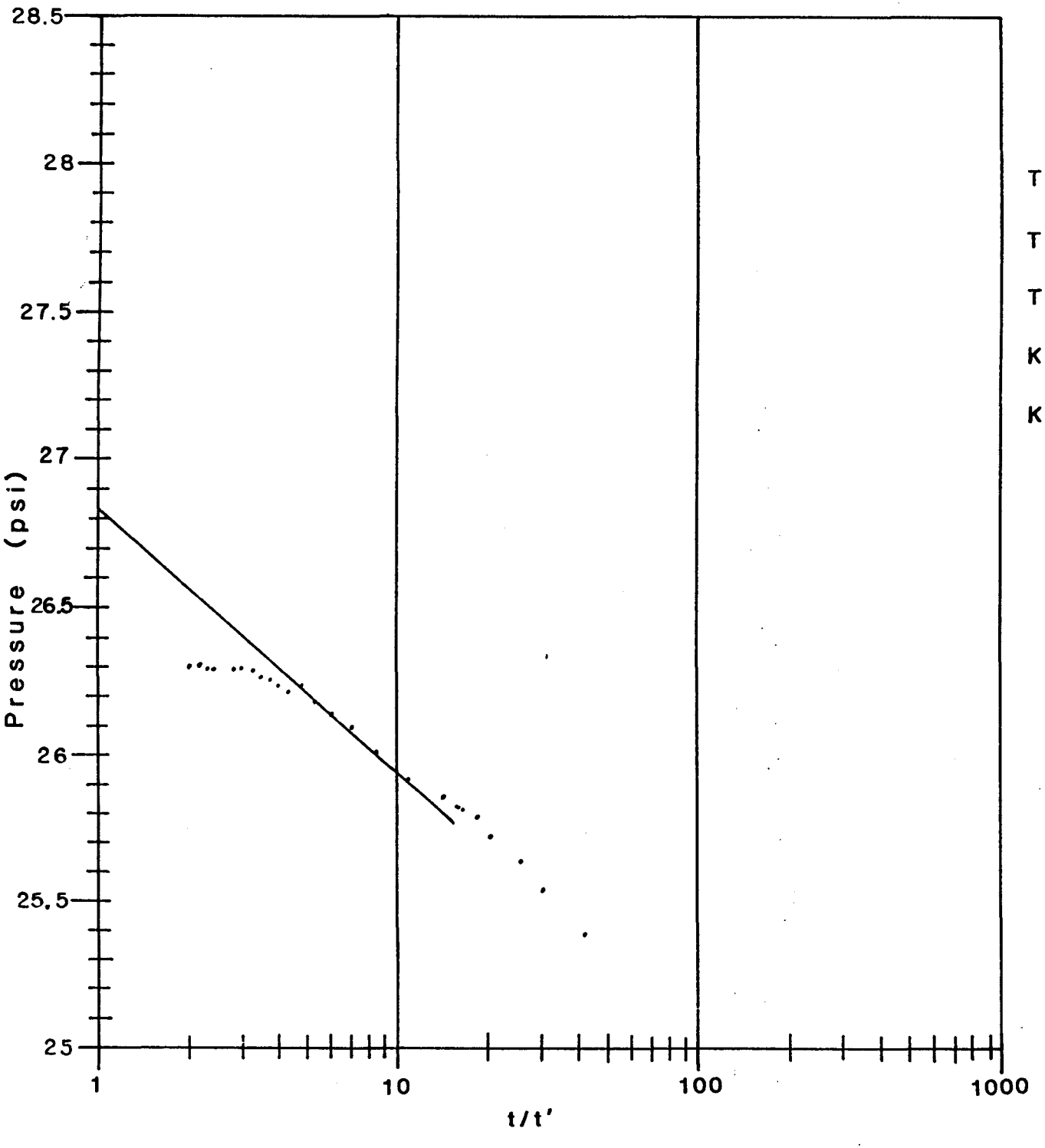

$$T = \frac{264\,Q}{\Delta s}$$

$$T = \frac{264\,(7)}{(26.83 - 25.94)(2.31)}$$

$$T = 900 \text{ gpd/ft}$$

$$K = \frac{900}{11} = 82 \text{ gpd/ft}^2$$

$$K = 3.9 \times 10^{-3} \text{ cm/sec}$$

Figure: B-4
HORNER PLOT
Well: TW-6
Interval: 505'-516'

PROJECT	REVISIONS
DATE	

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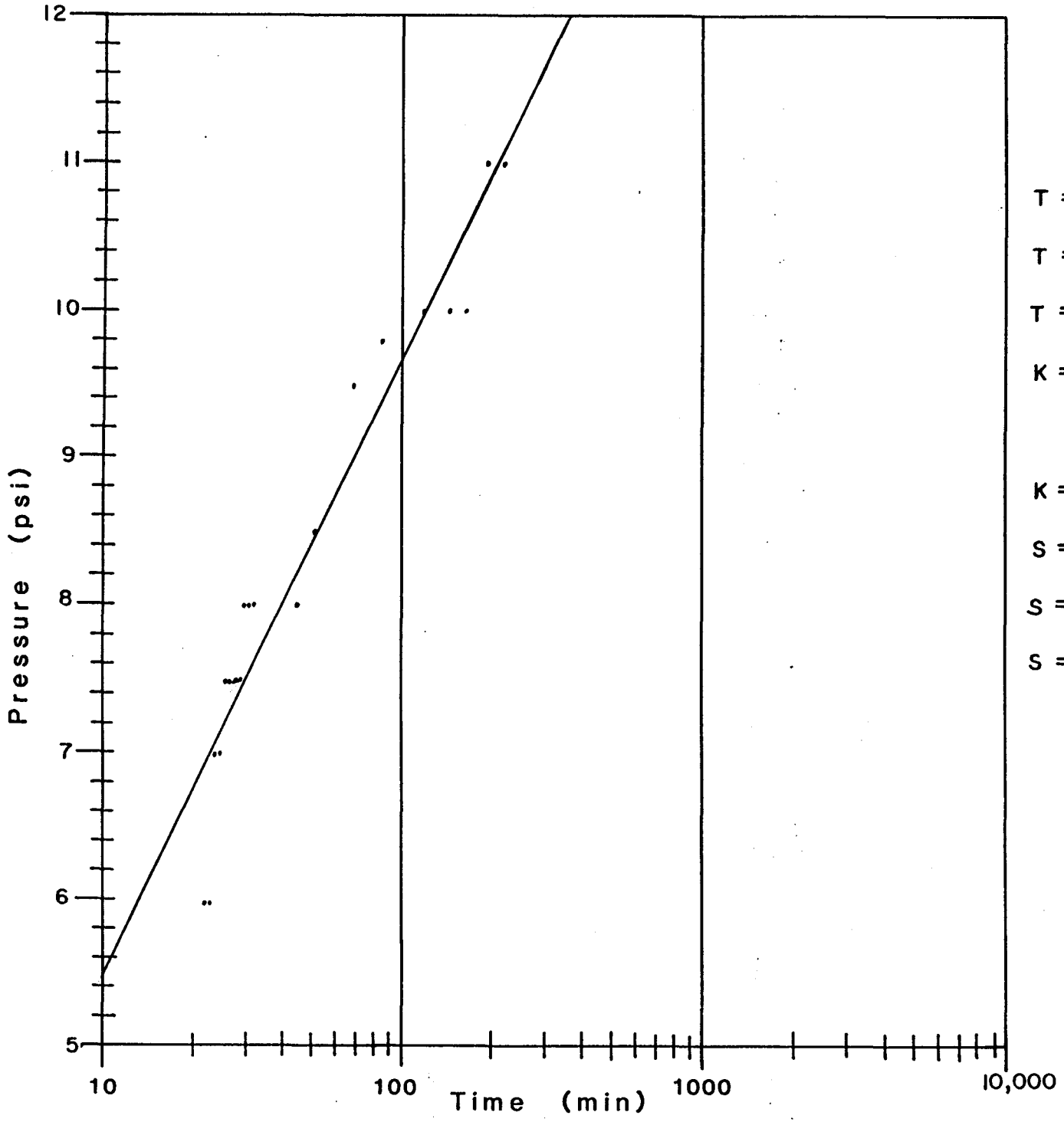

$$T = \frac{264\,Q}{\Delta s}$$

$$T = \frac{264\,(45)}{(9.65-5.5)\ 2.31}$$

$$T = 1200 \text{ gpd/ft}$$

$$K = \frac{1200}{(525-480)} = 27 \text{ gpd/ft}^2$$

$$K = 1.3 \times 10^{-3} \text{ cm/sec}$$

$$S = \frac{0.3\,T\,t_0}{1440\,(r^2)}$$

$$S = \frac{1300\,(0.6)(0.3)}{1440\,(100)^2}$$

$$S = 1.6 \times 10^{-5}$$

Figure: B-5
JACOB DRAWDOWN PLOT
Observation Well: TW-6
Interval: 480'-525'
Test Well: TW-7

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DATE	

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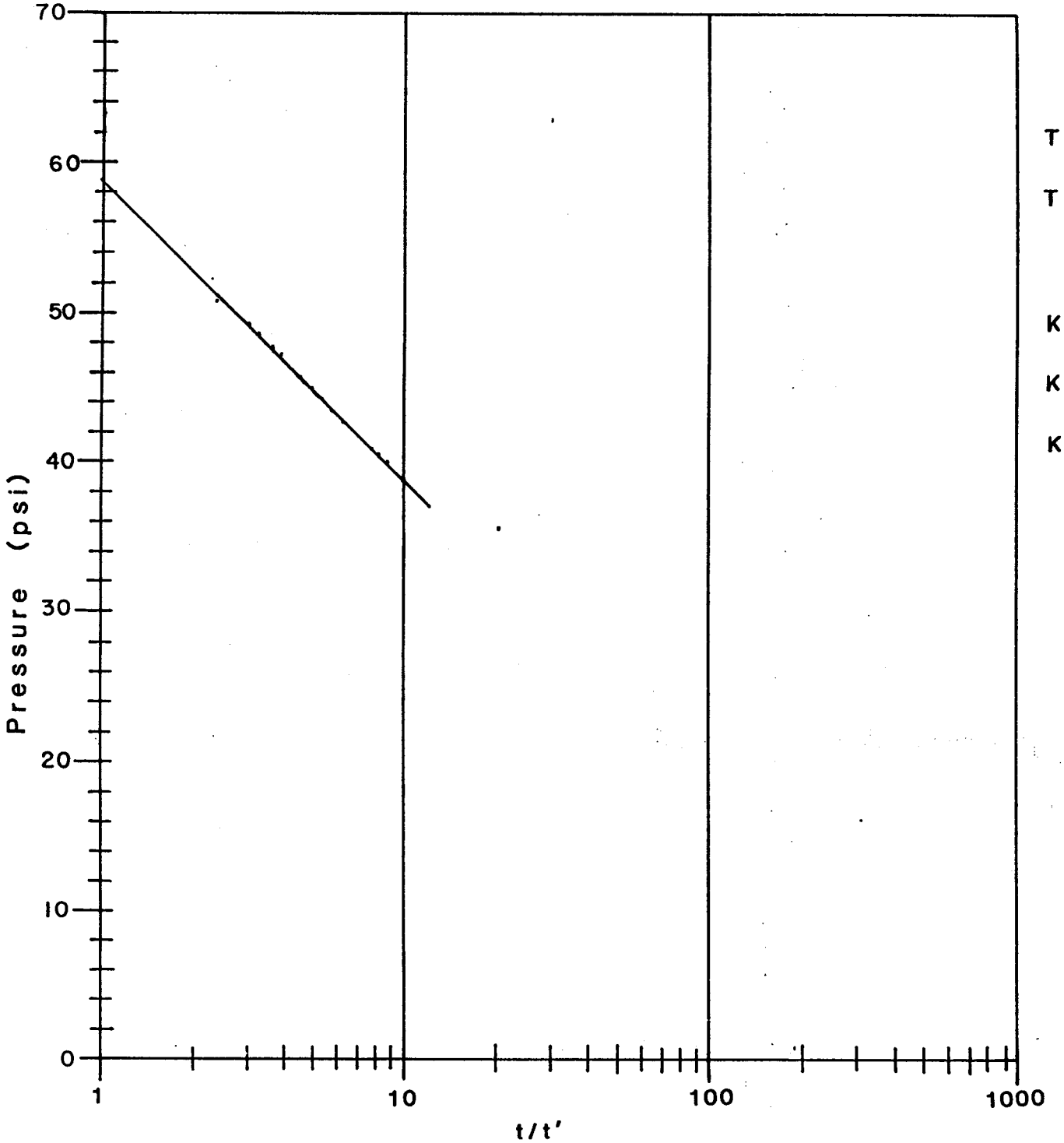

$$T = \frac{264\,Q}{\Delta s}$$

$$T = \frac{264\,(45)}{19\,(2.31)} = 270 \text{ gpd/ft}$$

$$K = \frac{270}{50}$$

$$K = 5.4 \text{ gpd/ft}^2$$

$$K = 2.6 \times 10^{-4} \text{ cm/sec}$$

Figure: B-6
JACOB RECOVERY PLOT
Observation Well: TW-7
Interval: 480'-525'
Test Well: TW-7

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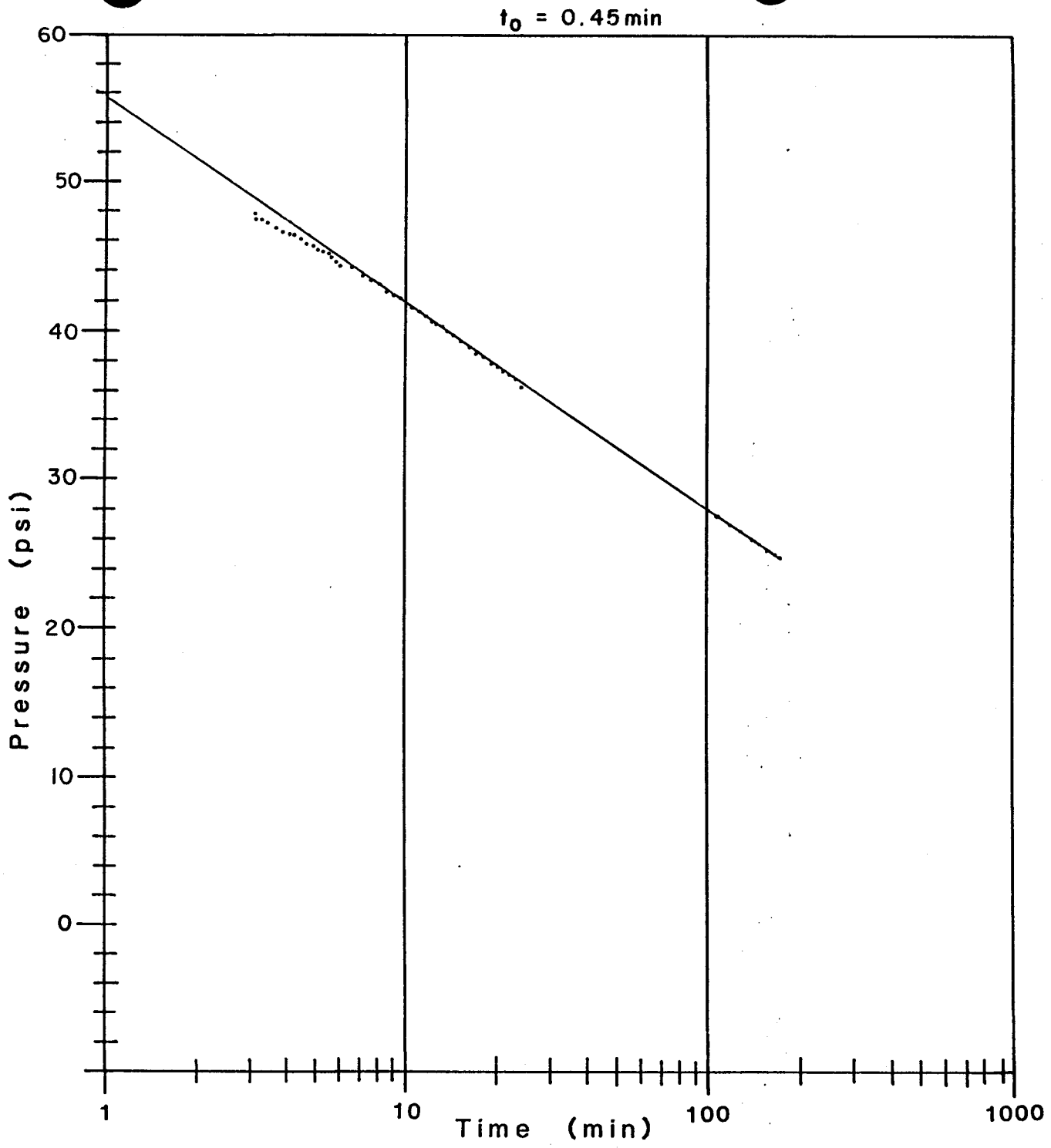

$$T = \frac{264\,Q}{\Delta s}$$

$$T = \frac{264\,(100)}{(42-28)\,2.31}$$

$$T = 816 \text{ gpd/ft}$$

$$K = \frac{816 \text{ gpd/ft}}{50}$$

$$K = 16 \text{ gpd/ft}^2$$

$$K = 8 \times 10^{-4} \text{ cm/sec}$$

$$S = \frac{0.3\,T\,t_o}{r^2}$$

$$S = \frac{0.3\,(816)\,(0.43)}{(100)^2\;1440}$$

$$S = 7 \times 10^{-6}$$

Figure: B-7
JACOB DRAWDOWN PLOT
Observation Well: TW-6
Interval: 800'-850'
Test Well: TW-7

