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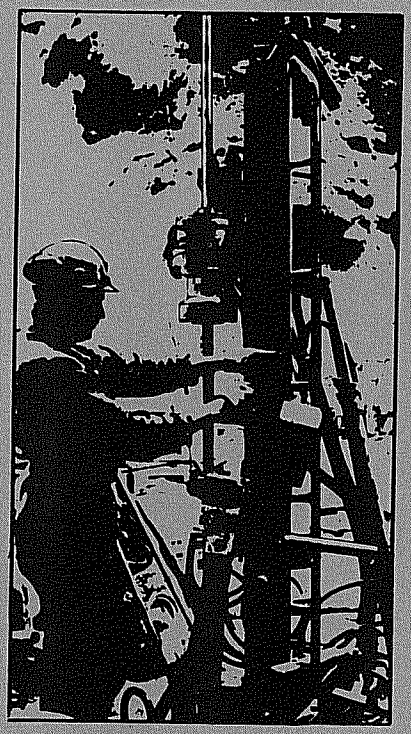

Technical Information Report No. 46

FRACTURE AND HYDROLOGY DATA FROM FIELD STUDIES AT STRIPA, SWEDEN

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April 1981

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PREFACE

This report is one of a series documenting the results of the Swedish-American cooperative research program in which the cooperating scientists explore the geological, geophysical, hydrological, geochemical, and structural effects anticipated from the use of a large crystalline rock mass as a geologic repository for nuclear waste. This program has been sponsored by the Swedish Nuclear Power Utilities through the Swedish Nuclear Fuel Supply Company (SKBF), and the U.S. Department of Energy (DOE) through the Lawrence Berkeley Laboratory.

The principal investigators are L.B. Nilsson and O. Degerman for SKBF, and N.G.W. Cook, P.A. Witherspoon, and J.E. Gale for LBL. Other participants will appear as authors of the individual reports.

Previous technical reports in this series are listed below.

1. Swedish-American Cooperative Program on Radioactive Waste Storage in Mined Caverns by P.A. Witherspoon and O. Degerman. (LBL-7049, SAC-01).

2. Large Scale Permeability Test of the Granite in the Stripa Mine and Thermal Conductivity Test by Lars Lundstrom and Haken Stille. (LBL-7052, SAC-02).

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10. Mechanical and Thermal Design Considerations for Radioactive Waste Repositories in Hard Rock. Part I: An Appraisal of Hard Rock for Potential Underground Repositories of Radioactive Waste by N.G.W. Cook; Part II: In Situ Heating Experiments in Hard Rock: Their Objectives and Design by N.G.W. Cook and P.A. Witherspoon. (LBL-7073, SAC-10).

11. Full-Scale and Time-Scale Heating Experiments at Stripa: Preliminary Results by N.G.W. Cook and M. Hood. (LBL-7072, SAC-11).

12. Geochemistry and Isotope Hydrology of Groundwaters in the Stripa Granite: Results and Preliminary Interpretation by P. Fritz, J.F. Barker, and J.E. Gale. (LBL-8285, SAC-12).

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15. An Approach to the Fracture Hydrology at Stripa: Preliminary Results by J.E. Gale and P.A. Witherspoon. (LBL-7079, SAC-15).

16. Preliminary Report on Geophysical and Mechanical Borehole Measurements at Stripa by P. Nelson, B. Paulsson, R. Rachiele, L. Andersson, T. Schrauf, W. Hustrulid, O. Duran, and K.A. Magnussen. (LBL-8280, SAC-16).

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26. Part I: Some Results From a Field Investigation of Thermo-Mechanical Loading of a Rock Mass When Heater Canisters are Emplaced in the Rock by M. Hood. Part II: The Application of Field Data from Heater Experiments Conducted at Stripa, Sweden for Repository Design by M. Hood, H. Carlsson, and P.H. Nelson. (LBL-9392, SAC-26).

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52. Characterization of the Fracture System at Stripa with Emphasis on the Ventilation Drift by A. Rouleau and J. E. Gale. (LBL-14875, SAC-52).

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ABSTRACT

The purpose of this report is to present the basic fracture and hydrology data collected as part of the joint LBL-KBS fracture hydrology program at Stripa, Sweden. A detailed description of the fracture-core logging and hydrology borehole testing procedures is included as well as a description of how the fracture and hydrology data were coded and organized. Based on this coding a series of computer data files for the fracture and hydrology borehole data have been constructed and these are described in detail. The fracture data file for one borehole is presented as an example in an appendix along with all of the raw and some partially processed and analyzed fracture hydrology data files. A detailed description of how this data will be analyzed to develop a thorough understanding of the fracture system and hydrogeologic characteristics of the Stripa site is presented.

1. INTRODUCTION

1.1 Background

The overall fracture hydrology program at Stripa is described by Gale and Witherspoon (1979) and consists of five basic field components (Fig. 1.1). These components are (1) calculations of directional permeabilities. (2) analysis of the groundwater geochemistry and isotopes, (3) tracer tests, (4) an underground ventilation experiment to measure in-situ seepage and (5) pump tests. Data obtained from each of the five components will be synthetized and integrated through the use of numerical flow and transport models.

Fracture hydrology field studies started in late 1977 and were terminated in early 1980. Preliminary results of the fracture hydrology program at Stripa are documented in the following reports and papers: Gale and Witherspoon (1979), Forster and Gale (1979), Forster and Gale (1981), Gale and Raven (1980), Gale et al. (1979), Witherspoon et al. (1979a), Olkiewicz et al (1979), Fritz et al. (1979a), Fritz et al. (1979b), Fritz et al. (1979c), Andrews et al. (1980), Fritz et al. (1980), Witherspoon et al. (1979b), Witherspoon et al. (1980), and Witherspoon et al. (1981). Other summary papers appear in various conference and workshop proceedings.

As part of this field program we have conducted an extensive series of borehole measurements and observations. These include (1) in-situ pore measurements during drilling, (2) measurements of the variation in water levels in boreholes open at the surface, (3) water outflow measurements from instrument and heater boreholes in conjunction with the thermal

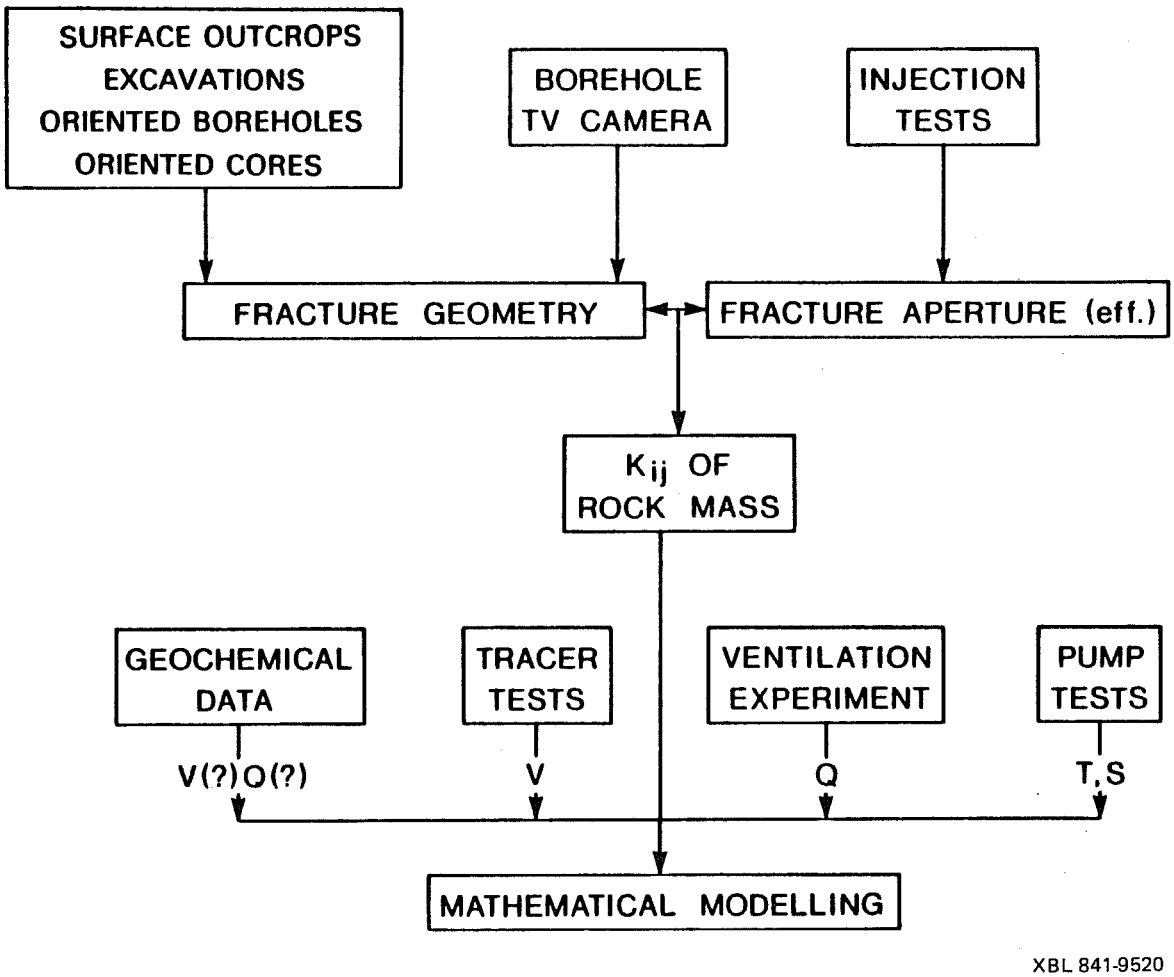

Fig. 1.1. Block diagram of fracture hydrology program at Stripa.

experiments, (4) measurement of the water pressures and flow rates, during both injection tests in surface boreholes and withdrawal and injection tests in the subsurface boreholes, from discrete boreholes intervals that were isolated using packer assemblies, (5) measurement of water level changes versus time during pumping out tests in several surface water wells, and (6) detailed description of the fracture planes intersected by the drillcore and measurement of the relative orientations of the fractures. These measurements provide the data base that will be used to develop an understanding of the physical hydrogeology of the Stripa site.

1.2 Objective and Scope

In this report the techniques and tools used to obtain and the procedures used to process the fracture and hydrology data into computer files are described. The fracture and hydrology data from each borehole and testing activity are summarized in the main body of the report and a complete record of all of the measurements is given in the appendices. Only a very preliminary analysis and discussion of the data have been attempted in this report. Detailed analysis and interpretations is a subject for future reports. A brief discussion of the geology of the Stripa site is included to provide an understanding of the structural setting and lithologic variation in the Stripa area. Preliminary data on the pore pressures in the rock mass, water table variations, and dewatering associated with the thermal experiments are also presented to give the reader some appreciation for the general hydrological characteristics of the Stripa site.

1.3 General Geology and Borehole Locations

The Stripa mine, located in south central Sweden, is an iron ore mine in which mining operations stopped in 1977. Excavations for the thermal and hydrology experiments have been mined in a medium grained granite under the north limb of an easterly plunging syncline of metamorphic rocks. The geology of the site has been described by Olkiewicz et al. (1979). Figure 1.2 shows the distribution of outcrops in the immediate area of the test excavations and the location of the hydrology boreholes. The test excavations projected into plan view in Fig. 1.2 are located approximately 338 meters below the ground surface.

The surface boreholes consist of six water table wells, WT-1 through WT-6, a pump test well WT-7 (also a water table well), and three long inclined boreholes SBH-1, SBH-2 and SBH-3 (Fig. 1.2). SBH-1 is an open, 76 mm diameter, diamond corehole, 385 meters in length that angles downward at 45 degrees and passes over the top of the test excavations and terminates at approximately the 290 meter level. SBH-2, also diamond cored, was drilled from the west toward the test excavations. This borehole is 365 meters in length, angles downward at 52 degrees and terminates in the position shown in Fig. 1.2 at approximately the 290 meter level. SBH-3, 315 meters in length, also diamond cored, is drilled from the north at an angle of approximately 50 degrees south towards the test excavations, terminating in the position shown. All three inclined surface boreholes were oriented to optimize their intersection with the major fractures sets.

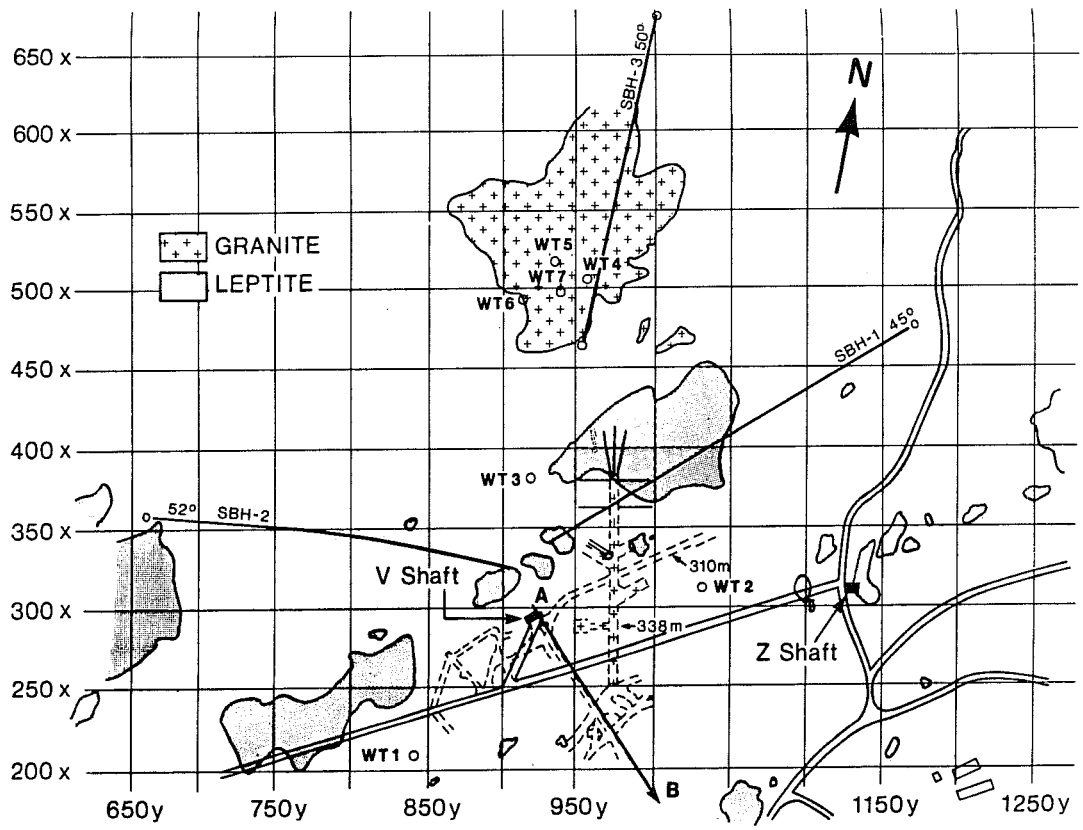

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Fig. 1.2. General geology and hydrology borehole locations (squares are 50 meters on a side).

The subsurface hydrology boreholes (Fig. 1.3) are located at the north end of the test excacations. This group of boreholes are all diamond coreholes, 76 mm in diameter, and 30 meters in length, except R-1 and R-6 which are 40 meters in length. The survey data for each borehole is given in Table 1.1.

The overall layout of the subsurface hydrology boreholes with respect to the location and orientation of boreholes for the thermal-mechanical experiments are shown in Fig. 1.4.

1.4 General Comments on the Hydrological Setting of the Stripa Site

The most significant perturbation of the hydrologic regime at Stripa has been that produced by excavations made during the iron-ore mining. Mining started as an open pit operation some 400 years ago and continued as an underground operation for about the last 40 years. In the initial phases of the Stripa program it was proposed that the mine had acted as a major drain, decreasing the pore pressures in the surrounding rock mass. Thus the in-situ pore pressures were measured during the drilling of the three surface wells, SBH-1, SBH-2 and SBH-3.

Measurement of the in-situ pore pressures was accomplished by stopping the drilling every 20 to 30 meters, removing the drill rods, lowering a single packer to within 5 to 10 meters of the bottom of the borehole, inflating the packer and hence sealing off a section at the bottom of the borehole. The in-situ pore-pressure in this cavity was monitored, using a strain gauge transducer-packer assembly (Fig. 1.5), until the cavity pressure approximated a steady-state condition.

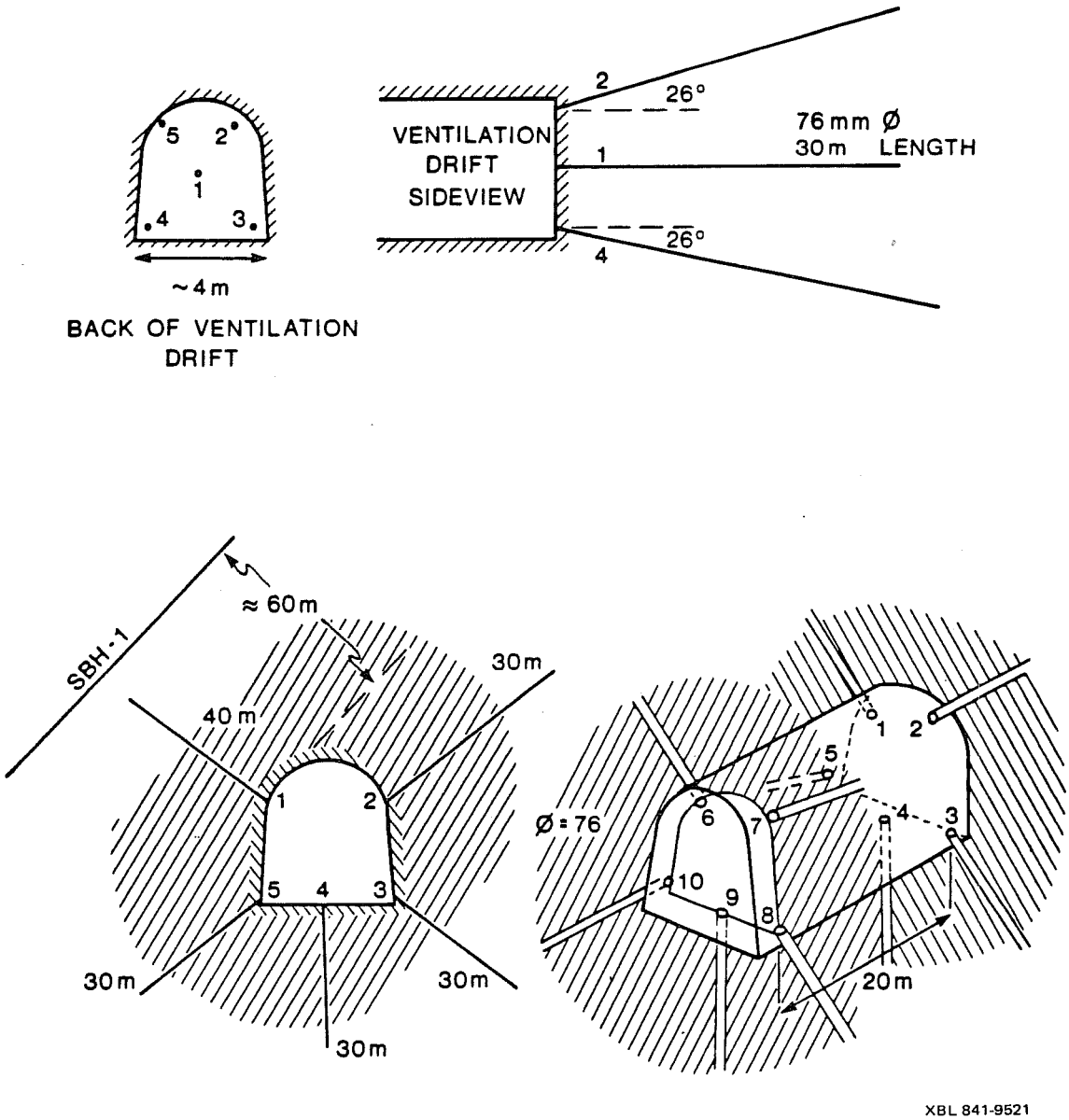

Fig. 1.3. Location and orientation of subsurface hydrology boreholes.

TABLE 1.1 SURVEY DATA

HOLE No.	COORDINATES - MINE SYSTEM TOP OF HOLE X	Y	Z	BOTTOM OF HOLE X	Y	Z	DIRECTION TRUE NORTH BEARING	PLUNGE
R 1	384.122	974.863	333.134	384.345	948.946	302.438	260.5	+50.0
R 2	384.089	978.538	333.148	383.881	997.396	310.654	80.6	+50.0
R 3	384.087	978.981	336.378	383.809	1007.215	346.620	80.6	-19.9
R 4	384.097	976.577	336.496	384.072	976.654	366.605	98.0	-89.8
R 5	384.125	974.363	336.368	384.353	946.110	346.666	260.5	-20.0
R 6	364.116	974.583	333.089	364.479	948.895	302.447	260.8	+50.0
R 7	364.099	978.192	333.135	363.933	997.282	310.267	80.5	+50.1
R 8	364.089	978.732	336.405	363.780	1007.006	346.553	80.6	-19.7
R 9	364.106	976.421	336.688	364.078	976.379	366.722	226.3	-89.9
R 10	364.119	974.257	336.402	364.423	946.006	346.614	260.6	-19.9
HG-1	386.220	976.593	334.376	416.204	976.629	334.383	350.1	0.0
HG-2	385.988	977.456	332.683	412.836	983.738	321.017	3.2	+22.9
HG-3	385.867	978.239	335.211	412.893	989.751	341.480	13.1	-12.0
HG-4	385.788	975.776	335.895	412.799	969.536	347.788	337.0	-23.1
HG-5	386.003	974.888	333.518	412.957	964.029	326.041	328.1	+14.4
SBH-1	482.6	1169.4	21.731	340.2	930.2	285.4	229.2	-43.5
SBH-2	363.5	662.3	26.657	326.9	902.4	290.4	88.7	-47.4
SBH-3	674.4	1001.2	29.138	464.2	954.2	259.6	182.6	-46.9
S-1	330.885	974.287	336.970	347.060	945.578	359.839	289.4	-34.8
S-2	332.799	974.968	337.196	348.699	946.217	359.977	288.9	-34.7

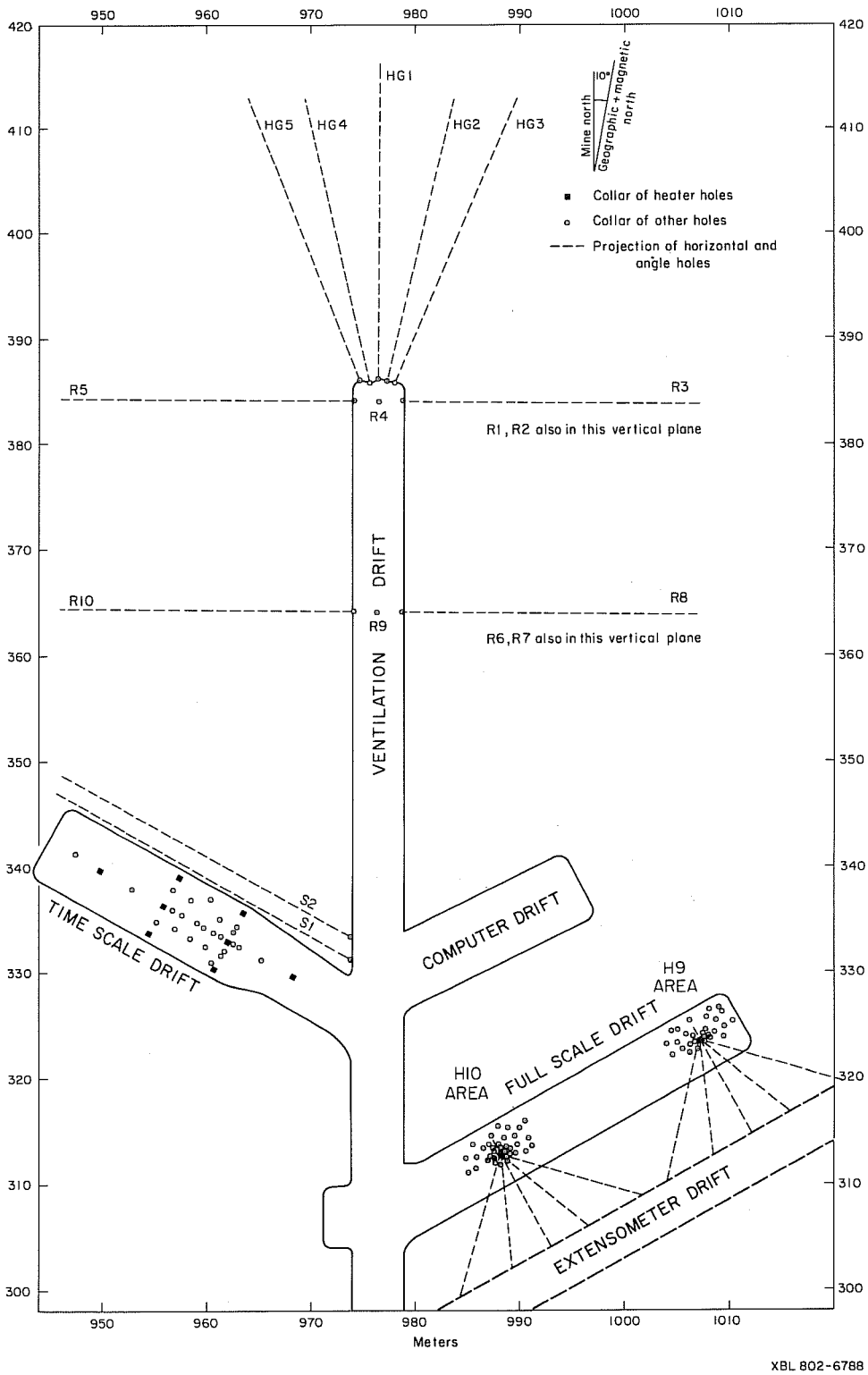

Fig. 1.4. Plan view of the experiment areas 340 m underground at Stripa, showing locations of horizontal and vertical boreholes. All experiments are in granite.

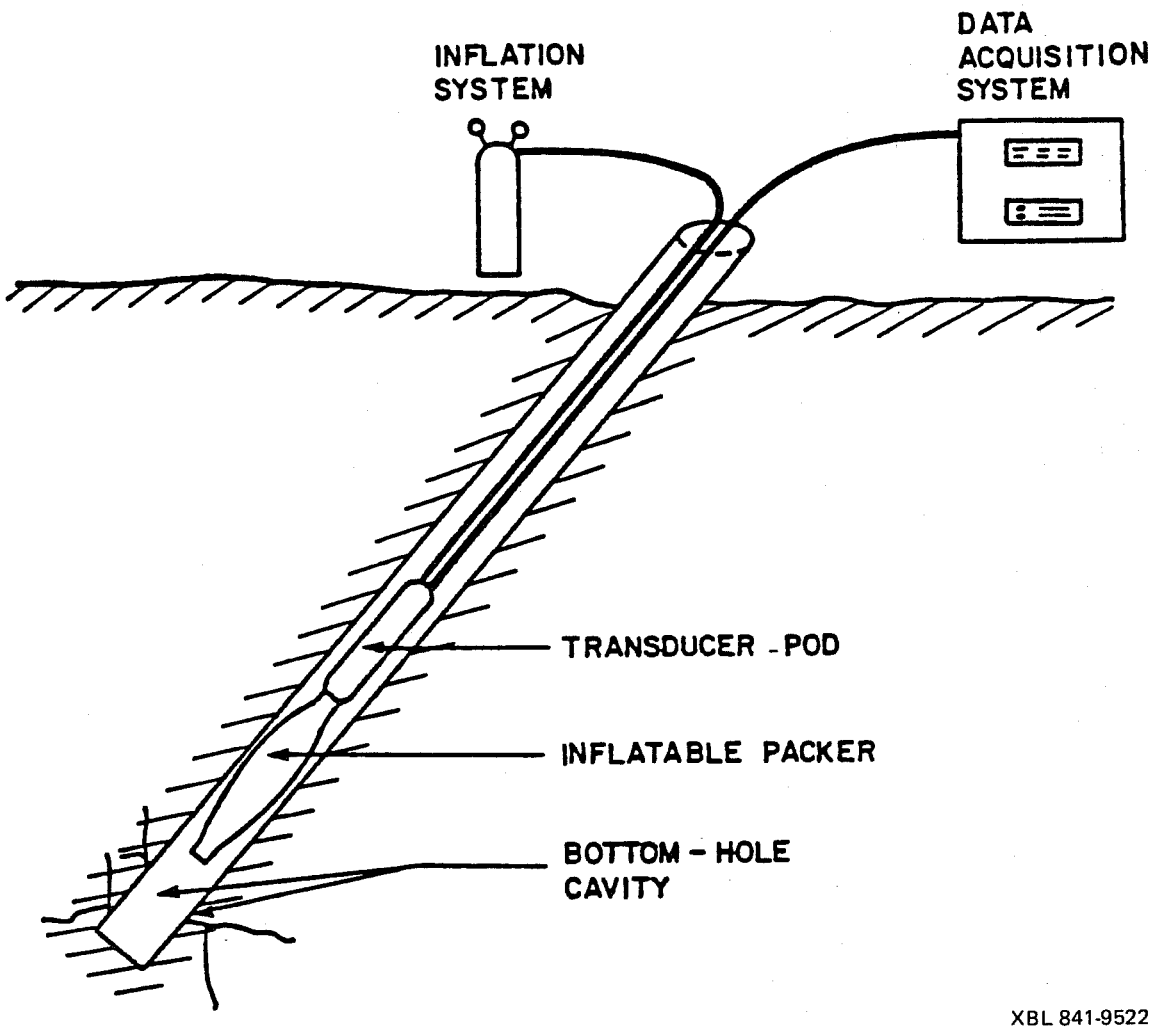

Fig. 1.5. Single transducer probe for in-situ pressure measurements.

The in-situ pore pressures for SBH-1, SBH-2 and SBH-3 are plotted in Figs. 1.6, 1.7, and 1.8. The data used to construct these figures are tabulated in Tables 1.2, 1.3, and 1.4. In Fig. 1.9 we have reproduced a plot of the in-situ fluid pressures measured by the Swedish Geological Survey (Olkiewicz, et al., 1978) in the deep borehole drilled from the 410 m level, DbhV-1.

SBH-1 shows that the fluid pressure increase with the depth, in the borehole test intervals, does not follow the hydrostatic pressure line indicating that a strong downward gradient exists, starting at about 100 m below the ground surface. In SBH-2 no measurements were made, during the drilling, below the 100-m level. However the data from SBH-3 show pressures less than hydrostatic starting at the surface. Overall the strong downward gradients confirm the expected draining effect of the old mine workings. However the flowing borehole at the 410-m mine level and the overall gradients in DbHV-1 (Fig. 1.9) suggest that groundwaters from a deep flow system are discharging upward into the mine.

In addition to measuring the in-situ fluid pressures during drilling, seven water table wells, described in the previous section, were drilled in the area above the test excavations (Fig. 1.2). The water levels in each well were measured every week using a water level tape. These data, for all seven wells, have been plotted in Fig. 1.10. In addition, Stevens F water level recorders were placed on four of the water table wells. All of the recorders experienced float problems and this, combined with a lack of trained personnel, resulted for the most part in very incomplete and unreliable records. Well No. WT-3 based on weekly water level measurements

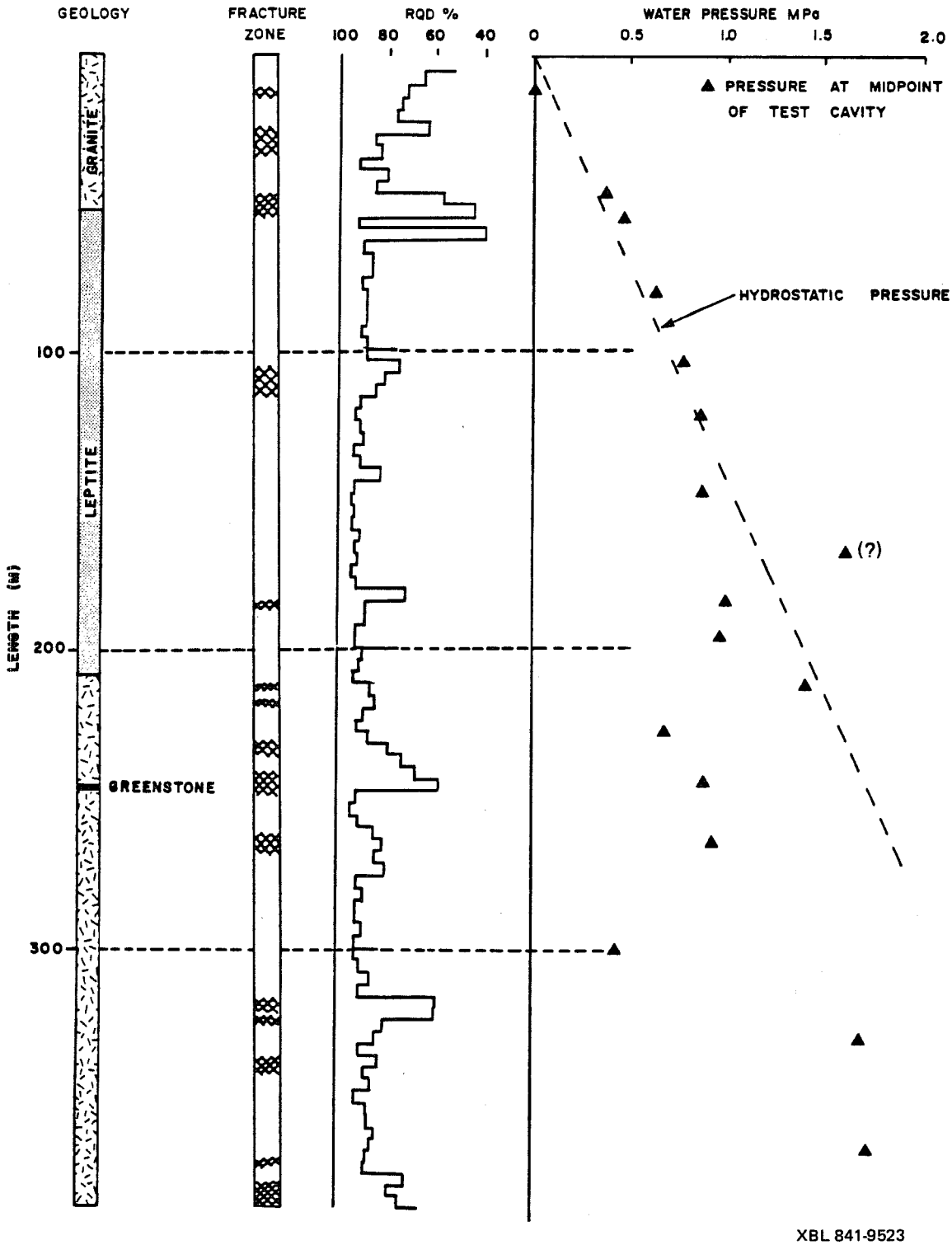

Fig. 1.6. Results of fracture and pressure measurements in SBH-1.

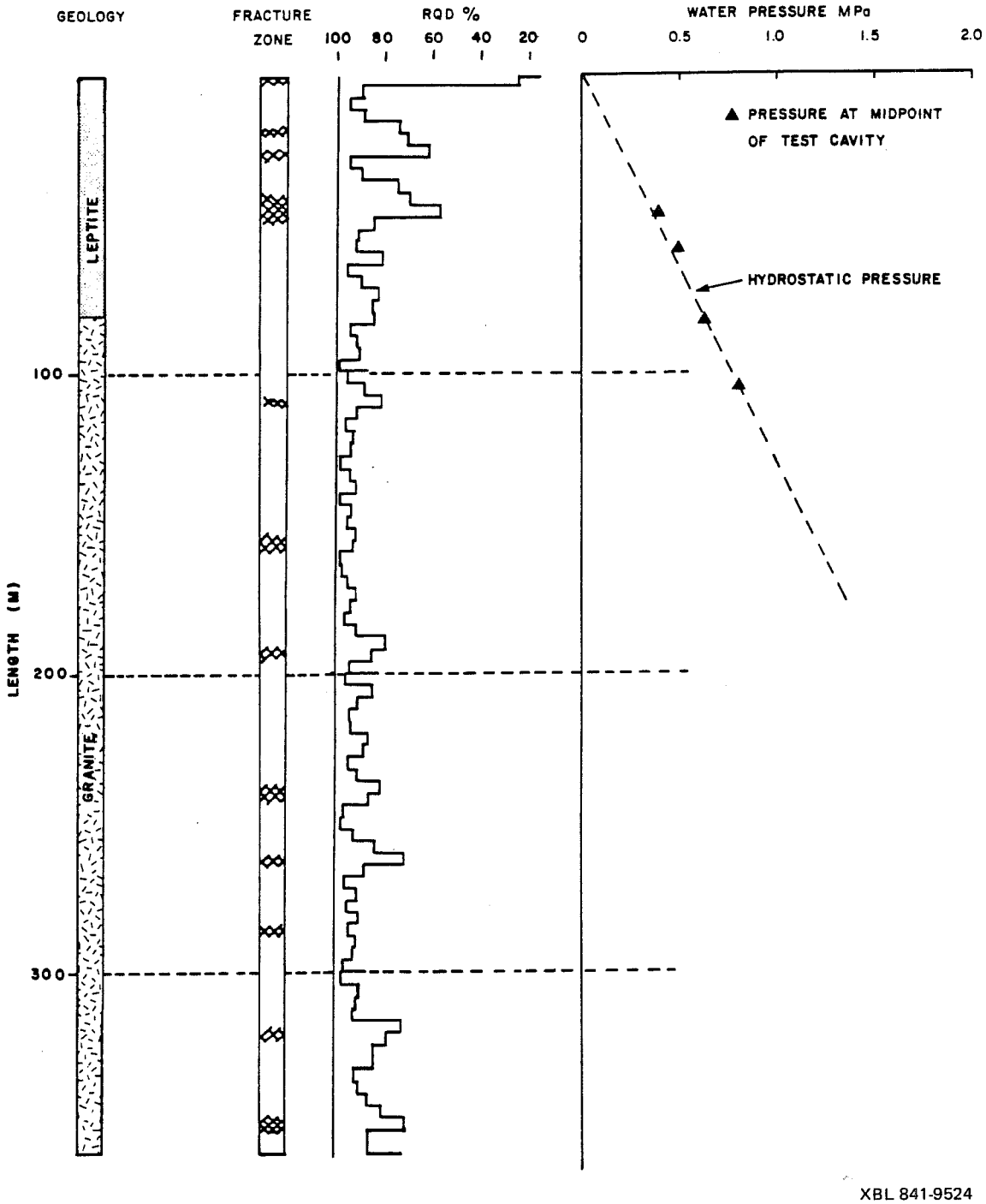

Fig. 1.7. Results of fracture and pressure measurements in SBH-2.

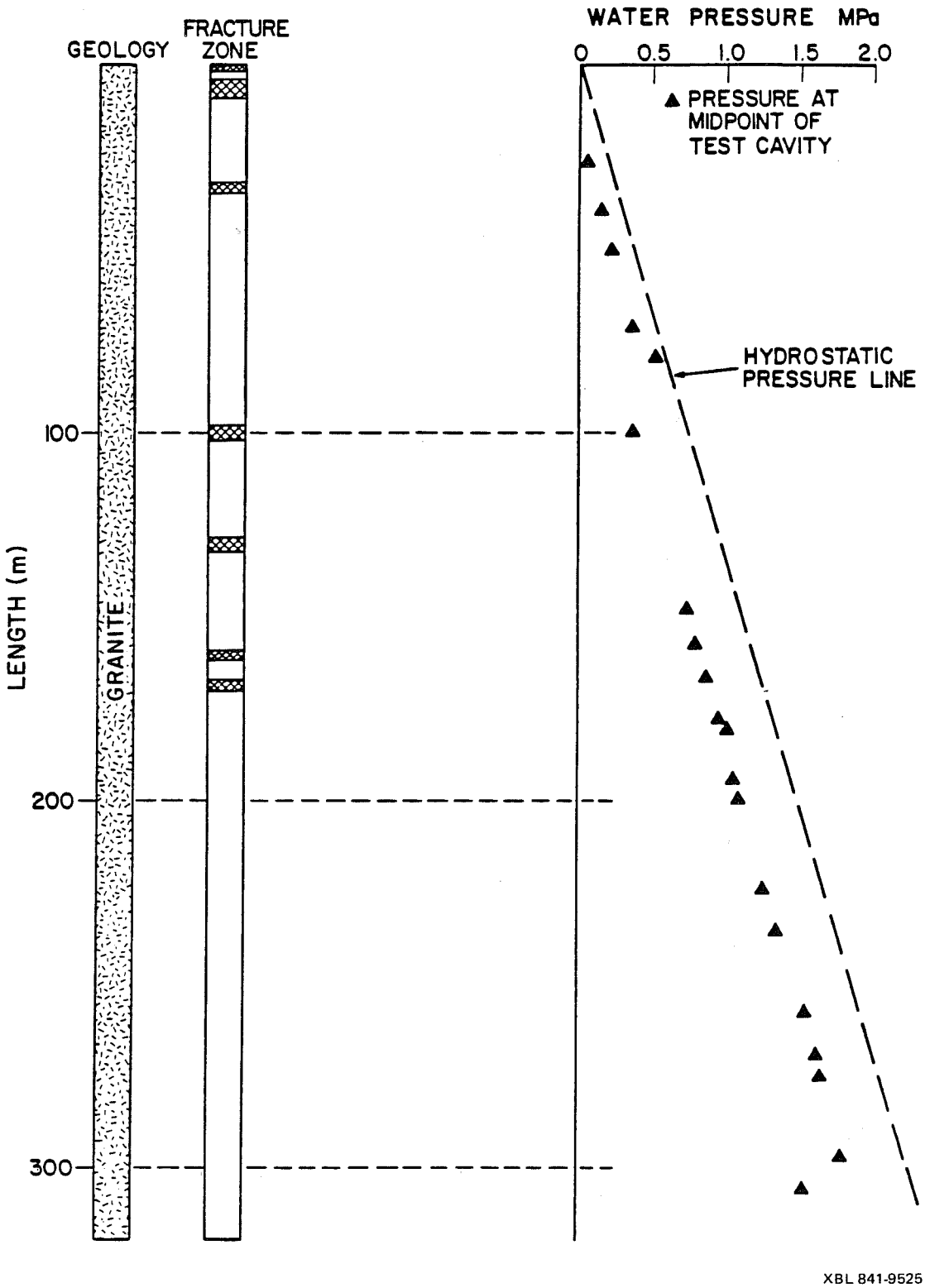

Fig. 1.8. Results of fracture and pressure measurements in SBH-3.

TABLE 1.2 IN-SITU PRESSURE MEASURED IN SBH-1 DURING DRILLING

Hole Length * m	Mine "Z" *	Pressure, Psi	kPa
47.4	53.0	55	379
47.0	52.5	54	373
57.3	60.0	68	471
82.9	80.2	91	627
104.6	96.8	114.0	785
124.3	111.9	126	868
150.5	132.0	127	875
170.2	147.1	236	1,626
187.5	160.3	145	999
200.1	169.9	140	964
216.0	182.2	206	1,419
231.8	194.3	100	689
250.8	208.8	129	889
270.1	224.4	136	937
299.1	245.8	60	413
329.4	269.0	248	1,709
368.5	299.0	250	1,723
339.4	276.7	217	1,495

* Cavity Mid point

TABLE 1.3 IN-SITU PRESSURE MEASURED IN SBH-2 DURING DRILLING

Hole Length*, m	Mine "Z"*, m	Pressure, psi	Pressure kPa
47.43	53.03	55.0	378.9
46.98	52.47	54.2	373.4
57.32	60.6I	68.4	47I.2
82.9	80.2I	9I.0	626.9
I04.6	96.83	II4.0	785.3

TABLE 1.4 IN-SITU PRESSURES MEASURED IN SBH-3 DURING DRILLING

INTERVAL MID POINT* (M)	IN-SITU PRESSURE * (Psi)	IN-SITU PRESSURE* (kPa)
26.65	7.08	48.81
39.9	19.78	136.38
50.2	31.94	220.22
71.4	53.22	366.93
79.8	74.29	512.20
99.65	53.66	369.97
147.95	106.94	737.31
157.5	115.69	797.64
166.5	125.91	868.11
177.9	137.63	948.91
180.8	146.13	1007.52
194.0	153.28	1056.81
199.2	158.95	1095.91
210.3	-	-
224.2	182.49	1258.2
235.35	196.08	1351.90
257.4	221.94	1530.20
269.0	233.54	1610.18
274.6	240.69	1659.47
285.95	-	-
296.8	258.28	1780.75
306.6	221.34	1526.06

* At Cavity Mid Point

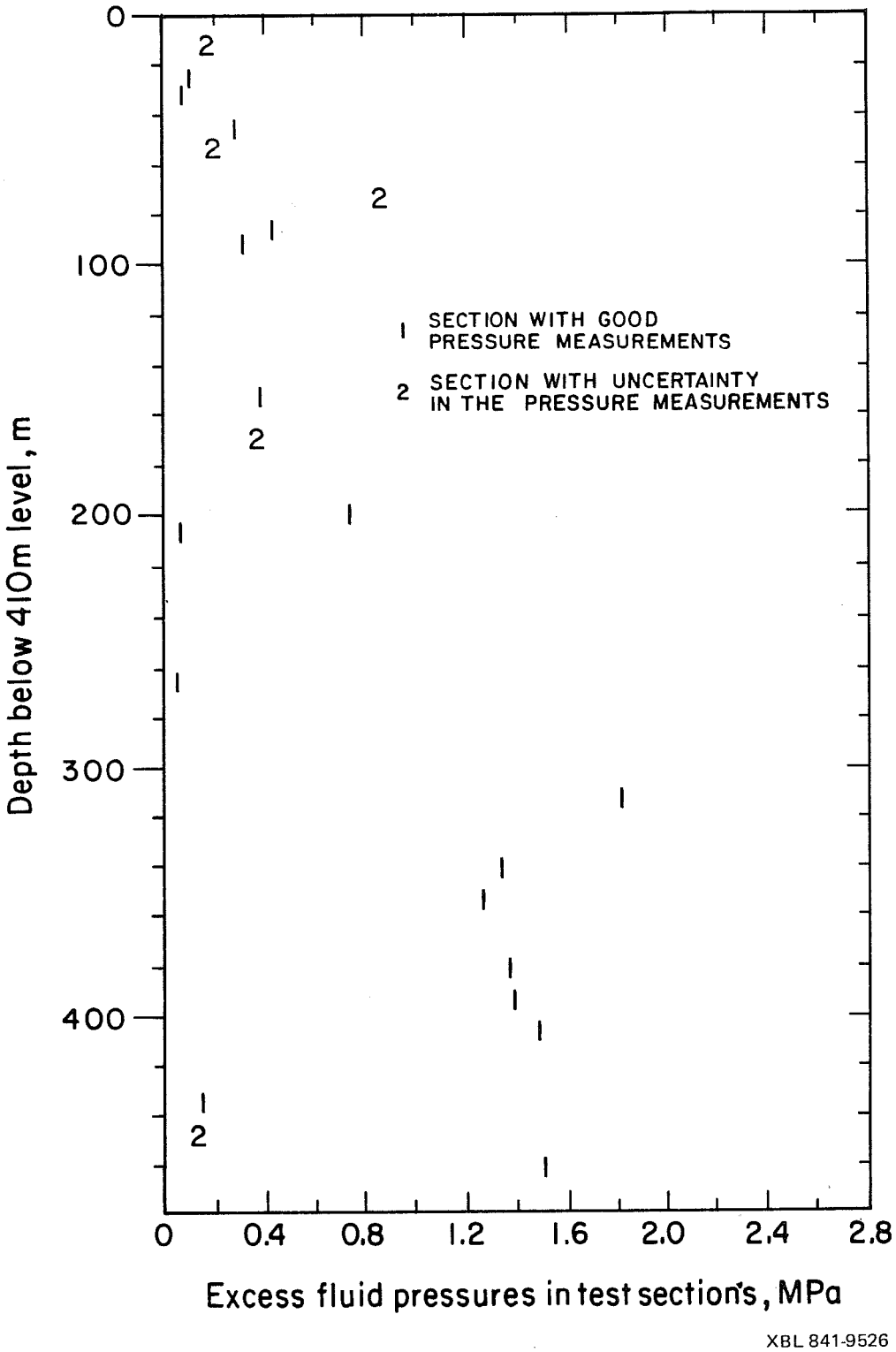

Fig. 1.9. Results of pressure measurements in borehole DbhV-1 at the 410 m level (after Olkiewicz et al., 1978).

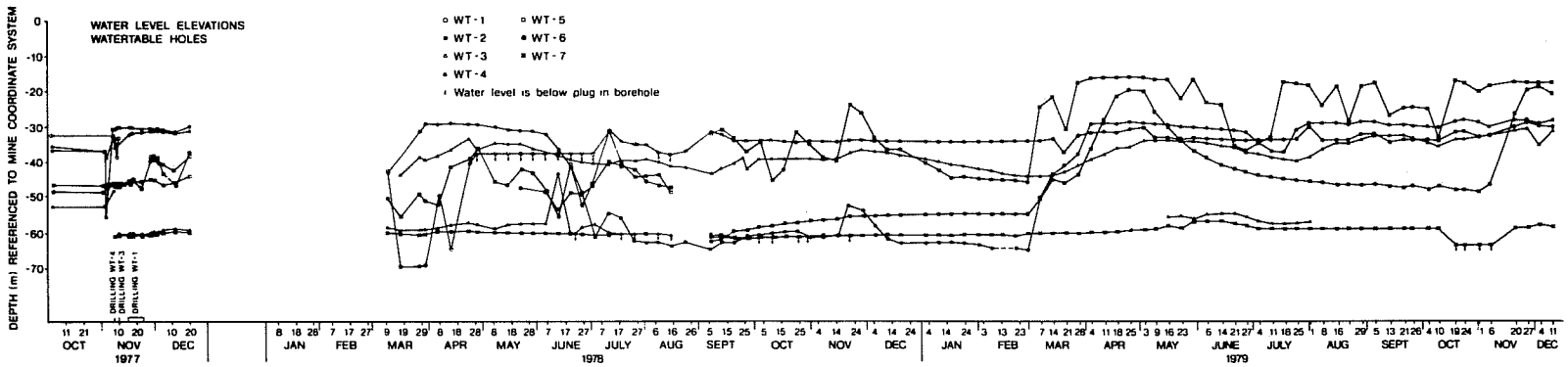

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Fig. 1.10. Water levels in surface wells based on weekly water level measurements.

provided the best overall record (Fig. 1.11) and as shown in Figs. 1.12 and 1.13 exhibited rapid variations in water levels on a daily basis. The daily water level variations in WT-3 were significantly different during spring runoff (Fig. 1.12) than during the late summer periods (Fig. 1.13). The water levels in all of the wells rose during periods of rainfall, but the exact position of the water table could not be determined because as the wells were deepened there was a corresponding drop in the water levels. This also indicates that the pore pressures in the rock mass have been reduced by drainage into the mine excavations. However, despite the reduced pore pressures the rock mass appeared to be saturated.

Around the immediate test area the groundwater gradient, as will be shown in Chapter 3, was directed into the excavations. The resulting groundwater inflows required continuous dewatering of the heater and instrument holes (Fig. 1.4) during the thermal-mechanical experiments. A record was maintained of the volume of water pumped from each borehole and the time at which it was pumped during this dewatering activity. These inflow data, presented in Figs. 1.14 and 1.15 for selected boreholes, give a reasonable measure of the volumes of water flowing through the fractured granite at Stripa.

The in-situ pressures from both surface and subsurface boreholes, the water table data, and the dewatering records will be subjected to a detailed analysis in future reports that will deal with the hydrogeology of the Stripa site. These data have been presented here to provide some limited background for the presentation of the fracture and injection-withdrawal hydrology data.

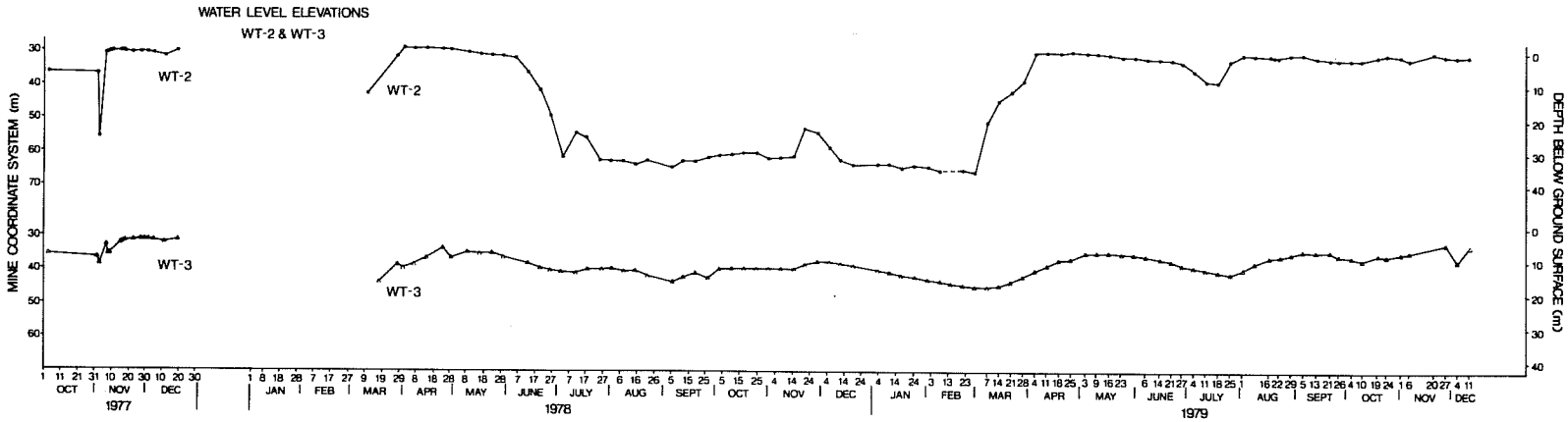

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Fig. 1.11. Water level variations in WT-3 based on weekly measurements.

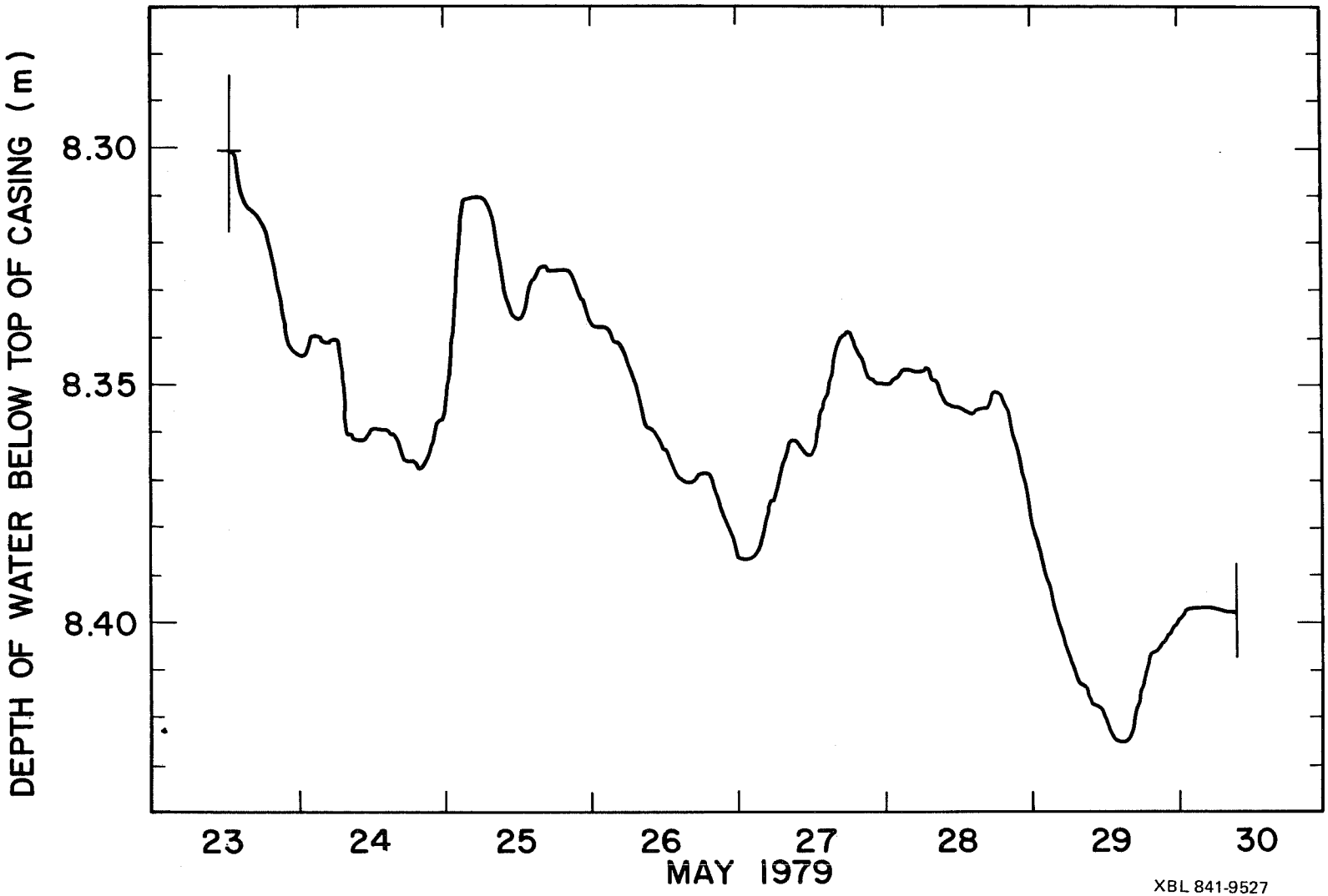

Fig. 1.12. Continuous water level record for WT-3 during spring runoff for the period of May 23rd to May 30, 1979.

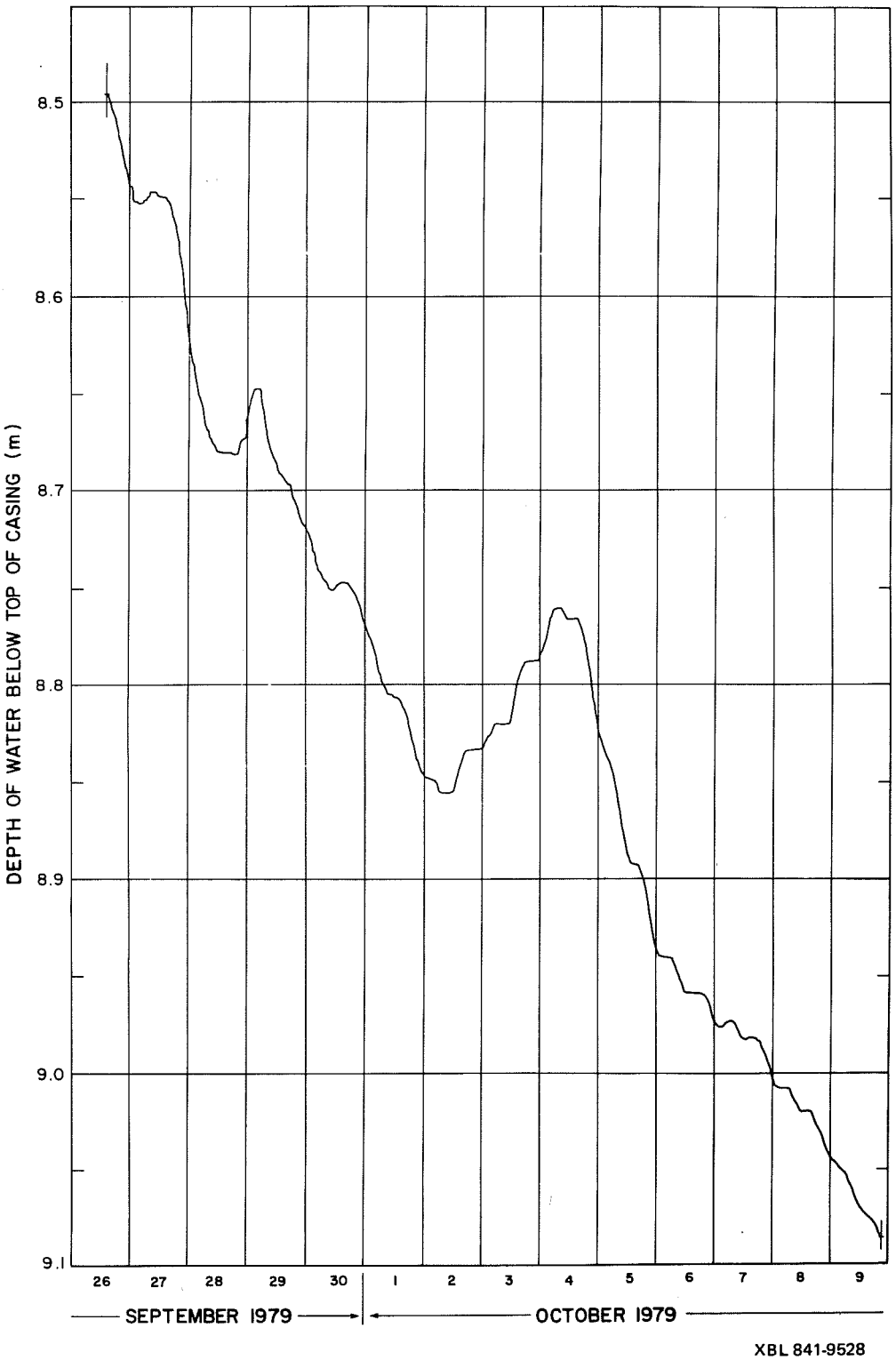

Fig. 1.13. Continuous water level record for WT-3 during the late summer-fall period, i.e., September to October. Note the continuous decrease in water levels during this period in comparison to the more fluctuating record for the May period shown in Fig. 1.12.

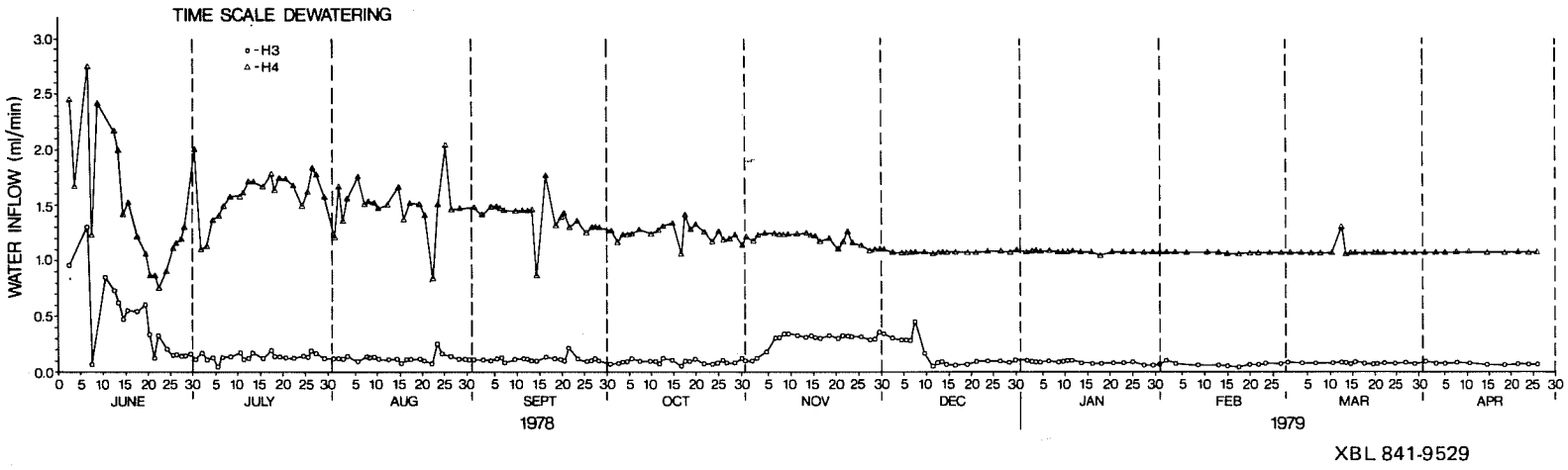

Fig. 1.14. Record of water pumped from heater boreholes H3 and H4 as part of the dewatering activities during time-scaled heater experiment. See Fig. 1.4 for location of boreholes.

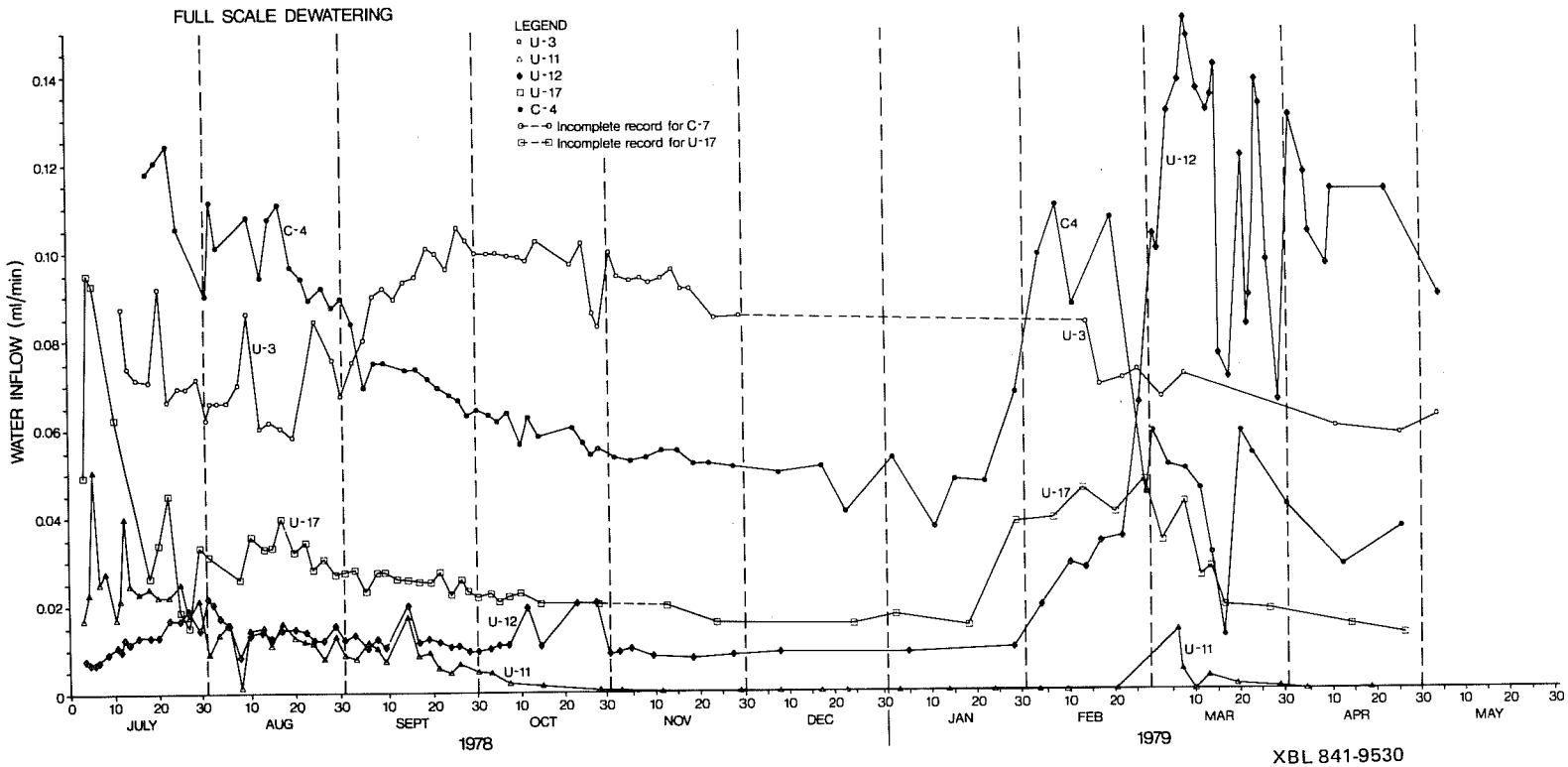

Fig. 1.15. Record of water pumped from selected boreholes in the full-scale heater experiment site as part of the dewatering activities during the full-scale experiment. See Fig. 1.4 for location of boreholes.

2. FRACTURE DATA

2.1 Introduction

Since the central component of the fracture hydrology program is the calculation of directional permeabilities from measured fracture orientations, spacings, and apertures, considerable attention has been devoted to the characterization and mapping of the fracture system at the Stripa test site. Basic data on fracture orientations, fracture spacings, fracture lengths and the surface characteristics of the fracture planes, including any mineral infillings or coatings, have been obtained by mapping the surface and sub-surface exposures (Olkiewicz et al., 1979; Rouleau et al., 1981). Additional data on fracture orientations, spacings and surface characteristics have been obtained by logging the drill core and conducting TV camera surveys of selected boreholes.

In this chapter the procedures used to orient, reconstruct, and log the drill core are described. In addition the mapping and coding procedures for the drill core data are described using examples of the coded data. Examples from selected drill cores are given in Appendix A-1.

2.2 Core Logging Procedures

2.2.1 Determining Relative Fracture Orientations

Fractures may be considered as planar features whose orientation in space can be fully described by two angular measurements. If a borehole intersects a fracture plane the resulting trace of the fracture on the borehole wall and on the core surface will be circular (if the fracture is perpendicular to the borehole). Figure 2.1 shows a section of core with an elliptical trace generated by the intersection of the borehole with the

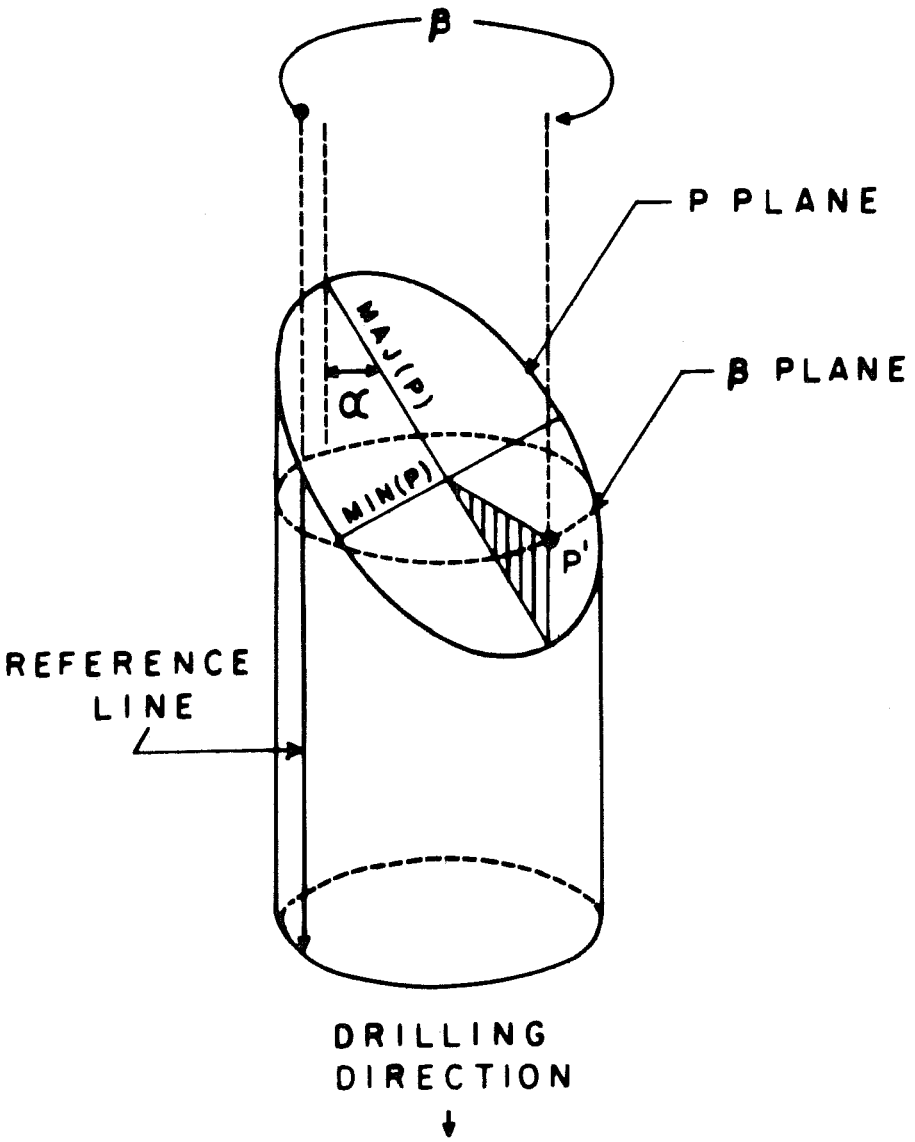

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Fig. 2.1. Angles α and β and the reference line (after Goodman, 1976).

fracture plane (P plane). Also shown in Fig. 2.1 are the major and minor axes of the elliptical trace. Measurement of angles α (angle between the core axis and major axis of ellipse) and β (angle measured clockwise around the core in the β plane from the reference line to the dip side of the major axis of the ellipse) can be used to describe the orientation of a fracture with respect to a reference line drawn parallel to the core axis. Knowing the bearing and plunge of the borehole (thus the orientation of the reference line) one can determine the strike and dip of the fracture plane from α and β data using techniques described by Goodman (1976). Values of α and β may also be determined by direct observation of the fracture trace on the borehole walls using borehole television or borehole periscope equipment.

2.2.2 Core Reconstruction and Fracture Mapping

To obtain fracture orientation data from borehole cores where natural reference planes (such as regular foliation or bedding) are unavailable one must first obtain a reference line that will be parallel to the core axis.

A reference line may be obtained in a variety of ways, including core scribing, core indenting, taking an impression of the core stub, and paint marks on the core (Goodman, 1976). In all of these cases an inclined hole is required for the marking techniques to allow determination of the lower side of the hole. This is where the reference line is drawn. Cores obtained from inclined holes in this study were marked with a simple core indentor (Fig. 2.2). This indentor was lowered on a wireline to the bottom of the hole at the end of each core run. When the hole bottom was reached,

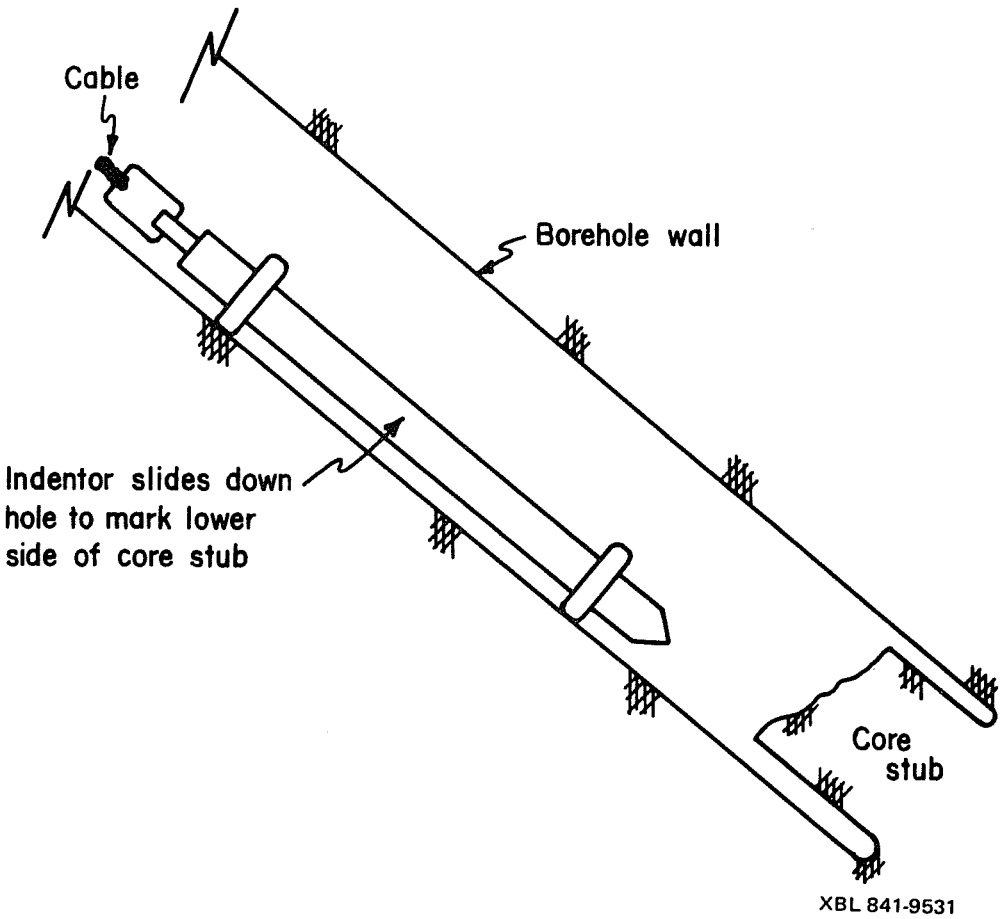


Fig. 2.2. Core indentor.

the indentor was raised several feet then released. This allowed the indentor to slide along the lower side of the borehole and indent the lower side of the face of the core stub. As each core run was removed from the hole the following steps were performed:

1. The split triple-tube was opened and a preliminary reference line was drawn on the core parllel to the edge of one half of the triple tube using a felt pen. This permanently shows the relative position of each core section as it came from the barrel. A split PVC pipe was then placed on top of the core and securely taped to the lower split tube.

