L-BAP. PHASE II GROUND WATER HYDROLOGY PROGRAM

DEFINITION OF THE UPPER TRANSMISSIVE ZONE OF THE 1ST TRES HERMANOS SANDSTONE

TECHNICAL REPORT 88-1

INTERA TECHNOLOGIES, INC.
AUSTIN, TEXAS

JANUARY 4, 1988

H01100R192

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1.0 INTRODUCTION AND PHASE I GROUND WATER HYDROLOGY PROGRAM REVIEW

The L-Bar Uranium Mine/Mill is undergoing reclamation in accordance with State and Federal Regulations. A Reclamation Plan has been submitted to the Nuclear Regulatory Commission and is currently undergoing revisions. In addition to the Reclamation Plan, an investigation for the purpose of defining the extent of seepage from the tailings pond in the uppermost aquifer has been initiated. Phase I of the ground water hydrology program undertaken in early 1987 resulted in the installation of wells for monitoring background water quality and additional pumpback wells to the west of the tailings dam. A limited number of peripheral wells were installed on the L-Bar property for background purposes. These wells were assigned numbers in the field which resulted in some confusion, therefore they are renumbered as follows. The renumbering is not reflected in the 01/29/88 revision to the Reclamation Plan but will be reflected in subsequent documentation.

Field Number	Reassigned Number	Geologic Unit
MW-4C	MW-30	1st Tres Hermanos
MW-9A	Destroyed	N/A
MW-9B	MW-37	1st Tres Hermanos
MW-13B	MW-32	1st Tres Hermanos
MW-17B	MW-33	1st Tres Hermanos
MW-27B	MW-34	1st Tres Hermanos
MW-28	MW-28 (same)	1st Tres Hermanos
MW-29	MW-29 (same)	1st Tres Hermanos

The geologic logs, well completion details and location map of the Phase I installation program are provided in Appendix I.

The Phase I program identified that the most appropriate background ground water quality indicator was chloride (Cl). Additional general indicators of background chemistry would be considered in conjunction with chloride, such as: concentration trends, pH and constituent ratios (such as Cl/SO_4). A background well (MW-29) for use in a detection monitoring program was tentatively identified, as were tentative point of compliance wells (MW-1A, MW-26 or 27 and MW-33). The Phase I program was considered completed August 19, 1987 as detailed in Appendix II.

1.1 PHASE II GROUND WATER HYDROLOGY PROGRAM

The purpose of the Phase II Ground Water Hydrology Program is to evaluate the extent of ground water impact due to seepage from the tailings in the uppermost transmissive zone (UTZ) of the 1st Tres Hermanos sandstone. This unit is the uppermost aquifer in the vicinity of the tailings pond. Based on previous boreholes and well installations, the top of the 1st Tres Hermanos is characterized by a well-defined apparent erosional contact with the overlying Mancos Shale. Based on outcrop observations to the east of the mine, the upper 10 to 20 feet of the 1st Tres Hermanos is a fairly clean whitish sandstone. With depth the amount of sand decreases and the formation grades into Mancos shale.

The lower gradational contact had resulted in some uncertainty with respect to the hydrologically active portion of the 1st Tres Hermanos. Well logs and 1st Tres Hermanos screened intervals from previous investigations were quite variable. Details from the previous investigations were also sketchy, as the mine files were incomplete.

In order to rationalize the overall ground water monitoring program, the initial step in the Phase II program was designed to identify the UTZ of the 1st Tres Hermanos sandstone and to screen that defined interval in subsequent monitor well installations. The initial plan for UTZ definition, detailed in Appendix III, included coring, geophysical logging, and permeability testing of two boreholes to the west of the tailings dam. This report describes the results of the UTZ definition of the 1st Tres Hermanos sandstone.

2.0 PHASE II CORED HOLES

Two boreholes were drilled in the approximate locations identified in the Phase II Plan submission to NRC dated November 6, 1987. The final borehole locations are shown on Plate R4.5-1. The drilling program was initiated December 7, 1987. A copy of the drilling contract and specifications is provided in Appendix IV. The holes were advanced with air mist rotary drilling techniques to within several feet of the anticipated depth of the top of the 1st Tres Hermanos. The top of the 1st Tres Hermanos had been contoured (apparently from exploration cores and geophysical logs) by unidentified Western Reserve personnel in unpublished form. The remainder of the borehole was completed by coring through the 1st Tres Hermanos and into the underlying formation. The drill cuttings and cores of the Phase II cored holes and the Phase I investigation indicated the top of the 1st Tres Hermanos was within a few feet of the expected depth based on the contour map. Consequently, the contour map for the top of the 1st Tres Hermanos has been adopted as the basis for further work in the area. As discussed below, the lower contact, although gradational geologically, is relatively well defined hydrologically and on the basis of geophysical logging. These data are also consistent with previous unpublished isopach maps for the 1st Tres Hermanos, therefore these unpublished maps (Western Reserve maps) are considered technically appropriate for use in the ground water hydrology program.

2.1 GEOLOGIC LOGS

The field geologic logs are provided in detail in Appendix V and in graphical form in Plate R4.5-2. The first cored hole, RMC-1 was advanced with air mist rotary drilling methods to about 64 feet and the geology was determined on the basis of cuttings from the borehole. Approximately 1 foot of very plastic Mancos shale was removed in the core above the 1st Tres Hermanos contact, thereby very clearly defining the contact. As observed in outcrops, the uppermost 10 to 20 feet is relatively sandy, with varying amounts of silt and shale. Shale partings are numerous, as are shells and shell pseudomorphs. The core is characterized by interlaminated shale/sandstone/siltstone. On the basis of core observations, the lower contact was approximated at 102-104 feet where the shale content appeared to dominate.

Borehole RMC-2, shown in Plate R4.5-2, was drilled using air mist and logged from cuttings to 22 feet, and then using drillcore to 160 feet. The geology at this location is similar to RMC-1. Shale was intersected in the upper 22 feet of the borehole and this unit was in contact with a yellow to beige, mottled sandstone containing shell remnants. The sandstone unit extended to 121 feet and varied in appearance from grey massive to grey brown mottled. Shale lenses were intersected throughout the sandstone sequence. The lower contact of the sandstone with the underlying shale was marked by a gradation from sandstone to sandy shale with a decrease in sand grain size. Interlayers of bentonitic shale were intersected at 139 feet and 148.6 feet in the borehole. The bottom of the borehole at 161 feet was silty shale with shell remnants. Disseminated pyrite crystals were found at 152 and 160 feet in the core.

2.2 GEOPHYSICAL LOGS

The results of the geophysical logging of boreholes RMC-1 and RMC-2 are summarized in Plate R4.5-2. The geophysical results, geology and hydraulic test results were superimposed to provide a composite map showing the correlation between the data. Both boreholes were logged for formation resistivity, neutron response, gamma ray response and spontaneous potential (SP) response.

At the shale/sandstone interface marking the top of the 1st Tres Hermanos, in RMC-1 and RMC-2, the SP, resistivity and neutron logs reflect the contact. The increased electrical resistivity of the sandstone results in an inflection in the resistivity profile, with the electrical resistivity of the formation being a function of the chemical nature of the water in the pore spaces. The neutron log (or porosity log) measures a formations' porosity or moisture content. With the porosity of the fine-grained shale higher than the First Tres Hermanos sandstone porosity, the reflection in the neutron log is expected. Within the 1st Tres Hermanos the neutron log response shows several local inflections at either borehole, these inflections mark areas of more massive sandstone within a predominantly sandstone/siltstone/shale unit. The spontaneous potential response at the shale-sandstone contact results from the difference in resistivity between the borehole fluid and the formation water. In more permeable formations, the resistivity contrast between borehole and formation fluid is usually less given the invasion of drilling fluid into the formation resulting in a lower SP response.

The lower contact of the 1st Tres Hermanos with the Mancos Shale is marked by inflections in the neutron, resistivity (RMC-2), and SP logs. In the lower section of the boreholes where shale becomes dominant, the neutron log shows a negative inflection indicating increase in formation porosity and saturated moisture content. The gradual inflection in the resistivity log at RMC-2 below 120 feet indicates a transitional contact with increasing shale content in the sand of the Tres Hermanos. The SP response marking an increased shale content in the Tres Hermanos is pronounced at RMC-1 and at RMC-2 shows several inflections probably reflecting sandstone interlayers and the presence of bentonite near the bottom of the borehole

2.3 HYDRAULIC CONDUCTIVITY TESTING

The objectives of the hydraulic conductivity testing were to obtain time-recovery data from falling head tests conducted within discrete intervals of borehole RMC-1 and RMC-2. The purpose of testing was to determine hydraulic conductivity of the bedrock on an interval-by-interval basis.

The testing methodology consisted of lowering a double packer hydraulic test tool down the uncased borehole to the desire depth on tubing string, setting a mini-packer in the tubing string above the top packer element and inflating the double packer system with N_2 gas. The test interval is left undisturbed for as long as possible to obtain a static or near static fluid level in the tubing string. This level is measured prior to the start of testing. The integrity of the upper packer seat was checked by adding water to the annular space and monitoring the fluid level in the tubing string connected to the isolated interval. In most instances little or no communication was found between the annular space and test interval. The mini packer inside the tubing string was inflated with N_2 gas and a slug of water was then added to the tubing. The magnitude of the slug was generally between 5 and 10 meters of water. Water levels in the tubing string are taken before deflation of the minipacker and immediately after deflation. Comparing this water level with the near-static level measured earlier provides the magnitude of the slug. After deflation of the mini-packer, fluid levels were measured in the tubing until sufficient data were available to permit an interpretation of formation hydraulic conductivity.

In borehole RMC-1, nine different intervals were tested by slug injection between 69.06 and 169.37 feet. Interval lengths were increased from 5.45 feet to 9.49 feet, and then to 16.57 feet near the bottom of the borehole as the hydraulic conductivity of the formation decreased with depth. At RMC-2, six intervals were tested at a packer spacing of 16.57 feet from a depth of 52.58 feet to 155.72 feet in the borehole.

The testing results are provided in Appendix VI as raw-data, a summary of borehole configuration during testing and a semi-log plot of the time-recovery data. A summary of the formation hydraulic conductivities for each test interval is provided in Plate R4.5-2. Where the formation was of low hydraulic conductivity (less than 2E-09 m/s) such that recovery could not be obtained in a reasonable period of monitoring, a maximum hydraulic conductivity was reported based on an extrapolated recovery curve. A discussion of the results is provided in the following section.

3.0 FIRST TRES HERMANOS SANDSTONE UTZ DEFINITION

The definition of the Upper Transmissive Zone in the bedrock at the L-Bar site is most apparent from the hydraulic test results, as shown in Figure 2. At elevation 6134 feet above sea level at RMC-2 and 6121 feet above sea level at RMC-1, at the contact of the Mancos Shale with the 1st Tres Hermanos, a contrast exists of two orders of magnitude in hydraulic conductivity corresponding to a change in lithology from shale to sandstone. It is anticipated that the hydraulic conductivity of the Upper Mancos Shale is in the order of 1.0E-09 m/s or less, similar to that of the Mancos Shale underlying the 1st Tres Hermanos. This contact of the Mancos with the 1st Tres Hermanos defines the upper boundary of the UTZ. The lower boundary is most clearly defined by the contrast in hydraulic conductivity of from 4E-07 m/s to 8E-08 m/s in the 1st Tres Hermanos and 2E-09 m/s (or less) in the underlying Mancos Shale. The thickness of the upper transmissive zone, from the upper contact of the 1st Tres Hermanos to the lower transmissive boundary, is approximately 40 feet.

Based on this definition of the UTZ, the remainder of the monitoring wells completed as per the Phase II Hydrology Program will be screened over the 40 ft. interval from the top of the 1st Tres Hermanos Sandstone.

APPENDIX I

PHASE I DRILLING LOGS AND COMPLETION DETAILS

6850 Austin Center Boulevard
Suite 300
Austin, Texas 78731
Telephone: (512) 346-2000
Telex: 792 352
Telecopy: (512) 346-9436

INTERA
Technologies Inc.

FILE COPY

December 18, 1986

Mr. Clint Lewis
Kennecott
1515 Mineral Square
Salt Lake City, Utah 84112

Dear Clint:

Enclosed are three copies of the Technical Specifications for the seven wells to be drilled at the L-Bar mine. If you have any questions regarding the specifications please give me a call. I have also sent a copy to Dil Robertson at the mine.

Sincerely,

David L. Graham

David L. Graham
Staff Consultant

DLG:lli

TECHNICAL SPECIFICATIONS FOR WELL CONSTRUCTION

Scope of Work

The scope of work outlined in this contract is for the construction of 3 pump-back and 4 monitoring wells at the Kennecott L-Lar Uranium Mine/Mill. The approximate locations and estimated depths are shown on the attached location map. General construction details for the wells are depicted on the attached well construction diagram.

The work is to be comprised of drilling; procuring and installation of casing, screen, sand-bentonite seal and grouting materials; procuring and installing pumps and pumping assemblies; providing driller's well logs and daily work logs; and completing other work as needed for the construction of these wells. The Owner will stake locations, construct access roads as needed, and provide a bulldozer to aide in the movement of the drill rig. The Contractor is to supply all equipment, materials and labor necessary to complete the seven wells. The contractor shall remain on site until the completion of all work.

The construction of the wells are the responsibility of the Contractor. However, all work will be supervised by a Kennecott on-site Technical Representative. The Technical Representative will have the responsibility of determining the final well specifications (i.e., geology, screened interval, etc.). All measurements regarding volumes of filter-pack, grout, bentonite etc. and position of these materials within the well annulus will be confirmed by the Technical Representative.

Technical Specifications

- Well Materials

  Casing - Flush threaded, 5 inch, schedule 40 PVC.
  Screen - Flush threaded, 5 inch, schedule 40 PVC, 0.020 slot size.

Well Bottoms - Threaded PVC caps or plugs.

Sand Pack - 8/12 or 6/9 grade course sand or gravel.

Bentonite - 0.25 inch pellets for seals above filter pack and "hole-plug" bentonite for backfilling overdrilled portions of hole.

Grout Mixture - The grout shall be a high sulfate resistant neat cement with approximately three percent bentonite by weight and not more than 8 gallons of water per 100 pounds of grout mixture.

- Pump Materials

Pumps - 1/3 to 1/2 hp., preferably constructed of stainless steel, 230 volt power, single phase power.

Pump Riser Pipe - 1 inch galvanized, threaded and coupled tubing.

Fuse Box - to match pumps selected.

Pump Wire - to match pumps selected.

Surface Discharge Valve - "faucet" type or 1/4 turn valve to regulate discharge from pump.

Fluid Level Pump Switches - upper and lower fluid level sensors to activate and pump when pre-set levels are attained.

Water-level Tubing - 1 inch PVC or galvanized pipe installed inside the 5 inch casing to allow periodic water level measurements to be made.

Drilling and Well Completion

Drilling is to be conducted using air rotary methods. No foam is to be used in the drilling operation without prior approval from the Technical Representative. The drill rig and drill tools shall be steam cleaned prior to arrival on site but will not be required to be steam cleaned between each boring. No hydrocarbon based pipe-dope will be used during drilling. Silicon or vegetable oil based lubricants are acceptable.

The boreholes will have a nominal diameter of 7 7/8". All boreholes will penetrate the surficial alluvium, fully penetrate the First Tres Hermanos Sandstone and "tag" (penetrate approximately one or two feet) the top of the Mancos Shale. Care shall be taken to ensure the hole is as straight and plumb as possible.

The Technical Representative will determine the construction details for each well at the completion of the borehole based on observation of the cuttings, and driller's suggestions.

When the well casing is installed in the borehole it will be held in tension from the drill rig to assure that the casing is straight while the filter pack, bentonite seal and grout are installed. The filter pack, bentonite, and grout will be tremied as necessary based on well depth and hole stability.

If the hole is over drilled, it will be back-filled to the appropriate depth with cuttings and bentonite. The sand-pack will be brought two feet above the screen. A six foot bentonite seal will be placed above the sand-pack. Grout will be placed from the top of the bentonite seal to ground surface and a four by four foot grout pad will be laid around the well-head.

Upon completion of the well, the driller will dedicate two hours to well development as required. The development should include jetting and/or airlifting.

Pump Installation

The pumps will be installed and wired by the Contractor within three feet of the bottom of the well. The Contractor is also responsible for assuring that electrical power is provided for each pump. Fluid level detectors will be installed in each well. The lower fluid detector will be installed one foot above the pump. The upper fluid level detector will be installed three feet below the initial water table. It will be installed in such a manner that its elevation within the well is easily adjusted. A faucet or control valve will be installed to regulate discharge from the pumps. Once installed, the discharge control valve will be connected to the existing collection system with appropriate materials.

Drillers Report

For each borehole completed, the Driller shall prepare a log including the following minimum information:

1) The depths at which changes and soil of rock types are noticed.
2) A brief description of each soil or rock type encountered.
3) The depth at which water is encountered (on each formation if possible).