PROJECT	REVISIONS
DATE	

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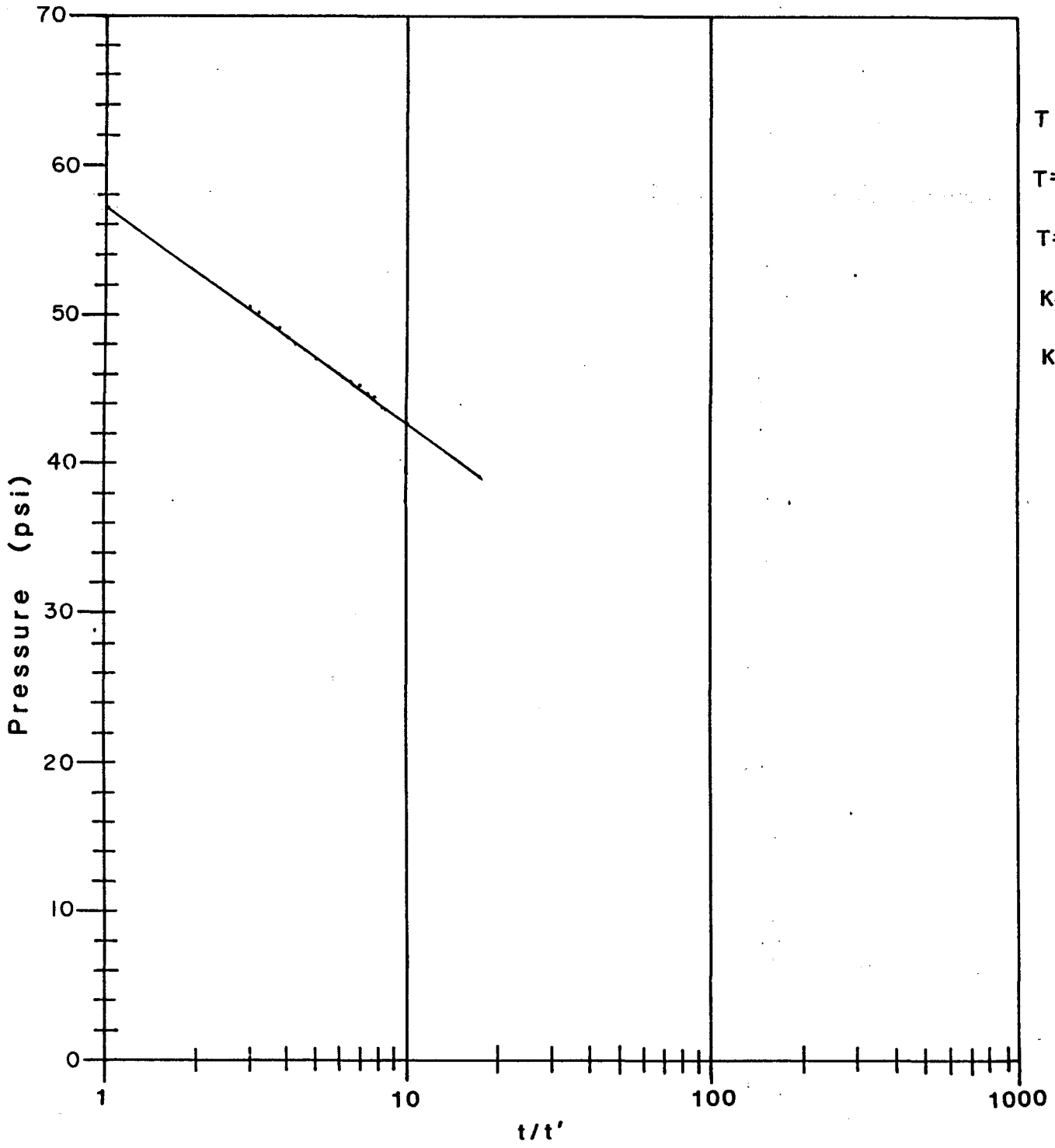

$$T = \frac{264\ Q}{\Delta s}$$

$$T = \frac{264\ (100)}{14\ (2.31)}$$

T= 816 gpd/ft

K= 16 gpd/ft^2

K= 7.6 x 10^{-4} cm/sec

Figure: B-8
JACOB RECOVERY PLOT
Observation Well: TW-7
Interval: 800'-850'
Test Well: TW-7

PROJECT	REVISIONS
DATE	

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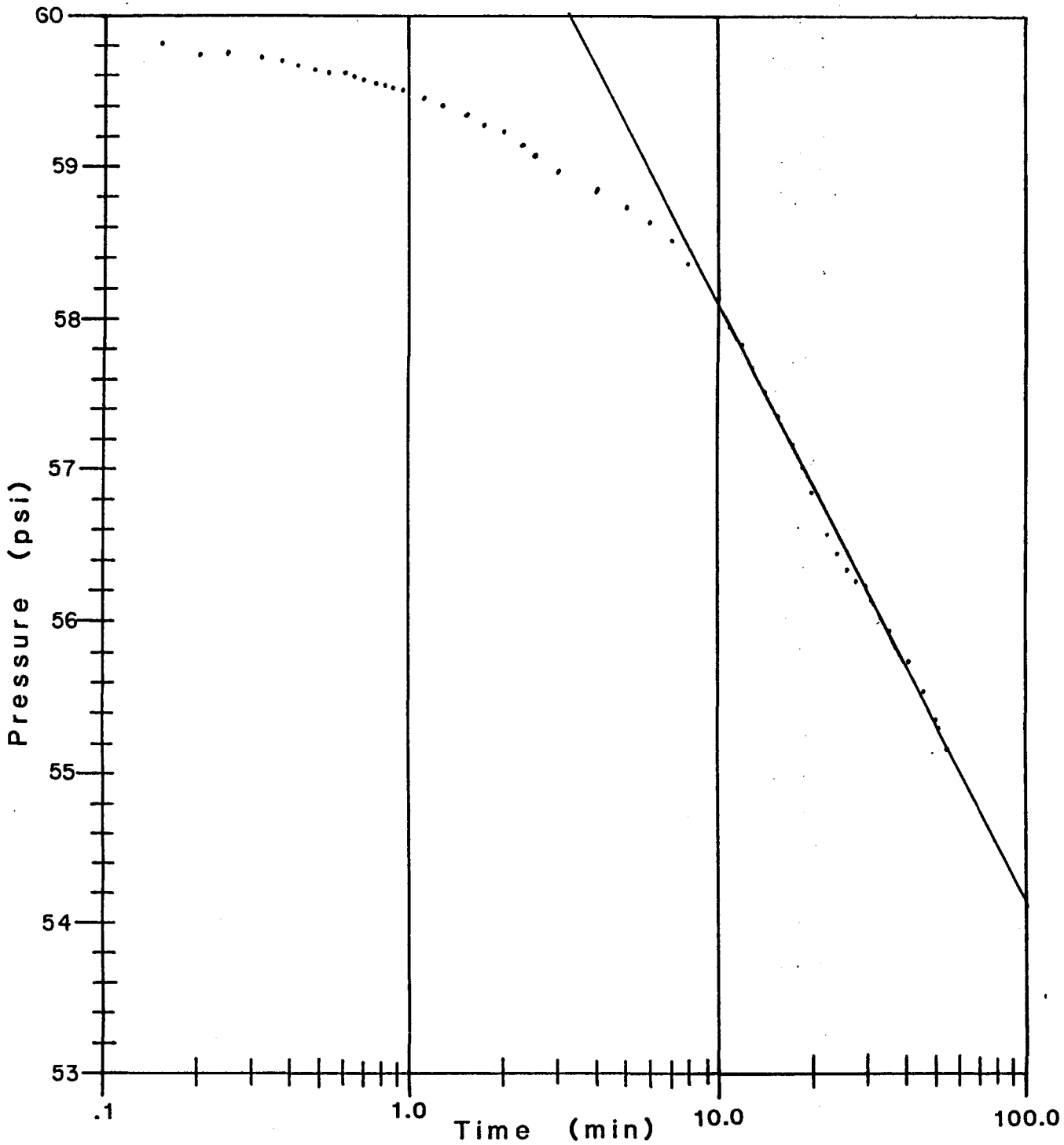

$$T = \frac{264\,Q}{\Delta s}$$

$$T = \frac{264\,(45)}{(58.1 - 54.2)\,2.31}$$

$$T = 1320 \text{ gpd/ft}^2$$

$$K = 6.1 \times 10^{-4} \text{ cm/sec}$$

$$S = \frac{0.3\,T t_o}{r^2}$$

$$S = \frac{0.3(1300)(3)}{(100)^2\ 1440}$$

$$S = 8 \times 10^{-5}$$

Figure: B-9
JACOB DRAWDOWN PLOT
Observation Well: TW-6
Interval: 0 - 850'
Test Well: TW-7

PROJECT	REVISIONS
DATE	

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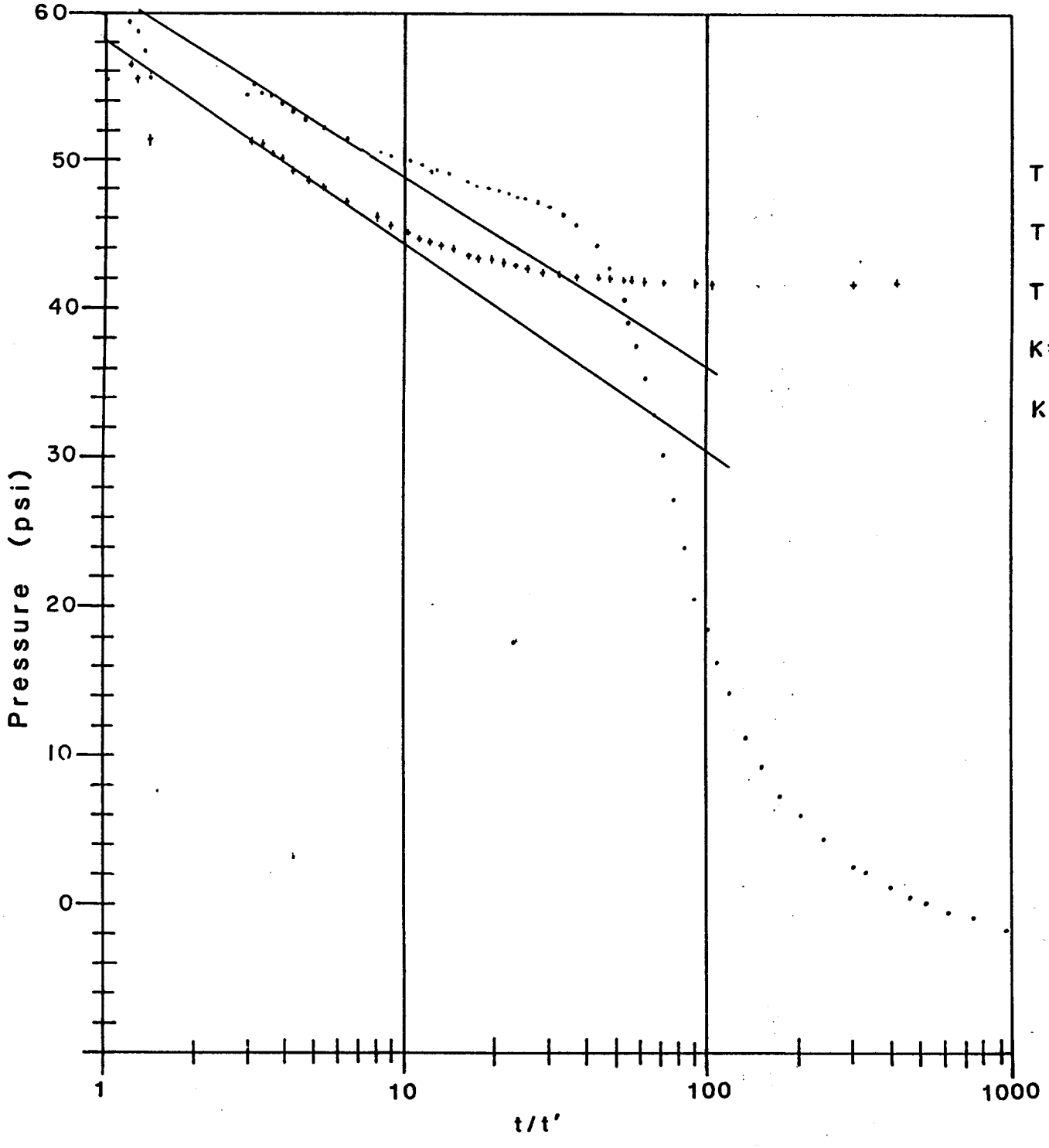

TW-7	TW-6
$T = \frac{264\,Q}{\Delta s}$	
$T = \frac{264(42)}{(50-43.5)\,2.31}$	$T = \frac{264\,(100)}{(44.5-30.5)\,2.31}$
$T = 738 \times gpd/ft^2$	$T = 816 \times gpd/ft^2$
$K = \frac{738}{100} = 7.4\ gpd/ft^2$	$K = \frac{816}{100} = 8.2\ gpd/ft^2$
$K = 3.5 \times 10^{-4}$ cm/sec	$K = 3.9 \times 10^{-4}$ cm/sec

Figure: B-10
JACOB RECOVERY PLOT
Observation Well: TW-7
Interval: 0 - 850'
Test Well: TW-7

PROJECT	REVISIONS
DATE	

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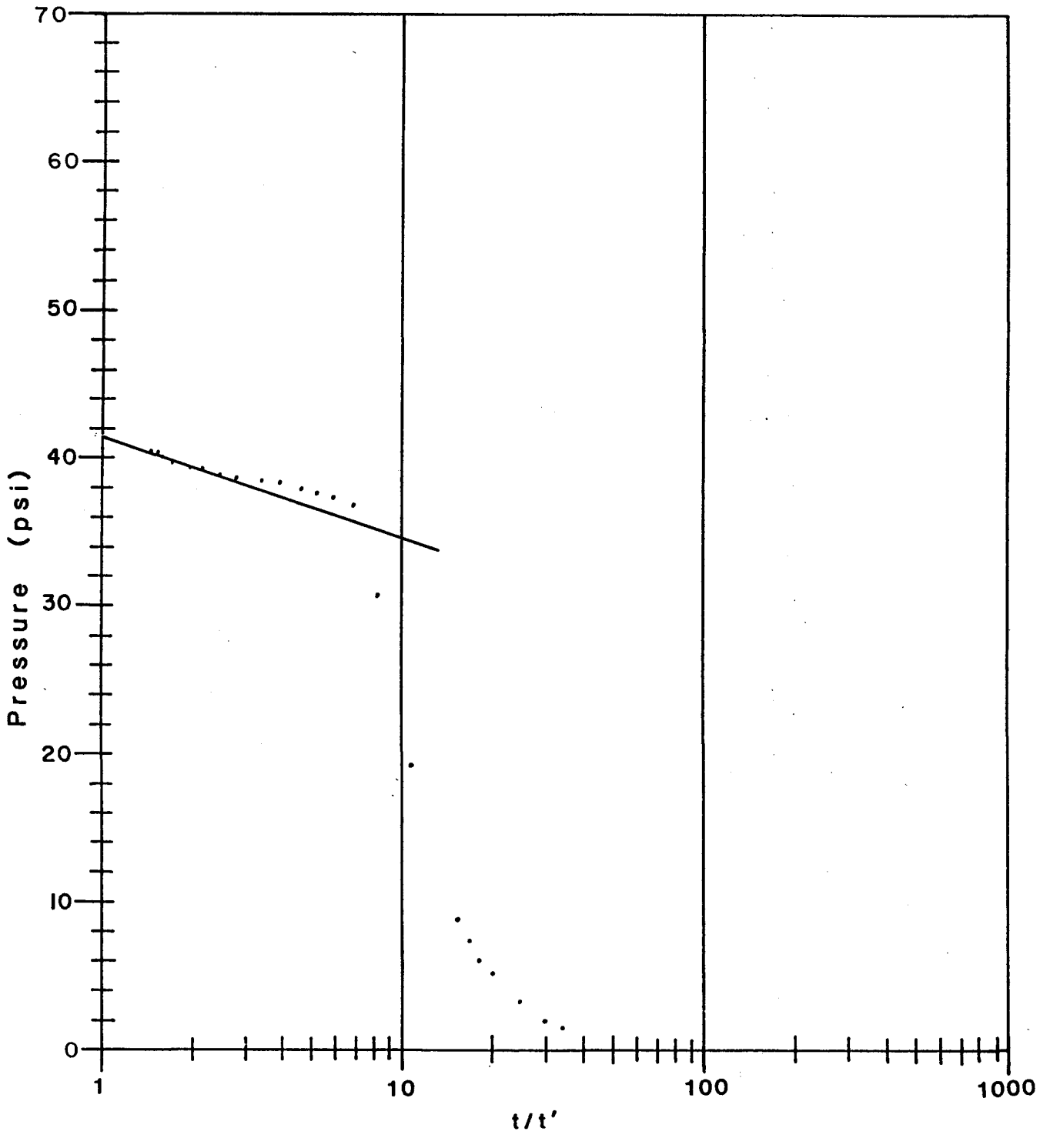

$$T = \frac{264\ Q}{\Delta s}$$

$$T = \frac{264\ (3.3)}{(41.5-34.5)\ 2.31}$$

$$T = 54\ \text{gpd/ft}$$

$$K = \frac{54}{11} = 4.9\ \text{gpd/ft}^2$$

$$K = 2.3 \times 10^{-4}\ \text{cm/sec}$$

Figure: B-11
HORNER PLOT
Well: TW-7
Interval: 453'-464'