2. The core was then rotated so that it sat in the split PVC pipe and the split-tube was removed.

3. The top piece of core was rotated in the pipe so that the indentation on the core was adjacent to the side of the PVC pipe. Each subsequent piece of core was then rotated so that the surfaces of each core section mated properly.

4. Once the core was considered to be properly reconstructed, a final reference line (representing the lower side of the hole) was drawn on the core. The core was now ready for determining the values of α and β for each fracture. Angles were measured with a simple goniometer as shown in Fig. 2.3. β angles were measured using a strip of mylar with 0-360° markings also shown in Fig. 2.3.

2.2.3 Characterization of Fracture Surfaces

Both surface and internal characteristics of fractures were logged. These characteristics included:

1. Distinction between natural fractures and fractures induced during drilling,

2. distinction between open and closed fractures and where possible an estimation of aperture,

3. definition of the form of the fracture surfaces,

4. definition of the roughness of the fracture surfaces,

5. definition of any weathering present on fracture surfaces,

6. identification and description of fracture fillings, and

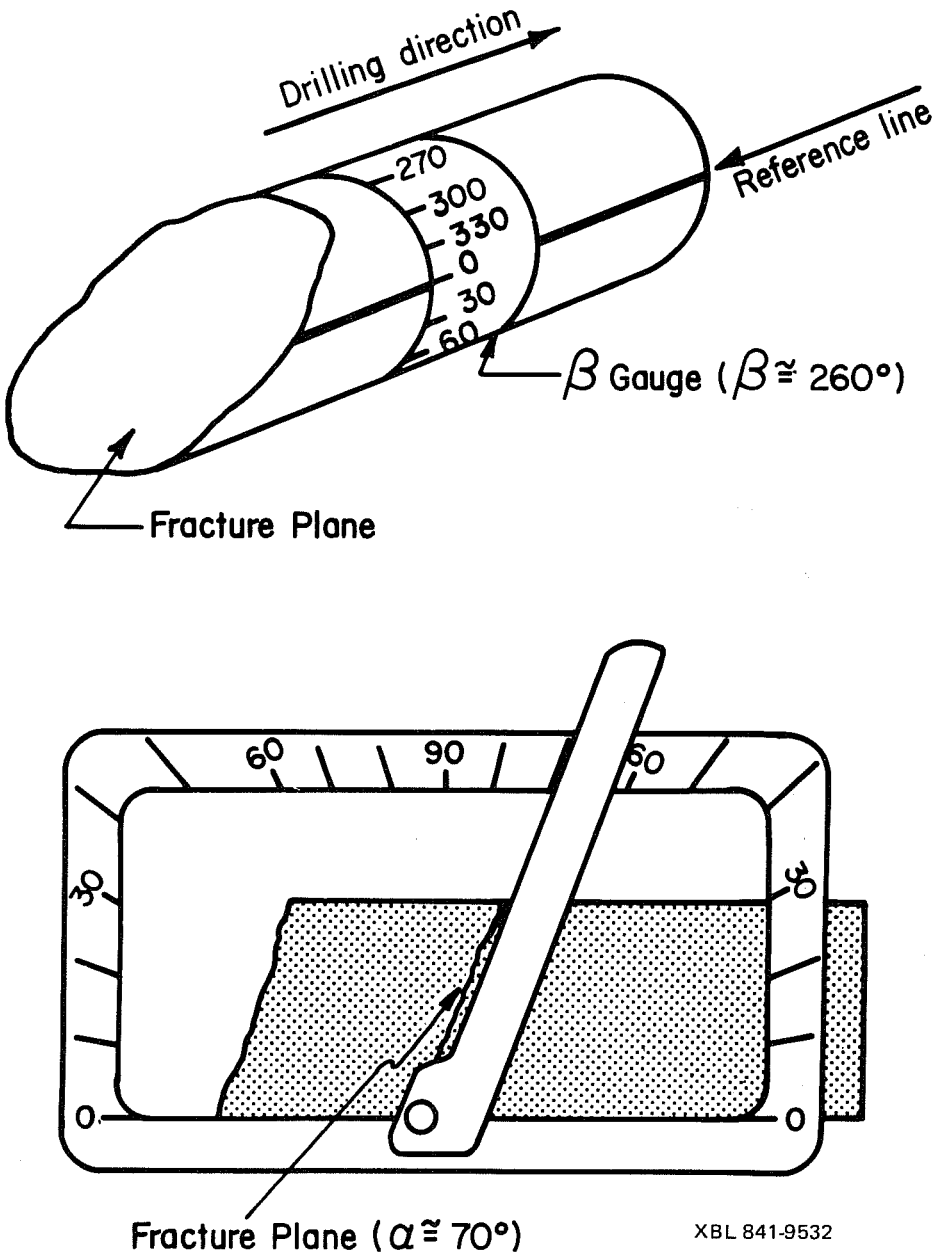


Fig. 2.3. Measurement of α and β angles.

7. description of the rock containing the fracture.

Many of these characteristics can be observed in both periscope and T.V. logging procedures. However, the most complete data are obtained from rock cores in which fractures can be opened to see details of their surface and internal characteristics. The following is an outline of fracture plane characteristics that were determined by core logging techniques. More detailed information can be found in ISRM Commission on Standardization of Field and Lab Tests (1978) and Piteau (1971).

Natural fractures can usually be readily distinguished from breaks induced by drilling. Induced breaks will appear fresh, generally at 90 degrees to the core axis and irregular in surface character. In contrast, natural fractures often will be weathered, slicken-sided or contain gouge.

Closed fractures are fractures which are visible in the core and have sufficient cohesion not to have been opened during drilling. Open fractures may have surfaces which mate very closely or they may have very poorly mating surfaces. The poorer the degree of mating, the greater the effective aperture of the fracture (thus the greater the opportunity for fluid flow).

The form of the fracture surfaces can be described as planar, curved (undulating) or irregular (stepped) (Fig. 2.4). These distinctions assist in determining the origin and continuity of each fracture and are used in conjunction with the following roughness classification.

The roughness classification used in this study was based on that outlined by Piteau (1971). Thus, fracture surfaces are considered to range

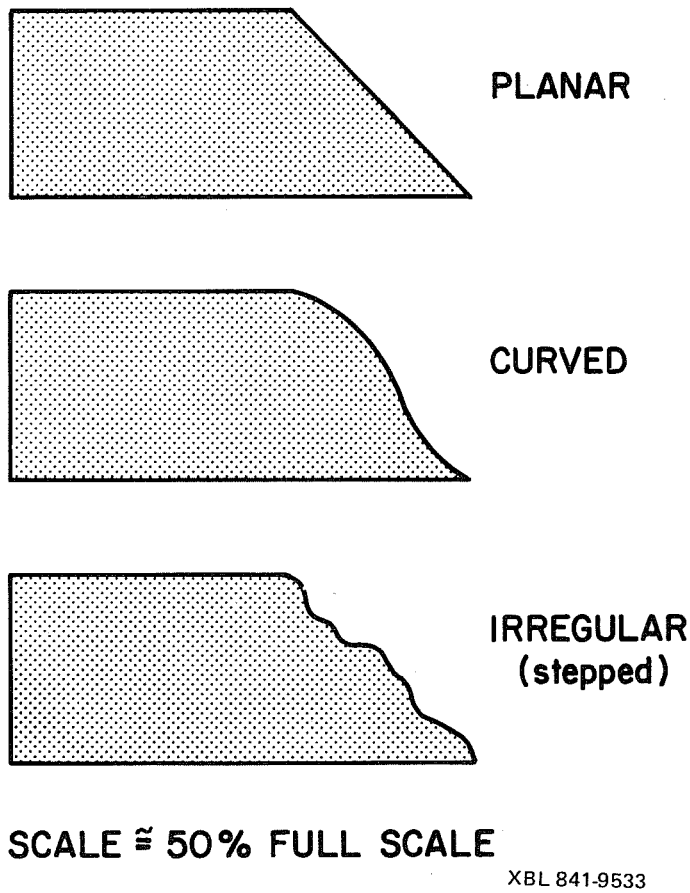


Fig. 2.4. Classification of the form of the fracture surface.

from rough to smooth or slicken-sided where slicken-sided indicates clear evidence of previous shear displacement along the fracture (Fig. 2.5).

Fracture surfaces may appear fresh to very weathered depending on their depth below ground surface and the degree of groundwater movement. Iron stains and a slightly worn appearance suggests moderate to high weathering of the fracture surface.

Fracture fillings or gouge consist of materials derived from breakage of the country rock, alteration products, precipitations from fluids or intrusions of igneous materials. The type, color, thickness and hardness are noted. The gouge or filling type can be recorded with symbols such as K for calcite, Ch for chlorite etc. Gouge thickness can be measured with an ordinary ruler. Hardness is determined according to the following classification by Piteau (1971).

A set of simple mechanical tests based on the physical properties of rock is set up to establish classification of their hardness, and the symbols are recorded. With considerable experience and test background, and using the fingers, a pocket knife, and geological pick, the complete range of classification in the field can be established as follows:

S1 Very soft: Easily molded in fingers; shows distinct heelmarks.

S2 Soft: Moulds in fingers with strong pressure; faint heelmarks.

S3 Firm: Very difficult to mould in fingers; difficult to cut with hand spade.

S4 Stiff: Cannot be moulded in fingers; cannot be cut with hand spade and requires hand-picking for excavation.

S5 Very stiff: Very tough and difficult to move with handpick; requires pneumatic spade for excavation.

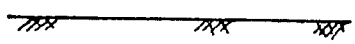
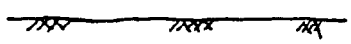
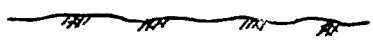
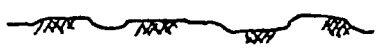
Category	Degree of Roughness	Sketch
1	Slickensided Surfaces	
2	Smooth	
3	Defined Steps	
4	Small Steps	
5	Very Rough	

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Fig. 2.5. Roughness classification after Piteau (1971).

R1 Very soft rock: Material crumbles under firm blows with a sharp end of a geological pick and can be peeled off with a knife; it is too hard to cut a triaxial sample by hand.

R2 Soft rock: Can just be scraped and peeled with a knife; indentations 1/16 in. to 1/8 in. show in the specimen with firm blows of the pick point.

R3 Hard rock: Cannot be scraped or peeled with a knife; hand held specimen can be broken with a hammer end of a geological pick with a single firm blow.

R4 Very hard rock: Hand-held specimen breaks with hammer end of pick under more than one blow.

R5 Very, very hard rock: Specimen requires many blows with geological pick to break through intact material.

In this study three basic groupings were used to describe the hardness of the gouge and infilling material. Soft (S), which includes S1, and S2, medium hard (MH), which includes S3, S4, and S5, and hard (H), which includes R1 and R2. The rock containing the fracture is described by determining the lithology, hardness (see above) and internal structural features.

2.3 Data Processing, Coding and Verification Procedures

Standard forms for core logging and recording basic drilling data (Figs. 2.6 and 2.7)were used. About 10 to 15 individuals were involved in logging the hydrology boreholes. Attempts were made to minimize the individual's variation in the core logging process by overlapping the loggers as much as possible at the beginning and end of each shift. Despite these efforts one must expect differences in the fracture logging between loggers, especially in determining roughness and hardness.

The raw fracture data were transferred directly from the logging sheets used at the drill site to a computer file. Because of the need to provide

Depth (meters)	STRUCTURAL AND DISCONTINUITIES												GOUGE				PLANAR FEATURES		LOCATION: SB BOREHOLE: #H1 BOX: #67
	BREAKS							CHARACTER											
	Description of Strata	Natural fracture	Induced	Uncertain	Opened	Closed	Planar	Curved	Irregular	Roughness	Weathering	Type	Color	Thickness	Hardness		Dip direction	Angle of dip " "	Remarks
352.60																			start
352.60	Granite	*					*			2	SW	Cl	BC	<1	MH		295	70	partly induced
352.91	"	*										Cl	BL	<1	MH		o	35-45	several smaller fractures
353.15	"	*					*			1	MW	Cl, Ca	Bl, wh	<1	MH		25	10	sheared 130
	"	*					*			2	MW	Cl, Ca	Bl, Gr, wh	<1	MH		25	60	
353.75	"	*					*			2	SW	Cl	Gr	<1	MH		--	90	rotated
354.05	"	*					*			1		Cl, py	Gr, Bl, ye	<1	MH, H		295	65	sheared = 70
354.31	"	*					*			1	SW	Cl, py	Bl, ye	<1	MH, H		320	60	
354.55	"	*					*					Cl, py	Bl, ye	≤1	MH, H		295	55	
354.63	"	*					*			2	SW	Cl, Ca	Bl, wh	<1	MH		60	85	
354.87	"																		U/T

Fig. 2.6 Fracture Data Sheet

Location

Location: SBH 1	Date: 77/11/08			Drill crew: Goran Jonsson			Logger: G.M.	
TIME	CORE INTERVAL	BIT PRESSURE	WATER PRESSURE	BIT INFORMATION			WATER DEPTH	GENERAL INFORMATION
				TYPE	No.	TIME CHANGE		
7:25	379.84	26	20	D 100	98291	771108	33.20	Start
8:30								uptake
9:45	382.00							core on surface
11:20								start
11:35								uptake
12:45	382.05							core on surface

Fig. 2.7 Drill Record Sheet

a complete drilling record, each computer record started with a flag. If the flag is 11 then the record contains fracture data, if the flag is 22 the record contains data on the drill-rig schedule, performance, etc., when the flag is 33 the record contains comments about either the logging or drilling operation, when the flag is 44 the record contains data on core lengths, etc., and when the flag is 55 the record contains core and drilling data, dates, location, core box no., name of logger, etc.

The specific coding and record format for each record type are outlined below. For the fracture data record, i.e., with flag of 11, the following coding and format was used;

Parameter	Format	Column
Flag	I2	1-2
Depth	F10.3	3-12
Description of Strata	3A4	13-24
Fracture Type 1-Natural 2-Induced 3-Uncertain	I2	25-26
Fracture Condition 1-Open 2-Closed 3-Other	I2	27-28
Fracture Plane Characteristics 1-Planar 2-Curved 3-Irregular	I2	29-30
Fracture Roughness (1-5 mm)	I2	31-32
Weathering	A4	33-36

Gough Type	A4	37-40
Colour	A4	41-44
Thickness	A4	45-48
Hardness	A4	49-52
Relative Orientations		
-Beta	F 50	53-57
-Alpha	F 50	58-62
Comments	4A4	63-78

The drill data record (Flag 22) used the following format;

Parameter	Format	Column
Flag	I2	1-2
Time (hr. min)	2F4.0	3-10
Core Interval	2F6.2	11-22
Bit Pressure	F5.2	23-27
Water Pressure	F5.2	28-32
Bit Information	3A4	33-44
Water Depth	F5.0	45-49
Information	7A4	50-78

Comment cards (Flag 33) have the following format;

Parameter	Format	Column
Flag	I2	1-2
Comments	18A4	3-74

Core Data cards (Flag 44) have the following format;

Parameter	Format	Column
Flag	I2	1-2
Core Interval	2F10.2	3-22
Measured Core Interval	F10.2	23-32

Number of Core Pieces	I4	33-36
Sample Recovery percent	F5.2	37-41
Core Recovery Percent	F5.2	42-46
Mean Core Length	F5.1	47-51
Sum of Core Length	F5.1	52-56
Comments	5A4	57-76

Core and drilling data records (Flag 55) have the following format;

Parameter	Format	Column
Flag	I2	1-2
Date	3I2	3-8
Borehole No.	A4	9-12
Core Box No.	A4	13-16
Drill Crew	10A4	17-56
Logger	4A4	57-72

Symbols and abbreviations that commonly appear in each record are:

(1) for colors,

Green	= GR	White	= WH
Brown	= BR	Black	= BL
Yellow	= Y	Blue	= BE
Red	= RE	Grey	= GY

Black, Green and White = BGW
and Black, Yellow and White = BYW

and (2) for mineral infillings and coatings;

Epidote	= EP	Calcite	= CA
Flouite	= FL	Chlorite	= CL
Iron (oxides)	= FE	Mica	= MI
Quartz	= QT	Pyrite	= PY
Sulphur	= SU	Clay	= CY
Silt	= SI	Sand	= SD

Feldspar = FD (most cases is microcline)
Mica, Chloride Calcite = MCLA
Sulphur, Feldspar, Chlorite = SFCL
Chlorite, Calcite, Quartz = CLAQ
Pyrite, Chlorite, Calcite = PCLA
and Epidote, Chlorite, Calcite = ECLA

In addition, when more than one fracture orientation value was given this is indicated by "-----" and the extra readings were given under a comment card flag. Comment cards were generally used if the logger felt that the orientation values were incorrect or if the space provided for a particular category was inadequate.

The only way to verify the accuracy of the data from the logging of a drill-core is to have a different logger relog the core. Because of the tight drilling schedules at Stripa and the limited professional manpower, relogging of the core was not feasible. In nearly all cases the fracture and core logging were checked each day by a drill shift supervisor. In order to minimize the number of errors that normally exist in transferring data from original field logging sheets to computer records,

the computer record was compared line by line to the original field records by a second individual who had not been involved in the original data coding and processing.

Also, in addition to the basic fracture data, other core data collected during the logging process included the following:

(1) Core Interval:

Given as the depth at which a drill run was started to the depth at which the drill run finished. Depths are recorded to the nearest centimeter. The length drilled can be determined by taking the difference between the two depths.

(2) Measured Core Interval:

This is the measured length of the sample recovered from the uptake of each drill run. This length may be greater or less than the core interval due to core stubs being left in the hole at the end of a coring run.

(3) Number of Core Pieces:

The number of pieces of solid core

(4) Sample Recovery %:

$$S.R. = \frac{\text{Measured Core Interval}}{\text{Core Interval}} \times 100$$

(5) Core Recovery %:

$$C.R. = \frac{\text{Sum of Core Lengths}}{\text{Core Interval}} \times 100$$

(6) Mean Core Length:

Sum of core lengths/numbers of core pieces

(7) Sum of Core Lengths:

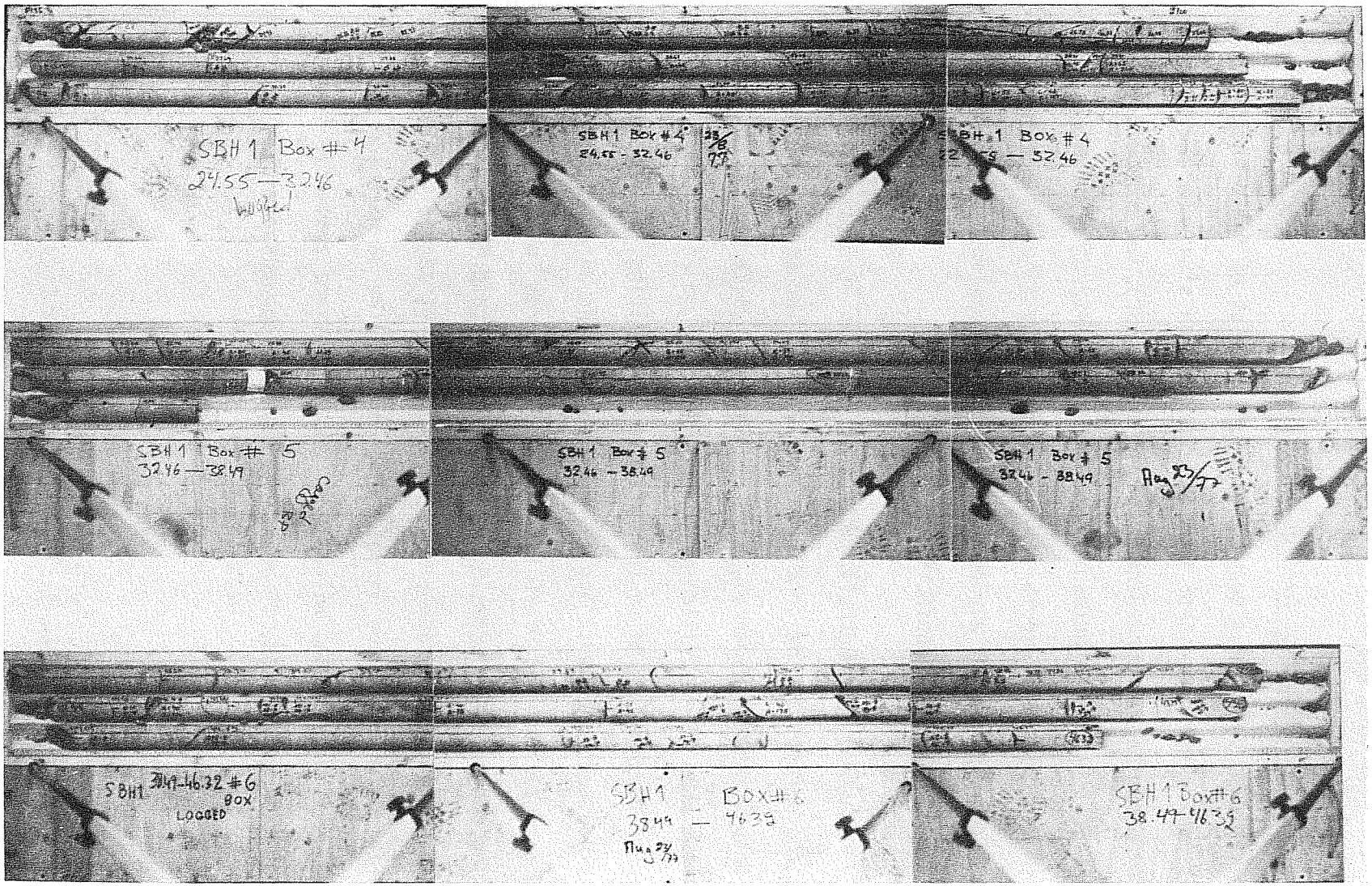
The sum of the lengths of the solid pieces of core.

Also, to ensure a reference for later work, a complete photographic record of the core was maintained. This is discussed in the next section.

2.4 Types and Format of Available Data

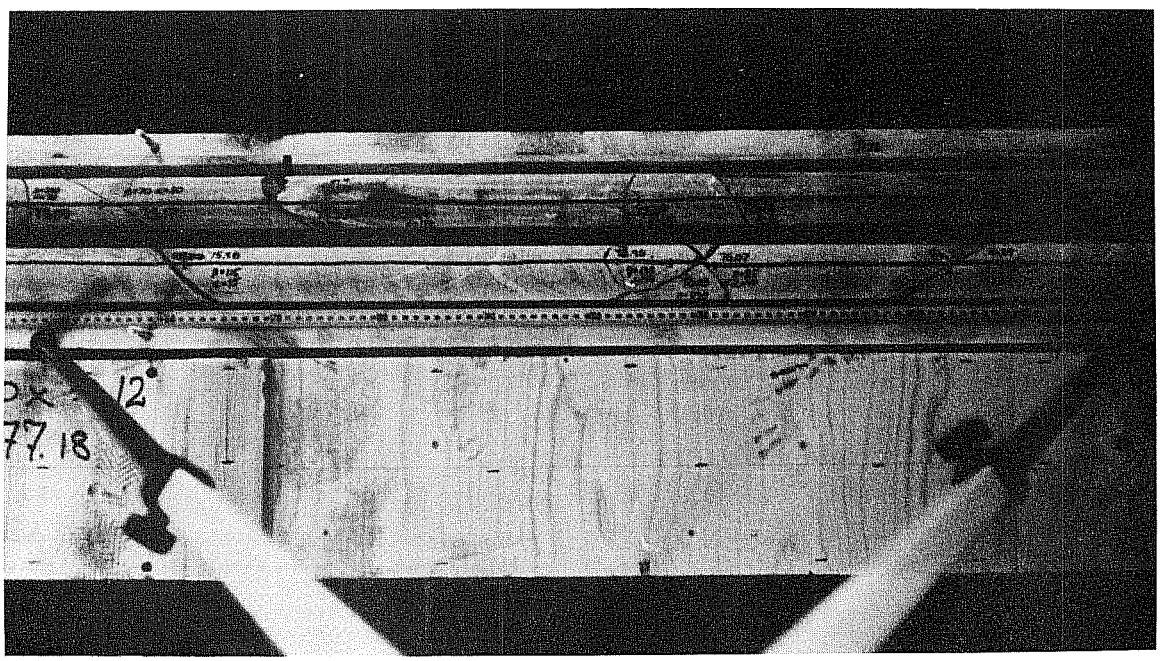
For each borehole a copy of the complete set of field fracture logging sheets are available either from the Stripa mine site, the Earth Sciences Division of the Lawrence Berkeley Laboratory (LBL), or from J.E. Gale of the Earth Sciences Department, Memorial University of Newfoundland (MUN). The complete set of computer coded fracture data files is also available from either LBL or MUN either in the form of computer printout (Appendix A-1) or on 9-track magnetic tape.

In general the photographic record consists of black and white polaroid photographs of the core immediately after the core was removed from the triple tube core barrel, a 35 mm black and white photograph of each core box when it was filled with core, and a 35 mm color slide, taken after the core had been moved to the core storage building, of four or five core boxes grouped together. The polaroid photographs were immediately cut to form a continuous record of the core and fractures for the hydrology testing program. An example of part of this record is given in Fig. 2.8. Figures 2.9 and 2.10 show examples of the sort of detail available from both the 35-mm black and white photographs and the 35-mm color photographs. Copies of the black and white 35-mm photographs are available from the Stripa mine and copies of the 35-mm color photographs are available from either MUN or LBL.



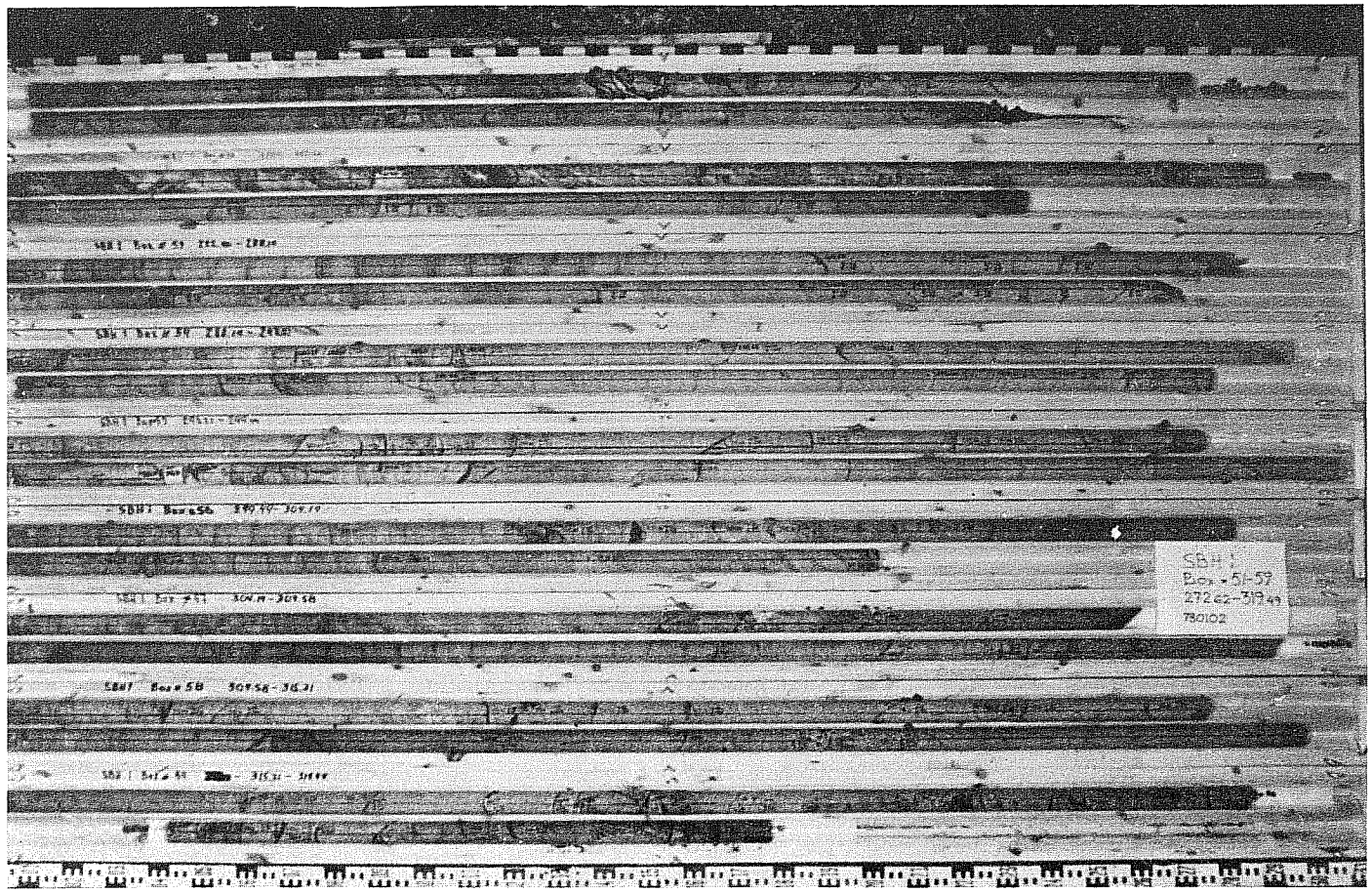
XBB 849-7345

Fig. 2.8 Example of Drill Core Record Made from Polaroid Photographs



XBB 842-810

Fig. 2.9. Example of 35-mm black and white photograph of drill core.



XBB 849-7346

Fig. 2.10. Black and white print of 35 mm color photograph of drill core.

2.5 Summary

The fracture data file for borehole R3 is given as an example in Appendix A-1. The complete fracture data file, which is available on either computer cards or magnetic tape, contains 10,515 records or lines of data. The flags used to start each record and the coding and structure of the data files provide for ready sorting and analysis of the fracture. The survey coordinates given in Chapter 1 and the relative orientations given in the data file permit one to calculate the true orientations of the fractures. Thus the fracture data files as presented enable one to calculate the statistics of fracture orientation and spacings.

3. BOREHOLE PACKER INJECTION AND WITHDRAWAL TESTS

3.1 Introduction

The hydraulic characteristics of fractured rock masses and the different methods of determining the permeability of fractured rocks as well as the conceptual framework for analyzing flow in fractured igneous and metamorphic rock masses have been discussed by Gale and Witherspoon (1979) and Gale (1980). The overall approach varies depending on whether one is attempting to determine the total flux through the system or determine the rate of movement of either water or a contaminant. In the disposal of nuclear waste one is directly concerned with radionuclide migration problems. It is reasonable to assume, when matrix hydraulic conductivities are 10^{-12} cm/sec, that in fractured granitic and metamorphic rocks radionuclide migration takes place through individual fractures. Thus one must pay particular attention to the structural geology and develop the hydraulic parameters for the rock mass from the level of the individual conduits, utilizing their statistics of orientation, spacing, continuity and aperture.

As outlined by Gale and Witherspoon (1979) the fracture hydrology program at Stripa was designed to provide data on the hydraulic characteristics of the fracture system such that when these data are combined with the fracture geometry data a more complete description of the fracture permeability of the rock mass will be possible. Central to this study was a systematic borehole packer injection-withdrawal test program. The main borehole testing program consisted of injection tests in the surface boreholes and injection-withdrawal tests in the subsurface boreholes using a 2-m packer spacing. In several boreholes a selected number of long

intervals (6 to 7-m packer spacings) and single fractures (0.5 to 0.8-m packer spacings) were also tested. The calendar periods during which each borehole was tested, the type of test performed, and the test method are given in Table 3.1. Appendix B-1 gives a complete summary of the individual boreholes tested, the number and type of tests attempted and the types of raw data available for each tests. This record shows that a total of 433 two-meter interval injection and withdrawal tests were attempted. Also a total of 94 single fractures and a total of 29 six to seven-meter zone tests were attempted. The exact number of successful tests will not be known until each of the test results and records have been subjected to a detailed analysis.

3.2 Data Collection and Transfer Procedures

In this section a brief outline of the data collection and data transfer procedures used are given. The procedures for testing the surface and subsurface boreholes differed slightly because of the test conditions encountered. A detailed step by step discussion of the procedures is given in Appendix B-2.

3.2.1 Data Collection Procedures

The basic set of equipment used for borehole packer tests is shown schematically in Fig. 3.1. The main components are the borehole probe-packer unit, the electrical monitoring system, the flow rate measuring system, and other water supply and operating equipment. While a number of different borehole probe units were used to isolate the test cavities in the boreholes at Stripa, the basic borehole probe-packer assembly was similar to that shown in Fig. 3.2. This assembly consists of two packers

Table. 3.1 Schedule of hydrology testing at Stripa.

BOREHOLE	LENGTH OF BOREHOLE	TEST TYPE*	TEST METHOD**	TESTING DATE
S-1	All	2m	O	25 May - 1 Jun '78
S-2	All	2m	O	1 Jun - 7 Jun '78
R-3	All	2m	B	24 Jan - 15 Jun '79
R-3	All	S.F.	B	3 May - 15 May '79
R-4	All	2m	B	27 Nov - 12 Dec '78
R-4	All	S.F.	B	23 May - 28 Jun '79
R-5	All	2m	B	19 Feb - 28 Feb '79
R-5	All	S.F.	B	21 May - 31 May '79
R-6	All	4m	O	14 Jun - 26 Jun '79
R-7	All	4m	O	5 Jun - 13 Jun '79
R-8	All	2m	F	29 Jun - 31 Jul '78
R-8	All	S.F.	B	6 Mar - 19 Apr '79
R-9	All	2m	F	14 Jul - 31 Jul '78
R-9	All	S.F.	B	26 Mar - 4 Apr '79
R-10	All	2m	F	17 Jul - 3 Aug '78
R-10	All	S.F.	B	6 Mar - 20 Mar '79
HG-1				
HG-2	All	2m	B	30 Nov - 12 Dec '78
HG-2	All	2m	B	20 Nov - 23 Nov '78
HG-3	All	2m	F	7 Aug - 24 Aug '78
HG-3	All	S.F.	B	5 Apr - 20 Apr '79
HG-4	All	2m	F	8 Aug - 22 Aug '78

Table 3.1 (continued).

BOREHOLE	LENGTH OF BOREHOLE	TEST TYPE*	TEST METHOD**	TESTING DATE
HG-4	All	S.F.	B	24 Apr - 15 May '79
HG-5	All	2m	B	4 Jan - 25 Jan '79
SBH-1	48-106	2m	B	10 Sep - 27 Sep '79
	105-152	2m	B	27 Oct - 9 Nov '78
	202-382	2m	B	6 Sep - 16 Oct '78
SBH-1	All	6-7m	B	13 Nov - 23 Nov '79
SBH-1	All	S.F.	B	12 Oct - 7 Nov '79
SBH-2	21-355	2m	F	10 Jun - 17 Oct '79
SBH-3	All	2m	F	March '80

* In the "Test Type" column 2m refers to a 2m test interval, 6-7 m refers to tests intervals 6 or 7 meters in length and S.F. refers to intervals that contain a single fracture, usually about a .5m test interval.

** Test Method refers to the method used to measure flowrates, i.e. F refers to positive displacement flow tanks, B, refers to the bubble injection line system and O refers to other methods usually used for outflow, or injection tests.

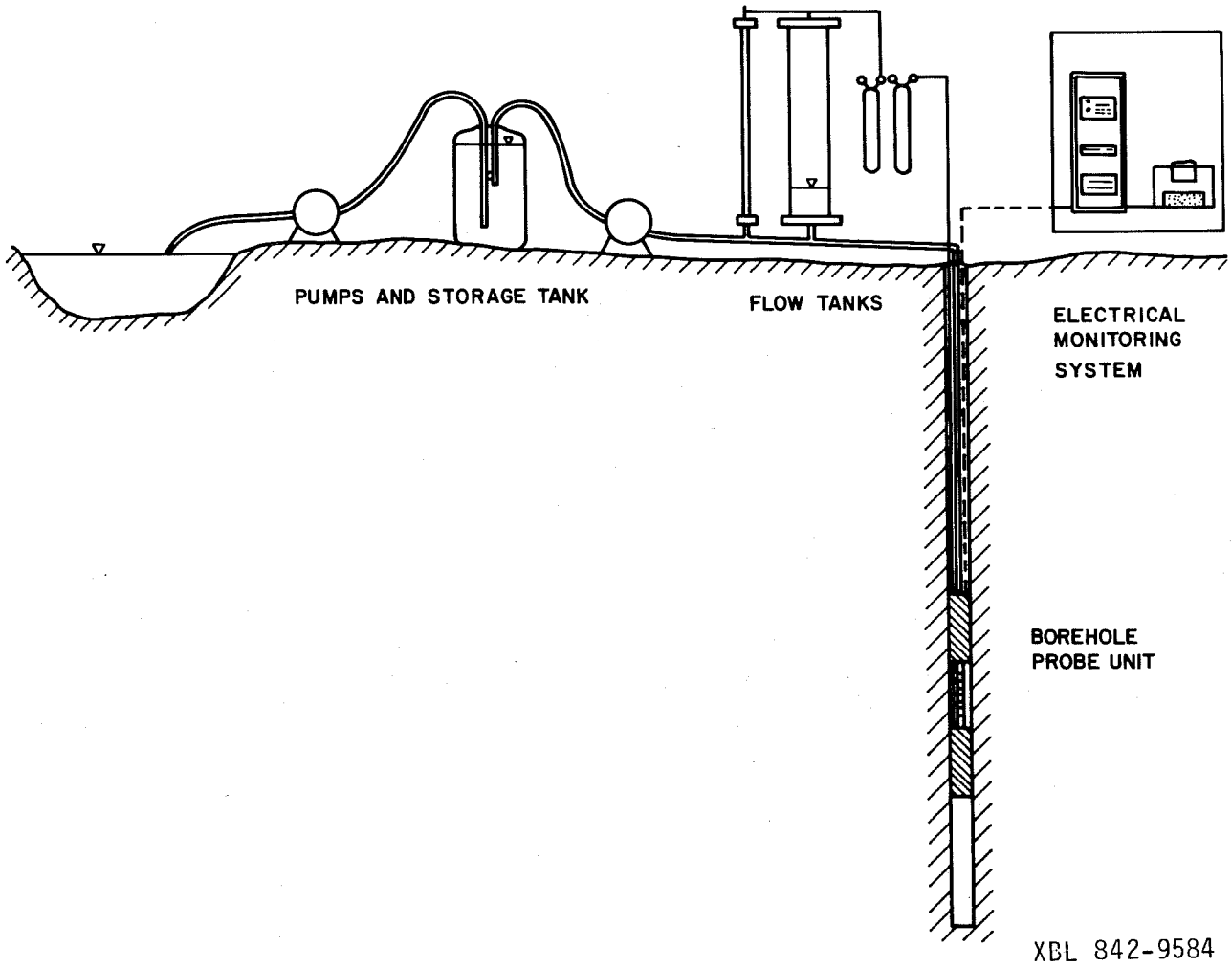


Fig. 3.1. Schematic of surface and borehole hydrology testing equipment.

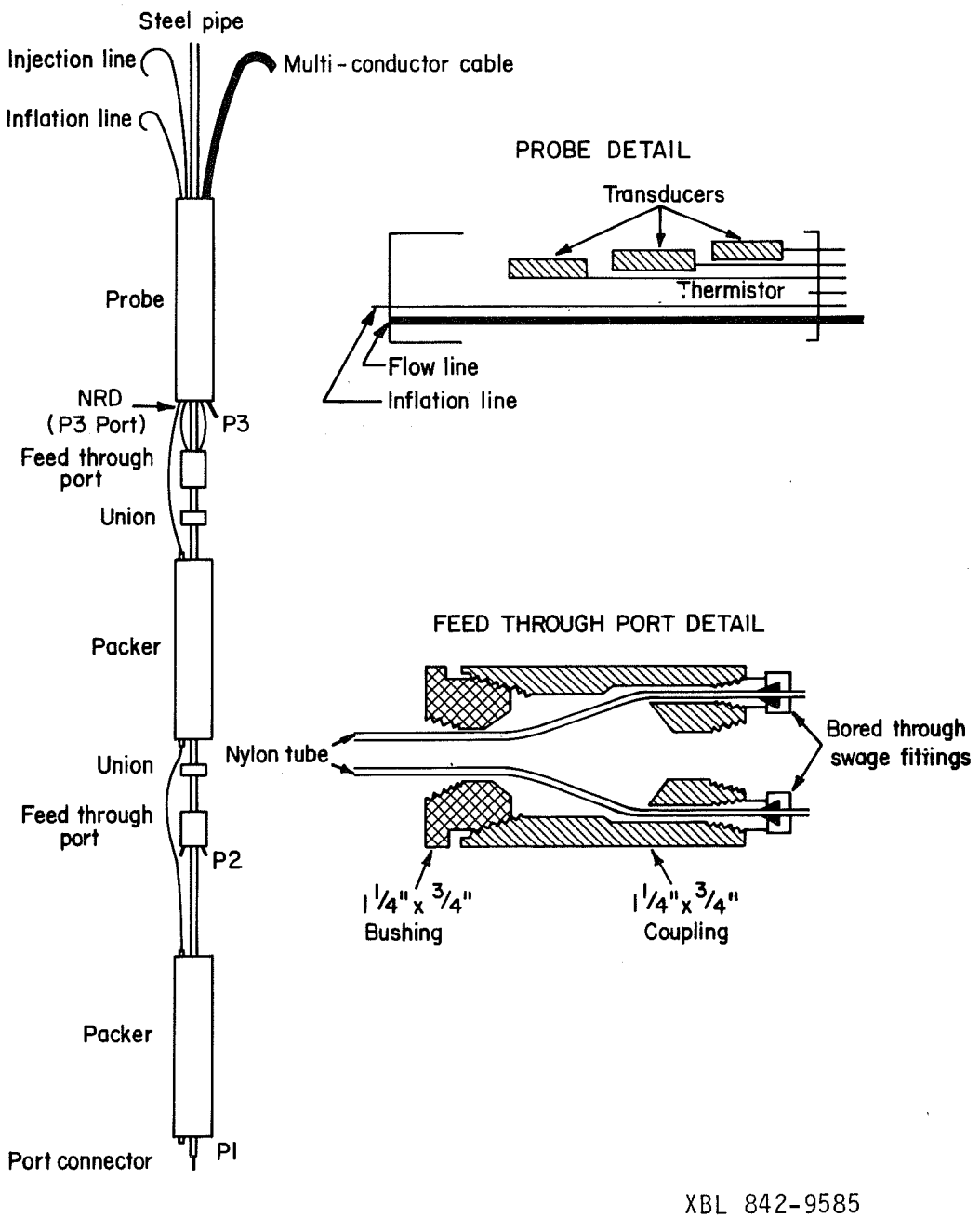
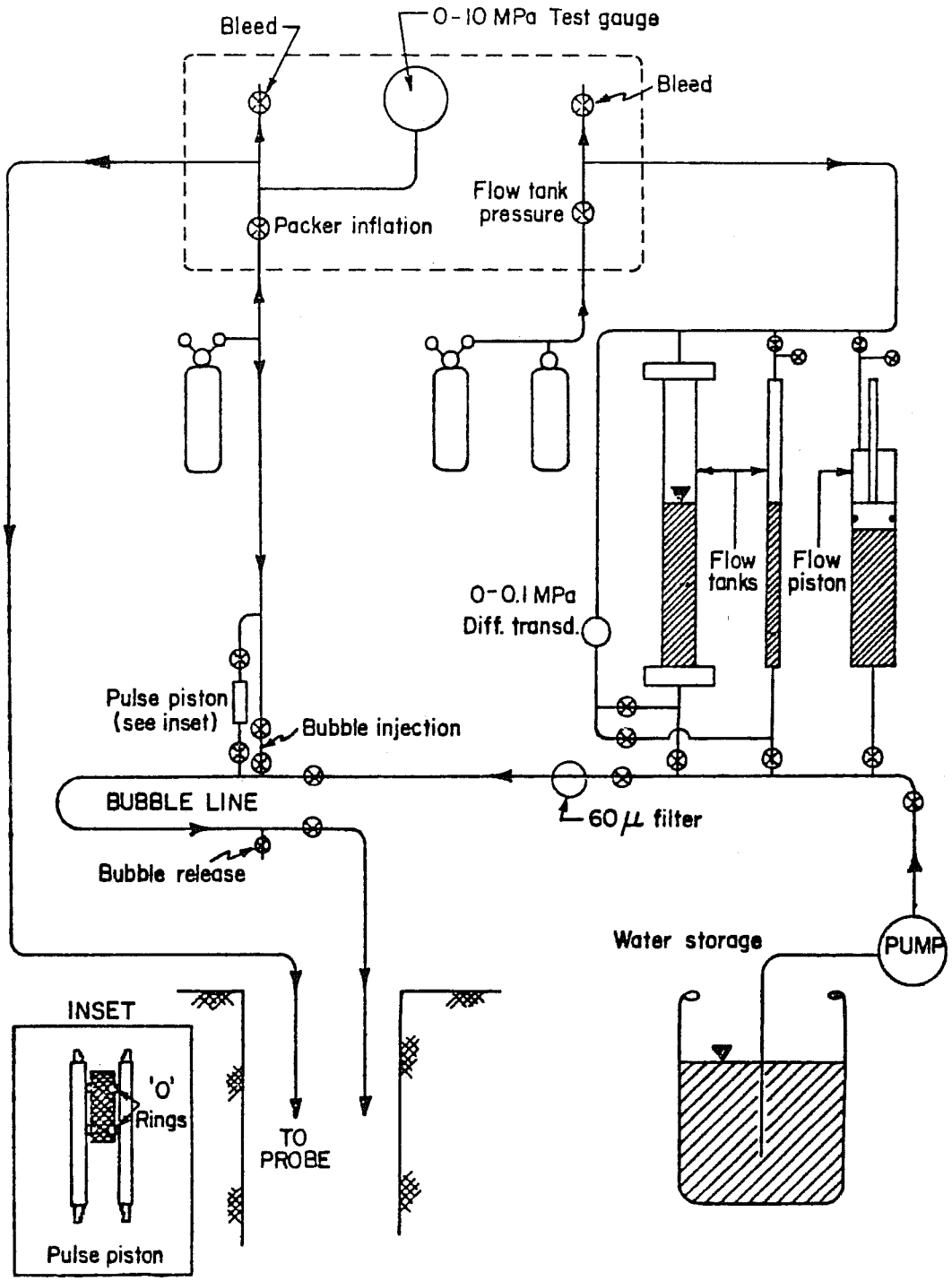


Fig. 3.2. Schematic of downhole testing equipment.

and a probe plus the necessary connecting pipes and tubing. The packers are inflatable borehole seals that are inflated with compressed nitrogen. The two packers are joined by a perforated steel pipe that allows water to flow from the packer mandrels into the test cavity. The probe is basically a watertight case that holds three electronic pressure transducers and a thermistor. The feed-through ports provide a means of feeding nylon tubes into the packer mandrels while maintaining a good pressure seal in the test cavity. A reference point referred to as the NRD is an arbitrary position on the probe assembly used to determine the position of the probe and other components in the borehole. The distance to this point is called the nominal reference depth or NRD. In nearly all of our testing the position of the P3 transducer port was chosen as the NRD point.

Compressed nitrogen was delivered to the packers by the nylon inflation line while water pressure was delivered to the test cavity by the nylon injection line. A multiconductor cable provided transmission of input power to the probe and returned the output signals to the surface. The probe assembly was raised and lowered in the hole by a 1.9 cm diameter steel pipe connected to the top of the probe. Surface or up-hole equipment used to conduct injection tests and pressure pulse tests is shown in Fig. 3.3. This equipment consisted of the following components: (1) Packer inflation system: A compressed nitrogen bottle provided gas pressure to inflate the packers. Packer pressure was controlled by valves on the control board and monitored by the adjacent gauge. (2) Pulse piston: A piston is placed on a T-connection in the injection line during testing of the subsurface boreholes such that the packer inflation pressure could be used to fire the piston. The piston was simply a small bullet that traveled



XBL 842-9587

Fig. 3.3 Schematic of surface testing equipment.

inside the tube when air pressure was applied. The piston then displaced a known volume of water, thus generating a pressure pulse in the test cavity. (3) Flow tanks: A number of different size flow tanks were used. Water in the tanks was pressurized using compressed nitrogen. The tank pressure was controlled while the downhole test cavity water pressure was monitored with a pressure transducer in the probe. A manometer or differential transducer was used to monitor the change in water level in the tank over a specified time period. These data were used to calculate the rate of water flow into the test cavity. Variations in tank pressure were controlled by a volume of air contained under the same pressure in a connected buffer tank. (4) Flow pistons: Flow pistons, which were used in testing several of the subsurface boreholes, have the same purpose as flow tanks however they operate in a somewhat different manner. Compressed nitrogen was used to apply pressure to the top side of the piston, which applied pressure to the water below the piston. The rate of movement of the piston rod was used to calculate the rate of flow of water into the test cavity. (5) Bubble line: The bubble line was installed downstream of the flow tanks and/or flow pistons and provided a means of measuring low flow rates. An air bubble was injected into the injection line using a valve system connected to the packer inflation line. The rate of movement of the bubble in the tube was used to calculate the rate of water flow into the test cavity. The bubble was removed from the tube at the end of the bubble line so that air was not injected into the test cavity. The bubble line approach was used in testing sections of SBH-1, SBH-3 and a number of sections of the subsurface boreholes.

In testing SBH-2 and some sections of SBH-3 a four-flow-tank assembly was used. In this case the diameter of the smallest flow tank was similar to the diameter of the bubble line and hence provided the necessary flow rate range for testing the low permeability sections. The relative accuracy of each flowrate measuring system is summarized in Table 3.2. (6) Water supply: Water was pumped into the flow tanks from a storage tank and transferred into the flow pistons from the filled flow tanks. Large particulate matter in the water was allowed to settle out in the storage tank while smaller particles were filtered out prior to entering the bubble line.

The electronic signal generation and collection system, which with minor variations was used in the testing of all of the boreholes, is shown in Fig. 3.4. This system used a number of power supplies to power the transducers and the thermistors and provided a means for observing and saving both digital and graphical data. Transducers (P1, P2, P3 and the differential transducer) thermistors (probe temperature) are powered by regulated DC power supplies, however, the output voltage of the power supplies were monitored during testing. The output voltage of the thermocouple mounted on the tank was converted directly to temperature in degrees Celcius by the data logger. The data logger collected voltage signals from the various sources at programmed time intervals and directed the teletype to print and punch the signal data. The thermistor box provided power to the thermistors and incorporated a Wheatstone bridge to measure changes of temperatures down to 0.01°C over a linear range of several degrees. The chart recorder was used to monitor the ongoing change in the cavity pressure and tank level during testing. In the testing of SBH-2 the output from the flow tank differential

Table 3.2. Flowrate measuring ranges

1) Injection Line - Air bubble method

Lower limit:
- Position of air bubble can be determined to within ± 1.5 mm.
- Thus to obtain 1% accuracy the bubble must move 150 mm, giving for a 30 minute test a minimum flowrate of 0.056 ml/min.
- For 120 minute test minimum flowrate is 0.014 ml/min.

Upper limit:
- Timing error ± 0.2 seconds
- Thus to obtain 1% accuracy a minimum of 20 seconds of injection time is required.
- For a one metre long bubble tube this provides a maximum flowrate of 34 ml/min. A five metre bubble tube would provide a maximum flowrate of 150 ml/min. (maximum practical limits)

2) Small Flow Tank - Used primarily on SBH-2-

Lower limit:
- Transducer accuracy is 0.002 VDC
- 1% accuracy requires a change of .2 VDC
- A change of 1.0 VDC in transducer reading is equal to 6.25 ml of water
- Thus minimum volume for 1% accuracy is 1.25 ml.
- Minimum flowrate for a 30 minute test is 0.042 ml/min.
- Minimum flowrate for a 120 minute test is 0.010 ml/min.

3) Larger Flow Tank - Used primarily in testing SBH-1

Lower limit:
- Transducer accuracy is 0.002 VDC
- 1% accuracy requires a change of .2 VDC
- A change of .00000206 VDC is equal to 1 ml of water
- Thus a minimum volume for 1% accuracy is 9708 ml of water
- For a 30 minute test the minimum flowrate is 323 ml/min
- For a 120 minute test the minimum flowrate is 80 ml/min

* Acceptance of a 10% accuracy would permit one to measure flowrates on the order of 10^{-3} ml/min.

** Upper limits on the flow tanks is determined by the volume of water in each tank and the length of time required to obtain good test results.

*** Several different sizes of tanks were used in testing SBH-2 and one intermediate size tank was used in testing the other boreholes. These tanks provide flowrates that complimented the ranges provided by the tanks described above.

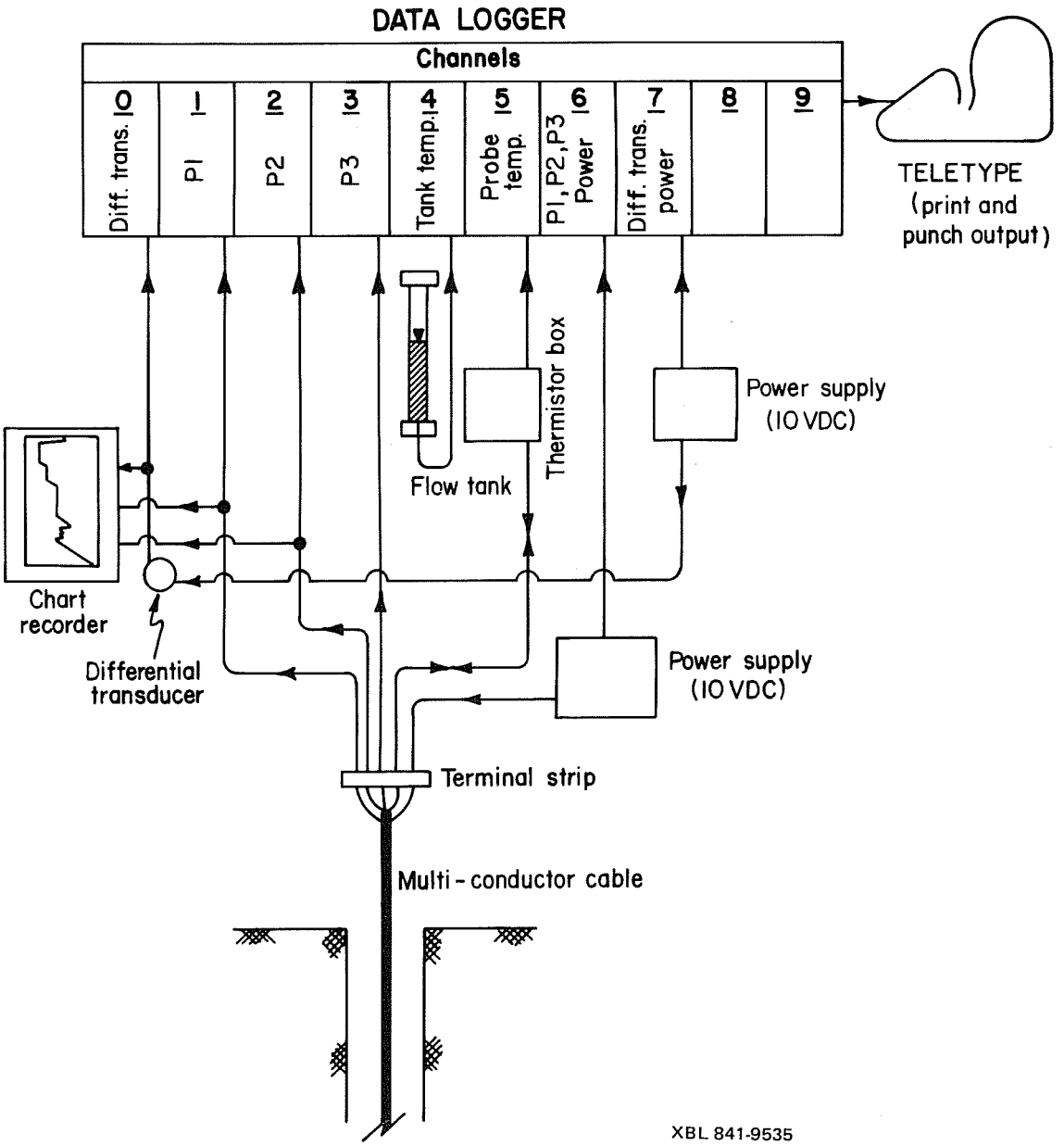


Fig. 3.4. Schematic of data acquisition system.

transducer was monitored on the chart recorder and used to determine the flow rates. The teletype system was not used at SBH-2.

3.2.2 In-Situ Pore Pressure Measurement

In-situ pore pressure measurements are required to determine in-situ fluid pressure and hence existing pressure gradients in borehole testing. The downhole probe assembly described in the previous section is not well suited to the measurement of in-situ pressures during injection tests.

In the surface boreholes in-situ fluid pressures in the rock mass around the test interval before injection testing were determined by the following approach. If the column of water generated by the fluid pressure in the test cavity rose to within 8 to 10 meters of the ground surface, the in-situ fluid pressures were determined by closing a valve in the flow line, thereby removing the fluid pressure imposed on the test cavity by the flow tank. In intervals with moderate to high permeabilities this excess fluid pressure would decay to the original in-situ pressure in a reasonable period of time. In intervals with low permeabilities the times required for the fluid pressures to decay to their in-situ values were excessive. Thus the approach discussed in the following section on data processing was used to obtain the data need for the calculation of the gradients present during the injection test. The problem of measuring in-situ pressures could be resolved by installing a valve above the top packer that could be controlled from the surface. A downhole valve would eliminate the column of water imposed by the flow tanks during in-situ pressure measurements and could be opened to allow injection or pulse testing. Alternatively, as discussed in Chapter 1, in-situ pressures can

be measured during drilling by setting a single packer several meters above the end of the hole at the end of each drill run. This was the approach used to obtain in-situ pressures during the drilling of SBH-1, SBH-2 and SBH-3.

In subsurface boreholes in which groundwater was seeping into the test excavations, the pore pressures in the rock mass were much greater than the pressure of the column of water in the injection line, and hence it was very easy to obtain, by closing the injection line, an exact measure of the in-situ pore pressure in the cavity being tested. The in-situ pressure data are presented in Appendix B-3 and discussed briefly at the end of this chapter.

3.2.3 Injection Testing

Injection tests were conducted by measuring the steady-state rate of flow into a test cavity under a constant pressure. Several pressures in excess of the in-situ groundwater pressures were applied to the test cavity in a stepwise fashion as shown in the strip chart record in Fig. 3.5. The strip chart record in Fig. 3.5 shows the fluid pressure (P_1) in the wellbore below the packer assembly and the fluid pressure in the test cavity (P_2) for a test in the R9 borehole. Both an outflow test and an injection test are shown. In testing the surface boreholes where in-situ pressures were unknown an excess head was applied to the test cavity by the column of water in the injection system and the corresponding flowrate was monitored. Additional pressure increments were applied using the flow tanks or flow pistons (Fig. 3.3) described earlier. Once an excess pressure was applied, the flow rate (using flow tank, flow piston or bubble

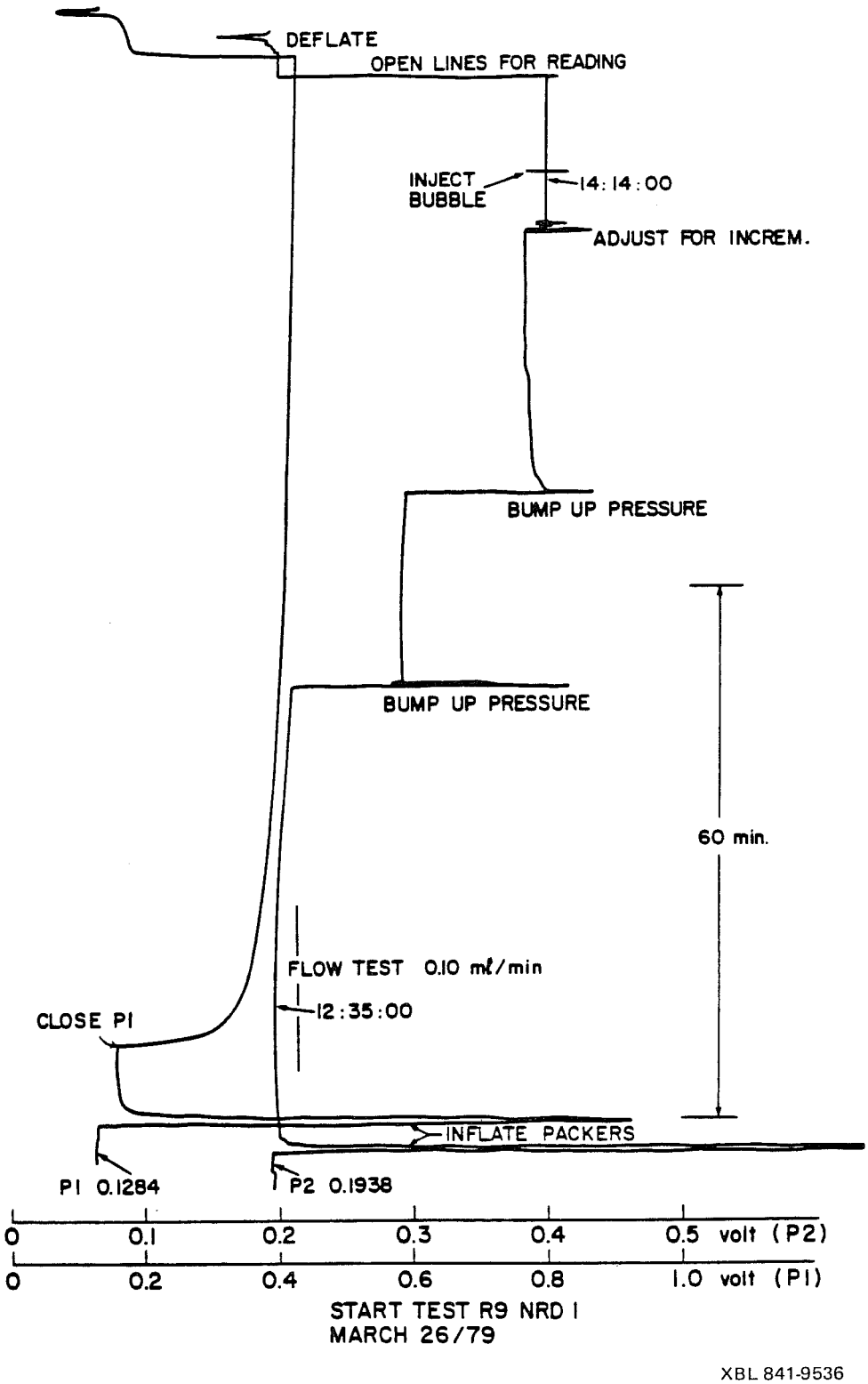


Fig. 3.5. Example of strip chart record for an injection test.

line) was monitored until steady pressure and flowrate conditions were achieved.

Steady state conditions were assumed to exist when the fluid pressures did not vary by more than 0.0003 MPa per minute and three consecutive flowrate measurements did not vary by more than 5%. In a number of test intervals these conditions were not reached and quasi-steady state tests were performed. When steady-state conditions were reached, the steady-state pressures and flowrates were recorded and the next pressure increment started.

In the subsurface boreholes we were able to measure the rate of groundwater flowing out of each test cavity. This was accomplished by simply opening the injection line at the flow tanks and measuring directly, with a calibrated cylinder, the volume of flow out of the injection line over some given time period. Usually an outflow test was performed both before and after any injection tests were carried out (Appendix B-3).

3.2.4 Pulse Testing

Pulse tests were conducted, in a limited number of test cavities, by monitoring the decay of a small transient pressure pulse imposed on the test-cavity pressure. In a pulse test, when the piston is fired, a known volume of water is displaced in the test cavity (and in the line to the surface) causing a pressure increase. The character of this pressure increase and decay is primarily dependent upon rock mass characteristics such as degree of fracturing and the permeability and porosity. The data obtained from the pressure pulse testing program at Stripa are presented in an earlier report by Forster and Gale (1981).

3.3 Data Processing Procedures

3.3.1 Types of Raw Data Available

As indicated in the previous section, injection test data were collected using a basic data logger system. All of the electronic sensors produced a dc voltage and this was converted by the A-D system in the data logger to a digital form. The voltages and temperatures (°C) were printed in digital form either on the data logger printer or on a teletype. In a number of the tests (Appendix B-1) the data were also recorded by teletype on punched paper tape.

In addition to the printed and punched paper tape records the analog signals from the transducer monitoring the test cavity and the differential transducer monitoring the flow tank were generally monitored using a strip-chart recorder (Fig. 3.5). Also for each test all of the pertinent data for that test and the test interval were recorded on a data sheet. An example of one of the two data sheets used is given in Fig. 3.6. After the borehole test data have been analyzed copies of all of the data sheets and records with explanatory notes will be placed on file at the Stripa test site and at LBL.

3.3.2 Data Reorganization, Coding and Storage

After the data were received, the data sheets, strip-chart record, teletype printer output, and punched paper tape output for each test were assembled for each borehole. Separate files were created for the 2-m, single fracture, and long interval tests, respectively. The punched paper tape was transferred onto magnetic tapes and the computer printouts filed by borehole number.

INJECTION TEST DATA SHEET SBH 1 NRD 362

Hole No. SBH 1 Location STRIPA Date OCT 12 - 1978 63c

Borehole Length 384.8 m Borehole Diameter 76 mm Bearing/plunge 45

Field Engineer BN Technical Staff 1. W. 2.

System checked by W Time 10:30 Reference pt. 358.41

Type of packer(s)

Depth Data

Elev. of collar 0.34 m

Distance to G.W.L. m

Top of upper seal 358.84 m

Top of test cavity 360.24 m

Bottom of test cavity 362.04 m

Bottom of lower Seal 363.63 m

Length of borehole probe 6.84 m

Length of cable used ~610 m

Length of inj. tubing ~350 m

Diameter of inj. tubing 3.79 mm

Length of inj. cavity 1.80 m

Length of bottom end cavity m

Length of top end cavity 358.84 m

Position of P1 358.13 m

Position of P2 357.90 m

Position of P3 357.67 m

Transducer Data	Pressure P1	Pressure P2	Pressure P3	Flow Tank	Temperature Thermistor
Data Logger channel	0	1	2	3	5
Calibration	0.00506	0.00509	0.00510	0.000604	–
Surface Reading	-0.0672	0.0473	0.0267	–	–
Heading before inflation	1.1754	1.3150	1.3374	4.722	0.5236
Reading after inflation	1.8570	1.8364	1.3497	4.801	0.5240
Reading before deflation	1.0376	1.8475	1.3474	4.416	0.5253
Reading after deflation	1.1848	1.3248	1.3464	4.415	0.5255
Surface Reading	–	–	–	–	–

Injection Data

Normal Injection Pressure, MPa or % overburden press	Flowrate VDC	Flowrate cc/sec /min	Pressure Surface VDC	Pressure Surface MPa	Pressure Tank Downhole VDC	Pressure Tank Downhole MPa	Position start	Position stop
0 HP+0 0% MPa		0.05	0.0290		1.8487		4.778	4.783
.1 5%								
.2 HP+0.14 10% MPa		0.05	0.1252		1.9451		4.735	4.733
.3 15%								
.4 HP+0.28 20% MPa		0.06	0.2319		2.0514		4.545	4.545
.3 15%								
.2 10%								
.1 5%								
0 0%								

Indicate if borehole testing continued without removing packer from borehole. P1 = pressure below injection cavity, P2 = pressure in injection cavity, P3 = pressure above injection cavity.

Fig. 3.6 Example of Data Sheet Used in Recording Injection Test Results (a) Injection Test Data Sheet.

FLOWRATE DATA SHEET

Date: OCT 12 - 1978 Borehole No. SBH 1 63d

by: W - BN NRD 362

X-sectional area of inj. tube: 0.1127 cm²

TIME	Data Logger TIME	DISTANCE	FLOWRATE	COMMENTS
				1st.
0	10:57			
0-4	11:01	2.35	0.07	
4-8	:05	2.15	0.06	
8-12	:09	2.00	0.06	
12-16	:13	2.00	0.06	
16-20	:17	1.85	0.05	
20-24	:21	1.80	0.05	
				2nd
0	11:30			
0-4	:34	2.45	0.08	
4-8	:38	2.55	0.07	
8-12	:42	2.32	0.06	
12-16	:46	2.10	0.06	
16-20	:50	2.00	0.06	
20-24	:54	1.90	0.05	
24-28	:58	1.60	0.05	
0	12:09			
0-4	:13	2.70	0.08	
4-8	:17	2.45	0.07	
8-12	:21	2.15	0.06	
12-16	:25	2.30	0.06	
16-20	:29	2.00	0.06	

Fig. 3.6 Example of Data Sheet Used in Recording Injection Test Results (b) Flowrate Data Sheet.

The key pieces of data for each test interval and each test increment were transcribed into computer files. As indicated in the previous section there are three basic types of input files. These are (1) 2-m tests in which flowtanks equipped with differential transducers were used to measure flowrates, (2) 2-m tests in which a bubble line system was used to measure flowrates, given directly in ml. per minute, and (3) single fracture tests using a bubble line to obtain flowrates. Flowrates are given directly in ml. per minute.

Individual flags (i.e., a two digit number) are used to identify the different data cards. These flags appear in columns 1 and 2 of each data card as follows:

Flags	Type of Data Card
99	Comment card
88	Headings, calibration factors, initial readings etc.
11	Outflow tests, time, pressure, flow data; first increment
12	Outflow tests, time, pressure, flow data; second increment
13	Outflow tests, time, pressure, flow data; third increment
21	Injection tests, time, pressure, flow data; first increment
22	Injection tests, time, pressure, flow data; second increment
23	Injection tests, time, pressure, flow data; third increment

Comments Cards (99): Information starts in column 5 and is read in a 19A4 format. Comments are transferred unchanged to the output file.

The information contained on heading cards (88) varies according to the type of test being conducted. For the three main test types the following data are supplied.

Test Type	Variable	Format	Columns
1	Flag	I2	1- 2
	Blank	2X	3- 4
	NRD, Nominal Reference Depth	I3	5- 7
	Blank	2X	8- 9
	NTEST, number of inflow and outflow tests for the given interval	I2	10-11
	Blank	2X	12-13
	INTT, Top of test interval (m)	F6.2	14-19
	Blank	2X	20-21
	INTB, Bottom of test interval (m)	F6.2	22-27
	Blank	3X	28-30
	SURF, Transducer reading at the surface (M, H^2 O)	F6.4	31-36
	Blank	2X	37-38
	CALP2, P_2 Transducer calibration factor (volts/psi)	F7.5	39-45
	Blank	3X	46-48
	CALFT, Flow tank calibration factor, volts per millilitre	F8.6	57-64

2. For test number 2 the same data and format are used except that the flow tank calibration factor is not included (CALFT).

3. For test type number 3 note that CALFT is also not supplied and that there is a small change in the format: i.e., format is 'I2, F6.2, I2, 2X, F6.2, 2X, F6.2, 3X, F6.4, 2X, F7.5, 3X, F6.4)

The outflow test data card(s) (i.e., flag equal to 11, 12, 13, etc.) provides the pressure and flowrate data required for the calculation of permeabilities from steady state outflow tests. The variables and formats used for the different test types are:

Test Type	Variable	Format	Columns
1	Flag	I2	1- 2
	Blank	2X	3- 4
	SHR, hour at which test started	F2.0	5- 6
	Blank	1X	7
	SMIN, minute at which test started	F2.0	8- 9
	Blank	1X	10
	SSEC, second at which test started	F2.0	11-12
	Blank	2X	13-14
	FHR, hour at which test ended	F2.0	11-12
	Blank	2X	13-14
	FHR, hour at which test ended	F2.0	15-16
	Blank	1X	17
	FMIN, Minute at which test ended	F2.0	18-19
	Blank	1X	20
	FSEC, second at which test ended	F2.0	18-19
	Blank	3X	23-25
	SP2, P2 transducer reading at the start of the test (volts)	F6.4	26-31
	Blank	3X	32-34
	FP2, P2 transducer reading at the end of the test (volts)	F6.4	35-40

Test Type	Variable	Format	Columns
	Blank	8X	41-48
	OUTFLO, volume of flow recorded during outflow test (ml)	F7.2	49-55
2	Flag	I2	1- 2
	Blank	19X	3-21
	SP2, P2 transducer reading at the start of the test (volts)	F6.4	22-27
	Blank	3X	28-30
	FP2, P2 transducer reading at the end of the test (volts)	F6.4	31-36
	Blank	8X	37-44
	FLOWR, flowrate in ml/min.	F9.4	45-53
3.	Flag	I2	1- 2
	Blank	19X	3-21
	SP2, P2 transducer reading at the start of the test (volts)	F6.4	22-27
	Blank	3X	28-30
	FLOWR, flowrate in ml/min	F8.3	45-52

The injection test data cards (i.e. Flag equal to 21, 22, 23, etc.) provides data similar to that in the outflow tests data file. The data on fluid pressures and flowrates are sufficient for the calculation of steady state permeabilities. The variables and formats used for the different test types are:

Test Type	Variable	Format	Columns
1	Flag	I2	1-28
	Blank	2X	3- 4
	SHR, Hours, reading at the start of the test	F2.0	5- 6
	Blank	1X	7
	SMIN, Minutes, reading at the start of the test	F2.0	8- 9
	Blank	1	10
	SSEC, seconds, reading at the start of the test	F2.0	11-12
	Blank	2X	13-14
	FHR, hours reading at the end of the test	F2.0	15-16
	Blank	1X	17
	FMIN, minutes, reading at the end of the test	F2.0	18-19
	Blank	1X	20
	FSEC, seconds, reading at the end of the test	F2.0	21-22
	Blank	3X	23-25
	SP2, P2 transducer reading at the start of the test	F6.4	26-31
	Blank	3X	31-34
	FP2, P2 transducer reading at the end of the test (volts)	F6.4	35-40
	FP2, P2 transducer reading at the end of the test (volts)	F6.4	35-40
	Blank	3X	41-43

Test Type	Variable	Format	Columns
	SFT, flow tank transducer reading at the start of the test (volts)	F6.4	44-49
	Blank	2X	50-51
	FFT, flow tank transducer reading at the end of the test (volts)	F6.4	52-57
2	Flag	I2	1- 2
	Blank	19X	3-21
	SP2, P2 transducer reading at the start of the test (volts)	F6.4	22-27
	Blank	3X	28-30
	FP2, P2 transducer reading at the end of the test (volts)	F6.4	31-36
	Blank	8X	37-44
	FLOWR, Flowrate, ml/min	F9.4	45-53
3	Flag	I2	1- 2
	Blank	19X	3-21
	SP2, P2 transducer reading at the start of the test (volts)	F6.4	22-27
	Blank	3X	28-30
	FP 2, P2 transducer reading at the end of the test (volts)	F6.4	31-36
	Blank	8X	37-44
	FLOWR	F8.3	45-52

3.3.3 Processing of data from surface and subsurface boreholes

Raw data files for both the surface (except SBH-2) and subsurface boreholes are given in Appendix B-3. In the subsurface boreholes the groundwater gradient is directed towards the drift and hence, as discussed earlier in this report, it was possible to measure the initial in-situ fluid pressures in each test cavity. Thus in the raw data files for the subsurface boreholes the in-situ fluid pressures given are the absolute fluid pressures measured in the sealed-off cavity. Thus the fluid pressures for each injection or withdrawal test in the record are references to the in-situ fluid pressure. To determine the effective injection or withdrawal fluid pressure the fluid pressure given for each test must be subtracted from the in-situ pressure.

In the surface boreholes only injection tests were carried out. During the injection test the test cavity was connected to the flow tanks on the surface by the injection line which was filled with water. In all three surface boreholes the hydraulic heads decreased with depth reflecting the draining effect of the underground mine. Thus, without a downhole valve in the injection line, it was impossible to obtain a direct measure of the in-situ fluid pressure for each injection test interval.