The contractor shall provide the Technical Representative with any relevant data and/or samples requested by the Owner or Technical Representative. While the Technical Representative will prepare his own report, the drillers log shall be prepared and submitted as an independent document.

The driller shall also maintain a daily log including, number of feet drilled, number of hours on job, any additives used with or without the Technical Representatives approval, shut downs due to breakdown, feet or casing set, amount of sand pack, bentonite and grout used in each well.

FIELD REPORT FOR SEVEN ADDITIONAL WELLS INSTALLED JANUARY 1987
PENETRATING THE FIRST TRES HERMANOS SANDSTONE
IN THE VICINITY OF THE L-BAR TAILINGS IMPOUNDMENT

PREPARED BY:

INTERA Technologies, Inc.
6850 Austin Center Blvd., Suite 300
Austin, Texas 78731

February, 1987

H01100R036

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Purpose of Well Installations

The seven additional monitoring wells installed in January of 1987 were installed for two reasons; 1) to obtain more background water quality data for the First Tres Hermanos Sandstone in the immediate vicinity of the L-Bar tailings impoundment, and 2) to add two additional pumpback wells to the existing pumpback system as stated in Section 6.5.2 of the Closure Plan. Wells MW-27B and MW-13B were installed as additional pumpback wells (see Figure 8 for locations). However, due inclement weather immediately after their installation no pumps have been installed in either well. Pumps will be installed and connected to the existing pumpback system as soon as weather conditions permit. It is anticipated that installation will occur within the next two months.

The remaining five wells were installed to obtain additional background water quality data in the First Tres Hermanos Sandstone. MW-17B and MW-29 were installed slightly up dip and along strike at increasing distances northeast of the tailings impoundment. MW-28 was installed directly up dip and MW-9B was installed directly down dip of the impoundment at a greater distance than existing well MW-9. MW-4C was installed along strike at the southwest edge of the impoundment. (See Figures 8 and 9).

These wells will be incorporated into the regular rounds of waterlevel measurements and water quality sampling conducted by CEP. The first round of water quality sampling will be conducted in mid-February and the data will be available in early March. No well development or pump tests were conducted in the new wells due to inclement weather. It is anticipated that development of these wells will be completed prior to their initial sampling.

Also due to the poor weather conditions at the time of drilling, these wells were not surveyed to establish a well head elevation. These surveys will be conducted as soon as possible to provide a reference for water level elevation measurements.

General Installation Procedure

The boreholes were drilled by Stewart Brothers Drilling, Grants New Mexico, using a Gardner Denver 15W drill rig with 950 cfm, 300 psi air compressor. A rotary drilling method using air/water mist as a drilling fluid was employed. Water used in drilling operations was obtained from the mines water supply wells. The cuttings were continuously caught and logged over 5 foot intervals, at significant lithologic changes, and where drilling progress changed markedly. The holes were stable with no swelling or significant caving encountered with the exception of one zone in borehole MW-29.

Upon completion of the borehole, overdrilled portions were backfilled with "Hole plug" bentonite poured from the surface. Colorado silica sand, 8-12 grade, was used for the filter pack in all the wells. Sand was installed dry by pouring slowly from the surface. Bentonite pellets (0.25 inch) were slowly poured from the surface to form a seal between filter pack and grout surface seal. Prior to the installation of the grout surface seal, approximately 5 gallons of water was poured down the annulus to aide in swelling the bentonite pellets. The water was allowed to react with the bentonite for at least 15 to 30 minutes before the grout was installed. A grout surface seal, composed of high sulfate resistant cement, was installed from the top of the bentonite seal to ground surface in the well annulus. Approximately 7 gallons of water were added to the grout mixture per sack of cement. For wells MW-9B, MW-28 and MW-29 the grout mixture contained 3% (by weight) bentonite and was tremied into place and circulated to ground surface by 1.25 inch tremi pipe held about 7 feet above the bentonite seal. The grout for the other wells was mixed without bentonite and poured from the surface into place. Wells outside the radiation hazard fence (MW-9B, MW-17B, MW-28 and MW-29) were fitted with surface protective steel casings with locking well covers. The wells inside the radiation hazard fence received only slip covers, because of the potential installation of dewatering pumps in the future with pitless adapters. When the protective casing was installed the grout in the annulus was topped off to ground-level and poured into a 4' by 4' by 0.5 ' thick surface pad.

Exceptions To Installation Procedure

MW-17B was significantly over drilled because it was the first borehole completed in the area by INTERA and the supervising personnel wanted to become familiar with the gradational contact between the Mancos Shale and First Tres Hermanos sandstone. This borehole, and others, confirmed the sharp upper stratigraphic contact and very gradational lower contact described in the literature* for the First Tres Hermanos Sandstone.

Upon completion of the over drilled portion of the borehole, tremi-pipe was set at 135 feet below ground level (BGL) and grout was circulated to 65' BGL. The grout was high sulfate resistant cement with 3% bentonite content. After the tremi-pipe was removed several shovels of cuttings were placed down the borehole on top of the grout followed by 100 lbs. of hole-plug bentonite that came to 60' BGL. Once the bentonite seal was in place the well completion followed the stated procedures.

Two problems were encountered in the installation of MW-29. First, because such a great thickness of First Tres Hermanos Sandstone (~ 100') and there was a limited amount of well materials on site, two sections of screen seperated by blank casing and a 9' bentonite seal were installed. The purpose of this construction was to allow packer tests to be conducted if required in this interval. Such tests could provide information related to the vertical hydraulic conductivity of the upper and lower portions of the First Tres Hermanos Sandstone at this location.

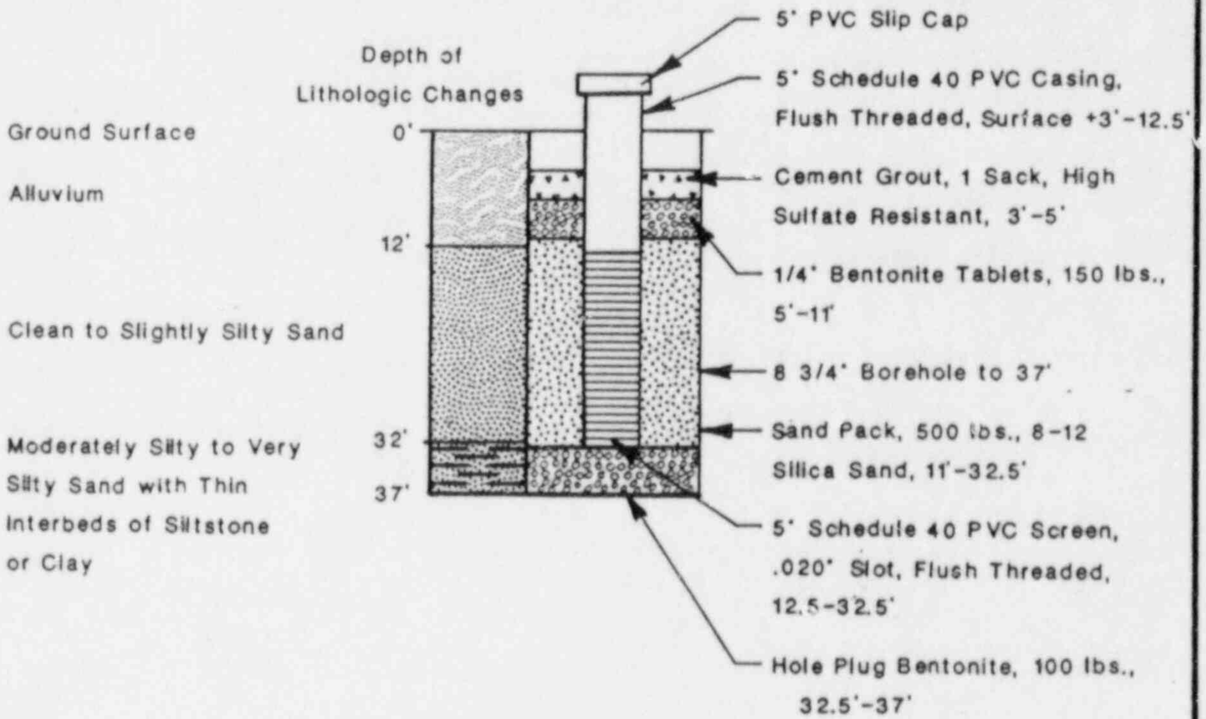
The second detail worth noting in the construction of MW-29 is a large wash out that occurred in the borehole during drilling across the interval of 90-104 feet BGL. During drilling one to two inch pieces of sandstone were discharged with the cuttings once the First Tres Hermanos was encountered. It is believed that the majority of these pieces probably originated in the wash out zone. The wash out was filled during

* Moench, R.H. and J.S. Schlee, 1967, Geology and Uranium Deposits of the Laguna District, New Mexico, U.S.G.S. Prof. Paper 519, 117 p.

well construction with 4.5 cubic yards of 3/8th inch pea gravel. The gravel was trucked from Grants and used instead of 8-12 sand due to the lack of additional 8-12 sand.

The remaining wells followed the stated general construction procedures.

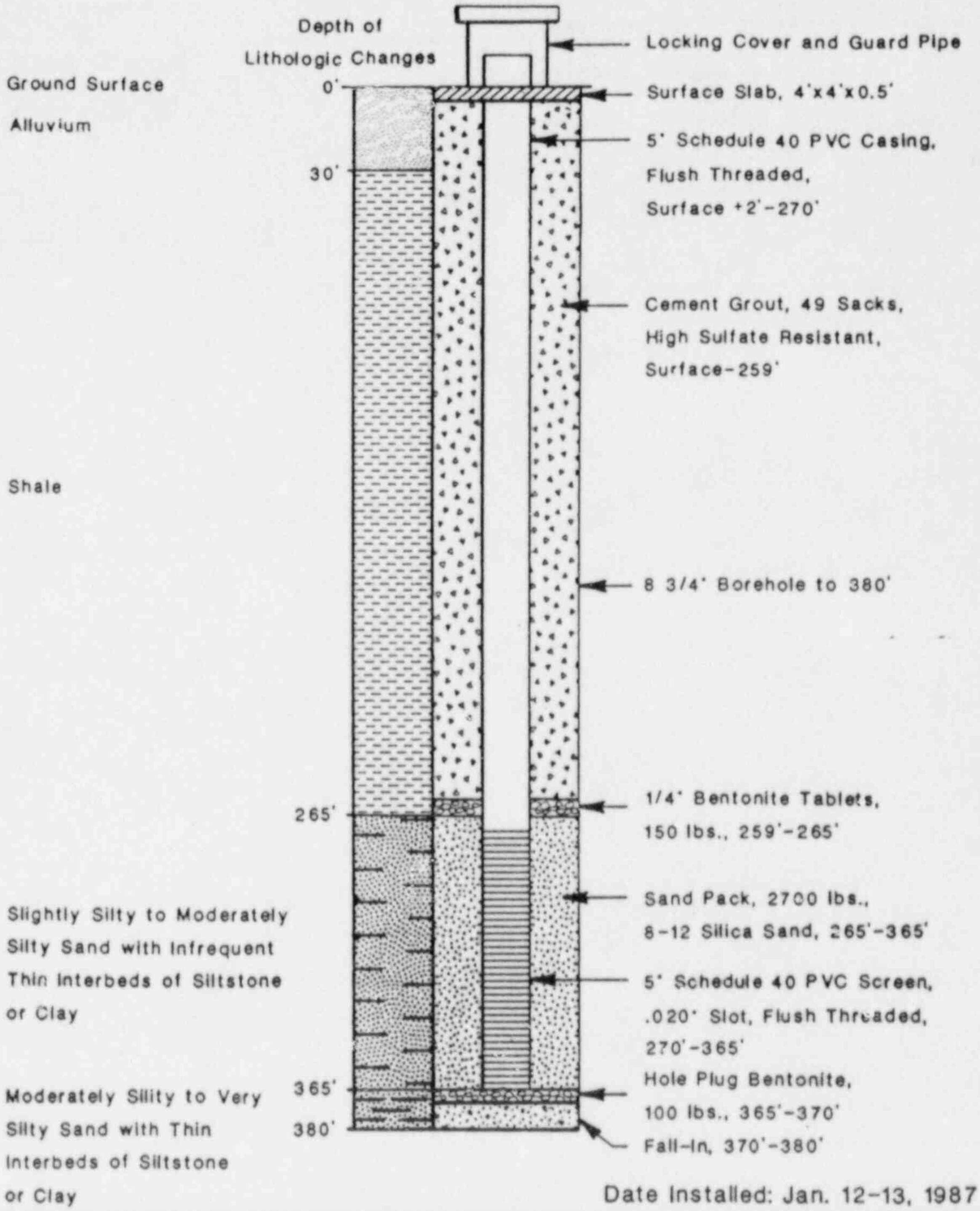
Monitor Well 4-C



Date Installed: Jan. 8, 1987

Drawn by	Date	Kennecott L-Bar Monitor Well 4-C
Checked by	Date	
Revisions	Date	
INTERA Technologies	Scale: 1"=20'	Figure 1.

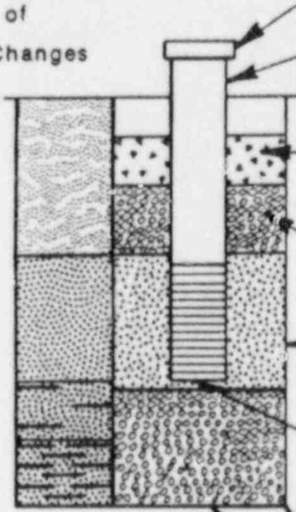
Monitor Well 9-B



Date Installed: Jan. 12-13, 1987

Drawn by	Date	Kennecott L-Bar Monitor Well 9-B		
Checked by	Date			
Revisions	Date			
INTERA Technologies		Scale: 1" = 60'	Figure 2.	

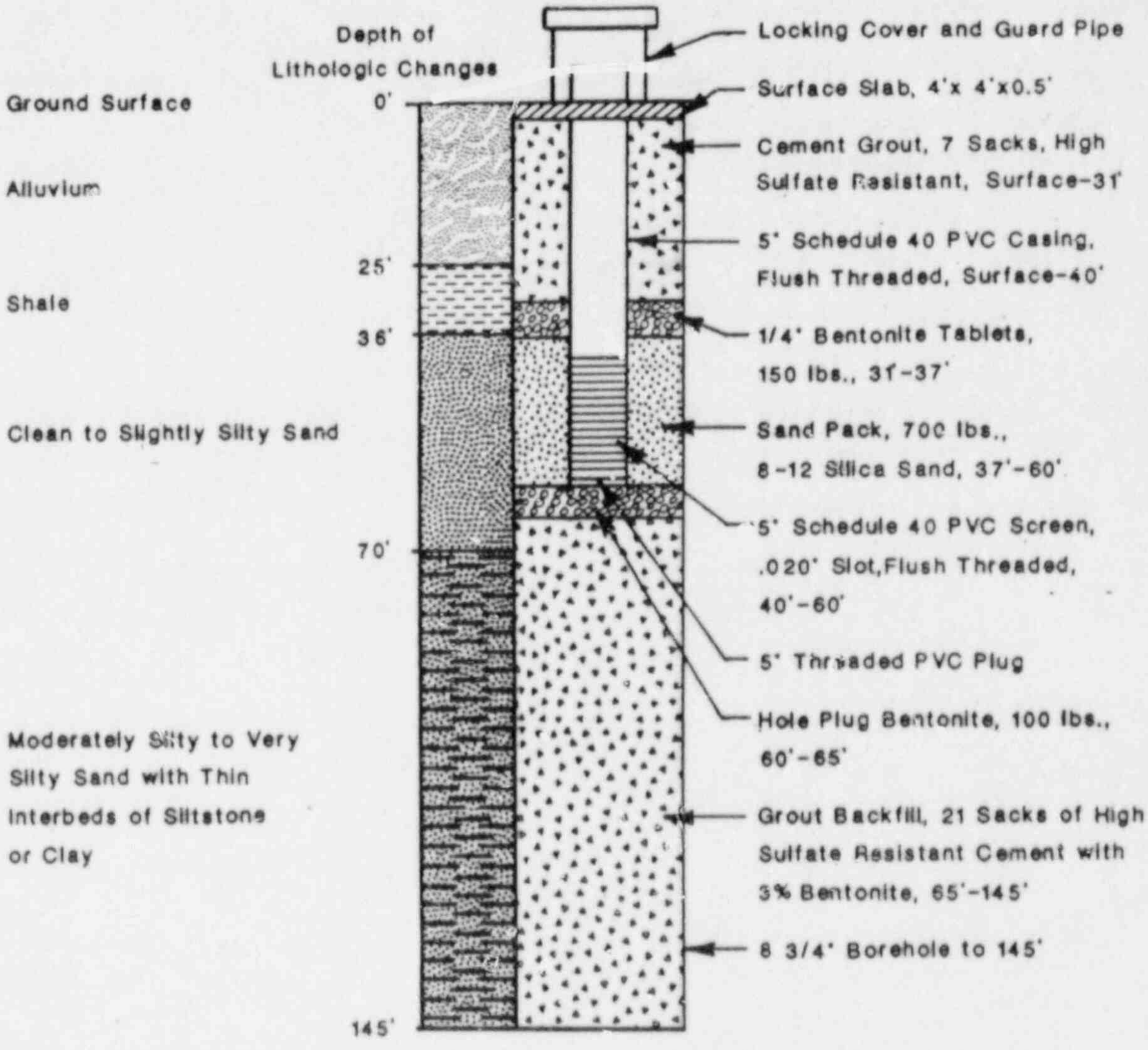
Monitor Well 13-B



Date Installed: Jan. 8, 1987

Drawn by	Date	Kennecott L-Bar Monitor Well 13-B	
Checked by	Date		
Revisions	Date		
INTERA Technologies		Scale: 1"=20'	Figure 3.