PROJECT	REVISIONS
DATE	

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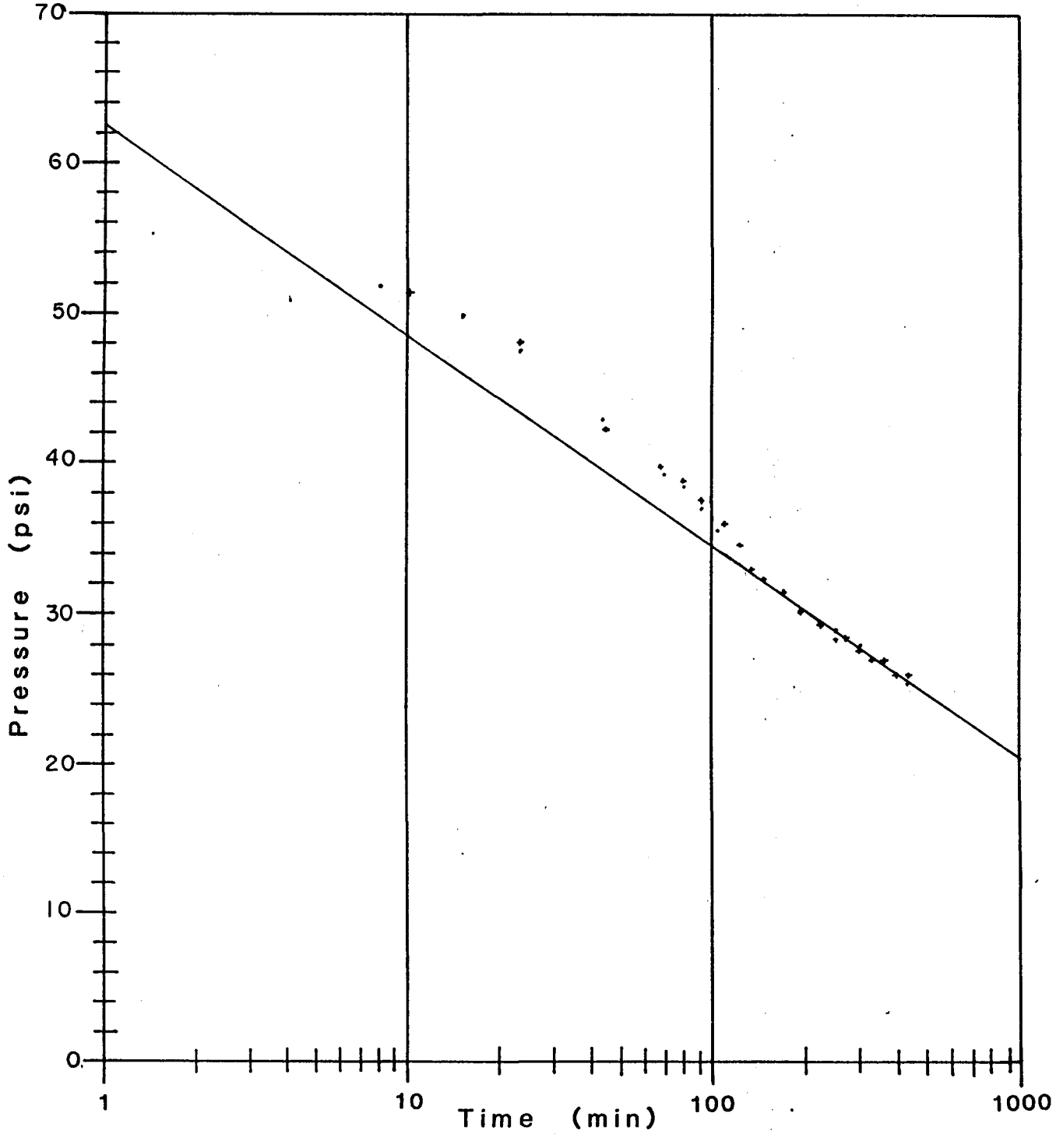

$$T = \frac{264\,Q}{\Delta s}$$

$$T = \frac{264\,(125)}{(34-20.5)\,2.31}$$

$$T = 1060 \text{ gpd/ft}$$

$$K = \frac{1060}{70}$$

$$K = 15 \text{ gpd/ft}^2$$

$$S = \frac{0.3\,T t_o}{1440\,r^2}$$

$$S = \frac{0.3\,(1060)\,(3)}{1440\,(300)^2}$$

$$S = 7.4 \times 10^{-6} \quad \text{(TW-8)}$$

$$S = \frac{0.3\,(1060)\,(2)}{1440\,(200)^2}$$

$$S = 1.1 \times 10^{-5} \quad \text{(TW-6)}$$

Figure: B-12
JACOB DRAWDOWN PLOT
Observation Wells: TW-6, TW-8
Interval: First Sandstone
Test Well: TW-9

PROJECT	REVISIONS
DATE	

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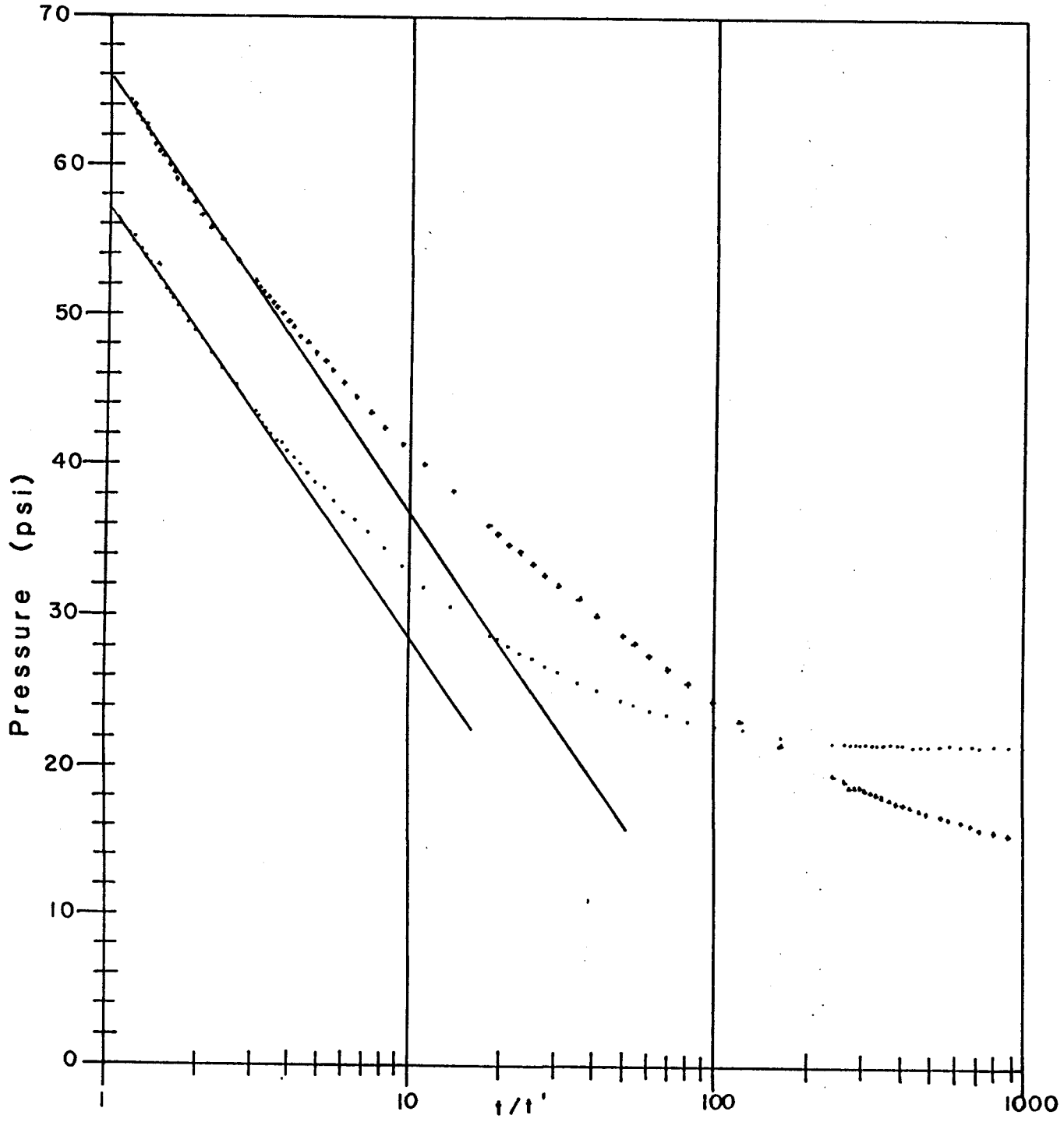

$$T = \frac{264\,Q}{\Delta s}$$

$$T = \frac{264\,(125)}{(57-28.2)\,2.31}$$

$T = 500$ gpd/ft (TW-8)

$$K = \frac{500}{50'} = 10 \text{ gpd/ft}^2 \text{ (TW-8)}$$

$$T = \frac{264\,(125)}{(66-36.5)\,2.31}$$

$T = 484$ gpd/ft (TW-9)

$$K = \frac{484}{50} = 9.7 \text{ gpd/ft}^2 \text{ (TW-9)}$$

Figure: B-13
JACOB RECOVERY PLOT
Observation Well: TW-8
Interval: First Sandstone
Test Well: TW-9

PROJECT	REVISIONS
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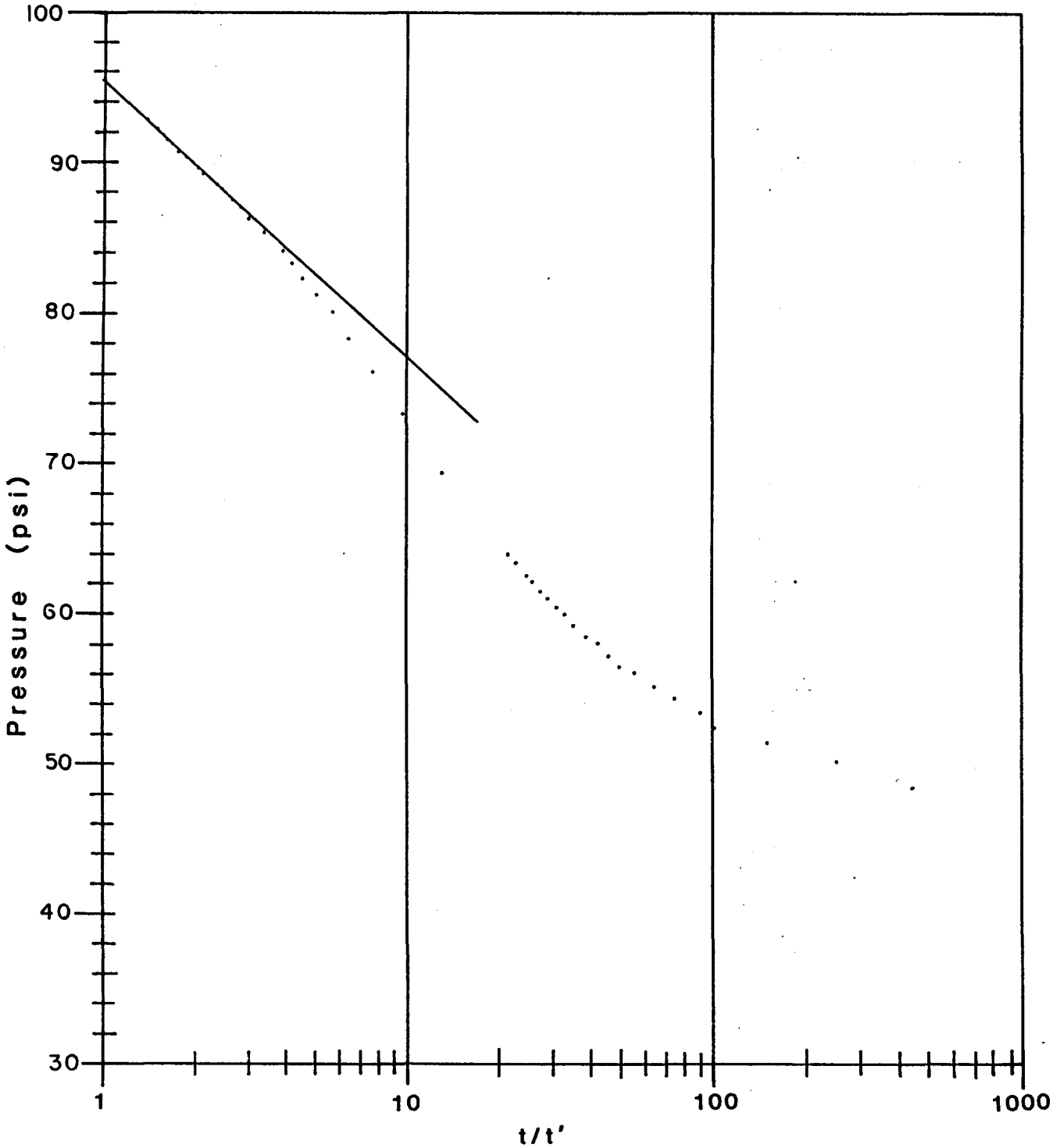

$$T = \frac{264\ Q}{\Delta s}$$

$$T = \frac{264(15)}{(95.2-87.2)(2.31)}$$

$T = 210$ gpd/ft

$$K = \frac{210}{50} = 4.2 \text{ gpd/ft}^2$$

$K = 2 \times 10^{-4}$ cm/sec

Figure: B-14
HORNER PLOT
Well: TW-2
Test Interval: 280'-330'

PROJECT	REVISIONS
DATE	

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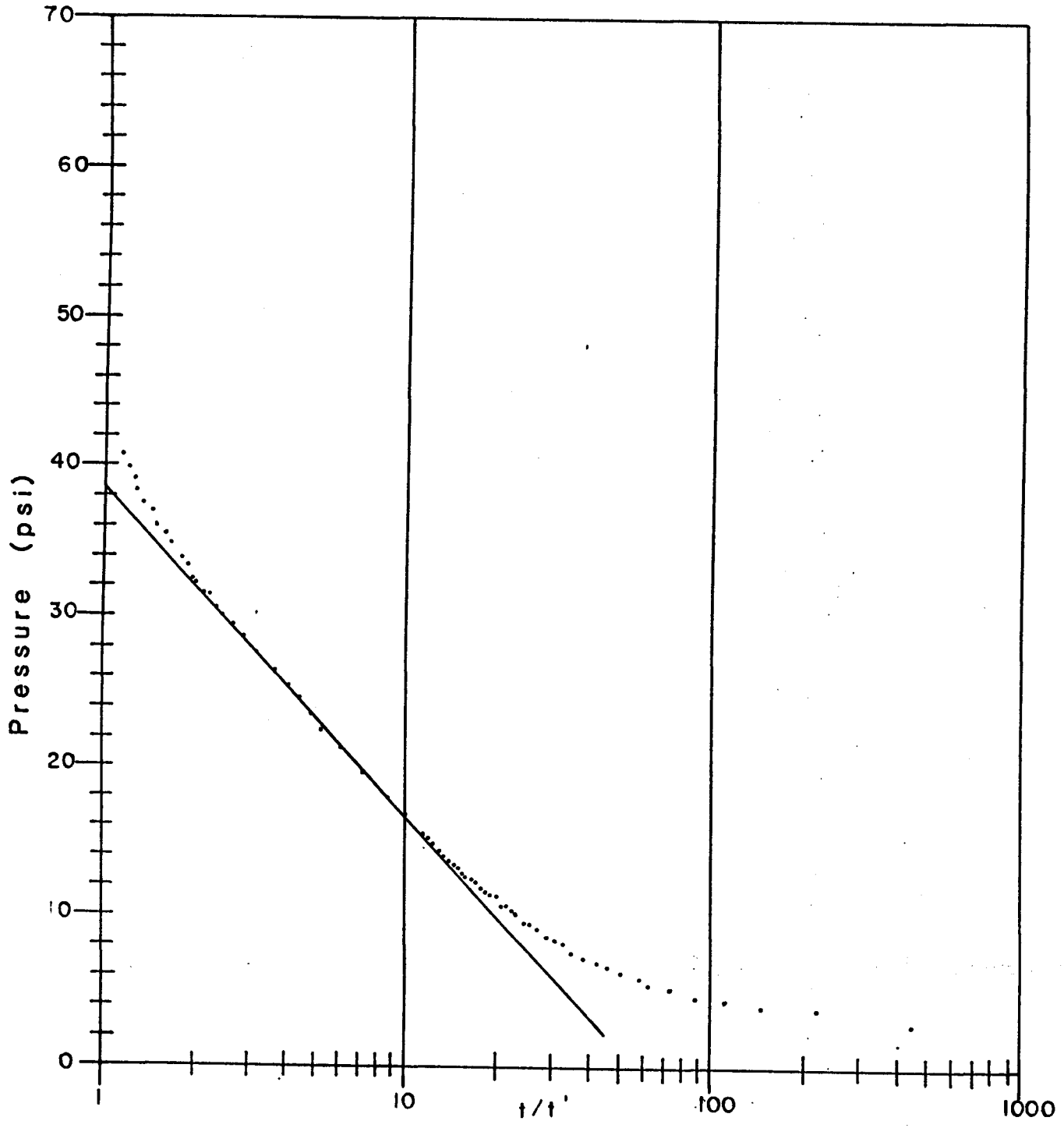
FIGURE



$$T = \frac{264\ Q}{\Delta s\ 2.31}$$

$$T = \frac{264\ (10)}{2.31\ (38-16.5)}$$

$$T = 53\ \text{gpd/ft}$$

Figure: B-15
HORNER PLOT
Well: TW-5
Interval: Unknown

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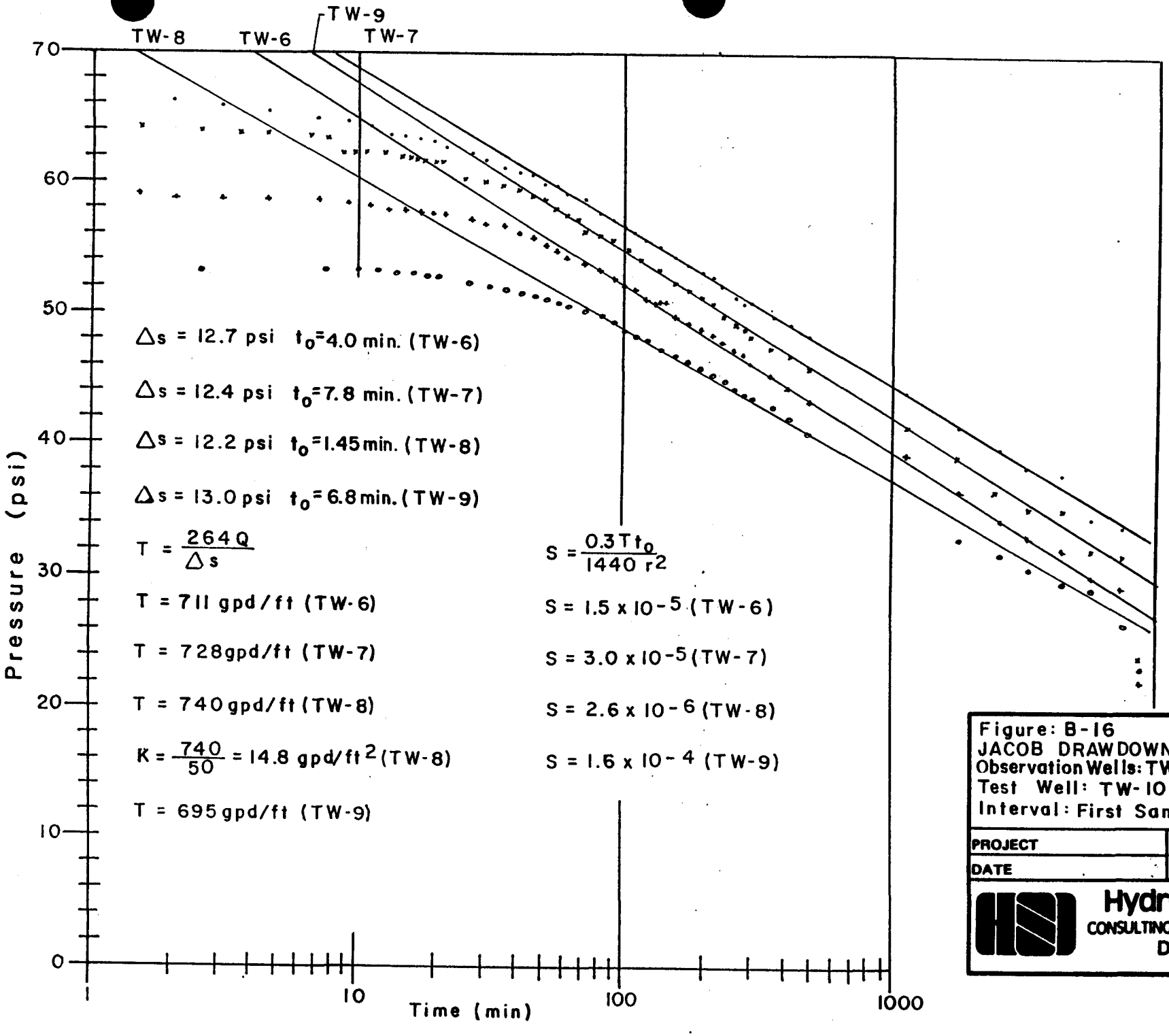