In some cases, as in SBH-2, the in-situ fluid pressure was estimated for some test zones based on the measured injection and flow rate data, the measured P_1 pressure below the test zone, and the results of multiple pressure injection tests in adjacent test zones. In the rest of the tests in the surface boreholes an attempt was made to complete at least two injection tests in each test interval. Thus instead of using the difference

between the in-situ fluid pressure and the fluid pressure in a given test interval, as a means of determining the pressure gradient, the fluid pressure and flowrate measured during this first test increment was used as the reference point. Thus the data needed to interpret a steady state injection test was obtained by determining the difference in injection pressures and the corresponding difference in flowrates from two injection tests. As indicated earlier in this report steady state conditions were not always achieved and hence in some cases steady-state analysis were performed on quasi steady state data.

3.4 Preliminary Data Analysis

In this report, rather than just presenting the raw data, we have undertaken a preliminary analysis in order to make the data more meaningful to the reader. This preliminary analysis consisted of calculating porous media permeabilities, hydraulic conductivities, equivalent single fracture apertures and transmissibilities for the test intervals. The results of these calculations are presented in Appendix B-4.

In this preliminary test analysis we have assumed that flow from the test cavity is governed by Darcy's law. No corrections have been made for the orientation of the borehole. Thus for a vertical borehole we have:

$$Q = 2\pi r L \frac{KdH}{dr} \qquad (1)$$

where: Q is the volumetric flowrate

K is the hydraulic conductivity

dH/dr is the gradient

r is the radius

L is the length of the test cavity

$2\pi rL$ is the cavity surface area through which flow is occurring.

Rearranging, this equation becomes

$$\int_{r_w}^{r_b} \frac{dr}{r} = \int_{H_w}^{H_b} \frac{K}{Q} \, 2\pi L dH \tag{2}$$

where r_w is the radius of the borehole, r_b is the radial distance to the flow or pressure boundary, H_w is the hydraulic head at the boreholes and the H_b is the hydraulic head at the flow or pressure boundary (Fig. 3.7). Integrating this equation leads to an expression for hydraulic conductivity

$$K = \frac{Q(r_b - r_w)}{L \; 2\pi \; (H_b - H_w)} \tag{3}$$

Intrinsic Permeability can be calculated from K by using the relationship

$$k = \frac{\mu K}{\gamma} \tag{4}$$

where μ is the dynamic viscosity and γ is the specific weight of water. Transmissibility (T) can be determined by multiplying the hydraulic conductivity by the length of the interval being evaluated.

In addition to the basic porous media parameters of K, k and T it is instructive to assume that flow from the cavity is taking place through a single fracture (Fig. 3.7) oriented normal to the borehole, and to compute the aperture of this fracture. The equation for computing this equivalent uniform fracture aperture can be obtained by substituting the expression

$$K_f = \frac{(2b)^2}{12\mu} \tag{5}$$

where K_f is the hydraulic conductivity of the fracture and 2b is the fracture aperture, in equation (3) and replacing L by 2b. The fracture aperture then, for the measured flowrates and pressures at the borehole and the assumed boundary conditions, is given by

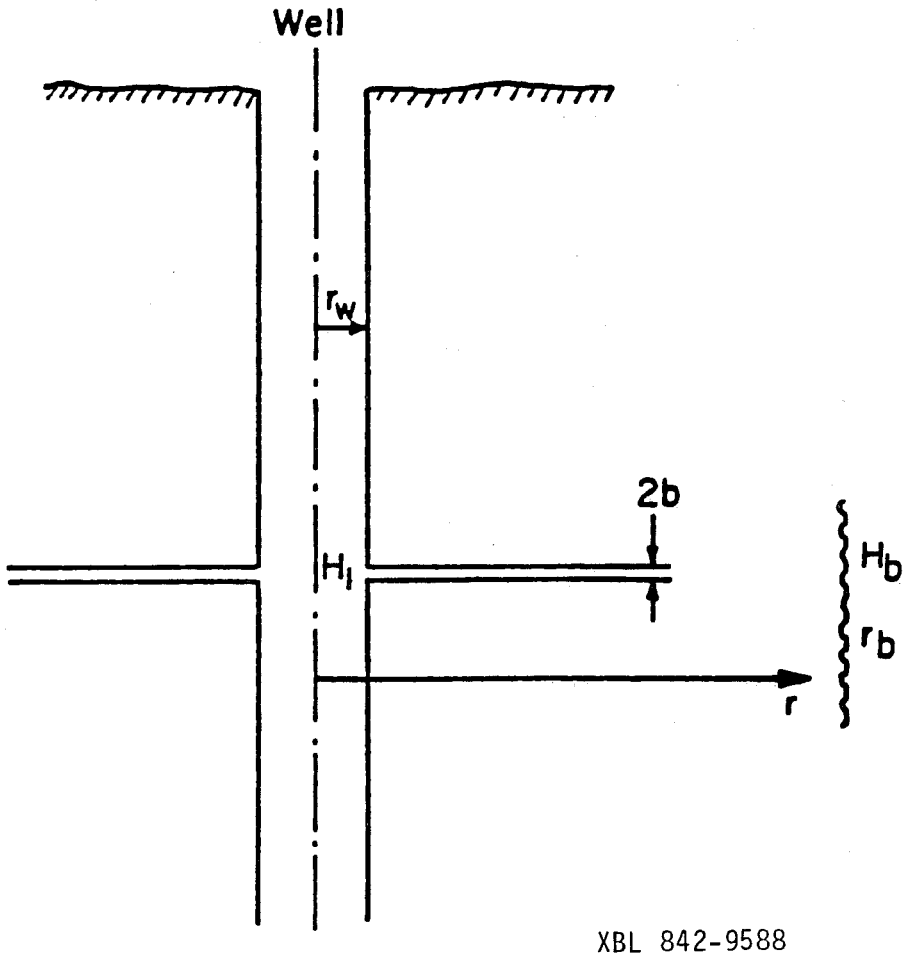


Fig. 3.7. Flow from cavity to fracture.

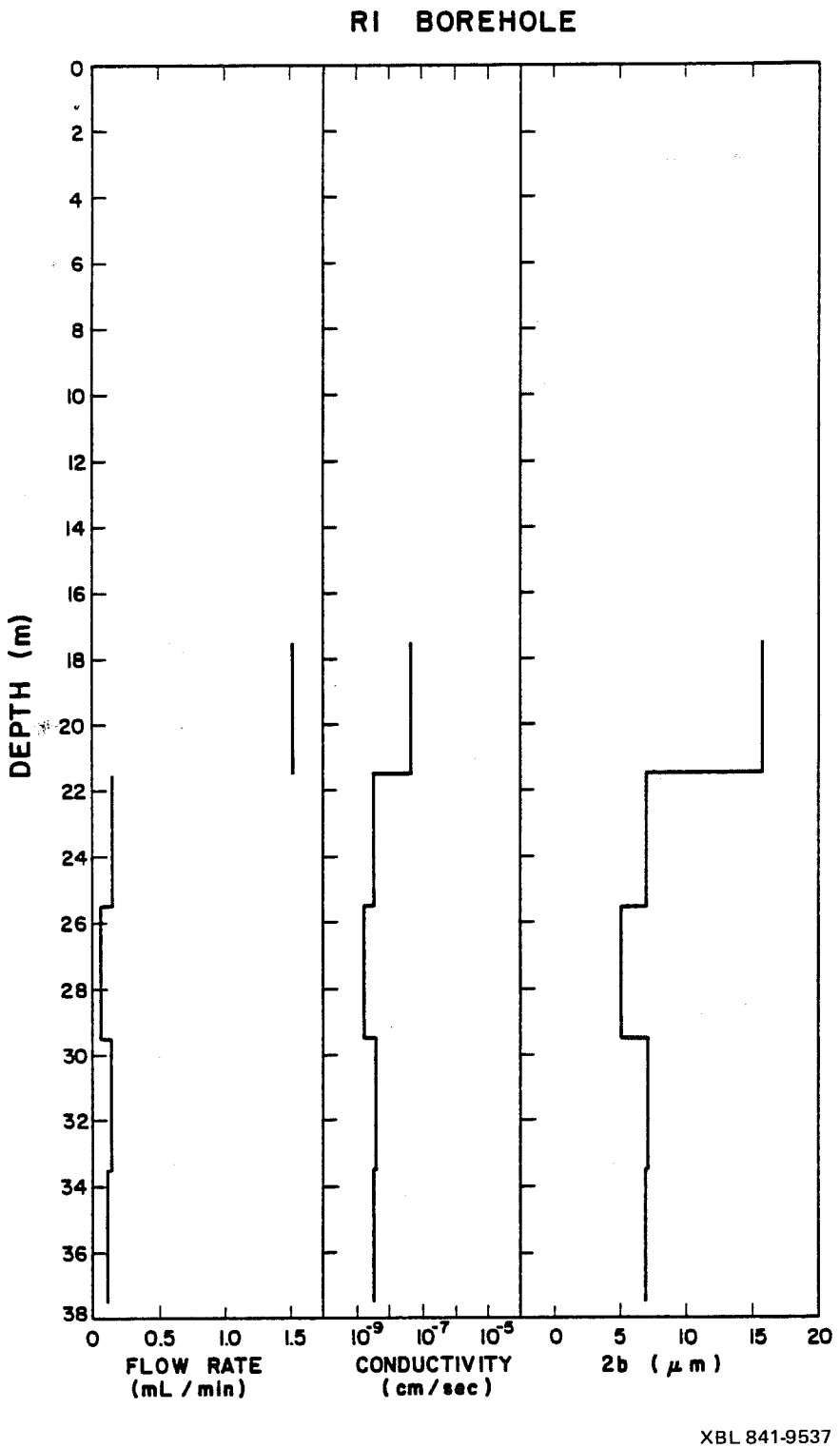


Fig. 3.8. Preliminary data on flowrates, porous media hydraulic conductivities, and equivalent single fracture apertures from packer testing in borehole R1.

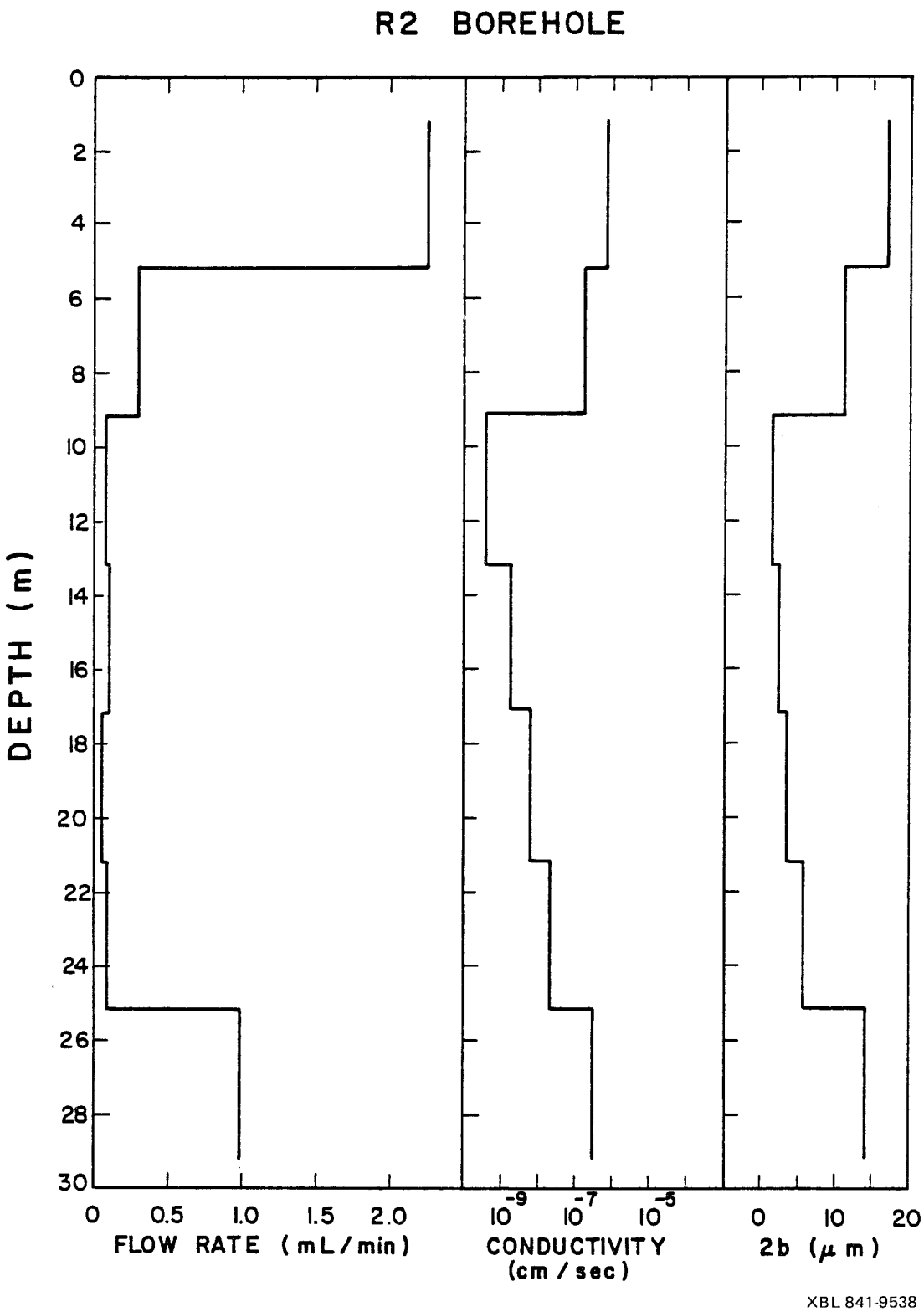


Fig. 3.9. Preliminary data on flowrates, porous media hydraulic conductivities, and equivalent single fracture apertures from packer testing in borehole R2.

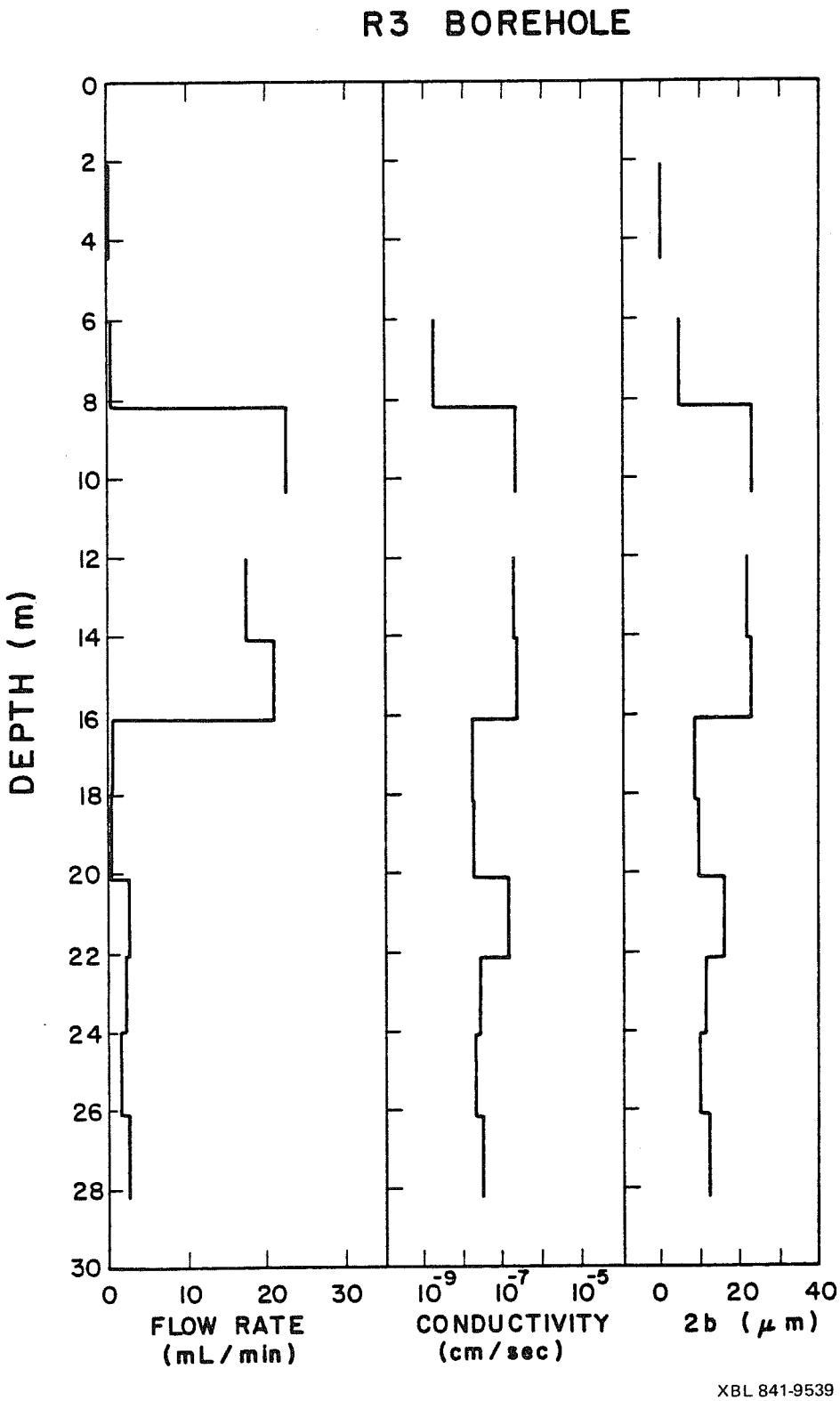


Fig. 3.10. Preliminary data on flowrates, porous media hydraulic conductivities, and equivalent single fracture apertures from packer testing in borehole R3.

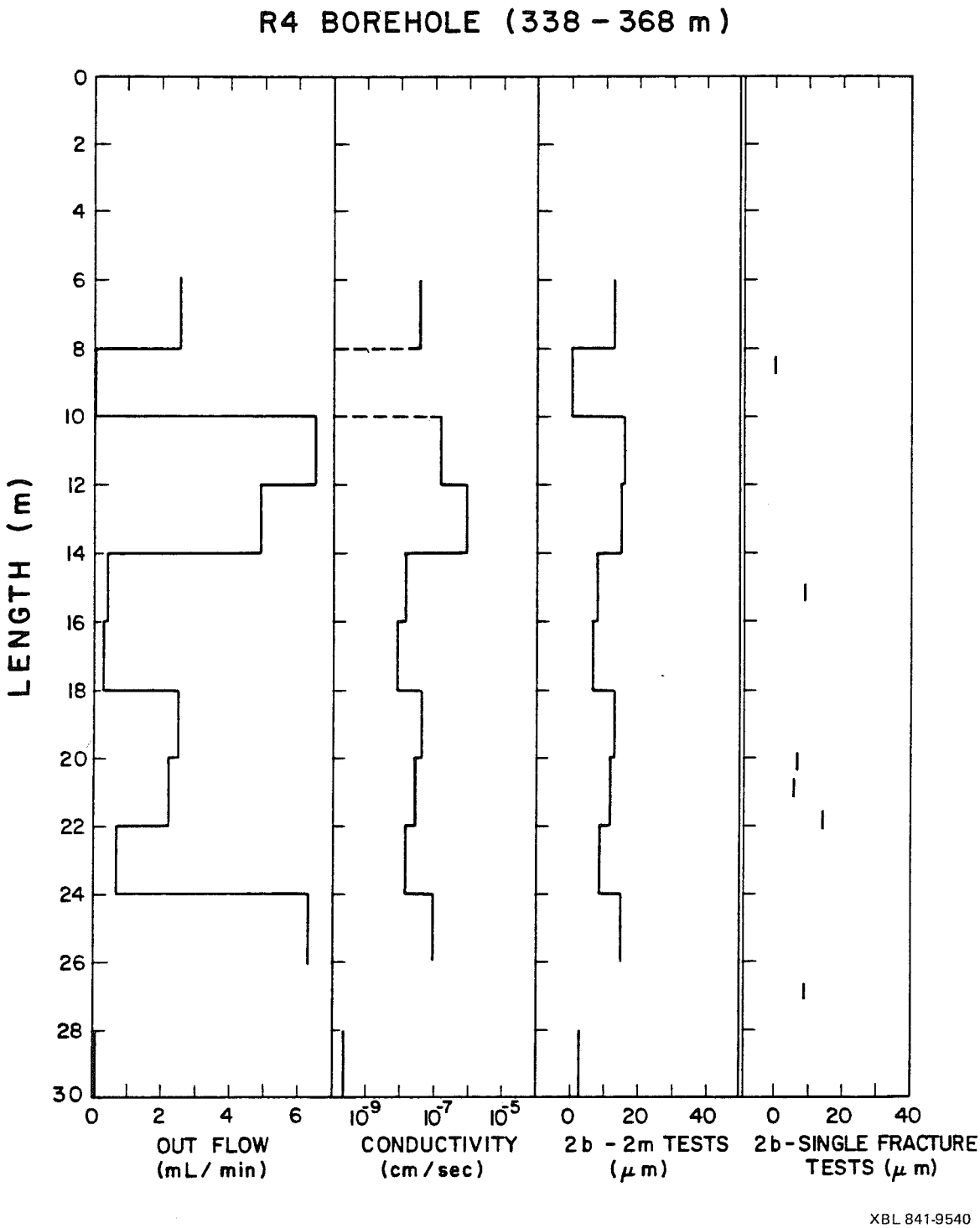


Fig. 3.11. Preliminary data on flowrates, porous media hydraulic conductivities, and equivalent single fracture apertures from packer testing in borehole R4.

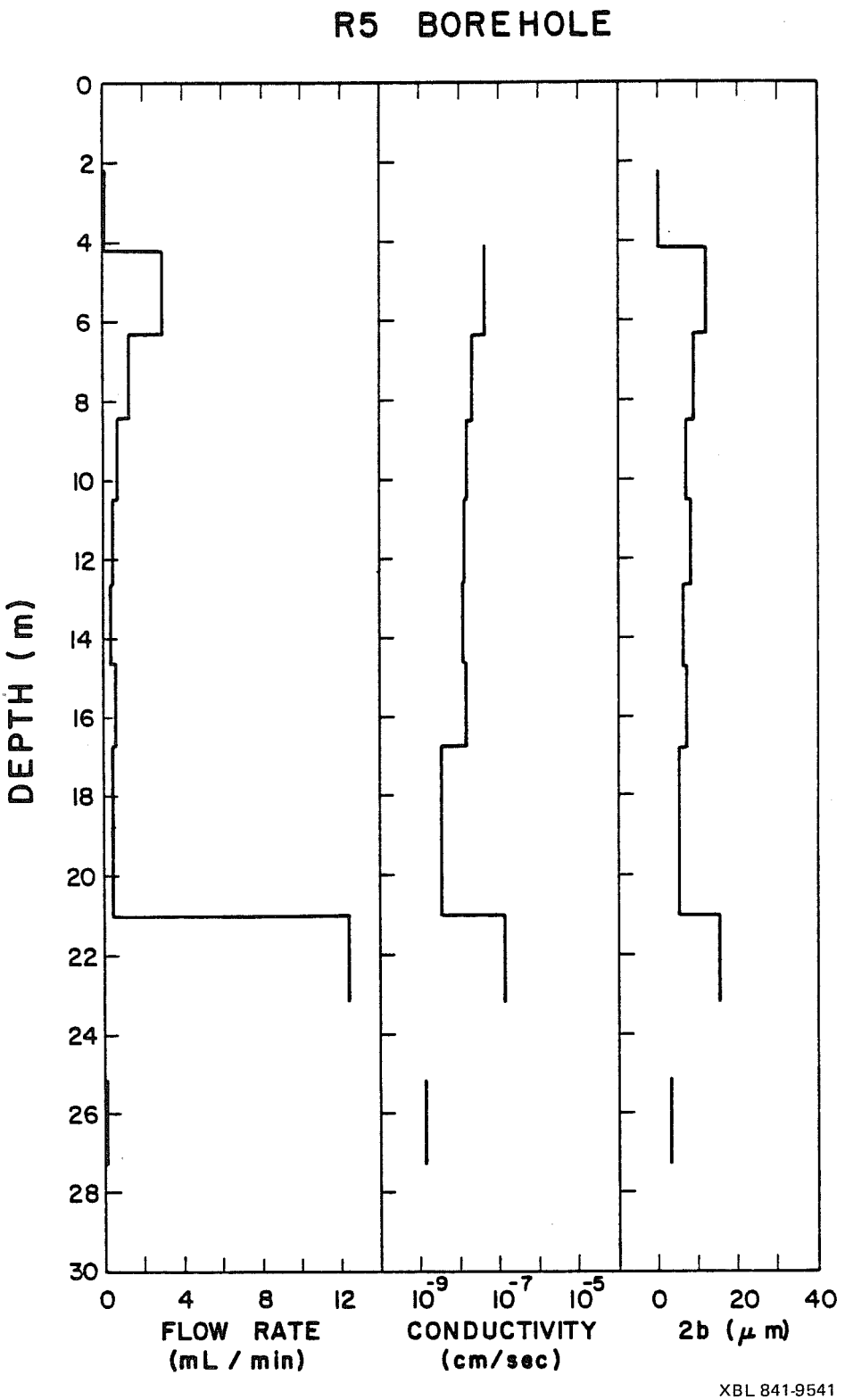


Fig. 3.12. Preliminary data on flowrates, porous media hydraulic conductivities, and equivalent single fracture apertures from packer testing in borehole R5.

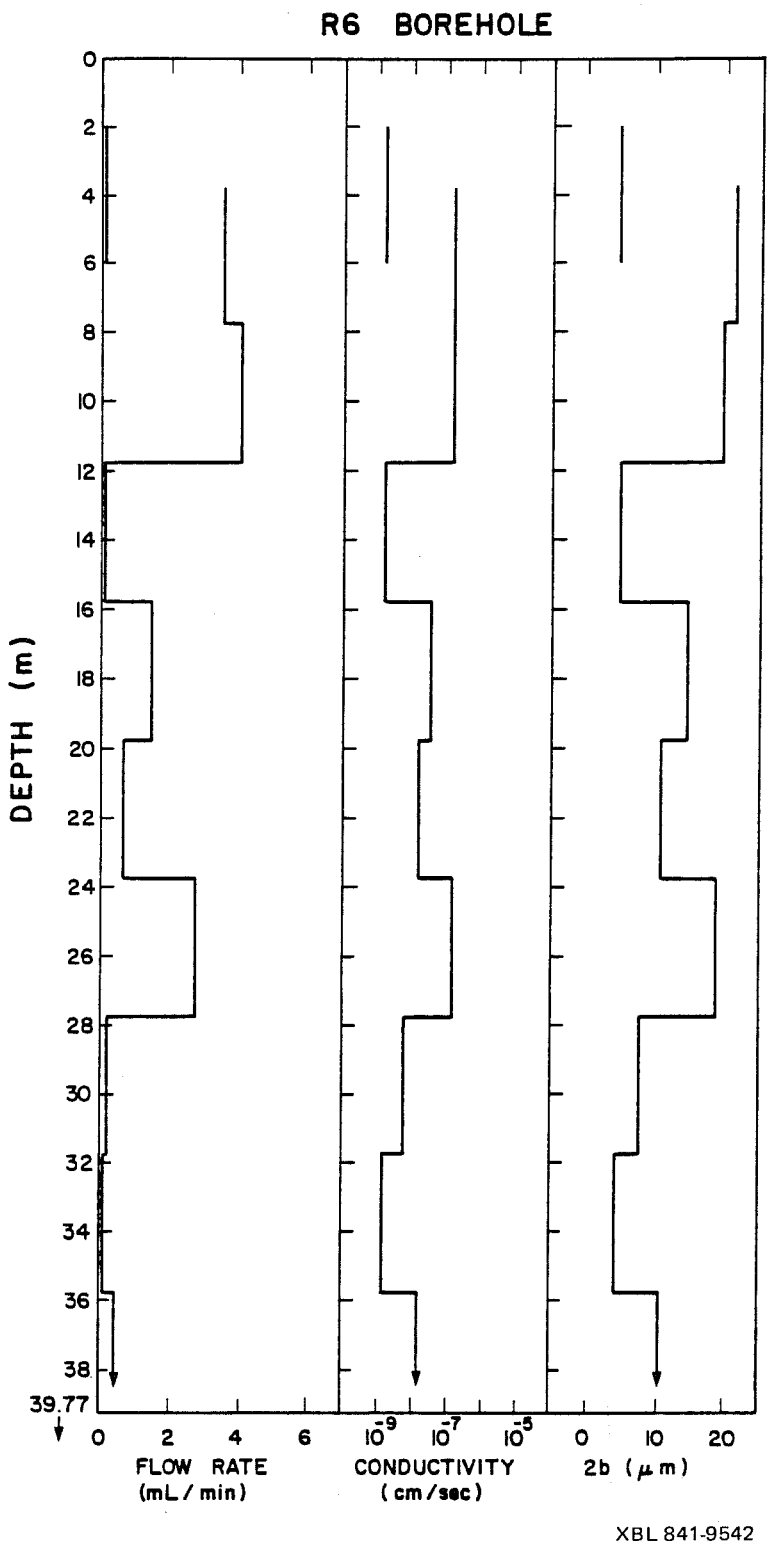


Fig. 3.13. Preliminary data on flowrates, porous media hydraulic conductivities, and equivalent single fracture apertures from packer testing in borehole R6.

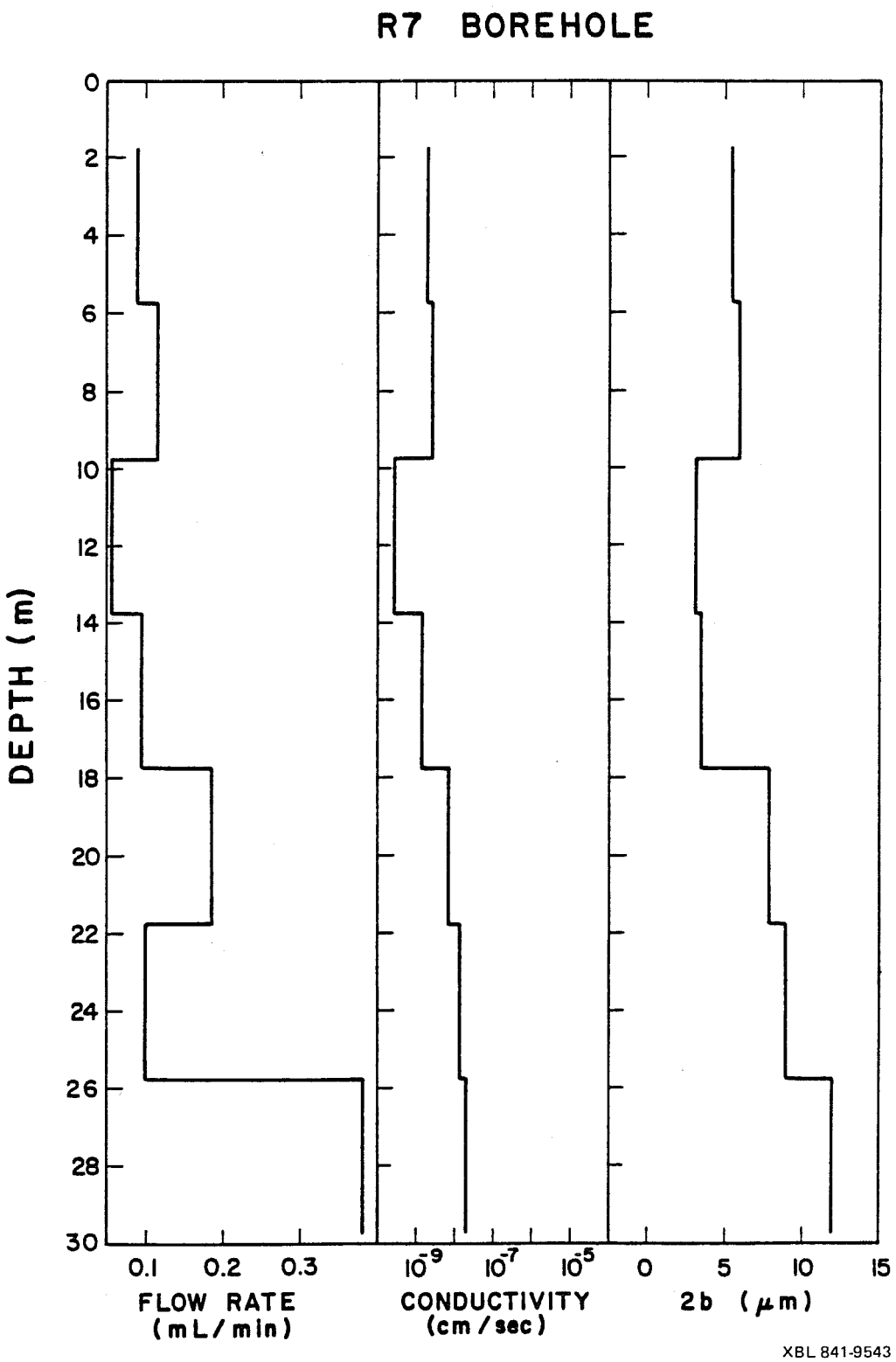


Fig. 3.14. Preliminary data on flowrates, porous media hydraulic conductivities, and equivalent single fracture apertures from packer testing in borehole R7.

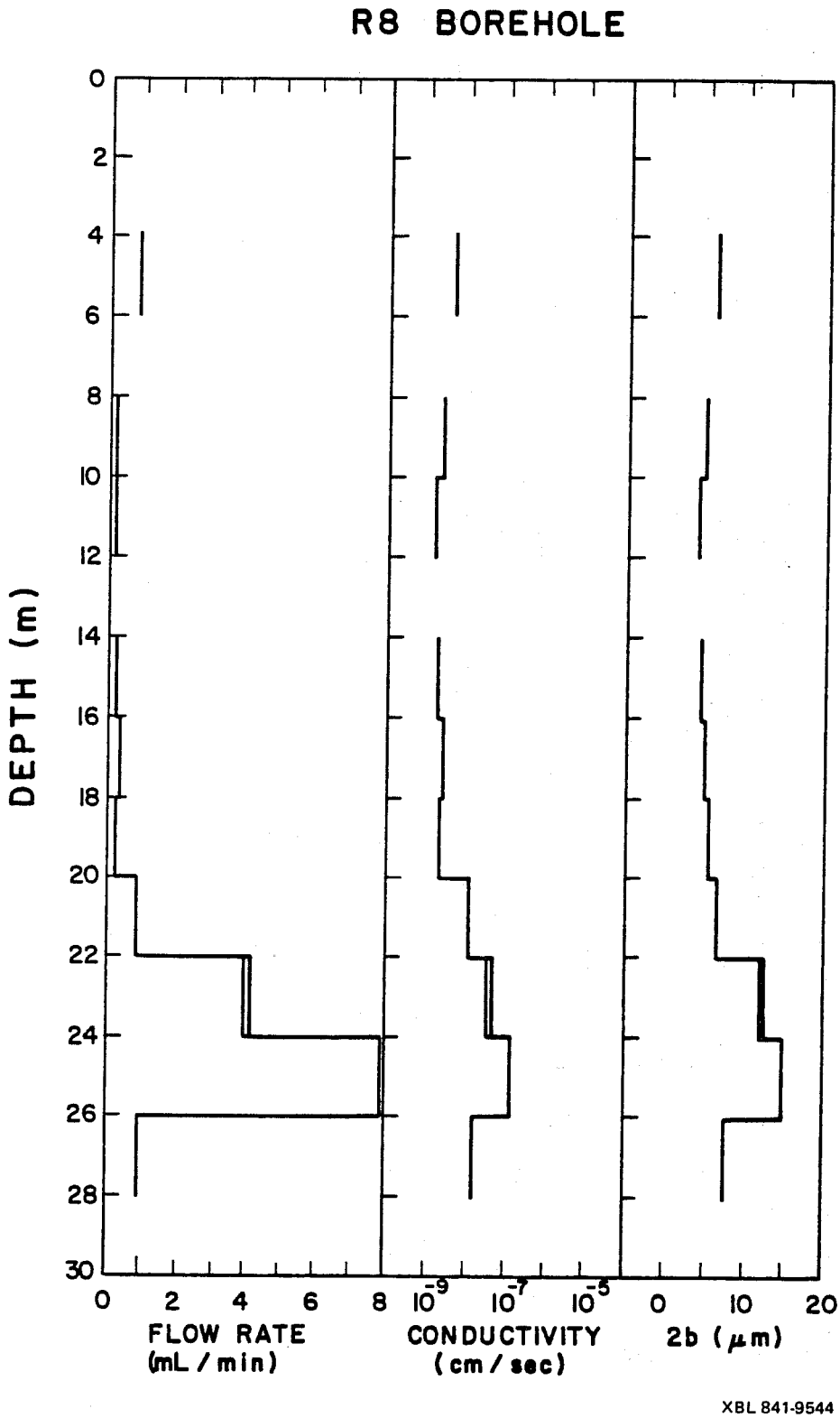


Fig. 3.15. Preliminary data on flowrates, porous media hydraulic conductivities, and equivalent single fracture apertures from packer testing in borehole R8.

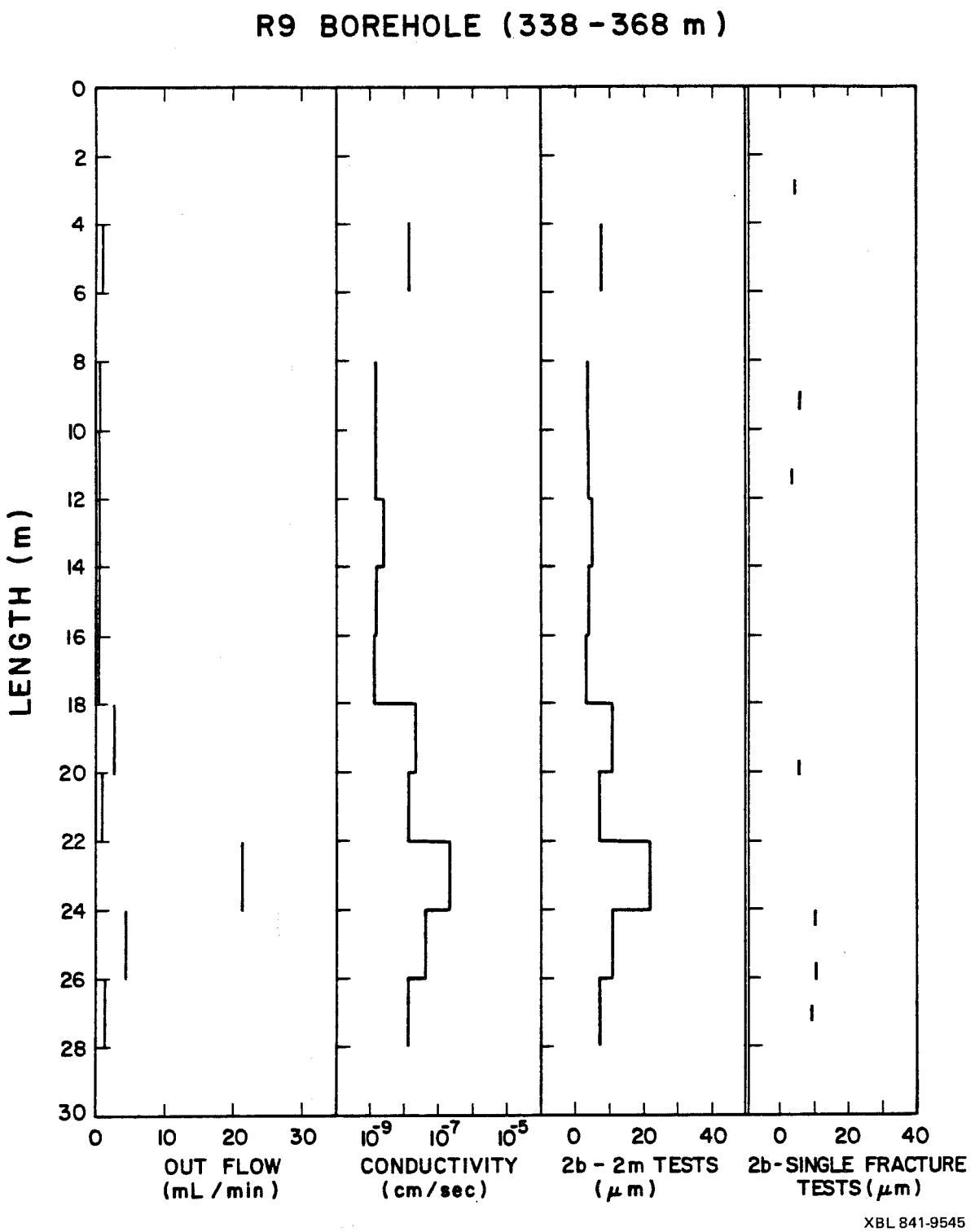


Fig. 3.16. Preliminary data on flowrates, porous media hydraulic conductivities, and equivalent single fracture apertures from packer testing in borehole R9.

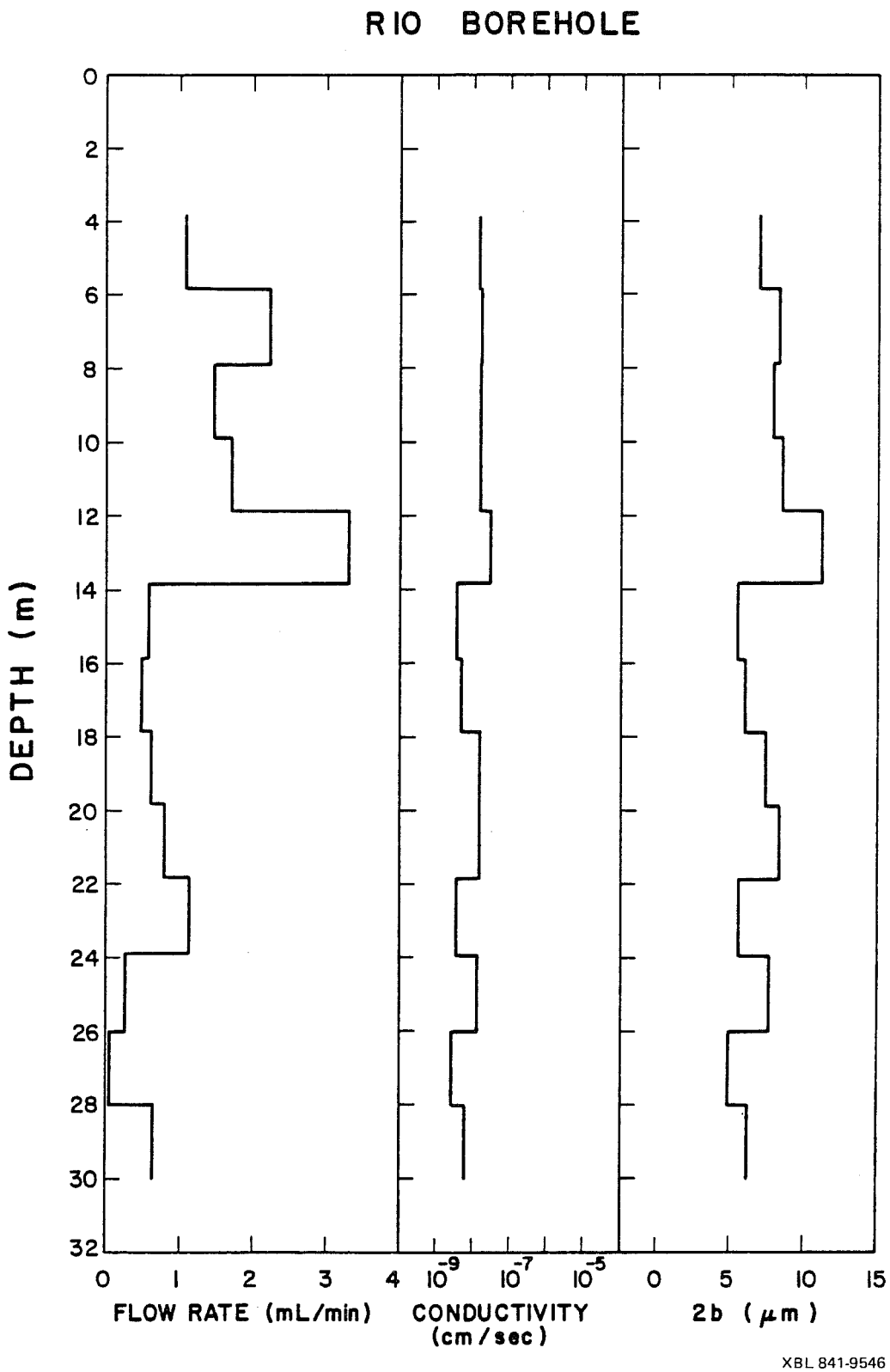


Fig. 3.17. Preliminary data on flowrates, porous media hydraulic conductivities, and equivalent single fracture apertures from packer testing in borehole R10.

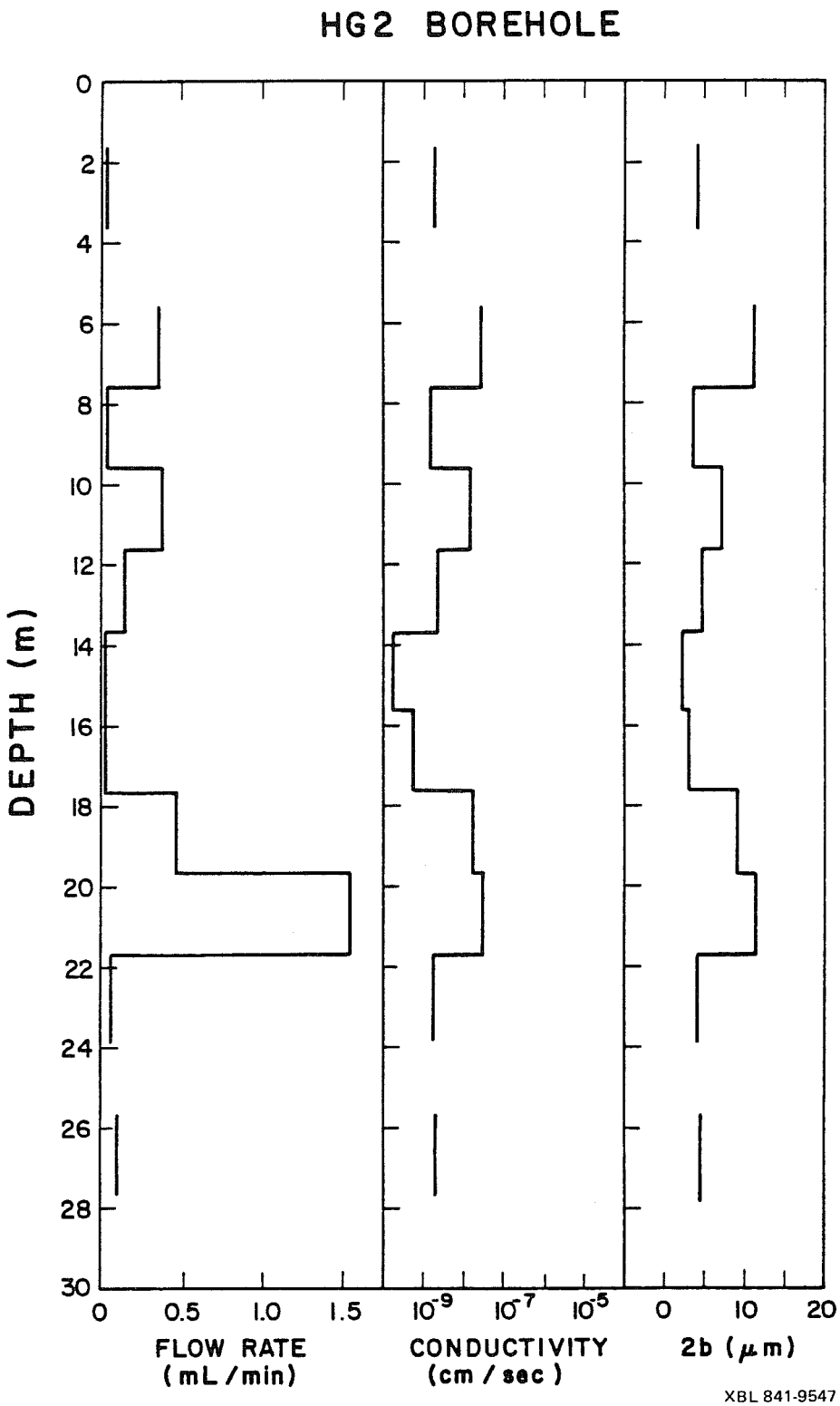


Fig. 3.18. Preliminary data on flowrates, porous media hydraulic conductivities, and equivalent single fracture apertures from packer testing in boreholes HG-2.

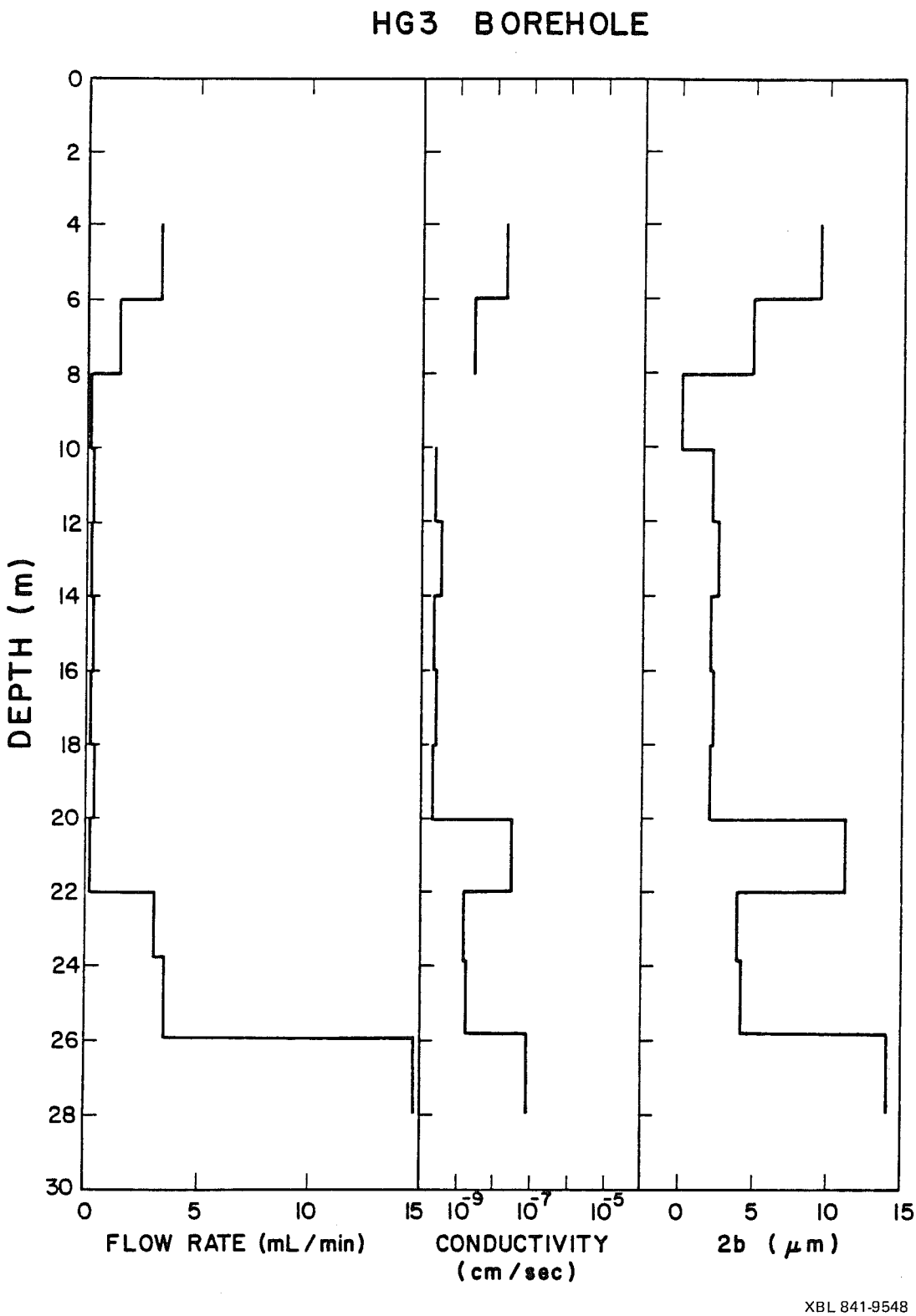


Fig. 3.19. Preliminary data on flowrates, porous media hydraulic conductivities, and equivalent single fracture apertures from packer testing in borehole HG-3.

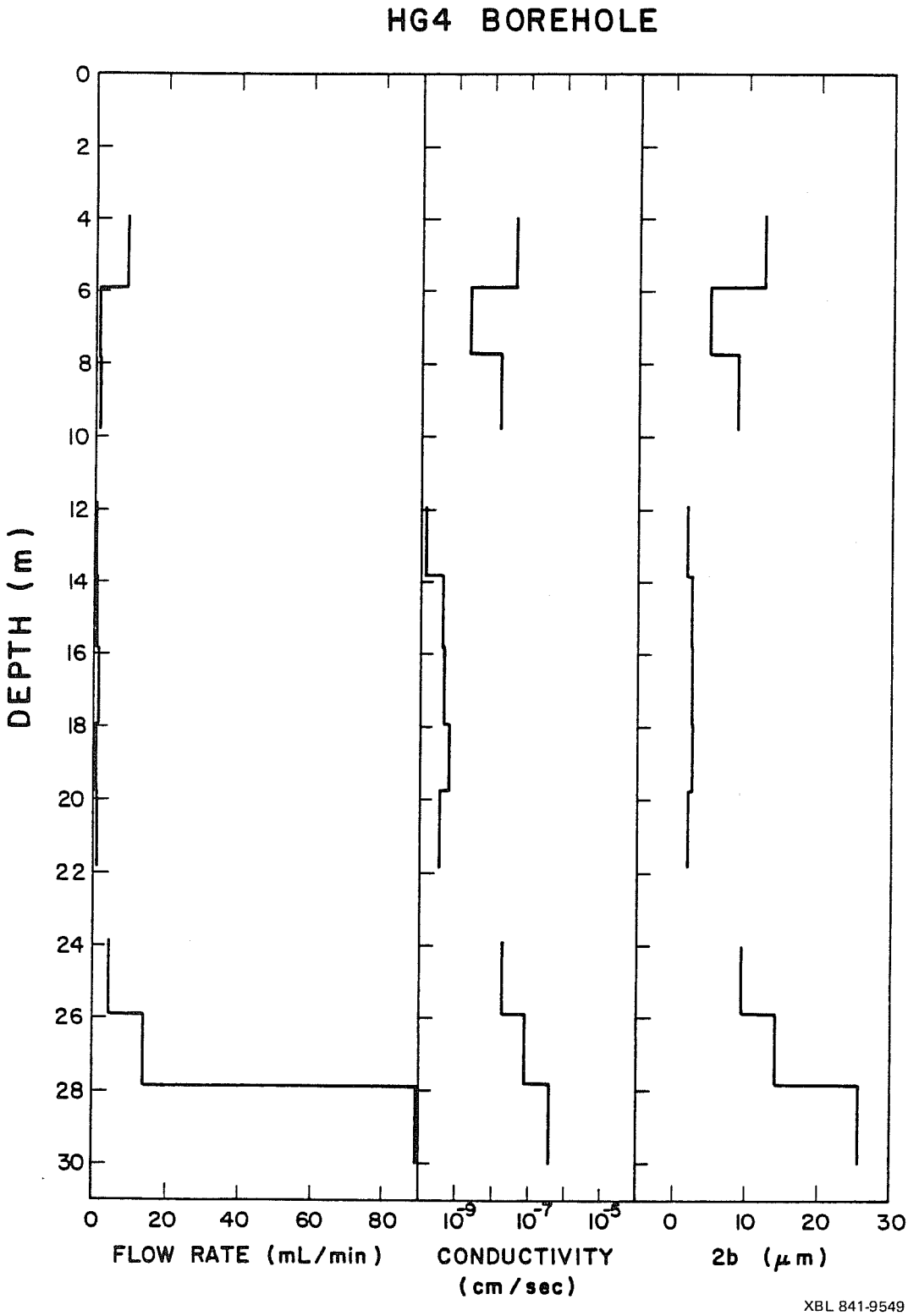


Fig. 3.20. Preliminary data on flowrates, porous media hydraulic conductivities, and equivalent single fracture apertures from packer testing in borehole HG-4.

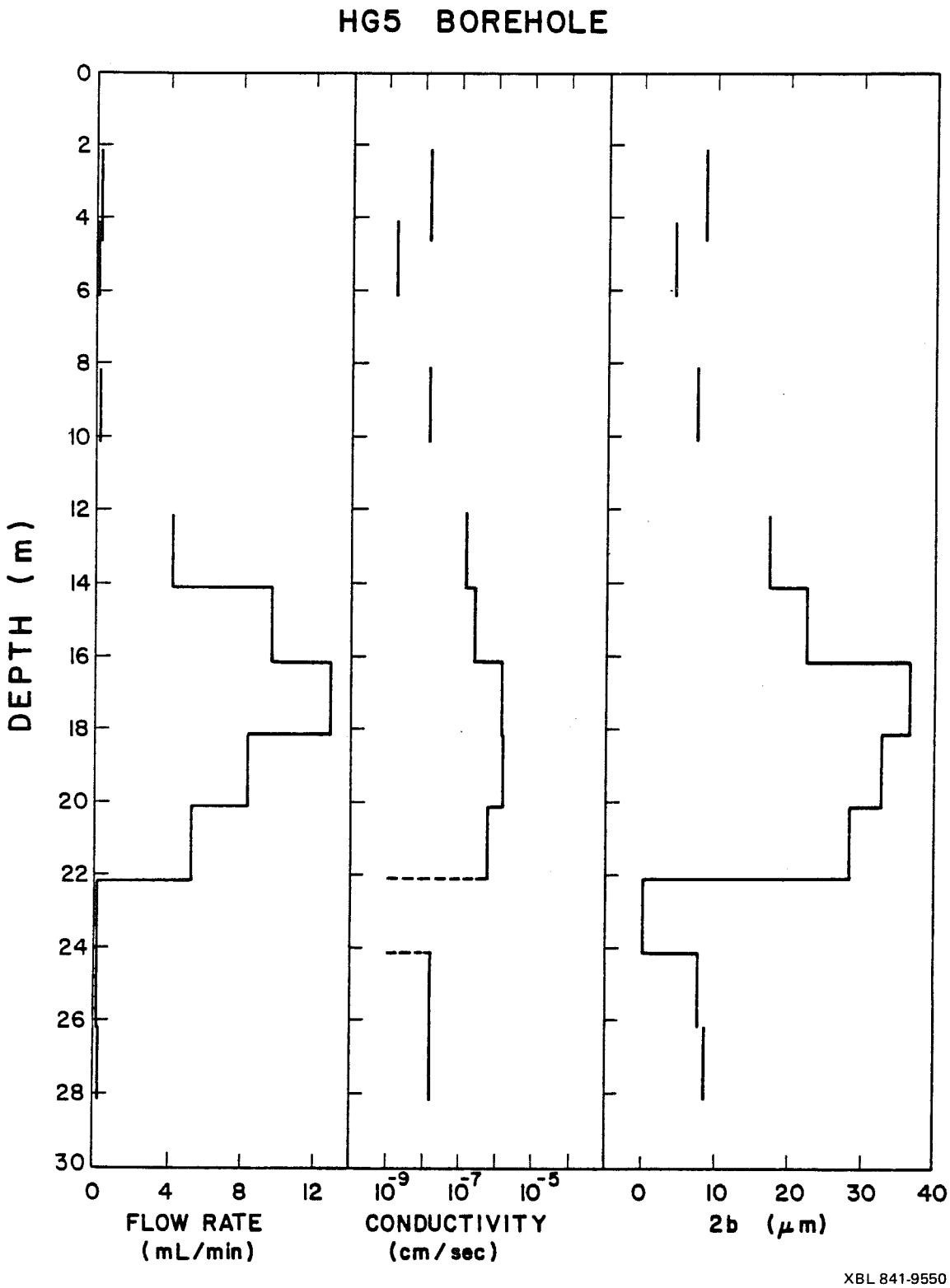


Fig. 3.21. Preliminary data on flowrates, porous media hydraulic conductivities, and equivalent single fracture apertures from packer testing in borehole HG-5.

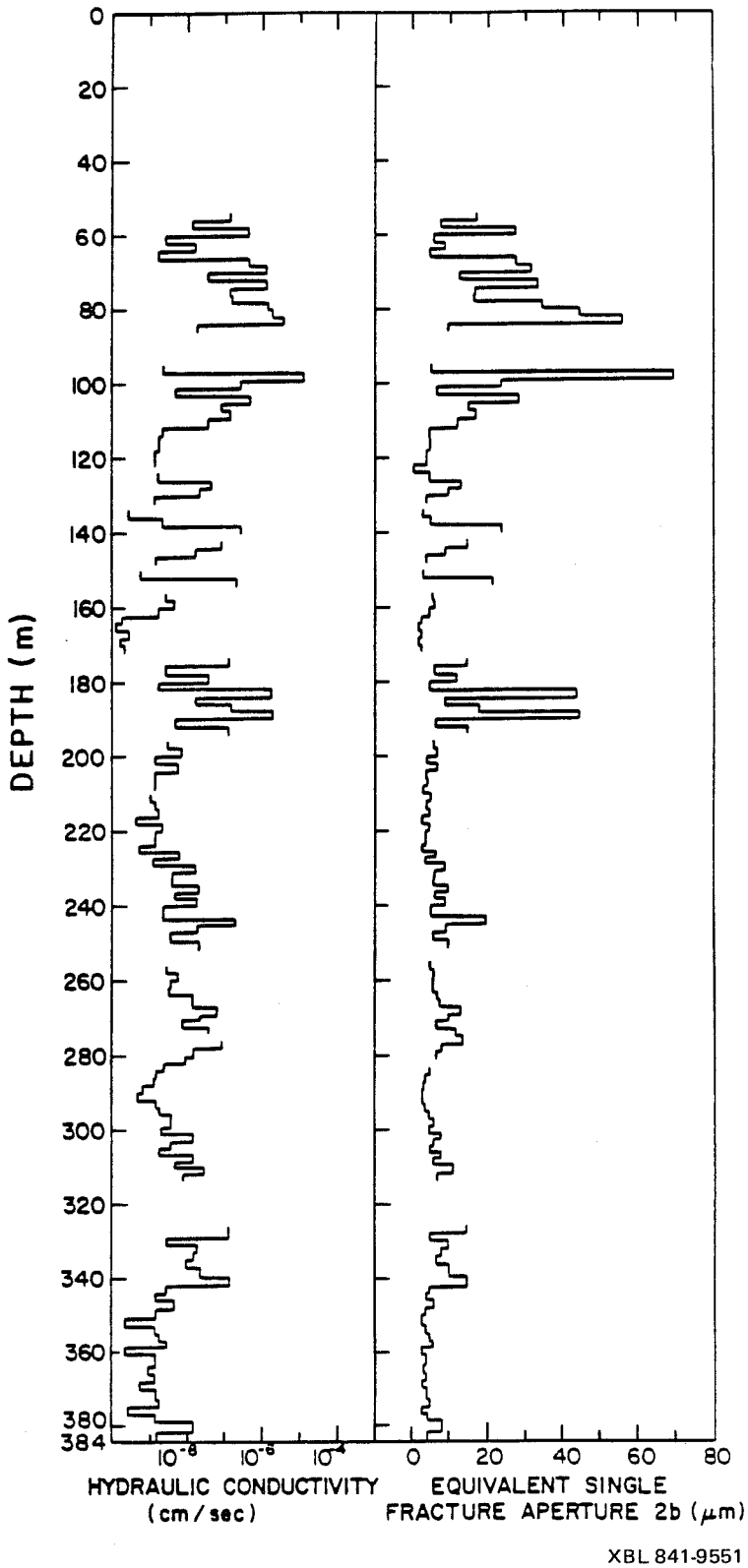


Fig. 3.22. Preliminary data on porous media hydraulic conductivities and equivalent single fracture apertures from packer tests in borehole SBH-1.

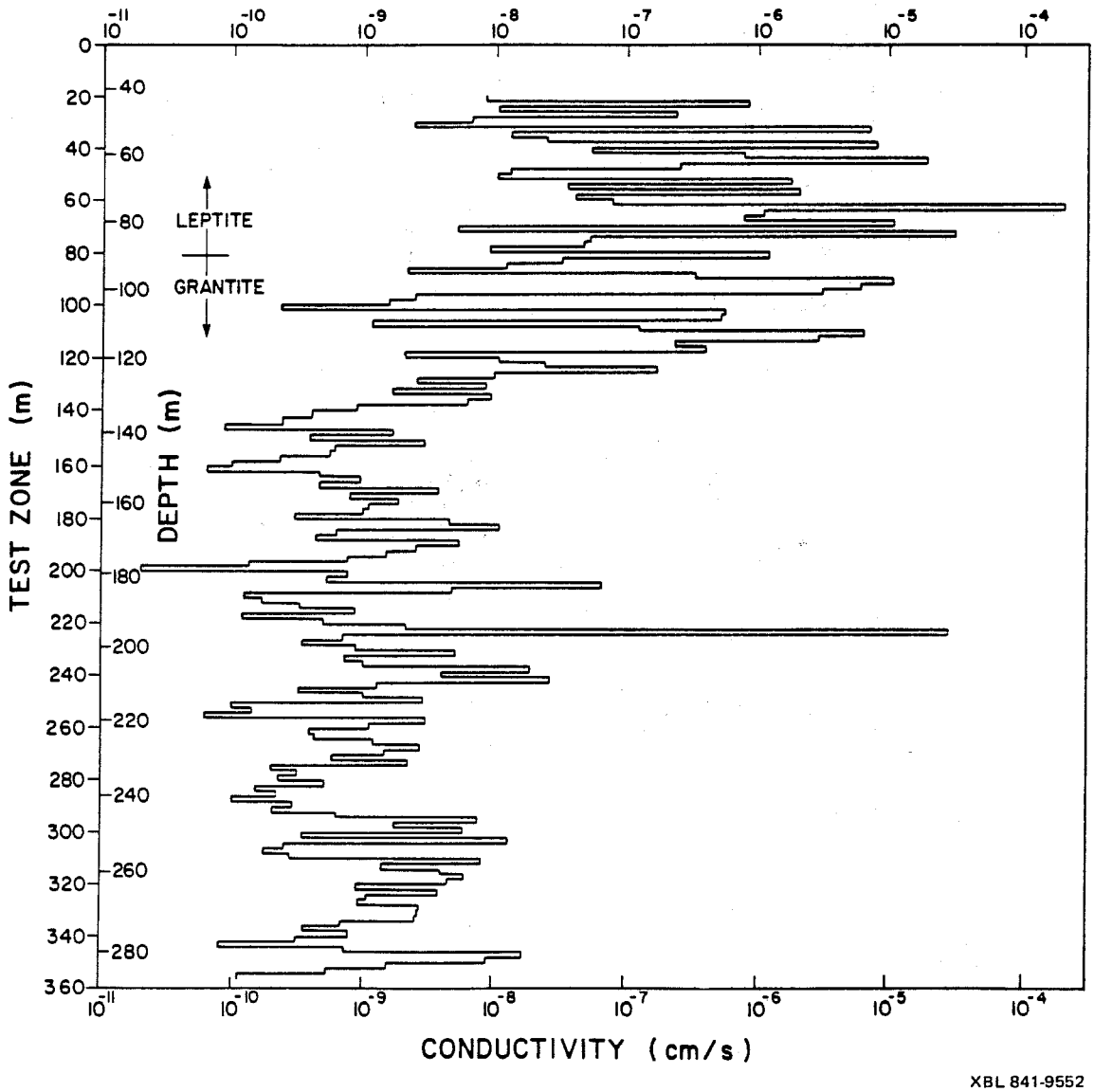


Fig. 3.23. Preliminary data on porous media hydraulic conductivities and equivalent single fracture apertures from packer tests in borehole SBH-2.

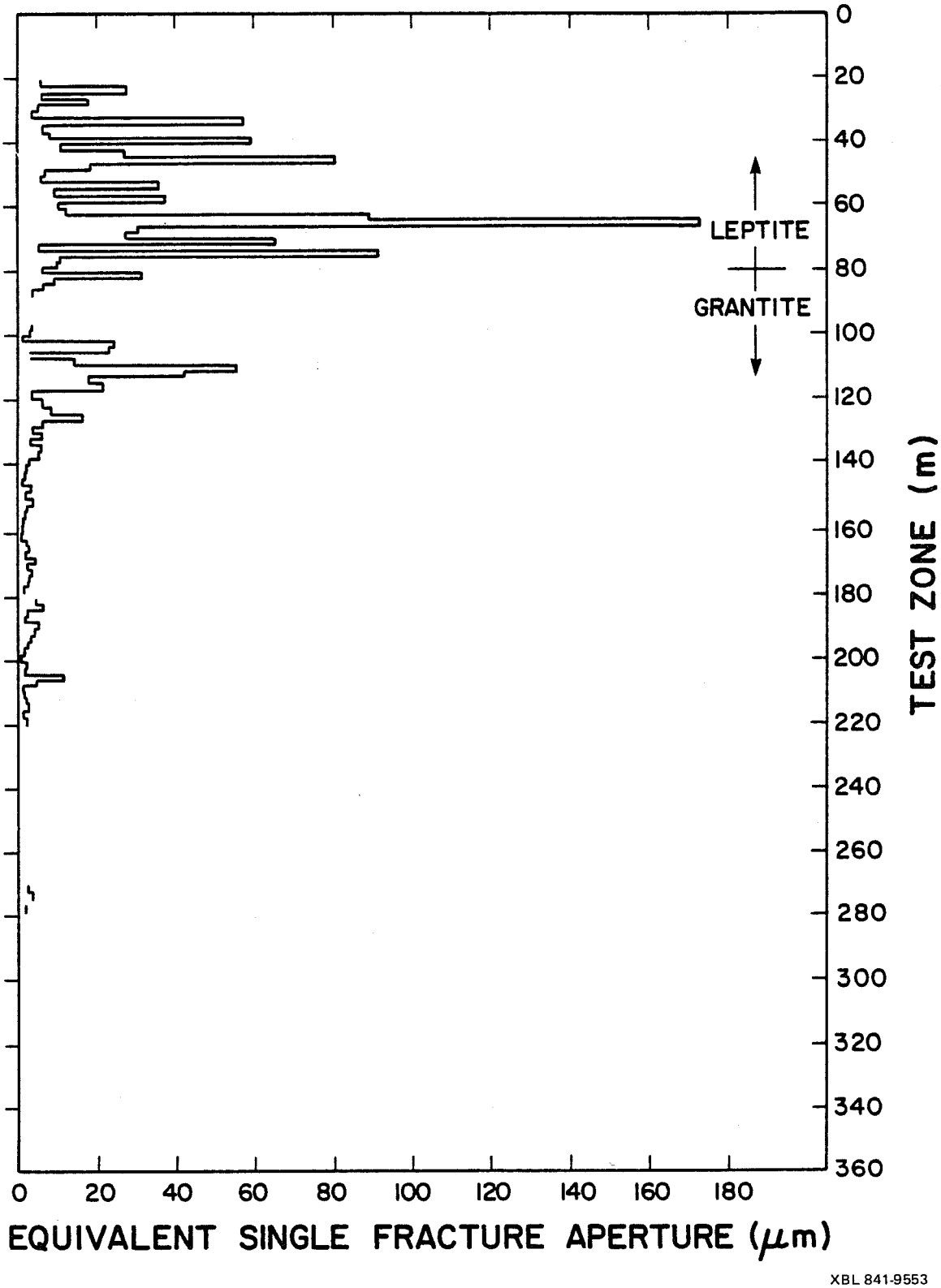


Fig. 3.24. Preliminary data on porous media hydraulic conductivities and equivalent single fracture apertures from packer tests in borehole SBH-3.

$$2b = \left[-\left(\frac{12\mu}{2\pi\gamma} \right) \left(\ln r_b - \ln r_w \right) \frac{Q}{H_b - H_w} \right]^{1/3} \qquad (6)$$

Using values for $\mu = 1.24 \times 10^{-3}$ Pa·s, $\gamma = 9801.8$ N·M^{-3}, representing an average water temperature of 12°C, $r_w = 0.038$ m and $r_b = 10$ m (Gale, 1975, p. 128) selected injection and/or withdrawal test data for each 2-m or 4-m interval in each borehole were analyzed. These data are tabulated in Appendix B-4. In Figs. 3.8 to 3.21 we have plotted the flowrates, porous media hydraulic conductivities and equivalent single fracture apertures as a function of borehole length for each of the subsurface boreholes, except HG-1. For boreholes R4 and R9 we have also plotted the effective fracture apertures determined from tests on single fractures. The calculated hydraulic conductivities range from 10^{-10} cm/sec to 10^{-7} cm/sec and the corresponding equivalent single fracture apertures rarely exceed 20 micrometers except for sections of HG-4 and HG-5 where the maximum calculated apertures are about 25 and 35 micrometers, respectively. The calculated fracture apertures are generally about 5 to 10 micrometers in size.

In Figs. 3.22 to 3.24 we have plotted hydraulic conductivity and equivalent single fracture data for SBH-1, SBH-2 and SBH-3. While the hydraulic conductivities vary over a considerable range, 10^{-11} to 10^{-4} cm/sec for SBH-2, the test results do indicate a trend of decreasing fracture permeability with depth. Similar trends exist in the SBH-1 and SBH-2 plots. The wide range of values in the hydraulic parameters demonstrate the need for a procedure than can, based on sound theoretical principles, systematically incorporate and integrate this variability to

provide a description of the rock mass permeability that is more meaningful than a single scalar representing the arithmetic or geometric mean of all of the tests conducted in a given borehole.

4. CLOSURE

Every effort has been made to ensure the accuracy of the data presented in this report. The fracture data file has been cross-checked by several different individuals and contains all the data that were available to the author. As pointed out in Chapter 3, the acceptability of each injection or withdrawal test cannot be determined until the test has been thoroughly evaluated and any necessary corrections to the test data completed. However in compiling the hydrology data files we have excluded the test data that were questionable. Thus the data files, while not fully complete, do contain the essential data for each test interval. When the current analysis of the test data has been completed we expect that some additional test data will be added to the data files, but we expect that corrections to the existing data files will be limited.

Future analysis of the data documented in this report will focus on attempts (1) to characterize the rock mass fracture parameters and (2) to assess the physical hydrogeologic characteristics of the Stripa site. The characterization of the rock mass fracture parameters can be separated into two general activities: (1) rock mass characterization using the standard rock engineering approach and (2) a statistical analysis of the fracture system.

The rock mass characterization work will include a brief review of the geology of the Stripa area, including the test excavations and a thorough analysis of the structural lineaments using available air photographs. The basic rock mass characterization schemes such as those described by Knill and Jones (1965), Deere et al. (1967), Bieniawski (1974), Barton et

al. (1975), and Ege (1968) will be reviewed with respect to procedures, original purpose and degree of applicability to nuclear waste disposal problems in igneous rocks. Several of these methods will be applied to the borehole fracture data at Stripa in an attempt to determine both the sensitivity of the various methods and the influence of borehole drilling methods, core size, and borehole orientation on the characterization of the Stripa granite. The main emphasis will be in characterizing the rock mass around the ventilation drift in an attempt to relate the general rock mass fracturing characteristics to the distribution of permeabilities as measured by borehole packer tests. A final goal of the analysis of the fracture data should be to develop a three dimensional picture of the fracture system influencing the ventilation experiment.

The statistical analysis of the fracture system at Stripa will consist of an attempt to develop the statistics of fracture spacing, orientation, continuity, and interconnection using data from fracture mapping in the drifts and the data obtained from core logging and TV-borehole camera logging. These statistics will also contribute to the data base needed for the development of a three dimensional description of the fracture system in the rock mass around the ventilation drift, although the primary goal of this analysis is to provide the geometrical parameters of spacing and orientation needed to undertake an initial calculation of the directional permeabilities of sections of the rock mass. This detailed fracture analysis should also enable one to determine the degree of variation in the basic geometrical fracture parameters throughout the rock mass.

An assessment of the physical hydrogeologic characteristics of the Stripa site requires that one first complete a detailed analysis of the injection and withdrawal borehole packer test data. An attempt will be made to correct the test data, if necessary, for the effects of turbulent flow, entrance losses, relative orientation of boreholes and the fractures intersecting the test interval, gravity effects, and quasi-steady-state test conditions. The permeability values for each test zone will be calculated using both porous media and fracture flow concepts. These permeability values will be correlated with the degree of fracturing observed in the drill core and the fractures identified by TV-camera logging. This analysis will provide a more complete and meaningful distribution of permeability values for each borehole than that presented in this report.