Monitor Well 17-B

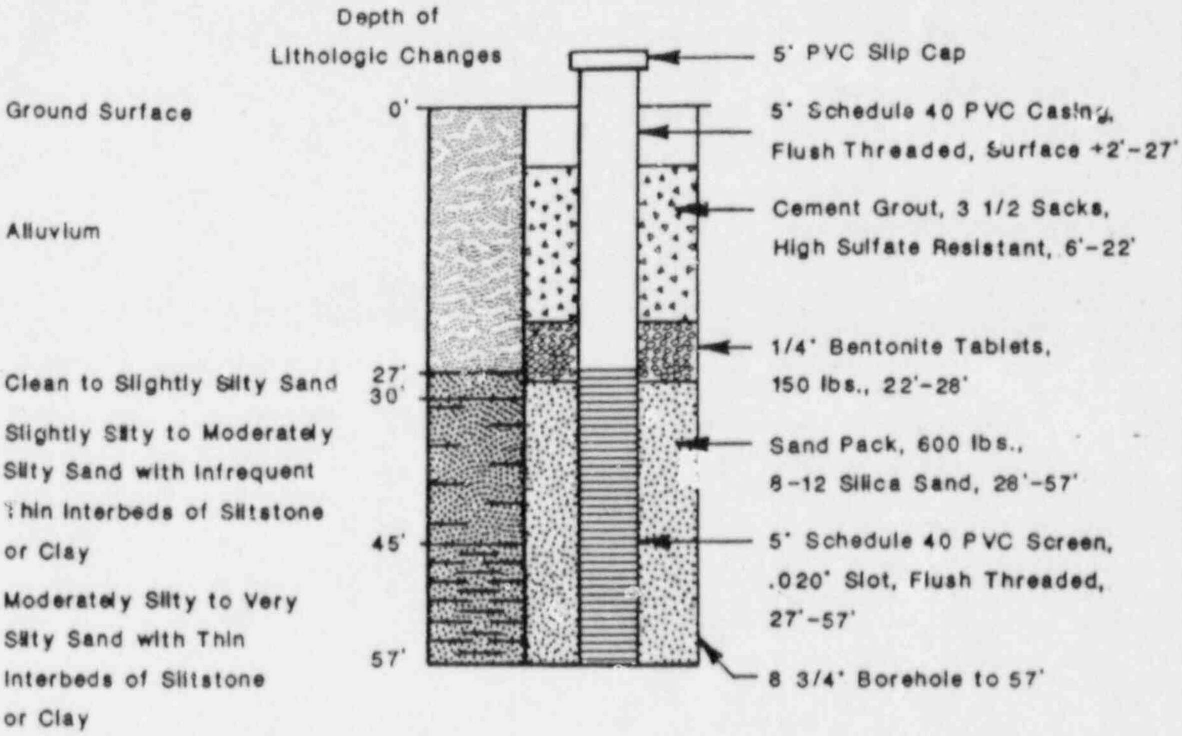


Date Installed: Jan. 7, 1987

Drawn by	Date	Kennecott L-Bar Monitor Well 17-B
Checked by	Date	
Revisions	Date	

INTERA Technologies	Scale: 1"=30'	Figure 4.

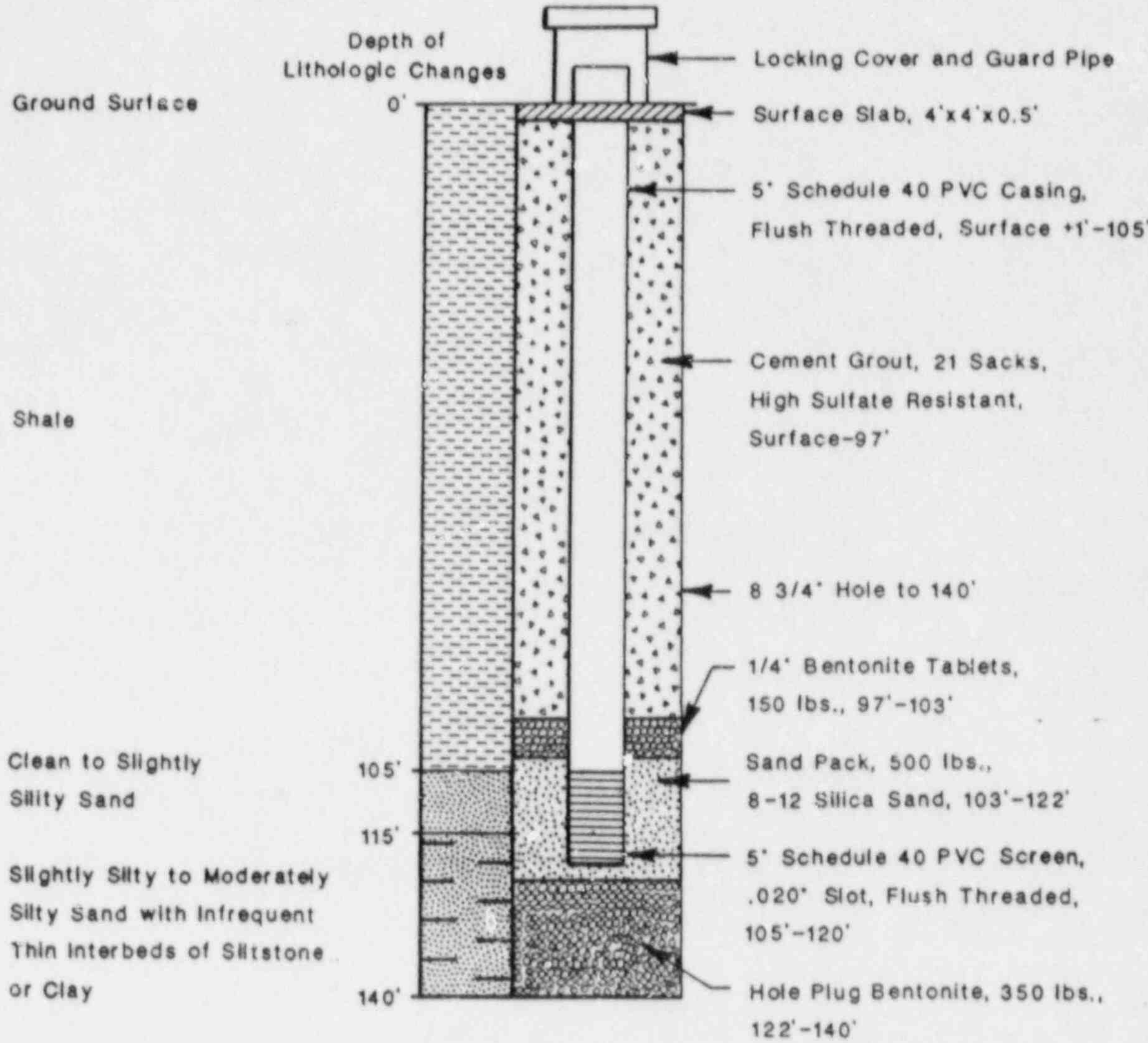
Monitor Well 27-B



Date Installed: Jan. 8, 1987

Drawn by	Date	Kennecott L-Bar Monitor Well 27-B	
Checked by	Date		
Revisions	Date		
INTERA Technologies		Scale: 1"=20'	Figure 5.

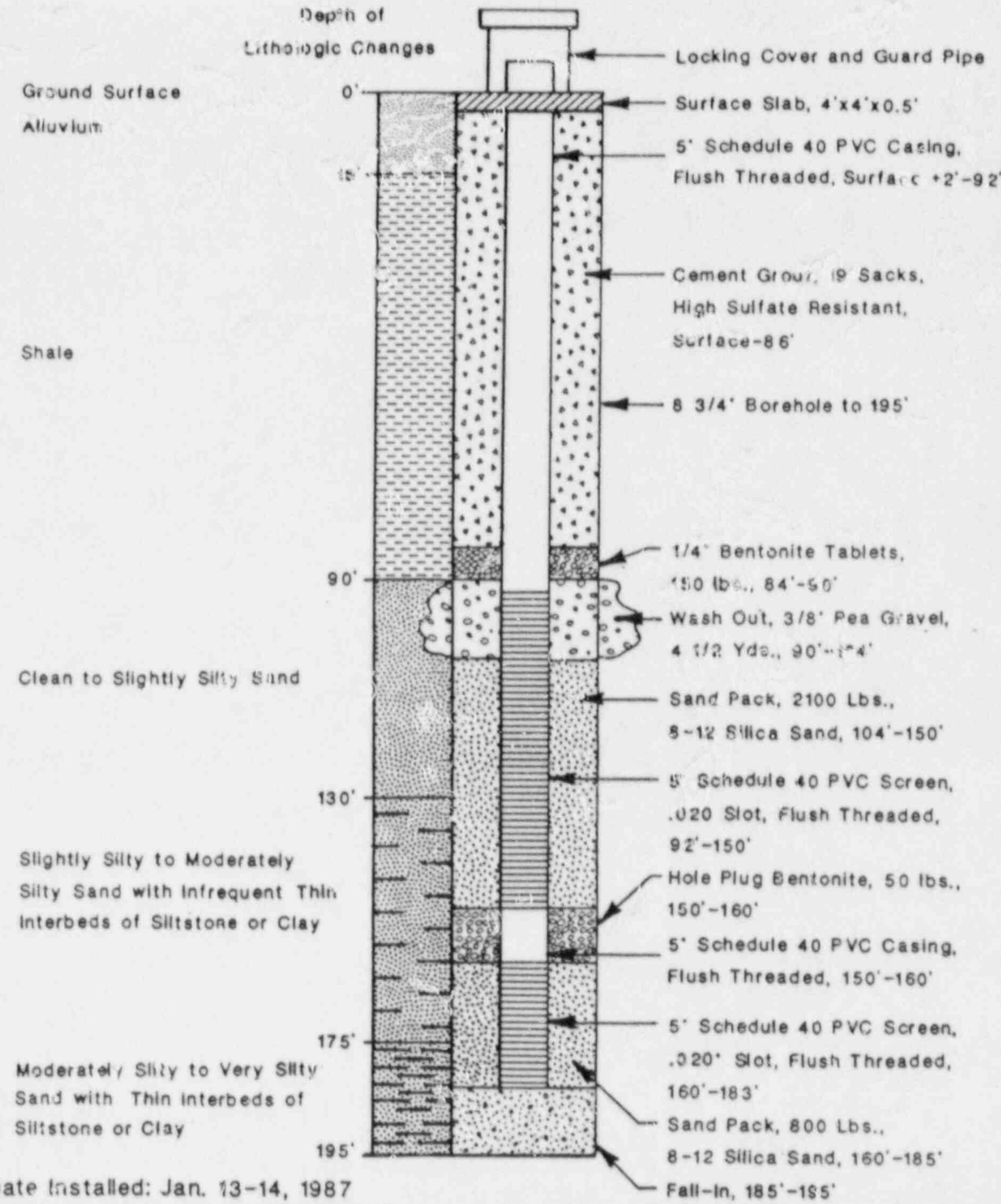
Monitor Well 28



Date Installed: Jan. 9, 1987

Drawn by	Date	Kennecott L-Bar Monitor Well 28
Checked by	Date	
Revisions	Date	
INTERA Technologies	Scale: 1"=30'	Figure 6.

Monitor Well 29



Date Installed: Jan. 13-14, 1987

Drawn by	Date	Kennecott L-Bar
Checked by	Date	Monitor Well 29
Revisions	Date	
INTERA Technologies	Scale: 1"=30'	Figure 7.

MW-4C

Borehole Interval	Cutting's Description
0-5'	Tan, sandy, silty clay.
5-12'	Tan, sandy, silty, clay. Gypsum occurs in vugs and as euhedral crystals, some basalt cuttings in lower portion of interval.
12-25'	Tan and iron stained, fine quartz sand, subrounded, well sorted.
25-32'	Tan to greyish orange, fine sand, subrounded, well sorted.
30-37'	Grey to dark grey, slightly silty to very silty fine quartz sand. Becomes siltier downward with some thin clay interbeds occurring near the bottom of the interval.

	Stratigraphic Interpretation
0-12'	Alluvium with basalt cobbles.
12-32'	First Tres Hermanos Sandstone
32-37'	Transitional Mancos Shale between First and Second Tres Hermanos Sandstone.

MW-9B

Borehole Interval	Cutting's Description
0-30'	Tan sandy, clayey silt alluvium with some basalt cuttings near bottom of interval.
30-40'	Orangey tan to tannish grey weathered shale.
40-265'	Black shale
265-365'	Light grey to grey, slightly silty to silty fine quartz sand, sub-rounded, moderately sorted. Drilling slightly easier from 310 to 365'.
365-380'	Grey, silty fine quartz sand, subrounded, moderately sorted, interlaminated with grey siltstone and orangish claystone or siltstone.

	Stratigraphic Interpretation
0-30'	Alluvium with basalt cobbles.
30-265'	Mancos Shale
265-365'	First Tres Hermanos Sandstone
365-380'	Transitional Mancos Shale between First and Second Tres Hermanos.

<u>MW-13B</u>

Borehole Interval	Cutting's Description
0-16'	Tan, sandy, silty, clay with some sandstone and basalt cuttings.
16-29'	Tan to iron stained, fine quartz sand, subrounded, well sorted.
29-35'	Light grey to grey, fine quartz sand, subrounded, well sorted, interbedded with laminae of silstone and shale.
35-42'	Grey to dark grey, fine quartz sand, subrounded, well sorted with significant siltstone and shale laminae.

<u>Stratigraphic Interpretation</u>

0-17'	Alluvium with sandstone and basalt cobbles.
17-29'	First Tres Hermanos Sandstone
29-35'	Transitional Mancos Shale between First and Second Tres Hermanos.

MW-17B

Borehole Interval	Cutting's Description
0-5'	Tan, slightly sandy very clayey silt.
5-10'	Tan to orange and light grey, slightly sandy very clayey silt to silty clay, some gypsum present in vugs.
10-20'	Light grey with some orangish cutting's, slightly sandy very clayey silt to silty clay.
20-25'	Light grey with some orangish cutting's, slightly sandy, very clayey silt to silty clay with few shale fragments.
25-30'	Dark grey to black, shale with small amount of black clay, some of shale gypsiferous.
30-36'	Dark grey to black, shale, some of shale gypsiferous.
36-60'	Light grey, slightly silty fine sand, subrounded, well sorted, quartz sand.
60-80'	Grey, slightly silty to silty fine sand, subrounded, well sorted quartz sand, becomes shalier downward.
80-100'	Dark grey, very shaley fine quartz sand to sandy shale, subrounded, moderately sorted.
100-110'	Dark grey, very shaley, medium quartz sand, to sandy shale, subrounded to subangular, moderately sorted.
110-125'	Dark grey, very shaley fine quartz sand, subrounded, well sorted.
125-135'	Grey, very sandy shale, fine quartz sand, subrounded, well sorted.
135-145'	Dark grey to black, very shaley fine quartz sand, subrounded, well sorted.

MW-17B
(continued)

Borehole Interval	Stratigraphic Interpretation
0-25'	Alluvium
25-36'	Mancos Shale
36-60'	First Tres Hermanos Sandstone
60-145'	Transitional Mancos Shale between First and Second Tres Hermanos Sandstone.

MW-27B

Borehole Interval	Cutting's Description
0-27'	Tan to orangish tan, sandy silty clay.
27-30'	Grey, silty fine quartz sand, subrounded, well sorted, micaceous.
30-45'	Light grey, moderately silty, fine quartz sand, subrounded to rounded, well sorted.
45-57'	Grey, silty fine quartz sand, subrounded, well sorted, becomes siltier and shalier downwards.

Stratigraphic Interpretation

0-27'	Alluvium
27-56'	First Tres Hermanos Sandstone
56-57'	Mancos Shale between First and Second Tres Hermanos.

MW-28

Borehole Interval	Cutting's Description
0-40'	Tan shale
40-45'	Light grey shale
45-60'	Grey shale
60-65'	Tannish light grey shale
65-105'	Grey shale
105-120'	Light grey, fine quartz sand, sub to well rounded, well sorted.
120-140'	Light grey to tan, fine quartz sand, sub to well rounded, well sorted, thinly interbedded with sandy silts and clayey silts, grey to orangish tan. Silt and clay interbeds become more prevalent towards 140'. Crystalline gypsum occurred in cutting's from 120 to 140'.