Figure: B-16
JACOB DRAWDOWN PLOT
Observation Wells: TW-6, TW-7, TW-8, TW-9
Test Well: TW-10
Interval: First Sandstone

PROJECT	REVISIONS
DATE	

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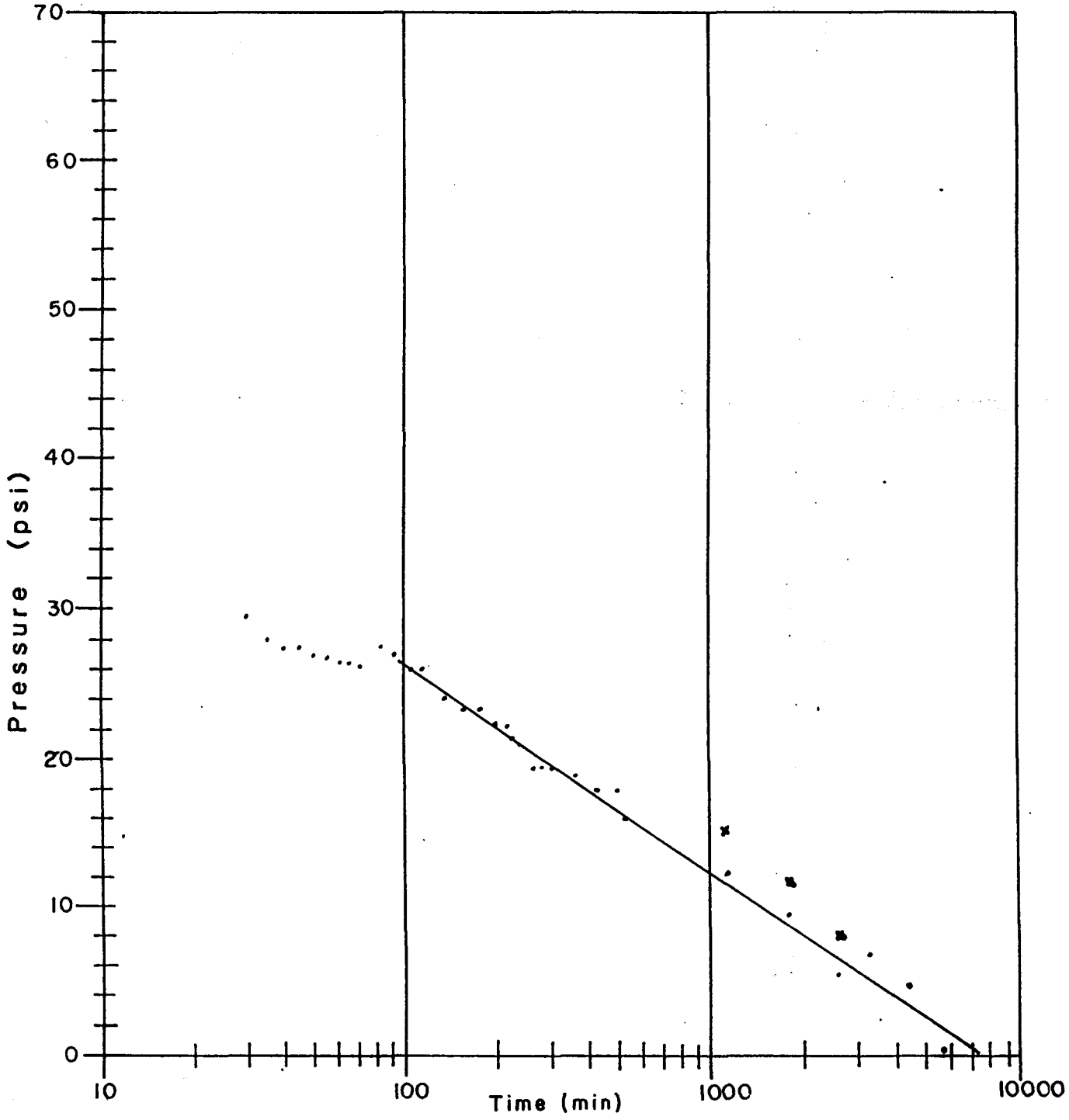

$$T = \frac{264\,Q}{\Delta s}$$

$$T = \frac{264\,(79)}{2.31\,(26.2 - 12.2)}$$

$$T = 645 \text{ gpd/ft}$$

$$K = \frac{645}{50} = 13 \text{ gpd/ft}^2$$

Figure: B-17
JACOB DRAWDOWN PLOT
Observation Well: TW-10
Test Well: TW-10
Interval: First Sandstone

PROJECT	REVISIONS
DATE	

Hydro-Search, Inc.
CONSULTING HYDROLOGISTS-GEOLOGISTS
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COMMERCIAL TESTING & ENGINEERING CO.
GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • (312) 953-9300
SINCE 1908
Member of the SGS Group (Société Générale de Surveillance)

PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

February 29, 1988

Job No.: 9125

Date Rec'd: February 18, 1988

Date Sampled: February 18, 1988

Sampled By: UP&L

Sample ID:

DEER CREEK MINE
3rd No. Roans Canyon
No Time Sampled
Rec'd at 4:20 p.m. hr.
amended

AUG 2 6 1988
DENVER

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

WATER ANALYSIS

Alk., Total	295	mg/l CaCO3	Magnesium	30.70	mg/l
02/19/88		9:15 a.m. hr.	02/24/88		2:30 p.m. hr
Anions, Total	6.85	meq/l	Manganese	0.01<	mg/l
			02/23/88		9:25 a.m. hr
Calcium	84.1	mg/l	pH	7.01	Units
02/24/88		2:00 p.m. hr.	02/18/88		4:35 p.m. hr
Cations, Total	7.45	meq/l	Potassium	1.75	mg/l
			02/23/88		9:15 a.m. hr
Chloride	7.0	mg/l	Sodium	15.89	mg/l
02/24/88		3:00 p.m. hr.	02/23/88		9:00 a.m. hr
Conductivity	420	umhos/cm	Solids, Dissolved	330.0	mg/l
02/19/88		9:00 a.m. hr.	02/19/88		10:00 a.m. h
Hardness, Total	336	mg/l CaCO3	Solids, Suspended	1.0<	mg/l
			02/19/88		10:00 a.m. h
Iron	0.02<	mg/l	Sulfate	43.0	mg/l
02/23/88		9:35 a.m. hr.	02/23/88		11:00 a.m. h

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ANALYST: O. Tyson

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

May 27, 1988

Job No.: 9249

Date Rec'd: May 19, 1988

Date Sampled: May 18, 1988

Sampled By: UP&L

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

Sample ID:

DEER CREEK MINE
2nd Fault Zone
3rd No. Fault
Drilling Hole 88-2
Depth 770'-850'
Rec'd 10:30 am
Sampled 9:30 pm

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295 ALK

WATER ANALYSIS

Arsenic	05/26/88 1:00 pm	0.001	mg/l
Barium	05/26/88 10:45 am	0.08	mg/l
Beryllium	05/26/88 9:30 am	<0.005	mg/l
Boron	05/26/88 2:00 pm	0.19	mg/l
Calcium	05/24/88 10:10 am	104.5	mg/l
Cations, Total		8.42	meq/l
Chromium	05/26/88 11:45 am	0.02<	mg/l
Copper	05/24/88 2:30 pm	0.010<	mg/l
Hardness, Total		385	mg/l CaCO3
Iron	05/24/88 1:15 pm	0.83	mg/l
Lead	05/24/88 2:00 am	0.020<	mg/l
Magnesium	05/24/88 10:00 pm	30.10	mg/l
Manganese	05/24/88 2:30 pm	0.03	mg/l
Mercury	05/25/88 1:00 pm	0.003	mg/l
Molybdenum	05/26/88 11:15 am	0.10<	mg/l
Nickel	05/24/88 2:15 pm	0.02<	mg/l
Phosphorus, Total	05/26/88 11:10 am	0.09	mg/l
Potassium	05/24/88 9:50 am	1.63	mg/l
Selenium	05/26/88 3:00 pm	0.001<	mg/l
Silica	05/26/88 10:00 am	4.10	mg/l
Silver	05/24/88 3:00 pm	0.020	mg/l
Sodium	05/24/88 9:30 pm	16.00	mg/l
Sulfate	05/26/88 10:00 am	100.0	mg/l
Sulfide	05/20/88 2:15 pm	0.10<	mg/l
Vanadium	05/26/88 11:00 am	0.20<	mg/l
Zinc	05/24/88 1:45 pm	0.03	mg/l

ANALYST: _____

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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COMMERCIAL TESTING & ENGINEERING CO.
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PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

May 27, 1988

Job No.: 9250

Date Rec'd: May 19, 1988

Date Sampled: May 18, 1988

Sampled By: UP&L

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

Sample ID:

DEER CREEK MINE
2nd Fault Zone
3rd No. Fault
Drilling Hole 88-2
Depth 770'-850'
Rec'd 10:30 am
Sampled 11:15 pm

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WATER ANALYSIS

Arsenic	0.001	mg/l	05/26/88 1:00 pm
Barium	0.03	mg/l	05/26/88 10:45 am
Beryllium	0.01<	mg/l	05/26/88 9:30 am
Boron	0.23	mg/l	05/26/88 2:00 pm
Calcium	109.8	mg/l	05/24/88 10:10 am
Cations, Total	8.88	meq/l	
Chromium	0.02<	mg/l	05/26/88 9:45 am
Copper	0.010<	mg/l	05/24/88 2:30 pm
Hardness, Total	410	mg/l CaCO3	
Iron	1.91	mg/l	05/24/88 1:15 pm
Lead	0.020<	mg/l	05/24/88 2:00 pm
Magnesium	32.90	mg/l	05/24/88 10:00 am
Manganese	0.07	mg/l	05/24/88 2:30 pm
Mercury	0.001	mg/l	05/25/88 1:00 pm
Molybdenum	0.10<	mg/l	05/26/88 11:45 am
Nickel	0.02<	mg/l	05/24/88 2:15 pm
Phosphorus, Total	0.16	mg/l	05/26/88 11:10 am
Potassium	1.74	mg/l	05/24/88 9:50 am
Selenium	0.001<	mg/l	05/26/88 3:00 pm
Silica	3.40	mg/l	05/26/88 10:00 am
Silver	0.020	mg/l	05/24/88 3:00 pm
Sodium	15.10	mg/l	05/24/88 9:30 am
Sulfate	99.0	mg/l	05/26/88 10:00 am
Sulfide	0.10<	mg/l	05/20/88 2:30 pm
Vanadium	0.20<	mg/l	05/26/88 11:00 am
Zinc	0.03	mg/l	05/24/88 1:45 pm

ANALYST: D. Tyson

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

May 27, 1988

Job No.: 9252

Date Rec'd: May 20, 1988

Date Sampled: May 19, 1988

Sampled By: UP&L

Sample ID:

DEER CREEK MINE
Roans Canyon Fault
Depth 200'-500'
Rec'd 12:00 pm
Sampled 1930

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

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WATER ANALYSIS

66.94 Alk., Total	05/23/88 10:45 am	293	mg/l CaCO3
Arsenic	05/26/88 1:00 pm	0.002	mg/l
Anions, Total		8.70	meq/l
Barium	05/26/88 10:45 am	0.25	mg/l
Beryllium	05/26/88 9:30 am	<0.005	mg/l
Boron	05/26/88 2:00 pm	0.23	mg/l
59.62 Calcium	05/24/88 10:10 am	105.0	mg/l
Cations, Total		8.78	meq/l
Chloride	05/23/88 11:45 am	9.0	mg/l
2.8 Chromium	05/26/88 9:45 am	0.02<	mg/l
Conductivity	05/20/88 4:00 pm	900	umhos/cm
Copper	05/24/88 2:30 pm	0.010<	mg/l
Fluoride	05/23/88 3:00 pm	0.23	mg/l
Hardness, Total		408	mg/l CaCO3
Iron	05/24/88 1:15 pm	0.69	mg/l
Lead	05/24/88 2:00 pm	0.020<	mg/l
Magnesium	33.2 05/24/88 10:00 am	35.50	mg/l
Manganese	05/24/88 2:30 pm	2.34	mg/l
Mercury	05/25/88 1:00 pm	0.003	mg/l
Molybdenum	05/26/88 11:15 am	0.10<	mg/l
Nickel	05/24/88 2:15 pm	0.03	mg/l
pH	05/20/88 3:30 pm	7.40	Units
Phosphorus, Total	05/26/88 11:10 am	0.38	mg/l
Potassium	05/24/88 9:50 am	1.80	mg/l
Selenium	05/26/88 3:00 pm	0.001<	mg/l
Silica	05/26/88 10:00 am	3.70	mg/l
Silver	05/24/88 3:00 pm	0.010<	mg/l
Sodium	7.15 05/24/88 9:30 am	13.40	mg/l

ANALYST: D. Tyson

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

May 27, 1988

Job No.: 9252

Date Rec'd: May 20, 1988

Date Sampled: May 19, 1988

Sampled By: UP&L

Sample ID:

DEER CREEK MINE
Roans Canyon Fault
Depth 200'-500' -
Rec'd 12:00 pm
Sampled 1930

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

WATER ANALYSIS

Solids, Dissolved	400.0	mg/l	Sulfide	0.10<	mg/l
05/25/88	9:00 am		05/20/88	2:30 pm	
Solids, Suspended	448.0	mg/l	Vanadium	0.20<	mg/l
05/25/88	9:00 am		05/26/88	11:00 am	
Sulfate	130.0	mg/l	Zinc	0.06	mg/l
30.23 05/26/88	10:00 am		05/24/88	1:45 pm	

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ANALYST: D. Tipon

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PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

May 27, 1988

Job No.: 9253

Date Rec'd: May 20, 1988

Date Sampled: May 20, 1988

Sampled By: UP&L

Sample ID:

DEER CREEK MINE
Roans Canyon Fault
Depth 200'-500'
Rec'd 3:15 pm
Sampled 8:45 am

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

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WATER ANALYSIS

Alk., Total	05/23/88	10:45 am	292 mg/l CaCO3	Iron	05/24/88	1:15 pm	0.54 mg/l
Arsenic	05/26/88	1:00 pm	0.002 mg/l	Lead	05/24/88	2:00 pm	0.020< mg/l
Anions, Total			8.54 meq/l	Magnesium	05/24/88	10:00 am	35.00 mg/l
Barium	05/26/88	10:45 am	0.21 mg/l	Manganese	05/24/88	2:30 pm	1.40 mg/l
Beryllium	05/26/88	9:30 am	0.005< mg/l	Mercury	05/24/88	1:00 Pm	0.0031 mg/l
Boron	05/26/88	2:00 pm	0.20 mg/l	Molybdenum	05/26/88	11:45 am	0.10< mg/l
Calcium	05/24/88	10:10 am	103.5 mg/l	Nickel	05/24/88	2:15 pm	0.02 mg/l
Cations, Total			8.66 meq/l	pH	05/20/88	3:30 pm	7.45 Units
Chloride	05/23/88	11:45 am	8.0 mg/l	Phosphorus, Total	05/26/88	11:10am	0.45 mg/l
Chromium	05/26/88	9:45 am	0.02< mg/l	Potassium	05/24/88	9:50am	2.30 mg/l
Conductivity	05/20/88	4:00 pm	900 umhos/cm	Selenium	05/26/88	3:00pm	0.001< mg/l
Copper	05/24/88	2:30 pm	0.010< mg/l	Silica	05/26/88	10:00am	4.00 mg/l
Fluoride	05/23/88	3:00 pm	0.20 mg/l	Silver	05/24/88	3:00 pm	0.030 mg/l
Hardness, Total			403 mg/l CaCO3	Sodium	05/24/88	9:30am	12.90 mg/l

ANALYST: D. Tyson

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

May 27, 1988

Job No.: 9253

Date Rec'd: May 20, 1988

Date Sampled: May 20, 1988

Sampled By: UP&L

Sample ID:

DEER CREEK MINE
Roans Canyon Fault
Depth 200'-500'
Rec'd 3:15 pm
Sampled 8:45 am

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

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WATER ANALYSIS

Solids, Dissolved	354.0	mg/l	Sulfide	0.10<	mg/l
05/25/88 9:00 am			05/20/88 3:00 pm		
Solids, Suspended	454.0	mg/l	Vanadium	0.20<	mg/l
05/25/88 9:00 am			05/26/88 11:00 am		
Sulfate	125.0	mg/l	Zinc	0.03	mg/l
05/26/88 10:00 am			05/24/88 1:45 pm		

ANALYST: D. Tyson

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COMMERCIAL TESTING & ENGINEERING CO.

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PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

August 19, 1988

Job No.: 9348

Sample ID: TW-9

Date Rec'd: August 1, 1988

ROANS CANYON 88-4
1st Sand Unit
Temp (none given)
Flow 148
Time Sampled 09:44 hr.
Time Rec'd 10:30 hr.