The permeability data will be analyzed to determine the fracture aperture distribution parameters. These fracture aperture parameters will be combined with fracture geometry parameters to provide the data necessary for the calculation of the directional permeabilities of the fractured rock mass at Stripa. These calculations will use an approach that assumes that each fracture is continuous. Obviously future work will include an attempt to incorporate the degree of fracture interconnection or continuity in these calculations.

The above data analysis will focus on developing parameters and other numerical model parameters necessary for constructing a three dimensional finite element model for the general flow system at Stripa. The modeling work will be directed towards the calculation of flow tubes and groundwater

velocities in an attempt to relate the geochemical and isotopic data to the physical hydrology data.

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APPENDIX A-1

CODED FRACTURE DATA FILE FOR BOREHOLE R3

```
33 END OF HOLE
55780307 R3 1                                                    STENN A
44 00.00          2.10       2.10  18100.094.00 0.10 1.97
11     00.000GRANITE       2                                          START
11     00.040GRANITE       2
11     00.070GRANITE       3    3 2 MW CACL                        90
11     00.100GRANITE       1 1 1 1 MW CLCA BGW  1 MH       0    30 SHEARED B=35
33 0.1 TO 0.21 IS A 40 MM THICK ZONE WITH PEGMATITE B=0 A=30  GRAN./PEG./GRAN.
11     00.470GRANITE       1 1 1 1 SW CA  WH   <1 MH     320    40
11     00.590GRANITE       2
11     00.620GRANITE       1 1 1 2 SW CL  GR   <1 MH     290    50 PARTLY INDUCED
11     00.780GRANITE       1 1 1 1 SW CA  WH   <1 MH     335    55
11     00.800GRANITE       1 1 1 1 HW CLEPGRBL  2 MH-H   140    60
33 0.8 TO 0.82 IS A ZONE WITH EP APROX. 15-20 MM THICK
33 00.870GRANITE A SEALED FRACTURE WITH EP THICKNESS 1 MM B=100 A=70
11     00.870GRANITE       2
11     00.970GRANITE       1 1 3 2 MW EP  GR   <1 H      165    70
11     01.000GRANITE       1 1 3 2 SW CLEPBLGR <1 MH-H   145    70 ROTATED
11     01.110GRANITE       1 1 1 1 MW CLCA BGW <1 MH     255    30 *
33  *  ORIENTATION NOT SURE ... ROTATED
11     01.130GRANITE       1 1 3 2 MW CL  BL   <1 MH            90 *
11     01.190GRANITE       1 1 1 2 SW CL  BL   <1 MH     135    50
11     01.220GRANITE       1 1 2 1 SW CL  BL   <1 MH     120    65 ROTATED
11     01.250GRANITE       1 1 2 2 SW CLCA  BL <1 MH     120    45
11     01.320GRANITE       1 1 2 2 SW CLCABLGR <1 MH      30    55
11     01.400GRANITE       1 1 1 1 SW CL  BL   <1 MH     135    65
11     01.470GRANITE       1 1 1 1 SW CL  BL   <1 MH     145    85
33 01.510GRANITE A SEALED FRACTURE WITH EP THICKNESS 1 MM B=150 A=60
11     01.560GRANITE       1 1 1 1 MW CL  BL   <1 MH     150    55
33 01.600GRANITE SEALED PART OPENED FRAC.WITH CLCA THICKNESS <1MM B=120 A=20
11     01.630GRANITE       1 1 1 2 SW CACL WH  <1 MH     280    35
11     01.850GRANITE       1 1 1 2 SW CACL WH  <1 MH     290    70 PARTLY INDUCED
33 02.10                                                           UPTAKE
55780308 R3 1                                                    STENN A
44 02.10          02.89      0.79   8100.  96.0 0.10 0.76
11      2.100GRANITE       2                                          START
33 2.110GRANITE A SEALED FRACTURE WITH CA THICKNESS<1 MM B=285 A=65
11      2.200GRANITE       1 1 1 1 MW CLCAGRWH <1 MH     275    70
11      2.240GRANITE       1 1 1 1 SW CLCAGRWH <1 MH     275    65
11      2.300GRANITE       1 1 1 2 MW CLCAGRWH <1 MH     280    60
33 2.310GRANITE A SEALED FRACTURE WITH CACL THICKNESS <1 MM B=90 A=20
11      2.370GRANITE       1 1 1 3 SW CLCAGRWH <1 MH     285    65
11      2.420GRANITE       1 1 3 2 SW CACL WH  <1 MH     275     0
11      2.540GRANITE       1 1 1 2 MW CLCA GR  <1 MH     270    50
11      2.600GRANITE       1 1 1 2 MW CL  GR   <1 MH     265    65
11      2.660GRANITE       1 1 1 1 SW CL  BL   <1 MH      95    75
11      2.710GRANITE       1 1 2 2S-MWCLCABLWH <1 MH     275    55
33 2.780GRANITE THREE SEALED FRACTURES WITH EP THICKNESS 2 MM B=135 A=35
33 2.890GRANITE                                                    UPTAKE
55780308 R3 1-2                                                  STENN A
44  2.89          4.60       1.71  10100.098.00 0.17 1.68
11      2.890GRANITE                                               START
11      2.900GRANITE       1 1 2 2 SW CLCAGRWH <1 MH     250    55
33 3.000GRANITE A SEALED FRACTURE WITH EP THICKNESS 1 MM B=115 A=45
11      3.120GRANITE       1 1 1 1 SW MCLA GR  <1 MH     270    45
11      3.340GRANITE       1 1 1 1 MW CLCABLWH <1 MH     270    50
11      3.500GRANITE       1 1 1 1 SW CL  BL   <1 MH     140    35
11      3.530GRANITE       1 1 1 1 SW CL  BL   <1 MH     140    40 ROTATED
11      3.760GRANITE       2
11      3.900GRANITE       1 1 2 2 SW CL  BL   <1 MH     220    70
11      3.990GRANITE       1 1 2 1 SW CL  BL   <1 MH     140    55
11      4.090GRANITE       1 1 1 2 MW CLCABLWH <1 MH     140    40
11      4.400GRANITE       1 1 1 1 SW CLCA BL  <1 MH     145    40 BOX
2
11      4.510GRANITE       2
33 4.600GRANITE                                                    UPTAKE
55780308 R3 2                                                    STENN A
44  4.60          6.66       2.06    9100.090.00 0.21 1.87
11      4.600GRANITE                                               START
33 4.60 TO 4.62 IS GRAVEL
11      4.620GRANITE       1 1 1 2 SW CLCA BL  <1 MH     160    35
11      4.620GRANITE       1 1 3 2 SW CLCA BL  <1 MH      50    55
11      4.620GRANITE       1 1 1 2 SW CLCAGRWH <1 MH     280    55
33 4.710GRANITE  SEALED FRACTURE WITH EP(CL?),THICKNESS 1MM B=300 A=55
11      4.730GRANITE       1 1 3 2 MW CL  BL   <1         235    60
11      4.990GRANITE       1 1 3 2 SW CLCA BL  <1 MH     160    55
33 5.130GRANITE  SEALED FRACTURE WITH EP THICKNESS <1-1MM B=195 A=60
33 5.330GRANITE  EP CA  THICKNESS 10MM B=305 A=35
11      5.360GRANITE       2
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33 5.82 TO 5.890GRANITE ZONE WITH EP THICKNESS 20MM B=150 A=50-60
11      5.900GRANITE        1 1 2 2 SW CLCABLWH <1 MH     120    25END IN NEXT FRACT.
11      5.960GRANITE        1 1 2 2 MW EPCLGR3L <1 H      170    60
11      6.080GRANITE        1 1 3 2 SW CACL BGW <1 MH     340    70 PARTLY INDUCED
33 6.100GRANITE SEALED FRACTURE WITH EP THICKNESS 2MM B=275 A=35
33 6.170GRANITE SEALED FRACTURE WITH EP THICKNESS 2MM B=155 A=60
11      6.910GRANITE        1 1 1 1 SW CLCABLWH <1 MH     300    60
11      6.910GRANITE        1 1 1 2 SW CLCA BL  <1 MH     220    50
11      6.340GRANITE        1 1 1 3 SW CACLWHGR <1 MH     315    55
11      6.390GRANITE        1 1 1 1 SW CL  BL   <1 MH     135    65
11      6.430GRANITE        1 1 3 2 MW CLCABLWH <1 MH     340    15 GRAVEL
11      6.460GRANITE        1 1 1 2 SW CL  BL   <1 MH       0    25 GRAVEL
11      6.510GRANITE        1 1 1 1 SW CL  BL   <1 MH     125    55 GRAVEL
11      6.530GRANITE        1 1 1 3M-SW CL BL   <1 MH     125    65 GRAVEL
11      6.540GRANITE        1 1 1 2S-MW CL BL   <1 MH     175    55 GRAVEL
11      6.560GRANITE        1 1 1 1 SW CL  BLGR <1 MH      20    50 GRAVEL
33 6.660GRANITE                                                     UPTAKE
55780309 R3 2                                                 STENN A
44 6.66          8.24       1.58   4100.091.14 0.36 1.44
11      6.660GRANITE        2                                         START
33 6.730GRANITE A SEALED FRACTURE WITH CL THICKNESS <1MM B=150 A=60
11      7.240GRANITE        1 1 1 1 SW CLCA BL  <1 MH      50    65
11      7.670GRANITE        1 1 1 1 MW CL   BL  <1 MH      20    40
11      7.950GRANITE        1 1 3 2 SW CLCA BL  <1 MH     155    65
11      7.960GRANITE        1 1 1 1 SW CACL WH  <1 MH      50    40
11      8.040GRANITE        1 1 3 3 SW CACL WH  <1 MH       0    45
11      8.090GRANITE        1 1 2 1 MW CLCA BL  <1 MH      50    25
33 8.240GRANITE                                                     UPTAKE
55780309 R3 3                                                 STENN A
44  8.29         10.09       1.85  11100.095.68 0.16 1.77
11      8.240GRANITE        2                                         START
11      8.260GRANITE        1 1 1 1 SW CA  WH   <1 MH      50    35 MOSTLY CLOSED
11      8.340GRANITE        1 1 3 2 SW CL  BL   <1 MH      20    45
11      8.490GRANITE        1 1 3 3 MW CLCAGRWH <1 MH      65    15
11      8.660GRANITE        1 1 1 2 SW CL  BLGR <1 MH     335    60
11      8.850GRANITE        1 1 1 3 SW CLCAWHGR <1 MH      55    30
11      8.960GRANITE        1 1 1 2 SW CLCABLWH <1 MH     310    60 ROTATED
11      9.260GRANITE        1 1 1 1 SW CACLWHGR <1 MH       0    50
11      9.420GRANITE        1 1 1 2 SW CL  BLGR <1 MH      20    35
11      9.610GRANITE        1 1 1 1 SW CACL WH  <1 MH     355    50
33 9.61 AND 9.68  GRANITE/PEGMATITE/GRANITE  WITH B=355 A=50
11      9.340GRANITE        1 1 1 3 SW CA  WH   <1 MH      80    10
11      9.840GRANITE        1 1 1 2 SW CLCA BL  <1 MH     355    55
11      9.860GRANITE        1 1 1 2 SW CACLWHBL <1 MH     295    30
11      9.970GRANITE        2
11     10.030GRANITE        1 1 1 1 MW CL  BL   <1 MH      20    45
33 10.090GRANITE                                                    UPTAKE
55780309 R3 3                                                 STENN A
44 10.09         10.92       0.83    5100.092.77 0.15 0.77
11     10.090GRANITE        1 1 1 2 SW CL  BL   <1 MH     300    30 START GRAVEL
11     10.100GRANITE        1 1 1 1S-MW CL BLGR <1 MH     295    30 GRAVEL
11     10.210GRANITE        1 1 1 2 SW CL  BL   <1 MH      30    40
11     10.260GRANITE        1 1 1 3 SW CLCA BL  <1 MH     305    30
11     10.330GRANITE        1 1 3 2 SW CA  WH   <1 MH      60    75
11     10.780GRANITE        1 1 1 2 SW CA  WH   <1 MH      20    45
11     10.850GRANITE        1 1 2 2 SW CL  BL   <1 MH     100    50
33 10.920GRANITE                                                    UPTAKE
55780310 R3 3-4                                               STENN A
44 10.92         13.89       2.97    8100.0100.0 0.37 2.97
11     10.920GRANITE        2                                         START
11     11.010GRANITE        1 1 1 2 SW CACLWHGR <1 MH      35    40+++ 35    40
33 11.03    GRANITE/PEGMATITE     B=350 A=20
11     11.310PEGMATITE      2
33 11.47    PEGMATITE/GRANITE     B=350 A=20
11     11.800GRANITE        1 1 3 2 MW CL  BLGR <1 MH      85    70
11     11.970GRANITE        1 1 2 2 SW CA  WH   <1 MH     275    40
11     12.100GRANITE        1 1 3 2 SW CL  BL   <1 MH      90    50 BOX
4
33 12.39-12.70 A SEALED FRACTURE WITH CL THICKNESS 1MM B=105 A=10
11     12.620GRANITE        1 1 1 1 SW PYCLBLYE <1 MH           90
11     13.070GRANITE        1 1 1 1 SW CL  GR   <1 MH     315    50
33 13.890GRANITE                                                    UPTAKE
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55780310 R3 4                                                    STENN A
44 13.89          14.86        0.97    7100.097.94 0.14 0.95
11     13.890GRANITE        1 1 1 2 S-MW CL   GR <1 MH     355    65
11     13.910GRANITE        1 1 1 2 MW CA   WH   <1 MH     260    20
33 13.960GRANITE  A SEALED FRACTURE EP THICKNESS 2-6MM B=280 A=45
11     14.050GRANITE        1 1 2 2 SW CACLWHBL <1 MH      60    55
11     14.390GRANITE        1 1 1 1 MW CLCAGRWH <1 MH      15    45
11     14.460GRANITE        1 1 2 2 SW CACLWHGR <1 MH     310    45
11     14.590GRANITE        1 1 1 1 MW CLCABLWH <1 MH     345    45
11     14.650GRANITE        1 1 1 2 MW CLCABLWH <1 MH       0    55
11     14.730GRANITE        1 1 2 3 SW CA   WH   <1 MH     350    75 PARTLY INDUCED
33 14.860GRANITE                                                    UPTAKE
55780310 R3 4-5                                                  STENN A
44 14.86        16.52          1.66   12100.088.02 0.12 1.47
11     14.860GRANITE                                                START
11     14.850GRANITE        1 1 1 1 SW CLCA BGW <1 MH     335    55
11     15.010GRANITE        1 1 1 1 MW CLCABLWH <1 MH     325    40
11     15.200GRANITE        1 1 2 2 SW CLCABLGR <1 MH       0    60
11     15.200GRANITE        1 1 1 1 MW CLCAGRWH <1 MH     335    55
11     15.500GRANITE        1 1 2 2 MW CLCAGRWH <1 MH      45    60
11     15.590GRANITE        1 1 2 2 SW CLCAGRWH <1 MH     275    40
11     15.700GRANITE        1 1 1 1 MW CA       <1        305    75
11     15.750GRANITE        1 1 1 1 SW CACLWHGR <1 MH     295    75
11     15.830GRANITE        1 1 3 2 SW CLCAGRWH <1 MH     280    40 BOX
5
11     15.910GRANITE        1 1 1 1 MW CLCABLWH <1 MH     115    60
33 15.91-15.95   A ZONE WITH EP
11     15.910GRANITE        1 1 1 1 MW CLCABLWH <1 MH     195    20
11     15.950GRANITE        1 1 1 1 MW CLCABLWH <1 MH     120    60
11     16.010GRANITE        2
11     16.130GRANITE        2
11     16.360GRANITE        2
11     16.380GRANITE        1 1 1 2 MW CACLWHGR<1-1MH     180    15
33 16.520GRANITE                                                    UPTAKE
55780310 R3 5                                                    STENN A
44 16.52        19.19          2.66   10100.0100.0 0.27 2.66
11     16.520GRANITE        2                                       ROTATED START
11     17.480GRANITE        1 1 1 1 MW CLEPBLWH  1 MH-H  300    25
11     17.570GRANITE        1 1 1 1 MW CL       <1        320    65 PARTLY INDUCED
11     17.630GRANITE        2
11     17.670GRANITE        1 1 1 1 SW CL   BL   <1 MH     270    40
11     18.150GRANITE        1 1 3 2 SW CL   BL   <1 MH     190    35
11     18.500GRANITE        1 1 1 1 SW CLCA BL   <1 MH     240    50
11     18.680GRANITE        2                                       ROTATED
11     18.690GRANITE        1 1 1 1S-MWCLCABLWH <1 MH     200    20 MOSTLY CLOSED
11     19.020GRANITE        2
11     19.120GRANITE        1 1 1 1 MW CACLWHBL <1 MH     275    40
33 19.190GRANITE                                                    UPTAKE
55780310 R3 6                                                    STENN A
44 19.19        21.86          2.67   10100.098.50 0.26 2.63
11     19.190GRANITE        1 1 1 2 SW CA   WH   <1 MH      80    65 START
11     19.420GRANITE        1 1 1 1 MW CLCABLWH<1-1MH     200    25 SHEARED B 170
11     19.710GRANITE        1 1 2 2 MW CLCA BL <1-1MH     210    30
11     20.060GRANITE        1 1 3 2 SW CA   WH   <1 MH      10    55
11     20.100GRANITE        1 1 1 1 MW CLCABLWH <1 MH     230    35
11     20.190GRANITE        1 1 1 1 SW CLCAGRBL <1 MH     265    45 ROTATED
11     20.370GRANITE        1 1 1 2 MW CLCABLGR <1 MH      25    45
11     20.490GRANITE        2
11     20.840GRANITE        1 1 1 1 SW CLCABLWH <1 MH     205    35
11     21.210GRANITE        1 1 1 2 SW CLCABLWH <1 MH       5    55
11     21.380GRANITE        1 1 1 1 SW CLCABLWH <1 MH      25    40
33 21.47-21.750GRANITE SEALED FRACT. WITH THICKNESS 2MM B=140 A=40
33 21.860GRANITE                                                    UPTAKE
55780310 R3 6
44 21.86        22.87          1.01    6100.0100.0 1.00 0.17  1.01
11     21.860GRANITE        1 1 1 1 MW CL   BL   <1 MH     215    45 START
11     21.860GRANITE        1 1 1 1 SW CLCABLWH <1 MH      20    45
11     21.970GRANITE        2
11     22.100GRANITE        1 1 1 1 SW CL   BL   <1 MH     225    45
11     22.330GRANITE        1 1 2 2 SW CA   WH   <1 MH       5    75
11     22.580GRANITE        1 1 2 2 MW CA   WH   <1 MH     305    50
11     22.660GRANITE        1 1 1 2 SW CLCAWHBL <1 MH     340    70
33 22.870GRANITE                                                    UPTAKE
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55780310 R3 6                                                    STENN A
44 22.87          23.27        ¬.25    0000.0000.0 0.00 0.00
11     22.870GRANITE        2                                          START
11     22.900GRANITE        1 1 1 2 SW CA  WH   <1 MH     280    50
11                          1 1 1 1 MW CLCABLWH  1 MH              20
33 22.90-23.27 GRAVEL  NATURAL FRACTURE FILLED WITH CLCA
33             ONE FRACTURE HAS A LOT OF CA (2-3MM)
33 23.270GRANITE                                                   UPTAKE
55780313 R3 7                                                    STENN A
44 23.27          24.46        1.19    6100.069.75 0.14 0.83
11     23.270GRANITE        1 1 1 2 SW CACLWHBL <1 MH      70    65 START
11     23.270GRANITE        1 1 3 2 MW CACLWHBL<1-1MH     195    20
33 23.27-23.50  A SEALED FRACTURE WITH QUARTZ THICKNESS 4-4M B=130 A=10
11     23.530GRANITE        1 1 1 1 MW CL  BL   <1 MH     165    45
33 23.53-23.81  A SEALED FRACTURE WITH QUARTZ THICKNESS 4-5MM B=140 A=5-10
11     23.610GRANITE        1 1 3 2 SW CLCABLWH <1 MH     220    40
11     23.730GRANITE        1 1 1 3 SW CL  BL   <1 MH       5    70
11     23.790GRANITE        1 1 1 2 MW CL  BLGR <1 MH     290    40
11     23.810GRANITE        1 1 1 4 MW CL  BLGR <1 MH     295    50
11     23.940GRANITE        1 1 1 1 MW CL  GR  <1-1MH     335    50
11     24.120GRANITE        1 1 1 1 MW CLCAGRWH  1 MH     265    35
33 24.12-24.35  GRAVEL  THE FRACTURE FILLED WITH CLCA
11     24.350GRANITE        1 1 1 2 SW CL  WH   <1 MH     205    15
11     24.380GRANITE        1 1 1 2 SW CLCABLWH <1 MH     285    25
33 24.460GRANITE                                                   UPTAKE
55780313 R3 7                                                    STENN A
44 24.46          25.30        0.82    698. 70.    0.10 0.59
11     24.460GRANITE        3   3 1 MW                    240    65 START
11     24.510GRANITE        1 1 1 2 MW CL  GR   <1 MH     270    60
11     24.630GRANITE        1 1 1 2 MW CLAQ BGW<1-1MH-H     5    70
11     24.730GRANITE        1 1 3 2 SW CLCABLWH <1 MH     300    70
11     24.870GRANITE        1 1 2 1 SW CLCABLWH <1 MH      45    50
11     24.970GRANITE        1 1 1 1 SW CLCAGRWH <1 MH     305    50
11     25.040GRANITE        1 1 1 1 SW CL  BL   <1 MH     350    70 ROTATED
33 24.84-25.170GRANITE      1 1 3 2 SW CA  WH   <1 MH     250   ¬3  PARTLY CLOSED
11     25.170GRANITE        1 1 1 1 SW CL  WH   <1 MH     290    60 ROTATED
11     25.270GRANITE        1 1 1 1 SW CL  WH   <1 MH     110    80
33 25.300GRANITE                                                   UPTAKE
55780313 R3 7                                                    STENN A
44 25.30          26.76        1.45    699.  72.   0.18 1.05
11     25.300GRANITE        1 1 1 1 SW CL  BLGR <1 MH     285    55 START
11     25.530GRANITE        1 1 1 1 SW CLCABLWH <1 MH     340    50
11     25.570GRANITE        1 1 1 2 MW CLCABLWH <1 MH     345    65
11     25.900GRANITE        1 1 2 2 SW CL  BL   <1 MH      60    55
11     26.070GRANITE        1 1 1 1 SW CLCAWHBL <1 MH     330    75
11     26.130GRANITE        1 1 1 1 SW CL  BLWH <1 MH      50    60
11     26.310GRANITE        1 1 2 2 SW CA  WH   <1 MH     280    30
11     26.360GRANITE        1 1 1 1M-SWCA  WH   <1 MH     345    65 ROTATED
11     26.450GRANITE        1 1 1 1 SW CA  WH   <1 MH      45    70 ROTATED
33 26.50-26.820GRANITE      1 1 1 2 MW CLCAWHBL <1 MH       ?    10
33 26.50-27.91 NO ORIENTATION LINE
11     26.610GRANITE        1 1 1 1 SW CACLWHBL <1 MH            75
11     26.640GRANITE        2
33 26.760GRANITE                                                   UPTAKE
55780313 R3 8                                                    STENN A
44 26.76          28.27        1.52    8101. 101.  0.19 1.52
11     26.760GRANITE        1 1 1 2 SW CL  BL   <1 MH       ?    50 START
11     26.760GRANITE        1 1 1 2 SW CA  WH   <1 MH            55
11     26.990GRANITE        1 1 1 3 SW CA  WH   <1 MH            60
11     27.070GRANITE        1 1 1 2 SW CA  WH   <1 MH            60
11     27.240GRANITE        1 1 1 2 SW CA  WH   <1 MH            70
11     27.370GRANITE        1 1 1 1 SW CA  WH   <1 MH            60 ROTATED
11     27.470GRANITE        1 1 3 2 SW CA  WH   <1 MH            35 ROTATED
11     27.910GRANITE        1 1 1 2 SW CLCAGRWH <1 MH      20    45 PARTLY INDUCED
11     28.140GRANITE        1 1 1 2 MW CLCABLGR <1 MH     335    50
33 28.270GRANITE                                                   UPTAKE
5570313 R3 8                                                     STENN A
44 28.27          30.01        1.68    697. 83.    0.24 1.45
11     28.270GRANITE        2                                          START
11     28.400GRANITE        1 1 1 1 SW CACLGRWH <1 MH      25    65
11     28.440GRANITE        1 1 1 1 SW CL  GR   <1MH-H     25    65
11     28.550GRANITE        1 1 3 2 SW CA  WH   <1 MH            90
11     28.700GRANITE        1 1 1 2 SW CL  GR   <1 MH     240    55
11     28.720GRANITE        1 1 1 2 SW CA  WH   <1 MH      25    80
11     28.770GRANITE        1 1 2 2 SW CL  BLGR <1 MH       0    40
33 28.71-28.81  GRAVEL
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11      28.810GRANITE        1 1 1 2 MW CA  WH    <1 MH     130    35
33 29.46-29.78 SEALED FRACT. WITH CACL THICKNESS <1-1MM B=190 A=10
11      29.730GRANITE        1 1 1 1 SW CLCABLWH <1 MH     200    15
11      29.740GRANITE        1 1 1 2 SW CA  WH    <1 MH      65    50
11      29.840GRANITE        2
11      29.950GRANITE        1 1 1 1 SW CA  WH    <1 MH     205    75
33 26.27-30.010GRANITE SEALED FRACT. WITH CACL THICKNESS<1-1MM B=190 A=0
33 30.01                                                        UPTAKE
55780220 R4 1                                        STENN A
44 00.00          1.48       1.49    7101.0101.0 0.21 1.49
33      GRANITE                                                  START
11       0.020GRANITE        2
11       0.050GRANITE        1 1 1 1 SW CLCABLWH <1 MH     240    70  MOSTLY INDUCED
11       0.170GRANITE        1 1 1 2 SW CACLWHBL <1 MH     285    70
11       0.210GRANITE        2
11       0.420GRANITE        2
11       0.640GRANITE        1 1 1 1 SW CLCABLWH <1 MH       5    60  SHEARED B=75
33 0.830GRANITE SEALED FRACTURE WITH EP?(CL) THICKNESS<1MM B=110 A=25
33 0.870GRANITE SEALED FRACT. WITH EP?(CL) THICKNESS<1-1MM B=110 A=25
33 1.480GRANITE                                                 UPTAKE
55780307 R4 1                                        STENN A
44  1.48      2.90       1.40    899.0099.00 0.18 1.40
11       1.480GRANITE                                            START
11       1.490GRANITE        1 1 1 2 SW CA  WH    <1 MH     245    65 PARTLY INDUCED
11       2.090GRANITE        1 1 3 4 SW CLCABLWH <1 MH     150    70 END FRACT. 211
11       2.110GRANITE        1 1 1 2 SW CLCABLGR <1 MH     185    30 MOSTLY CLOSED
11       2.270GRANITE        1 1 1 2 SW CLCA BL  <1 MH     170    70
11       2.450GRANITE        2
11       2.510GRANITE        1 1 1 3 MW CLCABLWH <1 MH     155    70
11       2.610GRANITE        1 1 1 1 MW CL  BL   <1 MH     220    80
11       2.660GRANITE        1 1 1 1 SW CLCABLWH <1 MH      65    65 SHEARED B=65
33       2.820GRANITE        2     HARD ROTATED CORE
33 2.82-2.84  NO CORE
11       2.890GRANITE        2
33       2.900GRANITE                                            UPTAKE
55780301 R4 1                                        STENN A
44  2.90          3.93       0.94    591.0 85.0  0.18 0.88
11       2.900GRANITE        1 1 2 2 SW CLCABLWH <1 MH       ?    80 START
33 2.90-3.03   GRAVEL  CORE LOSS   ¬8CM
11       3.030GRAITE         1 1 1 1 MW CLCABLWH <1 MH            65 SHEARED
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APPENDIX B-1

HYDROLOGY TESTING DATA INVENTORY

APPENDIX B-1

A. Inventory of Hydrology Test Data

The following record sheets show, for each borehole, the interval tested, the number of injection tests (inflow) and the number of outflow tests. Also the record shows, for each test, if the basic injection test data sheet, flowrate data sheet, stripchart record, teletype printer output and the teletype punch tape record are available. Additional information is provided in the comment column.

The column labeled NRD indicates the nominal reference depth that was used during testing. It was generally referenced to the bottom of the transducer pod in order to avoid problems when individual packer elements having different lengths were placed in the packer assembly.

* indicates information available

\- indicates information missing or available in a different format

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
SBH 1	48	50.0	52.03	3	0	*	*	*	*		2m test cavities
	50	52.0	54.03	1	0	*	*	*	*		
	52	54.0	56.03	2	0	*	*	*	*		
	54	56.0	58.03	2	0	*	*	*	*		
	56	58.0	60.03	2	0	*	*	*	*		
	58	60.0	62.03	3	0	*	*	*	*		
	60	62.0	64.03	2	0	*	*	*	*		
	62	64.0	66.03	2	0	*	*	*	*		
	64	66.0	68.03	2	0	*	*	*	*		Stripchart 48-64
	66	68.0	70.03	2	0	*	*	*	*		Stripchart 66-84
	68	70.0	72.03	2	0	*	*	*	*		
	70	72.0	74.03	2	0	*	*	*	*		
	72	74.0	76.03	2	0	*	*	*	*		
	74	76.0	78.03	2	0	*	*	*	*		
	76	78.0	80.03	2	0	*	*	*	*		
	78	80.0	82.03	2	0	*	*	*	*		
	80	82.0	84.03	2	0	*	*	*	*		
	82	84.0	86.03	2	0	*	*	*	*		
	84			2	0		*	*	*		
	86										
	88										
	90										
	92										
	94	95.51	97.54	2	0	*	*	*	*		Stripchart 94, 96
	96	97.51	99.54	3	0	*	*	*	*		
	98	99.51	101.54	3	0	*	*	*	*		
	100	101.51	103.54	2	0	*	*	*	*		For stripchart see additional output for SBH-1
	102	103.51	105.54	2	0	*	*	*	*		
		105.4	107.45	0	0	-	-	-	-		Test not completed.
	104	105.53	107.56	1	0	*	*	*	*		
	104	105.51	107.54	2	0	*	*	*	*		
	105	105.51	107.50	2	0	*	*	*	*		
	106	107.53	109.56	0	0	*	-	*	*		Restarted-air in lines.
	106	107.53	109.56	1	0	*	*	*	*		

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
SBH 1	108	108.0	100.0	3	0	*	*	*	*		
	110	110.0	112.0	4	0	*	*	*	*		
	112	112.0	114.0	3	0	*	*	*	*		2m test cavities
	114	114.0	116.0	3	0	*	*	*	*		
	116	116.0	118.0	3	0	*	*	*	*		
	118	118.0	120.0	2	0	*	*	*	*		
	120	120.0	122.0	3	0	*	*	*	*		
	122	1220.0	124.0	3	0	*	*	*	*		
	124	124.0	126.0	3	0	*	*	*	*		
	126	126.0	128.0	3	0	*	*	*	*		
	128	128.0	130.0	3	0	*	*	*	*		
	130	130.0	132.0	2	0	*	*	*	*		
	132	132.0	134.0	2	0	*	*	*	*		
	134	134.0	136.0	2	0	*	*	*	*		
	136	136.0	138.0	3	0	*	*	*	*		
	138	138.0	140.0	3	0	*	*	*	*		
	140	140.0	142.0	2	0	*	*	*	*		
	142	142.0	144.0	3	0	*	*	*	*		
	143	145.61	147.41	1	0	*	-	*	*		No flow measured
	144	144.0	146.0	3	0	*	*	*	*		
	146	146.0	148.0	3	0	*	*	*	*		
	148	148.0	150.0	3	0	*	*	*	*		
	150	150.0	152.0	2	0	*	*	*	*		
	152	152.0	154.0	3	0	*	*	*	*		Stripcharts 152-172
	152	154.0	156.03	2	0	*	*	*	*		See add. output SBH 1
	154	156.0	158.03	2	0	*	*	*	*		
	156	158.0	160.03	2	0	*	*	*	*		
	158	160.0	162.03	2	0	*	*	*	*		
	160	162.0	164.03	3	0	*	*	*	*		
	162a	164.03	166.83	0	0	*	-	*	*		Test stopped,
	162b	164.03	166.83	2	0	*	-	*	*		air blockage Zero - Flow
	162	164.0	166.03	3	0	*	*	*	*		
	164	166.0	168.03	2	0	*	*	*	*		
	166	168.0	170.03	2	0	*	*	*	*		

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
SBH 1	168	170.0	172.03	3	0	*	*	*	*		
	170	172.0	174.03	2	0	*	*	*	*		
	172	174.0	176.03	2	0	*	*	*	*		
	174	176.0	178.03	2	0	*	*	*	*		Stripcharts 174-200 See add. output SBH-1
	176	178.0	180.03	2	0	*	*	*	*		
	178	180.0	182.03	2	0	*	*	*	*		
	178	181.75	183.55	3	0	*		*	*		
	180	182.0	184.03	2	0	*	*	*	*		
	182	184.0	186.03	2	0	*	*	*	*		
	184	186.0	188.03	2	0	*	*	*	*		
	186	188.0	190.03	4	0	*	*	*	*		
	188	190.0	192.03	2	0	*	*	*	*		
	190	192.0	194.03	2	0	*	*	*	*		
	192	194.0	196.03	2	0	*	*	*	*		
	194	196.0	198.03	2	0	*	*	*	*		
	196	198.0	200.03	2	0	*	*	*	*		
	198	200.0	202.03	2	0	*	*	*	*		
	200	202.0	204.03	2	0	*	*	*	*		
	202	204.16	205.96	2	0	*	*	*	*		
	204	207.26	209.06	3	0	*	*	*	*		
	206	210.87	212.46	2	0	*	*	*	*		
	208	210.84	212.64	2	0	*	*	*	*		
	210	212.64	214.44	2	0	*	*	*	*		
	212	214.44	216.24	2	0	*	*	*	*		
	214	216.24	218.04	2	0	*	*	*	*		
	216	218.04	219.84	2	0	*	*	*	*		
	218	219.84	221.64	2	0	*	*	*	*		
	220	221.64	223.44	2	0	*	*	*	*		
	222	223.44	225.24	2	0	*	*	*	*		
	224	225.24	227.04	2	0	*	*	*	*		
	226	227.04	228.84	2	0	*	*	*	*		
	228	228.84	230.64	2	0	*	*	*	*		
	230	230.64	232.44	2	0	*	*	*	*		
	232	230.64	232.44	2	0	*	*	*	*		

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
SBH1	234	234.24	236.04	3	0	*	*	*	*		
	236	236.04	237.84	4	0	*	*	*	*		
	238	237.84	239.64	3	0	*	*	*	*		
	240	239.64	241.44	2	0	*	*	*	*		
	242	241.44	243.24	2	0	*	*	*	*		
	244	243.24	245.04	2	0	*	*	*	*		
	246	245.04	246.84	2	0	*	*	*	*		2 m Test Cavities
	248	246.84	248.64	2	0	*	*	*	*		
	250	248.64	250.44	2	0	*	*	*	*		
	252	250.44	252.24	2	0	*	*	*	*		
	254	252.24	254.04	2	0	*	*	*	*		
	256	254.04	255.84	2	0	*	*	*	*		
	258	255.84	257.64	2	0	*	*	*	*		
	259	257.64	259.44	2	0	*	*	*	*		
	260	259.44	261.24	2	0	*	*	*	*		
	262	261.24	263.04	2	0	*	*	*	*		
	264	263.04	264.84	2	0	*	*	*	*		
	266	264.84	266.64	2	0	*	*	*	*		
	268	266.64	268.44	2	0	*	*	*	*		
	270	268.44	270.24	2	0	*	*	*	*		
	272	270.24	272.04	2	0	*	*	*	*		
	274	272.04	273.84	2	0	*	*	*	*		
	276	273.84	275.64	5	0	*	-	*	*		
	277	275.64	277.44	2	0	*	*	*	*		
	278	277.44	279.24	2	0	*	*	*	*		
	280	279.24	281.04	2	0	*	*	*	*		
	282	281.04	282.84	2	0	*	*	*	*		
	284	283.27	284.64	3	0	*	*	*	*		
	286	284.64	288.44	2	0	*	*	*	*		
	288	286.44	288.24	2	0	*	*	*	*		
	290	288.24	290.04	2	0	*	*	*	*		
	292	291.84	293.64	2	0	*	*	*	*		
	294	293.64	295.44	2	0	*	*	*	*		
	296	295.44	297.24	2	0	*	*	*	*		

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
SBH 11	298	297.24	299.04	3	0	*	*	*	*		2 m test cavities
	300	299.04	300.84	2	0	*	*	*	*		
	302	300.84	302.64	2	0	*	*	*	*		
	304	302.64	304.44	2	0	*	*	*	*		
	306	304.44	306.24	2	0	*	*	*	*		
	308	306.24	308.04	2	0	*	*	*	*		
	310	303.04	309.84	2	0	*	*	*	*		
	311	309.84	311.64	2	0	*	*	*	*		
	312	311.64	313.44	2	0	*	*	*	*		
	314	313.44	315.24	3	0	*	-	*	*		
	316	315.24	317.04	3	0	*	-	*	*		Flow rates noted
	318	317.04	318.84	3	0	*	-	*	*		but no data sheet
	320	317.84	320.64	3	0	*	-	*	*		
	322	320.64	322.44	2	0	*	-	*	*		
	324	322.44	324.24	3	0	*	-	*	*		
	326	324.24	326.04	4	0	*	-	*	*		
	327	326.04	327.84	2	0	*	*	*	*		
	328	327.84	329.64	2	0	*	*	*	*		
	330	329.64	331.44	2	0	*	*	*	*		
	332	331.44	333.24	2	0	*	*	*	*		
	334	333.24	335.04	2	0	*	*	*	*		
	336	335.04	336.84	2	0	*	*	*	*		
	338	336.84	338.64	7	0	*	-	*	*		Flow rates noted
	340	338.64	340.44	2	0	*	*	*	*		
	342	340.44	342.24	2	0	*	*	*	*		
	344	342.24	344.04	2	0	*	*	*	*		
	345	344.04	345.84	2	0	*	*	*	*		
	347	345.84	347.64	2	0	*	*	*	*		
	349	347.64	349.44	2	0	*	*	*	*		
	350	349.44	351.24	2	0	*	*	*	*		
	352	351.24	353.04	2	0	*	*	*	*		
	354	353.04	354.84	2	0	*	*	*	*		
	356	354.84	356.64	3	0	*	*	*	*		
	358	356.64	358.44	2	0	*	*	*	*		

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	MRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
SBH 4	360	358.44	360.24	3	0	*	*	*	*		2 m test cavities
	362	360.24	362.04	3	0	*	*	*	*		
	363	362.04	363.84	3	0	*	*	*	*		
	364	363.84	365.64	3	0	*	*	*	*		
	365	365.64	367.44	3	0	*	*	*	*		
	368	367.44	369.24	2	0	*	*	*	*		
	370	369.24	371.04	2	0	*	*	*	*		
	372	371.04	372.84	2	0	*	*	*	*		
	374	372.84	374.64	2	0	*	*	*	*		
	376	374.44	376.44	2	0	*	*	*	*		
	378	376.44	378.24	2	0	*	*	*	*		
	380	378.24	380.04	3	0	*	*	*	*		
	381	380.04	381.84	3	0	*	*	*	*		
	382	381.84	383.64	3	0	*	*	*	*		
SBH 1	1	50.0	56.0	3	0	*	*	*	*		6-7 m Test Cavities
	2	60.	66.	2	0	*	*	*	*		
	3	86.	92.	4	0	*	*	*	*		
	-	103	110	8	0	*	*	*	*		
	-	179.39	186.61	3	0	*	*	*	*		
	-	231.39	238.61	3	0	*	*	*	*		
	-	272.89	280.11	3	0	*	*	*	*		
	-	290.39	297.61	3	0	*	*	*	*		
	-	294.39	301.61	3	0	*	*	*	*		
	-	314.89	322.11	2	0	*	*	*	*		
	-	318.89	326.11	2	0	*	*	*	*		

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
SBH1	65.19	64.61	65.41	2	0	*	*	*	*		# 1 0.8 m Test Cavi.
	77.73	77.15	77.95	2	0	*	*	*	*		# 2
	80.92	80.34	81.16	2	0	*	*	*	*		# 3
	211.02	210.44	211.24	3	0	*	*	*	*		# 4
	220.69	220.11	220.91	4	0	*	*	*	*		5
	231.08	230.50	231.30	2	0	*	*	*	*		6
	251.0	250.42	251.22	2	0	*	*	*	*		7
	259.23			2	0	*	*	*	*		8
	264.15			2	0	*	*	*	*		9
	285.39			3	0	*	*	*	*		10A
	285.05			3	0	*	*	*	*		10B
	298.04			2	0	*	*	*	*		11
	303.03			2	0	*	*	*	*		12
	308.43			3	0	*	*	*	*		13
	328.05			2	0	*	*	*	*		14A Faulty valve
	328.05			2	0	*	*	*	*		14B injection tank
	341.23			2	0	-	*	*	*		15.
	342.65			1	0	*	*	*	*		16
	211.02			3	0	*	*	*	*		1
	220.69			3	0	*	*	*	*		2
	231.08			2	0	*	*	*	*		3
	251.0			4	0	*	*	*	*		4
	259.23			3	0	*	*	*	*		5
	264.15			4	0	*	*	*	*		6
	285.05			4	0	*	*	*	*		7
	298.04			3	0	*	*	*	*		8
	303.03			3	0	*	*	*	*		9
	308.43			3	0	*	*	*	*		10
	328.05			2	0	*	*	*	*		11
	341.23			2	0	*	*	*	*		12
	341.23			3	0	*	*	*	*		13
	358.60			3	0	*	*	*	*		14
	361.53			3	0	*	*	*	*		15
	358.35			2	0	*	*	*	*		16
	374.20			3	0	*	*	*	*		17

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
SBH 2	21	20	22	4	0	*	*	*	*		2 m Test Cavities
	23	22	24	4	0	*	*	*	*		
	25	24	26	3	0	*	*	*	*		
	27	26	28	2	0	*	*	*	*		
	29	28	30	3	0	*	*	*	*		
	31	30	32	2	0	*	*	*	*		
	33	32	34	2	0	*	*	*	*		
	35	34	36	4	0	*	*	*	*		
	37	36	38	3	0	*	*	*	*		
	39	38	40	2	0	*	*	*	*		
	41	40	42	2	0	*	*	*	*		
	43	42	44	3	0	*	*	*	*		
	45	44	46	2	0	*	*	*	*		
	47	46	48	1	0	*	*	*	*		
	49	48	50	3	0	*	*	*	*		Test #1
	49	48	50	2	0	*	*	*	*		Test #2
	51	50	52	1	0	*	*	*	*		
	53	52	54	2	0	*	*	*	*		
	55	54	56	3	0	*	*	*	*		
	57	56	58	2	0	*	*	*	*		
	59	58	60	1	0	*	*	*	*		
	61	60	62	3	0	*	*	*	*		
	62	61	63	1	0	*	*	*	*		
	63	62	64	2	0	*	*	*	*		
	65	64	66	1	0	*	*	*	*		
	67	66	68	2	0	*	*	*	*		
	69	68	70	1	0	*	*	*	*		
	71	70	72	3	0	*	*	*	*		
	73	72	74	2	0	*	*	*	*		
	75	74	76	2	0	*	*	*	*		
	77	76	78	1	0	*	*	*	*		
	79	78	80	3	0	*	*	*	*		
	81	80	82	1	0	*	*	*	*		
	83	82	84	2	0	*	*	*	*		

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
SBH 2	85	84	86	3	0	*	*	*	*		2 m Test Cavities
	87	86	88	3	0	*	*	*	*		
	89	88	90	1	0	*	*				
	91	90	92	3	0	*	*				
	93	92	94	2	0	*	*				
	95	94	96	1	0	*	*				
	97	96	98	3	0	*	*	*	*		
	99	98	100	2	0	*	*	*	*		
	101	100	102	1	0	*	*	*	*		
	103	102	104	3	0	*	*	*	*		
	105	104	106	2	0	*	*	*	*		
	107	106	108	1	0	*	*	*	*		
	109	108	110	3	0	*	*	*	*		
	111	110	112	2	0	*	*	*	*		1st Test
	111	110	112	1	0	*	*	*	*		2nd Test
	113	112	114	1	0	*	*	*	*		
	115	114	116	3	0	*	*	*	*		
	117	116	118	2	0	*	*	*	*		
	119	118	120	1	0	*	*	*	*		
	121	120	122	2	0	*	*	*	*		
	123	122	124	2	0	*	*	*	*		
	125	124	126	2	0	*	*	*	*		
	127	126	128	2	0	*	*	*	*		
	129	128	130	1	0	*	*	*	*		
	131	130	132	2	0	*	*	*	*		
	133	132	134	2	0	*	*	*	*		
	135	134	136	2	0	*	*	*	*		
	137	136	138	3	0	*	*	*	*		
	139	138	140	3	0	*	*	*	*		
	141	140	142	1	0	*	*	*	*		
	143	142	144	1	0	*	*	*	*		
	145	144	146	1	0	*	*	*	*		
	147	146	148	2	0	*	*	*	*		
	149	148	150	1	0	*	*	*	*		

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
SBH 2	151	150	152	1	0	*	*	*	*		2 m Test cavities
	153	152	154	2	0	*	*	*	*		
	155	154	156	1	0	*	*	*	*		
	157	156	158	1	0	*	*	*	*		
	159	158	160	1	0	*	*	*	*		
	161	160	162	1	0	*	*	*	*		
	163	162	164	1	0	*	*	*	*		
	165	164	166	2	0	*	*	*	*		
	167	166	168	1	0	*	*	*	*		
	169	168	170	2	0	*	*	*	*		
	171	170	172	1	0	*	*	*	*		
	173	172	174	1	0	*	*	*	*		
	175	174	176	1	0	*	*	*	*		
	177	176	178	1	0	*	*	*	*		
	179	178	180	2	0	*	*	*	*		Test not used, times too short.
	179	178	180	2	0	*	*				
	181	180	182	2	0	*	*				
	183	182	184	2	0	*	*				
	185	184	186	2	0	*	*				
	187	186	188	2	0	*	*				
	189	188	190	2	0	*	*				
	191	190	192	2	0	*	*				
	193	192	194	2	0	*	*				
	195	194	196	2	0	*	*				
	197	196	198	2	0	*	*				
	199	198	200	2	0	*	*				
	201	200	202	2	0	*	*				
	203	202	204	2	0	*	*				
	205	204	206	3	0	*	*				
	207	206	208	2	0	*	*				
	209	208	210	1	0	*	*				
	211	210	212	2	0	*	*				
	213	212	214	3	0	*	*				
	215	214	216	2	0	*	*				

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
	217	216	218	2	0	*	*				2 m Test Cavities
	219	218	220	2	0	*	*				
	221	220	222	2	0	*	*				
	223	222	224	2	0	*	*				
	225	224	226	2	0	*	*				
	227	226	228	2	0	*	*				
	229	228	230	2	0	*	*				
	231	230	232	2	0	*	*				
	233	232	234	2	0	*	*				
	235	234	236	2	0	*	*				
	237	236	238	3	0	*	*				
	239	238	240	2	0	*	*				
	241	240	242	2	0	*	*				
	243	242	244	2	0	*	*				
	245	244	246	2	0	*	*				
	247	246	248	2	0	*	*				
	249	248	250	2	0	*	*				
	251	250	252	2	0	*	*				
	253	252	254	2	0	*	*				
	255	254	256	2	0	*	*				
	257	256	258	2	0	*	*				
	259	258	260	2	0	*	*				
	261	260	262	2	0	*	*				
	263	262	264	2	0	*	*				
	265	264	266	2	0	*	*				
	267	266	268	2	0	*	*				
	269	268	270	2	0	*	*				
	271	270	272	2	0	*	*				
	273	272	274	2	0	*	*				
	275	274	276	2	0	*	*				
	277	276	278	2	0	*	*				
	279	278	280	2	0	*	*				
	281	280	282	2	0	*	*				
	283	282	284	1	0	*	*				

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
SBH 2	285	284	286	1	0	*	*				2 m test cavities
	287	286	288	1	0	*	*				
	289	288	290	2	0	*	*				
	291	290	292	2	0	*	*				
	283	292	294	2	0	*	*				
	295	294	296	2	0	*	*				
	297	296	298	2	0	*	*				
	299	298	300	2	0	*	*				
	301	300	302	2	0	*	*				
	303	302	304	2	0	*	*				
	305	304	306	2	0	*	*				
	307	306	308	2	0	*	*				
	309	308	310	2	0	*	*				
	311	310	312	2	0	*	*				
	313	312	314	2	0	*	*				
	315	314	316	2	0	*	*				
	317	316	318	2	0	*	*				
	319	318	320	2	0	*	*				
	321	320	322	2	0	*	*				
	323	322	324	2	0	*	*				
	325	324	326	2	0	*	*				
	327	326	328	2	0	*	*				
	329	328	330	2	0	*	*				
	331	330	332	2	0	*	*				
	333	332	334	2	0	*	*				
	335	334	336	2	0	*	*				
	337	336	338	2	0	*	*				
	339	338	340	2	0	*	*				
	341	340	342	2	0	*	*				
	343	342	344	2	0	*	*				
	345	334	336	2	0	*	*				
	347	346	348	3	0	*	*				
	349	348	350	2	0	*	*				
	351	350	352	2	0	*	*				

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
SBH 2	353	352	354	2	0	*	*				2m test cavities
	355	354	356	2	0	*	*				
HG 2	2	1.61	3.61	3	0	*	*	*	*		
	4	3.61	5.61	2	0	*	*	*	*		
	6	5.61	7.61	4	0	*	*	*	*		
	8	7.61	9.61	2	0	*	*	*	*		
	10	9.64	11.64	3	0	*	*	*	*		
	12	11.64	13.64	3	0	*	*	*	*		
	14	13.64	15.64	2	0	*	*	*	*		
	16	15.64	17.64	1	0	*	*	*	*		
	18	17.67	19.67	3	0	*	*	*	*		
	20	19.67	21.67	3	0	*	*		*		
	22	21.67	23.67	2	0	*	*		*		
	24	23.67	25.67	2	0	*	*		*		
	26	25.66	27.66	2	0	*	*		*		

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
HG 3	2	4.09	6.12	1	2	*		*	*		Redone
	2	4.05	6.08	2	2	*		*	*		2 m Test Cavities
	4	5.98	8.01	2	2	*		*	*		(teletype see
	6	8.08	10.11	2	2	*		*			HG3 & 4 teletype
	8	10.04	12.07	2	2	*		*	*		output)
	10	12.02	14.05	2	2	*		*	*		
	12	14.01	16.04	2	2	*		*	*		
	14	16.00	18.03	2	2	*		*			
	16	17.88	19.91	0	0	*					test cancelled; leak
	16	17.72	19.75	2	2	*		*			
	18	18.80	21.83	2	2	*		*			? distances wrong
	20	21.84	23.82	2	2	*		*			
	22	23.72	25.80	2	2	*		*			
	24	25.88	27.91	2	2	*		*			
HG 3	1.7	1.61	1.95	1	1	*	*		*		
	2.5	2.33	2.67	1	1	*	*		*		.34m test cavities
	5.4	5.2	5.54	1	1	*	*		*		(single fracture
	6.4	6.21	6.55	0	1	*			*		tests)
	7.2	7.01	7.35	0	1	*			*		
	9.8	9.59	9.93	0	1	*			*		
	10.4	10.27	10.61	1	1	*	*		*		
	12.2	11.99	12.33	0	1	*			*		
	15.2	15.01	15.35	1	1	*	*		*		
	18.2	18.03	18.37	1	1	*	*		*		Teletype see HG3&4
	18.9	18.75	19.09	1	1	*	*		*		Teletype output
	20.8	20.66	21.00	1	1	*	*		*		
	23	22.96	23.30	1	1	*	*		*		
	27	27.13	27.47	11	2	*	*		*		
	28	28.39	28.73	4	0	*	*		*		

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
HG 4	2	3.87	5.85	2	2	*		*	*		2m Test Cavities
	4	5.78	7.76	2	2	*		*	*		
	6	7.79	9.77	0	0	*		-	*		abort, air in cavity
	6	7.81	9.79	2	2	*		*	*		
	8	9.87	11.85	2	1	*		*			teletype NRD 2-8, 12-16,20-26 see see HG3&4 teletype output.
	10	11.82	13.80	2	2	*		*			
	12	13.81	15.79	2	2	*		*	*		
	14	15.92	17.90	2	2	*		*	*		
	16	17.77	19.75	2	2	*		*	*		
	18	19.86	21.84	2	2	*		*			
	20	21.84	23.82	2	2	*		*	*		
	22	23.81	25.79	2	2	*		*	*		
	24	25.81	27.79	2	2	*		*	*		
	26	27.91	30.0	3	2	*		*	*		
HG 4	1.2	1.05	1.39	0	1	*			*		.34m test cavities .49m cavities no test
	3.6	3.47	3.81	0	1	*			*		
	6.0	5.91	6.4	0	0	*					
	8.0	8.03	8.52	1	1	*	*				
	10.	9.99	10.48	1	0	*	*				(teletype 20.-27.2 see HG4 teletype output single fracture)
	15.5	15.46	15.95	1	0	*	*				
	20.	19.71	20.2	1	0	*	*		*		
	20.5	20.53	21.02	1	1	*	*		*		
	26.5	26.39	26.88	1	0	*	*		*		
	27.2	26.39	26.88	1	0	*	*		*		will not hit fracture?
	28.5	-	-	-	0	*	-	-	-		No test-too close to end of borhole

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
HG 5	0	2.14	4.14	2	0	*	*	*	*		2m Test Cavities
	2	4.14	6.14	1	0	*	*	*	*		
	4	6.10	8.10	2	0	*	*	*	*		
	6	8.14	10.14	3	0	*	*				teletype see HG 5
	8	10.14	12.14	1	0	*	*	*	*		teletype output
	10	12.14	14.14	3	0	*	*	*	*		
	12	14.14	16.14	3	0	*	*	*	*		
	14	16.14	18.14	3	0	*	*	*	*		
	16	18.14	20.14	3	0	*	*	*	*		
	18	20.14	22.14	2	0	*	*	*	*		
	20	22.14	24.14	1	0	*	*	*	*		
	22	24.14	26.14	1	0	*	*	*	*		
	24	26.14	28.14	1	0	*	*	*	*		
	26			0	0	*	*	-	-		Not tested, air leak in system.

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
R-3	0	2.04	4.47	3	1	*	*		*		2m test cavities
	2	3.98	6.41	1	0	*	*	*	*		
	4	5.98	8.41	2	1	*	*	*	*		
	6	8.08	10.32	3	1	*	*	*	*		values missing from sheets see teletype
	8	10.02	12.26	3	2	*	*	*			stripcharts 6-24
	10	12.09	14.33	3	2	*	*	*			see R3,R5 stripchart
	12	14.00	16.24	3	2	*	*	*			teletype 8,16-24 see
	14	15.95	18.19	3	1	*	*	*			R holes teletype
	16	17.96	20.2	3	1	*	*	*	*		Teletype 0-4 see
	18	19.97	22.21	3	1	*	*	*	*		HG5 18-24
	20	22.01	24.25	3	1	*	*	*	*		
	22	23.97	26.21	3	1	*	*	*	*		
	24	25.97	28.21	3	0	*	*	*	*		
R-3	1.47	1.30	1.64	0	1	*			*		0.34 m test cavities
	2.2	2.03	2.37	0	1	*			*		(single fracture)
	3.9	3.73	4.07	0	1	*			*		
	4.6	4.45	4.79	0	1	*			*		
	5.8	5.66	6.00	0	1	*			*		
	6.5	6.41	6.75	1	2	*	*		*		
	10.3	10.16	10.50	1	1	*	*		*		
	12.6	12.45	12.79	1	0	*	*		*		Teletype, see cross
	14.	13.79	14.13	1	2	*	*		*		Referenced files
	15.9	15.76	16.10	1	0	*	*		*		
	21.6	21.44	21.78	1	1	*	*		*		
	23.1	22.93	23.27	2	2	*	*		*		
	24.7	24.81	24.85	0	0	*	-	-	-		End of testing in R-3 hole blocked @ 26.67

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
R-4	4	3.90	6.11	3	1	*	*	*	*		2m test Cavities
	6	5.90	8.11	3	4	*	*	*	*		
	8	7.90	10.11	3	2	*	*	*	*		
	10	9.90	12.11	3	5	*	*	*	*		
	12	11.90	14.11	3	1	*	*	*	*		
	14	13.90	16.11	3	1	*	*	*	*		
	16	15.80	18.01	3	1	*	*	*	*		Stripcharts 14-26
	18	17.82	20.03	3	3	*	*	*	*		See HG-2 Stripcharts
	20	19.80	22.01	3	2	*	*	*	*		
	22	21.92	24.13	3	2	*	*	*	*		
	24	23.92	26.13	3	0	*	*	*	*		
	26	25.85	28.06	3	0	*	*	*	*		
	28	27.93	30.	1	1	*	*	*	*		
R-4	1.5	1.36	1.85	0	0	*			*		0.49 m Test
	7.3	10.42	10.91	0	0	*			*		Cavities
	13.1	14.96	15.45	1	0	*	*		*		(single fracture)
	16.5	8.24	8.73	1	0	*	*		*		
	18.1	19.87	20.36	1	0	*	*		*		
	18.9	20.65	21.14	1	0	*	*	*	*		
	19.8	21.58	22.07	1	0	*	*	*			
	24.9	26.65	27.14	1	0	*	*	*			
	27.9	27.61	28.10	0	0	*	-	*	-		Test Discontinued
											Teletype see R4,5
											Teletype output
											(single fracture)

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
R-5	2	2.13	4.24	2	0	*		*	*		2m Test Cavities
	4	4.26	6.37	3	1	*	*	*	*		
	6	6.32	8.43	3	2	*	*	*	*		
	8	8.37	10.48	2	2	*	*	*	*		
	10	10.52	12.63	1	1	*	*	*	*		
	12	12.56	14.67	1	1	*	*	*	*		Stripcharts 2-24
	14	14.67	16.78	1	2	*	*	*	*		see stripcharts R3,5
	16	16.79	18.90	1	2	*	*	*	*		Teletype see R-Holes
	18	18.82	20.93	1	1	*	*	*	*		Teletype output
	20	21.02	23.13	1	1	*	*	*	*		
	22	23.11	25.22	0	1	*		*	*		0.0 flow - no injec-
	24	25.17	27.28	1	1	*	*	*	*		tion test done
	26	26.08	28.19	0	2	*		*	*		0.0 flow, no injec- tion test done
R-5	1.	1.47	1.81	0	0	*			*		0.34m Test
	3.4	3.21	3.55	0	0	*			*		Cavities
	9.8	9.60	9.94	1	0	*	*		*		
	10.3	10.09	10.43	1	1	*	*		*		Teletype see R4,5
	11.3	11.15	11.49	0	1	*			*		Teletype output
	12.7	12.54	12.88	1	1	*	*		*		(single fracture)
	15.5	15.31	15.65	0	1	*			*		
	17.2	17.07	17.41	0	1	*			*		
	18.9	18.74	19.08	0	1	*			*		
	21.0	20.89	21.23	0	1	*			*		
	22.2	22.03	22.37	0	1	*			*		
	26.	25.92	26.26	1	1	*	*		*		
	27.1	26.95	27.29	1	0	*	*		*		
	28.5	28.32	28.66	0	1	*			*		

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
R-6	4	2.0	6.0	1	0	*	*	*	*		4m Test Cavities
	8	3.77	7.77	1	0	*	*	*	*		using slightly different data she sheets
	12	7.77	11.77	1	0	*	*	*	*		
	16	11.77	15.77	1	0	*	*	*	*		flowrates not calc.
	20	15.77	19.77	1	0	*	*	*	*		
	24	19.77	23.77	1	0	*	*	*	*		
	28	23.77	27.77	1	0	*	*	*	*		
	32	27.77	31.77	1	0	*	*	*	*		
	36	31.77	35.77	1	0	*	*	*	*		
	40	35.77	39.77	1	0	*	*	*	*		
R-7	6	1.77	5.77	1	0	*	*	*	*		
	10	5.77	9.77	1	0	*	*	*	*		
	14	9.77	13.77	1	0	*	*	*	*		
	18	13.77	17.77	1	0	*	*	*	*		
	22	17.77	21.77	1	0	*	*	*	*		
	26	21.77	25.77	1	0	*	*	*	*		
	30	25.77	29.77	1	0	*	*	*	*		

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
R-8	2	3.97	6.00	2	2	*		*	*		2m Test Cavities
	2.05	4.07	6.06	0	2	*		*	*		
	4	6.03	8.06	2	2	*		*	*		
	6	8.04	10.07	3	2	*		*	*		
	8	10.01	12.02	2	2	*		*	*		
	10	12.00	14.03	2	2	*		*	*		
	12	14.01	16.04	2	1	*		*	*		
	14	16.02	18.05	2	1	*		*	*		
	16	18.05	20.08	2	1	*		*	*		
	18	19.99	22.02	2	1	*		*	*		
	20	22.02	24.05	2	2	*		*	*		# 2
	20	21.99	24.02	2	2	*		*	*		# 2
	22	24.01	26.04	2	3	*		*	*		
	24	26.01	28.04	2	2	*		*	*		Teletype 26 see R-Holes Teletype output
	26	28.09	30.04	2	2	*		*	*		
R-8	1	1.31	2.15	0	1	*	*	*	*		single fracture
	2	1.68	2.52	0	0	*	*	*	*		0.85 m Test Cavitie
	2.5	2.26	3.10	0	0	*	*	*	*		"
	3.0	2.89	3.73	1	0	*	*	*	*		"
	3.5	3.31	4.15	1	0	*	*	*	*		"
	4.5	4.08	4.92	1	0	*	*	*	*		May not be valid test
	5.5	5.27	5.73	1	0	*	*	*	*		0.46m test cavities
	10.	9.80	10.26	1	0	*	*	*	*		"
	10.5	10.44	10.9	1	0	*	*	*	*		"
	11.5	11.41	11.87	0	1	*			*		"
	13.25	13.12	13.58	0	1	*			*		"
	19.25	19.06	19.55	0	1	*	*		*		Data not valid, test redone
	19.5	19.61	20.10	0	1	*			*		
	21.5	21.56	22.05	1	0	*	*		*		"
											Stripcharts 1-10.5 see R8,R9,R10 Teletype 1-11.5 see R-holes teletype output

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
R-9	2	3.99	6.02	2	2	*		*	*		2m Test Cavities
	4	5.98	8.01	2	2	*		*	*		
	6	8.01	10.04	2	1	*		*	*		
	8	10.05	12.08	2	2	*		*	*		
	10	12.03	14.06	2	1	*		*	*		
	12	14.02	16.05	2	2	*		*	*		
	14	16.06	18.09	2	2	*		*	*		Teletype 4-12,14-24 see R-Holes Teletype output
	16	18.07	20.10	2	2	*		*	*		
	18	20.02	22.05	2	2	*		*	*		
	20	22.04	24.07	3	2	*		*	*		
	22	24.00	26.03	3	2	*		*	*		
	24	26.01	28.04	2	2	*		*	*		
	26	28.06	30.03	2	2	*		*	*		
											Single fracture
R-9	1	2.75	3.09	1	1	*	*	*	*		0.34 m Test Cavities
	2	8.99	9.33	1	1	*	*	*	*		
	3	11.18	11.52	1	1	*	*	*	*		Stripcharts-see R8,R9, R10 Stripcharts
	4	16.73	17.07	0	1	*		*	*		
	5	19.71	20.05	1	1	*	*	*	*		
	6	21.06	21.4	0	1	*		*	*		Teletype see R-Holes
	7	22.38	22.72	1	1	*	*	*	*		Teletype output
	8	24.10	24.44	1	1	*	*	*	*		
	9	25.75	26.09	1	1	*	*	*	*		
	10	26.86	27.2	1	1	*	*	*	*		
	10	26.86	27.20	11	1	*	*	*	*		
	11	7.03	7.37	0	1	*			*		

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
R-10	2	3.83	5.81	2	2	*		*	*		2m Test Cavities
	4	5.87	7.85	2	2	*		*	*		
	6	7.90	9.88	2	2	*		*	*		
	8	9.88	11.86	2	3	*		*	*		
	10	11.80	13.78	2	2	*		*	*		
	12	13.87	15.85	2	2	*		*	*		
	14	15.84	17.82	2	2	*		*	*		
	16	17.85	19.83	2	2	*		*	*		
	18	19.85	21.83	2	2	*		*	*		
	20	21.81	23.79	0	0	*	-	*	-		Equip. Failure Rerun
	20	21.80	23.78	2	2	*			*		
	?	23.77	25.75	0	0	*	-	-	-		Aborted
	22	24.03	26.06	2	2	*		*	*		
	24	26.01	28.04	2	2	*		*	*		Teletype 10-18,20-26
	26	28.08	30.04	2	2	*		*	*		see R-Holes teletype output
R-10	1	3.91	4.76	1	1	*	*	*	*		Single fracture
	2	2.69	3.54	0	1	*		*	*		0.85 m Test Cavities
	3	5.03	5.88	1	1	*	*	*	*		
	4	5.93	6.78	0	1	*		*	*		Stripcharts see R8,R9,
	5	8.30	9.15	0	1	*		*	*		R10 Stripcharts
	6	8.80	9.65	1	1	*	*	*	*		
	7	11.83	12.68	1	2	*	*	*	*		teletype 1-4 see R=Hole
	8	16.31	17.16	1	4	*	*	*	*		teletype output
	9	17.12	17.97	1	2	*	*	*	*		
	10	24.58	25.43	1	1	*	*	*	*		
	11	11.81	12.66	11	1	*	*	*	*		

HYDROLOGY TESTING DATA INVENTORY

BOREHOLE	NRD	INTERVAL FROM	INTERVAL TO	# OF TESTS INFLOW	# OF TESTS OUTFLOW	INJECTION TEST DATA SHEET	FLOW RATE DATA SHEET	STRIPCHART	TELETYPE	PUNCH TAPE	COMMENTS
S-1	4	5.98	8.01	0	1	*		*	*		2 m Test Cavities
	6	7.93	9.96	0	1	*		*	*		
	8	9.98	12.01	0	1	*		*	*		
	10	11.98	14.02	0	1	*		*	*		
	12	13.98	16.01	0	1	*		*	*		
	14	16.00	18.03	0	0	*		*	*		
	16	17.97	20.0	0	1	*		*	*		
	18	19.88	21.99	0	1	*		*	*		
	20	21.99	24.07	0	1	*		*	*		
	22	24.07	26.10	0	1	*		*	*		
	24	25.98	28.01	0	1	*		*	*		
	26	28.03	30.06	0	1	*		*	*		
	28	30.04	32.01	0	1	*		*	*		
	30	31.96	33.99	0	1	*		*	*		
	32	33.97	36.00	0	1	*		*	*		
	34	35.95	37.98	0	1	*		*	*		
S-2	2	4.08	6.11	0	1	*		*	*		
	4	5.93	7.96	0	1	*		*	*		
	6	8.04	10.07	0	1	*		*	*		
	8	9.98	12.01	0	1	*		*	*		
	10	11.98	14.01	0	1	*		*	*		
	12	14.00	16.02	0	1	*		*	*		
	14	15.97	18.00	0	1	*		*	*		
	16	18.03	20.06	0	1	*		*	*		
	18	19.96	21.99	0	1	*		*	*		
	20	21.96	23.99	0	1	*		*	*		
	22	23.97	26.0	0	-1	*		*	*		
	24	25.98	28.01	0	1	*		*	*		
	26	28.01	30.04	0	1	*		*	*		
	28	29.90	32.01	0	1	*		*	*		
	30	31.95	33.98	0	1	*		*	*		
	32	33.98	36.01			*		*	*		
	34	35.96	37.99	0	1	*		*	*		No time for flow test

APPENDIX B-2

HYDROLOGY TESTING PROCEDURES

APPENDIX B-2

B2.1 INTRODUCTION

Hydrologic testing was performed at Stripa, during the period May 15, 1979 to March 30, 1980, in boreholes drilled from the ground surface (surface) and from the mine workings (subsurface). Differences between test environments encountered during testing of the surface and subsurface boreholes required the development of different test procedures. However, the techniques for preparation of equipment prior to testing were similar for both systems. The following section contains a description of the equipment preparation techniques used in both test environments. Subsequent sections contain individual descriptions of the test procedures used underground and on the surface.

B2.2 EQUIPMENT PREPARATION PRIOR TO TESTING

B2.2.1 Assembly of Equipment

The equipment configurations used for both surface and subsurface testing were similar. Figure 3.1 shows the test system used in testing surface boreholes SBH-1. In the underground test system water for the storage tank was obtained from the mine water supply and a 1/8-inch nylon line ran from the P1 transducer to the top of the borehole.

B2.2.2 Equipment Checks

Prior to probe assembly all packers were tested to ensure the correct sealing of all components. To check for leakage, packers were inflated in a steel pipe to about 3.5 MPa, using compressed nitrogen. Both the packer and pipe were then submerged in water and the joints, O rings and seals checked for escaping gas bubbles.

B2.2.1 Electrical Equipment

The general electrical system configuration used for hydrologic testing at Stripa is illustrated in Fig. 3.4. Prior to any testing, all pressure transducers, thermocouples, power supplies and monitoring components were carefully checked for proper performance.

B2.2.2 Final System Check

Prior to the start of any new testing, the fully assembled probe was inserted into a 5-m steel pipe for a trial test. The packers were inflated to approximately 3.4 MPa and the cavity water pressure was raised to around 1 MPa. If any leaks existed in the probe they could be detected either visually or by monitoring the cavity pressure transducer. If no leaks exist the pressure in the cavity will remain constant when the injection line valve (between the flow tank and probe) is closed. As a last step in the final system check, the P1 port (see Fig. 3.1) must be pressurized to check for any possible leaks. A water line is attached to the P1 port and pressurized to around 1 MPa. As described above, if leaks exist, the pressure in the line will decrease with time.

B2.3 EQUIPMENT CALIBRATION

B2.3.1 Pressure Transducers

All pressure transducers were calibrated every three or four weeks, the period varying to accommodate the testing schedule. Calibration consisted of pressurizing the transducers with compressed nitrogen using increments of 0.7 MPa (100 psi) from 0 MPa to about 4 MPa (600 psi) and back down to 0 MPa. The output voltage for the transducers at each pressure increment was recorded along with the pressure reading from a calibrated

Heise gauge connected to the same pressure line. Calibration factors could then be calculated for each transducer from these measurements.

B2.3.2 Thermocouples and Thermistors

All thermocouples and thermistors were calibrated every two or three months depending on the testing schedule. Calibration involved the recording of the temperatures of the thermocouples, thermistors, and a sensitive mercury thermometer all immersed in a water bath. The temperature of the water was changed from 0°C to 80°C and back to 0°C; thus the temperature sensors were calibrated for a wide range of temperatures.

B2.3.3 Flow Tanks

A flow tank and a differential pressure transducer was used to measure flow rates during injection tests. Figure 3.3 shows a typical set-up for a flow tank system. A flow tank combined with a differential pressure transducer was calibrated by releasing fixed volumes of water (measured using a graduated cylinder) and recording a drop in output voltage for the differential pressure transducer for each volume released. Normally a field calibration consisted of a total volume release of approximately 70 percent of the tank capacity in increments of 10 percent of the total volume released. In addition, the flow tank system was normally calibrated under different applied pressures (atmospheric, 1 MPa and 2 MPa).

B2.3.4 Bubble Injection Line

The velocity of an air bubble in the injection line is a direct measure of the flowrate during an injection test. This method was used when the flowrates in a 2-m interval of borehole (76 mm diameter) were low (generally less than 15 ml/min). The section of the injection line in

which the air bubble velocity is measured must be calibrated in order to calculate flowrates. An injection line calibration involves the recording of the volume of water displaced for a given displacement of the air bubble. The calibrations at Stripa consisted of ten to fifteen of such recordings. The volume of water displaced was measured using a 10 ml graduated cylinder and the displacement of the bubble was normally between 90 and 95 cm. The average of all the recordings made was used as the calibration factor.

B2.3 SURFACE HYDROLOGIC TESTING PROCEDURES

(1) Insert probe in borehole and lower to the desired testing interval.

(2) Prepare data logger, chart recorder, and teletype for the beginning of testing: write introductory comments (Test No., Interval, etc.); monitor P1 and P2 on the chart recorder; monitor all channels on data logger and teletype.

(3) Flush the injection line to remove any air that may be in the line. (Flushing normally is done while the probe is being lowered to the desired interval).

(4) Record two or three scans of the channels at one or two minute intervals to check the operation of the equipment prior to the beginning of testing.

(5) Inflate the packers to approximately 3.5 MPa. During inflation, observe the pressure build-up in the cavity (P2 transducer). If the pressure exceeds surface hydrostatic pressure, open the injection line valve allowing flow into the flow tank, thus relieving the cavity pressure. (The flow tank must be open to atmospheric pressure.) All channels should be scanned at regular intervals (1 or 2 minutes) throughout the test.

(6) When the packers are fully inflated, the borehole pressures P1, P2, and P3 will stabilize. At this point, the injection line valve should be closed (if it was opened in last step). The interval is now shut-in and cavity pressures will adjust gradually to the in-situ groundwater pressures if there are no vertical gradients and the water level is within a few meters of the surface. This may take from a few minutes to several hours depending on the permeability of the interval. All channels should be scanned at regular intervals as the cavity pressure stabilizes.

(7) Constant pressure injection testing of the interval may begin as soon as a stable cavity pressure has been reached, above the in-situ pressure recorded in the previous step. Normally three or four increments of cavity pressure can be easily achieved. Figure 3.3 illustrates how an air reservoir coupled with a flow tank can be used to produce constant injection pressures during the test. The flow rates can be measured either by a flow tank and differential pressure transducer or by using the air bubble injection line method described in Chapter 3. Table 3.2 shows the range of flow rates accuracy that can be maintained with each of the methods mentioned above.

(8) After the injection tests are completed the pressure in the cavity is lowered to surface hydrostatic pressure by opening the flow tank to the atmosphere. The packers can then be deflated and the probe may be moved to the next interval for continued testing.

B2.4 UNDERGROUND HYDROLGOIC TESTING PROCEDURES

Test procedures used in the subsurface boreholes followed the format outlined below;

(1) Turn on all monitoring equipment and allow sufficient time for all components to reach operating temperature. During the test program the equipment is shut-down during weekends and periods of equipment failure. At least 1 hour is allowed for equipment warm-up after periods of shut-down.

(2) Record sensor outputs if equipment has been removed from hole since the last test.

(3) Place the probe at the desired test depth plus 0.1 m (packers move out of the hole approximately 0.1 m during inflation).

(4) Record all sensor outputs and calibrate chart recorder.

(5) Inflate packers to approximately 3.3 MPa, ensuring that lines to the lower and inflation cavities are open. Record sensor outputs continuously until the packers are sealed.

(6) Monitor variations in the lower cavity pressure P1 on the chart recorder during inflation and control the lower (P1) cavity pressure using the valve at the surface. Attempt to keep lower cavity pressure at the shut-in pressure estimated from the previous test in order to minimize the potential for over pressurizing the cavity and to reduce the shut-in time.

(7) When the lower cavity pressure P1 becomes semi-stable, shut the injection line valve and allow the pressure to increase in the injection cavity.

(8) When the pressure in the injection cavity has stabilized (changed less than 0.0003 MPa per minute) record the stable shut-in pressure and open the injection line.

(9) When cavity pressures are stable and at least 30 minutes of outflow have occurred, measure the flow of water from the injection cavity using 10-ml graduated cylinder.

(10) Using shut-in pressures calculated from data obtained in step 8 calculate the first injection pressure PI1 (110% of shut-in pressure). Adjust the cavity pressure to PI1 and monitor tank level (flow) and cavity pressure on the chart recorder for at least 30 minutes. If no flow is observed in 30-45 minutes calculate and apply the second injection pressure PI2 (140% of shut-in pressure). If flow is observed in 30 minutes during the first injection try to obtain a flow of at least 3 ml in 2 hours. The second injection pressure PI2 is calculated (140% of shut-in pressure) and applied (if flow is obtained at PI1) again a flow of at least 3 ml in 2 hours is desired.

(11) After completion of the last injection test open the injection cavity and repeat the outflow test of Step 9.

(12) Deflate the packers and record all sensor readings to check against those of Step 4.

(13) Move to the next test location (plus .1 m) or remove probe from hole. If probe is removed from hole record all sensor readings when probe is out of hole to check against readings of Step 2.

These procedures were also used to test two holes concurrently thus reducing the total required test time. In order to test two holes concurrently one system was usually in the shut-in phase (Step 6) while the other system was in any of the other phases of the test sequence.

APPENDIX B-3

HYDROLOGY DATA FILES

B-3.1 Subsurface Boreholes, 2-m and 4-m Interval Tests

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FILE: HG2PERM  SDATA    A1  06/09/81  16:04:14  UNIVERSITY OF WATERLOO  PAGE 001

99  HOLE HG2 HYDROLOGY DATA
88    2  12    1.61    3.61   0.2057  0.00508   0.5143
21  15 02     15 08     0.5584   0.5587          0.002 11.0 11.1-1.310 -1.337
22  07 41     07 45     0.5575   0.5579          0.020 11.1 10.9-1.333 -1.334
23  08 41     08 47     0.5743   0.5744          0.000 11.1 11.1-1.334 -1.330
99  HG2 NRD4  NO FLOWRATE IS INDICATED
88    6  26    5.61    7.61   0.2057  0.00508   0.6210
21  08 11     08 13     0.6556   0.6555          0.270 11.3 11.3-1.353 -1.353
22  08 34     08 36     0.6842   0.6842          0.530 11.1 11.2-1.353 -1.353
23  08 58     09 00     0.7002   0.6999          0.660 11.0 11.1-1.352 -1.351
24  09 22     09 24     0.6604   0.6603          0.340 11.2 11.3-1.352 -1.352
88    8  14    7.61    9.61   0.2057  0.00508   0.6509
21  13 26     13 30     0.7013   0.7015          0.011 11.1 11.3-1.352 -1.352
22  14 32     14 34     0.7237   0.7235          0.023 11.1 11.1-1.353 -1.353
88   10  13   9.64   11.64   0.2057  0.00508   0.7002
21  07 32     07 41     0.7530   0.7527          0.138 10.9 11.1-1.357 -1.356
22  08 41     08 44     0.8340   0.8339          0.309 11.1 11.2-1.356 -1.355
23  09 40     09 44     0.8739   0.8737          0.367 11.0 11.0-1.354 -1.353
88   12  14  11.64   13.64   0.2057  0.00508   0.6668
21  13 31     13 43     0.7161   0.7161          0.033 11.0 11.0-1.349 -1.345
22  14 23     14 29     0.8081   0.8079          0.102 11.0 11.1-1.351 -1.351
23  14 58     15 00     0.8703   0.8700          0.147 11.0 11.1-1.349 -1.349
99  HG2 NRD12  NO FLOWTEST DONE DUE TO LACK OF TIME
88   14  10  13.64   16.68   0.2057  0.00508   0.6482
21  06 42     07 00     0.6907   0.6905          0.012 11.0 10.8-1.356 -1.354
22  08 00     08 08     0.7347   0.7346          0.007 10.8 10.8-1.353 -1.354
88   16   6  15.64   17.64   0.2057  0.00508   0.5913
21  12 44     12 58     0.7054   0.7055          0.017 10.8 10.8-1.350 -1.351
99  HG2 NRD16  FIRST TWO TESTS ARE NOT REPRESENTATIVE OF SYSTEM
88   18  20  17.67   19.67   0.2057  0.00508   0.7227
21  12 30     12 32     0.7751   0.7751          0.270 11.0 11.0-1.356 -1.456
22  12 57     12 59     0.7992   0.7993          0.360 11.0 11.0-1.356 -1.356
23  13 16     13 18     0.8267   0.8266          0.470 10.9 10.8-1.355 -1.352
88   20  40  19.67   21.67   0.2057  0.00508   0.8085
21  10 18     10 20     0.8528   0.8628          0.509 10.7 10.7-1.356 -1.356
22  11 34     11 36     0.8785   0.8785          0.420 10.7 10.7-1.352 -1.352
23  12 05     12 07     0.9820   0.9820          1.555 10.7 10.8-1.352 -1.352
88   22   2  21.67   23.67   0.2057  0.00508   0.6842
22  06 50     06 58     0.7856   0.7884          0.050 10.7 10.6-1.358 -1.358
99  HG2 NRD22 FIRST INCREMENT NEGATIVE FLOWRATE
99  HG2 NRD22 SECUND INCREMENT NOT ALL PRESSURES FOUND
99  HG2 NRD24 NO FLOWRATE IS INDICATED
88   26  18  25.66   27.66   0.2057  0.00508   0.7626
21  08 41     08 45     0.8175   0.8177          0.025 10.7 11.5-1.359 -1.358
22  10 04     10 10     0.9274   0.9271          0.094 10.7 10.6-1.358 -1.358
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99  HOLE HG3   HYDROLOGY DATA
88    2   4    4.05    6.08   0.0599  0.00508   0.7241  0.000600   5.00
11   10 31 50  11 42 32   0.0583   0.0563   0.0     -230.0 12.4 12.4
21   11 52 28  12 13 28   0.7949   0.7959  2.0190  2.0190 12.7 12.4
22   12 16 45  12 50 45   0.9866   0.9876  2.0037  2.0037 12.5 12.5
12   14 21 54  14 24 36   0.0539   0.0643  0.0     -8.45  12.5 12.5
88    4   4    5.98    8.01   0.0599  0.00508   0.3183  0.000600   5.00
11    7 55 22   8 25 22   0.0583   0.0585  0.0     -5.5   12.4 12.3
21   10 18 57  10 52 44   0.3740   0.3738  1.8122  1.8111 12.5 12.6
22   11  4 40  11 42 40   0.4230   0.4232  1.8089  1.8084 12.5 12.6
12   12 27 40  13  2 14   0.0585   0.0588  0.0     -5.95  12.6 12.7
88    6   3    8.06   10.11   0.0605  0.00508   0.1366  0.000600   5.00
11   18 22 00  18 37 00   0.0650   0.0650  0.0     0.0    13.0 13.0
21   18 55 26  19 25 26   0.1447   0.1446  3.4325  3.4313 13.0 13.1
22   19 34  0  20  4  0   0.1677   0.1677  3.4274  3.4271 12.9 12.9
99  NRD 6, NEGATIVE FLOW COULD BE SEEN
88    8   4   10.04   12.07   0.0605  0.00508   0.4526  0.000600   5.00
11   16  3 30  16 33 30   0.0666   0.0658  0.0     -0.8   13.1 13.0
21   16 45  3  17 15  0   0.4927   0.4924  3.3518  3.3516 13.0 13.1
22   17 23  0  17 53  0   0.6202   0.6199  3.3443  3.3443 13.0 13.1
12   18 35 36  19 05 36   0.0657   0.0655  0.0     -0.8   13.1 13.0
88   10   4   12.02   14.05   0.0605  0.00508   0.7680  0.000600   5.00
11   14 38 36  15 08 36   0.0674   0.0673  0.0     -2.05  13.0 13.0
21   15 24  0  15 54  0   0.8394   0.8389  3.0166  3.0148 13.1 13.0
22   16  4  0  16 34  0   0.9819   0.9814  3.0073  3.0074 13.1 13.0
12   17 13 30  17 43 30   0.0677   0.0676  0.0     -2.0   13.1 13.0
88   12   4   14.01   16.04   0.0605  0.00508   0.5160  0.000600   5.00
11   16 00 30  16 30 30   0.0713   0.0712  0.0     -0.8   13.0 13.0
21   16 41  0  17  9  0   0.5614   0.5611  2.9474  2.9472 12.9 13.1
22   17 17  0  17 47  0   0.6988   0.6984  2.9407  2.9405 13.1 13.0
12   18 26 01  18 56 01   0.0716   0.0716  0.0     -0.75  12.9 13.0
88   14   4   16.00   18.03   0.0605  0.00508   0.6451  0.000600   5.00
11   11 00 42  11 32 42   0.0748   0.0757  0.0     -1.15  12.9 13.0
21   11 51 40  12 29 40   0.7044   0.7037  2.9048  2.9045 13.0 13.0
22   12 39 19  13  9 19   0.8809   0.8809  2.8952  2.8943 12.9 13.0
12   13 43 42  14 13 42   0.0749   0.0748  0.0     -1.9   13.0 12.8
88   16   4   17.72   19.75   0.0581  0.00508   0.4648  0.000600   5.00
11   15 51 25  16 21 25   0.0597   0.0693  0.0     -0.7   12.9 12.9
21   16 38 35  17  5 25   0.5047   0.5049  2.5495  2.5491 13.0 13.0
22   17 16 20  17 52 30   0.5880   0.5887  2.5453  2.5452 13.0 12.9
12   18 44 20  19 10 20   0.0703   0.0719  0.0     -0.9   12.8 13.0
99  NRD 16, NOTE: THERE WAS A CHANGE IN INPUT POWER DURING TEST
88   18   4   19.76   21.83   0.0581  0.00508   0.0747  0.000600   5.00
11   22  5  3  22 34 33   0.0731   0.0755  0.0     -0.1   13.0 13.0
21   22 45 40  23 16 51   0.8081   0.8049  2.5077  2.5062 12.9 12.9
22   23 25 28  23 55 28   1.0308   1.0277  2.4969  2.4963 12.9 12.9
12   00 50  4   1 20  4   0.0743   0.0745  0.0     -1.2   13.0 12.9
88   20   4   21.84   23.82   0.0581  0.00508   0.8641  0.000600   5.00
11   10 34 23  11  4 23   0.0755   0.0756  0.0     -8.6   12.7 12.4
21   11 20 42  11 50 14   0.9026   0.9019  2.4835  2.4827 12.7 12.5
22   12  7 22  12 38 38   1.0786   1.0769  2.4755  2.4741 12.7 12.8
12   13 18 00  13 47 59   0.0774   0.0780  0.0     -8.6   12.7 12.7
88   22   4   23.72   25.80   0.0581  0.00508   0.8464  0.000600   5.00
11   21 17 18  21 43 18   0.0783   0.0770  0.0     -8.4   12.5 12.5
21   21 49 33  22 23 38   0.8696   0.8680  2.4454  2.4443 12.6 12.5
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22   22 30 33   23 32  6    1.1628    1.1587   2.4319   2.4266 12.5 12.6
12   00 06 46   00 23 53    0.0787    0.0785    0.0     -5.8   12.5 12.5
88    24    4   25.88    27.91    0.0581   0.00508   0.9403   0.000600    5.00
11    4 19 40   04 41 06    0.0908    0.0922    0.0    -312.0 12.5 12.5
21    4 50 22    6 52  0    1.0284    1.0265   2.4146   2.2957 12.5 12.6
22    7  5  2    8 14 27    1.1182    1.1148   2.2787   2.1766 12.5 12.6
12   10  1 12   10 31 12    0.0904    0.0894    0.0     -354.0 12.7 12.7
90   END OF DATA
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99   HOLE HG4    HYDROLOGY DATA
88     2    4     3.87     5.85    0.0767   0.00508    0.8998   0.000600    5.00
11    16 29 00   16 44 00    0.0825    0.0891   0.0      -133.0   12.9 12.8
21    17  9 18   17 39 18    0.9845    0.9861   3.6420   3.6420 12.8 12.7
22    17 54 35   18 24  0    1.2392    1.2394   3.6180   3.6180 12.6 12.6
12    19 24 33   19 42 33    0.0810    0.0810   0.0       -70.0   12.6 12.7
88     4    4     5.78     7.76    0.0767   0.00508    1.1008   0.000600    5.00
11    14 11 21   14 21 51    0.0840    0.0839   0.0       -7.25   12.9 12.9
21    14 30 55   15 13 55    1.2000    1.2003   2.9600   2.9600 13.0 12.8
22    15 27 53   16 18 51    1.5090    1.5093   2.9300   2.9270 13.0 12.7
12    17 23 30   17 33 00    0.0834    0.0845   0.0       -10.5   12.7 12.7
88     6    4     7.81     9.79    0.0767   0.00508    0.3145   0.000600    5.00
11    16 01 00   16 11 00    0.0896    0.0897   0.0       -9.0    12.4 12.4
21    16 21  3   18 23  3    0.3382    0.3370   1.8578   1.8417 12.2 12.4
22    18 32 21   18 54 21    0.3631    0.3628   1.8397   1.8360 12.4 12.3
12    20 19 00   20 27 00    0.0902    0.0900   0.0       -9.2    12.2 12.3
88     8    3     9.87    11.85    0.0767   0.00508    0.0617   0.000600    5.00
21    13 38 35   14 11 35    0.3987    0.3979   3.9510   3.9498 12.6 12.7
22    14 16 40   14 53 40    0.4946    0.4937   3.9429   3.9421 12.6 12.8
12    15 22 41   15 52 49    0.0969    0.0963   0.0       -0.6    12.5 12.7
99   NRD 8,NOTE: SHUT IN LESS THAN TRANS. ZERO AND LESS THAN READ BEFORE INFLAT.
88    10    4    11.82    13.80    0.0776   0.00508    0.7642   0.000600    5.00
11    13  4 26   13 46 12    0.1020    0.1016   0.0       -0.8    12.9 12.9
21    14  5 29   14 38 17    0.8335    0.8335   3.8876   3.8858 12.9 12.9
22    14 42 50   15 19 50    1.0009    1.0009   3.8753   3.8750 12.9 12.9
12    16 01 00   16 41 00    0.1019    0.1014   0.0       -0.65   13.0 13.0
88    12    4    13.81    15.79    0.0776   0.00508    1.3276   0.000600    5.00
11     7 54 56    8 29 35    0.1068    0.1074   0.0       -4.95   13.0 13.0
21     8 36 44   10 57 52    1.4607    1.4592   3.3481   3.3379 13.1 13.0
22    11  3 46   13 45  0    1.5869    1.5856   3.3291   3.3217 13.1 13.1
12    14 22 00   14 52 00    0.1075    0.1069   0.0       -1.60   13.0 13.1
88    14    4    15.92    17.90    0.0776   0.00508    1.2185   0.000600    5.00
11    07 38 34   08 11 46    0.1123    0.1125   0.0       -4.00   13.0 13.2
21     8 20 54    8 49 40    1.3363    1.3370   3.0424   3.0424 13.0 13.1
22     9 54  7   11 59 34    1.6717    1.6735   3.0181   3.0106 12.9 13.1
12    12 39 36   13 19 40    0.1129    0.1136   0.0       -5.80   13.0 13.2
88    16    4    17.77    19.75    0.0776   0.00508    1.5022   0.000600    5.00
11     7 22 58    7 55 15    0.1182    0.1183   0.0       -3.05   13.0 13.0
21     8  6 47   10  7 32    1.6465    1.6463   2.9606   2.9550 13.0 13.0
22    10 13 46   12 14 54    2.0766    2.0766   2.9245   2.9116 12.9 13.0
12    13 43 56   14 17 29    0.0561    0.0563   0.0       -5.20   13.1 13.0
88    18    4    19.86    21.84    0.0776   0.00508    0.9072   0.000600    5.00
11     6 53 30    7 23 30    0.0632    0.0635   0.0       -1.20   12.9 12.9
21     7 32 11    8  3 49    0.9972    0.9926   2.9164   2.9164 12.8 12.9
22     8 22  2    8 50  2    1.2390    1.2380   2.9047   2.9038 12.9 12.9
12    10 06 18   10 38 18    0.0638    0.0634   0.0       -0.8    12.9 12.9
88    20    4    21.84    23.82    0.0190   0.00509    0.0216   0.000600    5.00
11    13 12 00   13 30 00    0.0681    0.0682   0.0        0.0    12.9 13.1
21    14  3 10   14 41 52    1.0092    1.0062   2.8635   2.8617 13.0 13.0
22    14 52 42   15 26 15    1.3042    1.3017   2.8477   2.8466 13.1 13.0
12    16  2 46   16 32 46    0.0677    0.0672   0.0       -0.6    13.0 13.0
88    22    4    23.81    25.79    0.0190   0.00509    0.8341   0.000600    5.00
11    20 05 00   21 14 49    0.0773    0.0758   0.0      -287.0   12.9 13.0
21    21 39 43    0 14 47    0.9178    0.9163   2.8431   2.7984 13.0 13.1
22     0 30 20    2 32 19    0.9987    0.9957   2.7890   2.7339 13.1 12.9
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12    3 30 04    4 25 26    0.0765    0.0769   0.0    -193.0    12.9 12.9
88   24    4   25.81    27.79    0.0190   0.00509    0.8462   0.000600    5.00
11   10 27 00   10 47 00    0.0905    0.0891   0.0    -262.0    13.0 13.1
21   10 55  0   11 53 29    0.9291    0.9302   2.7211 2.6566    13.0 12.9
22   12  9 26   12 39 26    1.0135    1.0141   2.6265 2.5753    13.0 13.0
12   12 47 12   13 49 51    0.0929    0.0884   0.0    -360.0    13.0 13.0
88   26    4   27.91    30.0     0.0190   0.00509    0.8484   0.000600    5.00
11    3  3 41    3 10  8    0.1551    0.1544   0.0    -510.0    13.0 13.0
21    5 22 12    5 55  0    1.0681    1.0685   3.3701 2.7665    13.0 13.0
22   05 59 51    6 20  7    1.0027    1.0008   2.7240 2.5120    13.1 13.1
12   08 37 20    8 42 20    0.1522    0.1521   0.0    -379.0    12.9 12.9
90   END OF DATA
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FILE: HG5PERM  SDATA    A1  06/09/81  14:46:24  UNIVERSITY OF WATERLOO  PAGE 001

99  HOLE HG5 HYDROLOGY DATA
88    0  12     2.14     4.61    0.2043   0.00508    0.3165
21  13 39      13 41       0.3419    0.3418            0.120 11.6 11.7-1.347 -1.346
22  14 04      14 06       0.3739    0.3738            0.190 11.9 11.7-1.347 -1.347
88    2   4     4.14     6.14    0.2043   0.00507    0.2901
21  13 41      13 43       0.3139    0.3140            0.010 10.6 10.6-1.348 -1.349
99  HG5 NRD4 NO FLOWRATE IS INDICATED
88    6  29     8.14    10.14    0.1987   0.00507    0.4329
21  13 19      13 21       0.4556    0.4556            0.070 10.4 10.6-1.357 -1.356
22  13 51      13 53       0.4935    0.4838            0.150 10.4 10.4-1.357 -1.357
23  14 41      14 43       0.5034    0.5033            0.158 11.0 10.9-1.359 -1.360
99  HG5 NRD8 NO FLOWRATE INDICATED
88   10  23   12.14    14.14    0.1987   0.00507    0.8468
21  14 02      14 03       0.9115    0.9115            2.090 10.5 10.6-1.358 -1.360
22  14 29      14 30       0.9408    0.9406            2.900 10.6 10.6-1.359 -1.359
23  14 49      14 50       0.9799    0.9797            4.090 10.6 10.7-1.359 -1.358
88   12  22   14.14    16.14    0.1987   0.00507    0.8677
21  12 42      12 43       0.9293    0.9292            4.14  11.2 11.3
22  13  7      13  7 21.0   .9625    0.9625            6.45  11.5 11.5
23  13 36 30   13 36 44.2 1.0078    1.0078            9.55  11.4 11.4
88   14  41   16.14    18.14    0.1987   0.00507    0.2152
21  10 56 00   10 56 40    0.2320    0.2320            4.260 11.0 10.9-1.360 -1.360
22  11 23 00   11 24 00    0.2450    0.2448            7.660 11.0 11.1-1.360 -1.360
23  11 49 40   11 50 00    0.2596    0.2595           12.910 11.0 11.0-1.361 -1.361
88   16  33   18.14    20.14    0.1987   0.00507    0.4611
21  08 27 45   08 28 15    0.4852    0.4852            3.590 10.7 10.6-1.364 -1.364
22  08 51 00   08 51 20    0.5122    0.5121           13.430 10.7 10.7-1.364 -1.364
23  09 13 00   09 13 30    0.5000    0.4998            8.370 10.8 10.8-1.363 -1.363
88   18  09   20.14    22.14    0.1935   0.00507    0.8791
21  14 38 00   14 39 00    0.9161    0.9161            5.200 11.0 11.0-1.358 -1.357
99  HG5 NRD18 NO REFERENCE TIMES FOR SECOND INCREMENT
99  HG5 NRD20 NO FLOWRATE IS INDICATED
88   22   2   24.14    26.14    0.1935   0.00507    0.2833
21  11 31      11 35       0.3020    0.3019            0.054 10.0  9.9-1.357 -1.358
88   24   5   26.14    28.14    0.1935   0.00507    0.2609
21  09 01      09 03       0.2719    0.2718            0.040 10.3 10.8-1.360 -1.360
99  HG5 NRD26 NOT TESTED
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FILE: RIPERM   SDATA    A1  06/09/81  15:13:03  UNIVERSITY OF WATERLOO  PAGE 001

99 HOLE R1 HYDROLOGY DATA
99 R1 NRD 20 NO FLOWRATES GIVEN
88    24    6   17.5     21.5     0.0351   0.005      0.590
21   16 41 40   16 46 40    0.553     0.652              1.5228
88   28     8   21.5     25.5     0.0351   0.005      0.543
21    7 33 20    7 50 00    0.615     0.614              0.1455
88   32     8   25.5     29.5     0.0351   0.005      0.477
21    7 33 20    7 50 00    0.541     0.540              0.0524
88   36     8   29.5     33.5     0.0351   0.005      0.695
21    7 33 20    7 50 00    0.758     0.757              0.1403
88   40     8   33.5     37.5     0.0351   0.005      0.803
21    7 33 20    7 50 00    0.862     0.860              0.1153
```