Stratigraphic Interpretation

0-105'	Mancos Shale
105-120'	First Tres Hermanos Sandstone
120-140'	Mancos Shale between First and Second Tres Hermanos.

Borehole Interval	Cutting's Description
0-15'	Tan, sandy, clayey, silt with gypsum in vugs.
15-35'	Light tannish grey, slightly weathered shale.
35-90'	Light grey to grey shale; shale gypsiferous from 15 to 50'.
90-175'	Light grey to grey, fine quartz sand, well-to subrounded, well sorted; becomes silty in lower half of interval; top 5' of interval produced approximately 5 gpm of water; 150' to 175' exceptionally hard drilling; 160' to 165' a produced few cutting's coated with pyrite.
175 -195'	Light grey to grey, silty fine quartz sand, subrounded, well sorted, interlaminated with tan siltstone and possibly some tannish clay.

	Stratigraphic Interpretation
0-15'	Alluvium
15-90'	Mancos Shale
90-175'	First Tres Hermanos Sandstone
175-195'	Transitional Mancos Shale between First and Second Tres Hermanos Sandstone.

INITIAL WATER LEVELS

MW-9B

Date Completed: 1/13/87

Date	Time	DTW-BTOC[1]
1-13-87	0930	6.53[2]
1-14-87	1340	121.79

MW-13B

Date Completed: 1/8/87

Date	Time	DTW-BTOC
1-9-87	1223	19.14
1-9-87	1821	19.13
1-10-87	1621	19.23
1-11-87	1840	19.36
1-13-87	1522	18.96
1-14-87	1225	25.53[3]

MW-14C

Date Completed: 1/8/87

Date	Time	DTW-BTOC
1-9-87	1212	32.53
1-9-87	1817	32.51
1-10-87	1617	32.65
1-11-87	1836	32.78
1-13-87	1500	32.51
1-14-87	1245	32.68

MW-17B

Date Completed: 1/7/87

Date	Time	DTW-BTOC
1-9-87	1155	32.53
1-9-87	1817	32.51
1-10-87	1617	32.65
1-11-87	1836	32.78
1-13-87	1500	32.51
1-14-87	1245	32.68

INITIAL WATER LEVELS

(continued)

MW-27B

Date Completed: 1/8/87

Date	Time	DTW-BTOC
1-9-87	1218	30.84
1-9-87	1824	30.79
1-10-87	1624	30.84
1-11-87	1844	30.92
1-13-87	1530	30.55
1-14-87	1220	30.51

MW-28

Date Completed: 1/9/87

Date	Time	DTW-BTOC
1-9/87	1718	98.56
1-9-87	1734	112.18
1-9-87	1748	112.47
1-9-87	1803	112.77
1-9-87	1833	113.26
1-10-87	1430	Dry [4]
1-13-87	1445	Dry

MW-29

Date Completed: 1/14/87

No water-level data.

[1] DTW-BTOC - "Depth to water in feet below top of PVC casing".

[2] This water-level was taken immediately after the installation of grout in the annulus and is intepreted to reflect the response of the filter-pack and aquifer to the loading of the grout.

[3] After taking the water-level on 1-13-87 5.5 gallons were bailed from the well to collect a water quality sample, by 1-14-87 the water-level had recovered very little.

[4] Well TD = 121.5' BTOC

H01100R036

APPENDIX II

PHASE I COMPLETION LETTER FROM NRC TO KENNECOTT, AUG. 19, 1987

GEGrisak

F.Y.I.

R

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
URANIUM RECOVERY FIELD OFFICE
BOX 25325
DENVER, COLORADO 80225

AUG 1? 1987

URFO:SRG
Docket No. 40-8904
SUA-1472
04008904183E

FILE COPY

Kennecott
ATTN: Roger Andrews, Manager
Asset Evaluation and Divestiture
10 East South Temple
P.O. Box 11248
Salt Lake City, Utah 84147

Gentlemen:

This letter concerns the results of the August 13, 1987 technical meeting on ground-water hydrology at the L-Bar facility with your technical representative, Intera Technologies. Also, it addresses phase 2 of the drilling project. The purpose of the technical meeting was to (1) reach general agreement on the results of phase 1 of the drilling project concerning background water quality in the vicinity of the tailings pond, (2) to reach a technical consensus on the scope and technical criteria for drilling additional boreholes to further delineate the areal extent of seepage, and (3) to discuss the criterion for establishing a detection monitoring program to ensure compliance with 40 CFR 192.32(a)(2). The technical agreements reached in the meeting are outlined in the enclosed meeting summary (Enclosure 1).

Of primary significance is the technical agreement that chloride is a more appropriate "general indicator" of background water quality in the Tres Hermanos Sandstone than such parameters as sulfate or gypsum saturation indices. It was agreed that additional general indicators, such as trends (increasing concentrations), pH, and constituent ratios (Cl/SO_4) would also be further considered in evaluating native ground water versus seepage-contaminated ground water.

Using the general indicators of background water quality is necessary in selecting a background well for the forthcoming detection monitoring program, which requires monitoring of specific parameters as indicators of seepage of hazardous constituents. In the meeting, general technical consensus was reached delineating a specific well that would probably satisfy our criterion as a background well for the detection monitoring program. You will be receiving a letter in the near future requesting you to propose a program to satisfy requirements of 40 CFR 192.32(a)(2) detection monitoring. In addition to a specific background well, three point of compliance wells were also tentatively identified in the meeting that would satisfy our criterion for point of compliance wells. As a result of this technical consensus on background water quality, phase 1 of the drilling program is considered to be completed and phase 2 must commence soon.

As agreed to in the technical meeting, a basis for determining the "uppermost transmissive zone" (UTZ) of the upper Tres Hermanos Sandstone aquifer (the uppermost aquifer), the zone that should be monitored, must be established as the initial milestone in the phase 2 program. The determination of criteria for the delineation the UTZ will be the basis for completion and screening of any new wells and for assessing the proper completion and screened interval of existing monitoring wells (i.e., is the appropriate strata, the UTZ, being adequately monitored).

As you are aware, phase 2 as originally intended was to possibly include drilling on Cebolleta land. As agreed to in the July 30, 1987 meeting, we will not pursue the matter of you drilling on Cebolleta land until near the end of this year, or sooner, pending outcome of the legal case before the New Mexico Supreme Court. Therefore, with the above in mind, it is requested that you submit a proposed plan, including milestones and milestone completion dates, for phase 2 of the drilling project by September 18, 1987.

If you have any questions, please contact Scott Grace of my staff at (303) 236-2805.

Sincerely,

Edward F. Hawkins, Chief
Licensing Branch 1
Uranium Recovery Field Office
Region IV

Enclosure: As stated

cc: NMEID
Cebolleta
SW Research

Enclosure 1

MEETING SUMMARY

NRC/KENNECOTT HYDROLOGIC TECHNICAL MEETING
at Uranium Recovery Field Office
(between S. Grace, NRC and G. Grisak, Intera)

August 13, 1987

TOPICS FOR DISCUSSION/AGENDA

- Background Water Quality.
  - Results of drilling and analysis to date
  - General water quality indicators (?)
- Phase 2 Planning: Areal extent of seepage.
  - Appropriate interval to be screened in Tres Hermanos wells.
  - Penetration of monitoring wells 1A, 2A, 3A and 4A.
  - Completion/Screened Interval in other monitoring wells.
- Areas with inadequate monitor well coverage (north and east).
- Detection Monitoring Program
  - Background well
  - Point of Compliance wells.

NRC/KENNECOTT HYDROLOGIC TECHNICAL MEETING
August 13, 1987

ACTION ITEMS/COMMITMENTS

1) General background water quality indicator shall be Chloride. Consideration to other indicators, such as chemical ratios (i.e. Cl/SO4) and trends, will be given.

2) For the upcoming detection monitoring program (DMP), an appropriate background well would be MW-29. Appropriate (as discussed in criterion 3 of URFO DMP memo) point of compliance wells would be MW-1A, MW-26 and MW-17B.

3) For phase 2 of the drilling program, the following general approach as been agreed as appropriate:

   a.) cored borehole with geophysical logging and packer tests in the vicinity west of MW-2A and between MW-6 and MW-7.

   b.) Results of (a) will provide the basis for determining the "uppermost transmissive zone" (UTZ) of the upper Tres Hermanos Sandstone.

   c.) The "UTZ" will be determined on the basis of the packer testing in the cored borehole (a).

   d.) With the UTZ criteria, drilling of additional boreholes will be planned north and east of the pond to further delineate seepage and potential areas to be monitored.

The above actions items and commitments agreed to by both USNRC and Kennecott.

Scott R Grace
USNRC Representative
8-13-87
date

[signature]
Kennecott Representative
(INTERA) 8-13-87
date

APPENDIX III

PHASE II GROUND WATER HYDROLOGY INVESTIGATION:
NOVEMBER 6, 1987 PLAN SUBMITTED TO NRC

INTERA

INTERA Technologies Inc.
Suite 300
6850 Austin Center Blvd.
Austin, Texas 78731

Tel.: (512)-346-2000
Telex: 792 352
Telecopier: (512) 346-9436

November 6, 1987

FILE COPY

Mr. Scott Grace
U.S. Nuclear Regulatory Commission
730 Simms St., Suite 100A
Golden, CO 80401

RE: Source Material License SUA-1472:
Phase II Environmental Monitoring Program

Dear Mr. Grace:

The attached plan for the Phase II Ground Water Hydrology Investigation is submitted for your review and comments or approval. I believe the plan is consistent with our discussions concerning delineation of offsite and onsite ground water contamination.

The program will commence as soon as possible following NRC approval.

As per our telephone conversation today, a license amendment application fee of $150 is enclosed.

Yours sincerely,

G.E. Grisak
Vice President

GEG/lac
enclosure

cc: M.B. LaGraff, L-Bar Project Manager, B.P. America
Greg Lewis, New Mexico EID

H01100C156

L-BAR

Environmental Monitoring Program

Phase II - Ground Water Hydrology Investigation

November 6, 1987

Purpose

The purpose of this drilling, testing, and well installation program is to evaluate the extent of ground water impacts, due to seepage from the tailings, in the uppermost transmissive zone (UTZ) of the 1st Tres Hermanos sandstone. The drilling program includes both on-site and off-site well installations.

A. Identification of UTZ

The UTZ is the uppermost permeable zone within the 1st Tres Hermanos sandstone. Based on previous boreholes and well installations, the top of the 1st Tres Hermanos is characterized by a well-defined apparent erosional contact with the overlying Mancos Shale. The upper 10 to 20 feet of the 1st Tres Hermanos is a fairly clean whitish sandstone. With depth the amount of sand decreases and the formation grades back into the Mancos Shale.

a). Drilling, Coring, Geophysical Logging, Hydraulic Testing

i) Drilling, Coring, and Laboratory Testing

Two boreholes will be drilled and cored at the approximate locations shown on Figure 1. Continuous coring will start at the top of the 1st Tres Hermanos, following installation of an 8" surface casing to the top of the 1st Tres Hermanos. Coring will continue until either 10 continuous feet of Mancos Shale core is removed or the total depth of the borehole is 50 feet above the 2nd Tres Hermanos. It is considered imperative that the apparent integrity of the isolation between the 1st Tres Hermanos and 2nd Tres Hermanos provided by the intervening Mancos Shale is not compromised by breaching the zone with the boreholes. The depth of the 2nd Tres Hermanos is approximately 220 feet in the southern cored hole area (estimated from 2nd Tres Hermanos well MW13) and about 275 feet in the northern cored hole area (estimated from the 2nd Tres Hermanos well MW11). Therefore the maximum depth of the cored holes in the southern and northern sites will be approximately 170 feet and 225 feet, respectively.

Cores will be extracted and logged on site, photographed and boxed for shipment to Austin, Texas for laboratory analysis and storage. One foot samples at 5 foot intervals will be extracted and laboratory tests for vertical permeability will be conducted on the cores.

ii) The boreholes will be E-logged (SP and resistivity)

(iii) Hydraulic Testing - Packer Tests

The boreholes will be tested at 5 foot intervals (slug tests) using a double packer system, providing the integrity of the holes is such that the hole remains open to allow the testing. It is anticipated that the hole will remain open, based on recent drilling and well installations. The arbitrary 5 foot interval may be varied, depending on the detailed logging of the core.

iv) UTZ Definition

Based on the hydraulic testing and core permeability testing in i) and iii) above, effective horizontal and vertical hydraulic conductivities will be estimated for individual and combined 5 foot intervals of the 1st Tres Hermanos sandstone (individual thicknesses tested and used in the calculations may vary from the arbitrary 5 foot thickness, depending on the detailed core logging). The UTZ will be considered to be the approximate aggregate thickness where the effective vertical (normal to bedding) hydraulic conductivity is less than .05 of the effective hydraulic conductivity parallel to bedding. In other words, assuming equivalent vertical and horizontal gradients, 95 percent of the flow would be in the horizontal direction and 5 percent would be in the vertical direction. Effective hydraulic conductivity will be calculated for the approximate horizontal and vertical directions as the thickness-weighted arithmetic mean and harmonic mean, respectively.

The UTZ thickness as calculated from the testing will be compared to the core logs and geophysical logs, and an attempt will be made to determine a final UTZ definition consistent with the available data. This UTZ thickness will be recommended to the regulatory authorities (NRC and NMEID) for approval and subsequent monitoring wells will be screened across this interval.

B. Monitoring Well Installation

On agreement of the thickness of the UTZ and receipt of approval from NRC and NMEID, the monitoring wells shown on Figure 1 will be completed in the UTZ. Completions will be similar to that shown on Figure 2.

The wells will be cleaned by pumping or bailing prior to completion of the well installation program.

C. <u>Sampling and Analysis</u>

i) Initial Sampling

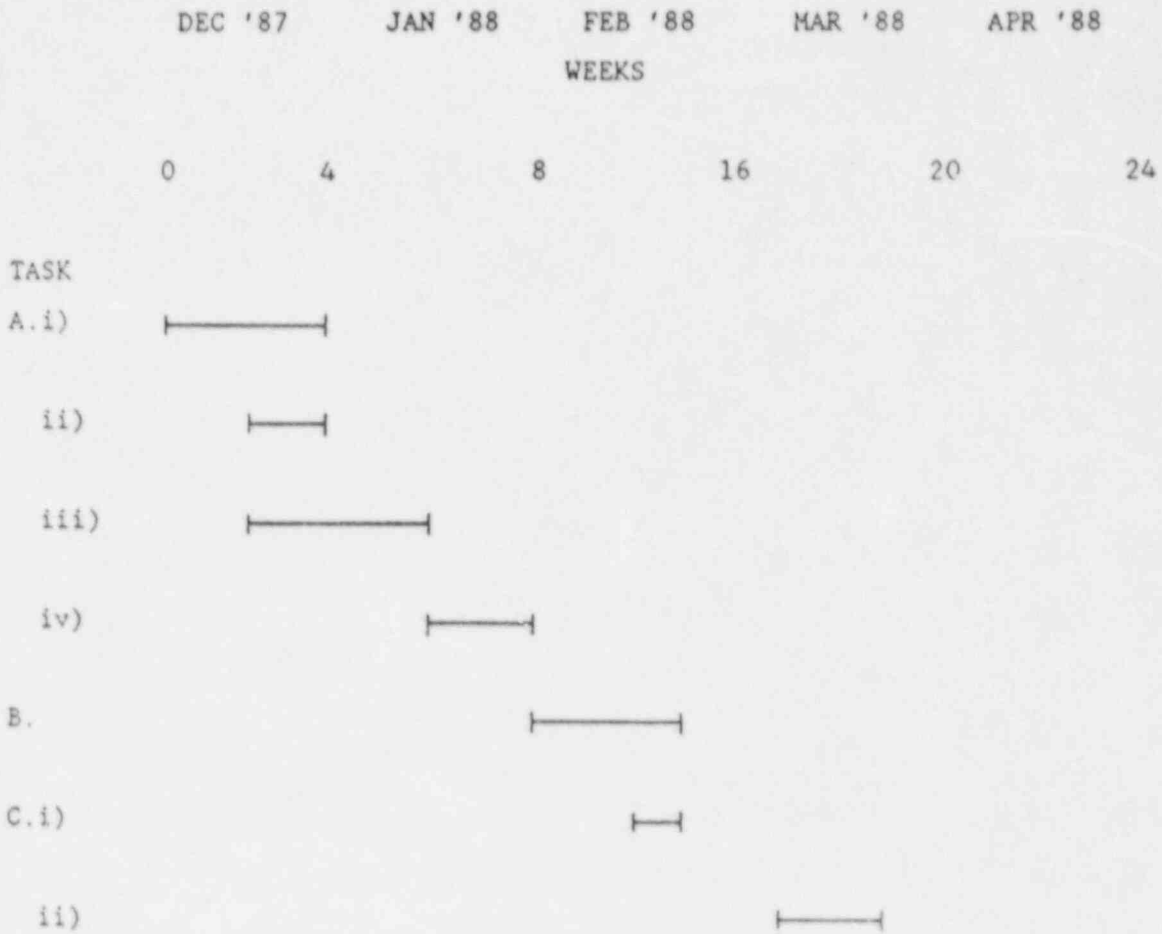
The new monitoring wells will be sampled immediately after installation and analyzed in the field for Cl, SO_4 and pH.

ii) Primary Sampling

The wells will be sampled again during the subsequent quarterly monitoring event and the samples analyzed consistent with NRC Source Material License SUA-1472 and NMEID Discharge Plan DP-150.