Date Sampled: July 30, 1988

Sampled By: UP&L

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

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WATER ANALYSIS

Acidity	110	mg/l CaCO3	Chromium	0.02<	mg/l
08/03/88		09:50 hr.	08/09/88		14:15 hr
Aluminum	0.44	mg/l	Conductivity	659	umhos/cm
08/09/88		15:15 hr.	08/01/88		13:30 hr
Alk., Carbonate	1<	mg/l CaCO3	Copper	0.010<	mg/l
08/01/88		14:30 hr.	08/09/88		10:00 hr
Alk., Total	274	mg/l CaCO3	Fluoride	0.37	mg/l
08/01/88		14:30 hr.	08/11/88		15:00 hr
Arsenic	0.002<	mg/l	Hardness, Total	388	mg/l CaC
08/10/88		11:00 hr.			
Anions, Total	8.66	meq/l	Iron	1.31	mg/l
			08/05/88		10:30 hr
Barium	0.03<	mg/l	Iron, Dissolved	1.12	mg/l
08/09/88		14:00 hr.	08/05/88		10:30 hr
Beryllium	0.01<	mg/l	Lead	0.020<	mg/l
08/09/88		15:00 hr.	08/09/88		09:15 hr
Boron	0.03	mg/l	Magnesium	37.80	mg/l
08/05/88		14:00 hr.	08/05/88		15:10 hr
			Manganese	0.06	mg/l
			08/05/88		15:30 hr
Cadmium	0.002<	mg/l	Mercury	0.001<	mg/l
08/09/88		09:30 hr.	08/10/88		09:45 hr
Calcium	93.2	mg/l	Molybdenum	0.10<	mg/l
08/05/88		14:30 hr.	08/09/88		14:40 hr
Cations, Total	8.50	meq/l	Nickel	0.02<	mg/l
			08/09/88		09:45 hr
Chloride	6.0	mg/l	pH	7.38	Units
08/05/88		16:00 hr.	08/01/88		13:30 hr

ANALYST: J. Koman

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

August 23, 1988

Job No.: 9348

Date Rec'd: August 1, 1988

Date Sampled: July 30, 1988

Sampled By: UP&L

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

Sample ID:

ROANS CANYON 88-4
1st Sand Unit
Temp (none given)
Flow 148
Time Sampled 09:44 hr.
Time Rec'd 10:30 hr.
Amended Selenium

WATER ANALYSIS

Phosphorus, Total	0.33	mg/l		Solids, Dissolved	486.0	mg/l	
08/12/88			13:30 hr.	08/03/88			11:00 hr
Potassium	2.40	mg/l		Solids, Suspended	198.0	mg/l	
08/05/88			11:00 hr.	08/09/88			11:00 hr
Selenium	0.002<	mg/l		Sulfate	150.0	mg/l	
08/19/88			15:30 hr.	08/02/88			09:35 hr
Silica	5.40	mg/l		Vanadium	0.10<	mg/l	
08/09/88			10:15 hr.	08/09/88			14:30 hr
Silver	0.010<	mg/l		Zinc	0.20	mg/l	
08/09/88			14:00 hr.	08/09/88			09:00 hr
Sodium	15.70	mg/l					
08/05/88							

ANALYST: J. Koman

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

August 19, 1988

Job No.: 9347

Date Rec'd: August 1, 1988

Date Sampled: July 30, 1988

Sampled By: UP&L

Sample ID:

ROANS CANYON 88-4
1st Sand Unit
Temp (none given)
Flow 148
Time Sampled 11:10 hr.
Time Rec'd 10:30 hr.

RECEIVED
AUG 19 1988
MINING DIV.
FIELD OFFICE

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

WATER ANALYSIS

Acidity	118	mg/l CaCO3	Conductivity	658	umhos/cm
08/03/88		09:50 hr.	08/01/88		13:30 hr
Aluminum	0.34	mg/l	Copper	0.010<	mg/l
08/09/88		16:45 hr.	08/09/88		10:00 hr
Alk., Carbonate	1<	mg/l CaCO3	Fluoride	0.38	mg/l
08/01/88		14:30 hr.	08/11/88		15:00 hr
Alk., Total	268	mg/l CaCO3	Hardness, Total	368	mg/l CaC
08/01/88		14:30 hr.			
Arsenic	0.002<	mg/l	Iron	0.47	mg/l
08/10/88		11:00 hr.	08/05/88		10:30 hr
Anions, Total	8.47	meq/l	Iron, Dissolved	0.46	mg/l
			08/05/88		10:30 hr
Barium	0.03<	mg/l	Lead	0.020<	mg/l
08/09/88		14:00 hr.	08/09/88		09:15 hr
Beryllium	0.01<	mg/l	Magnesium	35.30	mg/l
08/09/88		15:00 hr.	08/05/88		15:30 hr
Boron	0.04	mg/l	Manganese	0.01<	mg/l
08/05/88		14:00 hr.	08/05/88		15:10 hr
Cadmium	0.002<	mg/l	Mercury	0.001<	mg/l
08/09/88		10:30 hr.	08/10/88		14:00 hr
Calcium	89.1	mg/l	Molybdenum	0.10<	mg/l
08/05/88		14:30 hr.	08/09/88		14:40 hr
Cations, Total	8.07	meq/l	Nickel	0.02<	mg/l
			08/09/88		09:45 hr
Chloride	6.5	mg/l	pH	7.35	Units
08/05/88		16:00 hr.	08/01/88		13:30 hr
Chromium	0.02<	mg/l	Phosphorus, Total	0.31	mg/l
08/09/88		14:15 hr.	08/12/88		14:00 hr

ANALYST: J. Komar

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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For Your Protection

OVER 40 BRANCH LABORATORIES STRATEGICALLY LOCATED IN PRINCIPAL COAL MINING AREAS,
TIDEWATER AND GREAT LAKES PORTS, AND RIVER LOADING FACILITIES

COMMERCIAL TESTING & ENGINEERING CO.
GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • (312) 953-9300
CE 1908
Member of the SGS Group (Société Générale de Surveillance)

PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

August 23, 1988

Job No.: 5347

Date Rec'd: August 1, 1988

Date Sampled: July 30, 1988

Sampled By: UP&L

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

Sample ID:

ROANS CANYON 88-4
1st Sand Unit
Temp (none given)
Flow 148
Time Sampled 11:10 hr.
Time Rec'd 10:30 hr.
Amended Selenium

WATER ANALYSIS

Potassium	1.40	mg/l	Solids, Dissolved	544.0	mg/l
08/05/88		13:30 hr.	08/03/88		11:00 hr
Selenium	0.002<	mg/l	Solids, Suspended	70.0	mg/l
08/19/88		11:00 hr.	08/09/88		11:00 hr
Silica	2.90	mg/l	Sulfate	146.0	mg/l
08/09/88		15:30 hr.	08/02/88		09:35 hr
Silver	0.020	mg/l	Vanadium	0.10<	mg/l
08/09/88		10:15 hr.	08/09/88		14:30 hr
Sodium	15.80	mg/l	Zinc	0.16	mg/l
08/05/88		14:00 hr.	08/09/88		09:00 hr

ANALYST: J. Koman

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

August 19, 1988

Job No.: 9346

Date Rec'd: August 1, 1988

Date Sampled: July 30, 1988

Sampled By: UP&L

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

RECEIVED
AUG 19 1988
MINING DIV.
FIELD OFFICE

Sample ID:

ROANS CANYON
1st Sand Unit
Temp 46
Flow 132.7
Time Sampled 13:15 hr.
Time Rec'd 10:30 hr.

WATER ANALYSIS

Acidity	98	mg/l CaCO3	Conductivity	660	umhos/cm
08/03/88		09:50 hr.	08/01/88		13:30 hr
Aluminum	0.10<	mg/l	Copper	0.010<	mg/l
08/09/88		16:45 hr.	08/09/88		10:00 hr
Alk., Carbonate	1<	mg/l CaCO3	Fluoride	0.37	mg/l
08/01/88		14:30 hr.	08/11/88		15:00 hr
Alk., Total	285	mg/l CaCO3	Hardness, Total	419	mg/l CaC
08/01/88		14:30 hr.			
Arsenic	0.002<	mg/l	Iron	1.18	mg/l
08/10/88		11:00 hr.	08/05/88		10:30 hr
Anions, Total	8.86	meq/l	Iron, Dissolved	0.48	mg/l
			08/05/88		10:30 hr
Barium	0.03<	mg/l	Lead	0.020<	mg/l
08/09/88		14:00 hr.	08/09/88		09:15 hr
Beryllium	0.01<	mg/l	Magnesium	40.60	mg/l
08/09/88		15:00 hr.	08/05/88		15:30 hr
Boron	0.03	mg/l	Manganese	0.06	mg/l
08/05/88		14:00 hr.	08/05/88		15:10 hr
Cadmium	0.002<	mg/l	Mercury	0.001<	mg/l
08/09/88		10:30 hr.	08/10/88		14:00 hr
Calcium	100.7	mg/l	Molybdenum	0.10<	mg/l
08/05/88		14:30 hr.	08/09/88		14:40 hr
Cations, Total	9.07	meq/l	Nickel	0.02<	mg/l
			08/09/88		09:45 hr
Chloride	7.0	mg/l	pH	7.38	Units
08/05/88		16:00 hr.	08/01/88		13:30 hr
Chromium	0.02<	mg/l	Phosphorus, Total	0.22	mg/l
08/09/88		14:15 hr.	08/12/88		14:00 hr

ANALYST: J. Koman

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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OVER 40 BRANCH LABORATORIES STRATEGICALLY LOCATED IN PRINCIPAL COAL MINING AREAS,
TIDEWATER AND GREAT LAKES PORTS, AND RIVER LOADING FACILITIES

COMMERCIAL TESTING & ENGINEERING CO.
GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • (312) 953-9300
SINCE 1908
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PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

August 23, 1988

Job No.: 9346

Date Rec'd: August 1, 1988

Date Sampled: July 30, 1988

Sampled By: UP&L

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

Sample ID:

ROANS CANYON
1st Sand Unit
Temp 46
Flow 132.7
Time Sampled 13:15 hr.
Time Rec'd 10:30 hr.
Amended Selenium

WATER ANALYSIS

Potassium	1.50	mg/l		Solids, Dissolved	584.0	mg/l	
08/05/88			13:30 hr.	08/03/88			11:00 hr
Selenium	0.002<	mg/l		Solids, Suspended	208.0	mg/l	
08/19/88			11:00 hr.	08/09/88			11:00 hr
Silica	3.00	mg/l		Sulfate	149.0	mg/l	
08/09/88			15:30 hr.	08/02/88			09:35 hr
Silver	0.040	mg/l		Vanadium	0.10<	mg/l	
08/09/88			10:15 hr.	08/09/88			14:30 hr
Sodium	15.50	mg/l		Zinc	0.18	mg/l	
08/05/88			14:00 hr.	08/09/88			09:00 hr

ANALYST: J. Koman

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

M Uy

Manager, Huntington Laboratory

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PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

August 19, 1988

Job No.: 9345

Date Rec'd: August 1, 1988

Date Sampled: July 30, 1988

Sampled By: UP&L

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

Sample ID:

ROANS CANYON
88-4
1st Sand Unit
Temp (none given)
Flow 110 gpm
Time Sampled 17:15 hr.
Time Rec'd 10:30 hr.

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AUG 19 1988
MINING DIV.
FIELD OFFICE

WATER ANALYSIS

Acidity	116	mg/l CaCO3	Conductivity	710	umhos/cm
08/03/88		09:50 hr.	08/01/88		13:30 hr
Aluminum	0.27	mg/l	Copper	0.010<	mg/l
08/09/88		16:45 hr.	08/09/88		10:00 hr
Alk., Carbonate	1<	mg/l CaCO3	Fluoride	0.39	mg/l
08/01/88		14:30 hr.	08/11/88		15:00 hr
Alk., Total	301	mg/l CaCO3	Hardness, Total	415	mg/l CaC
08/01/88		14:30 hr.			
Arsenic	0.002<	mg/l	Iron	0.36	mg/l
08/10/88		11:00 hr.	08/05/88		10:30 hr
Anions, Total	8.91	meq/l	Iron, Dissolved	0.35	mg/l
			08/05/88		10:30 hr
Barium	0.03<	mg/l	Lead	0.020<	mg/l
08/09/88		14:00 hr.	08/09/88		09:15 hr
Beryllium	0.01<	mg/l	Magnesium	39.70	mg/l
08/09/88		15:00 hr.	08/05/88		15:30 hr
Boron	0.04	mg/l	Manganese	0.02	mg/l
08/05/88		14:00 hr.	08/05/88		15:10 hr
Cadmium	0.002<	mg/l	Mercury	0.001<	mg/l
08/09/88		10:30 hr.	08/10/88		14:00 hr
Calcium	100.6	mg/l	Molybdenum	0.10<	mg/l
08/05/88		14:30 hr.	08/09/88		14:40 hr
Cations, Total	8.96	meq/l	Nickel	0.02<	mg/l
			08/09/88		09:45 hr
Chloride	7.5	mg/l	pH	7.40	Units
08/05/88		16:00 hr.	08/01/88		13:30 hr
Chromium	0.02<	mg/l	Phosphorus, Total	0.29	mg/l
08/09/88		14:15 hr.	08/12/88		14:00 hr

ANALYST: J. Kamar

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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Member of the SGS Group (Société Générale de Surveillance)

PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

August 23, 1988

Job No.: 9345

Date Rec'd: August 1, 1988

Date Sampled: July 30, 1988

Sampled By: UP&L

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

Sample ID:

ROANS CANYON
88-4
1st Sand Unit
Temp (none given)
Flow 110 gpm
Time Sampled 17:15 hr.
Time Rec'd 10:30 hr.
Amended Selenium

WATER ANALYSIS

Potassium	1.40	mg/l	Solids, Dissolved	498.0	mg/l
08/05/88		13:30 hr.	08/03/88		11:00 hr
Selenium	0.002<	mg/l	Solids, Suspended	187.0	mg/l
08/19/88		11:00 hr.	08/09/88		11:00 hr
Silica	3.40	mg/l	Sulfate	135.0	mg/l
08/09/88		15:30 hr.	08/02/88		09:35 hr
Silver	0.020	mg/l	Vanadium	0.10<	mg/l
08/09/88		10:15 hr.	08/09/88		14:30 hr
Sodium	14.90	mg/l	Zinc	0.17	mg/l
08/05/88		14:00 hr.	08/09/88		09:00 hr

ANALYST: J. Komar

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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COMMERCIAL TESTING & ENGINEERING CO.
GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • (312) 963-9300

Member of the SGS Group (Société Générale de Surveillance)

PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

September 29, 1988

Job No.: 9420

Date Rec'd: September 15, 1988

Date Sampled: September 14, 1988

Sampled By: UP&L

Sample ID:

ROANS CANYON FAULT
TW-10
Flow 0.35/79.3 gpm
Rec'd 910 hr.
Sampled 1511 hr.

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

WATER ANALYSIS

Acidity 09/15/88 1400 hr.	24 mg/l CaCO3	Conductivity 09/15/88 1200 hr.	720 umhos/cm
Aluminum 09/22/88 1000 hr.	0.10< mg/l	Copper 09/23/88 1000 hr.	0.010< mg/l
Alk., Carbonate 09/15/88 1430 hr.	1< mg/l CaCO3	Fluoride 09/22/88 1500 hr.	0.30 mg/l
Alk., Total 09/15/88 1430 hr.	299 mg/l CaCO3	Hardness, Total	326 mg/l CaCO3
Arsenic 09/28/88 930 hr.	0.001< mg/l	Iron 09/19/88 1530 hr.	0.28 mg/l
Anions, Total 09/29/88	7.09 meq/l	Iron, Dissolved 09/19/88 1530 hr.	0.25 mg/l
Barium 09/22/88 1200 hr.	0.20< mg/l	Lead 09/23/88 1300 hr.	0.030< mg/l
Beryllium 09/23/88 1100 hr.	0.01< mg/l	Magnesium 09/19/88 1439 hr.	32.10 mg/l 36.4
Boron 09/23/88 930 hr.	0.04 mg/l	Manganese 09/19/88 1515 hr.	0.01< mg/l
Cadmium 09/23/88 1130 hr.	0.002< mg/l	Mercury 09/28/88 1000 hr.	0.001< mg/l
53.5 Calcium 09/19/88 1300 hr.	77.8 mg/l	Molybdenum 09/22/88 1400 hr.	0.10< mg/l
Cations, Total 09/29/88	7.24 meq/l	Nickel 09/23/88 1400 hr.	0.03 mg/l
5.85 Chloride 09/23/88 900 hr.	15.0 mg/l	pH 09/15/88 1120hr.	7.20 units
Chromium 09/22/88 1030 hr.	0.02< mg/l	Phosphorus, Total 09/29/88 1445 hr.	0.01< mg/l

ANALYST: D. Tipon

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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FROM UP&L HTG FLD OFC 10/01/88 10:58 P. 2

COMMERCIAL TESTING & ENGINEERING CO.
GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • (312) 953-9300

Member of the SGS Group (Société Générale de Surveillance)

PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

September 29, 1988

Job No.: 9420

Date Rec'd: September 15, 1988

Date Sampled: September 14, 1988

Sampled By: UP&L

Sample ID:

ROANS CANYON FAULT
TW-10
Flow 0.35/79.3 gpm
Rec'd 910 hr.
Sampled 1511 hr.

UTAH POWER & LIGHT CO.
P.O. Box 1005
Huntington, Utah 84528

WATER ANALYSIS

Potassium	1.40 mg/l	Solids, Dissolved	398.0 mg/l
09/19/88	1450 hr.	09/23/88	930 hr.
Selenium	0.001< mg/l	Solids, Suspended	6.0 mg/l
09/22/88	1300 hr.	09/20/88	930 hr.
Silica	3.90 mg/l	Sulfate	40.0 mg/l
09/22/88	1500 hr.	09/20/88	1110 hr.
Silver	0.010< mg/l	Vanadium	0.20< mg/l
09/23/88	1350 hr.	09/22/88	1600 hr.
Sodium	15.90 mg/l	Zinc	0.05 mg/l
09/19/88	1445 hr.	09/23/88	1030 hr.

ANALYST: D. Tipon

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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FROM UP&L HTG FLD OFC 10/01/88 10:59 P. 3

TABLE D.1.