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FILE: R2PERM   SDATA    A1  06/09/81  15:16:41  UNIVERSITY OF WATERLOO  PAGE 001

99 HOLE R2 HYDROLOGY DATA
88     6    5     1.23     5.23    0.0351   0.005      0.278
21    7 05 00    7 08 20    0.346     0.347                2.2559
88    10    8     5.23     9.23    0.0351   0.005      0.268
21    7 33 20    7 50 00    0.299     0.298                0.2872
88    14    8     9.23    13.23    0.0351   0.005      0.165
21    7 33 20    7 50 00    0.589     0.588                0.0090
88    18    7    13.23    17.23    0.0351   0.005      0.498
21    7 31 40    7 48 20    0.588     0.587                0.0071
88    22    8    17.23    21.23    0.0351   0.005      0.586
21    7 33 40    7 50 00    0.605     0.604                0.0052
88    26    8    21.23    25.23    0.0351   0.005      0.617
21    7 01 40    7 18 20    0.677     0.675                0.0680
88    30    6    25.23    29.23    0.0351   0.005      0.758
21    7 11 40    7 16 40    0.811     0.811                0.9874
```

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99   HOLE R3    HYDROLOGY DATA        BUBBLE LINE USED
88     0  33     2.04     4.47    0.0590   0.00508    0.2027                                0.0412
21    9 10       9 14       0.2188    0.2188             0.042 10.4 10.1 0.4776 0.4780
22   11 47      11 51       0.2491    0.2490             0.076 10.1 10.0 0.4848 0.4847
23   12 59      13 03       0.2743    0.2745             0.141  9.7  9.8 0.4886 0.4888
12   13 20      13 50       0.0682    0.0706             0.0    9.9  9.9 0.4893 0.4913
99   R3 NRD2,NEGATIVE FLOW RATE,TEST DISCONTINUED,THERMO.ERROR,NO FLOW TEST DONE
88     2   1     3.98     6.41    0.0590   0.00508    0.2009                                0.0412
21    8 16       8 26       0.2164    0.2165             0.0   10.4 10.3 0.4537 0.4537
99   R3 NRD4,1ST INCR. NEGATIVE FLOW RATE TEST STOPPED
88     4   8     5.98     8.41    0.0590   0.00508    0.2421                                0.0412
22    9 23       9 31       0.3142    0.3144             0.020  9.8  9.8 0.4501 0.4475
12    9 47      11 07       0.0693    0.0690            -0.1    9.7  9.8 0.4448 0.4234
88     6  21     8.08    10.32    0.0516   0.00508    0.3942                                0.0412
21   12 46      12 47       0.4313    0.4313             2.62  10.8 10.9 0.5232 0.5234
22   13 36      13 37       0.4655    0.4652             5.86  10.9 10.9 0.5278 0.5277
23   14 22      14 23       0.4978    0.4976             8.70  10.9 10.9 0.5322 0.5324
12                           0.0770    0.0770           -30.0
12                           0.0770    0.0770           -19.0
99   R3 NRD 8;NOTE FLOW TEST RESULTS UNREASONABLE
88     8  17    10.02    12.26    0.0590   0.00508    0.4297                                0.0412
21    8 29       8 30       0.4699    0.4699             4.35  10.5 10.5 0.5991 0.5991
22    8 58       8 59       0.5010    0.5007             6.95  10.5 10.5 0.6003 0.6001
23   10 39      10 40       0.5268    0.5268             8.02  10.6 10.5 0.6018 0.6016
12   10 42      10 45       0.5265    0.5265           -37.7   10.5 10.5 0.6019 0.6019
88   10   31    12.09    14.33    0.0590   0.00508    0.3654                                0.0412
21    8  6       8  7       0.3987    0.3989             2.16  10.6 10.6 0.5947 0.5947
22    8 47       8 48       0.4229    0.4230             3.54  10.5 10.4 0.5950 0.5952
23   10 24      10 25       0.4209    0.4207             2.71  10.4 10.6 0.5949 0.5949
12                           0.0892    0.0895           -18.0
12   10 48      10 58       0.0891    0.0891           -17.0   10.4 10.5 0.5948 0.5948
88   12   26    14.0     16.24    0.0516   0.00508    0.3604                                0.0412
21    8 34       8 35       0.3923    0.3924             2.09  10.4 10.3 0.5947 0.5947
22    9  6       9  7       0.4195    0.4199             4.15   9.8  9.6 0.5953 0.5954
23   10 49      10 50       0.4501    0.4502             6.27  10.5 10.5 0.5967 0.5966
12                           0.0945    0.0943           -21.7
12   11 26      11 41       0.0943    0.0940           -20.0   10.7 10.8 0.5952 0.5946
88   14   28    15.95    18.19    0.0590   0.00508    0.1399                                0.0412
21   10 52      10 54       0.1493    0.1493             4.3   10.7 10.7 0.5920 0.5918
22   11 37      11 39       0.1577    0.1580             0.27  11.1 10.8 0.5919 0.5920
23   12 28      12 30       0.1719    0.1720             0.34  10.7 10.6 0.5920 0.5919
12   12 41      13 01       0.0926    0.0925            -0.2   10.8 10.7 0.5920 0.5921
88   16   26    17.96    20.20    0.0590   0.00508    0.1358                                0.0412
21    9 32       9 36       0.1467    0.1467             0.062 10.7 10.7 0.5900 0.5901
22   11 23      11 27       0.1540    0.1539             0.071 10.6 10.7 0.5899 0.5899
23   12 18      12 22       0.1665    0.1664             0.104 10.7 10.7 0.5903 0.5903
12   12 46      13  6       0.0977    0.0977            -0.22  10.7 10.8 0.5903 0.5902
88   18   26    19.97    22.21    0.0590   0.00508    0.2168                                0.0412
21    8 43       8 47       0.2344    0.2344             0.054 10.8 10.7 0.5912 0.5912
23   11 45      11 49       0.2672    0.2672             0.184 10.7 10.7 0.5909 0.5914
12   12 04      12 36       0.1034    0.1034            -2.88  10.7 10.8 0.5914 0.5919
88   20   22    22.01    24.25    0.0590   0.00508    0.3276                                0.0412
21    8 56       9 00       0.3564    0.3563             0.003 10.5 10.5 0.5893 0.5894
22   10 52      10 56       0.4046    0.4046             0.362 10.4 10.4 0.5898 0.5897
23   11 32      11 34       0.4329    0.4327             0.610 10.3 10.5 0.5900 0.5899
```

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12                          0.1040    0.1040          -2.2
99   R3 NRD 20, TIME PERIOD OF FLOWTEST WAS NOT RECORDED
99   R3 NRD 22, FIRST INCR. NEGATIVE FLOW
88    22  19    23.97    26.21    0.0590   0.00508    0.3445                          0.0412
21    8 49       8 53       0.3785    0.3785            0.0    10.4 10.4 0.5889 0.5890
22   10 36      10 38       0.4291    0.4291            0.192  10.4 10.5 0.5887 0.5887
23   11 12      11 14       0.4662    0.4662            0.367  10.5 10.5 0.5890 0.5891
12   11 27      11 53       0.1149    0.1149           -1.6    10.6 10.4 0.5889 0.5885
88    24  34    25.97    28.21    0.0590   0.00508    0.3706                          0.0412
21    9 31       9 35       0.4111    0.4111            0.011  10.4 10.4 0.5887 0.5888
22   11 50      11 54       0.4337    0.4337            0.133  10.3 10.4 0.5881 0.5882
23   12 35      12 37       0.4619    0.4619            0.362  10.9 10.9 0.5880 0.5880
12   13 03      13 21       0.1208    0.1207           -2.96
90   END OF DATA
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FILE: R4PERM    SDATA    A1  06/09/81  15:41:34  UNIVERSITY OF WATERLOO  PAGE 001

99  HOLE R4   HYDROLOGY DATA        BUBBLE LINE USED
99  R4 NRD4,FLOW TEST INFLOW HIGHLY VARIABLE,CRUDE ESTIMATE (L.T.1ML/MIN)
88     4  19     3.90     6.11   0.0540  0.00509    0.3486                    0.230
21   9 08       9 12       0.3651   0.3646            0.18              2.4337 2.4284
22  11 25      11 29       0.3898   0.3895            0.51              2.4068 2.4062
23  12  9      12 11       0.4051   0.4051            0.86              2.3958 2.3962
99  R4 NRD4 SURFACE TEMP.WAS NOT BEING MONITORED
88     6  19     5.90     8.11   0.0540  0.00509    0.3200                    0.230
21   8  8        8 12       0.3599   0.3599            0.31  11.2 10.9 2.5196 2.5265
22   9 03       9 05       0.3727   0.3726            0.47  10.8 11.1 2.4972 2.5013
23   9 37       9 39       0.3903   0.3904            0.63  10.9 11.1 2.5014 2.4949
12                          0.0908   0.0923           -2.5
99  R4 NRD 8,FLOWRATE MEASURED WITH OPEN LINE,GLASS CYLINDER NOT ACCURATE ENOUGH
88     8  19     7.90    10.11   0.0540  0.00509    0.3431                    0.230
21   8 05      08 09       0.3990   0.3986            0.042 11.0 10.9 2.6184 2.6506
22   9 01       9 05       0.4150   0.4149            0.042 11.0 11.0 2.6392 2.6386
23   9 32       9 36       0.4288   0.4286            0.056 10.9 10.9 2.6377 2.6391
12  10 58      11 02       0.0977   0.0979            0.0   10.9 11.0 2.6467 2.6471
99  R4 NRD 10,POSSIBLE READING ERROR W.R.T. THE FLOWRATE AT 8:08 FIRST INCR.
88    10  24     9.90    12.11   0.0540  0.00509    0.3882                    0.230
21   8 08       8 10       0.4225   0.4226            0.81  10.9 11.0 2.6937 2.6877
22   9 28       9 29       0.^509   0.4509            1.39  11.0 11.0 2.6738 2.6678
23  10 00      10 01       0.4753   0.4752            2.15  11.0 11.0 2.6620 2.6695
12  10 19      11 29       0.1211   0.1151           -6.5   11.2 11.1 2.6635 2.6664
88    12  26    11.90    14.11   0.0540  0.00509    0.3909                    0.230
21  14 42      14 43       0.4261   0.4259            0.746 11.1 11.2 2.7232 2.7371
22   8 07       8 09       0.4401   0.4397            0.921 11.0 11.0 2.7135 2.7042
23   8 54       8 56       0.4602   0.4603            1.25  11.1 11.0 2.7043 2.7084
12   9 40      10 07       0.1393   0.1406           -4.89  11.0 10.9 2.7146 2.7275
88    14  14    13.90    16.11   0.0540  0.00509    0.2734                    0.230
21  10 35      10 47       0.2947   0.2946            0.055 11.2 11.2 3.3491 3.3364
22  12 03      12 11       0.3166   0.3165            0.100 11.2 11.3 3.3263 3.3214
23  12 58      13 02       0.3381   0.3380            0.149 10.6 11.1 3.2903 3.2894
12  13 18      13 40       0.1429   0.1428           -0.382 11.1 11.2 3.2874 3.2618
88    16  14   15.80    18.01   0.0540  0.00509    0.2966                    0.230
21   7 38       7 47       0.3238   0.3238            0.010 11.1 11.1 3.1682 3.1871
22   8 53       9 02       0.3673   0.3672            0.018 11.1 11.1 3.1818 3.1875
23   9 36       9 42       0.4064   0.4065            0.029 11.1 11.1 3.1851 3.1894
12  10 42      11 02       0.1586   0.1594           -0.26  11.0 10.8 3.1695 3.1552
88    18  21   17.82    20.03   0.0540  0.00509    0.3661                    0.230
21  13 47      13 49       0.3983   0.3981            0.39  11.0 11.0 3.1604 3.1621
22  14 23      14 25       0.4307   0.4308            0.57  11.0 11.0 3.1569 3.1560
23  14 48      14 49       0.4482   0.4484            0.610 11.0 11.1 3.1480 3.1614
11                          0.1728   0.1780           -2.6
11                          0.1728   0.1780           -2.4
12  14 56      15 08       0.1728   0.1780           -2.34  11.1 10.9 3.1596 3.1535
88    20  21   19.80    22.01   0.0540  0.00509    0.4259                    0.230
21   7  2       7 04       0.4654   0.4652            0.480 10.8 10.9 3.1673 3.1620
22   7 40       7 42       0.4844   0.4848            0.622 11.3 10.9 3.1794 3.1838
23   8 22       8 24       0.5041   0.5042            0.870 10.9 10.9 3.1823 3.1763
11                          0.1857   0.1860           -2.27
12   8 40       9 12       0.1857   0.1859           -2.10  10.9 10.7 3.1726 3.1510
88    22  16   21.92    24.13   0.0540  0.00509    0.3882                    0.230
21  12 56      12 58       0.4217   0.4217            0.04  10.9 10.9 3.2970 3.2919
22  13 28      13 32       0.4540   0.4542            0.07  10.9 10.9 3.2594 3.2640
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23  13 56     13 58      0.4883   0.4884          0.10  10.9 10.8 3.2465 3.2504
11  14 08     14 14      0.1998   0.2000         -0.73
12  14 26     14 40      0.2001   0.2002         -0.70  10.8 10.8 3.1928 3.2102
88   24  22   23.92   26.13   0.0540  0.00509   0.525                     0.230
21   8  3      8 04      0.5611   0.5610          0.91  10.8 10.9 3.1819 3.1935
22   8 31      8 33      0.5801   0.5800          1.18  10.9 10.9 3.1417 3.2101
23   8 55      8 57      0.6034   0.6033          1.60  10.9 10.8 3.2654 3.3068
12   9 15      9 22      0.2141   0.2150         -6.3   10.8 10.9 3.4184 3.4123
99  R4 NRO 24, NO FLOW READING
88   26  22   25.85   28.06   0.0540  0.00509   0.5217                    0.230
21  12 28     12 32      0.5300   0.5300          0.082 10.9 11.0 3.3834 3.3900
22  13 10     13 11      0.6235   0.6230          2.13  10.9 10.8 3.4048 3.4041
23  13 40     13 41      0.6685   0.6685          2.98  10.9 10.8 3.3148 3.3165
99  R4 NRO 28, 2ND INCR. ACTUALLY 2ND PART OF FIRST INCR.
88   28   5   27.93   30.0    0.0565  0.00509   0.5305                    0.052
21  15 24     15 32      0.6277   0.6276          0.031 10.8 10.7 0.5711 0.5724
22   7 43      7 59      0.6255   0.6256          0.009 10.8 10.8 0.5870 0.5866
12   8 37      8 49      0.1416   0.1420         -0.025 10.7 10.7 0.5862 0.5863
90  END OF DATA
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FILE: R5PERM    SDATA    A1  06/09/81  15:47:51  UNIVERSITY OF WATERLOO  PAGE 001

99  HOLE R5  HYDROLOGY DATA          BUBBLE LINE USED
88     2   7     2.13     4.24    0.1935  0.00511    0.2489                          -.12
21  13 48       13 50      0.2542    0.2544            0.0    10.8 10.5-1.365 -1.364
22  14 14       14 16      0.2587    0.2587            0.0    10.3 11.0-1.351 -1.346
12  14 19       14 24      0.1994    0.1996            0.0    11.0 10.8-1.346 -1.344
88     4  27     4.26     6.37    0.1935  0.00511    0.4560                          -.12
21  13 43       13 45      0.4783    0.4779            4.6    11.0 11.0-1.339 -1.337
22  14 23       14 25      0.4944    0.4945            0.58   11.0 11.1-1.335 -1.335
23  14 50       14 52      0.5079    0.5084            0.76   11.0 11.0-1.333 -1.333
12  15 02       15 02      0.2081    0.2081           -3.0    10.7 10.7-1.201 -1.201
88     6  24     6.32     8.43    0.1935  0.00511    0.4380
11  09 07       10 17      0.2056    0.2078           -1.26   10.7 10.7
21  13 30       13 32      0.4528    0.4629            0.14   13.0 12.9
22  13 57       13 59      0.4761    0.4759            0.198  12.9 12.9
23  14 16       14 18      0.4900    0.4902            0.268  12.9 12.9
12  14 42       14 42      0.2075    0.2075           -1.37   10.6 10.6
99  R5 NRD 6,THERMOSTAT RESULTS NOT VALID
88     8  11     8.37    10.48    0.1935  0.00511    0.4466                          0.327
11  14 59                  0.2103    0.2103           -0.73
21  11 19       11 21      0.4338    0.4739            0.011  12.9 12.9 3.381  3.202
22  11 43       11 45      0.4996    0.4998            0.020  13.1 13.0 3.382  3.387
12  11 57       12 34      0.2128    0.2128           -0.55
88    10   6    10.52    12.63    0.1935  0.00511    0.3517                          0.327
11  13 10       13 23      0.2178    0.2195           -0.5
21   8 33        8 35      0.3718    0.3717            0.0    11.7 11.7 3.436  3.435
88    12   7    12.56    14.67    0.1935  0.00511    0.3705                          0.327
11  09 16       11 02      0.2224    0.2238           -0.30
21  12 31       12 33      0.3904    0.3903            0.0    11.7 11.6 3.448  3.450
88    14   3    14.67    16.78    0.1935  0.00511    0.3937                          0.327
11  12 59       13 26      0.2274    0.2285           -0.39
21  09 09        9 14      0.4137    0.4139            0.0    11.6 11.7 3.560  3.561
12   9 24       10 59      0.2263    0.2259           -0.57   11.6 11.7 3.562  3.563
88    16   7    16.79    18.90    0.1935  0.00511    0.5705                          0.327
11  12 50       13 15      0.2315    0.2319           -0.37
21   9 00        9  2      0.6080    0.6080            0.011  12.9 13.0 3.586  3.586
12   9 10       10 36      0.2291    0.2291           -0.38
88    18   5    18.82    20.93    0.1935  0.00511    0.6444                          0.327
21  14 22       14 24      0.6890    0.6889            0.011  10.2 10.3 3.590  3.590
88    20  16    21.02    23.13    0.1935  0.00511    0.8068                          0.327
21   8 18        8 19      0.8726    0.8726            1.88   10.8 10.8 3.604  3.605
12   8 39        8 53      0.2420    0.2419           -12.5   10.8 10.7 3.605  3.606
99  R5 NRD 22, TEST UNSECCESSFUL
88    24   4    25.17    27.28    0.1935  0.00511    0.3783                          0.327
11  11 43       11 59      0.2507    0.2519           -0.04
21  12 55       12 57      0.4564    0.4565            0.0    10.8 10.7 3.614  3.614
99  R5 NRD 26  TEST UNSUCCESSFUL
90  END OF DATA
```

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99 HOLE R6 HYDROLOGY DATA
88     4    4     2.00     6.00    0.0351   0.005      0.176
21    7 43 20    8 00 00    0.213     0.212                0.0258
88     8    5     3.77     7.77    0.0351   0.005      0.305
21    7 18 20    7 20 00    0.365     0.364                3.5575
88    12    4     7.77    11.77    0.0351   0.005      0.306
21    7 01 40    7 03 20    0.389     0.387                4.0230
88    16    8    11.77    15.77    0.0351   0.005      0.402
21    7 16 40    7 33 20    0.485     0.483                0.0591
88    20    6    15.77    19.77    0.0351   0.005      0.536
21    7 21 40    7 26 40    0.617     0.616                1.4315
88    24    8    19.77    23.77    0.0351   0.005      0.511
21   11 38 20   11 41 40    0.597     0.597                0.6260
88    28    4    23.77    27.77    0.0351   0.005      0.575
21    6 50 00    6 53 20    0.642     0.641                2.7260
88    32    8    27.77    31.77    0.0351   0.005      0.527
21    7 11 40    7 16 40    0.596     0.595                0.1953
88    36    8    31.77    35.77    0.0351   0.005      0.593
21    7 53 20    7 56 40    0.669     0.669                0.0337
88    40    8    35.77    39.77    0.0351   0.005      0.789
21   12 11 40   12 16 40    0.848     0.847                0.4283
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FILE: R7PERM    SDATA    A1  06/09/81  15:53:25  UNIVERSITY OF WATERLOO  PAGE 001

99 HOLE R7 HYDROLOGY DATA
88     6    8     1.77     5.77    0.0351   0.005      0.215
21    8 03 20    8 20 00    0.294     0.293                0.0784
88    10    7     5.77     9.77    0.0351   0.005      0.229
22    7 50 00    8 23 20    0.321     0.319                0.1141
88    14    8     9.77    13.77    0.0351   0.005      0.345
21    8 05 20    8 22 00    0.411     0.411                0.0113
88    18    8    13.77    17.77    0.0351   0.005      0.458
21   11 00 40   11 17 20    0.642     0.651                0.0870
88    22    8    17.77    21.77    0.0351   0.005      0.505
21    7 58 20    8 15 00    0.564     0.563                0.1861
88    26    6    21.77    25.77    0.0351   0.005      0.530
21   11 46 40   11 51 40    0.552     0.552                0.0992
88    30    5    25.77    29.77    0.0351   0.005      0.406
21    8 48 20    9 05 00    0.443     0.441                0.3817
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99   HOLE R8 HYDROLOGY DATA
88     2   4    3.97     6.00   0.0595  0.00504   0.1412  0.000611    4.91    0.145
11   15 28 45  16 00 03   0.0662   0.0662   0.0     -2.8    12.7 12.6
21   16 37 08  16 57 43   0.1472   0.1472   4.224    4.224  12.7 12.5
22   17 21 31  17 33 31   0.1511   0.1516   4.223    4.222  12.5 12.7
12   17 44 46  18 13 56   0.0657   0.0656   0.0     -1.7    12.6 12.7
88     4   4    6.03     8.06   0.0595  0.00504   0.0702  0.000611    4.91    0.145
11   12 30 46  13 03 27   0.0703   0.0702   0.0     -3.4    12.6 12.7
21   16 50 49  17 00 56   0.1243   0.1201   4.229    4.232  12.6 12.6
22   17 09 29  17 21 43   0.1289   0.1282   4.228    4.229  12.6 12.6
12   17 27 03  17 37 40   0.0704   0.0703   0.0     -1.2    12.5 12.5
88     6   5    8.04    10.07   0.0595  0.00504   0.2833  0.000611    4.91    0.145
11    7 44 53   8 18 15   0.0755   0.0753   0.0     -4.3    12.5 12.5
21    8 44 57  11 47 08   0.2944   0.2940   4.214    4.22   12.6 12.5 1.4925 1.4905
22   11 51 57  12 11 56   0.3059   0.3052   4.219    4.219  12.5 12.5 1.4927 1.4911
23   12 16 24  12 39 17   0.3172   0.3151   4.218    4.218  12.6 12.6 1.4918 1.4921
12   13 18 06  13 39 06   0.0756   0.0756   0.0     -2.85   12.5 12.5 1.4920 1.4952
99   TEST ERROR IN NRD 8  ,RESULTS NOT VALID
88    10   4   10.01    12.02   0.0606  0.00504   0.4445  0.000611    4.91    0.145
11   13 29 28  14 00 48   0.0866   0.0861   0.0     -3.2    12.9 12.8 1.5534 1.5475
21   15 49 11  16  9 42   0.4523   0.4514   3.927    3.925  13.0 12.9 1.5585 1.5618
22   16 15 57  16 35 28   0.5210   0.5208   3.921    3.920  12.8 12.9 1.5631 1.5498
12   16 45 27  17 16 48   0.0859   0.0862   0.0     -2.8    12.9 12.9 1.5457 1.5468
88    12   3   14.01    16.04   0.0606  0.00504   0.4142  0.000611    4.91    0.145
21    7 46 23   8  6 46   0.4510   0.4511   3.931    3.932  13.0 13.0 1.5465 1.5425
22    8 12 42   8 30 18   0.4866   0.4850   3.930    3.929  13.0 13.0 1.5429 1.5499
12    8 53 29   9 24 52   0.0902   0.0906   0.0     -4.2    13.0 13.0 1.5445 1.5449
88    14   3   16.02    18.05   0.0415  0.00508   0.4845  0.000611    4.91    0.145
21   18 45 21  19  4 17   0.5266   0.5263   4.158    4.158  12.8 12.8 1.4214 1.4227
22   19  9 29  19 28 56   0.5705   0.5702   4.154    4.155  12.8 12.8 1.4225 1.4219
12   19 40 55  20  5 15   0.0949   0.0950   0.0     -7.1    12.8 12.8 1.4214 1.4217
88    16   4   18.05    20.08   0.0585  0.00508   0.3272  0.000611    4.91    0.145
21    7  4 56   7 27 17   0.3554   0.3562   4.164    4.165  12.7 12.7 1.4215 1.4219
22    7 31  5   7 52 44   0.3808   0.3806   4.163    4.163  12.7 12.7 1.4216 1.4212
23    7 55 54   8  2 19   0.4611   0.4634   4.156    4.155  12.7 12.7 1.4211 1.4206
12    8 18 19   8 49 20   0.0990   0.1006   0.0     -5.9    12.7 12.7 1.4213 1.4227
88    18   3   19.99    22.02   0.0585  0.00508   0.5138  0.000611    4.91    0.145
21   13 58 40  14 18 25   0.5513   0.5609   4.136    4.135  12.7 12.7 1.4236 1.4236
22   14 22 58  14 42 34   0.6054   0.6060   4.132    4.130  12.7 12.8 1.4239 1.4242
12   13 20 12  13 30 39   0.1050   0.1049   0.0     -8.43   12.7 12.7 1.4239 1.424
88    20   4   22.02    24.05   0.0585  0.00508   0.4978  0.000611    4.91    0.145
11   18 02 36  18 05 12   0.1130   0.1132   0.0     -10.6   12.7 12.8 1.4239 1.4237
21   18 19 50  18 32 33   0.5423   0.5416   4.062    4.055  12.8 12.8 1.4247 1.4243
22   18 36 26  18 55 36   0.5862   0.5867   4.048    4.034  12.8 12.8 1.4249 1.4246
12   19 14 47  19 16 38   0.1128   0.1132   0.0     -9.15   12.8 12.8 1.4243 1.4245
88    22   4   24.01    26.04   0.0585  0.00508   0.4986  0.000611    4.91    0.145
11   12 13 38  12 45 14   0.1174   0.1176   0.0    -248.0   13.1 13.2 1.4237 1.4228
21   12 57 53  13 31 41   0.5461   0.5457   3.953    3.840  13.2 13.2 1.4233 1.4237
22   13 36 49  13 55 46   0.5868   0.5857   3.822    3.766  13.2 13.2 1.4238 1.4224
12   14 20 09  14 35 01   0.1156   0.1160   0.0    -128.0   13.3 13.2 1.4234 1.4236
88    24   4   26.63    28.04   0.0585  0.00508   0.4293  0.000611    4.91    0.145
11   19 17 43  19 27 57   0.1168   0.1159   0.0     -9.2    13.1 13.1 1.7662 1.7466
21   19 36 43  19 58 35   0.4569   0.4665   3.739    3.737  13.1 13.1 1.7505 1.7708
22   20 01 37  20 28  7   0.5032   0.5027   3.734    3.730  13.0 13.1 1.7703 1.7546
12    7 22 39   7 28 14   0.1169   0.1159   0.0     -7.80   13.0 12.9 1.5903 1.6208
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88    26    4   28.09    30.04    0.0579   0.00509    0.1205   0.000608    4.91    0.145
11   17 20 00   18  6 00    0.1222    0.1224   0.0     -0.3     13.2 13.2 1.3757 1.3816
21   18 22 46   18 39 20    0.6003    0.6010   1.929    1.780   13.2 13.3 1.3813 1.3848
22   19  4  1   19 32  1    0.5033    0.5032   1.610    1.433   13.4 13.4 1.3862 1.3865
12   20 00 34   20 23 20    0.1216    0.1222   0.0     -1.4     13.2 13.2 1.3853 1.3857
99   NRD 20 SECOND TIME
88    20    4   21.99    24.02    0.0585   0.00504    0.4641   0.000611    4.91    0.145
11   11 49 15   11 51 15    0.1099    0.1103   0.0     -7.95    13.1 13.1 1.5738 1.5723
21   12 04 50   13 01 14    0.5041    0.5036   3.608    3.594   13.1 13.0 1.5730 1.5657
22   13 08 38   14 05 27    0.5463    0.5466   3.589    3.568   13.1 13.1 1.5653 1.5789
12   14 18 43   14 49 18    0.1105    0.1104   0.0     -133.0   13.1 13.0 1.5784 1.5735
90   END OF DATA
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99  HOLE R9  HYDROLOGY DATA
88     2   4    3.99    6.02   0.0515  0.00508   0.3350  0.000606   4.95   0.145
11  08 10 44  08 24 41   0.0732   0.0734   0.0    -8.5   13.1 13.0 1.5926 1.6041
21   8 40  7  12 26 45   0.3630   0.3645   3.432   3.421 13.0 12.9 1.5952 1.6011
22  12 32  3  14 32  3   0.3923   0.3934   3.419   3.407 12.9 12.9 1.5934 1.5874
12  15 17 47  15 30 29   0.0741   0.0740   0.0    -8.40  13.0 13.0 1.5748 1.6243
99  NRD 4 TEST FAILED, INTERVAL PRESSURE LESS THAN OPEN HOLE PRESSURE, NO FLOW.
88     6   3    8.01   10.04   0.0515  0.00508   0.1892  0.000606   4.95   0.145
11  11 28 57  11 53 01   0.1001   0.0997   0.0    -0.60  13.1 13.0 1.4762 1.4695
21  12 15 10  12 47 47   0.2009   0.1992   3.082   3.082 13.1 13.1 1.4813 1.4873
22  13 15 27  13 54 42   0.2231   0.2239   3.082   3.081 13.0 13.1 1.4912 1.4889
88     8   4   10.05   12.08   0.0515  0.00508   0.4351  0.000606   4.95   0.145
11   8  5 16   8 39 12   0.1162   0.1144   0.0    -3.4   13.0 13.0 1.5665 1.5768
21   8 52  5   9 23  6   0.4733   0.4733   2.736   2.736 13.0 13.0 1.5797 1.5779
22  11 15 44  11 43  3   0.5597   0.5596   2.731   2.730 13.1 13.1 1.5755 1.5682
12  11 52 47  12 22 47   0.1135   0.1143   0.0    -0.11  13.1 13.1 1.5518 1.5488
88    10   4   12.03   14.06   0.0515  0.00508   0.2720  0.000606   4.95   0.145
11  16 46 27  17 16 27   0.1259   0.1257   0.0    -3.3   13.2 13.2 1.6083 1.6323
21  17 27 16  17 54 56   0.2935   0.2920   2.132   2.132 13.2 13.2 1.6344 1.6282
22  17 59 36  18 29 36   0.3604   0.3586   2.128   2.128 13.2 13.2 1.6095 1.610
12  18 50 30  19 14 30   0.1266   0.1263   0.0     0.0   13.2 13.2 1.6147 1.6139
88    12   4   14.02   16.05   0.0515  0.00508   0.4247  0.000606   4.95   0.145
11  13 20 10  13 30 10   0.1414   0.1415   0.0    -1.15  13.3 13.3 1.6634 1.6609
21  13 39 47  14  0 56   0.4639   0.4625   1.791   1.792 13.4 13.3 1.6616 1.6557
22  14  5 53  14 28 43   0.5741   0.5749   1.788   1.787 13.3 13.2 1.6519 1.6569
12  14 39 11  14 49 11   0.1413   0.1409   0.0    -0.5   13.4 13.3 1.6429 1.6407
88    14   4   16.06   18.09   0.0577  0.00508   0.3177  0.000606   4.95   0.145
11  18 53 17  19 17 17   0.1613   0.1614   0.0    -0.75  13.2 13.2 1.4725 1.4833
21  19 46 49  20  2  7   0.3476   0.3479   4.258   4.258 13.2 13.2 1.5011 1.5055
22  20  7 56  20 29 18   0.4227   0.4227   4.252   4.251 13.2 13.2 1.5049 1.4962
12   6 57 59   7 22  2   0.1608   0.1603   0.0    -0.90  13.3 13.2 1.5829 1.5795
88    16   4   18.07   20.10   0.0577  0.00508   0.5450  0.000606   4.95   0.145
11  14 48 18  14 52 27   0.1761   0.1767   0.0   -10.60  13.4 13.5 1.6243 1.6195
21  16 28 53  18 17  8   0.5953   0.5973   3.973   3.954 13.5 13.4 1.6554 1.6434
22  18 29 53  20  6  0   0.6423   0.6460   3.946   3.914 13.5 13.4 1.6424 1.6340
12  20 18 18  20 22 18   0.1758   0.1761   0.0   -11.00  13.5 13.5 1.6373 1.6396
88    18   4   20.02   22.05   0.0577  0.00508   0.5456  0.000606   4.95   0.145
11  16 07 10  16 17 10   0.1882   0.1887   0.0    -9.4   13.4 13.4 1.6984 1.7025
21  16 32 40  17  4 40   0.5979   0.5968   3.579   3.577 13.4 13.4 1.7033 1.7067
22  17 11 17  18 53 45   0.6437   0.6413   3.572   3.564 13.4 13.6 1.7081 1.7131
12  19  7 45  19 17 45   0.1880   0.1888   0.0    -9.3   13.6 13.6 1.7274 1.7233
88    20   5   22.04   24.07   0.0577  0.00508   0.5547  0.000606   4.95   0.145
11   7  8 17   7 28 17   0.2148   0.2143   0.0   -405.0  13.5 13.5 1.7244 1.7196
21   7 49 17   8 17 48   0.6040   0.6028   3.542   3.406 13.5 13.6 1.7084 1.7239
22   8 22  0   8 42 44   0.6345   0.6342   3.384   3.276 13.6 13.7 1.7232 1.7267
23   8 48 21   9  8 21   0.6547   0.6561   3.243   3.126 13.7 13.7 1.7187 1.7241
12  10 51 51  11 13 31   0.2143   0.2160   0.0   -500.0  13.6 13.6 1.7378 1.7143
88    22   4   24.00   26.03   0.0577  0.00508   0.5747  0.000606   4.95   0.145
11  18 05 03  18 35 03   0.2189   0.2187   0.0   -135.0  13.6 13.6 1.7227 1.7253
21  18 44 18  19 57  8   0.6276   0.6590   2.453   2.406 13.6 13.6 1.7032 1.7251
22  20  0 55  20 28  0   0.6802   0.6800   2.403   2.384 13.6 13.6 1.7309 1.7334
12   6 38 48   7  6 48   0.2195   0.2190   0.0   -111.0  13.4 13.5 1.6517 1.7852
99  NRD 24, AT START OF FIRST FLOW TEST TEMPS AND PRES.NOT REC. ASSUMED CONSTANT
88    24   4   26.01   28.04   0.0577  0.00508   0.5008  0.000606   4.95   0.145
11  12 23 31  13 09 31   0.0017   0.0017   0.0    -65.0  13.4 13.4 1.7009 1.7009
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21   13 16 35   14 10 35    0.5476    0.5452    2.096    2.080 13.5 13.5 1.7131 1.5799
22   14 13 50   14 58  1    0.5908    0.5870    2.077    2.059 13.5 13.4 1.5842 1.6009
12   15 10 00   15 20 00    0.2299    0.2308    0.0    -25.0   13.4 13.4 1.6169 1.5922
88    26    4   28.06    30.03    0.0579   0.00508    0.2300   0.000606    4.95    0.145
11   11 14 13   11 44 13    0.2485    0.2499    0.0      0.0   13.3 13.3 1.5992 1.6086
21   11 56 26   12 27  2    0.6044    0.6046    1.978    1.974 13.3 13.4 1.6298 1.6314
22   12 30  1   12 58  1    0.7002    0.7031    1.969    1.968 13.4 13.4 1.6441 1.6047
12   13 34 10   14 06 38    0.2482    0.2486    0.0     -0.95  13.4 13.3 1.6161 1.6582
90   END OF DATA
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99   HOLE R10  HYDROLOGY DATA
88     2   4    3.83     5.81    0.0788   0.00507    0.6067   0.000606    4.95
11   19  9 30  19 18  1    0.0801    0.0822    0.0     -9.25   13.1 13.1
21   19 49 10  20 23 31    0.6782    0.6771    2.897    2.891 13.3 13.2
22    6 35 50   7 12 50    0.6805    0.7151    2.889    2.881 13.1 13.1
12    8 21 52   8 26  1    0.0801    0.0812    0.0     -9.30   13.2 13.1
88     4   4    5.87     7.85    0.0788   0.00507    0.7631   0.000606    4.95
11   16 55 54  17 25 55    0.0852    0.0854    0.0    -67.0    13.1 13.1
21   17 47 50  19 10 12    0.8542    0.8561    2.770    2.751 13.3 13.1
22   19 16 24  20 30 24    0.9208    0.9219    2.746    2.730 13.1 13.0
12    6 54 13   6 58 17    0.0855    0.0851    0.0     -9.5    12.9 13.0
88     6   4    7.90     9.88    0.0788   0.00507    0.5779   0.000606    4.95
11   14 24 55  14 32 11    0.0393    0.0889    0.0    -10.35   13.1 13.1
21   14 49 36  15 31 21    0.6282    0.6286    2.571    2.569 13.3 13.2
22   16 17 51  18 41 12    0.7766    0.7769    2.556    2.546 13.3 13.2
12   19 02  1  19 16  1    0.0880    0.0885    0.0    -10.4    13.2 13.2
88     8   4    9.88    11.86    0.0788   0.00507    0.5792   0.000606    4.95
11    8  2 30   8  8 30    0.0945    0.0956    0.0    -10.3    13.2 13.2
21    8 23 15   9 18 17    0.6309    0.6307    2.223    2.198 13.4 13.3
22   11 30 46  13  2 57    0.6826    0.6840    2.165    2.139 13.2 13.2
12   13 37 42  14  7 42    0.0953    0.0946    0.0    -103.0   13.2 13.2
88    10   4   11.8     13.78    0.0788   0.00507    0.4939   0.000606    4.95
11    6 40 15   6 42 15    0.1000    0.1003    0.0     -6.6    13.2 13.1
21    7 14 45   7 58 45    0.5366    0.5365    1.855    1.835 13.3 13.4
22    8 10 17   8 45 42    0.5772    0.5757    1.822    1.806 13.3 13.3
12    9 13 11  10 40  5    0.1005    0.1002    0.0    -110.7   13.3 13.2
88    12   4   13.87    15.85    0.0794   0.00507    0.6556   0.000606    4.95
11    8 18  9   8 36 40    0.1131    0.1132    0.0    -10.05   13.3 13.5
21    8 49 19  10 50 50    0.7114    0.7107    3.939    3.939 13.5 13.4
22   11 14 18  12 21 36    0.8871    0.8875    3.918    3.915 13.4 13.4
12   13 25 40  13 45 40    0.1108    0.1113    0.0     -7.3    13.5 13.5
88    14   4   15.84    17.82    0.0794   0.00507    0.4972   0.000606    4.95
11    8 47 45   9  7 45    0.1101    0.1112    0.0     -9.8    13.5 13.4
21   11  8 53  12 24  9    0.5506    0.5446    3.636    3.610 13.5 13.4
22   12 28 57  13 31 40    0.5820    0.5782    3.604    3.584 13.5 13.4
12   14  7 13  14 25 13    0.1101    0.1105    0.0     -9.7    13.4 13.4
88    16   4   17.85    19.83    0.0794   0.00507    0.3661   0.000606    4.95
11   12  5 39  12 15 39    0.1127    0.1128    0.0     -6.2    13.6 13.6
21   12 45 15  13 10 34    0.3983    0.3991    2.499    2.497 13.8 13.7
22   13 23 17  15 23 20    0.4789    0.4792    2.469    2.456 13.7 13.6
12   16 20  8  16 40  8    0.1122    0.1129    0.0    -10.8    13.6 13.6
88    18   4   19.85    21.83    0.0794   0.00507    0.3460   0.000606    4.95
11    8 43 00  10 28 00    0.1179    0.1180    0.0    -83.0    13.5 13.5
21   10 57 57  11  8 57    0.3753    0.3750    2.127    2.125 13.5 13.5
22   11 14 20  12  5 20    0.3995    0.3997    2.117    2.103 13.4 13.5
12   12 36  1  12 51 00    0.1174    0.1175    0.0     -9.4    13.5 13.4
88    20   4   21.80    23.78    0.0730   0.00507    1.2049   0.000606    4.95
11   14 55 15  15 03 21    0.1323    0.1324    0.0     -9.0    13.2 13.1
21   15 27 25  16  1 54    1.2434    1.2424    1.226    1.225 13.1 13.2
22   16 14 48  17  2 48    1.4314    1.4312    1.218    1.217 13.2 13.2
12   17 32 00  17 40 00    0.1214    0.1215    0.0     -8.6    13.0 13.1
88    22   4   24.03    26.06    0.0579   0.00509    0.1689   0.000606    4.95
11   12 41 49  13 11 49    0.0881    0.0819    0.0     -6.9    13.2 13.3
21   13 24 10  13 57 14    0.1811    0.1816    2.628    2.627 13.2 13.3
22   14  1 18  14 15 18    0.2143    0.2142    2.624    2.622 13.2 13.3
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FILE: R10PERM  SDATA    A1  06/09/81  14:50:40  UNIVERSITY OF WATERLOO  PAGE 002

12   16 16  0   16 46  0    0.0779    0.0776    0.0      -6.85 13.2 13.2
88    24    4   26.01    28.04    0.0579   0.00509   0.1038   0.000606    4.95
11    7  5 14    7 35 14    0.0768    0.0769    0.0      -0.6  13.0 13.0
21   14 25  5   16  1  5    0.2141    0.2129    2.621    2.612 13.3.13.2
22    8 27 15    8 53 52    0.4018    0.4005    2.506    2.467 13.1 13.1
12   10 10 17   10 40 17    0.0768    0.0768    0.0      -0.3  13.1 13.1
88    26    4   28.08    30.04    0.0574   0.00509   0.5066   0.000606    4.95
11   18 20  0   18 37 00    0.0770    0.0769    0.0     -10.6  13.3 13.2
21   18 53 55   19 23 00    0.5586    0.5585    2.402    2.401 13.3 13.2
22   19 30 00   20 40 00    0.7071    0.7059    2.393    2.378 13.3 13.3
12    6 36 22    6 50 22    0.0770    0.0766    0.0      -9.4  13.2 13.3
90   END OF DATA
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B-3.2 Subsurface Boreholes, 2-m and 4-m Interval Tests

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99   SINGLE FRACTURE DATA FOR HG3
99   NOTE SOME TESTS HAD TEN (30) AND ELEVIN (31) INCREMENTS
88    1.7  3     1.61     1.95    0.1850   0.7381     0.2093
11                                 0.1745                -0.36
21    8 08       8 20       0.2199   0.2200              0.02   11.4 11.4
21    8 20       8 24       0.2200   0.2201              0.0    11.4 11.5
88    2.5  6     2.33     2.67    0.1858   0.7381     0.2102
11                                 0.1830                -0.31
21   12 30      12 46       0.2144   0.2147              0.00421 11.5 11.6
21   12 46      12 58       0.2147   0.2147              0.00661 11.5 11.5
21   12 58      13 18       0.2147   0.2147              0.00341 11.5 11.5
21   13 18      13 30       0.2148   0.2148              0.00571 11.5 11.5
21   13 30      13 54       0.2148   0.2148              0.00381 11.5 11.5
99   NRD 5.4 FLOWRATE BEFORE SHUT-IN 0.15 ML/MIN, ZERO FLOW
99   NRD 6.4 FLOWRATE 0.0 ML/MIN
99   NRD 7.2 FLOWRATE 0.0 ML/MIN
99   NRD 9.8 FLOWRATE 0.0 ML/MIN
88   10.4  6    10.27    10.61    0.1850   0.7381     0.2312
11                                 0.1949                -0.28
21    8 00       8 02       0.2628   0.2629              0.02   11.6 11.5
21    8  2       8  4       0.2629   0.2629              0.02   11.5 11.4
21    8  4       8  6       0.2629   0.2629              0.017  11.4 11.5
21    8  6       8  8       0.2629   0.2629              0.017  11.5 11.5
21    8  8       8 10       0.2629   0.2629              0.017  11.5 11.4
99   NRD 12.2 FLOWRATE BEFORE SHUT-IN 0.0 ML/MIN
88   15.2  4    15.01    15.35    0.1850   0.7381     0.2349
11                                 0.2018                -0.13
21   11 07      11  9       0.2613   0.2612              0.01   11.5 11.5
21   11  9      11 11       0.2612   0.2612              0.006  11.5 11.5
21   11 11      11 13       0.2512   0.2613              0.0    11.5 11.5
99   NRD 18.2  FLOWRATE BEFORE SHUT-IN 0.25 ML/MIN, NO FLOW
88   18.9  5    18.75    19.09    0.1850   0.7381     0.2428
11                                 0.2067                -0.30
21    8 55       8 57       0.2637   0.2635              0.01   11.4 11.4
21    8 57       8 59       0.2635   0.2635              0.006  11.4 11.4
21    8 59       9 01       0.2635   0.2636              0.01   11.4 11.3
21    9  1       9  3       0.2636   0.2635              0.01   11.3 11.3
88   20.8  4    20.66    21.00    0.1850   0.7381     0.2760
11                                 0.2107                -0.20
21   12 48      12 50       0.2918   0.2912              0.0    12.0 11.9
21   12 50      12 52       0.2912   0.2915              0.0    11.9 12.0
21   12 52      12 54       0.2915   0.2915              0.0    12.0 11.9
88   23.0  8    22.96    23.30    0.1850   0.7381     1.0367
11                                 0.2141                -0.40
21    8 31       8 33       1.1103   1.1104              0.02   11.1 11.2
21    8 33       8 35       1.1104   1.1104              0.018  11.2 11.3
21    8 35       8 37       1.1104   1.1097              0.019  11.3 11.3
21    8 37       8 39       1.1097   1.1098              0.025  11.3 11.2
21    8 39       8 41       1.1098   1.1096              0.019  11.2 11.3
21    8 41       8 43       1.1096   1.1090              0.019  11.3 11.3
21    8 43       8 45       1.1090   1.1091              0.016  11.3 11.3
88   27.0 80    27.23    27.47    0.1850   0.7381     0.9666
11                                 0.2203                -3.9
11                                                       -4.1
21    8 11       8 13       1.0475   1.0478              0.718  11.2 11.2
```

21	8	13		8	15		1.0478	1.0477		0.684	11.2	11.2
21	8	15		8	17		1.0477	1.0475		0.689	11.2	11.3
21	8	17		8	19		1.0475	1.0477		0.678	11.3	11.1
21	8	19		8	21		1.0477	1.0476		0.689	11.1	11.2
21	8	21		8	23		1.0476	1.0477		0.689	11.2	11.2
22	8	47		8	49		1.1210	1.1207		1.373	11.2	11.2
22	8	49		8	51		1.1207	1.1203		1.367	11.2	11.2
22	8	51		8	53		1.1203	1.1200		1.384	11.2	11.2
22	8	53		8	55		1.1200	1.1298		1.328	11.2	11.3
22	8	55		8	57		1.1298	1.1299		1.322	11.3	11.2
22	8	57		8	59		1.1299	1.1299		1.316	11.2	11.2
22	8	59		9	01		1.1298	1.1298		1.328	11.2	11.2
23	9	14		9	15		1.2011	1.2007		2.153	11.1	11.1
23	9	15		9	16		1.2007	1.2005		2.034	11.1	11.2
23	9	16		9	17		1.2005	1.2002		2.062	11.2	11.1
23	9	17		9	18		1.2002	1.2001		2.068	11.1	11.1
23	9	18		9	19		1.2001	1.2002		2.062	11.1	11.1
23	9	19		9	20		1.2002	1.2000		2.040	11.1	11.2
23	9	20		9	21		1.2000	1.2001		2.062	11.2	11.1
24	9	37		9	38		1.2792	1.2792		2.802	11.1	11.1
24	9	38		9	39		1.2792	1.2788		2.842	11.1	11.2
24	9	39		9	40		1.2788	1.2785		2.655	11.2	11.2
24	9	40		9	41		1.2785	1.2781		2.656	11.2	11.1
24	9	41		9	42		1.2781	1.2782		2.678	11.1	11.2
24	9	42		9	43		1.2782	1.2781		2.701	11.2	11.2
24	9	43		9	44		1.2781	1.2780		2.701	11.2	11.1
24	9	44		9	45		1.2780	1.2777		2.712	11.1	11.1
25	10	00		10	00	39.5	1.3617	1.3616		3.433	11.1	11.1
25	10	01		10	01	41.4	1.3616	1.3613		3.300	11.1	11.2
25	10	02		10	02	21.1	1.3613	1.3613		3.213	11.2	11.2
25	10	03		10	03	20.1	1.3607	1.3607		3.213	11.1	11.1
25	10	04		10	04	19.7	1.3510	1.3610		3.442	11.1	11.1
25	10	05		10	05	20.3	1.3608	1.3608		3.340	11.2	11.2
25	10	06		10	06	20.3	1.3506	1.3606		3.340	11.2	11.2
25	10	07		10	07	20.1	1.3601	1.3601		3.213	11.2	11.2
26	10	27		10	27	11.8	1.4346	1.4341		5.746	11.3	11.2
26	10	27	30	10	27	46.9	1.4341	1.4341		4.012	11.2	11.2
26	10	28		10	28	16.7	1.4341	1.4341		4.060	11.2	11.2
26	10	29		10	29	17.3	1.4341	1.4336		3.919	11.2	11.2
26	10	30		10	30	16.7	1.4336	1.4336		4.060	11.2	11.2
26	10	31		10	31	16.7	1.4336	1.4333		4.060	11.2	11.1
26	10	32		10	32	17.0	1.4333	1.4333		3.988	11.1	11.1
26	10	33		10	33	16.7	1.4333	1.4321		4.060	11.1	11.2
27	10	52		10	52	22.7	1.3494	1.3494		2.987	11.2	11.2
27	10	52	30	10	52	52.9	1.3494	1.3494		2.961	11.2	11.2
27	10	53		10	53	21.0	1.3494	1.3486		3.229	11.2	11.2
27	10	54		10	54	21.0	1.3486	1.3486		3.229	11.2	11.2
27	10	55		10	55	23.8	1.3486	1.3487		2.849	11.2	11.2
27	10	56		10	56	22.7	1.3487	1.3487		2.987	11.2	11.2
27	10	57		10	57	22.4	1.3487	1.3481		3.027	11.2	11.3
27	10	58		10	58	22.7	1.3481	1.3481		2.987	11.3	11.3
27	10	59		10	59	22.8	1.3481	1.3481		2.974	11.3	11.2
28	11	16		11	16	28.9	1.2803	1.2803		2.346	11.3	11.3
28	11	17		11	17	28.7	1.2800	1.2800		2.362	11.2	11.2
28	11	18		11	18	29.3	1.2797	1.2797		2.314	11.2	11.2

Elapsed time in secs (Not required)

28	11	20	11	20	29.3	1.2800	1.2800		2.314	11.2	11.2
28	11	22	11	22	28.7	1.2794	1.2794		2.362	11.2	11.2
28	11	24	11	24	27.7	1.2789	1.2789		2.448	11.3	11.3
28	11	25	11	25	28.7	1.2790	1.2790		2.362	11.3	11.3
28	11	26	11	26	28.7	1.2791	1.2791		2.362	11.3	11.3
29	11	46	11	46	43.4	1.1957	1.1957		1.562	11.3	11.3
29	11	47	11	47	44.0	1.1953	1.1953		1.541	11.3	11.3
29	11	48	11	48	43.9	1.1949	1.1949		1.544	11.3	11.3
29	11	49	11	49	43.7	1.1948	1.1947		1.551	11.3	11.3
29	11	50	11	50	39.7	1.1946	1.1946		1.708	11.3	11.3
29	11	51	11	51	42.0	1.1947	1.1947		1.614	11.3	11.3
29	11	52	11	52	41.7	1.1948	1.1948		1.626	11.3	11.3
29	11	53	11	53	41.8	1.1948	1.1948		1.622	11.3	11.3
29	11	54	11	54	41.8	1.1949	1.1949		1.622	11.3	11.3
30	12	13	12	15		1.1157	1.1156		1.000	11.4	11.3
30	12	15	12	17		1.1156	1.1155		1.008	11.3	11.3
30	12	17	12	19		1.1155	1.1154		1.006	11.3	11.3
31	12	31	12	33		1.0292	1.0288		0.381	11.2	11.4
31	12	33	12	35		1.0288	1.0291		0.322	11.4	11.3
31	12	35	12	37		1.0291	1.0289		0.370	11.3	11.4
31	12	37	12	39		1.0289	1.0286		0.339	11.4	11.4
31	12	39	12	41		1.0286	1.0289		0.370	11.4	11.3
88	28	37	28.39		28.73	0.1850	0.7381	1.0070			
21	10	29	10	31		1.0828	1.0827		1.020	11.2	11.3
21	10	31	10	33		1.0827	1.0822		1.023	11.3	11.2
21	10	33	10	35		1.0822	1.0821		1.025	11.2	11.1
21	10	35	10	37		1.0821	1.0818		0.977	11.1	11.1
21	10	37	10	39		1.0818	1.0817		0.932	11.1	11.2
21	10	41	10	43		1.0820	1.0820		0.961	11.3	11.3
21	10	43	10	45		1.0820	1.0816		0.955	11.3	11.2
21	10	45	10	47		1.0816	1.0817		0.932	11.2	11.2
21	10	47	10	49		1.0817	1.0816		0.932	11.2	11.2
21	10	49	10	51		1.0816	1.0815		0.932	11.2	11.2
22	11	11	11	12		1.1824	1.1820		2.960	11.2	11.1
22	11	12	11	13		1.1820	1.1817		2.271	11.1	11.2
22	11	13	11	15		1.1817	1.1816		2.124	11.2	11.1
22	11	15	11	16		1.1814	1.1815		2.102	11.3	11.2
22	11	16	11	17		1.1815	1.1816		2.136	11.2	11.2
22	11	17	11	18		1.1816	1.1816		2.147	11.2	11.2
22	11	18	11	19		1.1816	1.1815		2.068	11.2	11.3
22	11	19	11	20		1.1815	1.1814		2.068	11.3	11.3
22	11	20	11	21		1.1814	1.1810		2.091	11.3	11.1
22	11	21	11	22		1.1810	1.1811		2.091	11.1	11.2
23	11	41	11	41	24.7	1.2396	1.2396		2.745	11.2	11.2
23	11	41 30	11	41	54.9	1.2396	1.2396		2.723	11.2	11.2
23	11	42	11	42	24.9	1.2395	1.2395		2.723	11.3	11.3
23	11	43	11	43	25.0	1.2395	1.2395		2.712	11.3	11.3
23	11	44	11	44	25.2	1.2394	1.2393		2.690	11.3	11.2
23	11	45	11	45	25.1	1.2392	1.2392		2.701	11.2	11.2
23	11	46	11	46	24.8	1.2392	1.2391		2.734	11.2	11.3
23	11	47	11	47	24.8	1.2391	1.2391		2.734	11.3	11.3
23	11	48	11	48	25.1	1.2390	1.2390		2.701	11.3	11.2
23	11	49	11	49	25.2	1.2389	1.2389		2.690	11.2	11.2
23	11	50	11	50	25.2	1.2389	1.2389		2.690	11.2	11.2
23	11	50 30	11	50	55.1	1.2389	1.2389		2.701	11.2	11.2

24	12 15	12 17	1.0822	1.0818	0.568	11.2	11.2
24	12 17	12 19	1.0818	1.0818	0.749	11.2	11.3
24	12 19	12 21	1.0819	1.0821	0.729	11.3	11.3
24	12 21	12 23	1.0821	1.0816	0.735	11.3	11.2
24	12 23	12 25	1.0816	1.0820	0.737	11.2	11.3