On inspection of the analysis results and discussion with NRC and NMEID, recommendations concerning further investigations will be submitted.

D. Schedule


DEC '87
JAN '88
FEB '88
MAR '88
APR '88
WEEKS
0
4
8
16
20
24
TASK
A.i)
ii)
iii)
iv)
B.
C.i)
ii)

APPENDIX IV

DRILLING CONTRACT AND SPECIFICATIONS

INTERA

Intera Technologies Inc.
Suite 300
6850 Austin Center Blvd.
Austin, Texas 78731

Tel.: (512)-346-2000
Telex: 792 352
Telecopier: (512) 346-9436

FILE COPY

November 24, 1987

Joe Salazar Drilling
724 Elko
Grants, NM 87020

RE: Request for Bid: Drilling Contractor, L-Bar Mine, Seboyeta, New Mexico

Dear Sir:

Attached is a drilling contractor statement of work for coring, packer testing and monitor well installation at the L-Bar mine site. INTERA is seeking to contract for the services as described on the pricing basis identified on ATTACHMENT B - **PRICING SCHEDULE.**

Please return a completed and signed copy of ATTACHMENT B to the undersigned by December 1, 1987 if you are able to meet the technical and schedule requirements of the statement of work. The successful bidder will be notified December 2, 1987.

Thank you.

Yours sincerely,

G.E. Grisak
Vice President

GEG/lac
enclosure

cc LaGraff

H01100C170

INTERA

Intera Technologies Inc.
Suite 300
6850 Austin Center Blvd.
Austin, Texas 78731

Tel.: (512)-346-2000
Telex: 792 352
Telecopier: (512) 346-9436

November 24, 1987

Rodgers and Company, Inc.
2615 Isleta Blvd. SW
Albuquerque, NM 87105

RE: Request for Bid: Drilling Contractor, L-Bar Mine, Seboyeta, New Mexico

Dear Sir:

Attached is a drilling contractor statement of work for coring, packer testing and monitor well installation at the L-Bar mine site. INTERA is seeking to contract for the services as described on the pricing basis identified on ATTACHMENT B - **PRICING SCHEDULE.**

Please return a completed and signed copy of ATTACHMENT B to the undersigned by December 1, 1987 if you are able to meet the technical and schedule requirements of the statement of work. The successful bidder will be notified December 2, 1987.

Thank you.

Yours sincerely,

G.E. Grisak
Vice President

GEG/lac
enclosure

cc: LaGraff

H01100C171

DRILLING CONTRACT

L-Bar Drilling, Packer Testing and Monitor Well Installation

December 1987 - January 1988

ATTACHMENT A: STATEMENT OF WORK

ATTACHMENT B: PRICING SCHEDULE

ATTACHMENT C: OWNER RESPONSIBILITY

ATTACHMENT D: CONTRACTOR RESPONSIBILITY

ATTACHMENT E: SCHEDULE AND HOURS OF WORK

FIGURE 1. LOCATION MAP

FIGURE 2. WELL INSTALLATION SCHEMATIC COMPLETION*

FIGURE 3. SUSPENSION DETAIL FOR WELLS GREATER THAN 100 FEET DEEP

ATTACHMENT A

L-Bar Drilling & Testing
December 87 - January 88

STATEMENT OF WORK
FOR
DRILLING CONTRACTOR

PHASE I: CORING AND PACKER TESTING

OBJECTIVES

A. To obtain continuous core samples, using air or air mist coring, in two boreholes starting at the top of the First Tres Hermanos sandstone. Coring will be discontinued at the shallowest of a) recovery of 10 feet of relatively continuous Mancos shale core as determined by the owner's representative or b) 170 feet total depth in the southern hole and 225 feet total depth in the northern hole. The approximate locations of the boreholes are shown on Figure 1. The top of the First Tres Hermanos sandstone is at depths of approximately 25 to 75 feet at these locations.

B. To conduct permeability tests using a straddle packer system provided by the owner. The drilling contractor is requested to provide a shallow pump rig or equivalent for moving and setting the packers. A water tank or water truck for filling the packer drop tubing and nitrogen tanks for packer inflation will also be required.

WORK DETAIL

1. Ground Surface to top of First Tres Hermanos

   Drilling Method: Air rotary or alternative acceptable to owner

   Temporary Surface Casing: Set to depth of 10 feet to 20 feet, depending on the competency of the shallow weathered material.

   : Surface casing will be steel casing with an internal diameter of 6 1/2 inches to 8 inches, or as required to accommodate subsequent core drilling and packer testing.

   : Drilling depth (expected) to top of 1st Tres Hermanos
   southern hole - 25 feet
   northern hole - 75 feet

   Air rotary drilling will be discontinued as directed by the owner.

ii. Top of 1st Tres Hermanos to Total Depth (TD)

Continuous cores are to be obtained from the top of the 1st Tres Hermanos to TD. TD will be determined by the owner based on the criteria in i) above; however maximum TD's are:

southern hole - 170 feet from ground surface
northern hole - 225 feet from ground surface

Core size: 2 inch to 4 inch diameter
Coring method: Air or Air mist
Finished holesize: Minimum 5 1/2 inches
Maximum 7 1/2 inches
Hole must accommodate packer system of 4.4 inch O.D. deflated
: Hole can be reamed if necessary to achieve finished diameter

iii. Packer Testing

The cored interval of each borehole will be permeability tested using a straddle packer system provided by the owner. The contractor will provide a pump rig or equivalent and a water tank (minimum 250 gallon) or water truck and tubing, pipe or stem to be used as droppipe for the straddle packer system.

Droppipe specifications:

- minimum 2 7/8 inch ID water tight droppipe to connect to 2 3/8 inch O.D. aluminum pipe with external NPT threads. This droppipe will be used as standpipe for slug testing packed-off intervals and therefore must be watertight.

The contractor will also provide and replace as necessary two separate nitrogen tanks to be used to inflate the straddle packers and a small 2 inch OD internal packer. The owner will provide PVC drop pipe for the internal valve packer and all inflation tubing lines, regulators and gauges to connect to the nitrogen tanks.

The maximum packer testing depth will be 225'.

PHASE II: MONITOR WELL AND PIEZOMETER INSTALLATION

OBJECTIVE

To install a minimum of four monitor wells, 5 inch diameter PVC, and seven piezometers, 2 inch diameter PVC in the vicinity of the L-Bar tailings pond. PVC casing and screens will be provided by the owner. The contractor will provide steel surface casing and protective pipe.

i. Five inch monitor wells - PVC

A minimum of four, 5 inch diameter monitor wells will be installed to depths ranging from approximately 40 feet to 225 feet. The boreholes will be drilled using air or air mist rotary drilling methods. Temporary surface casing can be set as necessary to maintain hole integrity. Wells will be constructed of Schedule 80, flush joint threaded PVC with #20 slot PVC screens. Drill cuttings will be logged by the owner and TD and screened interval specified by the owner on a hole-by-hole basis. Shallow wells (less than 100 feet total depth) can be set on bottom hole (see Drawing 1). Wells deeper than 100 feet will be suspended as per Drawing 2 or alternative suspension method as approved by owner. Wells will be sand packed with graded silica sand to a depth of 5 feet above the top of the screen. Sand pack can be gravity-placed in shallow wells (less than 100' TD) while tremmie-type placement will be necessary in deeper wells. A bentonite pellet seal 10 feet thick will be placed above the sand pack. The depth of the top of the sand pack and top of the bentonite will be verified with drop-pipe depth soundings. A dry bentonite/sand backfill will be placed above the bentonite pellets and continued to a depth of 5 feet below ground surface. The surface of the wells will be finished with a cement plug, surface steel protective casing and locking cap as per Drawing 1 and Drawing 2 or alternatives as approved by the owner.

ii. Two inch monitor piezometers - PVC

A minimum of seven piezometers, two inch diameter, will be installed to depths ranging from 50 feet to 275 feet. The boreholes will be drilled using air or air mist rotary drilling methods. Temporary surface casing can be set as necessary to maintain hole integrity. Piezometers will be constructed of Schedule 40, flush joint threaded PVC with #20 slot PVC screens. Drill cuttings will be logged by the owner and TD and screened interval specified by the owner on a hole-by-hole basis. Shallow wells (less than 100 feet total depth) can be set on bottom hole (see Drawing 1). Wells deeper than 100 feet will be suspended as per Drawing 2 or alternative suspension methods as approved by owner. Well screens will be sand packed with graded silica sand to a depth of 5 feet above the top of the screen. Sand pack can be gravity-placed in shallow wells (less than 100' TD) while tremmie-type placement will be necessary in deeper wells. A bentonite pellet seal 10 feet thick will be placed above the sand pack. The depth of the top of the sand pack and top of the bentonite will be verified with drop-pipe depth soundings. A dry bentonite/sand backfill will be placed above the bentonite pellets and continued to a depth of 5 feet below ground surface. The surface of the wells will be finished with a cement plug, surface steel protective casing and locking cap as per Drawing 1 and Drawing 2 or alternatives as approved by the owner.

ATTACHMENT B

PRICING SCHEDULE

Bid Reply Form

REQUIRED ITEMS (1-6)

1) Mobilization and transportation of all necessary equipment, materials and personnel to the drilling location and return to contractors premises.

TOTAL MOBILIZATION	$_________

2)	Ii)	Core Drilling - Air or Airmist	
		Rig Time (including crew)	$_________ per hour
		Standby time	$_________ per hour
		Core boxes (wooden)	$_________ per box
3)	Iii)	Packer Testing - Pump Rig or Equivalent	
		Rig Time (include crew and water tank or truck)	$_________ per hour
		Standby time	$_________ per hour
4)	IIi)	Five inch PVC well installation	
		Rig time (including crew)	$_________ per hour
		Standby time	$_________ per hour
5)	IIIi)	Two inch PVC piezometer installation	
		Rig time (including crew)	$_________ per hour
		Standby time	$_________ per hour
6)	OTHER (if necessary)		
		Rig time (including crew)	$_________ per hour
		Standby time	$_________ per hour
7)	Sand pack - graded silica sand (graded to #20 slot screen)		$_________ per ____
	Bentonite pellets		$_________ per ____
	Sand/Bentonite dry backfill (pit run sand is acceptable)		$_________ per ____
	Surface protective steel casing with caps/locks and cement plug		
	a) Wells less than 100 feet deep		$_________ per well
	b) Wells greater than 100 feet deep		$_________ per well

8) OTHER MATERIALS
(as required)
COST plus (supported by invoice or other approved backup) ________%

______________________________ ________________
Contractor Signature Date

ATTACHMENT C

OWNER RESPONSIBILITY

(i) The Owner shall be responsible for selecting the drilling sites, and determining on the depth of the boreholes. The Owner shall be the sole judge as to the satisfactory drilling and associated work such as surface casing setting, the protection of the site, and the removal of debris and unused materials by the Contractor.

(ii) The Owner shall make arrangements for access and right-of-way for the specific work and the Contractor shall not enter on, nor occupy with men, tools, equipment or material, any ground outside the area designated, without the written consent of the party owning such ground. Other authorized contractors or employees or agents of the Owner may for all necessary purposes enter upon the premises as designated by the Owner and the Contractor shall conduct his work so as not to impede, unnecessarily, any work being done by others on or adjacent to the site.

(iii) If the Contractor, due to faulty workmanship, materials or equipment, fails to perform his work satisfactorily, the Owner may:

a) order the rig shut down until the necessary improvements or corrections have been made, or

b) terminate the contract.

(iv) In the event of unsuitable weather conditions, the Owner reserves the right to suspend work until said conditions allow the work to be satisfactorily continued. Payment for work stoppages ordered by the Owner shall not exceed eight hours in any one working day.

(v) No work shall be proceeded with unless supervised by the Owner or his representative.

ATTACHMENT D

CONTRACTOR RESPONSIBILITY

(i) Drilling Rig and Equipment - The Contractor shall provide drilling rig(s) capable of completing the statement of work. Contractor will further provide all necessary generators, air compressors, welding, cutting, and threading equipment, mud and grout pumps, tremmie tubes, drill stem, bits, core barrels and all other equipment or appurtenances required to complete the assigned work. A crew qualified to operate the drilling rig, install the surface casing and complete the coring and well installations using the prescribed methods will be provided by the Contractor.

(ii) Maintain his equipment in good repair to reasonably ensure against breakdown.

(iii) Be responsible for time lost in waiting for delivery of bits, tools, surface casing, pumps, parts, equipment, repair and services, except for time lost that is considered to have been a cause that is beyond the control of the Contractor. The Owners decision as to accepting or rejecting the claim for lost time will be final.

(iv) Down time in excess of 1/2 hour per day due to mechanical failures of the contractor's equipment will be the contractor's responsibility.

(v) Should the situation occur, be prepared to shut off and seal holes that encounter artesian flow or excessive gas.

(vi) Be prepared to provide, haul, set and recover temporary casing, if required.

(vii) Supply all living accommodations and expenses for all Contractor's employees.

(viii) Cleanup - The Contractor shall protect all structures, roads, pipelines, powerlines, trees, and other property during the progress of the work; shall remove and dispose of all cuttings, drillings and debris and unused materials from the site and shall, upon completion of the work replace or repair at his sole expense any of the above items damaged or destroyed due to carelessness of negligence on his part.

(ix) Equipment Cleaning - All drill stem, casing, pipe, etc., that will enter the borehole will be either new material or cleaned and air dried.

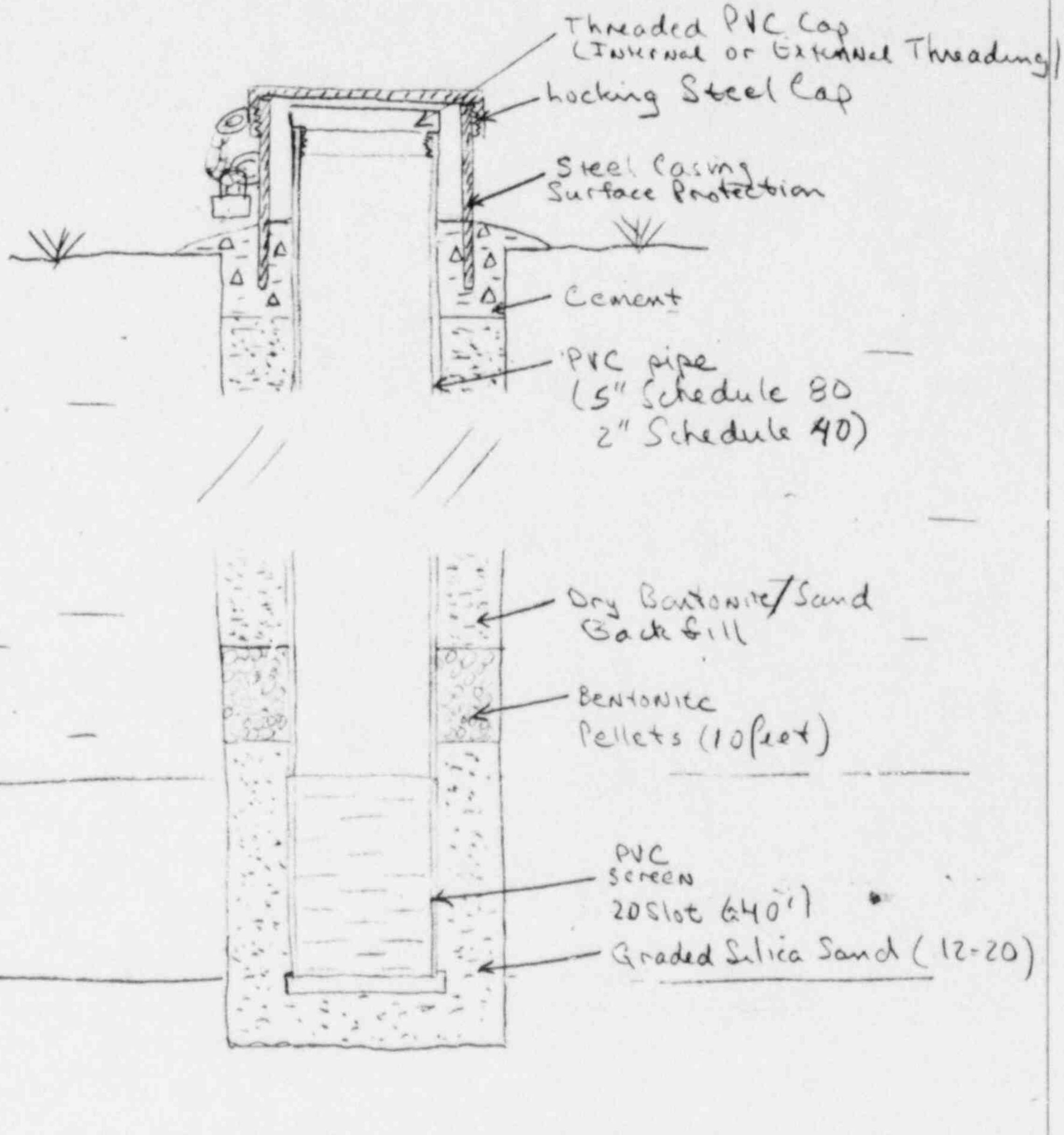
ATTACHMENT E

SCHEDULE AND HOURS OF WORK

Core Drilling and packer testing (PHASE I) is scheduled to start December 7, 1987 and to continue daily until December 22. Unless otherwise authorized the hours of work will not exceed 10 hours per day. Weekends of December 12/13 and December 19/20 will be worked. Field activities will cease December 22, 1987 at 5:00 PM and begin again January 4, 1988. Commencing January 4, 1988 only 5 day work weeks (Monday through Friday) will be worked until completion of the monitor well installations.