ROANS CANYON FAULT GRABEN FLOW MODEL INPUT
CALIBRATED STEADY STATE SIMULATION
UTAH POWER & LIGHT
DEER CREEK MINE

Nodal Coordinates i	j	Transmissivity (gpd/ft) i	j	Storage Coefficient	Head Elevation (ft AMSL)	Net Flow (gpd/ft^2)	Aquifer Thickness (ft)	Hydraulic Conductivity (gpd/ft) i	j
1	1	750	750	1.00E+22	7980.00	-1.00	50.00	15.00	15.00
1	2	750	750	5.00E-05	7979.69	-1.00	50.00	15.00	15.00
1	3	750	750	5.00E-05	7967.42	-1.00	50.00	15.00	15.00
1	4	750	750	5.00E-05	7949.41	-1.00	50.00	15.00	15.00
1	5	750	750	5.00E-05	7939.20	-1.00	50.00	15.00	15.00
1	6	750	750	5.00E-05	7928.35	-1.00	50.00	15.00	15.00
1	7	750	750	5.00E-05	7916.98	-1.00	50.00	15.00	15.00
1	8	750	750	5.00E-05	7911.13	-1.00	50.00	15.00	15.00
1	9	750	750	5.00E-05	7905.17	-1.00	50.00	15.00	15.00
1	10	750	750	5.00E-05	7902.15	-1.00	50.00	15.00	15.00
1	11	750	750	5.00E-05	7899.11	-1.00	50.00	15.00	15.00
1	12	750	750	5.00E-05	7896.05	-1.00	50.00	15.00	15.00
1	13	750	750	5.00E-05	7892.96	-1.00	50.00	15.00	15.00
1	14	750	750	5.00E-05	7889.86	-1.00	50.00	15.00	15.00
1	15	750	750	5.00E-05	7886.72	-1.00	50.00	15.00	15.00
1	16	750	750	5.00E-05	7883.57	-1.00	50.00	15.00	15.00
1	17	750	750	5.00E-05	7880.39	-1.00	50.00	15.00	15.00
1	18	750	750	5.00E-05	7873.95	-1.00	50.00	15.00	15.00
1	19	750	750	5.00E-05	7867.41	-1.00	50.00	15.00	15.00
1	20	750	750	5.00E-05	7853.94	-1.00	50.00	15.00	15.00
1	21	750	750	5.00E-05	7839.89	-1.00	50.00	15.00	15.00
1	22	750	750	5.00E-05	7825.07	-1.00	50.00	15.00	15.00
1	23	750	750	5.00E-05	7792.33	-1.00	50.00	15.00	15.00
1	24	750	750	1.00E+22	7750.00	-1.00	50.00	15.00	15.00
1	25	0	0	5.00E-05	7750.00	0.00	50.00	0.00	0.00
2	1	750	750	1.00E+22	7970.00	0.00	50.00	15.00	15.00
2	2	750	750	5.00E-05	7967.32	0.00	50.00	15.00	15.00
2	3	750	750	5.00E-05	7954.44	0.00	50.00	15.00	15.00
2	4	750	750	5.00E-05	7936.28	0.00	50.00	15.00	15.00
2	5	750	750	5.00E-05	7926.03	0.00	50.00	15.00	15.00
2	6	750	750	5.00E-05	7915.15	0.00	50.00	15.00	15.00
2	7	750	750	5.00E-05	7903.76	0.00	50.00	15.00	15.00
2	8	750	750	5.00E-05	7897.90	0.00	50.00	15.00	15.00
2	9	750	750	5.00E-05	7891.94	0.00	50.00	15.00	15.00
2	10	750	750	5.00E-05	7888.92	0.00	50.00	15.00	15.00
2	11	750	750	5.00E-05	7885.88	0.00	50.00	15.00	15.00
2	12	750	750	5.00E-05	7882.82	0.00	50.00	15.00	15.00
2	13	750	750	5.00E-05	7879.74	0.00	50.00	15.00	15.00
2	14	750	750	5.00E-05	7876.63	0.00	50.00	15.00	15.00
2	15	750	750	5.00E-05	7873.50	0.00	50.00	15.00	15.00
2	16	750	750	5.00E-05	7870.34	0.00	50.00	15.00	15.00
2	17	750	750	5.00E-05	7867.17	0.00	50.00	15.00	15.00

TABLE D.1

ROANS CANYON FAULT GRABEN FLOW MODEL INPUT
CALIBRATED STEADY STATE SIMULATION
UTAH POWER & LIGHT
DEER CREEK MINE

Nodal Coordinates i	Nodal Coordinates j	Transmissivity (gpd/ft) i	Transmissivity (gpd/ft) j	Storage Coefficient	Head Elevation (ft AMSL)	Net Flow (gpd/ft^2)	Aquifer Thickness (ft)	Hydraulic Conductivity (gpd/ft) i	Hydraulic Conductivity (gpd/ft) j
2	18	750	750	5.00E-05	7860.74	0.00	50.00	15.00	15.00
2	19	750	750	5.00E-05	7854.20	0.00	50.00	15.00	15.00
2	20	750	750	5.00E-05	7840.76	0.00	50.00	15.00	15.00
2	21	750	750	5.00E-05	7826.75	0.00	50.00	15.00	15.00
2	22	750	750	5.00E-05	7812.00	0.00	50.00	15.00	15.00
2	23	750	750	5.00E-05	7779.59	0.00	50.00	15.00	15.00
2	24	750	750	1.00E+22	7740.00	0.00	50.00	15.00	15.00
2	25	0	0	1.00E-05	7740.00	0.00	50.00	0.00	0.00
3	1	750	750	1.00E+22	7960.00	0.00	50.00	15.00	15.00
3	2	750	750	5.00E-05	7955.59	0.00	50.00	15.00	15.00
3	3	750	750	5.00E-05	7941.80	0.00	50.00	15.00	15.00
3	4	750	750	5.00E-05	7923.34	0.00	50.00	15.00	15.00
3	5	750	750	5.00E-05	7913.01	0.00	50.00	15.00	15.00
3	6	750	750	5.00E-05	7902.09	0.00	50.00	15.00	15.00
3	7	750	750	5.00E-05	7890.66	0.00	50.00	15.00	15.00
3	8	750	750	5.00E-05	7884.79	0.00	50.00	15.00	15.00
3	9	750	750	5.00E-05	7878.82	0.00	50.00	15.00	15.00
3	10	750	750	5.00E-05	7875.80	0.00	50.00	15.00	15.00
3	11	750	750	5.00E-05	7872.76	0.00	50.00	15.00	15.00
3	12	750	750	5.00E-05	7869.70	0.00	50.00	15.00	15.00
3	13	750	750	5.00E-05	7866.61	0.00	50.00	15.00	15.00
3	14	750	750	5.00E-05	7863.50	0.00	50.00	15.00	15.00
3	15	750	750	5.00E-05	7860.38	0.00	50.00	15.00	15.00
3	16	750	750	5.00E-05	7857.23	0.00	50.00	15.00	15.00
3	17	750	750	5.00E-05	7854.05	0.00	50.00	15.00	15.00
3	18	750	750	5.00E-05	7847.63	0.00	50.00	15.00	15.00
3	19	750	750	5.00E-05	7841.12	0.00	50.00	15.00	15.00
3	20	750	750	5.00E-05	7827.73	0.00	50.00	15.00	15.00
3	21	750	750	5.00E-05	7813.79	0.00	50.00	15.00	15.00
3	22	750	750	5.00E-05	7799.17	0.00	50.00	15.00	15.00
3	23	750	750	5.00E-05	7767.31	0.00	50.00	15.00	15.00
3	24	750	750	1.00E+22	7730.00	0.00	50.00	15.00	15.00
3	25	0	0	1.00E-05	7730.00	0.00	50.00	0.00	0.00
4	1	750	750	1.00E+22	7950.00	0.00	50.00	15.00	15.00
4	2	750	750	5.00E-05	7944.27	0.00	50.00	15.00	15.00
4	3	750	750	5.00E-05	7929.44	0.00	50.00	15.00	15.00
4	4	750	750	5.00E-05	7910.59	0.00	50.00	15.00	15.00
4	5	750	750	5.00E-05	7900.15	0.00	50.00	15.00	15.00
4	6	750	750	5.00E-05	7889.15	0.00	50.00	15.00	15.00
4	7	750	750	5.00E-05	7877.67	0.00	50.00	15.00	15.00
4	8	750	750	5.00E-05	7871.78	0.00	50.00	15.00	15.00
4	9	750	750	5.00E-05	7865.80	0.00	50.00	15.00	15.00

TABLE D.1

ROANS CANYON FAULT GRABEN FLOW MODEL INPUT
CALIBRATED STEADY STATE SIMULATION
UTAH POWER & LIGHT
DEER CREEK MINE

Nodal Coordinates i	Nodal Coordinates j	Transmissivity (gpd/ft) i	Transmissivity (gpd/ft) j	Storage Coefficient	Head Elevation (ft AMSL)	Net Flow (gpd/ft^2)	Aquifer Thickness (ft)	Hydraulic Conductivity (gpd/ft) i	Hydraulic Conductivity (gpd/ft) j
4	10	750	750	5.00E-05	7862.78	0.00	50.00	15.00	15.00
4	11	750	750	5.00E-05	7859.74	0.00	50.00	15.00	15.00
4	12	750	750	5.00E-05	7856.67	0.00	50.00	15.00	15.00
4	13	750	750	5.00E-05	7853.59	0.00	50.00	15.00	15.00
4	14	750	750	5.00E-05	7850.48	0.00	50.00	15.00	15.00
4	15	750	750	5.00E-05	7847.36	0.00	50.00	15.00	15.00
4	16	750	750	5.00E-05	7844.21	0.00	50.00	15.00	15.00
4	17	750	750	5.00E-05	7841.05	0.00	50.00	15.00	15.00
4	18	750	750	5.00E-05	7834.65	0.00	50.00	15.00	15.00
4	19	750	750	5.00E-05	7828.15	0.00	50.00	15.00	15.00
4	20	750	750	5.00E-05	7814.83	0.00	50.00	15.00	15.00
4	21	750	750	5.00E-05	7801.01	0.00	50.00	15.00	15.00
4	22	750	750	5.00E-05	7786.56	0.00	50.00	15.00	15.00
4	23	750	750	5.00E-05	7755.36	0.00	50.00	15.00	15.00
4	24	750	750	1.00E+22	7720.00	0.00	50.00	15.00	15.00
4	25	0	0	1.00E-05	7720.00	0.00	50.00	0.00	0.00
5	1	750	750	1.00E+22	7940.00	0.00	50.00	15.00	15.00
5	2	750	750	5.00E-05	7933.23	0.00	50.00	15.00	15.00
5	3	750	750	5.00E-05	7917.34	0.00	50.00	15.00	15.00
5	4	750	750	5.00E-05	7898.02	0.00	50.00	15.00	15.00
5	5	750	750	5.00E-05	7887.43	0.00	50.00	15.00	15.00
5	6	750	750	5.00E-05	7876.32	0.00	50.00	15.00	15.00
5	7	750	750	5.00E-05	7864.78	0.00	50.00	15.00	15.00
5	8	750	750	5.00E-05	7858.88	0.00	50.00	15.00	15.00
5	9	750	750	5.00E-05	7852.88	0.00	50.00	15.00	15.00
5	10	750	750	5.00E-05	7849.85	0.00	50.00	15.00	15.00
5	11	750	750	5.00E-05	7846.81	0.00	50.00	15.00	15.00
5	12	750	750	5.00E-05	7843.74	0.00	50.00	15.00	15.00
5	13	750	750	5.00E-05	7840.66	0.00	50.00	15.00	15.00
5	14	750	750	5.00E-05	7837.56	0.00	50.00	15.00	15.00
5	15	750	750	5.00E-05	7834.44	0.00	50.00	15.00	15.00
5	16	750	750	5.00E-05	7831.30	0.00	50.00	15.00	15.00
5	17	750	750	5.00E-05	7828.14	0.00	50.00	15.00	15.00
5	18	750	750	5.00E-05	7821.76	0.00	50.00	15.00	15.00
5	19	750	750	5.00E-05	7815.30	0.00	50.00	15.00	15.00
5	20	750	750	5.00E-05	7802.07	0.00	50.00	15.00	15.00
5	21	750	750	5.00E-05	7788.38	0.00	50.00	15.00	15.00
5	22	750	750	5.00E-05	7774.14	0.00	50.00	15.00	15.00
5	23	750	750	5.00E-05	7743.68	0.00	50.00	15.00	15.00
5	24	750	750	1.00E+22	7710.00	0.00	50.00	15.00	15.00
5	25	0	0	5.00E-05	7710.00	0.00	50.00	0.00	0.00
6	1	750	750	1.00E+22	7930.00	0.00	50.00	15.00	15.00

TABLE D.1

ROANS CANYON FAULT GRABEN FLOW MODEL INPUT
CALIBRATED STEADY STATE SIMULATION
UTAH POWER & LIGHT
DEER CREEK MINE

Nodal Coordinates i	Nodal Coordinates j	Transmissivity (gpd/ft) i	Transmissivity (gpd/ft) j	Storage Coefficient	Head Elevation (ft AMSL)	Net Flow (gpd/ft^2)	Aquifer Thickness (ft)	Hydraulic Conductivity (gpd/ft) i	Hydraulic Conductivity (gpd/ft) j
6	2	750	750	5.00E-05	7922.38	0.00	50.00	15.00	15.00
6	3	750	750	5.00E-05	7905.45	0.00	50.00	15.00	15.00
6	4	750	750	5.00E-05	7885.60	0.00	50.00	15.00	15.00
6	5	750	750	5.00E-05	7874.84	0.00	50.00	15.00	15.00
6	6	750	750	5.00E-05	7863.61	0.00	50.00	15.00	15.00
6	7	750	750	5.00E-05	7852.00	0.00	50.00	15.00	15.00
6	8	750	750	5.00E-05	7846.06	0.00	50.00	15.00	15.00
6	9	750	750	5.00E-05	7840.05	0.00	50.00	15.00	15.00
6	10	750	750	5.00E-05	7837.02	0.00	50.00	15.00	15.00
6	11	750	750	5.00E-05	7833.97	0.00	50.00	15.00	15.00
6	12	750	750	5.00E-05	7830.90	0.00	50.00	15.00	15.00
6	13	750	750	5.00E-05	7827.82	0.00	50.00	15.00	15.00
6	14	750	750	5.00E-05	7824.72	0.00	50.00	15.00	15.00
6	15	750	750	5.00E-05	7821.61	0.00	50.00	15.00	15.00
6	16	750	750	5.00E-05	7818.47	0.00	50.00	15.00	15.00
6	17	750	750	5.00E-05	7815.33	0.00	50.00	15.00	15.00
6	18	750	750	5.00E-05	7808.97	0.00	50.00	15.00	15.00
6	19	750	750	5.00E-05	7802.54	0.00	50.00	15.00	15.00
6	20	750	750	5.00E-05	7789.43	0.00	50.00	15.00	15.00
6	21	750	750	5.00E-05	7775.90	0.00	50.00	15.00	15.00
6	22	750	750	5.00E-05	7761.89	0.00	50.00	15.00	15.00
6	23	750	750	5.00E-05	7732.19	0.00	50.00	15.00	15.00
6	24	750	750	1.00E+22	7700.00	0.00	50.00	15.00	15.00
6	25	0	0	5.00E-05	7700.00	0.00	50.00	0.00	0.00
7	1	750	750	1.00E+22	7920.00	0.00	50.00	15.00	15.00
7	2	750	750	5.00E-05	7911.67	0.00	50.00	15.00	15.00
7	3	750	750	5.00E-05	7893.75	0.00	50.00	15.00	15.00
7	4	750	750	5.00E-05	7873.32	0.00	50.00	15.00	15.00
7	5	750	750	5.00E-05	7862.37	0.00	50.00	15.00	15.00
7	6	750	750	5.00E-05	7851.01	0.00	50.00	15.00	15.00
7	7	750	750	5.00E-05	7839.29	0.00	50.00	15.00	15.00
7	8	750	750	5.00E-05	7833.33	0.00	50.00	15.00	15.00
7	9	750	750	5.00E-05	7827.30	0.00	50.00	15.00	15.00
7	10	750	750	5.00E-05	7824.26	0.00	50.00	15.00	15.00
7	11	750	750	5.00E-05	7821.21	0.00	50.00	15.00	15.00
7	12	750	750	5.00E-05	7818.14	0.00	50.00	15.00	15.00
7	13	750	750	5.00E-05	7815.06	0.00	50.00	15.00	15.00
7	14	750	750	5.00E-05	7811.96	0.00	50.00	15.00	15.00
7	15	750	750	5.00E-05	7808.85	0.00	50.00	15.00	15.00
7	16	750	750	5.00E-05	7805.73	0.00	50.00	15.00	15.00
7	17	750	750	5.00E-05	7802.59	0.00	50.00	15.00	15.00
7	18	750	750	5.00E-05	7796.27	0.00	50.00	15.00	15.00

TABLE D.1

ROANS CANYON FAULT GRABEN FLOW MODEL INPUT
CALIBRATED STEADY STATE SIMULATION
UTAH POWER & LIGHT
DEER CREEK MINE

Nodal Coordinates i	j	Transmissivity (gpd/ft) i	j	Storage Coefficient	Head Elevation (ft AMSL)	Net Flow (gpd/ft^2)	Aquifer Thickness (ft)	Hydraulic Conductivity (gpd/ft) i	j
7	19	750	750	5.00E-05	7789.88	0.00	50.00	15.00	15.00
7	20	750	750	5.00E-05	7776.88	0.00	50.00	15.00	15.00
7	21	750	750	5.00E-05	7763.53	0.00	50.00	15.00	15.00
7	22	750	750	5.00E-05	7749.77	0.00	50.00	15.00	15.00
7	23	750	750	5.00E-05	7720.86	0.00	50.00	15.00	15.00
7	24	750	750	1.00E+22	7690.00	0.00	50.00	15.00	15.00
7	25	0	0	5.00E-05	7690.00	0.00	50.00	0.00	0.00
8	1	750	750	1.00E+22	7910.00	0.00	50.00	15.00	15.00
8	2	750	750	5.00E-05	7901.07	0.00	50.00	15.00	15.00
8	3	750	750	5.00E-05	7882.20	0.00	50.00	15.00	15.00
8	4	750	750	5.00E-05	7861.16	0.00	50.00	15.00	15.00
8	5	750	750	5.00E-05	7850.00	0.00	50.00	15.00	15.00
8	6	750	750	5.00E-05	7838.48	0.00	50.00	15.00	15.00
8	7	750	750	5.00E-05	7826.67	0.00	50.00	15.00	15.00
8	8	750	750	5.00E-05	7820.67	0.00	50.00	15.00	15.00
8	9	750	750	5.00E-05	7814.62	0.00	50.00	15.00	15.00
8	10	750	750	5.00E-05	7811.57	0.00	50.00	15.00	15.00
8	11	750	750	5.00E-05	7808.51	0.00	50.00	15.00	15.00
8	12	750	750	5.00E-05	7805.45	0.00	50.00	15.00	15.00
8	13	750	750	5.00E-05	7802.37	0.00	50.00	15.00	15.00
8	14	750	750	5.00E-05	7799.27	0.00	50.00	15.00	15.00
8	15	750	750	5.00E-05	7796.17	0.00	50.00	15.00	15.00
8	16	750	750	5.00E-05	7793.06	0.00	50.00	15.00	15.00
8	17	750	750	5.00E-05	7789.93	0.00	50.00	15.00	15.00
8	18	750	750	5.00E-05	7783.65	0.00	50.00	15.00	15.00
8	19	750	750	5.00E-05	7777.30	0.00	50.00	15.00	15.00
8	20	750	750	5.00E-05	7764.43	0.00	50.00	15.00	15.00
8	21	750	750	5.00E-05	7751.27	0.00	50.00	15.00	15.00
8	22	750	750	5.00E-05	7737.78	0.00	50.00	15.00	15.00
8	23	750	750	5.00E-05	7709.65	0.00	50.00	15.00	15.00
8	24	750	750	1.00E+22	7680.00	0.00	50.00	15.00	15.00
8	25	0	0	5.00E-05	7680.00	0.00	50.00	0.00	0.00
9	1	750	750	1.00E+22	7900.00	0.00	50.00	15.00	15.00
9	2	750	750	5.00E-05	7890.56	0.00	50.00	15.00	15.00
9	3	750	750	5.00E-05	7870.79	0.00	50.00	15.00	15.00
9	4	750	750	5.00E-05	7849.11	0.00	50.00	15.00	15.00
9	5	750	750	5.00E-05	7837.72	0.00	50.00	15.00	15.00
9	6	750	750	5.00E-05	7826.04	0.00	50.00	15.00	15.00
9	7	750	750	5.00E-05	7814.11	0.00	50.00	15.00	15.00
9	8	750	750	5.00E-05	7808.08	0.00	50.00	15.00	15.00
9	9	750	750	5.00E-05	7802.00	0.00	50.00	15.00	15.00
9	10	750	750	5.00E-05	7798.94	0.00	50.00	15.00	15.00