99 END OF HOLE

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99 HOLE HG4 SINGLE FRARTURE HYDROLOGY DATA
88    8    11      8.03      8.53    0.0653   0.7367     0.0666
21    8 10         8 14        0.0708    0.0708            0.023 11.4 11.4 0.595 0.594
21    8 14         8 18        0.0708    0.0709            0.008 11.4 11.5 0.594 0.594
21    8 18         8 22        0.0709    0.0708            0.020 11.5 11.5 0.594 0.593
21    8 22         8 26        0.0709    0.0708            0.008 11.5 11.5 0.593 0.595
21    8 26         8 30        0.0708    0.0708            0.003 11.5 11.4 0.594 0.593
21    8 30         8 34        0.0708    0.0709            0.062 11.4 11.5 0.593 0.595
21    8 34         8 38        0.0709    0.0710            0.011 11.5 11.5 0.595 0.594
21    8 38         8 42        0.0710    0.0709            0.003 11.5 11.5 0.594 0.593
21    8 42         8 46        0.0709    0.0711            0.000 11.5 11.4 0.593 0.593
21    8 46         8 50        0.0711    0.0709            0.003 11.4 11.6 0.593 0.594
12                                                        -0.091
88   10     3     9.99     10.48    0.0653   0.7367     0.1288
21    8 56         9 00        0.1423    0.1422            0.000 11.3 11.3 0.593 0.593
21    9 00         9 04        0.1422    0.1423            0.000 11.3 11.2 0.593 0.593
21    9 04         9 08        0.1423    0.1425            0.000 11.2 11.3 0.593 0.594
88   15.5    4    15.46     15.95    0.0653   0.7367     0.1029
21   18 09        18 13        0.1088    0.1072            0.025 11.4 11.5 0.588 0.589
21   18 13        18 15        0.1072    0.1072            0.000 11.5 11.5 0.589 0.589
21   18 15        18 17        0.1072    0.1072            0.000 11.5 11.5 0.589 0.589
21   18 17        18 19        0.1072    0.1072            0.000 11.5 11.5 0.589 0.588
88   20     3    19.71     20.20    0.0653   0.7367     0.1111
21   14 29        14 31        0.1172    0.1174            0.230 12.2 12.2 0.589 0.589
21   14 33        14 35        0.1174    0.1174            0.000 12.2 12.2 0.589 0.589
21   14 35        14 37        0.1174    0.1171            0.000 12.2 12.2 0.589 0.589
88   20.5    6    20.53     21.02    0.0653   0.7367     0.5871
21    8 16         8 18        0.6356    0.6355            0.000 11.1 11.1 0.513 0.512
21    8 18         8 20        0.6355    0.6353            0.000 11.1 11.1 0.512 0.511
21    8 20         8 22        0.6353    0.6351            0.00571 11.1 11.2 0.511 0.510
21    8 22         8 24        0.6351    0.6350            0.00571 11.2 11.2 0.510 0.511
21    8 24         8 25        0.6350    0.6349            0.000 11.2 11.2 0.511 0.509
12                                                        -0.400
88   26.5    2    26.39     26.88    0.0653   0.7367     0.3089
21    7 51         7 55        0.3315    0.3293            0.000 11.4 11.5 0.526 0.526
21    7 55         7 59        0.3293    0.3294            0.000 11.5 11.5 0.526 0.526
88   27.2    4    26.39     26.88    0.0653   0.7367     0.8825
21    7 26         7 31        0.9462    0.9461            0.016 11.5 11.4 0.548 0.548
21    7 31         7 35        0.9461    0.9456            0.014 11.4 11.5 0.548 0.550
21    7 35         7 39        0.9456    0.9449            0.014 11.5 11.5 0.550 0.549
21    7 39         7 43        0.9449    0.9444            0.014 11.5 11.6 0.549 0.550
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99 HOLE R3 SINGLE FRACTURE HYDROLOGY DATA
88    6.5  9      6.41      6.75    0.1795   0.7381      0.1999
11                                                          -0.22
11                                                          -0.19
21   10 50       10 52        0.6502    0.6599              0.048 11.3 11.4
21   10 52       10 54        0.6599    0.6598              0.042 11.4 11.4
21   10 54       10 56        0.6598    0.6597              0.045 11.4 11.3
21   10 56       10 58        0.6597    0.6598              0.045 11.3 11.3
21   10 58       11 00        0.6598    0.6598              0.042 11.3 11.3
21   11 00       11  2        0.6598    0.6597              0.045 11.3 11.2
21   11  2       11  4        0.6597    0.6598              0.042 11.2 11.3
88   10.3 21     10.16    10.50    0.1795   0.7381      0.6832
11                                                          -26.50
21    7 45        7 45 18.8 0.7471    0.7470                7.21  11.4 11.5
21    7 45 30     7 45 48.6 0.7470    0.7469                7.29  11.5 11.5
21    7 46        7 46 18.6 0.7469    0.7468                7.29  11.5 11.6
21    7 47        7 47 18.8 0.7468    0.7468                7.21  11.6 11.6
21    7 47 30     7 47 49.0 0.7468    0.7468                7.14  11.6 11.5
21    7 48        7 48 19.1 0.7468    0.7467                7.10  11.5 11.4
21    7 48 30     7 48 49.3 0.7467    0.7467                7.03  11.4 11.4
21    7 49        7 49 19.1 0.7467    0.7466                7.10  11.4 11.4
21    7 49 30     7 49 49.3 0.7466    0.7466                7.03  11.4 11.4
21    7 50        7 50 19.5 0.7466    0.7465                6.95  11.4 11.4
21    7 50 30     7 50 49.8 0.7465    0.7464                6.85  11.4 11.4
21    7 51        7 51 19.7 0.7464    0.7461                6.88  11.4 11.5
21    7 52        7 52 19.5 0.7461    0.7461                6.95  11.4 11.5
21    7 53        7 53 19.7 0.7461    0.7458                6.88  11.5 11.5
21    7 54        7 54 19.8 0.7458    0.7457                6.85  11.5 11.5
21    7 54 40     7 54 59.9 0.7457    0.7457                6.81  11.5 11.6
21    7 55 20     7 55 40.0 0.7457    0.7456                6.78  11.6 11.6
21    7 56        7 56 20.1 0.7456    0.7454                6.75  11.6 11.5
21    7 58        7 58 20.1 0.7454    0.7451                6.75  11.5 11.5
21    7 59 40     8 00        0.7451    0.7451              6.78  11.5 11.5
88   12.6  7     12.45    12.79    0.1795   0.7381      0.4929
21   10 50       10 52        0.5209    0.5210              0.011 11.9 12.0
21   10 52       10 54        0.5210    0.5208              0.008 12.0 12.0
21   10 54       10 56        0.5208    0.5209              0.008 12.0 12.0
21   10 56       10 58        0.5209    0.5209              0.014 12.0 12.1
21   10 58       11 00        0.5209    0.5210              0.011 12.1 12.1
21   11 00       11 02        0.5210    0.5210              0.011 12.1 12.0
21   11 02       11 04        0.5210    0.5212              0.011 12.0 12.1
88   14.0  5     13.79    14.13    0.1795   0.7381      0.3171
11                                                          -0.25
21    8  7        8  9        0.3375    0.3374              0.0   11.3 11.1
21    8  9        8 11        0.3374    0.3374              0.0   11.1 11.2
21    8 11        8 13        0.3374    0.3375              0.0   11.2 11.2
12                                                          -0.20
88   15.9  6     15.76    16.10    0.1795   0.7381      0.6712
21   14 12       14 14        0.7180    0.7179              0.034 11.8 11.6
21   14 14       14 16        0.7179    0.7180              0.028 11.6 11.7
21   14 16       14 18        0.7180    0.7177              0.034 11.7 11.7
21   14 18       14 20        0.7177    0.7178              0.028 11.7 11.6
21   14 20       14 22        0.7178    0.7174              0.028 11.6 11.6
21   14 22       14 24        0.7174    0.7174              0.028 11.6 11.6
88   21.6  4     21.44    21.78    0.1795   0.7381      0.2551
```

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11                                                          -0.30
21   14 11      14 13      0.2717    0.2717                 0.0    11.4 11.4
21   14 13      14 15      0.2717    0.2718                 0.0    11.4 11.6
21   14 15      14 17      0.2718    0.2718                 0.0    11.6 11.5
88   23.1 16    22.93    23.27    0.1795   0.7381      0.6455
11                                                          -1.6
11                                                          -1.33
21    7 57       7 59      0.6470    0.6470                 0.023 11.5 11.5
21    7 59       8  1      0.6470    0.6468                 0.017 11.5 11.5
21    8  1       8  3      0.6468    0.6467                 0.017 11.5 11.5
21    8  3       8  5      0.6467    0.6466                 0.017 11.5 11.5
22    8 16       8 18      0.6914    0.6911                 0.215 11.6 11.6
22    8 18       8 20      0.6911    0.6909                 0.198 11.6 11.7
22    8 20       8 22      0.6909    0.6910                 0.192 11.7 11.9
22    8 22       8 24      0.6910    0.6908                 0.198 11.7 11.7
22    8 24       8 26      0.6908    0.6907                 0.201 11.7 11.6
22    8 26       8 28      0.6907    0.6907                 0.192 11.6 11.6
22    8 28       8 30      0.6906    0.6904                 0.175 11.6 11.7
22    8 30       8 32      0.6904    0.6905                 0.186 11.7 11.6
22    8 32       8 34      0.6905    0.6903                 0.195 11.6 11.6
22    8 34       8 36      0.6903    0.6903                 0.195 11.6 11.7
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99 HOLE R4 SINGLE FRACTURE HYDROLOGY DATA
88  13.15 5    14.96    15.45    0.1486   0.7366     0.0910
21  08 00      08 02       0.2039    0.2039             0.418
21  08 02      08 04       0.2039    0.2038             0.424
21  08 04      08 06       0.2038    0.2038             0.412
21  08 06      08 08       0.2038    0.2040             0.418
21  08 08      08 10       0.2040    0.2040             0.418
88  16.5  6     8.24     8.73    0.1486   0.7366     0.2641
21  07 45      07 47       0.2763    0.2764             0.000
21   7 47       7 49       0.2764    0.2764             0.011
21   7 49       7 51       0.2763    0.2765             0.006
21   7 51       7 53       0.2765    0.2764             0.00
21   7 53       7 55       0.2764    0.2765             0.006
21   7 55       7 57       0.2765    0.2762             0.006
88  18.1  4    19.87    20.36    0.1486   0.7366     0.1605
21  12 39      12 41       0.1679    0.1676             0.011
21  12 41      12 43       0.1576    0.1675             0.011
21  12 43      12 45       0.1675    0.1676             0.011
21  12 45      12 47       0.1676    0.1673             0.011
88  18.9  9    20.65    21.14    0.1486   0.7366     0.1346
21  11 58      12 00       0.1515    0.1517             0.017
21  12  0       12  2       0.1517    0.1518             0.017
21  12  2       12  4       0.1518    0.1518             0.023
21  12  4       12  6       0.1518    0.1517             0.017
21  12  6       12  8       0.1517    0.1517             0.023
21  12  8       12 10       0.1517    0.1517             0.017
21  12 10       12 12       0.1517    0.1519             0.023
21  12 12       12 14       0.1519    0.1518             0.017
21  12 14       12 16       0.1518    0.1516             0.017
88  19.8  8    21.58    22.07    0.1486   0.7366     0.3094
21   8 27       8 29       0.3288    0.3289             0.339
21   8 29       8 31       0.3289    0.3288             0.344
21   8 31       8 33       0.3288    0.3288             0.311
21   8 33       8 35       0.3288    0.3287             0.311
21   8 35       8 37       0.3287    0.3287             0.299
21   8 37       8 39       0.3287    0.3285             0.299
21   8 39       8 41       0.3285    0.3284             0.294
21   8 41       8 43       0.3284    0.3283             0.294
88  24.9  7    26.65    27.14    0.1486   0.7366     0.1458
21  12 32      12 33       0.1548    0.1544             0.113
21  12 33      12 35       0.1544    0.1547             0.039
21  12 35      12 41       0.1547    0.1546             0.021
21  12 41      12 43       0.1546    0.1546             0.023
21  12 43      12 45       0.1546    0.1546             0.017
21  12 45      12 47       0.1546    0.1543             0.011
21  12 47 20   12 49 20    0.1543    0.1544             0.011
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99   R5SF PERMDATA
88    9.8   5     9.60    9.94     0.0557   0.7381     0.2628
21   11 08       11 10       0.3110    0.3110            0.0    11.6 11.6-1.360 -1.359
21   11 10       11 12       0.3110    0.3113            0.011  11.6 11.7-1.359 -1.360
21   11 12       11 14       0.3113    0.3113            0.006  11.7 11.6-1.360 -1.359
21   11 14       11 16       0.3113    0.3113            0.006  11.6 11.7-1.359 -1.360
21   11 16       11 18       0.3113    0.3113            0.006  11.7 11.7-1.360 -1.360
88   10.3   5    10.09   10.43     0.0557   0.7381     0.1096
11                                                        -0.25
21   14   2      14   4       0.2154    0.2153            0.0    11.7 11.7-1.357 -1.358
21   14   4      14   6       0.2153    0.2153            0.006  11.7 11.7-1.358 -1.357
21   14   6      14   8       0.2153    0.2154            0.006  11.7 11.7-1.357 -1.357
21   14   8      14 10       0.2154    0.2155            0.006  11.7 11.7-1.359 -1.359
88   12.7   5    12.54   12.88     0.0557   0.7381     0.2303
11                                                        -0.21
21    7 48        7 50       0.2496    0.2497            0.0    11.7 11.6-1.360 -1.361
21    7 50        7 52       0.2497    0.2496            0.0    11.6 11.8-1.361 -1.360
21    7 52        7 54       0.2496    0.2497            0.0    11.8 11.8-1.361 -1.361
21    7 54        7 56       0.2497    0.2497            0.0    11.8 11.8-1.361 -1.361
88   26     5    25.92   26.26     0.0557   0.7381     0.2675
11                                                        -0.33
21    7 53        7 55       0.2967    0.2970            0.0    12.1 12.1-1.361 -1.361
21    7 55        7 57       0.2970    0.2970            0.006  12.1 12.1-1.361 -1.361
21    7 57        7 59       0.2970    0.2969            0.006  12.1 12.0-1.361 -1.360
21    7 59        8  1       0.2969    0.2969            0.006  12.0 12.0-1.360 -1.360
88   27.1   5    26.95   27.29     0.0557   0.7381     0.4225
21   11 28       11 30       0.4566    0.4564            0.011  12.0 12.0-1.353 -1.354
21   11 30       11 32       0.4364    0.4565            0.0    12.0 11.9-1.354 -1.353
21   11 32       11 34       0.4365    0.4564            0.006  11.9 11.9-1.353 -1.352
21   11 34       11 36       0.4554    0.4565            0.006  11.9 11.9-1.352 -1.353
21   11 36       11 38       0.4565    0.4565            0.006  11.9 12.0-1.352 -1.353
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FILE: R8SF      PERMDATA B1  01/28/81  10:37:00  UNIVERSITY OF WATERLOO  PAGE 001

99 HOLE R8 SINGLE FRACTURE HYDROLOGY DATA
99 R8 NRD 1 NEGATIVE FLOWRATES
99 R8 NRD 2 NO INJECTION TESTS DONE DUE TO NEGLIGIBLE FLOWRATES
99 R8 NRD 2.5 NEGATIVE FLOWRATES
99 R8 NRD 3 NO INJECTION TESTS DONE DUE TO ZERO FLOWRATES
88    3.5  5     3.31     4.15    0.0571   0.7367     0.0749
21   08 53      09 00      0.1095    0.1095              0.018 12.0 11.9 0.6689 0.6687
21   09 00      09 09      0.1095    0.1094              0.014 11.9 12.1 0.6687 0.6686
21   09 09      09 20      0.1094    0.1093              0.011 12.1 11.9 0.6686 0.6685
21   09 20      09 31      0.1093    0.1094              0.010 11.9 11.7 0.6685 0.6684
21   09 31      09 39      0.1094    0.1093              0.010 11.7 12.0 0.6684 0.6683
88    4.5  3     4.08     4.92    0.0571   0.7367     0.6079
21   12 40      12 41      0.6661    0.6656              3.5   12.0 12.0 0.6577 0.6577
21   12 41      12 42      0.6656    0.6651              3.6   12.0 12.1 0.6577 0.6577
21   12 42      12 43      0.6651    0.6647              3.6   12.1 12.1 0.6577 0.6577
99 R8 NRD 4.5 FLOWRATES MAY NOT BE VALID
88    5.5  1     5.27     5.73    0.0508   0.7367     0.1039
21   09 13      09 17      0.1141    0.1140              0.017 11.6 11.8 0.6323 0.6321
88   10    12    9.80    10.26    0.0508   0.7367     0.0740
21   08 49      08 51      0.1278    0.1278              0.220 11.9 11.9 0.6145 0.6144
21   08 51      08 53      0.1278    0.1278              0.198 11.9 11.7 0.6144 0.6145
21   08 53      08 55      0.1278    0.1280              0.209 11.7 11.7 0.6145 0.6146
21   08 55      08 57      0.1280    0.1278              0.192 11.7 11.7 0.6146 0.6145
21   08 57      08 59      0.1278    0.1278              0.198 11.7 11.7 0.6145 0.6143
21   08 59      09 01      0.1278    0.1278              0.181 11.7 11.8 0.6143 0.6144
21   09 01      09 03      0.1278    0.1276              0.186 11.8 11.7 0.6144 0.6145
21   09 03      09 05      0.1276    0.1276              0.192 11.7 11.6 0.6145 0.6143
21   09 05      09 07      0.1276    0.1276              0.181 11.6 11.6 0.6143 0.6144
21   09 07      09 09      0.1276    0.1277              0.158 11.6 11.7 0.6144 0.6143
21   09 09      09 11      0.1277    0.1278              0.175 11.7 11.7 0.6143 0.6143
21   09 11      09 13      0.1278    0.1277              0.181 11.7 11.7 0.6143 0.6141
88   10.5  5    10.44    10.90    0.0508   0.7367     0.2090
21   08 14      08 18      0.2246    0.2244              0.020 11.5 11.5 0.6068 0.6068
21   08 18      08 22      0.2244    0.2243              0.020 11.5 11.5 0.0608 0.0607
21   08 22      08 26      0.2243    0.2242              0.014 11.5 11.5 0.0607 0.0608
21   08 26      08 30      0.2242    0.2242              0.014 11.5 11.4 0.6068 0.6066
21   08 30      08 34      0.2242    0.2242              0.014 11.4 11.6 0.6066 0.6065
99 R8 NRD 11.5 ZERO FLOWRATES ON FLOWTEST
99 R8 NRD 13.25 ZERO FLOWRATES ON FLOWTEST
99 R8 NRD 19.25 ZERO FLOWRATES ON FLOWTEST
99 R8 NRD 21.5 TELETYPE NOY LOCATED
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99 HOLE R9 SINGLE FRACTURE HYDROLOGY DATA
88   1     3    2.75     3.09    0.1845  0.7381     0.3834
11                                                     -0.10
21  14 18      14 20      0.3993    0.3994             0.0    12.4 12.5
21  14 20      14 22      0.3994    0.3995             0.0    12.5 12.5
21  14 22      14 24      0.3995    0.3994             0.0    12.5 12.3
88   2     5    8.99     9.33    0.1845  0.7381     0.5166
11                                                     -0.25
21  08 03      08 05      0.5460    0.5460             0.0    12.2 12.3
21  08 05      08 07      0.5460    0.5459             0.006  12.3 12.2
21  08 07      08 09      0.5459    0.5460             0.0    12.2 12.2
21  08 09      08 11      0.5460    0.5460             0.006  12.2 12.2
88   3     3   11.18    11.52    0.1845  0.7381     0.5571
11                                                     -0.06
21  13 06      13 08      0.5883    0.5883             0.0    12.3 12.3
21  13 08      13 10      0.5883    0.5883             0.0    12.3 12.2
21  13 10      13 12      0.5883    0.5882             0.0    12.2 12.3
99 HOLE R9 NRD 4 ZERO FLOWRATES ON FLOWTESTS
88   5     3   19.71    20.05    0.1845  0.7381     0.4847
11                                                     -0.14
21  08 05      08 07      0.4419    0.4418             0.0    11.7 11.8
21  08 07      08 09      0.4418    0.4421             0.0    11.8 11.8
21  08 09      08 11      0.4421    0.4422             0.008  11.8 11.7
21  08 11      08 13      0.4422    0.4420             0.0    11.7 11.8
88   8     8   24.10    24.44    0.1845  0.7381     0.5783
11                                                     -1.5
21  11 36      11 38      0.6178    0.6177             0.33   11.9 12.0
21  11 38      11 40      0.6177    0.6177             0.30   12.0 11.9
21  11 40      11 42      0.6177    0.6178             0.30   11.9 11.9
21  11 42      11 44      0.6178    0.6176             0.29   11.9 11.9
21  11 44      11 46      0.6176    0.6177             0.29   11.9 11.9
21  11 46      11 48      0.6177    0.6174             0.29   11.9 11.9
21  11 48      11 50      0.6174    0.6174             0.29   11.9 11.9
21  11 50      11 52      0.6174    0.6175             0.29   11.9 12.0
88   9     4   25.57    26.09    0.1845  0.7381     0.3702
11                                                     -0.11
21  08 09      08 11      0.4301    0.4302             0.0    11.6 11.7
21  08 11      08 13      0.4302    0.4301             0.006  11.7 11.7
21  08 13      08 15      0.4301    0.4302             0.006  11.7 11.8
21  08 15      08 17      0.4302    0.4302             0.0    11.8 11.8
88  10     9   26.86    27.20    0.1845  0.7481     0.5958
11                                                     -1.10
21  12 52      12 54      0.6617    0.6616 0.7381      0.32   11.8 11.8
21  12 54      12 56      0.6516    0.6616             0.34   11.8 11.9
21  12 56      12 58      0.6516    0.6615             0.32   11.9 11.9
21  12 58      13 00      0.6615    0.6614             0.32   11.9 11.9
21  13 00      13 02      0.6514    0.6613             0.33   11.9 11.9
21  13 02      13 04      0.6613    0.6614             0.32   11.9 11.8
21  13 04      13 06      0.6514    0.6614             0.33   11.8 11.7
21  13 06      13 08      0.6514    0.6615             0.32   11.7 11.7
21  13 08      13 10      0.6615    0.6614             0.32   11.7 11.8
88  10    62   26.86    27.20    0.1845  0.7381     0.5951
11                                                     -1.35
21  10 44      10 46      0.6405    0.6405             0.26   11.5 11.5
21  10 46      10 48      0.6405    0.6404             0.25   11.5 11.5
```

21	10	48	10	50	0.6404	0.6404	0.26	11.5	11.5
21	10	50	10	52	0.6404	0.6404	0.25	11.5	11.6
21	10	52	10	54	0.6404	0.6405	0.25	11.6	11.5
22	11	04	11	06	0.6750	0.6749	0.44	11.6	11.5
22	11	06	11	08	0.6749	0.6751	0.44	11.5	11.5
22	11	08	11	10	0.6751	0.6749	0.44	11.5	11.4
22	11	10	11	12	0.6749	0.6749	0.44	11.4	11.5
22	11	12	11	14	0.6749	0.6740	0.44	11.5	11.4
23	11	25	11	27	0.7159	0.7160	0.63	11.5	11.5
23	11	27	11	29	0.7160	0.7158	0.62	11.5	11.5
23	11	29	11	31	0.7158	0.7159	0.59	11.5	11.5
23	11	31	11	33	0.7159	0.7160	0.58	11.5	11.5
23	11	33	11	35	0.7160	0.7158	0.61	11.5	11.4
23	11	35	11	37	0.7158	0.7157	0.59	11.4	11.5
23	11	37	11	39	0.7157	0.7159	0.58	11.5	11.4
24	11	48	11	50	0.7532	0.7634	0.77	11.5	11.5
24	11	50	11	52	0.7534	0.7632	0.75	11.5	11.5
24	11	52	11	54	0.7532	0.7631	0.75	11.5	11.5
24	11	54	11	56	0.7631	0.7632	0.75	11.5	11.5
24	11	56	11	58	0.7632	0.7626	0.75	11.5	11.4
25	12	11	12	13	0.7979	0.7979	0.82	11.5	11.5
25	12	13	12	15	0.7979	0.7979	0.81	11.5	11.5
25	12	15	12	17	0.7979	0.7977	0.81	11.5	11.5
25	12	17	12	19	0.7977	0.7977	0.79	11.5	11.4
25	12	19	12	21	0.7977	0.7976	0.78	11.4	11.5
25	12	21	12	23	0.7976	0.7977	0.78	11.5	11.5
25	12	23	12	25	0.7977	0.7976	0.78	11.5	11.5
26	12	34	12	36	0.8381	0.8379	0.93	11.5	11.5
26	12	36	12	38	0.8379	0.8379	0.90	11.5	11.5
26	12	38	12	40	0.8379	0.8377	0.89	11.5	11.5
26	12	40	12	42	0.8377	0.8376	0.88	11.5	11.6
26	12	42	12	44	0.8376	0.8377	0.88	11.6	11.5
26	12	46	12	48	0.8372	0.8375	0.88	11.4	11.4
26	12	48	12	50	0.8375	0.8374	0.88	11.4	11.5
27	12	59	13	01	0.8014	0.8012	0.71	11.5	11.4
27	13	01	13	03	0.8012	0.8014	0.69	11.4	11.5
27	13	03	13	05	0.8014	0.8013	0.68	11.5	11.4
27	13	05	13	07	0.8013	0.8011	0.67	11.4	11.5
27	13	07	13	09	0.8011	0.8011	0.67	11.5	11.5
27	13	09	13	11	0.8011	0.8013	0.67	11.5	11.5
28	13	28	13	30	0.7506	0.7507	0.52	11.5	11.4
28	13	30	13	32	0.7507	0.7505	0.48	11.4	11.5
28	13	32	13	34	0.7505	0.7506	0.49	11.5	11.4
28	13	34	13	36	0.7506	0.7504	0.50	11.4	11.4
28	13	36	13	38	0.7504	0.7507	0.49	11.4	11.5
29	13	48	13	50	0.7182	0.7181	0.38	11.5	11.4
29	13	50	13	52	0.7181	0.7182	0.37	11.4	11.4
29	13	52	13	54	0.7182	0.7183	0.37	11.4	11.4
29	13	54	13	56	0.7183	0.7180	0.37	11.4	11.4
29	13	56	13	58	0.7180	0.7181	0.37	11.4	11.5
30	14	09	14	11	0.6785	0.6787	0.25	11.5	11.4
30	14	11	14	13	0.6787	0.6786	0.24	11.4	11.5
30	14	13	14	15	0.6786	0.6787	0.23	11.5	11.5
30	14	15	14	17	0.6787	0.6785	0.25	11.5	11.4
30	14	17	14	19	0.6785	0.6787	0.25	11.4	11.4

31	14	29	14 31	0.6328	0.6330	0.09	11.4	11.5
31	14	31	14 33	0.6330	0.6328	0.09	11.5	11.5
31	14	33	14 35	0.6328	0.6326	0.10	11.5	11.4
31	14	35	14 37	0.6326	0.6324	0.10	11.4	11.4
31	14	37	14 39	0.6324	0.6323	0.10	11.4	11.5

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99   R10 SINGLE FRACTURE DATA
99   NOTE SOME TESTS HAVE TEN (30) AND ELEVIN (31) INCREMENTS
88    1     3     3.91     4.76    0.1903  0.7381     0.2124
11                                                      -0.25
21    8 34        8 36        0.2334    0.2333          0.0    12.1 12.0
21    8 36        8 38        0.2333    0.2334          0.0    12.0 12.1
99   NRD 2, FLOWRATE BEFORE SHUT-IN 0.0 ML/MIN, NO FLOW
99   NRD 3, FLOWRATE BEFORE SHUT-IN 1.58 ML/MIN, NEG. F_OW
99   NRD 4, FLOWRATE BEFORE SHUT-IN 0.0  ML/MIN, NO FLOW
99   NRD 5, FLOWRATE BEFORE SHUT-IN 0.0  ML/MIN, NO FLOW
88    6     9     8.80     9.65    0.1903  0.7381     0.5381
11                                                      -0.46
21    8 10        8 12        0.5753    0.5754          0.02   12.2 12.0
21    8 12        8 14        0.5754    0.5754          0.02   12.0 12.1
21    8 14        8 16        0.5754    0.5753          0.02   12.1 12.1
21    8 16        8 18        0.5753    0.5754          0.02   12.1 12.2
21    8 18        8 20        0.5754    0.5754          0.02   12.2 12.2
21    8 20        8 22        0.5754    0.5755          0.02   12.2 12.2
21    8 22        8 24        0.5755    0.5754          0.02   12.2 12.2
21    8 24        8 26        0.5754    0.5757          0.02   12.2 12.2
88    7    12    11.83    12.68    0.1903  0.7381     0.5709
11                                                      -4.05
11                                                      -3.71
21    7 54        7 56        0.6089    0.6089          0.41   12.1 12.1
21    7 56        7 58        0.6089    0.6089          0.42   12.1 12.1
21    7 58        8 00        0.6089    0.6089          0.39   12.1 12.1
21    8 00        8 02        0.6089    0.6090          0.40   12.1 12.2
21    8 02        8 04        0.6090    0.6088          0.38   12.2 12.2
21    8 04        8 06        0.6088    0.6088          0.39   12.2 12.2
21    8 06        8 08        0.6088    0.6089          0.38   12.2 12.2
21    8 08        8 10        0.6089    0.6090          0.39   12.2 12.2
21    8 10        8 12        0.6090    0.6088          0.39   12.2 12.1
21    8 12        8 14        0.6088    0.6090          0.39   12.1 12.2
99   NRD 8  BEFORE SHUT-IN (INFLUENCE OF AIR ? )
88    8     8    16.31    17.16    0.1903  0.7381     0.2649
11                                                      -0.25
11                                                      -0.88
11                                                      -0.44
11                                                      -0.25
21   12 54       12 56        0.2847    0.2848          0.05   12.2 12.3
21   12 56       12 58        0.2848    0.2847          0.0    12.3 12.3
21   12 58       13 00        0.2847    0.2846          0.0    12.3 12.4
21   13 00       13 02        0.2846    0.2848          0.0    12.4 12.3
88    9     5    17.12    17.97    0.1903  0.7381     0.2387
11                                                      -0.90
11                                                      -0.50
21    7 56        7 58        0.2571    0.2575          0.0    12.0 12.0
21    7 58        8 00        0.2575    0.2572          0.0    12.0 12.0
21    8 00        8 02        0.2572    0.2574          0.0    12.0 12.0
88   10     5    24.58    25.43    0.1903  0.7381     0.7028
11                                                      -0.15
21   11 45       11 47        0.7503    0.7500          0.005  11.9 11.8
21   11 47       11 49        0.7500    0.7503          0.005  11.8 11.7
21   11 49       11 51        0.7503    0.7499          0.005  11.7 11.8
21   11 51       11 53        0.7499    0.7501          0.0    11.8 11.8
```

88 11 91 11.81 12.66 0.1903 0.7381 0.5718
11 -3.12

21	8	02	8	04	0.6088	0.6088	0.44	11.7 11.8
21	8	04	8	6	0.6088	0.6088	0.44	11.8 11.8
21	8	6	8	8	0.6088	0.6088	0.41	11.8 11.8
21	8	8	8	10	0.6088	0.6086	0.41	11.8 11.8
21	8	10	8	12	0.6086	0.6087	0.40	11.8 11.7
21	8	12	8	14	0.6087	0.6086	0.40	11.7 11.7
21	8	14	8	16	0.6086	0.6087	0.39	11.7 11.7
21	8	16	8	18	0.6087	0.6086	0.38	11.7 11.8
21	8	18	8	20	0.6086	0.6087	0.40	11.8 11.7
21	8	20	8	22	0.6087	0.6087	0.34	11.7 11.9
21	8	22	8	24	0.6087	0.6088	0.38	11.9 11.8
21	8	24	8	26	0.6088	0.6088	0.38	11.8 11.9
22	8	34	8	36	0.6471	0.6469	1.45	11.9 11.8
22	8	36	8	37	0.6469	0.6467	0.89	11.8 11.8
22	8	37	8	38	0.6467	0.6469	0.81	11.8 11.7
22	8	38	8	39	0.6469	0.6468	0.85	11.7 11.8
22	8	39	8	40	0.6468	0.6466	0.80	11.8 11.8
22	8	40	8	41	0.6466	0.6466	0.82	11.8 11.7
22	8	41	8	42	0.6466	0.6465	0.78	11.7 11.8
22	8	42	8	43	0.6465	0.6465	0.80	11.8 11.7
22	8	43	8	44	0.6465	0.6465	0.78	11.7 11.8
22	8	44	8	45	0.6465	0.6465	0.78	11.8 11.8
23	9	1	9	2	0.6855	0.6856	1.16	12.0 11.7
23	9	2	9	3	0.6856	0.6856	1.18	11.7 11.8
23	9	3	9	4	0.6856	0.6854	1.14	11.8 11.7
23	9	4	9	5	0.6854	0.6854	1.13	11.7 11.7
23	9	5	9	6	0.6854	0.6854	1.16	11.7 11.8
23	9	6	9	7	0.6854	0.6852	1.12	11.8 11.8
23	9	7	9	8	0.6852	0.6849	1.12	11.8 11.7
23	9	8	9	9	0.6849	0.6851	1.14	11.7 11.8
23	9	9	9	10	0.6851	0.6852	1.12	11.8 11.7
24	9	33	9	34	0.7221	0.7221	1.38	11.8 11.6
24	9	34	9	35	0.7221	0.7221	1.41	11.6 11.7
24	9	35	9	36	0.7221	0.7221	1.41	11.7 11.7
24	9	36	9	37	0.7221	0.7219	1.40	11.7 11.7
24	9	37	9	38	0.7219	0.7218	1.40	11.7 11.7
24	9	38	9	39	0.7218	0.7218	1.40	11.7 11.7
24	9	39	9	40	0.7218	0.7218	1.40	11.7 11.8
24	9	40	9	41	0.7218	0.7217	1.40	11.8 11.8
25	9	57	9	58	0.7616	0.7614	1.76	11.7 11.6
25	9	58	9	59	0.7514	0.7612	1.77	11.6 11.9
25	9	59	10	00	0.7512	0.7614	1.75	11.9 11.7
25	10	00	10	01	0.7514	0.7612	1.73	11.7 11.8
25	10	1	10	02	0.7612	0.7612	1.73	11.8 11.6
25	10	2	10	03	0.7612	0.7611	1.72	11.6 11.7
26	10	19	10	20	0.7581	0.7680	2.02	11.8 11.8
26	10	20	10	21	0.7580	0.7680	2.03	11.8 11.8
26	10	21	10	22	0.7680	0.7677	2.06	11.8 11.8
26	10	22	10	23	0.7677	0.7678	2.03	11.8 11.9
26	10	23	10	24	0.7578	0.7678	1.92	11.9 11.9
26	10	24	10	25	0.7678	0.7673	2.00	11.9 11.8
27	10	49	10	50	0.7697	0.7696	1.51	11.9 11.8
27	10	50	10	51	0.7696	0.7696	1.54	11.8 12.0

27	10 51	10 52	0.7696	0.7697	1.50	12.0	11.8
27	10 52	10 53	0.7597	0.7695	1.50	11.8	11.9
27	10 53	10 54	0.7595	0.7696	1.50	11.9	11.9
28	11 07	11 08	0.7247	0.7246	0.99	11.9	12.0
28	11 08	11 09	0.7246	0.7247	1.01	12.0	12.0
28	11 09	11 10	0.7247	0.7245	1.02	12.0	12.0
28	11 10	11 11	0.7245	0.7243	0.98	12.0	11.9
28	11 11	11 12	0.7243	0.7242	0.98	11.9	12.0
28	11 12	11 13	0.7242	0.7241	0.99	12.0	12.0
28	11 13	11 14	0.7241	0.7238	0.98	12.0	12.0
28	11 14	11 15	0.7238	0.7235	0.99	12.0	11.9
29	11 27	11 28	0.6857	0.6858	0.66	11.8	11.9
29	11 28	11 29	0.6858	0.6858	0.60	11.9	12.0
29	11 29	11 30	0.6858	0.6859	0.66	12.0	11.9
29	11 30	11 31	0.6859	0.6857	0.63	11.9	12.1
29	11 31	11 32	0.6857	0.6857	0.65	12.1	12.0
29	11 32	11 33	0.6857	0.6857	0.65	12.0	12.0
30	11 52	11 53	0.6436	0.6437	0.34	12.0	11.8
30	11 53	11 54	0.6437	0.6438	0.32	11.8	11.8
30	11 54	11 55	0.6438	0.6437	0.34	11.8	11.8
30	11 55	11 56	0.6437	0.6439	0.34	11.8	11.8
30	11 56	11 57	0.6439	0.6438	0.36	11.8	11.8
30	11 57	11 58	0.6438	0.6438	0.34	11.8	11.8
30	11 58	11 59	0.6438	0.6437	0.34	11.8	11.8
31	12 12	12 14	0.5980	0.5983	0.0	11.9	11.9
31	12 14	12 16	0.5983	0.5981	0.0	11.9	12.1
31	12 16	12 18	0.5981	0.5981	0.0	12.1	12.0
31	12 18	12 20	0.5981	0.5982	0.0	12.0	12.0

99 END OF HOLE

B-3.3 Subsurface Boreholes, 2-m and 4-m Interval Tests

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99   SBH1  HYDROLOGY DATA
99   NOTE      EXACT CORRELATION OF FLOWRATES WITH DATALOGGER NOT POSSIBLE
99   NRD 48,1ST INCR. FLOW WAS NEG.
88    42    3    50.00    52.03   0.1451   0.00504    0.2595
22   21 12       21 25        0.3032    0.3019            93.24    5.8   5.7
23   21 23       21 33        0.2962    0.2989            88.46    5.8   5.9
99   NRD 50;INSUFFICIENT TANK PRESSURE,FLOW EXCEEDS SYSTEMS CAPABILITIES
88    52   21    54.00    56.03   0.1451   0.00504    0.4759
21   18  9        18 11        0.4757    0.4758            1.363 12.7 12.7
22   12 42 59     12 42250.8 0.5342    0.5342            1.799 13.8 12.4
88    54   12    56.0     58.03   0.1451   0.00504    0.4298
21   14 41 59     14 51 59     0.4313    0.4313            0.174 13.6 13.6
22   16 32        16 42        0.4284    0.4281            0.095 12.8 12.4
23   17 26        17 36        0.4850    0.4850            0.150 12.8 11.9
88    56   14    58.00    60.03   0.1451   0.00504    0.5470
21    7 41         7 51        0.4751    0.4747            0.088 11.1 10.4
22   14 22        14 32        0.5483    0.5479            0.138 14.6 14.8
99   NRD 58, POOR P2 EQUALIZATION
88    58   10    60.00    62.03   0.1451   0.00504    0.3783
22    8 46         8 56        0.5359    0.5347            0.154 11.9 11.1
23   11 49        11 59        0.4935    0.4923            0.091 15.1 14.4
88    60    9    62.00    64.03   0.1451   0.00504    0.4913
21   13 32        13 42        0.4913    0.4901            0.162 15.3 15.5
22   14 59        15  9        0.5577    0.5576            0.293 14.8 15.0
88    62   15    64.0     66.03   0.1451   0.00504    0.3819
21    7 34         7 44        0.5106    0.5101            0.062  4.2  5.5
22    8 34         8 44        0.5888    0.5886            0.105  7.8  8.9
88    64    8    66.0     68.03   0.1451   0.00504    0.5072
21   11 53        11 53 60.0 .5056     0.5056            5.75  12.4 12.4
22   12 36        12 36 35.2 .5841     0.5819            9.801 12.0 12.9
88    66   16    68.0     70.03   0.1451   0.00504    0.5071
21   17 13 00     17 13103.4 0.5053    0.5053            6.673  8.2  8.2
22   18 50 00     18 50 79.5 0.5498    0.5498            8.679  7.0  7.0
88    68   11    70.0     72.03   0.1451   0.00504    0.5323
21   17 09 00     17 19 00     0.5322    0.5323            0.385  9.9  9.6
22   17 45 00     17 50 00     0.5944    0.5942            0.680  9.8  9.0
88    70    7    72.0     74.03   0.1451   0.00504    0.4772
21   20 32 30     20 32158.7 0.4986    0.4986            10.65   8.9  8.9
22   20 58 00     20 58 77     0.5576    0.5576            18.03   7.6  7.6
88    72   28    74.0     76.03   0.1451   0.00504    0.5358
21   15 14        15 16        0.5469    0.5471            1.811  9.1  6.9
22   16 01 00     16 01 98.0 0.6538    0.6538            3.520  9.0  9.0
88    74   12    76.0     78.03   0.1451   0.00504    0.5349
21   20 00        20 10        0.5348    0.5347            1.279       6.9
22   20 45        20 55        0.6463    0.6461            3.061  7.5  6.6
88    76   11    78.0     80.03   0.1451 0.00504    0.5264
21   11 49        11 49 50.4 0.5450    0.5450            13.690 11.1 11.1
22   13 03        13 03 32.6 0.6080    0.6080            21.165 12.1 12.1
88    78          80.0     82.03   0.1451 0.00504    0.5272
21   16 19        16 19 36.5 0.5274    0.5274            18.904 12.7 12.7
99   DATE CHANGES TO SEPT 26/79
22   10 15        10 15 42.8 0.5559    0.5559            16.121 13.9 13.9
88    80   15    82.00    84.03   0.1451   0.00504    0.5463
21   17 58        17 58 51.8 0.5410    0.5410            13.320 14.3
22   10 23        10 23 48.9 0.5594    0.5594            14.110 12.1
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88   82  10    84.00    86.03    0.1451   0.00504    0.5808
21   12 56      13 06        0.5843    0.5844            0.317 13.2 13.2
22   14  2      14 12        0.6862    0.6862            0.541 13.6 13.7
88   94   7    95.51    97.54    0.1566   0.00506    0.6751
21   20 02      20 12        0.6731    0.6730            0.004  9.2  9.0
22    7 50       8  1        0.7174    0.7175            0.030 10.4 10.3
88   96  10    97.51    99.54    0.1566   0.00506    0.6094
21   15 15      15 30        0.6040    0.6039           29.06 15.2 15.8
22   16 42      16 51        0.6405    0.6401           64.79 14.2 13.8
88   98  16    99.51   101.54    0.1566   0.00506    0.6925
21    7 40       7  40199.95 .6923    0.6923            3.450 10.3 10.3
22    8 08       8 08133.61 .7603    0.7603            5.164 10.9 10.9
23    8 38       6 36168.55 .6720    0.6720            2.047 10.0 10.0
88  100  10   101.51   103.54    0.1566   0.00506    0.7186
21   21 03      21 13        0.7192    0.7190            0.073  9.3  9.8
22   22 19      22 29        0.8045    0.8046            0.115  8.8  8.9
88  102  22   103.51   105.54    0.1566   0.00506    0.6935
21   18 02      18 02 91.80 .6940    0.6940            7.52  12.3 12.3
22   18 38      18 36 66.80 .7685    0.7685           10.02  11.4 11.4
88  104  12   105.53   107.56    0.1566   0.00506    0.5633
21   11  5      11  7        0.7606    0.7612            2.70  12.0 11.4
99   SBH1,NOTE REFERENCE PRESSURES AND TEMPS ARE AVERAGED
88  106  22   106.51   107.50    0.0594   0.00508    0.3129
21   12 54 44.812 55 48.2 0.5782    0.5766            7.015  2.0  2.1
22   13 25 33.113 27 34.1 0.7183    0.7185            9.91   2.2  2.3
88  108   6   107.53   109.56    0.1566   0.00506    0.5807
21    7 33 50    7 35 50    0.7263    0.7278            4.28   9.2  8.4
99  NRD 108,3RD INCR.;P2 AND TEMPS ARE AVERAGE FOR WHOLE INCR.
88  110  41   110.0    112.0    0.0594   0.00508    0.5290
21   13 32      13 34        0.6006    0.6007            0.766  2.7  2.6
22   14 00      14  1        0.7094    0.7094            0.338  2.6  2.7
23   14 14      14 16        0.6051    0.6053            0.180  2.6  2.7
24                       22.0 0.8291    0.8291            3.074  2.7  2.7
88  112  26   112.0    114.0    0.0594   0.00508    0.4737
21   17  5      17  7        0.5996    0.5997            0.152  2.6  2.6
22   17 26      17 28        0.6931    0.6929            0.234  2.4  2.2
23   18 09      18 11        0.8145    0.8145            0.225  2.3  2.3
88  114  17   114.0    116.0    0.0594   0.00508    0.6118
21    7  3       7  5        0.6825    0.6825            0.070  2.1  2.2
22    7 30       7 32        0.7423    0.7423            0.090  2.1  2.1
23    7 48       7 50        0.8201    0.8202            0.113  2.1  2.1
99  NRD 116,NO FLOW 1ST INCRE.;PRESSURE RANGE 0.6943V TO 0.6944V,DATA MISSING
88  116  14   116.0    118.0    0.0594   0.00508    0.6303
22   11 56      12 00        0.7633    0.7634            0.056  2.1  2.0
23   12 19      12 21        0.8402    0.8403            0.107  2.0  2.0
88  118  19   118.0    120.0    0.0594   0.00508    0.2184                          0.059
21   15 18      15 24        0.6378    0.6434            0.0    2.9  2.9 1.5114 1.5114
22   16 31      16 35        0.7057    0.7060            0.175  2.8  2.9 1.5115 1.5116
88  120  28   120.0    122.0    0.0594   0.00508    0.4057                          0.059
21    7  6       7  8        0.6667    0.6669            0.124  3.7  3.8 1.5126 1.5126
22    7 59       8 03        0.7582    0.7581            0.070  3.8  3.8 1.5129 1.5129
23    8 20       8 24        0.8833    0.8834            0.127  3.9  3.9 1.5128 1.5129
99  NRD 122, NO FLOW OBSERVED
88  122   5   122.0    124.0    0.0594   0.00508    0.4082                          0.059
21   10 26      10 28        0.6428    0.6443            0.0    4.1  4.2 1.5116 1.5117
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22  10 40      10 44        0.7219   0.7219          0.0     4.1   4.1 1.5123 1.5123
88  124  17  124.0    126.0    0.0594  0.00508   0.4235                          0.059
21  13 16      13 20        0.6762   0.6763          0.083   4.4   4.4 1.5111 1.5111
22  13 59      14  3        0.7718   0.7720          0.134   4.4   4.4 1.5117 1.5114
23  14 19      14 21        0.8936   0.8935          0.197   4.5   4.5 1.5107 1.5107
88  130  15  130.0    132.0    0.0594  0.00508   0.6971                          0.059
21  10  9      10 13        0.7689   0.7688          0.0     5.0   5.1 1.5111 1.5113
22  10 48      10 50        1.0224   1.0222          0.062   5.2   5.2 1.5115 1.5115
88  126  20  126.0    128.0    0.0594  0.00508   0.5148
21  15 50 22.615 56 44.2 0.6820   0.6850          3.06    4.6   4.7
22  16 25 35.616 27 33.3 0.8360   0.8355          4.06    4.5   4.6
88  128  27  128.0    130.0    0.0594  0.00508   0.4748
21   6 59       7 00        0.7066   0.7068          1.431   5.0   5.0
22                      34.5 0.7995   0.7996          1.960   5.0   5.0
23                      30.6 0.8612   0.8613          2.210   5.2   5.1
88  130  15  130.0    132.0    0.0594  0.00508   0.6971                          0.059
21  10  9      10 13        0.7689   0.7688          0.0     5.0   5.1 1.5111 1.5113
22  10 48      10 50        1.0224   1.0222          0.062   5.2   5.2 1.5115 1.5115
99  NRD 132. NEGATIVE FLOWRATE
99  NRD 134,SECOND INCR. NEG FLOW
88  134  19  134.0    136.0    0.0594  0.00508   0.4563                          0.059
21  13 42      13 44        0.7426   0.7426          0.023   6.2   6.2 1.5093 1.5095
88  136  13  136.0    138.0    0.0594  0.00508   0.4988                          0.059
21  15 40      15 46        0.7287   0.7286          0.005   6.1   6.2 1.5102 1.5106
23  16 26      16 28        1.0028   1.0030          0.338   6.1   6.2 1.5112 1.5112
88  138  24  138.0    140.0    0.0594  0.00508   0.4624                          0.059
21  17 48      17 48 32.0 0.7493   0.7493         21.13    6.0   6.0 1.5113 1.5113
22  18  5      18  5 18.6 0.9117   0.9117         36.35    6.0   6.0 1.5111 1.5111
99  NRD 140 ,NEG FLOWRATE
88  142  16  142.0    144.0    0.0594  0.00508   0.1689                          0.059
21  17 21      17 21 32.3 0.7807   0.7807         10.47    5.1   5.1 1.5115 1.5115
22  17 46      17 46 27.4 0.8810   0.8810         12.34    5.0   5.0 1.5115 1.5115
88  144  24  144.0    146.0    0.0594  0.00508   0.5230                          0.059
21   7 22       7 23        0.7639   0.7636          1.313   5.3   5.4 1.5115 1.5116
22   7 55       7 56        0.8275   0.8273          1.386   5.4   5.5 1.5111 1.5111
23   8 18       8 19        0.8833   0.8843          1.482   5.4   5.4 1.5112 1.5112
88  146  11  146.0    148.0    0.0594  0.00508   0.7612                          0.059
21  10 33      10 35        0.7886   0.7880          0.0     5.4   5.5 1.5103 1.5102
22  10 58      11  2        0.8733   0.8728          0.051   5.5   5.5 1.5107 1.5107
23  11 24      11 28        0.9876   0.9872          0.072   5.4   5.5 1.5112 1.5112
90  NRD 148 ,NO FLOW OBSERVED
88  150  13  150.0    152.0    0.0594  0.00508   0.6984                          0.059
21   6 39       6 43        0.7227   0.7218          0.0     6.3   6.3 1.5120 1.5120
22   7 23       7 27        0.9268   0.9266          0.034   6.5   6.5 1.5122 1.5122
88  152  32  152.0    154.0    0.0594  0.00508   0.6219                          0.059
21  10 25      10 25 28.4 0.8140   0.8140         11.70    6.8   6.8 1.5117 1.5117
22  10 51      10 51 24.8 0.8643   0.8643         13.63    6.8   6.8 1.5109 1.5109
23  11 07      11 07 19.3 0.9255   0.9255         17.52    6.9   6.9 1.5112 1.5112
88  152  12  154.00   156.03    0.1566  0.00506   0.7588
21  14 39 12   14 44 12    1.0031   1.0031          0.012  14.1  12.6
22  16  7      16 11        1.1017   1.1018          0.023  12.0  12.2
88  154  13  156.0    158.03    0.1566  0.00506   0.9891
21  19 40      19 42        1.0501   1.0496          0.063   9.8   9.3
22  20 13      20 17        1.0748   1.0748          0.069   8.3   8.4
88  156  19  158.0    160.03    0.1566  0.00506   0.9213
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21   8 41       8 45        0.9901    0.9908            0.170 10.4 10.9
22  10 42      10 44        1.0184    1.0183            0.126 14.7 14.7
88  158  24  160.0    162.03   0.1566   0.00506    0.9545
21  17 27      17 29        1.0197    1.0197            0.034 15.9 15.9
22  11 13      11 23        1.0893    1.0897            0.060 18.9 18.3
88  160  11  162.00   164.03   0.1566   0.00506    0.9604
22  16 26      16 30        1.1174    1.1174            0.009 18.0 18.6
23  17 14      17 19        1.2039    1.2037            0.013 17.2 17.7
99  NRD 162; FLOW REVERSES
88  162  14  164.0    166.03   0.1566   0.00506    0.9701
23  21 24 30  21 28 30     1.3200    1.3197            0.010 15.0 14.6
88  164  14  166.0    168.03   0.1566   0.00506    0.8247
21  10  3      10  7        0.9551    0.9551            0.00  10.8 10.8
22  11 51      11 55        1.0551    1.0552            0.020 14.1 13.9
88  166   9  168.0    170.03   0.1566   0.00506    0.7338
21   8 18       8 20        1.1117    1.1117            0.017 13.2 13.1
22   9  3       9  5        1.1621    1.1621            0.017 13.3 13.3
88  168  11  170.0    172.03   0.1566   0.00506    1.0018
22  19 59      19  9        1.1695    1.1694            0.007 14.1 14.0
23  19 51 20  20 01 35     1.2486    1.2483            0.015 13.2 12.5
88  172  22  174.0    176.03   0.1566   0.00506    1.0492
21  12 12      12 13        1.1464    1.1466            2.248 14.1 13.6
22  12 30      12 31        1.1678    1.1680            2.260 13.8 13.9
88  174  13  176.00   178.03   0.1566   0.00506    1.0378
21  16 44      16 45        1.1041    1.1041            0.107 14.1 14.1
22  17 40      17 41        1.1482    1.1482            0.128 13.8 13.8
88  176  11  178.00   180.03   0.1566   0.1566     1.0466
21  19  3      19  7        1.1325    1.1323            0.035 12.2 12.0
22  19 59      20  9        1.2073    1.2076            0.055 11.4 10.7
88  178   9  180.00   182.03   0.1566   0.00506    1.0655
21   8 21       8 25        1.1594    1.1594            0.063  8.9 10.0
22   8 49 10   8 53 10     1.2301    1.2304            0.086 10.2 10.5
88  180  28  182.00   184.00   0.1566   0.00506    1.0064
21  16 44      16 44 12.7 1.0707    1.0707            54.33  15.0 15.0
22  17 20      17 20 11.4 1.1236    1.1236            60.53  13.9 13.9
88  182  27  184.00   186.03   0.1566   0.00506    1.1082
21  18 42      18 46        1.1933    1.1932            0.450 11.7 10.9
22  19 41      19 43        1.2883    1.2883            0.719  9.7  9.5
88  184  27  186.00   188.03   0.1566   0.00506    1.1313
21   8 26       8 26 17.8 1.1875    1.1875            3.876  9.7  9.7
22   9 01       9  1 12.65 1.2912    1.2912            5.450 12.3 12.3
88  186  41  188.00   190.03   0.1566   0.00506    1.1006
21  11 11 30  11 11 36.65 1.1946    1.1946            20.75  15.8 15.8
23  12 04      12  4 34.00 1.1415    1.1415            20.25  16.6 16.6
24  12 53      12 53 49.55 1.1258    1.1258            13.92  17.5 17.5
88  188  10  190.00   192.03   0.1566   0.00506    1.1516
21  14 26      14 30        1.2516    1.2517            0.173916.9 17.6
22  16 20      16 30        1.3255    1.3249            0.222517.9 18.0
88  190  18  192.0    194.03   0.1566   0.00506    1.1674
21  18 11      18 15        1.1669    1.1669            0.681314.9 14.1
22  18 56      18 60        1.2057    1.2057            0.761613.2 13.6
99  NRD 192; NEG. AND REVERSING FLOW
88  194  12  196.00   198.03   0.1566   0.00506    1.1814
21  10 20      10 30        1.1855    1.1852            0.054 14.3 13.1
22  11 45      11 55        1.2475    1.2474            0.062 15.2 14.3
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99  NRD 196.1ST INCR; REVERSING FLOW
88  196  13  198.00  200.03   0.1566  0.00506   1.2091
21  14  5     14 15      1.2086   1.2085          0.056 16.1 15.8
22  15 19     15 49      1.2506   1.2507          0.067 16.0 14.7
88  198  12  200.00  202.03   0.1566  0.00506   1.2120
21  19 15     19 25      1.2121   1.2120          0.007 12.8 12.6
22  20 19     20 29      1.2629   1.2627          0.017 11.6 11.5
99  NRD 198 ;1ST INCR.REV FLOW
88  200   8  202.00  204.03   0.1566  0.00506   1.2288
21   8 42      8 52      1.2289   1.2289          0.088  9.9 11.1
22  10         10 45     1.2931   1.2932          0.096 12.0 12.3
88  202  41  204.16  205.96   0.0473  0.00510   0.4881                          0.042
21  16 40     16 41      1.1039   1.1039          0.151 14.4 14.4 0.4382 0.4383
22  17 55     17 56      1.3135   1.3135          0.189 12.8 12.7 0.4386 0.4386
88  204  34  207.26  209.06   0.0473  0.00509   0.5062                          0.042
21   7 43      7 44      1.1070   1.1070          0.182 10.0 10.2 0.4423 0.4424
22   8 34      8 35      1.2304   1.2304          0.214 10.5 10.5 0.4420 0.4420
23   9  5      9  6      1.2936   1.2937          0.246 11.1 11.1 0.4427 0.4427
88  206  28  210.87  212.46 0.0473   0.00509   0.4768                          0.042
21  12  3     12  4      1.1109   1.1110          0.088 12.4 12.5 0.4335 0.4337
22  13 15     13 16      1.2489   1.2489          0.096 13.0 13.0 0.4396 0.4393
99  NRD 208 1ST INCR. ZERO FLOW AT 1.1146V TO 1.1138V FOR 33 MIN.
88  208   8  210.84  212.64   0.0473  0.00509   1.2088                          0.042
22  16 59     17  0      1.3351   1.3351          0.054 12.3 12.3 0.4405 0.4405
88  210  28  212.64  214.44   0.0473  0.00509   0.5367                          0.042
21   8 24      8 25      1.1201   1.1201          0.112  7.8  8.0 0.4365 0.4365
22   9 13      9 14      1.3281   1.3282          0.204 16.1 16.3 0.4383 0.4382
88  212  34  214.44  216.24   0.0473  0.00509   0.6150                          0.042
21  12 43     12 44      1.1152   1.1152          0.123 14.3 14.3 0.4384 0.4384
22  14 13     14 14      1.3650   1.3650          0.321 14.2 14.2 0.4408 0.4408
88  214  45  216.24  218.04   0.0473  0.00509   0.5381                          0.042
21  11 53     11  4      1.1473   1.1473          0.039 11.2 11.2 0.4397 0.4398
22  12  2     12  3      1.2529   1.2529          0.077 11.6 11.6 0.4434 0.4434
88  216  23  218.04  219.84   0.4373  0.00509   1.0856                          0.042
21  17 30     17 31      1.1655   1.1657          0.103 11.4 11.5 0.4509 0.4510
22  18  9     18 10      1.3337   1.3337          0.133 11.3 11.3 0.4504 0.4503
88  218  26  219.84  221.64   0.0473  0.00509   0.5282                          0.042
21   9 37      9 38      0.1634   0.1634          0.147  9.4  9.4 0.4508 0.4508
22  10 19     10 20      1.3868   1.3868          0.225 10.7 10.7 0.4512 0.4513
88  220  43  221.64  223.44   0.0473  0.00509   0.6646                          0.042
21  13  1     13  2      1.1668   1.1668          0.171 10.3 10.4 0.4414 0.4414
22  13 43     13 44      1.3694   1.3694          0.182 10.4 10.4 0.4447 0.4446
88  222  26  223.44  225.24   0.0473  0.00509   0.5888                          0.042
21  16 35     16 36      1.1882   1.1882          0.102 10.4 10.4 0.4408 0.4408
22  17 30     17 31      1.4193   1.4193          0.100  9.9  9.9 0.4433 0.4433
88  224  22  225.24  227.04   0.0473  0.00509   0.9469                          0.042
21  11 07     11 08      1.1954   1.1956          0.373 12.4 12.3 0.4434 0.4434
22  11 33     11 34      1.4046   1.4046          0.613 12.6 12.6 0.4442 0.4444
88  226  15  227.04  228.84   0.0473  0.00509   0.1336                          0.042
21  19 02     19 04      1.2119   1.2117          0.185  8.9  8.9 0.4494 0.4496
22   6 57      7 03      1.3958   1.3958          0.212  2.9  3.3 0.4530 0.4533
88  228   5  228.84  230.64   0.0473  0.00509   1.3575                          0.042
21  11 42     11 48      1.2257   1.2264          0.189 14.7 15.0 0.4491 0.4490
22  12 28     12 32      1.4508   1.4509          0.353 15.1 15.2 0.4507 0.4509
88  230  12  230.64  232.44   0.0473  0.00509   1.1401                          0.042
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21    7 35        7 41        1.2300    1.2301          0.125  8.3   8.4 0.45    0.4570
22    8 15        8 19        1.4114    1.4143          0.264  8.8   8.8 0.4564  0.4570
88  232   10  232.64   234.44   0.0473   0.00509   1.1677                         0.042
21   13 19       13 27        1.2438    1.2436          0.140 11.0  11.0 0.4068  0.3936
22   14 57       14 03        1.4481    1.4482          0.263 11.3  11.4 0.3920  0.4005
88  234   31  234.24   236.04   0.0473   0.00509   0.6818                         0.042
21    7 54 30    7 55        1.2464    1.2466          2.67   9.5   9.6 0.4591  0.4591
22    8 28       8 28 30     1.2999    1.3000          3.10  10.0  10.1 0.4592  0.4564
23    8 45       8 45 30     1.3788    1.3789          3.57  10.5  10.4 0.4590  0.4594
88  236   41  236.04   237.84   0.0473   0.00509   1.1747                         0.042
21   11  6       11  7        1.2596    1.2596          0.191 12.3  12.2 0.4435  0.4440
22   11 27 30   11 28        1.3064    1.3066          0.201 12.6  12.6 0.4477  0.4484
23   11 43  30  11 44        1.3559    1.3558          0.221 12.3  12.3 0.4490  0.4491
24   11 57 30   11 58        1.4105    1.4105          0.253 12.3  12.4 0.4506  0.4508
88  238   16  237.84   239.64   0.0473   0.00509   0.8812                         0.042
21   16 00 23.316 00 45.7    1.2503    1.2503          1.433 11.9  11.9 0.4551  0.4551
22   16 24 20.316 24         1.3115    1.3118          1.625 11.7  11.7 0.4546  0.4551
23   16 41 55.016 42 25.5    1.4274    1.4263          2.157 11.5  11.2 0.4549  0.4558
88  240   16  239.64   241.44   0.0473   0.00509   1.1969                         0.042
21   10 28       10 29        1.2766    1.2768          0.103 13.5  13.5 0.4493  0.4496
22   10 55       10 56        1.4225    1.4225          0.117 14.8  14.9 0.4527  0.4530
88  242   18  241.44   243.24   0.0473   0.00509   1.2112                         0.042
21    9 11       9 12        1.2836    1.2835          0.108 10.1  10.1 0.4493  0.4496
22    9 30       9 32        1.4738    1.4737          0.144 10.8  10.7 0.4510  0.4513
88  244   13  243.24   245.04   0.0473   0.00509   0.9977                         0.042
21   11  5 22.911  5 46.4    1.2778    1.2778         13.72  14.3  14.3 0.4531  0.4538
22   11 48      11 48 16.6   1.4362    1.4362         19.43  14.6        0.4566  0.4566
88  246   17  245.04   246.84   0.0473   0.00509   1.2137                         0.042
21   15 24      15 26        1.3008    1.3008          0.764 14.0  14.0 0.4547  0.4540
22   15 50 30   15 51 30     1.4885    1.4885          1.106 13.4  13.4 0.4566  0.4558
88  248   10  246.84   248.64   0.0473   0.00509   1.2091                         0.042
21    7 17       7 25        1.3086    1.3081          0.1881 5.1   5.3 0.4620  0.4626
22    8  7       8 13        1.4698    1.4702          0.235  7.0   7.3 0.4624  0.4624
99  NRO  250;SHUT-IN VALUE NOT REPRESENTIVE OF G.W. PRESSURES,FLOW TOO LOW
99  NRO 252,1ST INCR. NO FLOW OBSERVED
88  252    3  250.44   252.24   0.0473   0.00509   1.5348                         0.042
22   14 35      14 42        1.5621    1.5619          0.157 13.3  13.2 0.4540  0.4545
88  258   11  255.64   257.64   0.0473   0.00509   1.3527                         0.042
21   11 26      11 30        1.342     1.3416          0.061 11.5  11.6 0.4509  0.4518
22   11 58      12  2        1.5504    1.5502          0.138 11.4  11.2 0.4562  0.4561
88  259   12  257.64   259.44   0.0473   0.00509   1.3758                         0.042
21   13 50      13 54        1.3567    1.3565          0.058 11.4  11.4 0.4545  0.4543
22   14 22      14 26        1.5618    1.5622          0.245 11.2  11.3 0.4585  0.4597
88  260    8  259.44   261.24   0.0473   0.00509   1.3825                         0.042
21   16 09      16 13        1.3654    1.3653          0.137  9.3   9.2 0.4511  0.4506
22   16 38      16 42        1.5461    1.5458          0.153  8.9   8.9 0.4554  0.4568
88  262   11  261.24   263.04   0.0473   0.00509   1.2731                         0.042
21    7 14       7 18        1.3663    1.3654          0.137  4.4   4.5 0.4685  0.4665
22    7 45       7 49        1.5257    1.5255          0.226  5.2   5.4 0.4676  0.4681
88  264   15  263.04   264.84   0.0473   0.00509   1.3114                         0.042
21   10 10      10 12        1.3849    1.3849          0.348 12.5  12.5 0.4627  0.4630
22   10 40      10 42        1.5841    1.5840          0.510 13.2  13.3 0.4642  0.4640
88  266   14  264.84   266.64   0.0473   0.00509   1.3728
21   12 46      12 50        1.3910    1.3911          0.303 14.5  14.7 0.4579  0.4590
22   13 32      13 34        1.5760    1.5760          0.447 14.8  14.9 0.4639  0.4642
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88  268  14  266.64  268.44   0.0473  0.00509   1.2887                          0.042
21  15 55 46.816  0 38.7 1.4018   1.4018          2.86   12.3 12.3 0.4661 0.4681
22  16 45      16 46 29.5 1.5645   1.5645          3.607  12.2 12.2 0.4688 0.4688
88  270  16  268.44  270.24   0.0473  0.00509   0.9210                          0.042
21   8 30       8 31 19.5 1.4113   1.4115          2.43    5.4  5.3 0.4766 0.4755
22   8 45       8 45 57.8 1.5500   1.5502          3.354   5.1  5.1 0.4759 0.4761
88  272  20  270.24  272.04   0.0473  0.00509   1.3551                          0.042
21  11 48      11 52        1.4296   1.4297          0.278  11.0 11.1 0.4683 0.4689
22  12 26      12 28        1.6273   1.6273          0.364  11.8 11.8 0.4705 0.4710
88  274  17  272.04  273.84   0.0472  0.00509   1.3623                          0.042
21  14 36      14 37 57.3 1.4355   1.4353          1.651  11.0 11.1 0.4620 0.4628
22  15  7      15  8        1.6129   1.6128          2.37   10.8 10.8 0.4672 0.4675
99  NRD 274, ERRUR MADE W.R.T. REFERENCE TIMES FOR 2ND INCR.
88  277  28  275.64  277.44   0.0473  0.00509   1.0120                          0.042
21  14 44      14 44 21.8 1.4411   1.4411          8.9    12.4 12.4 0.4742 0.4742
22  16 25      16 25 26.9 1.6233   1.6233          9.7     9.8  9.8 0.4785 0.4785
88  278  21  277.44  279.24   0.0473  0.00509   1.3106                          0.042
21   7 05       7 07        1.4624   1.4621          0.478   2.1  2.2 0.4777 0.4774
22   7 51       7 53        1.6132   1.6132          0.650   3.4  3.4 0.4764 0.4769
88  280   6  279.24  281.04   0.0473  0.00509   1.6486                          0.042
22  12 12      12 16        1.6706   1.6706          0.034  10.8 10.9 0.4748 0.4736
88  284  11  283.27  284.64   0.0473  0.00509   1.7137                          0.042
22   7 38       7 46        1.8816   1.8819          0.082   5.2  5.2 0.4652 0.4653
23   8 22       8 36        2.0011   2.0010          0.129   5.5  5.4 0.4635 0.4633
88  286  10  284.64  286.44   0.0473  0.00509   1.5546  0.000595
22  14 16 00  14 20 00   2.1598   2.1597          0.155   8.7  8.7
88  288  15  286.44  288.24   0.0473  0.00509   0.9115                          0.042
21   7  7       7 13        1.4913   1.4913          0.125   5.7  5.7 0.4851 0.4850
22   8 16       8 22        1.6574   1.6573          0.125   6.4  6.2 0.4823 0.4826
88  290   9  288.24  290.04   0.0473  0.00509   1.0098                          0.042
21  12 47      12 57        1.5090   1.5091          0.057   9.7 10.6 0.4817 0.4819
22  13 54      14 04        1.6613   1.6612          0.088   9.8  9.9 0.4843 0.4835
88  291  10  290.04  291.84   0.0473  0.00509   1.0427                          0.042
21  16 18      16 26        1.5159   1.5159          0.042   7.1  7.0 0.4829 0.4835
22  17  4      17 12        1.6584   1.6581          0.061   7.0  7.1 0.4852 0.4860
88  292   7  291.84  293.64   0.0473  0.00509   1.0536                          0.042
21   7 18       7 28        1.5196   1.5198          0.106   5.4  5.4 0.4903 0.4900
22   7 58       8 10        1.6808   1.6800          0.134   5.6  5.6 0.4892 0.4892
88  294  14  293.64  295.44   0.0473  0.00509   1.0200                          0.042
21  10 33      10 37        1.5298   1.5297          0.258   5.4  5.4 0.4852 0.4851
22  11 07      11 11        1.6812   1.6814          0.301   5.5  5.2 0.4866 0.4868
88  296  22  295.44  297.24   0.0473  0.00509   1.1753                          0.042
21  13 35      13 37        1.5410   1.5410          0.392   5.5  5.6 0.4811 0.4812
22  14  5      14  7        1.6745   1.6746          0.476   5.6  5.7 0.4845 0.4851
88  298  34  297.24  299.04   0.0473  0.00509   1.1421                          0.042
21  16 13      16 15        1.5460   1.5462          0.614   5.7  5.8 0.4848 0.4844
22  17 51      17 52        1.7573   1.7573          0.559   5.6  5.6 0.4960 0.4959
88  300  15  299.04  300.84   0.0473  0.00509   1.4822                          0.042
21  13 10      13 14        1.5647   1.5646          0.164   3.6  3.8 0.4888 0.4864
22  14 12      14 16        1.7469   1.7468          0.140   3.8  3.8 0.4901 0.4903
88  302  19  300.84  302.64   0.0473  0.00509   1.4971                          0.042
21  17 13      17 15        1.5714   1.5714          0.426   3.8  3.9 0.4882 0.4885
22  17 36      17 36        1.7297   1.7297          0.548   3.7  3.7 0.4896 0.4896
88  304  24  302.64  304.44   0.0473  0.00510   1.4574                          0.042
21  11 24      11 26        1.5765   1.5767          0.301   2.8  2.8 0.4834 0.4832
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22	11 58	12 0			1.7934	1.7935		0.293	3.0	2.8	0.4865	0.4867
88	306 25	304.44	306.24		0.0473	0.00509	1.2523					0.042
21	14 28	14 30			1.5836	1.5836		0.301	4.2	4.0	0.4859	0.4860
22	15 8	15 12			1.7087	1.7086		0.184	4.2	4.2	0.4893	0.4883
88	308 27	306.24	308.04		0.0473	0.00509	1.2516					0.042
21	17 18	17 19			1.5883	1.5885		0.989	4.3	4.2	0.4870	0.4875
22	17 45	17 46			1.7017	1.7018		1.290	4.2	4.7	0.4884	0.4865
88	310 35	308.04	309.64		0.0473	0.00509	1.2892					0.042
21	19 38	19 39			1.6010	1.6010		0.452	4.9	4.8	0.4870	0.4874
22	20 0	20 1			1.8364	1.8365		0.639	4.7	4.8	0.4887	0.4887
88	311 16	309.84	311.64		0.0473	0.00509	0.8855					0.042
21	7 32	7 32	56.3	1.6015		1.6015		5.728	5.1	5.1	0.5002	0.5002
22	8 11	8 11	47.0	1.7831		1.7831		6.862	5.1	5.1	0.5004	0.5004
88	312 19	311.64	313.44		0.0473	0.00509	1.5198					0.042
21	10 39	10 41			1.6193	1.6194		0.339	5.2	5.4	0.4910	0.4913
22	11 17	11 19			1.7794	1.7795		0.392	5.2	5.3	0.4929	0.4930
88	327 14	326.04	327.84		0.0473	0.00509	1.0098					0.042
21	16 10	16 10	26.9	1.6680		1.6680		12.0	7.6	7.6	0.4958	0.4958
22	16 55	16 55	43.5	1.8067		1.8067		14.8	7.7	7.7	0.4955	0.4955
88	328 9	327.84	329.64		0.0473	0.00509	1.6291					0.042
21	19 36	19 40			1.7000	1.7002		0.172	7.9	7.9	0.5047	0.5044
22	20 4	20 08			1.8711	1.8709		0.212	7.9	7.9	0.5043	0.5038
88	330 14	329.64	331.44		0.0473	0.00509	1.0365					0.042
21	8 58	8 58	22.4	1.6319		1.6319		0.480	5.0	5.0	0.5078	0.5078
22	10 13	10 13	19.4	1.8130		1.8130		0.554	5.3	5.3	0.5083	0.5083
88	332 22	331.44	333.24		0.0473	0.00509	1.6260					0.042
21	12 28	12 30			1.7078	1.7080		1.0	6.7	6.9	0.5101	0.5102
22	13 8	13 8	48.4	1.9034		1.9033		1.33	6.8	6.7	0.5109	0.5109
88	334 19	333.24	335.04		0.0473	0.00509	1.6709					0.042
21	15 17	15 19			1.7177	1.7178		0.510	7.0	6.9	0.5121	0.512
22	15 43	15 45			1.8945	1.8939		0.634	6.7	6.8	0.5123	0.5121
88	336 10	335.04	336.84		0.0473	0.00509	1.6808					0.042
21	7 51	7 55			1.6967	1.6968		0.21	8.9	8.7	0.5135	0.5136
22	8 42	8 46			1.8449	1.8451		0.27	8.6	8.7	0.5128	0.5134
88	340 30	338.64	340.44		0.0473	0.00509	1.6418					0.042
21	16 38	16 39			1.7382	1.7381		1.048	9.2	9.1	0.5082	0.5076
22	17 2	17 3			1.8929	1.8932		1.443	9.2	9.3	0.5090	0.5092
88	342 23	340.44	342.24		0.0473	0.00509	1.6585					0.042
21	18 54	18 54	36.8	1.7478		1.7478		3.675	9.0	9.0	0.5125	0.5125
22	19 10	19 10	29.4	1.8867		1.8869		4.600	9.0	8.9	0.5124	0.5119
88	344 15	342.24	344.04		0.0473	0.00509	1.7317					0.042
21	6 41	6 46			1.7603	1.7602		0.075	9.2	9.0	0.5124	0.5127
22	7 31	7 35			1.8971	1.8970		0.113	8.7	8.6	0.5125	0.5121
88	345 14	344.04	345.84		0.0473	0.00509	1.7758					0.042
21	10 17	10 21			1.7733	1.7733		0.030	9.2	9.2	0.5212	0.5206
22	11 4	11 8			1.9506	1.9505		0.056	9.1	9.4	0.5208	0.5210
88	347 15	345.84	347.64		0.0473	0.00509	1.9657					0.042
88	349 12	347.64	349.44		0.0473	0.00509	1.8602					0.042
21	15 52	15 56			1.9265	1.9265		0.150	10.0	10.4	0.5237	0.5235
22	16 24	16 26			2.0230	2.0229		0.180	10.0	10.1	0.5230	0.5238
88	350 10	349.44	351.24		0.0473	0.00509	1.7982					0.042
21	6 40	6 46			1.8004	1.8005		0.022	9.1	9.7	0.5220	0.5220
22	8 4	8 10			2.0077	2.0077		0.048	9.4	9.3	0.5218	0.5218
88	352 11	351.24	353.04		0.0473	0.00509	1.2881					0.042
21	10 1	10 5			1.8096	1.8097		0.0	9.1	9.5	0.5242	0.5240

22	10 42	10 46		2.0080	2.0083		0.04	10.3	9.9	0.5238	0.5237
88	354 16	353.04	354.84	0.0473	0.00509	1.8119					0.042
21	12 38	12 42		1.8172	1.8172		0.04	10.6	10.6	0.5249	0.5248
22	13 27	13 31		2.0652	2.0651		0.05	10.5	10.5	0.5242	0.5240
88	356 15	354.84	356.64	0.0473	0.00509	1.8273					0.042
21	15 34	15 38		1.9176	1.9175		3.20	10.6	10.5	0.5238	0.5229
23	17 6	17 10		2.0763	2.0762		0.11	10.7	10.6	0.5237	0.5231
88	358 16	356.64	358.44	0.0473	0.00509	1.8808					0.042
21	18 50	18 54		1.9310	1.9310		0.09	10.4	10.6	0.5239	0.5242
22	19 27	19 29		2.0654	2.0654		0.15	10.3	10.4	0.5242	0.5240
88	360 19	358.44	360.24	0.0473	0.00509	1.3192					0.042
21	7 54	7 58		1.8418	1.8420		0.03	8.1	8.2	0.5227	0.5227
23	9 8	9 12		2.0180	2.0180		0.04	8.2	8.2	0.5226	0.5229
88	362 18	360.24	362.04	0.0473	0.00509	1.8364					0.042
21	11 13	11 17		1.8487	1.8487		0.05	8.3	8.3	0.5248	0.5253
23	12 21	12 25		2.0514	2.0515		0.06	8.3	8.5	0.5256	0.5252
88	363 22	262.04	263.84	0.0473	0.00509	1.8333					0.042
21	15 54	15 58		1.9107	1.9106		0.050	9.0	9.1	0.5255	0.5251
23	17 21	17 25		2.1210	2.1208		0.072	9.2	9.1	0.5238	0.5245
88	364 16	363.84	365.64	0.0473	0.00509	1.7772					0.042
21	6 48	6 52		1.8364	1.8363		0.03	9.2	9.3	0.5240	0.5238
23	7 56	8 00		2.0767	2.0767		0.05	9.3	9.1	0.5240	0.5238
88	365 16	365.64	367.44	0.0473	0.00509	1.8584					0.042
21	10 14	10 18		2.0164	2.0165		0.05	9.4	9.6	0.5261	0.5261
23	11 29	11 33		2.1602	2.1603		0.07	9.7	9.6	0.5255	0.5254
88	368 13	367.44	369.24	0.0473	0.00509	1.8448					0.042
21	14 24	14 28		1.9447	1.9446		0.027	9.8	9.7	0.5258	0.5264
22	15 00	15 4		2.0861	2.0860		0.030	9.8	9.9	0.5254	0.5255
88	370 19	369.24	371.04	0.0672	0.00509	1.8718					0.042
21	12 31	12 35		1.9520	1.9525		0.076	8.3	8.2	0.5250	0.5257
22	13 35	13 39		2.0946	2.0946		0.061	8.0	7.9	0.5251	0.5253
88	372 14	371.04	372.84	0.0473	0.00509	1.8469					0.042
21	15 48	15 52		1.9781	1.9783		0.079	7.9	8.0	0.5266	0.5269
22	16 26	16 30		2.1419	2.1418		0.082	7.7	8.0	0.5262	0.5265
88	374 12	372.84	374.64	0.0473	0.00509	1.8905					0.042
21	10 49	10 57		1.9983	1.9968		0.136	6.4	6.3	0.5248	0.5244
22	11 38	11 44		2.2053	2.2058		0.134	6.3	6.3	0.5242	0.5244
88	376 9	374.64	376.44	0.0473	0.00509	1.3761					0.042
21	14 0	14 12		1.9861	1.9859		0.048	6.2	6.4	0.5256	0.5259
22	14 45	14 55		2.1139	2.1134		0.050	6.3	6.3	0.5254	0.5253
88	378 16	376.44	378.24	0.0473	0.00509	1.8558					0.042
21	8 22	8 26		1.9844	1.9848		0.104	4.5	4.6	0.5257	0.5257
22	10 36	10 40		2.0546	2.0545		0.052	4.2	4.4	0.5252	0.5258
88	380 22	378.24	380.04	0.0473	0.00509	1.8930					0.042
21	12 22	12 24		1.9940	1.9941		0.45	4.1	4.4	0.5265	0.5278
23	13 11	13 13		2.0880	2.0882		0.48	4.4	4.5	0.5268	0.5273
88	381 27	380.04	381.84	0.0473	0.00509	1.8212					0.042
21	15 52	15 54		2.0012	2.0014		0.65	4.4	4.3	0.5188	0.5182
23	16 49	16 51		2.1047	2.1047		0.71	4.7	4.6	0.5047	0.5024
88	382 17	361.84	383.64	0.0473	0.00509	1.4017					0.042
21	6 57	7 1		1.9115	1.9115		0.20	4.7	4.8	0.5186	0.5186
23	8 9	8 13		2.1437	2.1436		0.25	4.8	4.9	0.5187	0.5184

FILE: SBH3INJ DATA! * 06/10/81 09:25:02 UNIVERSITY OF WATERLOO PAGE 001

TEST INTERVAL (M.)		DELTA P (M.OF H2O)	DELTA Q (CC/MIN)	D=DIFFERENTIAL TRANSDUCER B=BUBBLOMETER
38- 40				D
40- 42	INC.1	5.49	0.61	D
40- 42	INC.2	5.25	1.72	D
42- 44		8.91	-0.16	D
44- 46		5.15	-0.06	D
46- 48		16.08	1.33	D
48- 50	INC.1	6.58	-0.62	D
48- 50	INC.2	5.75	-7.68	D
50- 52		3.13	-0.07	D
52- 54		5.16	0.42	D
54- 56		9.19	3.88	D
56- 58		1.02	-0.57	D
58- 60		1.06	-15.45	D
60- 62		17.60	3.83	D
62- 64				D
64- 66	UNABLE TO INTERPRET DATA			D
66- 68				D
68- 70		17.40	2.45	D
70- 72		3.79	10.95	D
72- 74		5.62	6.66	B
74- 76		10.34	0.12	B
76- 78		35.36	1.35	B
78- 80		34.34	0.05	B
80- 82		24.76	0.28	B
82- 84		9.63	-0.30	B
84- 86		12.03	0.00	B
86- 88				B
88- 90		16.01	0.1	B
90- 92		4.67	1.69	B
92- 94		4.54	0.10	B
94- 96		10.91	0.16	B
96- 98		4.48	0.05	B
98-100	INC.1	0.20	72.80	B
98-100	INC.2	0.24	90.06	B
100-102		0.43	60.76	B
102-104		4.50	26.42	B
104-106				B
106-108				B
108-110				B
110-112				B
112-114		27.12	0.014	B
114-116		18.90	0.023	B
116-118		24.04	0.022	B
118-120				B
120-122		10.24	0.004	B
122-124		1.24	26.90	B
124-126		7.88	2.23	B
126-128		23.23	2.54	B
128-130		13.86	15.42	B
130-132		21.93	12.60	B

132-134		24.96	2.13	B
134-136		24.06	3.23	B
136-138		4.69	0.25	B
138-140	INC.1	4.13	1.55	B
138-140	INC.2	7.91	2.50	B
140-142		9.93	0.03	B
142-144				B
144-146				B
146-148				B
148-150				B
150-152		13.17	0.13	B
152-154		8.77	0.45	B
154-156				B
156-158		8.42	0.03	B
158-160		14.99	10.40	B
160-162		24.51	3.80	B
162-164		11.45	0.64	B
164-166	INC.1	9.20	7.60	B
164-166	INC.2	5.06	3.50	B
166-168		5.56	0.10	B
168-170		20.49	0.90	B
170-172		23.13	0.28	B
172-174		7.88	0.02	B
174-176		9.53	0.02	B
176-178	INC.1	1.58	10.60	B
176-178	INC.2	1.79	9.20	B
178-180		14.85	0.32	B
180-182		26.02	0.34	B
182-184		10.53	1.40	B
184-186		10.88	0.00	B
186-188		27.08	1.20	B
188-190		27.46	0.19	B
190-192		19.08	0.01	B
192-194		1.01	1.42	B
194-196		18.12	0.13	B
196-198				B
198-200		19.69	0.29	B
200-202		27.79	2.60	B
202-204		29.08	0.60	B
204-206		14.67	2.20	B
206-208		13.63	0.07	B
208-210		7.77	0.05	B
210-212		0.68	28.00	B
212-214				B
214-216				B
216-218		BACKFLOWS		B
218-220				B
220-222		NO FLOW		
222-224		BACKFLOWS		
224-226		BACKFLOWS		
226-228		16.29	8.0	B
228-230		7.75	5.6	B
230-232		4.13	5.20	B
232-234		7.70	0.16	B
234-236	INC.1	6.24	1.6	B

234-236	INC.2	8.77	2.1	B
236-238		6.36	-0.02	B
238-240		14.96	0.05	B
240-242		27.82	0.058	B
242-244		24.96	-0.09	B
244-246		8.88	0.02	B
246-248		12.64	0.003	B
248-250		24.61	-0.007	B
250-252		16.97	-0.02	B
252-254	BACKFLOWS			B

254 TO 302: BACKFLOWS IN EVERY INTERVAL

B-3.4 Subsurface Boreholes, Single Fracture Tests

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C NOTE TEMPS. MAY NOT HAVE BEEN MONITORED,THEREFORE READINGS MEANINGLESS
C NOTE FORMAT FOR INPUT DATA DIFFERENT
99 HOLE SBH1 SINGLE FRACTURE HYDROLOGY DATA
88   65.19 47    64.61    65.61                                0.4168
21   08 59    09 03     0.4188    0.4202                       0.598 12.2 12.4 0.1832 0.1832
21   09 03    09 07     0.4202    0.4216                       0.561 12.4 13.3 0.1832 0.1831
21   09 07    09 11     0.4216    0.4228                       0.474 13.3 12.4 0.1831 0.1832
21   10 10    10 14     0.4251    0.4244                       0.138 13.5 13.6 0.1829 0.1830
21   10 14    10 18     0.4244    0.4247                       0.198 13.6 13.7 0.1830 0.1830
21   10 18    10 22     0.4247    0.4248                       0.178 13.7 11.9 0.1830 0.1830
21   10 22    10 26     0.4248    0.4250                       0.171 11.9 13.1 0.1830 0.1829
21   10 26    10 30     0.4250    0.4248                       0.204 13.1 13.4 0.1829 0.1839
21   10 30    10 34     0.4248    0.4252                       0.200 13.4 12.9 0.1839 0.1826
21   12 23    12 27     0.4101    0.4109                       0.483 13.8 13.1 0.1697 0.1698
21   12 27    12 31     0.4109    0.4107                       0.410 13.1 13.5 0.1698 0.1696
21   12 31    12 35     0.4107    0.4106                       0.365 13.5 13.3 0.1696 0.1696
21   12 35    12 39     0.4106    0.4106                       0.348 13.3 13.9 0.1696 0.1698
21   12 39    12 43     0.4106    0.4106                       0.365 13.9 14.1 0.1698 0.1709
21   12 43    12 47     0.4106    0.4108                       0.385 14.1 14.0 0.1709 0.1694
21   12 47    12 51     0.4108    0.4108                       0.328 14.0 13.9 0.1694 0.1694
21   12 51    12 55     0.4108    0.4111                       0.308 13.9 13.8 0.1694 0.1694
21   12 55    12 59     0.4111    0.4112                       0.276 13.8 14.9 0.1694 0.1693
21   12 59    13 03     0.4112    0.4112                       0.267 14.9 14.7 0.1693 0.1694
21   13 03    13 07     0.4112    0.4111                       0.259 14.7 14.0 0.1694 0.1694
21   13 11    13 15     0.4111    0.4112                       0.227 14.0 13.6 0.1694 0.1696
21   13 15    13 19     0.4112    0.4109                       0.208 13.6 13.2 0.1696 0.1695
21   13 19    13 23     0.4109    0.4110                       0.198 13.2 14.0 0.1695 0.1695
21   13 23    13 27     0.4110    0.4113                       0.187 14.0 13.4 0.1695 0.1696
21   13 27    13 31     0.4113    0.4111                       0.250 13.4 14.8 0.1696 0.1695
21   13 31    13 35     0.4111    0.4112                       0.188 14.8 13.8 0.1695 0.1693
21   13 35    13 39     0.4112    0.4113                       0.178 13.8 14.6 0.1693 0.1695
21   13 39    13 43     0.4113    0.4113                       0.155 14.6 13.6 0.1695 0.1693
21   13 43    13 47     0.4113    0.4110                       0.167 13.6 13.8 0.1693 0.1694
21   13 47    13 51     0.4110    0.4113                       0.175 13.8 14.0 0.1694 0.1694
21   13 51    13 55     0.4113    0.4114                       0.155 14.0 13.8 0.1694 0.1695
21   13 55    13 59     0.4114    0.4113                       0.141 13.8 13.1 0.1695 0.1694
21   13 59    14 03     0.4113    0.4113                       0.141 13.1 13.4 0.1694 0.1696
21   14 03    14 07     0.4113    0.4112                       0.131 13.4 13.7 0.1696 0.1696
21   14 07    14 11     0.4112    0.4113                       0.132 13.7 13.5 0.1696 0.1705
21   14 11    14 15     0.4113    0.4113                       0.185 13.5 14.0 0.1705 0.1693
21   14 15    14 19     0.4113    0.4113                       0.124 14.0 13.5 0.1693 0.1691
22   15 33    15 37     0.5233    0.5232                       0.080 13.5 13.4 0.2797 0.2800
22   15 37    15 41     0.5232    0.5233                       0.076 13.4 13.7 0.2800 0.2799
22   15 41    15 45     0.5233    0.5233                       0.076 13.7 13.4 0.2799 0.2800
22   15 45    15 49     0.5233    0.5231                       0.078 13.4 13.5 0.2800 0.2755
22   15 49    15 53     0.5231    0.5231                       0.072 13.5 12.6 0.2755 0.2803
22   15 53    16 03     0.5231    0.5229                       0.117 12.6 13.7 0.2803 0.2801
22   16 03    16 13     0.5229    0.5231                       0.068 13.7 12.3 0.2801 0.2798
22   16 13    16 23     0.5231    0.5230                       0.066 12.3 12.4 0.2798 0.2800
22   16 23    16 33     0.5230    0.5229                       0.062 12.4 12.4 0.2800 0.2813
22   16 43    16 53     0.5230    0.5229                       0.067 13.6 13.5 0.2798 0.2804
99   SBH1 NRD 65.19  FIST INCREMENT RESTARTED AT 12:23
88   77.73 37    77.15    77.95                                0.3948
21   13 07    13 11     0.4452    0.4468                       0.259 18.7 18.5 0.1395 0.1394
21   13 11    13 15     0.4468    0.4468                       0.132 18.5 18.5 0.1394 0.1395
```