Well Installation Schematic Drawing

(N.B. For wells greater than 100 foot depth, see Drawing — for 'suspension' detail.

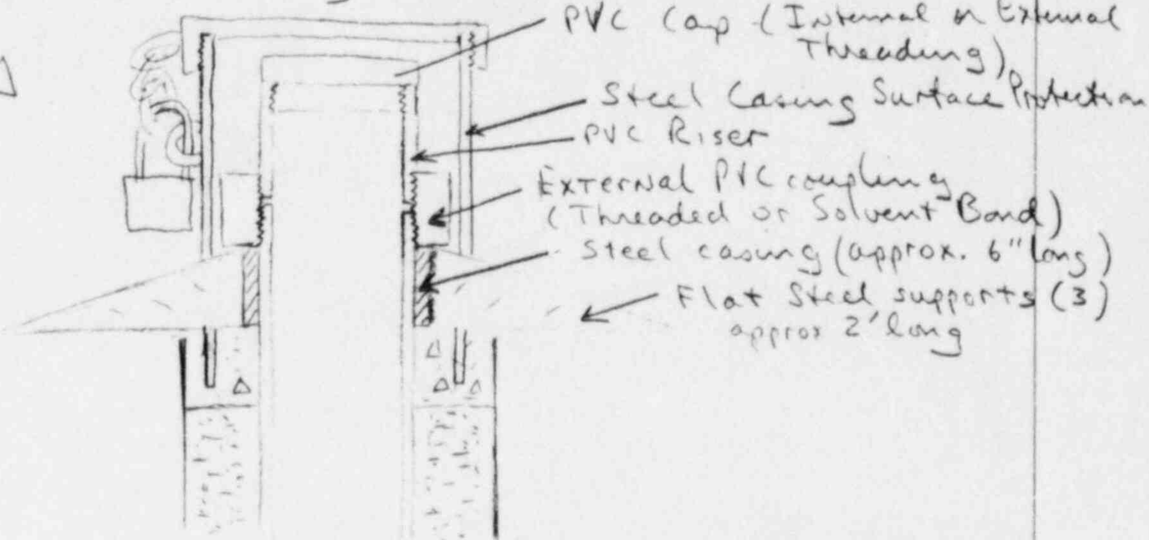


Drawing 1

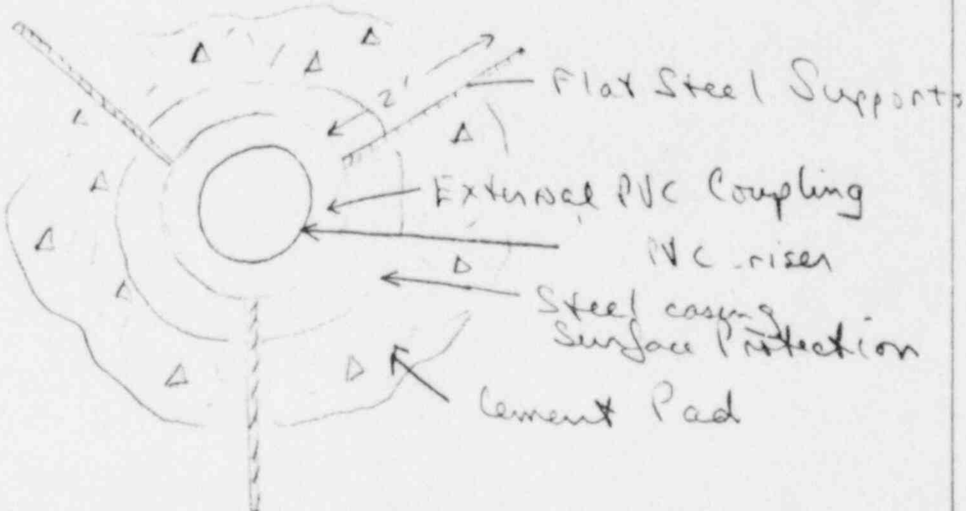
'Suspension' Detail for wells greater than 100 foot depth

Comment: Deeper PVC wells can collapse or break particularly at the screen where it is weakest due to the weight of the pipe plus adhered bentonite, clay, cement etc. Deeper wells should be suspended from surface using an appropriate surface coupling and mount

i) Cutaway

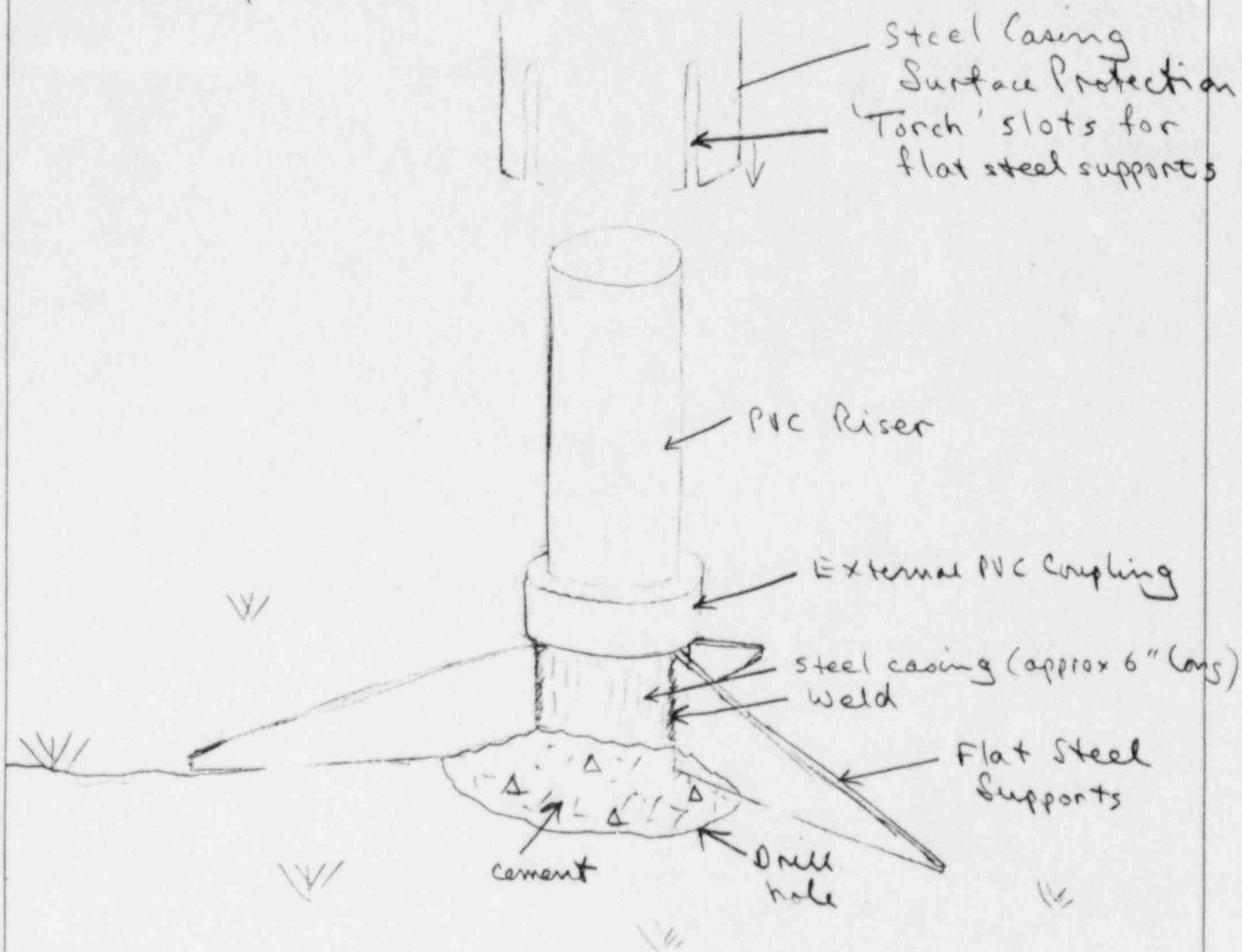


ii) Top View



Drawing 2

iii) Oblique



Drawing 2 cont'd.

APPENDIX V

FIELD GEOLOGIC LOGS

Hole	0-18'	Weathered deposits, d-m, beige-brown
	18-40'	Weathered deposits m-vm, darkbrown
	40-55'	Shale, soft, grey, m (sample 50-55)
	55-60'	Sandy shale, grey, harder, m, making water (sample 55-60')
Core	60-63'	Sandy shale as above
	63-65.5'	as above
	65.5-80	s.s. blk, olive grey, shale partings breaks

Drilling crew on site @ 9:00 (fillup water truck on @ well field)

Surface casing set 6" I.D. 1987 13:00 15

Problems with adapter, no oxygen for torch, broken adapter (5 7/8" bit)

1987 07:3 09
blew hole-water

Problems with breakout assembly
started tripping out @ 09:00
Problems with core apparatus
adjust core tube placement in core barrel
need to adjust bull line to Kelly

Started coring @ 11:00 @ 63' below ground surface
First core out @ 13:10
Lost ≃ 3' of core (shale washed out; found it later when we could only get 17' on next core.

Core log from top of sandstone contact

Breaks and/or fractures @	0.45		
	0.75		
	1.10		
	1.45		
	2.80		
	3.60		
	5.80	black face	
	6.85	black face	
	7.25	black face	shale
	8.00	black face	partings
	9.65	black face	
	9.95		
	10.40		
	11.20		
	12.15		
	13.5		
	14.15		
bottom	14.75		

1987-12-09

Crew on site @ 07:00
Equipment warm up

Coring @ 07:30

1st core of day out @ 10:10
started coring again @ 11:00
sent drill helper to Grants to get core boxes @ 11:00

Thursday, December 8, 1987

6:30AM Bob Coupland
7:00 Koogle & Pouls
- monitoring contract

Maua Flores - Eberline
Long term employer
??????
TLDs Quarterly
Track Etch cups
Air filters
Short Term
- same deal

New Contract with Eberline

Air samples - picked up every two weeks

Tech: R.M. Coupland; E.A. Michael
Geol: G.E. Grisak

RMC-1 Dec. 8, 1987

Coring started @ 63'
Top of 1st Tres Hermanos 65.5'

13:30
- Core extracted

- Approximately 3' of Mancos shale was initially considered lost but turned up in the top of the following core

63 - 80.5 Penetration (coring) rate = ___ ______.
start coring __________
finising coring 13:30

15:30 Core pulled; the missing 3 feet from core 63-80.5 was in the top of the core run; evidenced also by a full core after only ≈ 16' of core.

Penetration rate = ≈ 8'/hr

RMC-1 Core Log

Depth (ft)		RMC-1 K (permeability)
Core extracted 13:30 December 8, 1987		
65.5-67.5'	Swirl-bedded sandstone with shale partings whitish grey sst; grey/black shale	
67.5-74.0'	Whitish grey sst with numerous shells and shell pseudomorphs; minor shale partings	RMC-1 K1 67.2-68.3'
74.0-76.0'	Relatively clean whitish sst with shale partings and minor shells - vertical fracture between 74.8 and 76.0	RMC-1 K2 73.5-74.75'
76.0-80.5'	Mottled/shelliferous sandstone; grey/ mottles @ white mottles	RMC-1 K3 77.75-79.0'
80.5-91.0'	as before	RMC-1 K4 85.0-86'
91.0-92.2'	Massive bedded sandstone; lt. grey/white fractured @ 91.5, 91.7 (minor hor.)	
92.2-95.3'	mottled/shelliferous sandstone; grey/ mottled with white mottles; fractured @ 95.1, 93.9, 92.2 (minor hor.)	RMC-1 K5 90.7-91.5'
95.3-97.0'	Massive bedded sandstone; lt. grey/ white fractured @ 95.9, 96.2 (minor horizontal)	RMC-1 K6 95.9-96.7'

Shaliness begins to increase at ≈ 101, very gradational
Rock changes from a sandstone w/ shale stringers to a shale with sand/silt stringers.

Depth (ft)		RMC-1 K (permeability)
97.0-97.5'	Massive bedded s.s whitish grey	RMC-1 K7 101.8-103.0'
97.5-100.7'	sandstone, mottled/shelliferous grey mottled with shale, partings grey, fracture @ 99.5'	
100.7-100.8'	sandstone whitish grey	
100.8-101.5'	mottled sandstone, shale partings, grey	
101.5-101.9'	massive bedded sandstone, whitish grey	
101.9-116.0	mottled/shelliferous; fine ss, shale partings, grey black; increasing shale content	RMC-1 K8 107.2-108.2'

Depth (ft)		RMC-1 K (permeability)
116-117.0'	mottled shelliferous; s.s./siltstone grey mottled	
117.0-124.0'	mottled/shelliferous s.s/silt grey mottled (silty fine s.s.); shaliness increasing	RMC-1 K9 120.1-120.8'
124.0-134.5'	mottled/shelliferous shale/silt silty fine; darker grey mottled; fracture @ 130.7', shale parting; break @ 129.2', coal and fepyrite break @ 127.7'	RMC-1 K10 132.9-134.0'
134.5-135.2'	mottled/shelliferous shale/siltstone grey mottled (fine s.s.)	
135.2-137.0'	mottled/shelliferous shaly/siltstone, darker grey mottled, possible vertical fracture @ 136.5' (fine s.s.)	

Depth (ft)		RMC-1 K (permeability)
137.0-140.0'	mottled/shelliferous shale/siltstone grey mottled	
	vertical fracture ends @ 137.5'	RMC-1 K11 142.0-143.1'
140-157'	mottled/shelliferous silty shale, shaley siltstone, darker grey mottled	RMC-1 K12 152.5-153.4'
157-177'	shale with silty stringers, mottled, darker grey, sand/siltstone, reduced to less than 5% @ ≈ 165'	
177-180'	as before	

End of hole @ 180'
1987-12-09

1987-12-10

18-22'	s/s Upper Tres Hermanos? Set surface casing (6 5/8") @ 9:00 started coring @ 10:00	

RMC-2 Core Log

Depth (ft)		RMC-2 K (permeability)
22-23.0'	s.s. yellow beige mottled shelliferous	RMC-2 K1 22.8-24.0'
23-25.3'	s.s. grey mottled shelliferous	
25.3-25.6'	s.s. yellow beige mottled shelliferous	
25.5-31.0'	s.s. massive yellow beige, shale lense 29.2-29.4'	RMC-2 K2 27.1-27.8'
31.0-31.7'	s.s. grey block mottled shelliferous	
31.7-32.5'	s.s. yellow beige massive	

Depth (ft)		RMC-2 K (permeability)
32.5-33.0'	massive grey very soft	
33.0-34.0'	sample lost presumed to be as before only softer	
34.0-40.7'	s.s. grey mottled shelliferous	RMC-2 K3 37.8-39.0'
40.7-41.0'	grey massive	
41.0-46.8'	s.s. grey mottled shelliferous	
46.8-47.5'	grey massive	RMC-2 K4 46.8-47.6'

Depth (ft)		RMC-2 K (permeability)
47.5-51.0'	s.s grey mottled shelliferous	
51.0-52.2'	s.s. massive light grey	RMC-2 K5 50.9-52.2'
52.2-52.6'	s.s. massive darker grey	
52.6-53.2'	s.s. massive, dark grey, shale lenses @ 52.7, 52.8, 52.9, 53.0, 53.2	
53.2-59.6'	s.s. grey/black mottled shelliferous, s.s., massive lenses, shale partings closed fracture (hor) @ 56.2'	RMC-2 K6 57.5-58.6'

1987-12-11

Started coring @ 08:30

Filled water truck @ 07:30

Depth (ft)		RMC-2 K (permeability)
59.6-60.5'	s.s. massive, light grey, medium-fine grained mottled grey/black s.s. shelliferous lense @ 59.9-60.1'	
60.5-61.0'	s.s. grey/black mottled shelliferous	
61.0-61.2'	s.s. grey mottled shelliferous	
61.2-68.2'	s.s. grey/black mottled shelliferous, darker grey, fractures (hor.) 61.3-62.1'	RMC-2 K7 65.5-66.5'
68.2-70.7'	s.s. grey/black mottled shelliferous, lighter grey	