TABLE D.1

ROANS CANYON FAULT GRABEN FLOW MODEL INPUT
CALIBRATED STEADY STATE SIMULATION
UTAH POWER & LIGHT
DEER CREEK MINE

Nodal Coordinates i	Nodal Coordinates j	Transmissivity (gpd/ft) i	Transmissivity (gpd/ft) j	Storage Coefficient	Head Elevation (ft AMSL)	Net Flow (gpd/ft^2)	Aquifer Thickness (ft)	Hydraulic Conductivity (gpd/ft) i	Hydraulic Conductivity (gpd/ft) j
9	11	750	750	5.00E-05	7795.88	0.00	50.00	15.00	15.00
9	12	750	750	5.00E-05	7792.81	0.00	50.00	15.00	15.00
9	13	750	750	5.00E-05	7789.73	0.00	50.00	15.00	15.00
9	14	750	750	5.00E-05	7786.64	0.00	50.00	15.00	15.00
9	15	750	750	5.00E-05	7783.55	0.00	50.00	15.00	15.00
9	16	750	750	5.00E-05	7780.44	0.00	50.00	15.00	15.00
9	17	750	750	5.00E-05	7777.33	0.00	50.00	15.00	15.00
9	18	750	750	5.00E-05	7771.08	0.00	50.00	15.00	15.00
9	19	750	750	5.00E-05	7764.79	0.00	50.00	15.00	15.00
9	20	750	750	5.00E-05	7752.06	0.00	50.00	15.00	15.00
9	21	750	750	5.00E-05	7739.10	0.00	50.00	15.00	15.00
9	22	750	750	5.00E-05	7725.88	0.00	50.00	15.00	15.00
9	23	750	750	5.00E-05	7698.54	0.00	50.00	15.00	15.00
9	24	750	750	1.00E+22	7670.00	0.00	50.00	15.00	15.00
9	25	0	0	5.00E-05	7670.00	0.00	50.00	0.00	0.00
10	1	750	750	1.00E+22	7890.00	0.00	50.00	15.00	15.00
10	2	750	750	5.00E-05	7880.11	0.00	50.00	15.00	15.00
10	3	750	750	5.00E-05	7859.49	0.00	50.00	15.00	15.00
10	4	750	750	5.00E-05	7837.15	0.00	50.00	15.00	15.00
10	5	750	750	5.00E-05	7825.52	0.00	50.00	15.00	15.00
10	6	750	750	5.00E-05	7813.66	0.00	50.00	15.00	15.00
10	7	750	750	5.00E-05	7801.61	0.00	50.00	15.00	15.00
10	8	750	750	5.00E-05	7795.53	0.00	50.00	15.00	15.00
10	9	750	750	5.00E-05	7789.43	0.00	50.00	15.00	15.00
10	10	750	750	5.00E-05	7786.36	0.00	50.00	15.00	15.00
10	11	750	750	5.00E-05	7783.29	0.00	50.00	15.00	15.00
10	12	750	750	5.00E-05	7780.22	0.00	50.00	15.00	15.00
10	13	750	750	5.00E-05	7777.14	0.00	50.00	15.00	15.00
10	14	750	750	5.00E-05	7774.06	0.00	50.00	15.00	15.00
10	15	750	750	5.00E-05	7770.97	0.00	50.00	15.00	15.00
10	16	750	750	5.00E-05	7767.88	0.00	50.00	15.00	15.00
10	17	750	750	5.00E-05	7764.78	0.00	50.00	15.00	15.00
10	18	750	750	5.00E-05	7758.56	0.00	50.00	15.00	15.00
10	19	750	750	5.00E-05	7752.32	0.00	50.00	15.00	15.00
10	20	750	750	5.00E-05	7739.74	0.00	50.00	15.00	15.00
10	21	750	750	5.00E-05	7726.99	0.00	50.00	15.00	15.00
10	22	750	750	5.00E-05	7714.05	0.00	50.00	15.00	15.00
10	23	750	750	5.00E-05	7687.50	0.00	50.00	15.00	15.00
10	24	750	750	1.00E+22	7660.00	0.00	50.00	15.00	15.00
10	25	0	0	5.00E-05	7660.00	0.00	50.00	0.00	0.00
11	1	750	750	1.00E+22	7880.00	0.00	50.00	15.00	15.00
11	2	750	750	5.00E-05	7869.74	0.00	50.00	15.00	15.00

TABLE D.1

ROANS CANYON FAULT GRABEN FLOW MODEL INPUT
CALIBRATED STEADY STATE SIMULATION
UTAH POWER & LIGHT
DEER CREEK MINE

Nodal Coordinates i	Nodal Coordinates j	Transmissivity (gpd/ft) i	Transmissivity (gpd/ft) j	Storage Coefficient	Head Elevation (ft AMSL)	Net Flow (gpd/ft^2)	Aquifer Thickness (ft)	Hydraulic Conductivity (gpd/ft) i	Hydraulic Conductivity (gpd/ft) j
11	3	750	750	5.00E-05	7848.30	0.00	50.00	15.00	15.00
11	4	750	750	5.00E-05	7825.27	0.00	50.00	15.00	15.00
11	5	750	750	5.00E-05	7813.38	0.00	50.00	15.00	15.00
11	6	750	750	5.00E-05	7801.33	0.00	50.00	15.00	15.00
11	7	750	750	5.00E-05	7789.14	0.00	50.00	15.00	15.00
11	8	750	750	5.00E-05	7783.02	0.00	50.00	15.00	15.00
11	9	750	750	5.00E-05	7776.89	0.00	50.00	15.00	15.00
11	10	750	750	5.00E-05	7773.81	0.00	50.00	15.00	15.00
11	11	750	750	5.00E-05	7770.74	0.00	50.00	15.00	15.00
11	12	750	750	5.00E-05	7767.66	0.00	50.00	15.00	15.00
11	13	750	750	5.00E-05	7764.58	0.00	50.00	15.00	15.00
11	14	750	750	5.00E-05	7761.50	0.00	50.00	15.00	15.00
11	15	750	750	5.00E-05	7758.42	0.00	50.00	15.00	15.00
11	16	750	750	5.00E-05	7755.34	0.00	50.00	15.00	15.00
11	17	750	750	5.00E-05	7752.25	0.00	50.00	15.00	15.00
11	18	750	750	5.00E-05	7746.08	0.00	50.00	15.00	15.00
11	19	750	750	5.00E-05	7739.89	0.00	50.00	15.00	15.00
11	20	750	750	5.00E-05	7727.46	0.00	50.00	15.00	15.00
11	21	750	750	5.00E-05	7714.94	0.00	50.00	15.00	15.00
11	22	750	750	5.00E-05	7702.29	0.00	50.00	15.00	15.00
11	23	750	750	5.00E-05	7676.51	0.00	50.00	15.00	15.00
11	24	750	750	1.00E+22	7650.00	0.00	50.00	15.00	15.00
11	25	0	0	5.00E-05	7650.00	0.00	50.00	0.00	0.00
12	1	750	750	1.00E+22	7870.00	0.00	50.00	15.00	15.00
12	2	750	750	5.00E-05	7859.45	0.00	50.00	15.00	15.00
12	3	750	750	5.00E-05	7837.21	0.00	50.00	15.00	15.00
12	4	750	750	5.00E-05	7813.45	0.00	50.00	15.00	15.00
12	5	750	750	5.00E-05	7801.29	0.00	50.00	15.00	15.00
12	6	750	750	5.00E-05	7789.03	0.00	50.00	15.00	15.00
12	7	750	750	5.00E-05	7776.70	0.00	50.00	15.00	15.00
12	8	750	750	5.00E-05	7770.54	0.00	50.00	15.00	15.00
12	9	750	750	5.00E-05	7764.37	0.00	50.00	15.00	15.00
12	10	750	750	5.00E-05	7761.28	0.00	50.00	15.00	15.00
12	11	750	750	5.00E-05	7758.20	0.00	50.00	15.00	15.00
12	12	750	750	5.00E-05	7755.12	0.00	50.00	15.00	15.00
12	13	750	750	5.00E-05	7752.04	0.00	50.00	15.00	15.00
12	14	750	750	5.00E-05	7748.97	0.00	50.00	15.00	15.00
12	15	750	750	5.00E-05	7745.89	0.00	50.00	15.00	15.00
12	16	750	750	5.00E-05	7742.82	0.00	50.00	15.00	15.00
12	17	750	750	5.00E-05	7739.75	0.00	50.00	15.00	15.00
12	18	750	750	5.00E-05	7733.62	0.00	50.00	15.00	15.00
12	19	750	750	5.00E-05	7727.48	0.00	50.00	15.00	15.00

TABLE D.1

ROANS CANYON FAULT GRABEN FLOW MODEL INPUT
CALIBRATED STEADY STATE SIMULATION
UTAH POWER & LIGHT
DEER CREEK MINE

Nodal Coordinates i	Nodal Coordinates j	Transmissivity (gpd/ft) i	Transmissivity (gpd/ft) j	Storage Coefficient	Head Elevation (ft AMSL)	Net Flow (gpd/ft^2)	Aquifer Thickness (ft)	Hydraulic Conductivity (gpd/ft) i	Hydraulic Conductivity (gpd/ft) j
12	20	750	750	5.00E-05	7715.21	0.00	50.00	15.00	15.00
12	21	750	750	5.00E-05	7702.91	0.00	50.00	15.00	15.00
12	22	750	750	5.00E-05	7690.56	0.00	50.00	15.00	15.00
12	23	750	750	5.00E-05	7665.58	0.00	50.00	15.00	15.00
12	24	750	750	1.00E+22	7640.00	0.00	50.00	15.00	15.00
12	25	0	0	5.00E-05	7640.00	0.00	50.00	0.00	0.00
13	1	750	750	1.00E+22	7860.00	0.00	50.00	15.00	15.00
13	2	750	750	5.00E-05	7849.24	0.00	50.00	15.00	15.00
13	3	750	750	5.00E-05	7826.22	0.00	50.00	15.00	15.00
13	4	750	750	5.00E-05	7801.67	0.00	50.00	15.00	15.00
13	5	750	750	5.00E-05	7789.22	0.00	50.00	15.00	15.00
13	6	750	750	5.00E-05	7776.74	0.00	50.00	15.00	15.00
13	7	750	750	5.00E-05	7764.27	0.00	50.00	15.00	15.00
13	8	750	750	5.00E-05	7758.05	0.00	50.00	15.00	15.00
13	9	750	750	5.00E-05	7751.85	0.00	50.00	15.00	15.00
13	10	750	750	5.00E-05	7748.76	0.00	50.00	15.00	15.00
13	11	750	750	5.00E-05	7745.67	0.00	50.00	15.00	15.00
13	12	750	750	5.00E-05	7742.58	0.00	50.00	15.00	15.00
13	13	750	750	5.00E-05	7739.50	0.00	50.00	15.00	15.00
13	14	750	750	5.00E-05	7736.43	0.00	50.00	15.00	15.00
13	15	750	750	5.00E-05	7733.36	0.00	50.00	15.00	15.00
13	16	750	750	5.00E-05	7730.30	0.00	50.00	15.00	15.00
13	17	750	750	5.00E-05	7727.25	0.00	50.00	15.00	15.00
13	18	750	750	5.00E-05	7721.15	0.00	50.00	15.00	15.00
13	19	750	750	5.00E-05	7715.08	0.00	50.00	15.00	15.00
13	20	750	750	5.00E-05	7702.97	0.00	50.00	15.00	15.00
13	21	750	750	5.00E-05	7690.90	0.00	50.00	15.00	15.00
13	22	750	750	5.00E-05	7678.85	0.00	50.00	15.00	15.00
13	23	750	750	5.00E-05	7654.67	0.00	50.00	15.00	15.00
13	24	750	750	1.00E+22	7630.00	0.00	50.00	15.00	15.00
13	25	0	0	5.00E-05	7630.00	0.00	50.00	0.00	0.00
14	1	750	750	1.00E+22	7850.00	0.00	50.00	15.00	15.00
14	2	750	750	5.00E-05	7839.17	0.00	50.00	15.00	15.00
14	3	750	750	5.00E-05	7815.33	0.00	50.00	15.00	15.00
14	4	750	750	5.00E-05	7789.93	0.00	50.00	15.00	15.00
14	5	750	750	5.00E-05	7777.17	0.00	50.00	15.00	15.00
14	6	750	750	5.00E-05	7764.46	0.00	50.00	15.00	15.00
14	7	750	750	5.00E-05	7751.83	0.00	50.00	15.00	15.00
14	8	750	750	5.00E-05	7745.56	0.00	50.00	15.00	15.00
14	9	750	750	5.00E-05	7739.32	0.00	50.00	15.00	15.00
14	10	750	750	5.00E-05	7736.22	0.00	50.00	15.00	15.00
14	11	750	750	5.00E-05	7733.12	0.00	50.00	15.00	15.00

TABLE D.1

ROANS CANYON FAULT GRABEN FLOW MODEL INPUT
CALIBRATED STEADY STATE SIMULATION
UTAH POWER & LIGHT
DEER CREEK MINE

Nodal Coordinates i	j	Transmissivity (gpd/ft) i	j	Storage Coefficient	Head Elevation (ft AMSL)	Net Flow (gpd/ft^2)	Aquifer Thickness (ft)	Hydraulic Conductivity (gpd/ft) i	j
14	12	750	750	5.00E-05	7730.03	0.00	50.00	15.00	15.00
14	13	750	750	5.00E-05	7726.95	0.00	50.00	15.00	15.00
14	14	750	750	5.00E-05	7723.88	0.00	50.00	15.00	15.00
14	15	750	750	5.00E-05	7720.82	0.00	50.00	15.00	15.00
14	16	750	750	5.00E-05	7717.77	0.00	50.00	15.00	15.00
14	17	750	750	5.00E-05	7714.73	0.00	50.00	15.00	15.00
14	18	750	750	5.00E-05	7708.68	0.00	50.00	15.00	15.00
14	19	750	750	5.00E-05	7702.66	0.00	50.00	15.00	15.00
14	20	750	750	5.00E-05	7690.72	0.00	50.00	15.00	15.00
14	21	750	750	5.00E-05	7678.89	0.00	50.00	15.00	15.00
14	22	750	750	5.00E-05	7667.15	0.00	50.00	15.00	15.00
14	23	750	750	5.00E-05	7643.81	0.00	50.00	15.00	15.00
14	24	750	750	1.00E+22	7620.00	0.00	50.00	15.00	15.00
14	25	0	0	5.00E-05	7620.00	0.00	50.00	0.00	0.00
15	1	750	750	1.00E+22	7840.00	0.00	50.00	15.00	15.00
15	2	750	750	5.00E-05	7829.27	0.00	50.00	15.00	15.00
15	3	750	750	5.00E-05	7804.53	0.00	50.00	15.00	15.00
15	4	750	750	5.00E-05	7778.20	0.00	50.00	15.00	15.00
15	5	750	750	5.00E-05	7765.10	0.00	50.00	15.00	15.00
15	6	750	750	5.00E-05	7752.15	0.00	50.00	15.00	15.00
15	7	750	750	5.00E-05	7739.37	0.00	50.00	15.00	15.00
15	8	750	750	5.00E-05	7733.05	0.00	50.00	15.00	15.00
15	9	750	750	5.00E-05	7726.77	0.00	50.00	15.00	15.00
15	10	750	750	5.00E-05	7723.65	0.00	50.00	15.00	15.00
15	11	750	750	5.00E-05	7720.55	0.00	50.00	15.00	15.00
15	12	750	750	5.00E-05	7717.45	0.00	50.00	15.00	15.00
15	13	750	750	5.00E-05	7714.37	0.00	50.00	15.00	15.00
15	14	750	750	5.00E-05	7711.31	0.00	50.00	15.00	15.00
15	15	750	750	5.00E-05	7708.26	0.00	50.00	15.00	15.00
15	16	750	750	5.00E-05	7705.22	0.00	50.00	15.00	15.00
15	17	750	750	5.00E-05	7702.19	0.00	50.00	15.00	15.00
15	18	750	750	5.00E-05	7696.18	0.00	50.00	15.00	15.00
15	19	750	750	5.00E-05	7690.22	0.00	50.00	15.00	15.00
15	20	750	750	5.00E-05	7678.44	0.00	50.00	15.00	15.00
15	21	750	750	5.00E-05	7666.86	0.00	50.00	15.00	15.00
15	22	750	750	5.00E-05	7655.45	0.00	50.00	15.00	15.00
15	23	750	750	5.00E-05	7632.96	0.00	50.00	15.00	15.00
15	24	750	750	1.00E+22	7610.00	0.00	50.00	15.00	15.00
15	25	0	0	5.00E-05	7610.00	0.00	50.00	0.00	0.00
16	1	750	750	1.00E+22	7830.00	0.00	50.00	15.00	15.00
16	2	750	750	5.00E-05	7819.65	0.00	50.00	15.00	15.00
16	3	750	750	5.00E-05	7793.83	0.00	50.00	15.00	15.00