21	13	15	13	19	0.4468	0.4467	0.132	18.5	18.6	0.1395	0.1388
21	13	19	13	23	0.4467	0.4468	0.052	18.6	18.0	0.1388	0.1391
21	14	11	14	15	0.4456	0.4455	0.078	17.4	17.7	0.1396	0.1396
21	14	15	14	19	0.4455	0.4454	0.086	17.7	18.3	0.1396	0.1394
21	14	19	14	23	0.4454	0.4455	0.030	18.3	17.4	0.1394	0.1391
21	14	23	14	27	0.4455	0.4456	0.020	17.4	16.2	0.1391	0.1392
21	14	27	14	37	0.4456	0.4455	0.029	16.2	14.6	0.1392	0.1397
21	14	37	14	47	0.4455	0.4453	0.060	14.6	14.7	0.1397	0.1404
21	14	47	14	57	0.4453	0.4454	0.105	14.7	16.8	0.1404	0.1395
21	14	57	15	07	0.4454	0.4456	0.087	16.8	17.4	0.1395	0.1397
21	15	07	15	17	0.4456	0.4457	0.092	17.4	18.1	0.1397	0.1394
21	15	17	15	27	0.4457	0.4460	0.056	18.1	17.0	0.1394	0.1393
21	15	40	15	44	0.5316	0.5321	0.078	15.3	13.8	0.2246	0.2259
21	15	44	15	48	0.5321	0.5317	0.103	13.8	12.9	0.2259	0.2251
21	15	48	15	52	0.5317	0.5317	0.144	12.9	15.1	0.2251	0.2246
21	15	52	15	56	0.5317	0.5316	0.124	15.1	16.3	0.2246	0.2243
21	15	56	16	00	0.5316	0.5317	0.112	16.3	16.6	0.2243	0.2243
21	16	00	16	04	0.5317	0.5318	0.103	16.6	16.8	0.2243	0.2243
21	16	04	16	08	0.5318	0.5318	0.099	16.8	18.1	0.2243	0.2246
21	16	08	16	12	0.5318	0.5319	0.092	18.1	18.3	0.2246	0.2245
21	16	12	16	16	0.5319	0.5321	0.088	18.3	18.2	0.2245	0.2247
22	19	30	19	34	0.6190	0.6195	0.085	16.3	17.3	0.3107	0.3107
22	19	34	19	38	0.6195	0.6197	0.066	17.3	18.1	0.3107	0.3108
22	19	38	19	42	0.6197	0.6198	0.063	18.1	18.1	0.3108	0.3108
22	19	53	19	57	0.5024	0.5027	0.033	17.4	18.0	0.2035	0.2036
22	19	57	20	01	0.5027	0.5028	0.033	18.0	18.3	0.2036	0.2036
22	20	01	20	05	0.5028	0.5030	0.034	18.3	18.5	0.2036	0.2037
22	08	56	09	00	0.5077	0.5080	0.078	14.3	15.6	0.2025	0.2017
22	09	00	09	04	0.5080	0.5080	0.069	15.6	15.6	0.2017	0.2012
22	09	04	09	08	0.5080	0.5081	0.060	15.6	17.2	0.2012	0.2011
22	09	08	09	12	0.5081	0.5082	0.049	17.2	17.3	0.2011	0.2012
22	09	12	09	16	0.5082	0.5084	0.043	17.3	17.9	0.2012	0.2010
22	09	16	09	20	0.5084	0.5084	0.042	17.9	17.3	0.2010	0.2011
22	09	20	09	24	0.5084	0.5086	0.040	17.3	18.1	0.2011	0.2012
22	09	24	09	28	0.5086	0.5088	0.029	18.1	17.7	0.2012	0.2009
88	80.92	34	80.34		81.16		0.4531				
21	12	40	12	44	0.4568	0.4574	0.517	11.9	12.0	0.1410	0.1411
21	12	44	12	48	0.4574	0.4583	0.497	12.0	11.3	0.1411	0.1409
21	12	48	12	52	0.4583	0.4593	0.489	11.3	11.4	0.1409	0.1410
21	12	56	12	58	0.4608	0.4614	0.477	11.9	11.6	0.1411	0.1411
21	12	58	13	00	0.4614	0.4614	0.423	11.6	11.7	0.1411	0.1409
21	13	00	13	02	0.4614	0.4615	0.437	11.7	11.0	0.1409	0.1409
21	13	02	13	04	0.4615	0.4620	0.400	11.0	11.6	0.1409	0.1409
21	13	04	13	06	0.4620	0.4618	0.371	11.6	10.9	0.1409	0.1407
21	13	06	13	08	0.4618	0.4616	0.351	10.9	11.6	0.1407	0.1407
21	13	08	13	10	0.4616	0.4614	0.348	11.6	11.6	0.1407	0.1407
21	13	10	13	12	0.4614	0.4610	0.339	11.6	11.9	0.1407	0.1408
21	13	12	13	14	0.4610	0.4609	0.342	11.9	11.5	0.1408	0.1409
21	13	14	13	18	0.4609	0.4606	0.339	11.5	12.4	0.1409	0.1408
21	13	18	13	22	0.4606	0.4606	0.339	12.4	11.3	0.1408	0.1407
21	13	22	13	26	0.4606	0.4607	0.345	11.3	12.3	0.1407	0.1408
21	13	26	13	30	0.4607	0.4613	0.391	12.3	12.0	0.1408	0.1409
21	13	34	13	38	0.4623	0.4623	0.322	11.1	11.2	0.1408	0.1409
21	13	38	13	42	0.4623	0.4625	0.296	11.2	11.4	0.1409	0.1408
21	13	48	13	52	0.4623	0.4622	0.241	11.1	11.0	0.1410	0.1409

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21   13 52    13 56     0.4622    0.4618              0.236 11.0 11.0 0.1409 0.1409
21   13 56    14 00     0.4618    0.4614              0.233 11.0 10.7 0.1409 0.1410
21   14 00    14 04     0.4614    0.4611              0.236 10.7 11.2 0.1410 0.1410
22   14 32    14 36     0.5158    0.5160              0.296 10.9 10.7 0.1942 0.1942
22   14 36    14 40     0.5160    0.5162              0.273 10.7 10.7 0.1942 0.1941
22   14 40    14 44     0.5162    0.5162              0.256 10.7 11.7 0.1941 0.1941
22   14 52    14 56     0.5159    0.5154              0.236 10.7 10.9 0.1941 0.1941
22 X 14 56    15 00     0.5154    0.5153              0.228 10.9 11.4 0.1941 0.1941
22   15 00    15 04     0.5153    0.5151              0.221 11.9  9.9 0.1941 0.1940
22   15 06    15 10     0.5551    0.5548              0.310 10.5 10.8 0.2334 0.2333
22   15 10    15 14     0.5548    0.5549              0.284 10.8 10.5 0.2333 0.2332
22   15 18    15 22     0.5547    0.5548              0.270 10.9 11.3 0.2332 0.2332
22   15 22    15 26     0.5548    0.5548              0.263 11.3 10.6 0.2332 0.2332
22   15 26    15 30     0.5548    0.5543              0.262 10.6 10.8 0.2332 0.2332
88 208.43 16                                          1.7852
22   11 53    11 57     1.9500    1.9495              0.143
22   11 57    12 05     1.9495    1.9483              0.094
22   12 05    12 09     1.9483    1.9480              0.083
22   12 09    12 13     1.9480    1.9475              0.075
22   12 13    12 17     1.9475    1.9470              0.072
22   12 17    12 21     1.9470    1.9465              0.072
22   12 21    12 25     1.9465    1.9461              0.072
22   12 25    12 29     1.9461    1.9457              0.072
23   12 49    12 53     2.1588    2.1572              0.167
23   12 53    12 57     2.1572    2.1559              0.135
23   12 57    13 01     2.1559    2.1541              0.109
23   13 01    13 05     2.1541    2.1533              0.109
23   13 05    13 09     2.1533    2.1519              0.104
23   13 09    13 13     2.1519    2.1512              0.104
23   13 13    13 17     2.1512    2.1503              0.104
23   13 17    13 21     2.1503    2.1495              0.104
99   SBH1SF NRD 208.43 FIRST INCREMENT BACKFLOW
88 211.02 29  210.44  211.24                          1.1509  15/10/79
21   15 50    15 54     1.1646    1.1642              0.0776 11.2 11.3 0.1840 0.1845
21   15 54    15 58     1.1642    1.1644              0.0633 11.3 11.6 0.1845 0.1830
21   15 58    16 02     1.1644    1.1644              0.0345 11.6 12.9 0.1830 0.1830
21   16 02    16 06     1.1644    1.1643              0.0316 12.9 12.6 0.1830 0.1831
21   16 06    16 10     1.1643    1.1647              0.0316 12.6 11.9 0.1831 0.1831
21   16 10    16 14     1.X1647   1.1645              0.0287 11.9 12.2 0.1831 0.1832
21   16 14    16 18     1.1645    1.1644              0.0287 12.2 12.7 0.1832 0.1832
21   16 18    16 22     1.1644    1.1645              0.0258 12.7 11.9 0.1832 0.1832
21   16 22    16 26     1.1645    1.1646              0.0258 11.9 11.0 0.1832 0.1833
22   16 37    16 41     1.2142    1.2144              0.0690 11.9 12.9 0.2334 0.2318
22   16 41    16 45     1.2144    1.2143              0.0400 12.9 11.2 0.2318 0.2318
22   16 45    16 49     1.2143    1.2143              0.0345 11.2 12.0 0.2318 0.2318
22   16 49    16 53     1.2143    1.2142              0.0287 12.0 11.7 0.2318 0.2320
22   16 53    16 57     1.2142    1.2143              0.0387 11.7 11.8 0.2320 0.2318
22   16 57    17 01     1.2143    1.2143              0.0287 11.8 10.7 0.2318 0.2320
22   17 01    17 05     1.2143    1.2145              0.0287 10.7 12.6 0.2320 0.2318
23   08 50    08 54     1.2666    1.2663              0.0630  8.2  7.3 0.2845 0.2841
23   08 54    08 58     1.2663    1.2664              0.0570  7.3  6.8 0.2841 0.2838
23   08 58    09 02     1.2664    1.2662              0.1090  6.8  8.5 0.2838 0.2842
23   09 02    09 48     1.2662    1.2661              0.0580  8.5  7.7 0.2842 0.2830
23   09 48    09 52     1.2561    1.2662              0.0290  7.7  8.4 0.2830 0.2828
23   09 52    09 56     1.2662    1.2660              0.0550  8.4  7.9 0.2828 0.2828
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23  11 36   11 40    1.2661   1.2660            0.0110  8.9  7.6 0.2822 0.2820
23  11 40   11 50    1.2660   1.2658            0.0130  7.6  8.0 0.2820 0.2821
23  11 50   12 00    1.2658   1.2657            0.0410  8.0  7.6 0.2821 0.2828
23  12 00   12 10    1.2657   1.2661            0.0270  7.6  8.6 0.2828 0.2824
23  12 10   12 20    1.2661   1.2659            0.0090  8.6  7.3 0.2824 0.2825
23  12 20   12 30    1.2659   1.2658            0.0400  7.3  7.8 0.2825 0.2830
23  12 30   12 40    1.2658   1.2663            2.2000  7.8  7.9 0.2830 0.2819
88 211.02 14                   0.0535  0.7317    0.9779   29/10/79
21  13 16   13 20    1.0416   1.0415            0.000 10.1  9.2 0.2280 0.2281
21  13 20   13 24    1.0415   1.0414            0.029  9.2 10.3 0.2281 0.2280
21  13 24   13 28    1.0414   1.0412            0.029 10.3  9.7 0.2280 0.2280
21  13 28   13 32    1.0412   1.0412            0.029  9.7  9.3 0.2280 0.2278
22  14 25   14 29    1.1483   1.1483            0.010  7.6  8.3 0.3281 0.3280
22  14 29   14 33    1.1483   1.1481            0.020  8.3  7.9 0.3280 0.3279
22  14 33   14 37    1.1481   1.1479            0.026  7.9  7.9 0.3279 0.3278
22  14 37   14 41    1.1479   1.1478            0.034  7.9  8.3 0.3278 0.3278
22  14 41   14 45    1.1478   1.1475            0.029  8.3  8.7 0.3278 0.3278
22  14 45   14 49    1.1475   1.1474            0.029  8.7  8.2 0.3278 0.3276
23  15 32   15 36    1.3240   1.3235            0.017  7.4  6.9 0.5099 0.5103
23  15 36   15 40    1.3235   1.3233            0.017  6.9  6.9 0.5103 0.5096
23  15 40   15 44    1.3233   1.3230            0.029  6.9  8.2 0.5096 0.5093
23  15 44   15 48    1.3230   1.3226            0.029  8.2  7.1 0.5093 0.5094
23  15 48   15 52    1.3226   1.3224            0.026  7.1  7.5 0.5094 0.5094
88 220.69 30  220.11*  220.91                    1.0149   16/10/79
21  16 36   16 40    1.0613   1.0614            0.049  9.3  9.6 0.1818 0.1829
21  16 40   16 44    1.0614   1.0612            0.032  9.6 10.4 0.1829 0.1822
21  16 44   16 48    1.0612   1.0611            0.026 10.4 10.5 0.1822 0.1818
21  16 48   16 52    1.0611   1.0603            0.024 10.5 12.1 0.1818 0.1817
21  16 52   16 56    1.0603   1.0609            0.000 12.1 11.1 0.1817 0.1813
21  16 56   17 00    1.0609   1.0605            0.007 11.1 10.7 0.1813 0.1814
22  17 12   17 16    1.0880   1.0875            0.069  9.6  9.8 0.2080 0.2096
22  17 16   17 20    1.0875   1.0875            0.055  9.8  9.7 0.2096 0.2086
22  17 20   17 24    1.0875   1.0872            0.049  9.7 10.7 0.2086 0.2084
22  17 24   17 28    1.0872   1.0870            0.066 10.7 11.7 0.2084 0.2084
22  17 28   17 32    1.0870   1.0869            0.121 11.7 12.0 0.2084 0.2079
22  21 30   21 34    1.0852   1.1785           54.800 11.9 10.8 0.2990 0.2980
22  21 34   21 38    1.1785   1.1889            1.650 10.8 10.1 0.2980 0.2981
22  21 38   21 42    1.1889   1.1906            0.101 10.1 10.2 0.2981 0.2978
23  06 16   06 20    1.2029   1.2034            0.135  9.7 10.9 0.2908 0.2909
23  06 20   06 24    1.2034   1.2031            0.115 10.9 10.8 0.2909 0.2909
23  06 24   06 28    1.2031   1.2029            0.098 10.8 11.6 0.2909 0.2909
23  06 28   06 32    1.2029   1.2029            0.043 11.6 10.4 0.2909 0.2906
23  06 32   06 36    1.2029   1.2028            0.029 10.4  9.7 0.2906 0.2906
23  06 36   06 40    1.2028   1.2024            0.026  9.7  9.6 0.2906 0.2908
23  06 40   06 44    1.2024   1.2019            0.026  9.6  8.5 0.2908 0.2907
23  06 44   06 48    1.2019   1.2010            0.026  8.5  8.3 0.2907 0.2906
23  06 48   06 52    1.2010   1.2013            0.026  8.3  7.7 0.2906 0.2906
24  07 08   07 12    1.2704   1.2713            0.140  7.5  6.9 0.3383 0.3380
24  07 12   07 16    1.2713   X1.2713            0.054  6.9  7.3 0.3380 0.3380
24  07 16   07 20    1.2713   1.2710            0.051  7.3  6.7 0.3380 0.3377
24  07 20   07 24    1.2710   1.2705            0.054  6.7  7.1 0.3377 0.3377
24  07 24   07 28    1.2705   1.2686            0.051  7.1  6.7 0.3377 0.3374
24  07 28   07 32    1.2686   1.2695            0.051  6.7  7.0 0.3374 0.3370
88 220.69 21                   0.0535  0.7317    1.0300   30/10/79
21  06 27   06 31    1.1859   1.1861            1.040  8.7  8.6 0.3178 0.3177
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21	06 31	06 35	1.1861	1.1860			0.420	8.6	8.2	0.3177	0.3177
21	06 35	06 39	1.1860	1.1860			0.244	8.2	8.0	0.3177	0.3175
21	06 39	06 43	1.1860	1.1860			0.178	8.0	7.7	0.3175	0.3174
21	06 43	06 47	1.1860	1.1857			0.046	7.7	7.5	0.3174	0.3172
22	07 48	07 52	1.3785	1.3782			0.121	11.6	10.9	0.5145	0.5144
22	07 52	07 56	1.3782	1.3777			0.055	10.9	10.2	0.5144	0.5142
22	07 56	08 00	1.3777	1.3773			0.032	10.2	10.4	0.5142	0.5140
23	08 30	08 34	1.5476	1.5473			0.181	7.7	7.5	0.6911	0.6906
23	08 34	08 38	1.5473	1.5474			0.164	7.5	7.5	0.6906	0.6906
23	08 38	08 42	1.5474	1.5473			0.172	7.5	7.3	0.6906	0.6904
23	08 42	08 46	1.5473	1.5472			0.172	7.3	7.6	0.6904	0.6903
23	08 46	08 50	1.5472	1.5469			0.147	7.6	7.4	0.6903	0.6904
23	08 50	08 54	1.5469	1.5470			0.098	7.4	7.6	0.6904	0.6901
23	08 54	08 58	1.5470	1.5463			0.083	7.6	7.9	0.6901	0.6898
23	08 58	09 02	1.5463	1.5462			0.078	7.9	7.2	0.6899	0.6898
23	09 02	09 06	1.5462	1.5458			0.075	7.2	7.4	0.6898	0.6898
23	09 06	09 10	1.5458	1.5454			0.069	7.4	7.7	0.6898	0.6895
23	09 10	09 14	1.5454	1.5450			0.068	7.7	8.0	0.6895	0.6893
23	09 14	09 18	1.5450	1.5446			0.066	8.0	7.4	0.6893	0.6892
23	09 18	09 22	1.5446	1.5444			0.068	7.4	8.1	0.6892	0.6890
88	231.08	27 230.50	231.30				1.2305	17/10/79			
21	12 38	12 42	1.2795	1.2800			0.213	8.3	9.7	0.1826	0.1827
21	12 42	12 46	1.2800	1.2800			0.210	9.7	8.7	0.1827	0.1826
21	12 46	12 50	1.2800	1.2800			0.187	8.7	8.6	0.1826	0.1829
21	12 50	12 54	1.2800	1.2800			0.175	8.6	9.3	0.1829	0.1828
21	12 54	12 58	1.2800	1.2799			0.173	9.3	8.6	0.1828	0.1828
21	12 58	13 02	1.2799	1.2800			0.164	8.6	8.1	0.1828	0.1827
21	13 02	13 06	1.2800	1.2800			0.161	8.1	9.1	0.1827	0.1829
21	13 06	13 10	1.2800	1.2798			0.216	9.1	8.5	0.1829	0.1828
21	13 10	13 14	1.2798	1.2800			0.221	8.5	8.2	0.1828	0.1827
21	13 14	13 18	1.2800	1.2801			0.175	8.2	9.3	0.1827	0.1828
21	13 18	13 22	1.2801	1.2803			0.170	9.3	8.2	0.1828	0.1826
21	13 22	13 26	1.2803	1.2802			0.152	8.2	8.5	0.1826	0.1827
21	13 26	13 30	1.2802	1.2802			0.155	8.5	8.4	0.1827	0.1827
21	13 30	13 34	1.2802	1.2802			0.144	8.4	8.3	0.1827	0.1828
21	13 34	13 38	1.2802	1.2804			0.144	8.3	8.8	0.1828	0.1828
21	13 38	13 42	1.2804	1.2801			0.131	8.8	8.6	0.1828	0.1828
21	13 42	13 46	1.2801	1.2799			0.132	8.6	8.5	0.1828	0.1828
21	13 46	13 50	1.2799	1.2801			0.132	8.5	8.5	0.1828	0.1829
21	13 50	13 54	1.2801	1.2801			0.127	8.5	8.7	0.1829	0.1827
21	13 54	13 58	1.2801	1.2799			0.132	8.7	8.1	0.1827	0.1828
22	15 18	15 22	1.3332	1.3335			0.095	8.5	8.5	0.2364	0.2362
22	15 22	15 26	1.3335	1.3333			0.090	8.5	8.0	0.2362	0.2365
22	15 26	15 30	1.3333	1.3334			0.090	8.0	7.9	0.2365	0.2363
22	15 30	15 34	1.3334	1.3335			0.083	7.9	8.9	0.2363	0.2364
22	15 34	15 38	1.3335	1.3332			0.086	8.9	8.2	0.2364	0.2363
22	15 38	15 42	1.3332	1.3331			0.086	8.2	8.5	0.2363	0.2363
22	15 42	15 46	1.3331	1.3329			0.086	8.5	7.8	0.2363	0.2364
88	231.08	22		0.0535	0.7317		1.0705	30/10/79			
21	13 17	13 21	1.3150	1.3150			0.293	6.9	6.8	0.4109	0.4110
21	13 21	13 25	1.3150	1.3165			0.531	6.8	7.3	0.4110	0.4110
21	13 25	13 29	1.3165	1.3165			0.345	7.3	7.1	0.4110	0.4109
21	13 29	13 33	1.3165	1.3161			0.115	7.1	6.2	0.4109	0.4109
21	13 33	13 37	1.3161	1.3153			0.037	6.2	6.7	0.4109	0.4109
21	13 37	13 41	1.3153	1.3149			0.000	6.7	6.1	0.4109	0.4107

22	10	52	10	56	1.5757	1.5755		0.086	8.1	7.0	0.3361	0.3359
22	10	56	11	00	1.5755	1.5751		0.083	7.0	7.3	0.3359	0.3356
22	11	00	11	04	1.5751	1.5752		0.080	7.3	7.5	0.3356	0.3352
22	11	04	11	08	1.5752	1.5749		0.075	7.5	7.5	0.3352	0.3351
22	11	08	11	12	1.5749	1.5746		0.078	7.5	7.1	0.3351	0.3350
22	11	12	11	16	1.5746	1.5743		0.083	7.1	7.2	0.3350	0.3347
22	11	16	11	20	1.5743	1.5741		0.080	7.2	6.9	0.3347	0.3346
22	11	20	11	24	1.5741	1.5738		0.080	6.9	6.4	0.3346	0.3342
22	11	24	11	28	1.5738	1.5736		0.080	6.4	7.2	0.3342	0.3340
22	11	28	11	32	1.5736	1.5734		0.080	7.2	5.8	0.3340	0.3337
88	259	23	20			0.0535	0.7317	1.1899				
21	12	50	12	54	1.2833	1.2831		0.207				
21	12	58	13	02	1.2853	1.2850		0.207				
21	13	50	13	54	1.4418	1.4416		0.057				
22	13	54	13	58	1.4416	1.4414		0.023				
23	14	34	14	38	1.7007	1.7007		0.195				
23	14	38	14	42	1.7007	1.7006		0.118				
23	14	42	14	46	1.7006	1.7004		0.092				
23	14	46	14	50	1.7004	1.7001		0.077				
23	14	50	14	54	1.7001	1.7002		0.095				
23	14	54	14	58	1.7002	1.7001		0.086				
23	14	58	15	02	1.7001	1.7002		0.055				
23	15	2	15	6	1.7002	1.7000		0.055				
23	15	6	15	10	1.7000	1.6999		0.055				
23	15	10	15	14	1.6999	1.6997		0.040				
23	15	14	15	50	1.6997	1.6985		0.043				
23	15	50	15	54	1.6985	1.6983		0.032				
23	15	54	15	58	1.6983	1.6979		0.020				
23	15	58	16	2	1.6979	1.6980		0.020				
23	16	02	16	6	1.6980	1.6977		0.020				
23	16	6	16	10	1.6977	1.6974		0.020				
88	264.15	22						1.4035	18/10/79			
21	13	21	13	25	1.5555	1.5556		0.285	10.4	9.8	0.2916	0.2915
21	13	25	13	29	1.5556	1.5554		0.230	9.8	9.6	0.2915	0.2916
21	13	29	13	33	1.5554	1.5553		0.213	9.6	9.3	0.2916	0.2913
21	13	33	13	37	1.5553	1.5551		0.201	9.3	8.8	0.2913	0.2913
21	13	37	13	41	1.5551	1.5551		0.192	8.8	8.6	0.2913	0.2911
21	13	41	13	45	1.5551	1.5550		0.178	8.6	7.6	0.2911	0.2910
21	13	49	13	53	1.5547	1.5547		0.172				
21	13	53	13	57	1.5547	1.5545		0.172				
21	13	57	14	01	1.5545	1.5544		0.161				
21	14	1	14	5	1.5544	1.5542		0.164				
21	14	5	14	9	1.5542	1.5543		0.164				
21	14	9	14	17	1.5543	1.5542		0.155				
21	14	13	14	17	1.5542	1.5541		0.155				
21	14	17	14	21	1.5541	1.5539		0.155				
21	14	21	14	25	1.5539	1.5538		0.155				
22	15	34	15	38	1.6298	1.6295		0.124				
22	15	38	15	42	1.6295	1.6294		0.124				
22	15	42	15	46	1.6294	1.6292		0.124				
22	15	46	15	50	1.6292	1.6293		0.124				
22	15	50	15	54	1.6293	1.6290		0.124				
22	15	54	15	58	1.6290	1.6289		0.124				
22	15	58	16	02	1.6289	1.6289		0.124				
88	264.15	16				0.0535	0.7317	1.2265				

22	14 24	14 28	1.5867	1.5867		0.155	4.9	4.7	0.6917	0.6912
22	14 28	14 32	1.5867	1.5867		0.118	4.7	4.6	0.6912	0.6911
22	14 32	14 36	1.5867	1.5863		0.102	4.6	4.7	0.6911	0.6910
22	14 36	14 40	1.5863	1.5859		0.089	4.7	4.8	0.6910	0.6905
22	14 40	14 44	1.5859	1.5855		0.080	4.8	5.8	0.6905	0.6902
22	14 44	14 48	1.5855	1.5851		0.060	5.8	5.2	0.6902	0.6902
22	14 48	14 52	1.5851	1.5845		0.060	5.2	5.2	0.6902	0.6898
22	14 52	14 56	1.5845	1.5840		0.043	5.2	4.6	0.6898	0.6898
22	14 56	15 00	1.5840	1.5836		0.043	4.6	4.9	0.6898	0.6892
22	15 00	15 04	1.5836	1.5831		0.043	4.9	3.9	0.6892	0.6890
22	15 04	15 06	1.5831	1.5827		0.034	3.9	4.5	0.6890	0.6887
22	15 08	15 12	1.5827	1.5823		0.032	4.5	4.8	0.6887	0.6884
22	15 12	15 56	1.5823	1.5775		0.028	4.8	3.6	0.6884	0.6860
22	15 56	16 08	1.5775	1.5762		0.021	3.6	3.5	0.6860	0.6855
22	16 08	16 16	1.5762	1.5753		0.024	3.5	3.8	0.6855	0.6851
22	16 16	16 24	1.5753	1.5748		0.024	3.8	3.7	0.6851	0.6847
88	251.00 17	250.42	251.22			1.3199	17/10/79			
21	19 42	19 46	1.6873	1.6860		0.091	11.1	11.3	0.5024	0.5013
21	19 46	19 50	1.6860	1.6850		0.052	11.3	11.6	0.5013	0.5006
21	19 50	19 54	1.6850	1.6838		0.027	11.6	10.5	0.5006	0.4997
21	19 54	19 58	1.6838	1.6817		0.030	10.5	10.5	0.4997	0.4992
21	19 58	20 02	1.6817	1.6788		0.026	10.5	9.8	0.4992	0.4986
21	20 02	20 06	1.6788	1.6772		0.023	9.8	9.7	0.4986	0.4982
21	20 06	20 16	1.6772	1.6746		0.021	9.7	9.0	0.4982	0.4969
21	20 16	20 26	1.6746	1.6719		0.018	9.0	8.8	0.4969	0.4957
21	20 26	20 36	1.6719	1.6797		0.017	8.8	8.9	0.4957	0.4949
21	20 36	20 46	1.6797	1.6787		0.018	8.9	7.9	0.4949	0.4938
21	20 46	20 56	1.6787	1.6774		0.017	7.9	8.6	0.4938	0.4930
22	21 15	21 25	1.8029	1.7941		0.042	7.4	7.5	0.6171	0.6158
22	21 25	21 35	1.7941	1.7934		0.030	7.5	7.5	0.6158	0.6142
22	21 35	21 45	1.7934	1.7944		0.027	7.5	7.6	0.6142	0.6130
22	21 45	21 55	1.7944	1.7983		0.025	7.6	7.4	0.6130	0.6117
22	21 55	22 05	1.7983	1.7988		0.025	7.4	7.8	0.6117	0.6104
22	22 05	22 15	1.7988	1.7975		0.023	7.8	6.9	0.6104	0.6090
88	251.00 7			0.0535	0.7317		31/10/79			
21	06 24	06 28	1.2773	1.2772		0.000	8.8	8.8	0.2884	0.2882
22	07 00	07 04	1.4338	1.4335		0.029	6.3	6.9	0.4278	0.4274
24	08 11	08 15	1.6945	1.6941		0.043	5.2	5.4	0.6936	0.6934
24	08 15	08 19	1.6941	1.6938		0.029	5.4	6.4	0.6934	0.6929
24	08 19	08 23	1.6938	1.6936		0.063	6.4	5.8	0.6929	0.6924
24	08 23	08 27	1.6936	1.6936		0.049	5.8	5.3	0.6924	0.6922
24	08 27	08 31	1.6936	1.6934		0.009	5.3	5.7	0.6922	0.6923
88	259.23 22					1.3802	18/10/79			
21	09 48	09 52	1.5202	1.5203		0.106	9.7	9.0	0.4982	0.4969
21	09 52	09 56	1.5203	1.5200		0.104	7.0	7.8	0.2805	0.2804
21	09 56	10 00	1.5200	1.5201		0.098	7.8	7.9	0.2804	0.2805
21	10 00	10 04	1.5201	1.5198		0.098	7.9	7.9	0.2805	0.2804
21	10 04	10 08	1.5198	1.5200		0.098	7.9	7.6	0.2804	0.2803
21	10 08	10 12	1.5200	1.5197		0.098	7.6	7.3	0.2803	0.2799
22	10 28	10 32	1.5770	1.5769		0.120	6.2	6.9	0.3375	0.3375
22	10 32	10 36	1.5769	1.5767		0.104	6.9	6.8	0.3375	0.3371
22	10 36	10 40	1.5767	1.5764		0.098	6.8	7.1	0.3371	0.3367
22	10 40	10 44	1.5764	1.5762		0.095	7.1	6.4	0.3367	0.3365
22	10 44	10 48	1.5762	1.5759		0.095	6.4	8.0	0.3365	0.3364
22	10 48	10 52	1.5759	1.5757		0.089	8.0	8.1	0.3364	0.3361

21	06 37	06 41	1.3220	1.3215			0.037
22	07 28	07 32	1.4802	1.4798			0.029
22	07 32	07 36	1.4798	1.4795			0.000
22	07 36	07 40	1.4795	1.4792			0.000
23	08 09	08 13	1.5638	1.5630			0.080
23	08 13	08 17	1.5630	1.5629			0.017
23	08 17	08 21	1.5629	1.5623			0.000
24	08 43	08 47	1.7390	1.7385			0.195
24	08 47	08 51	1.7385	1.7380			0.092
24	08 51	08 55	1.7380	1.7376			0.077
24	08 55	08 59	1.7376	1.7373			0.060
24	08 59	09 03	1.7373	1.7369			0.046
24	09 03	09 07	1.7369	1.7364			0.043
24	09 07	09 11	1.7364	1.7359			0.043
24	09 11	09 15	1.7359	1.7356			0.043
24	09 15	09 19	1.7356	1.7356			0.043
88	285.05	20					1.5039
21	6 46	6 50	1.6542	1.6538			0.020
21	6 50	6 54	1.6538	1.6537			0.032
21	6 54	6 58	1.6537	1.6534			0.051
21	6 58	7 02	1.6534	1.6537			0.009
21	7 2	7 38	1.6537	1.6518			0.010
22	7 53	7 57	1.7901	1.7891			0.060
22	7 57	8 01	1.7891	1.7882			0.043
22	8 01	8 05	1.7882	1.7870			0.028
22	8 09	8 13	1.8016	1.8002			0.037
22	8 13	8 17	1.8002	1.7994			0.032
22	8 17	8 21	1.7994	1.7982			0.026
22	8 21	8 25	1.7982	1.7974			0.020
22	8 25	8 29	1.7974	1.7963			0.020
22	8 29	8 33	1.7963	1.7955			0.014
22	8 33	8 37	1.7955	1.7945			0.014
22	8 37	8 41	1.7945	1.7933			0.014
22	8 41	8 45	1.7933	1.7925			0.014
23	9 52	9 56	1.8788	1.8769			0.020
23	9 56	10 00	1.8769	1.8751			0.013
23	10 00	10 04	1.8751	1.8733			0.013
88	285.05	11			0.0535	0.7317	1.3655
21	14 28	14 32	1.4474	1.4474			0.693
21	14 32	14 36	1.4473	1.4473			0.129
22	15 33	15 37	1.6022	1.6022			0.020
22	15 37	15 41	1.6022	1.6021			0.006
24	16 40	16 44	1.8742	1.8738			0.112
24	16 44	16 48	1.8738	1.8735			0.034
24	16 48	16 52	1.8735	1.8732			0.026
24	16 52	16 56	1.8732	1.8730			0.014
24	16 56	17 00	1.8730	1.8728			0.005
24	17 00	17 04	1.8728	1.8729			0.000
24	17 04	17 08	1.8729	1.8724			0.005
88	298.04	19					1.5623
21	6 34	6 37	1.7114	1.7111			0.138
21	6 37	6 41	1.7111	1.7108			0.121
21	6 41	6 45	1.7108	1.7105			0.109
21	6 45	6 49	1.7105	1.7102			0.104
21	6 49	6 53	1.7102	1.7099			0.104

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21    6 53     6 57     1.7099    1.7098                0.104
21    6 57     7 01     1.7098    1.7096                0.101
21    7 01     7 05     1.7096    1.7093                0.101
21    7 05     7 09     1.7093    1.7092                0.101
22    7 26     7 30     1.8584    1.8580                0.193
22    7 30     7 34     1.8580    1.8577                0.161
22    7 34     7 38     1.8577    1.8576                0.152
22    7 38     7 42     1.8576    1.8572                0.135
22    7 42     7 46     1.8572    1.8569                0.132
22    7 46     7 50     1.8569    1.8567                0.123
22    7 50     7 54     1.8567    1.8565                0.121
22    7 54     7 58     1.8565    1.8564                0.118
22    7 58     8 02     1.8564    1.8562                0.118
22    8 02     8 06     1.8562    1.8559                0.118
99  SBH1 SF REF 298.04   NEGATIVE FLOWRATE MEASURED
88  303.03  19                                          1.5865
21    8 34     8 38     1.7585    1.7580                0.086
21    8 38     8 42     1.7580    1.7576                0.055
21    8 42     8 46     1.7576    1.7572                0.046
21    8 46     8 50     1.7572    1.7568                0.037
21    8 50     8 54     1.7568    1.7564                0.037
21    8 54     8 58     1.7564    1.7562                0.035
21    8 58     9 02     1.7562    1.7557                0.035
21    9 02     9 06     1.7557    1.7556                0.035
21    9 06     9 10     1.7556    1.7552                0.033
22    9 29     9 33     1.9213    1.9209                0.112
22    9 33     9 37     1.9209    1.9208                0.083
22    9 37     9 41     1.9208    1.9203                0.066
22    9 41     9 45     1.9203    1.9201                0.058
22    9 45     9 49     1.9201    1.9197                0.052
22    9 49     9 53     1.9197    1.9195                0.049
22    9 53     9 57     1.9195    1.9195                0.043
22    9 57    10 01     1.9195    1.9193                0.043
22   10 01    10 05     1.9193    1.9191                0.043
22   10 05    10 09     1.9191    1.9189                0.042
88  303.03   2                      0.0535   0.7317     1.3655
23   12 45    12 49     1.7701    1.7699                 0.000
23   12 49    12 53     1.7699    1.7699                 0.000
88  328.05  16                                           1.7022
21   06 54    06 58     2.0339    2.0334                0.080
21   06 58    07 02     2.0334    2.0328                0.066
21   07 02    07 06     2.0328    2.0322                0.063
21   07 06    07 14     2.0322    2.0309                0.055
21   07 14    07 18     2.0309    2.0304                0.055
21   07 18    07 22     2.0304    2.0296                0.055
22   10 08    10 12     2.2536    2.2530                0.095
22   10 12    10 16     2.2530    2.2525                0.080
22   10 16    10 20     2.2525    2.2517                0.083
22   10 20    10 24     2.2517    2.2512                0.078
22   10 24    10 28     2.2512    2.2507                0.075
22   10 28    10 32     2.2507    2.2498                0.072
22   10 32    10 36     2.2498    2.2492                0.060
22   10 36    10 40     2.2492    2.2485                0.066
22   10 40    10 44     2.2485    2.2481                0.066
22   10 44    10 48     2.2481    2.2475                0.066
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22	10	48	10	52	2.2475	2.2471		0.066
88	328.05	28						1.7041
21	13	48	13	52	1.8750	1.8738		0.089
21	13	52	13	56	1.8738	1.8732		0.066
21	13	56	14	00	1.8732	1.8724		0.046
21	14	00	14	04	1.8724	1.8715		0.058
21	14	04	14	08	1.8715	1.8707		0.063
21	14	08	14	12	1.8707	1.8699		0.062
21	14	12	14	16	1.8699	1.8693		0.058
21	14	16	14	20	1.8693	1.8685		0.062
21	14	20	14	24	1.8685	1.8680		0.055
21	14	24	14	28	1.8680	1.8673		0.058
21	14	28	14	32	1.8673	1.8667		0.055
21	14	32	14	36	1.8667	1.8660		0.049
21	14	36	14	40	1.8660	1.8653		0.049
21	14	40	14	44	1.8653	1.8647		0.049
22	15	40	15	44	2.0392	2.0371		0.049
22	15	44	15	48	2.0371	2.0350		0.037
22	15	48	15	52	2.0350	2.0329		0.032
22	15	52	15	56	2.0329	2.0308		0.020
22	16	00	16	04	2.0470	2.0447		0.049
22	16	04	16	08	2.0447	2.0429		0.032
22	16	08	16	12	2.0429	2.0408		0.029
22	16	50	16	54	2.0468	2.0465		0.016
22	16	54	16	58	2.0465	2.0461		0.020
22	16	58	17	02	2.0461	2.0456		0.026
22	17	02	17	06	2.0456	2.0454		0.029
22	17	06	17	10	2.0454	2.0447		0.029
22	17	10	17	14	2.0447	2.0445		0.029
22	17	14	17	18	2.0445	2.0442		0.029
88	328.05	34				0.0535	0.7317	1.5070
21	06	12	06	16	1.6185	1.6184		0.549
21	06	16	06	20	1.6184	1.6184		0.017
21	06	20	06	24	1.6184	1.6181		0.000
21	06	24	06	28	1.6181	1.6181		0.000
22	07	10	07	14	1.7743	1.7746		0.235
22	07	14	07	18	1.7746	1.7743		0.032
22	07	18	07	22	1.7743	1.7743		0.023
22	07	22	07	26	1.7743	1.7739		0.032
22	07	26	07	30	1.7739	1.7740		0.034
22	07	30	07	34	1.7740	1.7740		0.043
22	07	34	07	38	1.7740	1.7739		0.060
22	07	38	07	42	1.7739	1.7739		0.063
22	07	42	07	46	1.7739	1.7741		0.074
22	07	46	07	50	1.7741	1.7744		0.115
22	07	50	07	54	1.7744	1.7748		0.123
22	07	54	07	58	1.7748	1.7751		0.092
22	07	58	08	02	1.7751	1.7750		0.043
22	08	02	08	06	1.7750	1.7749		0.011
22	08	06	08	10	1.7749	1.7747		0.017
22	08	10	08	14	1.7747	1.7745		0.016
22	08	14	08	18	1.7745	1.7747		0.016
22	08	18	08	22	1.7747	1.7743		0.011
22	08	22	08	26	1.7743	1.7741		0.005
22	08	26	08	30	1.7741	1.7741		0.003

22	08 30	08 34	1.7741	1.7741			0.000	
22	08 34	08 38	1.7741	1.7741			0.003	
22	08 38	08 42	1.7741	1.7742			0.003	
22	08 42	08 46	1.7742	1.7742			0.017	
22	08 46	08 50	1.7742	1.7741			0.000	
22	08 50	08 54	1.7741	1.7749			0.000	
22	08 54	08 58	1.7749	1.7745			0.017	
22	08 58	09 02	1.7745	1.7746			0.005	
22	09 02	09 06	1.7746	1.7745			0.005	
22	09 06	09 10	1.7745	1.7745			0.005	
88	341.23	26					1.7648	
21	13 20	13 24	2.1011	2.1012			0.449	
21	13 24	13 28	2.1012	2.1011			0.313	
21	13 28	13 32	2.1011	2.1006			0.279	
21	13 32	13 36	2.1006	2.1004			0.219	
21	13 36	13 40	2.1004	2.1000			0.184	
21	13 40	13 44	2.1000	2.0994			0.158	
21	13 44	13 48	2.0994	2.0993			0.169	
21	13 48	13 52	2.0993	2.0988			0.169	
21	13 52	13 56	2.0986	2.0987			0.147	
21	13 56	14 00	2.0987	2.0983			0.124	
21	14 00	14 04	2.0983	2.0973			0.092	
21	14 04	14 08	2.0973	2.0969			0.109	
21	14 08	14 12	2.0969	2.0966			0.083	
21	14 12	14 16	2.0966	2.0961			0.078	
21	14 16	14 20	2.0961	2.0956			0.069	
21	14 20	14 24	2.0956	2.0955			0.058	
21	14 24	14 28	2.0955	2.0951			0.052	
21	14 28	14 32	2.0951	2.0947			0.050	
21	14 32	14 36	2.0947	2.0937			0.049	
22	16 08	16 12	2.3189	2.3196			0.106	
22	16 12	16 16	2.3196	2.3194			0.000	
22	16 16	16 20	2.3194	2.3190			0.000	
22	16 20	16 24	2.3190	2.3183			0.003	
22	16 24	16 28	2.3183	2.3178			0.014	
22	16 28	16 32	2.3178	2.3171			0.014	
22	16 32	16 36	2.3171	2.3168			0.014	
88	341.23	16			0.0535	0.7317	1.5977	
21	12 36	12 40	1.6951	1.6948			0.066	
21	12 40	12 44	1.6948	1.6947			0.000	
21	12 44	12 48	1.6947	1.6946			0.000	
21	12 48	12 52	1.6946	1.6943			0.000	
21	12 52	12 56	1.6943	1.6942			0.000	
22	13 17	13 21	1.8415	1.8539			1.005	
22	13 21	13 25	1.8439	1.8450			0.376	
22	13 25	13 29	1.8450	1.8450			0.083	
22	13 29	13 33	1.8450	1.8451			0.063	
22	13 33	13 37	1.8451	1.8457			0.158	
22	13 37	13 41	1.8457	1.8459			0.169	
22	13 41	13 45	1.8459	1.8456			0.023	
22	13 45	13 49	1.8456	1.8452			0.000	
22	13 49	13 53	1.8452	1.8450			0.000	
22	13 53	13 57	1.8450	1.8448			0.000	
22	13 57	14 01	1.8448	1.8446			0.000	
88	342.65	28					1.7698	

21	06 18		06 22	2.1053	2.1053			0.109
21	06 22		06 26	2.1053	2.1049			0.080
21	06 26		06 30	2.1049	2.1047			0.072
21	06 30		06 34	2.1047	2.1043			0.060
21	06 34		06 38	2.1043	2.1038			0.058
21	06 38		06 42	2.1038	2.1036			0.040
21	06 42		06 46	2.1036	2.1030			0.037
21	06 46		06 50	2.1030	2.1026			0.063
21	06 50		06 54	2.1026	2.1022			0.086
21	06 54		06 58	2.1022	2.1022			0.058
21	06 58		07 02	2.1022	2.1018			0.043
21	07 02		07 06	2.1018	2.1017			0.039
21	07 06		07 10	2.1017	2.1015			0.040
21	07 10		07 14	2.1015	2.1013			0.039
21	07 14		07 18	2.1013	2.1011			0.029
21	07 18		07 22	2.1011	2.1009			0.026
21	07 22		07 26	2.1009	2.1005			0.049
21	07 26		07 30	2.1005	2.1004			0.055
21	07 30		07 34	2.1004	2.1000			0.066
21	07 34		07 38	2.1000	2.1000			0.040
21	07 38		07 42	2.1000	2.0999			0.026
21	07 42		07 46	2.0999	2.0998			0.032
21	07 46		07 50	2.0998	2.0994			0.040
21	07 50		07 54	2.0994	2.0994			0.040
21	07 54		07 58	2.0994	2.0995			0.037
21	07 58		08 02	2.0995	2.0991			0.026
21	08 02		08 06	2.0991	2.0988			0.023
21	08 06		08 10	2.0988	2.0989			0.023
88	342.65	4			0.0535	0.7317		1.7056
21	06 05		06 09	1.7055	1.7054			0.000
22	06 45		06 49	1.8519	1.8517			0.020
22	06 49		06 53	1.8517	1.8516			0.002
23	07 21		07 25	1.9399	1.9398			0.046
88	358.60	9			0.0535	0.7317		1.6610
21	12 14		12 18	1.7575	1.7573			0.075
21	12 18		12 22	1.7573	1.7571			0.000
22	13 03		13 07	1.9116	1.9118			0.008
22	13 07		13 11	1.9118	1.9116			0.000
23	13 44		13 48	1.9966	1.9962			0.023
23	13 48		13 52	1.9962	1.9962			0.0028
23	13 52		13 56	1.9962	1.9959			0.000
23	13 56		14 00	1.9959	1.9957			0.000
23	14 00		14 04	1.9957	1.9952			0.000
88	361.53	17			0.0535	0.7317		1.6801
21	06 25		06 29	1.7698	1.7697			0.040
21	06 29		06 33	1.7697	1.7698			0.005
21	06 33		06 37	1.7698	1.7695			0.028
21	06 37		06 41	1.7695	1.7693			0.000
21	06 41		06 45	1.7693	1.7694			0.000
21	06 45		06 49	1.7694	1.7695			0.000
22	07 19		07 23	1.9257	1.9256			0.020
22	07 23		07 27	1.9256	1.9256			0.0028
22	07 27		07 31	1.9256	1.9253			0.0028
23	08 00		08 04	1.9943	1.9955			0.503
23	08 04		08 08	1.9955	1.9964			0.385

23	08	08	08	12	1.9964	1.9969			0.054
23	08	12	08	16	1.9969	1.9966			0.008
23	08	16	08	20	1.9966	1.9963			0.0028
23	08	20	08	24	1.9963	1.9963			0.000
23	08	24	08	28	1.9963	1.9960			0.000
23	08	28	08	32	1.9960	1.9960			0.000
88	365.35	11				0.0535	0.7317		1.7438
21	12	16	12	20	1.8199	1.8195			0.000
21	12	20	12	24	1.8195	1.8196			0.0028
21	12	24	12	28	1.8196	1.8192			0.000
21	12	28	12	32	1.8192	1.8194			0.000
21	12	32	12	36	1.8194	1.8192			0.000
22	13	00	13	04	1.9772	1.9769			0.048
22	13	04	13	08	1.9769	1.9764			0.011
22	13	08	13	12	1.9764	1.9764			0.005
22	13	12	13	16	1.9764	1.9757			0.0028
22	13	16	13	20	1.9757	1.9757			0.0028
22	13	20	13	24	1.9757	1.9752			0.000
88	374.20	2				0.0535	0.7317		1.7557
21	15	52	15	56	1.8357	1.8356			0.0022
22	17	16	17	20	2.0774	1.0770			0.000