Depth (ft)		RMC-2 K (permeability)
70.7-80.5'	s.s. grey/black/white mottled, shelliferous, shale partings, carbonaceous shale (soft coal) deposits @ 75.4'	RMC-2 K8 70.7-71.8'
80.5-84.0'	s.s. grey/black/white mottled, shelliferous, vert fracture(?) @ 83.3-83.5'	RMC-2 K9 80.0-80.7'
84.0-90.5'	s.s. grey/black/white, mottled, shelliferous, horizontal fracture @ 84.8'	
90.5-91.9'	s.s. grey/white mottled, shelliferous	
91.9-97.9'	s.s. grey/white/black mottled, shelliferous	

Depth (ft)		RMC-2 K (permeability)
97.9-99.0'	s.s. grey/black/white mottled, hor. fracture shelliferous	
99.0-101.0'	s.s. grey/black/white, mottled, shelliferous	
101-106.6'	s.s. grey/black/white mottled shelliferous	RMC-2 K10 101.5-102.8'
106.6-108.0'	s.s. massive light grey, shelliferous, beige-yellow-white shells, fractured	RMC-2 K11 107.5-108.1'
108-119.0'	s.s. grey/black/white mottled, darker	

Depth (ft)		RMC-2 K (permeability)
119-119.5'	s.s. grey/black/white mottled shelliferous fractured (vert.)	
119.5-120.7'	s.s. grey/black/white mottled shelliferous	
120.7-121.0'	a⌐ before, fractured (vert.)	
121.0-128.5'	shaley s.s. grey/black/white mottled, shelliferous, finer grained	
128.5-139.0'	sandy shale, grey/black/white mottled shelliferous, darker grey	RMC-2 K12 128.9-129.9'

Depth (ft)		RMC-2 K (permeability)
139.0-139.1'	bentonitic layer, pale grey/white	
139.1-141.0'	silty shale, dark grey/black	
141-148.6'	as before, same shells	RMC-2 K13 141.0-141.8'
148.6-150.0'	Bentonitic layer, washed out, ≈ 4" recovered, yellow white/beige mottled	
150.0-161.0'	silty shale, dark grey/black, white shells, Fe pyrite crystal deposits @ 152.2 and 160.1	RMC-2 K14 160.1-161.0'

1987-11-12

Harold Dalton on site @ 10:00 (Western Wireline)

Salazar Drilling on site 11:00 (200' of tubing)

Start reaming RMC 2 (5-7/8") @ 11:30

Log RMC2 @ 13:30

Start reaming RMC1 (5-7/8") @ 14:30

Log RMC1 @ 16:00

87/12/20

Check:

ID of tubing string 2/10"

on-site @ 8:30 am
- snowing, cloudy
- starting test #6
- checked interval overlap = 0.14' from test 5

afternoon
- pulled out packer assembly
- lengthened packer spacing 7", permeability very low
- installed test tool in borehole for 0.1 ft overlap of test 6.
- started test 7 ≈ 3:30

Stopped test after ~ 40 min. monitoring; 4 cm head drop; very low permeability

Lowered packer assembly 16' to new test zone.
Inflated packers; inserted minipacker prior to packer inflation

head in tubing	15.29 m	5:17 pm
	15.29 m	5:30 pm

Tubing level stable
Inflate packers
Run test
Very low permeability
Tubing full of water above ground; might freeze overnight
deflate packers to allow fluid to drop below ground
plan to drop packers 16' deeper for next test
off-site @ 6:00 pm

Packer Inflation:

@ 180 ft, ~ 60 m - 10 m to water = 50 m head

1. Inflation at surface = 200 psi
2. Annulus pressure @ 180 ft

   9.79 kPa/m
   6.895 kPa/psi

$$\frac{(KPa/m)}{(KPa/psi)} = \frac{kPa}{m} \times \frac{psi}{kPa}$$

$$= \frac{psi}{m}$$

$$\frac{9.79}{6.895} = 1.4 \text{ psi/m}$$

   50 m annulus head = 71 psi

3. slug pressure 10 m
   overpressure on packers = 1 order of magnitude
   = 100 m
   = 140 psi

4. total pressure @ 180 ft = 200 psi + 71 psi + 140 psi
   for packers ~ 400 psi

87/12/21

Checked with John Pickens, Frank Blaskovich re: low perm response of > 130' in borehole - RMC1; proceed with test #8 and monitored ~ 2 hours - Results: @ 2 hours < 1% recovery following slug injection

Pulling out of RMC-1 @ 2pm -

Checked results of perm testing (Tests 2, 3, 4, 5); see data binder
Looks like coverage is OK near the section of borehole showing perm contrast

Decided to finish on RMC-1 and move to RMC-2 to start testing near the contact. Note: property is wet; roads swampy

RMC-2

- set-up on hole @ 3:30 pm
- sounded hole ~ 50 m below top of casing
- caved ~ 10'

* water level in open borehole = 7.22 m below top casing

- stickup: top ground to top casing = 5 cm.

RMC-2   87/12/22

on site @ 8:30 pm with drillers preparations for test #2
temp ~ 30°F; sunny

objectives today
- testing @ 16' centers

88/01/05

RMC-1

on site @ 9AM
discussed plans for sampling
cementing holes, starting new holes-drillers on site with cement @ 9:30 AM
Plan to mix cement/bentonite slurry

*From Johnson
Mixing cement slurry (only)
5.2 gal/94 lb cement (1 sack)
for a slurry weight of 15.6 lb/gal

- cement bentonite slurry - proportions

3-5 lbs bentonite
6.5 gal. fresh water
94 lbs. (1 sack) cement

- bentonite shouldn't exceed 6% of total mix

- directions
  1. mix bentonite and water
  2. add cement
  3. pump directly to hole

- add sand for consistency in high fluid loss zones
- positive displacement pump
- 1 or 2" grout pipe; lower to bottom; grout in one step.

Volume slurry

use $\frac{\pi d^2 h}{4}$

where $d \approx 6$ in
≈ 15.24 in
$h \approx 170$ ft
≈ 5182 cm

$$\frac{\pi d^2 h}{4} = 945.2 \text{ L}$$

$= 249.7$ gal
≈ 6.2 barrels

RMC-1

Cement: low alkalai Type I, II
Portland

- Completed cementing with approximately 300 gals of 5 gal/94 lb cement mix

pulled off hole @ 13:30

- set up on RMC-2 @ 19:00
- cementing using same mix and technique

APPENDIX VI

PHASE II PACKER TEST RESULTS

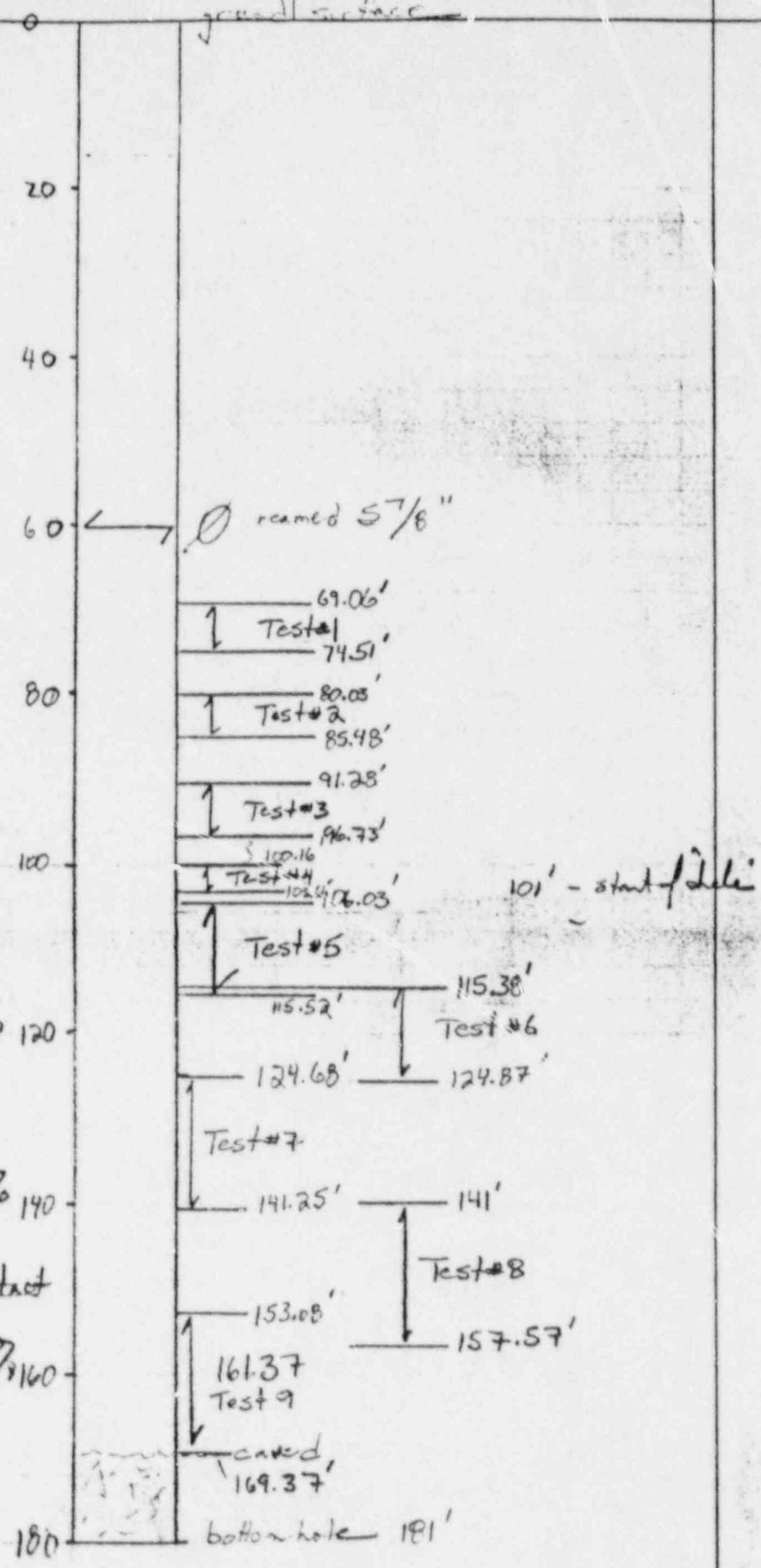
Test#2 2.5m / 5.6m 45‰
@100min

Test#3 6.15m / 7.63m 81%
@90min

Test#4 5.41m / 6.43m 84%
@90min

?contact

Test5 1.9m / 5.41 35%
@64min



KMC-#1

Summary of Packer Test Results

RMC #1

60

69.06 – 74.51 } 71.8 D — 4.0 E-07 m/s

80

83.03 – 85.48 } 82.8 D — 8.8 E-08 m/s

91.28 – 96.78 } 94.0 D — 2.5 E-07 m/s

100

100.16 – 105.61 } 102.9 D — 3.4 E-07 m/s

106.03 – 115.52 } 110.78 D — 6.0 E-08 m/s

115.52 – 124.87 } 120.1 D — ≤ 2.0 E-09 m/s

120

124.68 – 141.27 } 132.97 D — ≤ 2.0 E-09 m/s

140

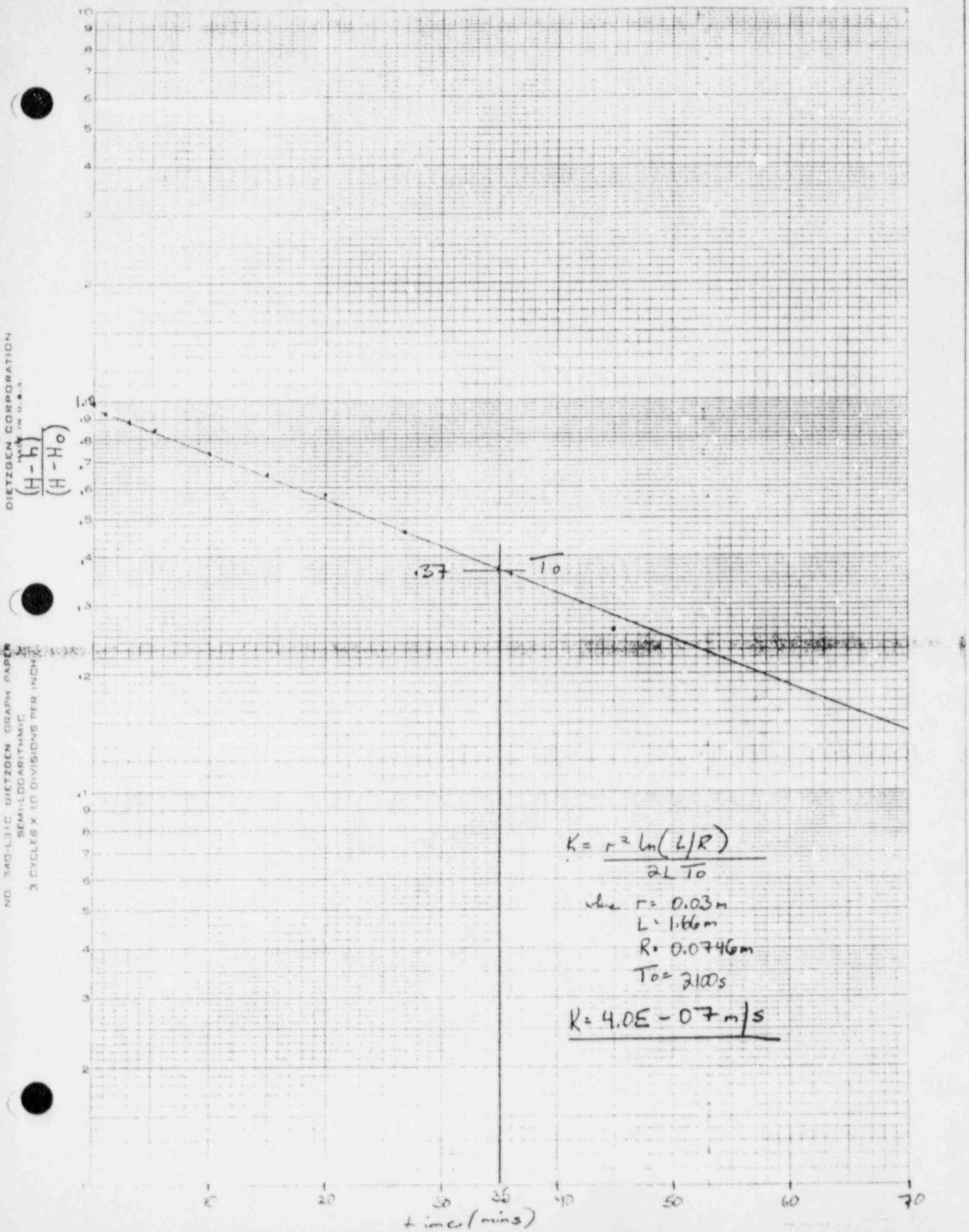
141.0 – 157.57 } 149.3 D — ≤ 2.0 E-09 m/s

153.08 – 169.37 } 161.37 D

160

180

200



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NO. 340-L31C DIETZGEN GRAPH PAPER
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3 CYCLES X 10 DIVISIONS PER INCH
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.37
To
K = r² ln(L/R) / 2L To
where r = 0.03m
L = 1.66m
R = 0.0746m
To = 2100s
K = 4.0E-07 m/s
time (mins)
10
20
30
35
40
50
60
70

INTERA TECHNOLOGIES, INC.

Borehole: RMC-1

Test Designation: 71.8D (69.06 - 74.51 ft) test #1)

Geology (formation/lithology):

CorePick from this Interval:
CorePick Designation:

Drilling Period:
From:
To:
Drilling Fluid:

Test Interval: (from top of casing)
Top: 69.06 ft.
Bottom: 74.51 ft
Midpoint: 71.79 ft.
Interval Length: 5.45 ft (does not include sliding-end length)

Borehole:
Average Diameter:

Packers:
Double packer inflation pressure ~~above annulus~~: ~250 psig
Shut-in packer inflation pressure: ~250 psig

Datum Point Description: Top of tubing
for water level measurements
Stick up from Ground Surface: 3.94 ft from top of casing to top of tubing; 0.98 ft from top of casing to ground surface (~)
Ground Surface Elevation: ______ (above sea level)

Tubing String:
Inside Diameter: 2 in.

Description of Packer in Tubing:
Top of Packer: ~60 ft (from top of casing)
Bottom of Packer: ~62.8 ft "
Tubing String ID: ~0.5 in
Tubing String OD: ~1.0 in.

Static Fluid Level in Test Interval (below datum): not available*
Static Fluid Level in Test Interval after minipacker inflation: not available

Static Fluid Level in Open Borehole below datum: not available
Magnitude of Slug: ~7.73 m

* measured at 14.94 m prior to adding slug but slug recovery dropped below this level; ∴ not static @ 14.94 m

INTERA TECHNOLOGIES, INC.