TABLE D.1

ROANS CANYON FAULT GRABEN FLOW MODEL INPUT
CALIBRATED STEADY STATE SIMULATION
UTAH POWER & LIGHT
DEER CREEK MINE

Nodal Coordinates i	Nodal Coordinates j	Transmissivity (gpd/ft) i	Transmissivity (gpd/ft) j	Storage Coefficient	Head Elevation (ft AMSL)	Net Flow (gpd/ft^2)	Aquifer Thickness (ft)	Hydraulic Conductivity (gpd/ft) i	Hydraulic Conductivity (gpd/ft) j
16	4	750	750	5.00E-05	7766.45	0.00	50.00	15.00	15.00
16	5	750	750	5.00E-05	7753.00	0.00	50.00	15.00	15.00
16	6	750	750	5.00E-05	7739.80	0.00	50.00	15.00	15.00
16	7	750	750	5.00E-05	7726.86	0.00	50.00	15.00	15.00
16	8	750	750	5.00E-05	7720.48	0.00	50.00	15.00	15.00
16	9	750	750	5.00E-05	7714.17	0.00	50.00	15.00	15.00
16	10	750	750	5.00E-05	7711.04	0.00	50.00	15.00	15.00
16	11	750	750	5.00E-05	7707.93	0.00	50.00	15.00	15.00
16	12	750	750	5.00E-05	7704.83	0.00	50.00	15.00	15.00
16	13	750	750	5.00E-05	7701.75	0.00	50.00	15.00	15.00
16	14	750	750	5.00E-05	7698.69	0.00	50.00	15.00	15.00
16	15	750	750	5.00E-05	7695.64	0.00	50.00	15.00	15.00
16	16	750	750	5.00E-05	7692.61	0.00	50.00	15.00	15.00
16	17	750	750	5.00E-05	7689.60	0.00	50.00	15.00	15.00
16	18	750	750	5.00E-05	7683.63	0.00	50.00	15.00	15.00
16	19	750	750	5.00E-05	7677.73	0.00	50.00	15.00	15.00
16	20	750	750	5.00E-05	7666.12	0.00	50.00	15.00	15.00
16	21	750	750	5.00E-05	7654.78	0.00	50.00	15.00	15.00
16	22	750	750	5.00E-05	7643.71	0.00	50.00	15.00	15.00
16	23	750	750	5.00E-05	7622.15	0.00	50.00	15.00	15.00
16	24	750	750	1.00E+22	7600.00	0.00	50.00	15.00	15.00
16	25	0	0	5.00E-05	7600.00	0.00	50.00	0.00	0.00
17	1	750	750	1.00E+22	7820.00	0.00	50.00	15.00	15.00
17	2	750	750	5.00E-05	7810.45	0.00	50.00	15.00	15.00
17	3	750	750	5.00E-05	7783.23	0.00	50.00	15.00	15.00
17	4	750	750	5.00E-05	7754.67	0.00	50.00	15.00	15.00
17	5	750	750	5.00E-05	7740.85	0.00	50.00	15.00	15.00
17	6	750	750	5.00E-05	7727.39	0.00	50.00	15.00	15.00
17	7	750	750	5.00E-05	7714.29	0.00	50.00	15.00	15.00
17	8	750	750	5.00E-05	7707.86	0.00	50.00	15.00	15.00
17	9	750	750	5.00E-05	7701.52	0.00	50.00	15.00	15.00
17	10	750	750	5.00E-05	7698.38	0.00	50.00	15.00	15.00
17	11	750	750	5.00E-05	7695.25	0.00	50.00	15.00	15.00
17	12	750	750	5.00E-05	7692.15	0.00	50.00	15.00	15.00
17	13	750	750	5.00E-05	7689.07	0.00	50.00	15.00	15.00
17	14	750	750	5.00E-05	7686.01	0.00	50.00	15.00	15.00
17	15	750	750	5.00E-05	7682.97	0.00	50.00	15.00	15.00
17	16	750	750	5.00E-05	7679.95	0.00	50.00	15.00	15.00
17	17	750	750	5.00E-05	7676.96	0.00	50.00	15.00	15.00
17	18	750	750	5.00E-05	7671.02	0.00	50.00	15.00	15.00
17	19	750	750	5.00E-05	7665.17	0.00	50.00	15.00	15.00
17	20	750	750	5.00E-05	7653.73	0.00	50.00	15.00	15.00

TABLE D.1

ROANS CANYON FAULT GRABEN FLOW MODEL INPUT
CALIBRATED STEADY STATE SIMULATION
UTAH POWER & LIGHT
DEER CREEK MINE

Nodal Coordinates i	Nodal Coordinates j	Transmissivity (gpd/ft) i	Transmissivity (gpd/ft) j	Storage Coefficient	Head Elevation (ft AMSL)	Net Flow (gpd/ft^2)	Aquifer Thickness (ft)	Hydraulic Conductivity (gpd/ft) i	Hydraulic Conductivity (gpd/ft) j
17	21	750	750	5.00E-05	7642.64	0.00	50.00	15.00	15.00
17	22	750	750	5.00E-05	7631.92	0.00	50.00	15.00	15.00
17	23	750	750	5.00E-05	7611.38	0.00	50.00	15.00	15.00
17	24	750	750	1.00E+22	7590.00	0.00	50.00	15.00	15.00
17	25	0	0	5.00E-05	7590.00	0.00	50.00	0.00	0.00
18	1	750	750	1.00E+22	7810.00	0.00	50.00	15.00	15.00
18	2	750	750	5.00E-05	7801.94	0.00	50.00	15.00	15.00
18	3	750	750	5.00E-05	7772.71	0.00	50.00	15.00	15.00
18	4	750	750	5.00E-05	7742.81	0.00	50.00	15.00	15.00
18	5	750	750	5.00E-05	7728.60	0.00	50.00	15.00	15.00
18	6	750	750	5.00E-05	7714.89	0.00	50.00	15.00	15.00
18	7	750	750	5.00E-05	7701.64	0.00	50.00	15.00	15.00
18	8	750	750	5.00E-05	7695.17	0.00	50.00	15.00	15.00
18	9	750	750	5.00E-05	7688.79	0.00	50.00	15.00	15.00
18	10	750	750	5.00E-05	7685.63	0.00	50.00	15.00	15.00
18	11	750	750	5.00E-05	7682.50	0.00	50.00	15.00	15.00
18	12	750	750	5.00E-05	7679.40	0.00	50.00	15.00	15.00
18	13	750	750	5.00E-05	7676.32	0.00	50.00	15.00	15.00
18	14	750	750	5.00E-05	7673.26	0.00	50.00	15.00	15.00
18	15	750	750	5.00E-05	7670.23	0.00	50.00	15.00	15.00
18	16	750	750	5.00E-05	7667.22	0.00	50.00	15.00	15.00
18	17	750	750	5.00E-05	7664.23	0.00	50.00	15.00	15.00
18	18	750	750	5.00E-05	7658.34	0.00	50.00	15.00	15.00
18	19	750	750	5.00E-05	7652.54	0.00	50.00	15.00	15.00
18	20	750	750	5.00E-05	7641.25	0.00	50.00	15.00	15.00
18	21	750	750	5.00E-05	7630.41	0.00	50.00	15.00	15.00
18	22	750	750	5.00E-05	7620.06	0.00	50.00	15.00	15.00
18	23	750	750	5.00E-05	7600.66	0.00	50.00	15.00	15.00
18	24	750	750	1.00E+22	7580.00	0.00	50.00	15.00	15.00
18	25	0	0	5.00E-05	7580.00	0.00	50.00	0.00	0.00
19	1	750	750	1.00E+22	7800.00	0.00	50.00	15.00	15.00
19	2	750	750	5.00E-05	7794.51	0.00	50.00	15.00	15.00
19	3	750	750	5.00E-05	7762.23	0.00	50.00	15.00	15.00
19	4	750	750	5.00E-05	7730.82	0.00	50.00	15.00	15.00
19	5	750	750	5.00E-05	7716.22	0.00	50.00	15.00	15.00
19	6	750	750	5.00E-05	7702.28	0.00	50.00	15.00	15.00
19	7	750	750	5.00E-05	7688.89	0.00	50.00	15.00	15.00
19	8	750	750	5.00E-05	7682.37	0.00	50.00	15.00	15.00
19	9	750	750	5.00E-05	7675.97	0.00	50.00	15.00	15.00
19	10	750	750	5.00E-05	7672.80	0.00	50.00	15.00	15.00
19	11	750	750	5.00E-05	7669.67	0.00	50.00	15.00	15.00
19	12	750	750	5.00E-05	7666.56	0.00	50.00	15.00	15.00

TABLE D.1

ROANS CANYON FAULT GRABEN FLOW MODEL INPUT
CALIBRATED STEADY STATE SIMULATION
UTAH POWER & LIGHT
DEER CREEK MINE

Nodal Coordinates i	Nodal Coordinates j	Transmissivity (gpd/ft) i	Transmissivity (gpd/ft) j	Storage Coefficient	Head Elevation (ft AMSL)	Net Flow (gpd/ft^2)	Aquifer Thickness (ft)	Hydraulic Conductivity (gpd/ft) i	Hydraulic Conductivity (gpd/ft) j
19	13	750	750	5.00E-05	7663.47	0.00	50.00	15.00	15.00
19	14	750	750	5.00E-05	7660.42	0.00	50.00	15.00	15.00
19	15	750	750	5.00E-05	7657.39	0.00	50.00	15.00	15.00
19	16	750	750	5.00E-05	7654.39	0.00	50.00	15.00	15.00
19	17	750	750	5.00E-05	7651.42	0.00	50.00	15.00	15.00
19	18	750	750	5.00E-05	7645.55	0.00	50.00	15.00	15.00
19	19	750	750	5.00E-05	7639.80	0.00	50.00	15.00	15.00
19	20	750	750	5.00E-05	7628.66	0.00	50.00	15.00	15.00
19	21	750	750	5.00E-05	7618.06	0.00	50.00	15.00	15.00
19	22	750	750	5.00E-05	7608.10	0.00	50.00	15.00	15.00
19	23	750	750	5.00E-05	7590.01	0.00	50.00	15.00	15.00
19	24	750	750	1.00E+22	7570.00	0.00	50.00	15.00	15.00
19	25	0	0	5.00E-05	7570.00	0.00	50.00	0.00	0.00
20	1	750	750	1.00E+22	7790.00	0.00	50.00	15.00	15.00
20	2	750	750	5.00E-05	7788.86	0.00	50.00	15.00	15.00
20	3	750	750	5.00E-05	7751.70	0.00	50.00	15.00	15.00
20	4	750	750	5.00E-05	7718.65	0.00	50.00	15.00	15.00
20	5	750	750	5.00E-05	7703.69	0.00	50.00	15.00	15.00
20	6	750	750	5.00E-05	7689.54	0.00	50.00	15.00	15.00
20	7	750	750	5.00E-05	7676.03	0.00	50.00	15.00	15.00
20	8	750	750	5.00E-05	7669.47	0.00	50.00	15.00	15.00
20	9	750	750	5.00E-05	7663.04	0.00	50.00	15.00	15.00
20	10	750	750	5.00E-05	7659.87	0.00	50.00	15.00	15.00
20	11	750	750	5.00E-05	7656.73	0.00	50.00	15.00	15.00
20	12	750	750	5.00E-05	7653.62	0.00	50.00	15.00	15.00
20	13	750	750	5.00E-05	7650.53	0.00	50.00	15.00	15.00
20	14	750	750	5.00E-05	7647.48	0.00	50.00	15.00	15.00
20	15	750	750	5.00E-05	7644.46	0.00	50.00	15.00	15.00
20	16	750	750	5.00E-05	7641.46	0.00	50.00	15.00	15.00
20	17	750	750	5.00E-05	7638.50	0.00	50.00	15.00	15.00
20	18	750	750	5.00E-05	7632.66	0.00	50.00	15.00	15.00
20	19	750	750	5.00E-05	7626.95	0.00	50.00	15.00	15.00
20	20	750	750	5.00E-05	7615.93	0.00	50.00	15.00	15.00
20	21	750	750	5.00E-05	7605.55	0.00	50.00	15.00	15.00
20	22	750	750	5.00E-05	7595.98	0.00	50.00	15.00	15.00
20	23	750	750	5.00E-05	7579.49	0.00	50.00	15.00	15.00
20	24	750	750	1.00E+22	7560.00	0.00	50.00	15.00	15.00
20	25	0	0	5.00E-05	7560.00	0.00	50.00	0.00	0.00
21	1	750	750	1.00E+22	7780.00	1.00	50.00	15.00	15.00
21	2	750	750	5.00E-05	7786.11	1.00	50.00	15.00	15.00
21	3	750	750	5.00E-05	7740.91	1.00	50.00	15.00	15.00
21	4	750	750	5.00E-05	7706.22	1.00	50.00	15.00	15.00

TABLE D.1

ROANS CANYON FAULT GRABEN FLOW MODEL INPUT
CALIBRATED STEADY STATE SIMULATION
UTAH POWER & LIGHT
DEER CREEK MINE

Nodal Coordinates i	Nodal Coordinates j	Transmissivity (gpd/ft) i	Transmissivity (gpd/ft) j	Storage Coefficient	Head Elevation (ft AMSL)	Net Flow (gpd/ft^2)	Aquifer Thickness (ft)	Hydraulic Conductivity (gpd/ft) i	Hydraulic Conductivity (gpd/ft) j
21	5	750	750	5.00E-05	7690.95	1.00	50.00	15.00	15.00
21	6	750	750	5.00E-05	7676.64	1.00	50.00	15.00	15.00
21	7	750	750	5.00E-05	7663.04	1.00	50.00	15.00	15.00
21	8	750	750	5.00E-05	7656.45	1.00	50.00	15.00	15.00
21	9	750	750	5.00E-05	7650.00	1.00	50.00	15.00	15.00
21	10	750	750	5.00E-05	7646.83	1.00	50.00	15.00	15.00
21	11	750	750	5.00E-05	7643.68	1.00	50.00	15.00	15.00
21	12	750	750	5.00E-05	7640.57	1.00	50.00	15.00	15.00
21	13	750	750	5.00E-05	7637.48	1.00	50.00	15.00	15.00
21	14	750	750	5.00E-05	7634.43	1.00	50.00	15.00	15.00
21	15	750	750	5.00E-05	7631.41	1.00	50.00	15.00	15.00
21	16	750	750	5.00E-05	7628.42	1.00	50.00	15.00	15.00
21	17	750	750	5.00E-05	7625.46	1.00	50.00	15.00	15.00
21	18	750	750	5.00E-05	7619.65	1.00	50.00	15.00	15.00
21	19	750	750	5.00E-05	7613.96	1.00	50.00	15.00	15.00
21	20	750	750	5.00E-05	7603.04	1.00	50.00	15.00	15.00
21	21	750	750	5.00E-05	7592.85	1.00	50.00	15.00	15.00
21	22	750	750	5.00E-05	7583.64	1.00	50.00	15.00	15.00
21	23	750	750	5.00E-05	7569.15	1.00	50.00	15.00	15.00
21	24	750	750	1.00E+22	7550.00	1.00	50.00	15.00	15.00
21	25	0	0	5.00E-05	7550.00	0.00	50.00	0.00	0.00
22	1	1000	1000	1.00E+22	7900.00	0.00	50.00	20.00	20.00
22	2	1000	1000	5.00E-05	7801.48	0.00	50.00	20.00	20.00
22	3	1000	1000	5.00E-05	7742.80	0.00	50.00	20.00	20.00
22	4	1000	1000	5.00E-05	7706.79	0.00	50.00	20.00	20.00
22	5	1000	1000	5.00E-05	7691.30	0.00	50.00	20.00	20.00
22	6	1000	1000	5.00E-05	7676.89	0.00	50.00	20.00	20.00
22	7	1000	1000	5.00E-05	7663.24	0.00	50.00	20.00	20.00
22	8	1000	1000	5.00E-05	7656.64	0.00	50.00	20.00	20.00
22	9	1000	1000	5.00E-05	7650.18	0.00	50.00	20.00	20.00
22	10	1000	1000	5.00E-05	7647.00	0.00	50.00	20.00	20.00
22	11	1000	1000	5.00E-05	7643.85	0.00	50.00	20.00	20.00
22	12	1000	1000	5.00E-05	7640.74	0.00	50.00	20.00	20.00
22	13	1000	1000	5.00E-05	7637.65	0.00	50.00	20.00	20.00
22	14	1000	1000	5.00E-05	7634.60	0.00	50.00	20.00	20.00
22	15	1000	1000	5.00E-05	7631.58	0.00	50.00	20.00	20.00
22	16	1000	1000	5.00E-05	7628.60	0.00	50.00	20.00	20.00
22	17	1000	1000	5.00E-05	7625.64	0.00	50.00	20.00	20.00
22	18	1000	1000	5.00E-05	7619.83	0.00	50.00	20.00	20.00
22	19	1000	1000	5.00E-05	7614.17	0.00	50.00	20.00	20.00
22	20	1000	1000	5.00E-05	7603.30	0.00	50.00	20.00	20.00
22	21	1000	1000	5.00E-05	7593.23	0.00	50.00	20.00	20.00

TABLE D.1

ROANS CANYON FAULT GRABEN FLOW MODEL INPUT
CALIBRATED STEADY STATE SIMULATION
UTAH POWER & LIGHT
DEER CREEK MINE

Nodal Coordinates i	Nodal Coordinates j	Transmissivity (gpd/ft) i	Transmissivity (gpd/ft) j	Storage Coefficient	Head Elevation (ft AMSL)	Net Flow (gpd/ft^2)	Aquifer Thickness (ft)	Hydraulic Conductivity (gpd/ft) i	Hydraulic Conductivity (gpd/ft) j
22	22	1000	1000	5.00E-05	7584.30	0.00	50.00	20.00	20.00
22	23	1000	1000	5.00E-05	7572.43	0.00	50.00	20.00	20.00
22	24	1000	1000	1.00E+22	7600.00	0.00	50.00	20.00	20.00
22	25	0	0	5.00E-05	7600.00	0.00	50.00	0.00	0.00