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99 HOLE SBH3 SINGLE FRACTURE HYDROLOGY DATA
88  43.6117   45.74   46.46   0.0780   0.7337    0.3138
21  11 37     11 39     0.3405   0.3406              0.280
21  11 39     11 41     0.3406   0.3408              0.289
21  11 41     11 43     0.3408   0.3411              0.286
21  11 43     11 45     0.3411   0.3410              0.272
21  11 45     11 47     0.3410   0.3411              0.194
21  11 47     11 49     0.3411   0.3410              0.355
21  11 49     11 51     0.3410   0.3410              0.230
21  11 51     11 53     0.3410   0.3412              0.280
21  11 53     11 55     0.3412   0.3414              0.286
21  11 55     11 57     0.3414   0.3415              0.302
22  12 16     12 18     0.3923   0.3923              0.233
22  12 18     12 20     0.3923   0.3922              0.289
22  12 20     12 22     0.3922   0.3921              0.186
22  12 22     12 24     0.3921   0.3921              0.375
22  12 24     12 26     0.3921   0.3922              0.189
22  12 26     12 28     0.3922   0.3921              0.189
22  12 28     12 30     0.3921   0.3921              0.191
88  60.9017   63.03   63.75   0.0708   0.7337    0.3924
21   8 03      8 05     0.4189   0.4188              0.133
21   8 05      8 07     0.4188   0.4189              0.128
21   8 07      8 09     0.4189   0.4189              0.119
21   8 09      8 11     0.4189   0.4190              0.125
21   8 17      8 19     0.4190   0.4189              0.108
21   8 19      8 21     0.4189   0.4190              0.100
21   8 21      8 23     0.4190   0.4189              0.100
21   8 23      8 25     0.4189   0.4188              0.103
21   8 25      8 27     0.4188   0.4191              0.103
22   8 39      8 41     0.4385   0.4388              0.183
22   8 41      8 43     0.4388   0.4389              0.161
22   8 43      8 45     0.4389   0.4389              0.150
22   8 45      8 47     0.4389   0.4393              0.150
22   8 47      8 49     0.4393   0.4392              0.144
22   8 49      8 51     0.4392   0.4394              0.150
22   8 51      8 53     0.4394   0.4395              0.139
22   8 53      8 55     0.4395   0.4396              0.144
88  81.5714   83.70   84.42   0.0780   0.7337    0.4894
21  12 58     13 00     0.5224   0.5220              0.089
21  13 00     13 02     0.5220   0.5221              0.111
21  13 02     13 04     0.5221   0.5222              0.136
21  13 04     13 06     0.5222   0.5221              0.125
21  13 06     13 08     0.5221   0.5223              0.125
21  13 08     13 10     0.5223   0.5223              0.125
21  13 10     13 12     0.5223   0.5222              0.122
22  13 23     13 25     0.5553   0.5556              0.175
22  13 25     13 27     0.5556   0.5557              0.142
22  13 27     13 29     0.5557   0.5557              0.164
22  13 29     13 31     0.5557   0.5559              0.144
22  13 31     13 33     0.5559   0.5563              0.142
22  13 33     13 35     0.5563   0.5561              0.142
22  13 35     13 37     0.5561   0.5564              0.139
88  93.2921   95.42   96.14   0.0780   0.7337    0.5588
21  17 29     17 31     0.5935   0.5939              0.469
21  17 31     17 33     0.5939   0.5936              0.427
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21   17 33      17 35      0.5936   0.5938          0.416
21   17 35      17 37      0.5938   0.5942          0.411
21   17 37      17 39      0.5942   0.5947          0.402
21   17 39      17 41      0.5947   0.5950          0.361
21   17 41      17 43      0.5950   0.5949          0.355
21   17 43      17 45      0.5949   0.5950          0.350
21   17 45      17 47      0.5950   0.5951          0.327
21   17 47      17 49      0.5951   0.5952          0.327
21   17 49      17 51      0.5952   0.5951          0.305
21   17 51      17 53      0.5951   0.5952          0.305
21   17 53      17 55      0.5952   0.5952          0.297
21   17 55      17 57      0.5952   0.5953          0.283
21   17 57      17 59      0.5953   0.5954          0.261
21   17 59      18 01      0.5954   0.5955          0.250
22   18 14      18 16      0.6948   0.6949          0.305
22   18 16      18 18      0.6949   0.6952          0.294
22   18 18      18 20      0.6952   0.6954          0.294
22   18 20      18 22      0.6954   0.6954          0.289
22   18 22      18 24      0.6954   0.6958          0.289
88   94.37 9    96.50    97.22    0.0780   0.7337     0.5594
21   10 46      10 48      0.6041   0.6041          0.114
21   10 48      10 50      0.6041   0.6043          0.078
21   10 50      10 52      0.6043   0.6043          0.075
21   10 55      10 57      0.6044   0.6042          0.039
21   10 57      10 59      0.6042   0.6040          0.078
21   10 59      11 01      0.6040   0.6044          0.089
21   11 01      11 03      0.6044   0.6055          0.114
21   11 03      11 05      0.6055   0.6055          0.075
21   11 05      11 07      0.6055   0.6057          0.075
99 SBH3 NRD 94.37 PRESSURE INCREASE ON INTERVAL 11 01 - 11.03
88 109.2514  111.38   112.10    0.0780   0.7337     0.6377
21   20 50      20 52      0.6703   0.6705          0.017
21   20 52      20 54      0.6705   0.6703          0.008
21   20 54      20 56      0.6703   0.6703          0.011
21   20 56      20 58      0.6703   0.6703          0.019
21   20 58      21 00      0.6703   0.6701          0.022
21   21 00      21 02      0.6701   0.6701          0.022
21   21 02      21 04      0.6701   0.6703          0.022
22   21 12      21 14      0.7040   0.7040          0.047
22   21 14      21 16      0.7040   0.7040          0.047
22   21 16      21 18      0.7040   0.7042          0.036
22   21 18      21 20      0.7042   0.7042          0.041
22   21 20      21 22      0.7042   0.7041          0.039
22   21 22      21 24      0.7041   0.7041          0.036
22   21 24      21 26      0.7041   0.7041          0.036
88 110.4116  112.54   113.26    0.0780   0.7337     0.6463
21   11 50      11 52      0.7038   0.7041          0.072
21   11 52      11 54      0.7041   0.7041          0.067
21   11 54      11 56      0.7041   0.7041          0.056
21   11 56      11 58      0.7041   0.7041          0.050
21   11 58      12 00      0.7041   0.7041          0.047
21   12 00      12 02      0.7041   0.7042          0.050
21   12 02      12 04      0.7042   0.7042          0.053
21   12 04      12 06      0.7042   0.7043          0.056
21   12 06      12 08      0.7043   0.7041          0.058
```

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21   12 08       12 10        0.7041    0.7043            0.056
22   12 18       12 20        0.7041    0.7041            0.067
22   12 20       12 22        0.7041    0.7041            0.050
22   12 22       12 24        0.7041    0.7041            0.058
22   12 24       12 26        0.7041    0.7041            0.058
22   12 26       12 28        0.7041    0.7041            0.058
22   12 28       12 30        0.7041    0.7040            0.058
88 137.0436   137.79   139.17    0.0780    0.7337    0.7943
21   15 41 00    15 41 37     0.8453    0.8453            9.12
21   15 41 37    15 42 12     0.8453    0.8447            9.38
21   15 42 12    15 42 47     0.8447    0.8441            9.49
21   15 43 22    15 43 57     0.8441    0.8444            9.49
21   15 43 57    15 44 32     0.8444    0.8447            9.49
21   15 44 32    15 45 09     0.8447    0.8450            9.06
21   15 45 09    15 45 45     0.8450    0.8461            9.25
21   15 45 45    15 46 20     0.8461    0.8472            9.43
21   15 46 20    15 46 55     0.8472    0.8483            9.49
21   15 46 55    15 47 31     0.8483    0.8449            9.49
22   16 03 00    16 03 34     0.8526    0.8626            9.88
22   16 03 34    16 04 08     0.8525    0.8626            9.82
22   16 04 08    16 04 42     0.8626    0.8626            9.88
22   16 04 42    16 05 08     0.8526    0.8626           10.21
22   16 05 08    16 05 42     0.8526    0.8625            9.91
22   16 05 42    16 06 16     0.8625    0.8625            9.91
22   16 06 16    16 06 50     0.8525    0.8624            9.88
22   16 06 50    16 07 24     0.8624    0.8624            9.82
22   16 07 24    16 08 00     0.8624    0.8623            9.82
22   16 08 00    16 08 34     0.8623    0.8622            9.85
22   16 08 34    16 09 08     0.8622    0.8621            9.85
22   16 09 08    16 09 41     0.8521    0.8622            9.88
22   16 09 41    16 10 15     0.8622    0.8623            9.85
22   16 10 15    16 10 49     0.8523    0.8623            9.82
23   16 28 00    16 28 31     0.8871    0.8871           10.78
23   16 28 31    16 29 02     0.8871    0.8870           10.81
23   16 29 02    16 29 33     0.8870    0.8869           10.81
23   16 29 33    16 30 03     0.8869    0.8868           10.88
23   16 30 03    16 30 34     0.8868    0.8867           10.88
23   16 30 34    16 31 04     0.8867    0.8866           10.92
23   16 31 04    16 31 34     0.8866    0.8865           10.95
23   16 31 34    16 32 05     0.8865    0.8864           10.85
23   16 32 05    16 32 36     0.8864    0.8865           10.81
23   16 32 36    16 33 07     0.8865    0.8866           10.85
23   16 33 07    16 33 38     0.8866    0.8866           10.81
88 138.8610   143.48   144.20    0.0780    0.7337    0.7509
21   18 05       18 07        0.8286    0.8286            0.028
21   18 07       18 09        0.8285    0.8287            0.028
21   18 09       18 11        0.8287    0.8285            0.028
21   18 11       18 13        0.8285    0.8285            0.025
21   18 13      X18 15         0.8285    0.8284            0.025
22   18 24       18 26        0.8527    0.8528            0.042
22   18 26       18 28        0.8528    0.8526            0.042
22   18 28       18 30        0.8526    0.8524            0.042
22   18 30       18 32        0.8524    0.8527            0.042
22   18 32       18 34        0.8527    0.8525            0.042
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B-3.5 Subsurface Boreholes, 6 to 7-m Interval Tests

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99 HOLE SBH2 6-7M INTERVAL HDROLOGY DATA
88  21.2712   23.50      29.52  0.075   0.7337     0.170
21  13 24 00  13 24 17     0.184     0.184            40.12
21  13 24 17  13 24 33     0.184     0.184            42.15
21  13 24 33  13 24 50     0.184     0.183            39.64
21  13 24 50  13 25 06     0.183     0.183            40.36
21  13 25 06  13 25 23     0.183     0.182            40.36
21  13 25 23  13 25 39     0.182     0.182            40.61
21  13 25 39  13 25 56     0.182     0.182            40.61
21  13 38 00  13 38 16     0.184     0.184            40.61
21  13 38 16  13 38 33     0.184     0.184            40.61
22  14 02 00  14 02 24     0.170     0.170            27.30
22  14 02 24  14 02 49     0.170     0.170            27.18
22  14 02 49  14 03 13     0.170     0.169            27.30
88  37.7718   40.00      46.018 0.075   0.7337     0.258
21  21 41 00  21 41 17     0.258     0.258            39.64
21  21 41 30  21 41 47     0.258     0.258            38.28
21  21 42 00  21 42 17     0.258     0.258            38.28
21  21 43 00  21 43 17     0.253     0.258            38.28
21  21 44 00  21 44 18     0.258     0.258            38.06
21  21 45 00  21 45 18     0.258     0.258            37.84
21  21 46 00  21 46 17     0.258     0.258            38.28
21  21 47 00  21 47 18     0.258     0.258            37.84
21  21 48 00  21 48 17     0.258     0.258            38.28
21   8 10 00   8 10 18     0.257     0.257            37.84
21   8 12 00   8 12 17     0.257     0.257            38.28
21   8 14 00   8 14 18     0.257     0.257            38.06
22   8 26 00   8 26 06     0.268     0.269           111.0
22   8 28 00   8 28 06     0.269     0.269           111.0
22   8 29 00   8 29 06     0.269     0.269           107.4
22   8 30 00   8 30 06     0.269     0.269           112.9
22   8 31 00   8 31 06     0.269     0.269           112.9
22   8 32 00   8 32 06     0.269     0.269           111.0
88  67.7710   70.00      76.018 0.075   0.7337     0.434
21  16 28 00  16 28 05     0.434     0.434           133.20
21  16 28 30  16 28 35     0.434     0.434           130.60
21  16 29 00  16 29 05     0.434     0.434           133.20
21  16 30 00  16 30 05     0.434     0.434           125.66
21  16 31 00  16 31 05     0.434     0.434           128.08
21  16 32 00  16 32 05     0.434     0.434           133.20
21  16 41 00  16 41 05     0.436     0.436           144.78
21  16 41 30  16 41 35     0.436     0.436           138.75
21  16 42 00  16 42 05     0.435     0.435           141.70
21  16 43 00  16 43 05     0.435     0.435           141.70
88  85.7715   88.0       94.018 0.075   0.7337     0.487
21  17 15 00  17 15 05     0.518     0.518           133.20
21  17 15 30  17 15 35     0.518     0.518           130.60
21  17 16 00  17 16 05     0.518     0.518           125.66
21  17 17 00  17 17 05     0.518     0.518           133.20
21  17 17 00  17 18 05     0.518     0.518           133.20
21  17 19 00  17 19 05     0.518     0.518           133.20
21  17 20 00  17 20 05     0.518     0.518           128.08
21  17 21 00  17 21 05     0.518     0.518           133.20
22  17 30 00  17 30 04     0.521     0.521           158.60
22  17 30 30  17 30 34     0.521     0.521           162.44
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22   17 31 00   17 31 04     0.522     0.522          162.44
22   17 31 30   17 31 34     0.522     0.522          166.50
22   17 32 00   17 32 04     0.522     0.522          162.44
22   17 32 30   17 32 34     0.522     0.522          158.60
22   17 33 00   17 33 04     0.522     0.522          166.50
88  171.7725   174.00     180.018 0.075    0.7337    1.042
21   20 47      20 48       1.042     1.042            0.327
21   20 48      20 49       1.042     1.042            0.327
21   20 49      20 50       1.042     1.042            0.305
21   20 50      20 51       1.042     1.042            0.311
21   20 51      20 52       1.042     1.042            0.322
21   20 57      20 58       1.042     1.042            0.289
21   20 58      20 59       1.042     1.042            0.289
21   20 59      21 00       1.042     1.042            0.278
21   21 00      21 01       1.042     1.042            0.283
21   21 01      21 02       1.042     1.042            0.272
21   21 02      21 03       1.042     1.042            0.283
21   21 03      21 04       1.042     1.042            0.235
21   21 04      21 05       1.042     1.042            0.261
21   21 05      21 06       1.042     1.042            0.272
22   21 19      21 21       1.101     1.101            0.291
22   21 21      21 23       1.101     1.101            0.280
22   21 23      21 25       1.101     1.101            0.261
22   21 25      21 27       1.101     1.101            0.239
22   21 27      21 29       1.101     1.100            0.239
22   21 29      21 31       1.100     1.100            0.239
23   21 44      21 46       1.168     1.168            0.274
23   21 46      21 48       1.168     1.168            0.239
23   21 48      21 50       1.168     1.168            0.247
23   21 50      21 52       1.168     1.168            0.239
23   21 52      21 54       1.168     1.168            0.236
88  171.7716   174.00     180.018 0.075    0.7337    1.046
21   13 26      13 27       1.115     1.115            0.488
21   13 27      13 28       1.115     1.115            0.511
21   13 28      13 29       1.115     1.115            0.444
21   13 29      13 30       1.115     1.115            0.400
21   13 30      13 31       1.115     1.115            0.412
21   13 31      13 32       1.115     1.115            0.394
21   13 32      13 33       1.115     1.115            0.389
21   13 33      13 34       1.115     1.115            0.389
21   13 34      13 35       1.115     1.115            0.389
21   13 35      13 36       1.115     1.115            0.389
22   13 46      13 47       1.223     1.222            0.433
22   13 47      13 48       1.222     1.222            0.377
22   13 48      13 49       1.222     1.222            0.389
22   13 49      13 50       1.222     1.222            0.377
22   13 50      13 51       1.222     1.223            0.383
22   13 51      13 52       1.223     1.223            0.383
88  188.7723   191.0      197.018 0.075    0.7337    1.094
21   11 42      11 44       1.205     1.205            0.447
21   11 44      11 46       1.205     1.205            0.433
21   11 46      11 48       1.205     1.205            0.436
21   11 56      11 58       1.205     1.206            0.389
21   11 58      12 00       1.206     1.205            0.386
21   12 00      12 02       1.205     1.205            0.372
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21	12	02		12	04		1.205		1.205		0.372
21	12	04		12	06		1.205		1.206		0.355
21	12	06		12	08		1.206		1.205		0.369
21	12	08		12	10		1.205		1.205		0.352
21	12	10		12	12		1.205		1.205		0.355
21	12	12		12	14		1.205		1.206		0.355
22	12	26		12	28		1.313		1.313		0.438
22	12	28		12	30		1.313		1.314		0.441
22	12	30		12	32		1.314		1.314		0.425
22	12	32		12	34		1.314		1.313		0.433
22	12	34		12	36		1.313		1.314		0.411
22	12	36		12	38		1.314		1.314		0.394
22	12	38		12	40		1.314		1.314		0.361
22	12	40		12	42		1.314		1.314		0.386
22	12	42		12	44		1.314		1.313		0.400
22	12	44		12	46		1.313		1.313		0.397
22	12	46		12	48		1.313		1.313		0.397
88	200.2771			202.5			208.518	0.075		0.7337	1.180
21	15	58	00	15	59	21	1.178		1.181		4.071
21	15	59	30	15	59	48	1.182		1.183		3.784
21	16	00	00	16	00	17	1.185		1.185		4.012
21	16	00	30	16	00	47	1.186		1.186		3.964
21	16	01	00	16	01	17	1.186		1.186		3.964
21	16	01	30	16	01	47	1.187		1.187		3.941
21	16	02	00	16	02	17	1.187		1.187		3.941
21	16	02	30	16	02	47	1.188		1.188		3.918
21	16	03	00	16	03	17	1.189		1.189		3.964
21	16	03	30	16	03	47	1.190		1.190		3.918
21	16	04	00	16	04	18	1.191		1.191		3.700
21	16	05	00	16	05	18	1.191		1.191		3.700
21	16	06	00	16	06	18	1.192		1.192		3.700
21	16	07	00	16	07	18	1.192		1.192		3.700
21	16	08	00	16	08	18	1.193		1.193		3.806
21	16	09	00	16	09	17	1.193		1.193		3.742
21	16	10	00	16	10	17	1.193		1.193		3.806
21	16	11	00	16	11	17	1.193		1.192		3.700
21	16	12	00	16	12	17	1.192		1.192		3.742
21	16	13	00	16	13	17	1.192		1.192		3.742
21	16	14	00	16	14	17	1.192		1.192		3.742
22	16	25	00	16	25	18	1.188		1.188		3.784
22	16	26	00	16	26	18	1.189		1.188		3.763
22	16	27	00	16	27	15	1.190		1.190		4.440
22	16	28	00	16	28	17	1.192		1.192		3.828
22	16	29	00	16	29	18	1.192		1.192		3.742
22	16	30	00	16	30	18	1.192		1.192		3.700
22	16	31	00	16	31	18	1.192		1.192		3.742
23	16	43	00	16	43	31	1.266		1.266		4.311
23	16	44	00	16	44	31	1.266		1.266		4.311
23	16	45	00	16	45	16	1.266		1.266		4.215
23	16	46	00	16	46	31	1.266		1.266		4.256
23	16	47	00	16	47	31	1.266		1.266		4.269
23	16	48	00	16	48	31	1.266		1.266		4.311
23	16	49	00	16	49	31	1.266		1.267		4.325
23	16	50	00	16	50	31	1.267		1.267		4.297
23	16	51	00	16	51	31	1.267		1.266		4.283

23	16	52	00	16	52	31	1.266	1.266				4.311
23	16	53	00	16	53	31	1.266	1.266				4.283
23	16	54	00	16	54	31	1.266	1.266				4.269
23	16	55	00	16	55	31	1.266	1.267				4.297
23	16	56	00	16	56	31	1.267	1.267				4.297
23	16	57	00	16	57	31	1.267	1.266				4.269
23	16	58	00	16	58	31	1.266	1.266				4.269
23	16	59	00	16	59	31	1.266	1.266				4.283
23	17	00	00	17	00	31	1.266	1.266				4.269
24	17	13	00	17	13	29	1.316	1.316				4.593
24	17	13	30	17	13	59	1.316	1.316				4.625
24	17	14	00	17	14	43	1.316	1.316				4.625
24	17	15	00	17	15	29	1.316	1.316				4.531
24	17	15	30	17	15	59	1.316	1.316				4.593
24	17	16	00	17	16	29	1.316	1.316				4.593
24	17	16	30	17	16	59	1.316	1.316				4.641
24	17	17	00	17	17	29	1.316	1.316				4.577
24	17	18	00	17	18	29	1.316	1.315				4.674
24	17	19	00	17	19	28	1.315	1.314				4.690
24	17	20	00	17	20	29	1.314	1.315				4.593
24	17	21	00	17	21	29	1.315	1.316				4.577
24	17	22	00	17	22	29	1.316	1.316				4.562
24	17	23	00	17	23	29	1.316	1.315				4.609
24	17	24	00	17	24	29	1.315	1.315				4.609
24	17	25	00	17	25	29	1.315	1.316				4.577
24	17	26	00	17	26	29	1.316	1.316				4.562
24	17	27	00	17	27	29	1.316	1.316				4.625
24	17	28	00	17	28	29	1.315	1.315				4.609
24	17	29	00	17	29	29	1.315	1.315				4.577
24	17	30	00	17	30	29	1.315	1.315				4.562
24	17	31	00	17	31	30	1.315	1.315				4.625
24	17	32	00	17	32	29	1.315	1.315				4.625
24	17	33	00	17	33	29	1.315	1.315				4.546
24	17	34	00	17	34	29	1.315	1.315				4.546
88	255.7713			256.48			258.0	0.075	0.7337	1.450		
21	16	40		16	42		1.576	1.576				0.327
21	16	42		16	44		1.576	1.576				0.300
21	16	44		16	46		1.576	1.576				0.302
21	16	46		16	48		1.576	1.577				0.302
21	16	48		16	50		1.577	1.577				0.300
22	16	56		16	58		1.718	1.718				0.419
22	16	58		17	00		1.718	1.717				0.400
22	17	00		17	02		1.717	1.717				0.372
22	17	02		17	04		1.717	1.717				0.358
22	17	04		17	06		1.717	1.717				0.347
22	17	06		17	08		1.717	1.717				0.372
22	17	08		17	10		1.717	1.717				0.355
22	17	10		17	12		1.717	1.717				0.355
88	313.7729			316.02			322.02	0.075	0.7337	1.767		
21	18	46		18	48		1.770	1.769				1.110
21	18	48		18	50		1.769	1.769				1.110
21	18	50		18	52		1.769	1.769				1.138
21	18	52		18	54		1.769	1.768				1.143
21	18	54		18	56		1.768	1.768				1.143
21	18	56		18	58		1.768	1.767				1.127

22	7 45	7 47	1.766	1.766		1.021
22	7 47	7 49	1.766	1.766		1.041
22	7 49	7 51	1.766	1.767		1.018
22	7 51	7 53	1.767	1.767		1.041
22	7 53	7 57	1.767	1.768		1.034
23	8 07	8 09	1.886	1.888		1.213
23	8 09	8 11	1.888	1.887		1.190
23	8 11	8 13	1.887	1.888		1.179
23	8 13	8 15	1.888	1.888		1.168
23	8 19	8 21	1.888	1.888		1.154
23	8 21	8 23	1.888	1.887		1.132
23	8 23	8 25	1.887	1.887		1.168
23	8 25	8 27	1.887	1.887		1.168
23	8 27	8 29	1.887	1.887		1.166
24	8 48	8 50	2.008	2.008		1.332
24	8 50	8 52	2.008	2.008		1.338
24	8 52	8 54	2.008	2.008		1.329
24	8 54	8 56	2.008	2.008		1.313
24	8 56	8 58	2.008	2.008		1.318
24	9 02	9 04	2.008	2.007		1.288
24	9 04	9 06	2.007	2.007		1.299
24	9 06	9 08	2.007	2.007		1.318
24	9 08	9 10	2.007	2.007		1.318
88	327.7726	330.0	336.018	0.075	0.7337	1.836
21	16 45	16 47	1.831	1.831		0.455
21	16 47	16 49	1.831	1.831		0.438
21	16 49	16 51	1.831	1.831		0.463
21	16 51	16 53	1.831	1.831		0.458
21	16 53	16 55	1.831	1.831		0.455
21	16 55	16 57	1.831	1.831		0.463
22	17 04	17 06	1.956	1.956		0.605
22	17 06	17 08	1.956	1.956		0.599
22	17 08	17 10	1.956	1.956		0.583
22	17 10	17 12	1.956	1.956		0.566
22	17 12	17 14	1.956	1.956		0.555
22	17 14	17 16	1.956	1.956		0.552
22	17 16	17 18	1.956	1.956		0.541
23	17 30	17 32	2.090	2.090		0.755
23	17 32	17 34	2.090	2.090		0.722
23	17 34	17 36	2.090	2.090		0.697
23	17 36	17 38	2.090	2.090		0.666
23	17 38	17 40	2.090	2.090		0.655
23	17 40	17 42	2.090	2.090		0.635
23	17 42	17 44	2.090	2.090		0.627
23	17 44	17 46	2.090	2.090		0.599
23	17 46	17 48	2.090	2.090		0.597
23	17 48	17 58	2.090	2.090		0.602
23	17 58	18 00	2.090	2.090		0.599
23	18 00	18 02	2.090	2.090		0.588
23	18 02	18 04	2.090	2.090		0.588

APPENDIX B-4

SELECTED TEST RESULTS, POROUS MEDIA HYDRAULIC CONDUCTIVITIES, EQUIVALENT SINGLE FRACTURE APERTURES, ETC., FOR ALL OF THE BOREHOLES TESTED

FILE: HG2PERM SCHART A1 05/21/81 15:43:18 UNIVERSITY OF WATERLOO PAGE 001

0	INTERVAL (M)	DIFF. HEAD (M)	FLOW-RATE (CC/MIN)	PERMEA-BILITY (SQ.CM)	CONDUC-TIVITY (CM/SEC)	EQUIV. SING.FR. APERT. (MICRO M.)	TRANSMIS-SIVITY (SQ.CM/SEC)
99	HOLE HG2 HYDROLOGY DATA						
	1.61 TO 3.61	6.013	0.020	0.31E-13	0.25E-08	4.21	0.49E-06
	5.61 TO 7.61	5.452	0.340	0.58E-12	0.46E-07	11.18	0.92E-05
	7.61 TO 9.61	10.072	0.023	0.21E-13	0.17E-08	3.71	0.34E-06
	9.64 TO 11.64	21.308	0.373	0.16E-12	0.13E-07	7.32	0.26E-05
	11.64 TO 13.64	28.172	0.147	0.49E-13	0.39E-08	4.89	0.77E-06
	13.64 TO 16.68	11.977	0.007	0.36E-14	0.28E-09	2.36	0.86E-07
	15.64 TO 17.64	15.815	0.017	0.10E-13	0.79E-09	2.89	0.16E-06
	17.67 TO 19.67	14.401	0.470	0.31E-12	0.24E-07	9.01	0.48E-05
	19.67 TO 21.67	24.037	1.555	0.60E-12	0.48E-07	11.32	0.96E-05
	21.67 TO 23.67	14.242	0.050	0.33E-13	0.26E-08	4.28	0.52E-06
	25.66 TO 27.66	22.811	0.094	0.39E-13	0.30E-08	4.52	0.61E-06

160 TO 162	24.510	3.800	0.14E-11	0.11E-06	15.14	0.23E-04
162 TO 164	11.450	0.640	0.52E-12	0.41E-07	10.78	0.83E-05
164 TO 166	9.200	7.600	0.77E-11	0.61E-06	26.45	0.12E-03
164 TO 166	5.000	3.500	0.65E-11	0.51E-06	24.93	0.10E-03
166 TO 168	5.560	0.100	0.17E-12	0.13E-07	7.39	0.27E-05
168 TO 170	20.490	0.900	0.41E-12	0.32E-07	9.95	0.65E-05
170 TO 172	23.130	0.280	0.11E-12	0.89E-08	6.47	0.18E-05
172 TO 174	7.830	0.020	0.24E-13	0.19E-08	3.85	0.38E-06
174 TO 176	9.550	0.020	0.20E-13	0.15E-08	3.61	0.31E-06
176 TO 178	1.580	10.600	0.63E-10	0.50E-05	53.17	0.99E-03
176 TO 178	1.790	9.200	0.48E-10	0.38E-05	48.65	0.76E-03
178 TO 180	14.850	0.320	0.20E-12	0.16E-07	7.84	0.32E-05
180 TO 182	26.020	0.340	0.12E-12	0.97E-08	6.64	0.19E-05
182 TO 184	10.530	1.400	0.12E-11	0.98E-07	14.39	0.20E-04
184 TO 186	10.830	0.000	0.00E 00	0.00E 00	0.00	0.00E 00
186 TO 188	27.080	1.200	0.41E-12	0.33E-07	9.98	0.66E-05
188 TO 190	27.460	0.190	0.65E-13	0.51E-08	5.37	0.10E-05
190 TO 192	19.080	0.010	0.49E-14	0.39E-09	2.27	0.77E-07
192 TO 194	1.010	1.420	0.13E-10	0.10E-05	31.58	0.21E-03
194 TO 196	18.120	0.130	0.67E-13	0.53E-08	5.44	0.11E-05
198 TO 200	19.690	0.290	0.14E-12	0.11E-07	6.91	0.22E-05
200 TO 202	27.790	2.600	0.87E-12	0.69E-07	12.80	0.14E-04
202 TO 204	29.080	0.600	0.19E-12	0.15E-07	7.73	0.31E-05
204 TO 206	14.670	2.200	0.14E-11	0.11E-06	14.98	0.22E-04
206 TO 208	13.630	0.070	0.48E-13	0.38E-08	4.86	0.76E-06
208 TO 210	7.770	0.050	0.60E-13	0.48E-08	5.24	0.95E-06
210 TO 212	0.680	28.000	0.38E-09	0.30E-04	97.34	0.61E-02
226 TO 228	16.290	8.000	0.46E-11	0.36E-06	22.24	0.73E-04
228 TO 230	7.750	5.600	0.68E-11	0.53E-06	25.30	0.11E-03
230 TO 232	4.130	5.200	0.12E-10	0.93E-06	30.44	0.19E-03
232 TO 234	7.700	0.160	0.19E-12	0.15E-07	7.75	0.31E-05
234 TO 236	6.240	1.600	0.24E-11	0.19E-06	17.91	0.38E-04
234 TO 236	8.770	2.100	0.22E-11	0.18E-06	17.50	0.35E-04
236 TO 238	6.360	-0.020				*
238 TO 240	14.960	0.050	0.31E-13	0.25E-08	4.21	0.49E-06
240 TO 242	27.820	0.058	0.19E-13	0.15E-08	3.60	0.31E-06
242 TO 244	24.950	-0.090				*
244 TO 246	8.880	0.020	0.21E-13	0.17E-08	3.70	0.33E-06
246 TO 248	12.640	0.003	0.22E-14	0.18E-09	1.75	0.35E-07
248 TO 250	24.610	-0.007				*
250 TO 252	16.970	-0.020				*

* INDICATES A PECULIAR TEST WHICH SHOULD BE CHECKED

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FILE: SBH3INJ CHART * 06/10/81 14:21:00 UNIVERSITY OF WATERLOO PAGE 001

0 INTERVAL (M)	DIFF. HEAD (M)	FLOW-RATE (CC/MIN)	PERMEA-BILITY (SQ.CM)	CONDUC-TIVITY (CM/SEC)	EQUIV. SING.FR. APERT. (MICRO M.)	TRANSMIS-SIVITY (SQ.CM/SEC)
40 TO 42	5.490	0.610	0.10E-11	0.82E-07	13.55	0.16E-04
40 TO 42	5.250	1.720	0.31E-11	0.24E-06	19.43	0.48E-04
42 TO 44	8.910	0.160	0.17E-12	0.13E-07	7.38	0.27E-05
44 TO 46	5.160	-0.060				*
46 TO 48	16.080	1.330	0.77E-12	0.61E-07	12.28	0.12E-04
48 TO 50	6.580	-0.620				*
48 TO 50	5.760	-7.680				*
50 TO 52	3.130	-0.070				*
52 TO 54	5.150	0.420	0.76E-12	0.60E-07	12.22	0.12E-04
54 TO 56	9.190	3.880	0.39E-11	0.31E-06	21.15	0.62E-04
56 TO 58	1.020	-0.570				*
58 TO 60	1.060	15.450	0.14E-09	0.11E-04	68.86	0.22E-02
60 TO 62	17.600	3.830	0.20E-11	0.16E-06	16.96	0.32E-04
68 TO 70	17.400	2.450	0.13E-11	0.10E-06	14.67	0.21E-04
70 TO 72	3.790	10.950	0.27E-10	0.21E-05	40.15	0.43E-03
72 TO 74	5.620	6.660	0.11E-10	0.88E-06	29.83	0.18E-03
74 TO 76	10.340	0.120	0.11E-12	0.86E-08	6.38	0.17E-05
76 TO 78	35.360	1.350	0.36E-12	0.28E-07	9.49	0.56E-05
78 TO 80	34.340	0.050	0.14E-13	0.11E-08	3.20	0.22E-06
80 TO 82	24.760	0.280	0.11E-12	0.84E-08	6.33	0.17E-05
82 TO 84	9.680	-0.300				*
84 TO 86	12.030	0.000	0.00E 00	0.00E 00	0.00	0.00E 00
88 TO 90	16.010	0.100	0.14E-15	0.11E-10	5.19	0.92E-06
90 TO 92	4.670	1.690	0.34E-11	0.27E-06	20.09	0.53E-04
92 TO 94	4.540	0.100	0.21E-12	0.16E-07	7.90	0.33E-05
94 TO 96	10.910	0.160	0.14E-12	0.11E-07	6.90	0.22E-05
96 TO 98	4.480	0.050	0.10E-12	0.82E-08	6.30	0.16E-05
98 TO 100	0.200	72.800	0.34E-08	0.27E-03	201.27	0.54E-01
98 TO 100	0.240	90.060	0.35E-08	0.28E-03	203.32	0.55E-01
100 TO 102	0.430	60.760	0.13E-08	0.10E-03	146.82	0.21E-01
102 TO 104	4.500	26.420	0.55E-10	0.43E-05	50.85	0.87E-03
112 TO 114	27.120	0.014	0.48E-14	0.38E-09	2.26	0.76E-07
114 TO 116	18.900	0.023	0.11E-13	0.90E-09	3.01	0.18E-06
116 TO 118	24.040	0.022	0.86E-14	0.68E-09	2.74	0.14E-06
120 TO 122	10.240	0.004	0.37E-14	0.29E-09	2.06	0.58E-07
122 TO 124	1.240	26.900	0.20E-09	0.16E-04	78.62	0.32E-02
124 TO 126	7.880	2.230	0.26E-11	0.21E-06	18.51	0.42E-04
126 TO 128	23.230	2.540	0.10E-11	0.81E-07	13.48	0.16E-04
128 TO 130	13.860	15.420	0.10E-10	0.82E-06	29.21	0.16E-03
130 TO 132	21.930	12.600	0.54E-11	0.42E-06	23.43	0.85E-04
132 TO 134	24.950	2.130	0.80E-12	0.63E-07	12.41	0.13E-04
134 TO 136	24.060	3.230	0.13E-11	0.99E-07	14.43	0.20E-04
136 TO 138	4.690	0.250	0.50E-12	0.39E-07	10.61	0.79E-05
138 TO 140	4.130	1.550	0.35E-11	0.28E-06	20.33	0.55E-04
138 TO 140	7.910	2.500	0.30E-11	0.23E-06	19.20	0.47E-04
140 TO 142	9.930	0.030	0.23E-13	0.22E-08	4.08	0.45E-06
150 TO 152	13.170	0.130	0.92E-13	0.73E-08	6.05	0.15E-05
152 TO 154	8.770	0.450	0.48E-12	0.38E-07	10.47	0.76E-05
156 TO 158	8.420	0.030	0.33E-13	0.26E-08	4.31	0.53E-06
158 TO 160	14.990	10.400	0.65E-11	0.51E-06	24.96	0.10E-03

340	342	79	-21.09	100.09	0.0440	.348E-14	.325E-09	2.03	.650E-07
342	344	100	-22.99	122.99	0.0140	.902E-15	.841E-10	1.29	.168E-07
344	346	100	11.70	88.30	0.0920	.825E-14	.770E-09	2.71	.154E-06
346	348	140	-30.00	170.00	4.0000	.186E-12	.174E-07	7.65	.348E-05
348	350	190	-15.55	205.55	2.5300	.975E-13	.910E-08	6.16	.182E-05
350	352	198	-25.00	223.00	0.4840	.171E-13	.160E-08	3.45	.320E-06
352	354	178	-31.09	209.09	0.1600	.606E-14	.566E-09	2.44	.113E-06
354	356	150	-24.80	214.80	0.0340	.125E-14	.117E-09	1.44	.234E-07

230	232	143	-14.16	157.16	1.0790	.544E-13	.507E-08	5.07	.101E-05
232	234	135	-14.41	149.41	0.1490	.790E-14	.737E-09	2.67	.147E-06
234	236	142	-6.01	150.01	0.2030	.107E-13	.100E-08	2.95	.200E-06
236	238	330	-13.82	343.82	8.8320	.203E-12	.190E-07	7.87	.380E-05
238	240	82	-9.38	91.38	0.4940	.428E-13	.400E-08	4.68	.799E-06
240	242	145	-14.34	159.34	5.6420	.290E-12	.271E-07	8.87	.542E-05
242	244	129	-15.66	144.66	0.2500	.137E-13	.128E-08	3.20	.255E-06
244	246	134	-8.72	142.72	0.0630	.350E-14	.326E-09	2.03	.653E-07
246	248	127	-9.08	136.08	0.1880	.109E-13	.102E-08	2.97	.204E-06
248	250	76	-17.10	93.10	0.3720	.317E-13	.295E-08	4.24	.591E-06
250	252	120	7.95	112.05	0.0150	.106E-14	.989E-10	1.37	.198E-07
252	254	121	-12.40	133.40	0.0200	.154E-14	.144E-09	1.55	.288E-07
254	256	150	4.86	145.14	0.0120	.655E-15	.611E-10	1.16	.122E-07
256	258	142	7.46	134.54	0.5680	.334E-13	.312E-08	4.31	.624E-06
258	260	145	6.96	138.04	0.2140	.123E-13	.115E-08	3.09	.229E-06
260	262	155	26.95	128.05	0.0700	.433E-14	.404E-09	2.18	.808E-07
262	264	150	-17.17	167.17	0.1080	.512E-14	.478E-09	2.31	.955E-07
264	266	155	1.55	153.45	0.2600	.134E-13	.125E-08	3.18	.250E-06
266	268	182	-23.43	205.43	0.7800	.301E-13	.281E-08	4.16	.561E-06
268	270	180	-19.23	199.23	0.3980	.158E-13	.148E-08	3.36	.295E-06
270	272	160	-17.21	177.21	0.1410	.630E-14	.588E-09	2.47	.118E-06
272	274	72	-10.57	82.57	0.2580	.248E-13	.231E-08	3.90	.462E-06
274	276	160	29.78	130.22	0.0340	.207E-14	.193E-09	1.71	.386E-07
276	278	173	-2.12	175.12	0.0780	.353E-14	.329E-09	2.04	.658E-07
278	280	165	8.45	156.55	0.0500	.253E-14	.236E-09	1.82	.472E-07
280	282	50	-41.02	91.02	0.0660	.574E-14	.536E-09	2.40	.107E-06
282	284	100	-13.90	113.90	0.0240	.167E-14	.156E-09	1.59	.311E-07
284	286	100	10.06	89.94	0.0280	.247E-14	.230E-09	1.81	.460E-07
286	288	150	16.76	133.24	0.0190	.113E-14	.105E-09	1.39	.211E-07
288	290	108	-24.72	132.72	0.0540	.322E-14	.301E-09	1.98	.601E-07
290	292	124	-23.08	147.08	0.0420	.226E-14	.211E-09	1.76	.422E-07
292	294	39	-18.62	57.62	0.0510	.701E-14	.654E-09	2.56	.131E-06
294	296	165	-23.63	188.63	1.9740	.829E-13	.773E-08	5.84	.155E-05
296	298	170	-27.24	197.24	0.4740	.190E-13	.178E-08	3.57	.355E-06
298	300	170	-31.42	201.42	1.6390	.645E-13	.601E-08	5.37	.120E-05
300	302	150	-21.93	171.93	0.0830	.382E-14	.357E-09	2.09	.714E-07
302	304	196	-29.40	225.40	4.0360	.142E-12	.132E-07	6.98	.265E-05
304	306	190	-26.64	216.64	0.0760	.278E-14	.259E-09	1.88	.519E-07
306	308	190	-26.55	216.55	0.0540	.198E-14	.184E-09	1.68	.369E-07
308	310	190	-25.61	215.61	0.0650	.239E-14	.223E-09	1.79	.446E-07
310	312	58	-24.76	82.76	0.9290	.889E-13	.830E-08	5.98	.166E-05
312	314	161	-27.54	188.54	0.3690	.155E-13	.145E-08	3.34	.289E-06
314	316	75	-23.89	98.89	0.5510	.441E-13	.412E-08	4.73	.824E-06
316	318	78	-23.03	101.03	0.8570	.672E-13	.627E-08	5.44	.125E-05
318	320	193	-28.91	221.91	1.3990	.499E-13	.466E-08	4.93	.932E-06
320	322	190	-28.77	218.77	0.2780	.101E-13	.939E-09	2.89	.188E-06
322	324	126	-19.71	145.71	0.7870	.428E-13	.399E-08	4.08	.798E-06
324	326	150	-23.12	173.12	0.2580	.118E-13	.110E-08	3.05	.220E-06
326	328	150	-25.11	175.11	0.2270	.103E-13	.956E-09	2.91	.192E-06
328	330	268	-29.53	297.53	1.1260	.300E-13	.280E-08	4.16	.560E-06
330	332	94	-20.97	114.97	0.4260	.294E-13	.274E-08	4.13	.548E-06
332	334	159	-19.02	178.02	0.6350	.283E-13	.264E-08	4.08	.527E-06
334	336	39	-15.73	54.73	0.0520	.753E-14	.702E-09	2.62	.140E-06
336	338	164	-17.13	181.13	0.0900	.394E-14	.367E-09	2.11	.735E-07
338	340	190	-26.83	216.83	0.2450	.895E-14	.835E-09	2.78	.167E-06

118	120	50	8.13	41.87	0.1140	.216E-13	.201E-08	3.73	.402E-06
120	122	60	-1.25	61.25	0.0700	.113E-12	.105E-07	6.46	.210E-05
122	124	67	-6.14	73.14	2.3300	.252E-12	.235E-07	8.46	.471E-05
124	126	57	-5.26	62.26	14.4000	.183E-11	.171E-06	16.38	.342E-04
126	128	84	-5.09	89.09	1.1700	.104E-12	.971E-08	6.30	.194E-05
128	130	60	10.71	49.29	0.1670	.268E-13	.250E-08	4.01	.501E-06
130	132	70	-2.98	72.98	0.8450	.917E-13	.856E-08	6.04	.171E-05
132	134	90	8.44	81.56	0.1800	.175E-13	.163E-08	3.47	.326E-06
134	136	110	16.28	93.72	1.1700	.989E-13	.923E-08	6.19	.185E-05
136	138	106	-0.59	106.59	0.8770	.652E-13	.608E-08	5.39	.122E-05
138	140	110	-2.11	112.11	0.1330	.940E-14	.877E-09	2.83	.175E-06
140	142	60	6.85	53.15	0.0290	.432E-14	.403E-09	2.18	.807E-07
142	144	50	-1.78	51.78	0.0170	.260E-14	.243E-09	1.64	.485E-07
144	146	70	10.12	59.88	0.0070	.926E-15	.864E-10	1.30	.173E-07
146	148	60	8.79	51.21	0.1140	.176E-13	.165E-08	3.48	.329E-06
148	150	50	17.54	32.46	0.0170	.415E-14	.387E-09	2.15	.774E-07
150	152	120	0.88	119.12	0.4630	.308E-13	.287E-08	4.20	.575E-06
152	154	53	-5.02	58.02	0.0470	.642E-14	.599E-09	2.49	.120E-06
154	156	60	-6.35	66.35	0.0490	.585E-14	.546E-09	2.41	.109E-06
156	158	70	-4.45	74.45	0.0230	.245E-14	.228E-09	1.80	.457E-07
158	160	50	-2.96	52.96	0.0070	.105E-14	.977E-10	1.36	.195E-07
160	162	50	-8.51	58.51	0.0050	.677E-15	.632E-10	1.18	.126E-07
162	164	60	-3.16	63.16	0.0390	.489E-14	.456E-09	2.27	.913E-07
164	166	50	2.40	47.60	0.0600	.999E-14	.932E-09	2.88	.186E-06
166	168	60	-5.13	65.13	0.0410	.499E-14	.465E-09	2.29	.931E-07
168	170	41	-1.82	42.82	0.2200	.407E-13	.380E-08	4.61	.759E-06
170	172	50	-6.04	56.04	0.0600	.848E-14	.791E-09	2.73	.158E-06
172	174	80	11.62	68.38	0.1730	.200E-13	.187E-08	3.64	.374E-06
174	176	60	10.69	49.31	0.0730	.117E-13	.109E-08	3.04	.219E-06
176	178	60	6.68	53.32	0.0720	.107E-13	.998E-09	2.95	.200E-06
178	180	60	-7.27	67.27	0.0270	.318E-14	.297E-09	1.97	.593E-07
180	182	43	-11.38	54.38	0.3320	.484E-13	.451E-08	4.88	.902E-06
182	184	70	-6.90	76.90	1.1120	.115E-12	.107E-07	6.50	.214E-05
184	186	110	-11.19	121.19	0.1020	.667E-14	.622E-09	2.52	.124E-06
186	188	110	-14.14	124.14	0.0730	.466E-14	.435E-09	2.24	.869E-07
188	190	62	-9.59	71.59	0.5240	.580E-13	.541E-08	5.18	.108E-05
190	192	100	-14.44	114.44	0.3880	.269E-13	.251E-08	4.01	.501E-06
192	194	100	-12.22	112.22	0.2260	.160E-13	.149E-08	3.37	.298E-06
194	196	91	-10.41	101.41	0.1060	.828E-14	.773E-09	2.71	.155E-06
196	198	60	-10.64	70.64	0.0130	.146E-14	.136E-09	1.52	.272E-07
200	202	40	-7.87	47.87	0.0500	.827E-14	.772E-09	2.71	.154E-06
202	204	92	-9.64	101.64	0.0730	.569E-14	.531E-09	2.39	.106E-06
204	206	60	-17.44	77.44	6.8500	.701E-12	.654E-07	11.89	.131E-04
206	208	146	-9.89	155.89	1.0040	.510E-13	.476E-08	4.97	.952E-06
208	210	50	-15.31	65.31	0.0110	.133E-14	.124E-09	1.47	.249E-07
210	212	180	-13.57	193.57	0.0450	.184E-14	.172E-09	1.64	.344E-07
212	214	140	-12.49	152.49	0.0690	.358E-14	.334E-09	2.05	.669E-07
214	216	30	-6.14	36.14	0.0430	.943E-14	.879E-09	2.83	.176E-06
216	218	130	-7.16	137.16	0.0220	.127E-14	.119E-09	1.45	.237E-07
218	220	128	-12.36	140.36	0.0960	.542E-14	.505E-09	2.35	.101E-06
220	222	116	-11.99	127.99	0.3720	.230E-13	.215E-08	3.81	.430E-06
222	224	122	110.63	11.37	492.0000	.343E-09	.320E-04	93.70	.640E-02
224	226	125	-14.73	139.73	0.1330	.754E-14	.704E-09	2.63	.141E-06
226	228	125	-13.37	138.37	0.0650	.372E-14	.347E-09	2.07	.694E-07
228	230	130	-13.20	143.20	0.1730	.957E-14	.893E-09	2.84	.179E-06

TOP (M)	BOT (M)	INSTHD (M)	INJCHD (M)	DIFLHD (M)	INJCFR (CM3/MIN)	PERM (CM2)	COND (CM/S)	EGNT (UM)	TRANS (CM2/S)
20	22	23	-3.02	26.02	0.2950	.898E-13	.838E-08	6.00	.168E-05
22	24	36	-16.00	54.00	62.2000	.912E-11	.851E-06	27.98	.170E-03
24	26	18	-12.45	30.45	0.4170	.108E-12	.101E-07	6.39	.202E-05
26	28	20	7.71	12.29	3.9000	.251E-11	.235E-06	18.20	.469E-04
28	30	26	12.18	13.82	0.1210	.694E-13	.647E-08	5.50	.129E-05
30	32	31	14.47	16.53	0.0530	.254E-13	.237E-08	3.94	.474E-06
32	34	44	25.49	18.51	183.1400	.784E-10	.731E-05	57.30	.146E-02
34	36	35	8.28	26.72	0.4710	.140E-12	.130E-07	6.95	.261E-05
36	38	35	-6.19	41.19	1.3550	.261E-12	.243E-07	8.55	.486E-05
38	40	46	24.11	21.89	242.5000	.878E-10	.819E-05	59.50	.164E-02
40	42	40	-1.13	41.13	2.9500	.568E-12	.530E-07	11.09	.106E-04
42	44	40	-12.79	52.79	56.0000	.840E-11	.784E-06	27.22	.157E-03
44	46	41	31.37	9.63	262.3599	.216E-09	.201E-04	80.31	.403E-02
46	48	42	-2.38	44.38	15.2800	.273E-11	.254E-06	18.71	.509E-04
48	50	29	-20.30	49.30	0.8400	.135E-12	.126E-07	6.87	.252E-05
50	52	34	7.59	26.41	0.3600	.110E-12	.102E-07	6.41	.205E-05
52	54	57	13.17	43.83	106.2100	.192E-10	.179E-05	35.85	.358E-03
54	56	45	-8.13	53.13	2.5270	.377E-12	.352E-07	9.67	.703E-05
56	58	52	9.49	42.51	119.3200	.222E-10	.207E-05	37.65	.415E-03
58	60	64	29.42	34.58	1.8560	.425E-12	.397E-07	10.07	.793E-05
60	62	70	-0.19	70.19	7.3460	.829E-12	.774E-07	12.58	.155E-04
61	63	40	35.15	4.85	180.1300	.294E-09	.275E-04	89.05	.549E-02
62	64	40	39.02	0.98	268.2698	.217E-08	.202E-03	173.29	.405E-01
64	66	53	15.03	37.97	56.1900	.117E-10	.109E-05	30.41	.219E-03
66	68	53	4.98	48.02	50.6300	.835E-11	.779E-06	27.16	.156E-03
68	70	55	42.07	12.93	189.9000	.116E-09	.109E-04	65.36	.217E-02
70	72	51	-10.01	61.01	0.4160	.540E-13	.504E-08	5.06	.101E-05
72	74	41	35.46	5.54	226.1600	.323E-09	.302E-04	91.90	.603E-02
74	76	70	-1.70	71.70	4.9560	.548E-12	.511E-07	10.95	.102E-04
76	78	60	4.35	55.65	3.5300	.503E-12	.469E-07	10.64	.938E-05
78	80	52	-6.08	58.08	0.7000	.955E-13	.891E-08	6.12	.178E-05
80	82	52	15.80	36.20	56.4900	.128E-10	.119E-05	31.32	.239E-03
82	84	52	14.60	37.40	1.6300	.345E-12	.322E-07	9.39	.644E-05
84	86	47	-6.67	53.67	0.8600	.127E-12	.118E-07	6.73	.237E-05
86	88	45	13.37	31.63	0.0900	.225E-13	.210E-08	3.78	.421E-06
88	90	70	12.86	57.14	25.6500	.356E-11	.332E-06	20.44	.664E-04
90	92	77	53.60	23.40	351.0000	.119E-09	.111E-04	65.82	.222E-02
92	94	78	42.96	35.04	295.6699	.668E-10	.624E-05	54.33	.125E-02
94	96	60	34.14	45.86	193.2500	.334E-10	.311E-05	43.11	.623E-03
96	98	48	-11.27	59.27	0.1910	.255E-13	.238E-08	3.94	.476E-06
98	100	50	-1.01	51.01	0.1050	.163E-13	.152E-08	3.40	.304E-06
100	102	65	6.98	48.02	0.0150	.247E-14	.231E-09	1.81	.462E-07
102	104	60	-4.57	64.57	48.3800	.594E-11	.554E-06	24.24	.111E-03
104	106	68	4.75	63.25	45.6500	.572E-11	.533E-06	23.94	.107E-03
106	108	67	10.65	56.35	0.0880	.124E-13	.115E-08	3.10	.231E-06
108	110	66	2.10	63.90	10.7500	.133E-11	.124E-06	14.73	.249E-04
110	112	80	26.07	53.93	473.7000	.696E-10	.649E-05	55.07	.130E-02
112	114	80	34.21	45.79	180.0000	.311E-10	.291E-05	42.12	.581E-03
114	116	44	-10.72	54.72	17.1600	.248E-11	.232E-06	18.13	.464E-04
116	118	52	-1.47	53.47	28.9500	.429E-11	.400E-06	21.75	.800E-04

279.24	TO	281.04	3.042	0.034	0.12E-12	0.92E-08	6.30	0.17E-05
283.27	TO	284.64	39.731	0.129	0.44E-13	0.35E-08	4.17	0.48E-06
284.64	TO	286.44	83.674	0.155	0.19E-13	0.15E-08	3.46	0.27E-06
286.44	TO	288.24	103.128	0.125	0.13E-13	0.10E-08	3.01	0.18E-06
288.24	TO	290.04	90.076	0.088	0.10E-13	0.80E-09	2.80	0.14E-06
290.04	TO	291.84	85.112	0.061	0.74E-14	0.59E-09	2.52	0.11E-06
291.84	TO	293.64	86.667	0.134	0.16E-13	0.13E-08	3.26	0.23E-06
293.64	TO	295.44	91.438	0.301	0.34E-13	0.27E-08	4.19	0.49E-06
295.44	TO	297.24	69.031	0.476	0.72E-13	0.57E-08	5.37	0.10E-05
297.24	TO	299.04	85.064	0.559	0.68E-13	0.54E-08	5.28	0.97E-06
299.04	TO	300.84	36.593	0.140	0.40E-13	0.31E-08	4.41	0.57E-06
300.84	TO	302.64	32.162	0.548	0.18E-12	0.14E-07	7.25	0.25E-05
302.64	TO	304.44	46.374	0.293	0.66E-13	0.52E-08	5.21	0.93E-06
304.44	TO	306.24	63.099	0.184	0.30E-13	0.24E-08	4.03	0.43E-06
306.24	TO	308.04	62.297	1.290	0.22E-12	0.17E-07	7.74	0.31E-05
308.04	TO	309.84	75.668	0.639	0.88E-13	0.69E-08	5.74	0.12E-05
309.84	TO	311.64	124.111	6.862	0.57E-12	0.45E-07	10.74	0.82E-05
311.64	TO	313.44	135.902	0.392	0.11E-12	0.90E-08	6.25	0.16E-05
326.04	TO	327.84	101.891	14.800	0.15E-11	0.12E-06	14.82	0.21E-04
329.64	TO	331.44	107.367	0.554	0.54E-13	0.42E-08	4.87	0.76E-06
331.44	TO	333.24	38.349	1.330	0.36E-12	0.28E-07	9.19	0.51E-05
333.24	TO	335.04	30.046	0.634	0.22E-12	0.17E-07	7.79	0.31E-05
335.04	TO	336.84	22.704	0.270	0.12E-12	0.98E-08	6.43	0.18E-05
338.64	TO	340.44	34.740	1.443	0.43E-12	0.34E-07	9.76	0.61E-05
340.44	TO	342.24	31.567	4.600	0.15E-11	0.12E-06	14.83	0.22E-04
342.24	TO	344.04	22.863	0.113	0.51E-13	0.41E-08	4.80	0.73E-06
344.04	TO	345.84	24.162	0.056	0.24E-13	0.19E-08	3.73	0.34E-06
347.64	TO	349.44	22.503	0.180	0.83E-13	0.66E-08	5.64	0.12E-05
349.44	TO	351.24	28.968	0.048	0.17E-13	0.14E-08	3.34	0.24E-06
351.24	TO	353.04	69.561	0.040	0.42E-14	0.33E-09	2.08	0.59E-07
353.04	TO	354.84	35.017	0.050	0.15E-13	0.12E-08	3.17	0.21E-06
354.84	TO	356.64	34.422	0.110	0.33E-13	0.26E-08	4.15	0.47E-06
356.64	TO	358.44	25.525	0.150	0.61E-13	0.48E-08	5.09	0.87E-06
358.44	TO	360.24	72.274	0.030	0.43E-14	0.34E-09	2.10	0.61E-07
360.24	TO	362.04	29.735	0.060	0.21E-13	0.17E-08	3.56	0.30E-06
362.04	TO	363.84	39.767	0.072	0.19E-13	0.15E-08	3.44	0.27E-06
363.84	TO	365.64	41.412	0.050	0.13E-13	0.99E-09	3.00	0.18E-06
365.64	TO	367.44	41.750	0.070	0.17E-13	0.14E-08	3.35	0.25E-06
367.44	TO	369.24	33.358	0.030	0.93E-14	0.74E-09	2.72	0.13E-06
369.24	TO	371.04	30.806	0.061	0.21E-13	0.16E-08	3.54	0.29E-06
371.04	TO	372.84	40.783	0.082	0.21E-13	0.17E-08	3.56	0.30E-06
372.84	TO	374.64	43.562	0.134	0.32E-13	0.25E-08	4.10	0.45E-06
374.64	TO	376.44	101.981	0.050	0.51E-14	0.40E-09	2.22	0.72E-07
376.44	TO	378.24	27.481	0.052	0.20E-13	0.16E-08	3.49	0.28E-06
378.24	TO	380.04	26.963	0.480	0.18E-12	0.15E-07	7.36	0.26E-05
380.04	TO	381.84	39.199	0.710	0.19E-12	0.15E-07	7.40	0.27E-05
381.84	TO	383.64	102.589	0.250	0.25E-13	0.20E-08	3.79	0.36E-06

164.00	TO	166.03	48.647	0.010	0.19E-14	0.15E-09	1.66	0.30E-07
166.00	TO	168.03	32.053	0.020	0.57E-14	0.45E-09	2.41	0.92E-07
168.00	TO	170.03	59.572	0.017	0.26E-14	0.21E-09	1.86	0.42E-07
170.00	TO	172.03	34.306	0.015	0.40E-14	0.32E-09	2.14	0.65E-07
174.00	TO	176.03	16.510	2.260	0.13E-11	0.10E-06	14.53	0.20E-04
176.00	TO	178.03	15.356	0.128	0.52E-13	0.41E-08	5.72	0.12E-05
178.00	TO	180.03	0.723	0.055	0.70E-12	0.55E-07	11.94	0.11E-04
180.00	TO	182.03	22.915	0.086	0.35E-13	0.27E-08	4.38	0.55E-06
182.00	TO	184.00	16.301	60.530	0.35E-10	0.27E-05	43.65	0.55E-03
184.00	TO	186.03	25.050	0.719	0.26E-12	0.21E-07	8.63	0.42E-05
186.00	TO	188.03	22.240	5.450	0.23E-11	0.18E-06	17.64	0.36E-04
188.00	TO	190.03	3.505	13.920	0.37E-10	0.29E-05	44.64	0.59E-03
190.00	TO	192.03	24.146	0.223	0.85E-13	0.67E-08	5.91	0.14E-05
192.00	TO	194.03	5.327	0.762	0.13E-11	0.10E-06	14.74	0.21E-04
196.00	TO	198.03	9.187	0.062	0.62E-13	0.49E-08	5.33	0.10E-05
198.00	TO	200.03	5.779	0.067	0.11E-12	0.84E-08	6.38	0.17E-05
200.00	TO	202.03	7.066	0.017	0.22E-13	0.18E-08	3.78	0.36E-06
202.00	TO	204.03	8.950	0.096	0.99E-13	0.78E-08	6.22	0.16E-05
204.16	TO	205.96	113.904	0.189	0.17E-13	0.14E-08	3.34	0.25E-06
207.26	TO	209.06	108.881	0.246	0.23E-13	0.19E-08	3.70	0.33E-06
210.87	TO	212.46	106.758	0.096	0.11E-13	0.84E-09	2.72	0.13E-06
210.84	TO	212.64	17.463	0.054	0.32E-13	0.25E-08	4.11	0.46E-06
212.64	TO	214.44	109.434	0.204	0.19E-13	0.15E-08	3.47	0.28E-06
214.44	TO	216.24	103.702	0.321	0.32E-13	0.25E-08	4.11	0.46E-06
216.24	TO	218.04	98.835	0.077	0.81E-14	0.64E-09	2.59	0.12E-06
218.04	TO	219.84	34.305	0.133	0.40E-13	0.32E-08	4.43	0.57E-06
219.84	TO	221.64	118.719	0.225	0.20E-13	0.16E-08	3.49	0.28E-06
221.64	TO	223.44	97.453	0.182	0.19E-13	0.15E-08	3.47	0.28E-06
223.44	TO	225.24	114.833	0.100	0.90E-14	0.72E-09	2.69	0.13E-06
225.24	TO	227.04	63.286	0.613	0.10E-12	0.80E-08	6.01	0.14E-05
227.04	TO	228.84	174.524	0.212	0.13E-13	0.10E-08	3.01	0.18E-06
228.84	TO	230.64	12.907	0.353	0.28E-12	0.22E-07	8.49	0.40E-05
230.64	TO	232.44	37.713	0.264	0.73E-13	0.57E-08	5.39	0.10E-05
232.64	TO	234.44	38.778	0.263	0.70E-13	0.56E-08	5.34	0.10E-05
234.24	TO	236.04	96.381	3.570	0.38E-12	0.30E-07	9.40	0.55E-05
236.04	TO	237.84	32.638	0.253	0.81E-13	0.64E-08	5.58	0.11E-05
237.84	TO	239.64	75.447	2.157	0.30E-12	0.23E-07	8.62	0.42E-05
239.64	TO	241.44	31.200	0.117	0.39E-13	0.31E-08	4.38	0.55E-06
241.44	TO	243.24	36.303	0.144	0.41E-13	0.33E-08	4.46	0.59E-06
243.24	TO	245.04	60.631	19.430	0.33E-11	0.26E-06	19.29	0.47E-04
245.04	TO	246.84	37.996	1.106	0.30E-12	0.24E-07	8.67	0.43E-05
246.84	TO	248.64	36.075	0.235	0.68E-13	0.53E-08	5.26	0.96E-06
250.44	TO	252.24	3.761	0.167	0.43E-12	0.34E-07	9.78	0.62E-05
255.84	TO	257.64	27.322	0.138	0.52E-13	0.41E-08	4.84	0.75E-06
257.64	TO	259.44	25.746	0.245	0.99E-13	0.78E-08	5.97	0.14E-05
259.44	TO	261.24	22.600	0.153	0.70E-13	0.56E-08	5.33	0.10E-05
261.24	TO	263.04	34.913	0.226	0.67E-13	0.53E-08	5.25	0.96E-06
263.04	TO	264.84	37.699	0.510	0.14E-12	0.11E-07	6.72	0.20E-05
264.84	TO	266.64	28.103	0.447	0.17E-12	0.13E-07	7.09	0.24E-05
266.64	TO	268.44	38.142	3.607	0.98E-12	0.78E-07	12.84	0.14E-04
268.44	TO	270.24	86.986	3.354	0.40E-12	0.32E-07	9.52	0.57E-05
270.24	TO	272.04	37.637	0.364	0.10E-12	0.79E-08	6.01	0.14E-05
272.04	TO	273.84	34.643	2.370	0.71E-12	0.56E-07	11.53	0.10E-04
275.64	TO	277.44	84.524	9.700	0.12E-11	0.94E-07	13.70	0.17E-04
277.44	TO	279.24	41.841	0.650	0.16E-12	0.13E-07	7.03	0.23E-05

INTERVAL (M)	DIFF. HEAD (M)	FLOW-RATE (CC/MIN)	PERMEA-BILITY (SQ.CM)	CONDUC-TIVITY (CM/SEC)	EQUIV. SING.FR. APERT. (MICRO M.)	TRANSMIS-SIVITY (SQ.CM/SEC)
99 SBH1 HYDROLOGY DATA						
99 NRO 48, 1ST INCR. FLOW WAS NEG.						
50.00 TO 52.03	5.313	88.460	0.15E-09	0.12E-04	71.98	0.25E-02
54.00 TO 56.03	8.141	1.799	0.20E-11	0.16E-06	17.04	0.33E-04
56.00 TO 58.03	7.708	0.160	0.18E-12	0.14E-07	7.58	0.29E-05
58.00 TO 60.03	0.154	0.138	0.83E-11	0.65E-06	27.20	0.13E-03
60.00 TO 62.03	16.003	0.091	0.52E-13	0.41E-08	5.03	0.84E-06
62.00 TO 64.03	9.265	0.293	0.29E-12	0.23E-07	8.91	0.47E-05
64.00 TO 66.03	28.878	0.105	0.33E-13	0.26E-08	4.33	0.54E-06
66.00 TO 68.03	10.585	9.801	0.85E-11	0.67E-06	27.48	0.14E-03
68.00 TO 70.03	5.963	8.679	0.13E-10	0.11E-05	31.95	0.22E-03
70.00 TO 72.03	8.658	0.680	0.72E-12	0.57E-07	12.07	0.12E-04
72.00 TO 74.03	11.227	18.030	0.15E-10	0.12E-05	33.01	0.24E-03
74.00 TO 76.03	16.478	3.520	0.20E-11	0.16E-06	16.85	0.32E-04
76.00 TO 78.03	15.542	3.061	0.18E-11	0.14E-06	16.40	0.29E-04
78.00 TO 80.03	11.395	21.165	0.17E-10	0.14E-05	34.65	0.27E-03
80.00 TO 82.03	4.008	16.121	0.37E-10	0.29E-05	44.83	0.69E-03
82.00 TO 84.03	1.829	14.110	0.71E-10	0.56E-05	55.70	0.11E-02
84.00 TO 86.03	14.718	0.541	0.34E-12	0.27E-07	9.37	0.54E-05
95.51 TO 97.54	5.890	0.030	0.47E-13	0.37E-08	4.85	0.75E-06
97.51 TO 99.54	4.298	64.790	0.14E-09	0.11E-04	69.64	0.22E-02
99.51 TO 101.54	9.430	5.164	0.50E-11	0.40E-06	23.06	0.81E-04
101.51 TO 103.54	11.965	0.115	0.89E-13	0.70E-08	6.00	0.14E-05
103.51 TO 105.54	10.432	10.020	0.88E-11	0.70E-06	27.81	0.14E-03
105.53 TO 107.56	27.484	2.700	0.90E-12	0.72E-07	13.01	0.15E-04
105.51 TO 107.50	56.179	9.910	0.17E-11	0.13E-06	15.81	0.26E-04
107.53 TO 109.56	20.356	4.280	0.19E-11	0.15E-06	16.76	0.31E-04
110.00 TO 112.00	41.576	3.074	0.69E-12	0.55E-07	11.83	0.11E-04
112.00 TO 114.00	47.215	0.225	0.45E-13	0.35E-08	4.74	0.70E-06
114.00 TO 116.00	28.865	0.113	0.37E-13	0.29E-08	4.44	0.58E-06
116.00 TO 118.00	29.087	0.107	0.34E-13	0.27E-08	4.35	0.54E-06
118.00 TO 120.00	67.532	0.175	0.24E-13	0.19E-08	3.67	0.38E-06
120.00 TO 122.00	66.175	0.127	0.18E-13	0.14E-08	3.50	0.28E-06
122.00 TO 124.00	43.461	0.000	0.00E 00	0.00E 00	0.00	0.00E 00
124.00 TO 126.00	65.122	0.197	0.28E-13	0.22E-08	4.08	0.45E-06
126.00 TO 128.00	44.465	4.060	0.85E-12	0.67E-07	12.69	0.13E-04
128.00 TO 130.00	53.540	2.210	0.39E-12	0.31E-07	9.74	0.61E-05
130.00 TO 132.00	45.054	0.062	0.13E-13	0.10E-08	3.14	0.20E-06
134.00 TO 136.00	39.644	0.023	0.54E-14	0.43E-09	2.35	0.86E-07
136.00 TO 138.00	69.839	0.338	0.45E-13	0.36E-08	4.77	0.72E-06
138.00 TO 140.00	62.247	36.350	0.55E-11	0.43E-06	23.56	0.86E-04
142.00 TO 144.00	98.656	12.340	0.12E-11	0.92E-07	14.10	0.18E-04
144.00 TO 146.00	49.986	1.482	0.28E-12	0.22E-07	8.72	0.44E-05
146.00 TO 148.00	31.338	0.072	0.21E-13	0.17E-08	3.72	0.34E-06
150.00 TO 152.00	31.629	0.034	0.10E-13	0.79E-09	2.89	0.16E-06
152.00 TO 154.00	42.297	17.610	0.39E-11	0.31E-06	21.05	0.62E-04
156.00 TO 158.03	11.962	0.069	0.53E-13	0.42E-08	5.06	0.85E-06
158.00 TO 160.03	13.499	0.126	0.86E-13	0.68E-08	5.94	0.14E-05
160.00 TO 162.03	18.777	0.060	0.29E-13	0.23E-08	4.15	0.47E-06
162.00 TO 164.03	33.854	0.013	0.35E-14	0.28E-09	2.05	0.57E-07

FILE: R10PERM SCHART A1 05/21/81 16:34:27 UNIVERSITY OF WATERLOO PAGE 001

0	INTERVAL (M)	DIFF. HEAD (M)	FLOW-RATE (CC/MIN)	PERMEA-BILITY (SQ.CM)	CONDUC-TIVITY (CM/SEC)	EQUIV. SING.FR. APERT. (MICRO M.)	TRANSMIS-SIVITY (SQ.CM/SEC)
99	HOLE R10 HYDROLOGY DATA						
	3.83 TO 5.81	-72.954	-1.086	0.14E-12	0.11E-07	6.93	0.22E-05
	5.87 TO 7.85	-94.089	-2.232	0.22E-12	0.18E-07	8.10	0.35E-05
	7.90 TO 9.88	-67.853	-1.424	0.20E-12	0.16E-07	7.78	0.31E-05
	9.88 TO 11.86	-67.207	-1.717	0.24E-12	0.19E-07	8.30	0.38E-05
	11.80 TO 13.78	-54.659	-3.300	0.57E-12	0.45E-07	11.06	0.89E-05
	13.87 TO 15.85	-75.300	-0.543	0.68E-13	0.54E-08	5.45	0.11E-05
	15.84 TO 17.82	-53.659	-0.490	0.86E-13	0.68E-08	5.89	0.13E-05
	17.85 TO 19.83	-35.169	-0.620	0.17E-12	0.13E-07	7.34	0.26E-05
	19.85 TO 21.83	-31.657	-0.790	0.24E-12	0.19E-07	8.24	0.37E-05
	21.80 TO 23.78	-148.886	-1.111	0.70E-13	0.56E-08	5.51	0.11E-05
	24.03 TO 26.06	-11.601	-0.230	0.18E-12	0.14E-07	7.63	0.29E-05
	26.01 TO 28.04	-3.726	-0.020	0.49E-13	0.39E-08	4.94	0.79E-06
	28.08 TO 30.04	-59.408	-0.624	0.10E-12	0.79E-08	6.17	0.16E-05

0	INTERVAL (M)	DIFF. HEAD (M)	FLOW-RATE (CC/MIN)	PERMEA-BILITY (SQ.CM)	CONDUC-TIVITY (CM/SEC)	EQUIV. SING.FR. APERT. (MICRO M.)	TRANSMIS-SIVITY (SQ.CM/SEC)
99	HOLE R9 HYDROLOGY DATA						
	3.99 TO 6.02	-36.256	-0.609	0.15E-12	0.12E-07	7.22	0.25E-05
	8.01 TO 10.04	-12.372	-0.025	0.19E-13	0.15E-08	3.56	0.30E-06
	10.05 TO 12.08	-44.306	-0.100	0.21E-13	0.16E-08	3.70	0.33E-06
	12.03 TO 14.06	-20.255	-0.110	0.50E-13	0.40E-08	4.95	0.80E-06
	14.02 TO 16.05	-39.242	-0.115	0.27E-13	0.21E-08	4.03	0.43E-06
	16.06 TO 18.09	-21.661	-0.031	0.13E-13	0.11E-08	3.19	0.21E-06
	18.07 TO 20.10	-51.067	-2.554	0.46E-12	0.36E-07	10.39	0.74E-05
	20.02 TO 22.05	-49.480	-0.940	0.18E-12	0.14E-07	7.52	0.28E-05
	22.04 TO 24.07	-47.125	-20.250	0.40E-11	0.31E-06	21.27	0.64E-04
	24.00 TO 26.03	-49.307	-4.500	0.84E-12	0.66E-07	12.69	0.13E-04
	26.01 TO 28.04	-69.146	-1.413	0.19E-12	0.15E-07	7.71	0.30E-05

FILE: R8PERM SCHART A1 05/21/81 16:26:10 UNIVERSITY OF WATERLOO PAGE 001

0	INTERVAL (M)	DIFF. HEAD (M)	FLOW-RATE (CC/MIN)	PERMEA-BILITY (SQ.CM)	CONDUC-TIVITY (CM/SEC)	EQUIV. SING.FR. APERT. (MICRO M.)	TRANSMIS-SIVITY (SQ.CM/SEC)
99	HOLE R8 HYDROLOGY DATA						
	3.97 TO 6.00	-10.473	-0.089	0.79E-13	0.62E-08	5.76	0.13E-05
	8.04 TO 10.07	-29.031	-0.129	0.41E-13	0.32E-08	4.63	0.66E-06
	10.01 TO 12.02	-50.013	-0.102	0.19E-13	0.15E-08	3.58	0.30E-06
	14.01 TO 16.04	-45.216	-0.134	0.27E-13	0.22E-08	4.05	0.44E-06
	16.02 TO 18.05	-53.969	-0.292	0.50E-13	0.39E-08	4.95	0.80E-06
	18.05 TO 20.08	-31.504	-0.190	0.56E-13	0.44E-08	5.13	0.89E-06
	19.99 TO 22.02	-56.643	-0.807	0.13E-12	0.10E-07	6.83	0.21E-05
	22.02 TO 24.05	-53.297	-4.077	0.70E-12	0.56E-07	11.97	0.11E-04
	24.01 TO 26.04	-52.798	-7.848	0.14E-11	0.11E-06	14.93	0.22E-04
	26.63 TO 28.04	-43.357	-0.899	0.28E-12	0.22E-07	7.74	0.31E-05
	21.99 TO 24.02	-49.433	-3.975	0.74E-12	0.59E-07	12.17	0.12E-04

FILE: R7PERM SCHART A1 05/21/81 16:21:56 UNIVERSITY OF WATERLOO PAGE 001

0	INTERVAL (M)	DIFF. HEAD (M)	FLOW-RATE (CC/MIN)	PERMEA-BILITY (SQ.CM)	CONDUC-TIVITY (CM/SEC)	EQUIV. SING.FR. APERT. (MICRO M.)	TRANSMIS-SIVITY (SQ.CM/SEC)
99	HOLE R7 HYDROLOGY DATA						
	1.77 TO 5.77	11.050	0.078	0.33E-13	0.26E-08	5.42	0.10E-05
	5.77 TO 9.77	12.809	0.114	0.42E-13	0.33E-08	5.84	0.13E-05
	9.77 TO 13.77	9.290	0.011	0.57E-14	0.45E-09	3.01	0.18E-06
	13.77 TO 17.77	26.533	0.087	0.15E-13	0.12E-08	4.19	0.48E-06
	17.77 TO 21.77	8.234	0.186	0.11E-12	0.84E-08	7.97	0.33E-05
	21.77 TO 25.77	3.097	0.099	0.15E-12	0.12E-07	8.95	0.47E-05
	25.77 TO 29.77	5.067	0.382	0.35E-12	0.28E-07	11.91	0.11E-04

FILE: R6PERM SCHART A1 05/21/81 16:40:34 UNIVERSITY OF WATERLOO PAGE 001

99 HOLE R6 HYDROLOGY DATA

0 INTERVAL (M)	DIFF. HEAD (M)	FLOW-RATE (CC/MIN)	PERMEA-BILITY (SQ.CM)	CONDUC-TIVITY (CM/SEC)	EQUIV. SING.FR. APERT. (MICRO M.)	TRANSMIS-SIVITY (SQ.CM/SEC)
2.00 TO 6.00	5.138	0.026	0.23E-13	0.19E-08	4.83	0.74E-06
3.77 TO 7.77	8.375	3.557	0.20E-11	0.16E-06	21.19	0.63E-04
7.77 TO 11.77	11.542	4.023	0.16E-11	0.13E-06	19.84	0.52E-04
11.77 TO 15.77	11.542	0.059	0.24E-13	0.19E-08	4.86	0.76E-06
15.77 TO 19.77	11.331	1.432	0.59E-12	0.47E-07	14.14	0.19E-04
19.77 TO 23.77	12.105	0.626	0.24E-12	0.19E-07	10.50	0.76E-05
23.77 TO 27.77	9.360	2.726	0.14E-11	0.11E-06	18.68	0.43E-04
27.77 TO 31.77	9.642	0.195	0.95E-13	0.75E-08	7.68	0.30E-05
31.77 TO 35.77	10.698	0.034	0.15E-13	0.12E-08	4.13	0.47E-06
35.77 TO 39.77	8.234	0.428	0.24E-12	0.19E-07	10.52	0.77E-05

0	INTERVAL (M)	DIFF. HEAD (M)	FLOW-RATE (CC/MIN)	PERMEA-BILITY (SQ.CM)	CONDUC-TIVITY (CM/SEC)	EQUIV. SING.FR. APERT. (MICRO M.)	TRANSMIS-SIVITY (SQ.CM/SEC)
99 HOLE R5 HYDROLOGY DATA							
	2.13 TO 4.24	-6.804	0.000	0.00E 00	0.00E 00	0.00	0.00E 00
	4.26 TO 6.37	-34.143	-3.000	0.78E-12	0.62E-07	12.53	0.13E-04
	6.32 TO 8.43	-31.857	-1.260	0.35E-12	0.28E-07	9.60	0.58E-05
	6.32 TO 8.43	-31.747	-1.370	0.38E-12	0.30E-07	9.89	0.64E-05
	8.37 TO 10.48	-32.545	-0.730	0.20E-12	0.16E-07	7.95	0.33E-05
	8.37 TO 10.48	-32.201	-0.550	0.15E-12	0.12E-07	7.26	0.25E-05
	10.52 TO 12.63	-18.325	-0.500	0.24E-12	0.19E-07	8.49	0.40E-05
	12.56 TO 14.67	-20.301	-0.300	0.13E-12	0.10E-07	6.92	0.22E-05
	14.67 TO 16.78	-22.829	-0.390	0.15E-12	0.12E-07	7.26	0.25E-05
	14.67 TO 16.78	-23.083	-0.570	0.22E-12	0.17E-07	8.21	0.37E-05
	16.79 TO 18.90	-46.663	-0.370	0.70E-13	0.56E-08	5.62	0.12E-05
	16.79 TO 18.90	-47.021	-0.380	0.72E-13	0.57E-08	5.66	0.12E-05
	18.92 TO 20.93	-56.352	-0.450	0.71E-13	0.56E-08	5.63	0.12E-05
	21.02 TO 23.13	-77.796	-12.500	0.14E-11	0.11E-06	15.32	0.24E-04
	25.17 TO 27.28	-17.492	-0.040	0.20E-13	0.16E-08	3.71	0.34E-06

FILE: R4PERM SCHART A1 05/21/81 16:39:45 UNIVERSITY OF WATERLOO PAGE 001

0	INTERVAL (M)	DIFF. HEAD (M)	FLOW-RATE (CC/MIN)	PERMEA-BILITY (SQ.CM)	CONDUC-TIVITY (CM/SEC)	EQUIV. SING.FR. APERT.	TRANSMIS-SIVITY (SQ.CM/SEC)
99	HOLE R4 HYDROLOGY DATA						
	5.90 TO 8.11	-31.588	-2.500	0.67E-12	0.53E-07	12.10	0.12E-04
	7.90 TO 10.11	-33.904	0.000	0.00E 00	0.00E 00	0.00	0.00E 00
	9.90 TO 12.11	-37.319	-6.500	0.15E-11	0.12E-06	15.74	0.26E-04
	11.90 TO 14.11	-34.574	-4.890	0.12E-11	0.95E-07	14.69	0.21E-04
	13.90 TO 16.11	-17.996	-0.382	0.18E-12	0.14E-07	7.81	0.31E-05
	15.80 TO 18.01	-18.943	-0.260	0.12E-12	0.92E-08	6.75	0.20E-05
	17.82 TO 20.03	-26.354	-2.600	0.83E-12	0.66E-07	13.03	0.15E-04
	17.82 TO 20.03	-26.354	-2.400	0.77E-12	0.61E-07	12.68	0.13E-04
	17.82 TO 20.03	-26.354	-2.340	0.75E-12	0.59E-07	12.58	0.13E-04
	19.80 TO 22.01	-33.067	-2.270	0.58E-12	0.46E-07	11.54	0.10E-04
	19.80 TO 22.01	-33.074	-2.100	0.54E-12	0.42E-07	11.25	0.94E-05
	21.92 TO 24.13	-26.009	-0.730	0.24E-12	0.19E-07	8.57	0.41E-05
	21.92 TO 24.13	-25.974	-0.700	0.23E-12	0.18E-07	8.45	0.40E-05
	23.92 TO 26.13	-42.926	-6.300	0.12E-11	0.98E-07	14.87	0.22E-04
	27.93 TO 30.00	-53.676	-0.025	0.42E-14	0.33E-09	2.19	0.69E-07

FILE: R3PERM SCHART A1 05/21/81 16:38:41 UNIVERSITY OF WATERLOO PAGE 001

0	INTERVAL (M)	DIFF. HEAD (M)	FLOW-RATE (CC/MIN)	PERMEA-BILITY (SQ.CM)	CONDUC-TIVITY (CM/SEC)	EQUIV. SING.FR. APERT. (MICRO M.)	TRANSMIS-SIVITY (SQ.CM/SEC)
99	HOLE R3 HYDROLOGY DATA						
	2.04 TO 4.47	-18.468	0.000	0.00E 00	0.00E 00	0.00	0.00E 00
	5.98 TO 8.41	-23.961	-0.100	0.32E-13	0.25E-08	4.54	0.62E-06
	8.08 TO 10.32	-43.946	-30.000	0.57E-11	0.45E-06	24.82	0.10E-03
	8.08 TO 10.32	-43.946	-19.000	0.36E-11	0.29E-06	21.32	0.64E-04
	12.09 TO 14.33	-38.245	-18.000	0.39E-11	0.31E-06	21.93	0.70E-04
	12.09 TO 14.33	-38.279	-17.000	0.37E-11	0.29E-06	21.51	0.66E-04
	14.00 TO 16.24	-36.852	-21.700	0.49E-11	0.39E-06	23.63	0.87E-04
	14.00 TO 16.24	-36.887	-20.000	0.45E-11	0.36E-06	22.99	0.80E-04
	15.95 TO 18.19	-6.560	-0.200	0.25E-12	0.20E-07	8.81	0.45E-05
	17.96 TO 20.20	-5.278	-0.220	0.35E-12	0.28E-07	9.77	0.62E-05
	19.97 TO 22.21	-15.711	-2.880	0.15E-11	0.12E-06	16.01	0.27E-04
	22.01 TO 24.25	-30.978	-2.200	0.59E-12	0.47E-07	11.67	0.10E-04
	23.97 TO 26.21	-31.809	-1.600	0.42E-12	0.33E-07	10.41	0.74E-05
	25.97 TO 28.21	-34.615	-2.960	0.71E-12	0.56E-07	12.42	0.13E-04

FILE: R2PERM SCHART A1 05/21/81 16:38:14 UNIVERSITY OF WATERLOO PAGE 001

99 HOLE R2 HYDROLOGY DATA

INTERVAL (M)	DIFF. HEAD (M)	FLOW-RATE (CC/MIN)	PERMEA-BILITY (SQ.CM)	CONDUC-TIVITY (CM/SEC)	EQUIV. SING.FR. APERT. (MICRO M.)	TRANSMIS-SIVITY (SQ.CM/SEC)
1.23 TO 5.23	9.642	2.256	0.11E-11	0.86E-07	17.37	0.35E-04
5.23 TO 9.23	4.293	0.287	0.31E-12	0.25E-07	11.44	0.99E-05
9.23 TO 13.23	59.611	0.009	0.71E-15	0.56E-10	1.50	0.22E-07
13.23 TO 17.23	12.598	0.007	0.26E-14	0.21E-09	2.33	0.83E-07
17.23 TO 21.23	2.604	0.005	0.93E-14	0.74E-09	3.55	0.30E-06
21.23 TO 25.23	8.305	0.068	0.38E-13	0.30E-08	5.68	0.12E-05
25.23 TO 29.23	7.460	0.987	0.62E-12	0.49E-07	14.37	0.20E-04

FILE: R1PERM SCHART A1 05/21/81 16:37:48 UNIVERSITY OF WATERLOO PAGE 001

0	INTERVAL (M)	DIFF. HEAD (M)	FLOW-RATE (CC/MIN)	PERMEA-BILITY (SQ.CM)	CONDUC-TIVITY (CM/SEC)	EQUIV. SING.FR. APERT. (MICRO M.)	TRANSMIS-SIVITY (SQ.CM/SEC)
99 HOLE R1 HYDROLOGY DATA							
	17.50 TO 21.50	8.797	1.523	0.81E-12	0.64E-07	15.71	0.26E-04
	21.50 TO 25.50	10.064	0.146	0.68E-13	0.53E-08	6.87	0.21E-05
	25.50 TO 29.50	8.938	0.052	0.27E-13	0.22E-08	5.08	0.87E-06
	29.50 TO 33.50	8.797	0.140	0.75E-13	0.59E-08	7.10	0.24E-05
	33.50 TO 37.50	8.164	0.115	0.66E-13	0.52E-08	6.81	0.21E-05

FILE: HG5PERM SCHART A1 05/21/81 16:37:07 UNIVERSITY OF WATERLOO PAGE 001

0	INTERVAL (M)	DIFF. HEAD (M)	FLOW-RATE (CC/MIN)	PERMEA-BILITY (SQ.CM)	CONDUC-TIVITY (CM/SEC)	EQUIV. SING.FR. APERT. (MICRO M.)	TRANSMIS-SIVITY (SQ.CM/SEC)
9	HOLE HG5 HYDROLOGY DATA						
	2.14 TO 4.61	7.945	0.190	0.18E-12	0.14E-07	8.12	0.35E-05
	4.14 TO 6.14	3.311	0.010	0.28E-13	0.22E-08	4.07	0.45E-06
	8.14 TO 10.14	9.780	0.158	0.15E-12	0.12E-07	7.13	0.24E-05
	12.14 TO 14.14	18.462	4.090	0.21E-11	0.16E-06	17.06	0.33E-04
	14.14 TO 16.14	19.448	9.550	0.46E-11	0.36E-06	22.24	0.73E-04
	16.14 TO 18.14	6.156	12.910	0.20E-10	0.15E-05	36.08	0.31E-03
	18.14 TO 20.14	5.386	8.370	0.15E-10	0.11E-05	32.65	0.23E-03
	20.14 TO 22.14	5.136	5.200	0.95E-11	0.75E-06	28.31	0.15E-03
	24.14 TO 26.14	2.589	0.054	0.20E-12	0.15E-07	7.76	0.31E-05
	26.14 TO 28.14	1.520	0.040	0.25E-12	0.19E-07	8.38	0.39E-05

FILE: HG4PERM SCHART A1 05/21/81 16:36:39 UNIVERSITY OF WATERLOO PAGE 001

99 HOLE HG4 HYDROLOGY DATA

INTERVAL (M)	DIFF. HEAD (M)	FLOW-RATE (CC/MIN)	PERMEA-BILITY (SQ.CM)	CONDUC-TIVITY (CM/SEC)	EQUIV. SING.FR. APERT. (MICRO M.)	TRANSMIS-SIVITY (SQ.CM/SEC)
3.87 TO 5.85	-112.773	-8.867	0.74E-12	0.59E-07	12.08	0.12E-04
5.78 TO 7.76	-140.877	-0.690	0.46E-13	0.37E-08	4.79	0.72E-06
7.81 TO 9.79	-31.151	-0.900	0.27E-12	0.22E-07	8.65	0.43E-05
11.82 TO 13.80	-91.770	-0.019	0.20E-14	0.16E-09	1.67	0.31E-07
13.81 TO 15.79	-169.091	-0.143	0.80E-14	0.63E-09	2.66	0.12E-06
15.92 TO 17.90	-153.241	-0.120	0.74E-14	0.59E-09	2.60	0.12E-06
17.77 TO 19.75	-191.735	-0.094	0.47E-14	0.37E-09	2.23	0.73E-07
19.86 TO 21.84	-116.909	-0.040	0.32E-14	0.26E-09	1.97	0.51E-07
23.81 TO 25.79	-104.746	-4.111	0.37E-12	0.29E-07	9.58	0.58E-05
25.81 TO 27.79	-104.587	-13.100	0.12E-11	0.94E-07	14.10	0.19E-04
27.91 TO 30.00	-95.911	-79.070	0.74E-11	0.58E-06	26.43	0.12E-03

FILE: HG3PERM SCHART A1 05/21/81 16:35:56 UNIVERSITY OF WATERLOO PAGE 001

99 HOLE HG3 HYDROLOGY DATA

INTERVAL (M)	DIFF. HEAD (M)	FLOW-RATE (CC/MIN)	PERMEA-BILITY (SQ.CM)	CONDUC-TIVITY (CM/SEC)	EQUIV. SING.FR. APERT. (MICRO M.)	TRANSMIS-SIVITY (SQ.CM/SEC)
4.05 TO 6.08	-92.380	-3.253	0.32E-12	0.26E-07	9.24	0.52E-05
5.98 TO 8.01	-36.007	-0.183	0.47E-13	0.37E-08	4.85	0.75E-06
8.06 TO 10.11	-9.920	0.000	0.00E 00	0.00E 00	0.00	0.00E 00
10.04 TO 12.07	-53.533	-0.027	0.46E-14	0.36E-09	2.23	0.74E-07
12.02 TO 14.05	-97.070	-0.068	0.65E-14	0.51E-09	2.51	0.10E-06
14.01 TO 16.04	-61.617	-0.027	0.40E-14	0.32E-09	2.13	0.64E-07
16.00 TO 18.03	-78.948	-0.036	0.42E-14	0.33E-09	2.17	0.67E-07
17.72 TO 19.75	-54.766	-0.023	0.39E-14	0.31E-09	2.12	0.63E-07
19.76 TO 21.83	-0.055	-0.003	0.55E-12	0.44E-07	11.11	0.90E-05
21.84 TO 23.82	-109.247	-0.287	0.25E-13	0.20E-08	3.89	0.39E-06
23.72 TO 25.80	-106.504	-0.323	0.27E-13	0.22E-08	4.08	0.45E-06
25.88 TO 27.91	-117.595	-14.557	0.11E-11	0.90E-07	14.05	0.19E-04

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