TESTING DATA:

Designation: 71.8D (test #1)

Start Time: 10:26:00

Static Water Level for Test Interval: not available

Elapsed Time: (minutes)	Water Level Below Datum: (meters)	$\frac{\vert H-h \vert}{\vert H-H_o \vert}$	Elapsed Time: (minutes)	Water Level Below Datum: (m)	$\frac{\vert H-h \vert}{\vert H-H_o \vert}$
0.3	7.22	1.0	9.0	9.05	
0.7	7.55	0.96	9.5	9.13	
1.0	7.65	0.94	10.0	9.20	0.74
1.33	7.71		10.5	9.28	
1.66	7.79		11.0	9.35	
2.0	7.86		12.0	9.51	
2.33	7.92		13.0	9.65	
2.66	7.99		14.0	9.79	
3.0	8.05	0.89	15.0	9.94	0.65
3.5	8.15		16.0	10.08	
3.83	8.21		17.0	10.20	
4.17	8.26		18.0	10.33	
4.42	8.30		19.0	10.45	
4.83	8.36		20.0	10.58	0.5[illegible]
5.17	8.42	0.85	21.0	10.70	
5.5	8.49		22.0	10.81	
5.92	8.56		23.0	10.93	
6.33	8.62		24.075	11.12	
6.66	8.68		25.075	11.24	
7.00	8.74		27.0	11.37	0.46
7.5	8.81		28.0	11.47	
8.0	8.90		29.0	11.57	
8.5	8.98		30.0	11.66	

INTERA TECHNOLOGIES, INC.

TESTING DATA:

Designation: (test#1 cont'd)

Start Time: 10:26:00

Static Water Level for Test Interval: not available

Elapsed Time: (minutes)	Water Level Below Datum: (meters)	H-h / H-Ho	Elapsed Time:	Water Level Below Datum:
31.0	11.75			
32.0	11.84			
34.0	12.02			
36.0	12.20	0.36 ✓		
38.0	12.36			
40.0	12.52			
42.0	12.68			
45.0	12.96	0.26 ✓		
50.0	13.45			
54.0	13.79			
59.0	14.20			
65.0	14.65	0.04 ✓		
70.0	15.00	100% recovery		
80.0	15.62			
85.0	15.88			
90.0	16.14			
98.0	16.52			

KMC-1
Slug test #1

Slug injection response
87/12/17

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3 CYCLES × 10 DIVISIONS PER INCH

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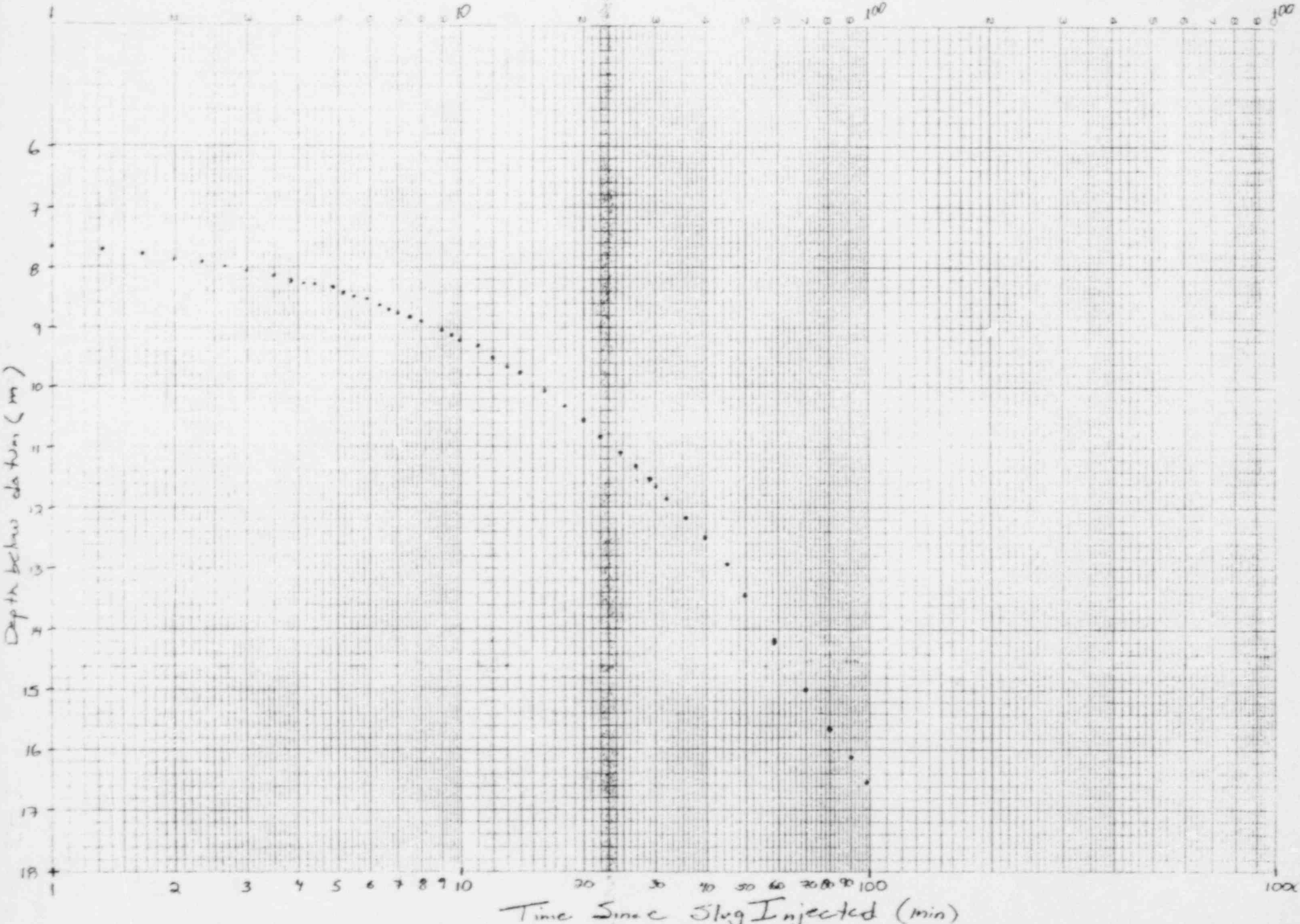
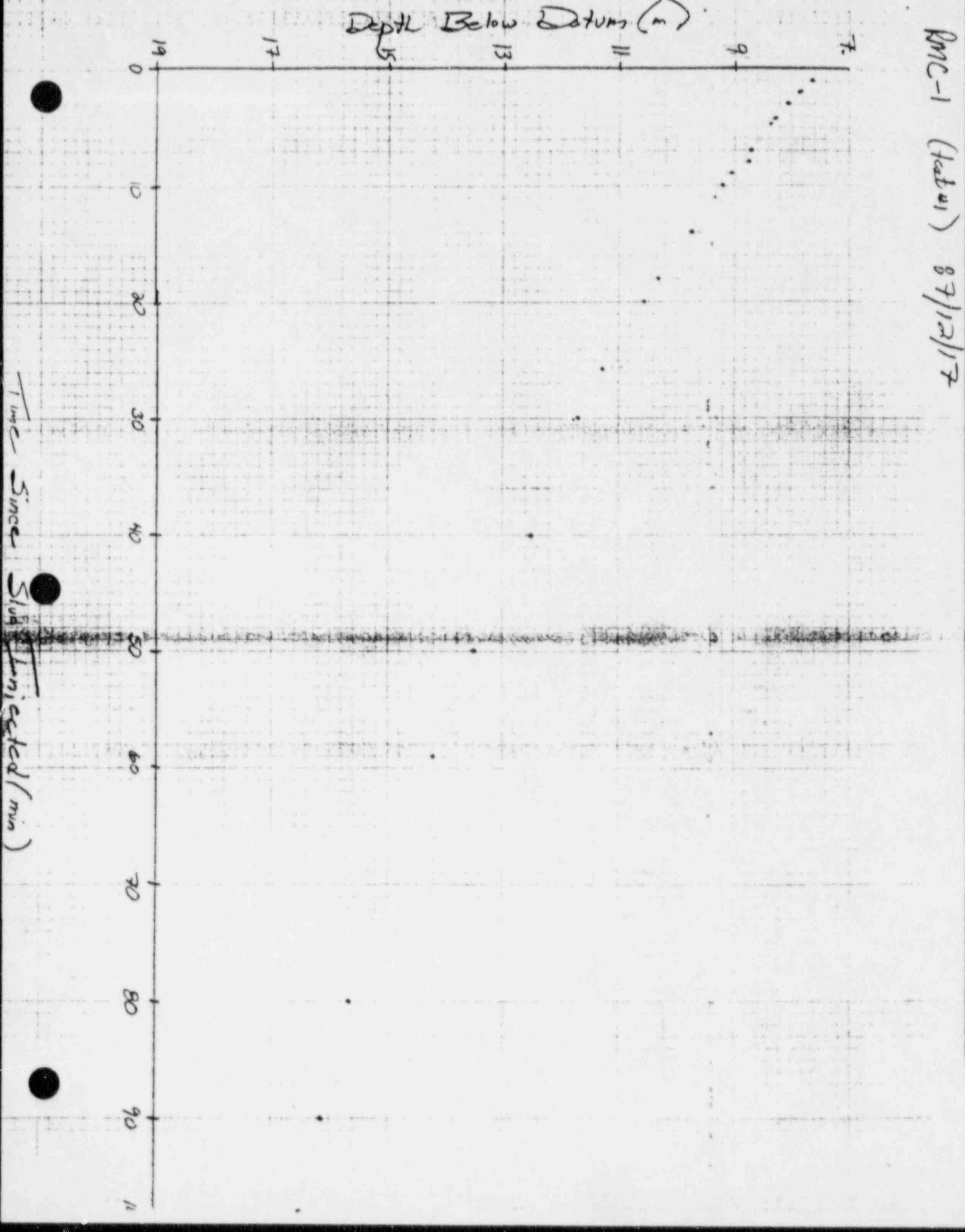
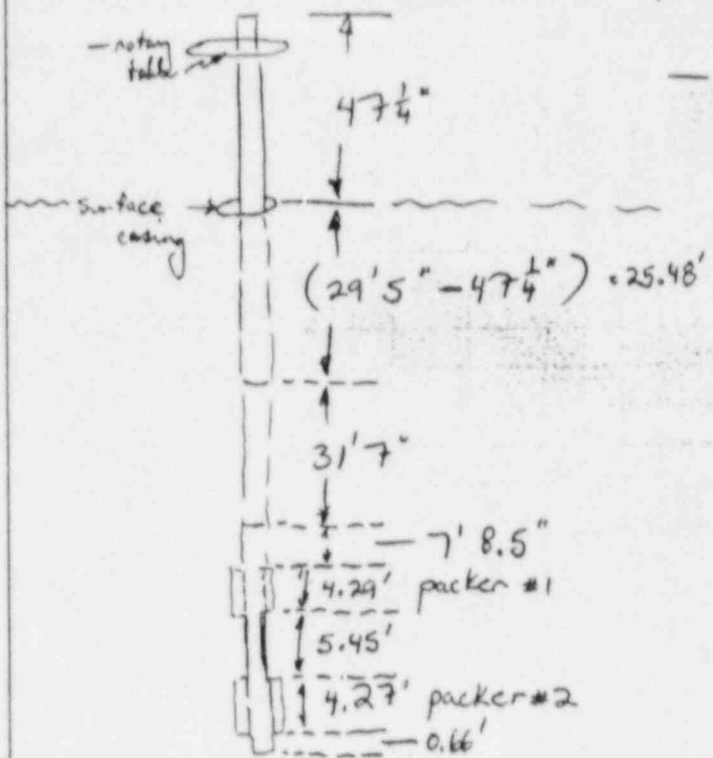
MADE IN U.S.A.

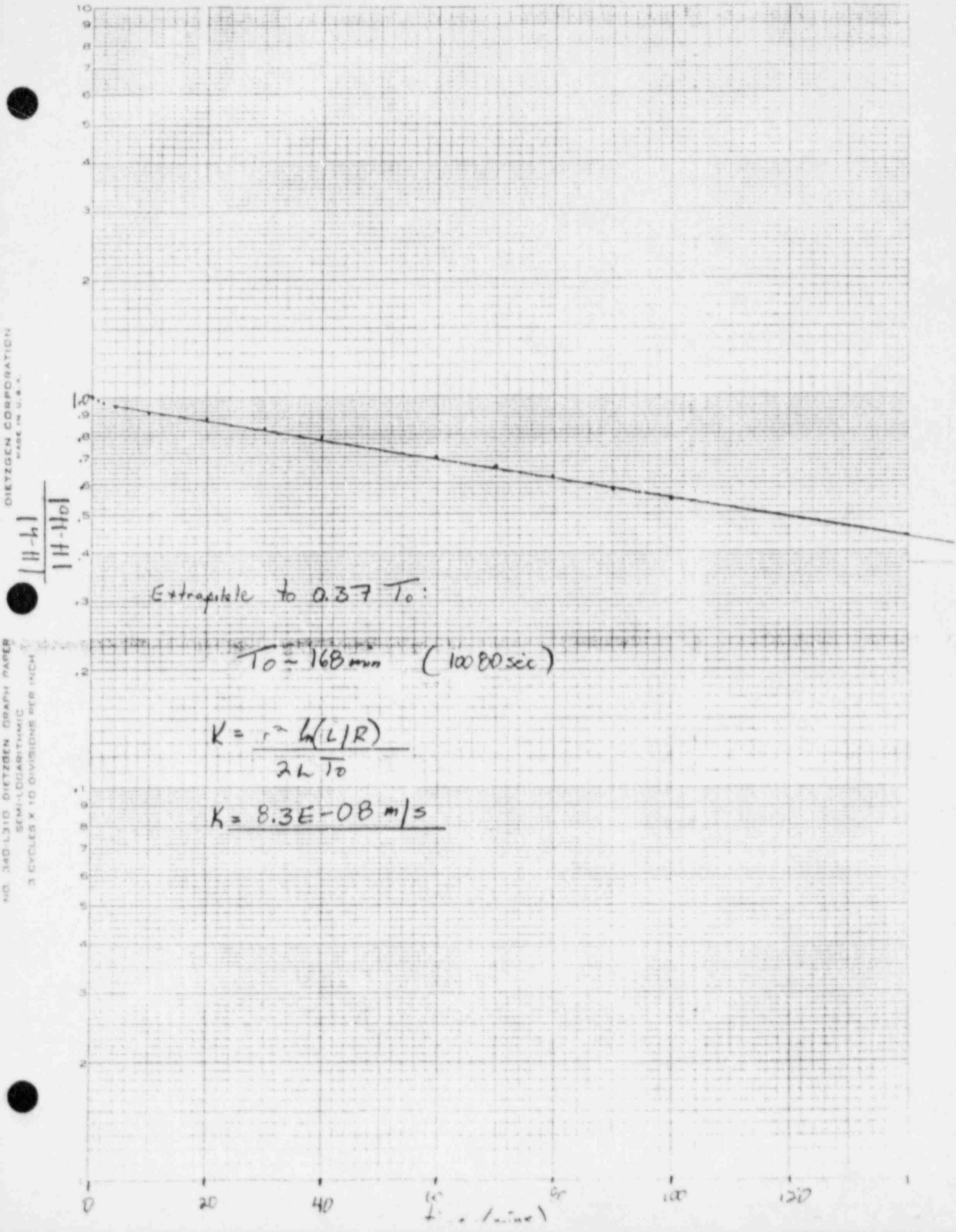



RMC-1 (test#1) 87/12/17
Depth Below Datum (m)
19
17
15
13
11
9
7
0
10
20
30
40
50
60
70
80
90
Time Since Slug Injected (min)

-Determine test #1 interval depth below top of casing 71.8D



- depth to bottom of packer #1 from top of casing = 69.06 ft.
- depth to top of packer #2 from top of casing = 74.51 ft.



|H-h| / |H-Ho|
Extrapolate to 0.37 To:
To ≈ 168 min (10080 sec)
K = r² ln(L/R) / 2L To
K = 8.3E-08 m/s
0
20
40
100
120
DIETZGEN CORPORATION
MADE IN U.S.A.
NO. 340-L310 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH

INTERA TECHNOLOGIES, INC.

Borehole: RMC-1

Test Designation: $ 82.8 D (85.48-80.03ft) (test #2)

Geology (formation/lithology):

CorePick from this Interval:
CorePick Designation:

Drilling Period:
From:
To:
Drilling Fluid:

Test Interval: (from top of casing)
Top: 80.03 ft
Bottom: 85.48 ft
Midpoint: 82.76 ft
Interval Length: 5.45 ft.

Borehole:
Average Diameter:

Packers:
Double packer inflation pressure ~~above annulus~~: 217 psig
Shut-in packer inflation pressure: ~225 psig

Datum Point Description: Top of tubing

Stick up from Ground Surface: ~3.94 ft from top of casing; 0.98 ft from top casing to ground surface.

Ground Surface Elevation: (above sea level)

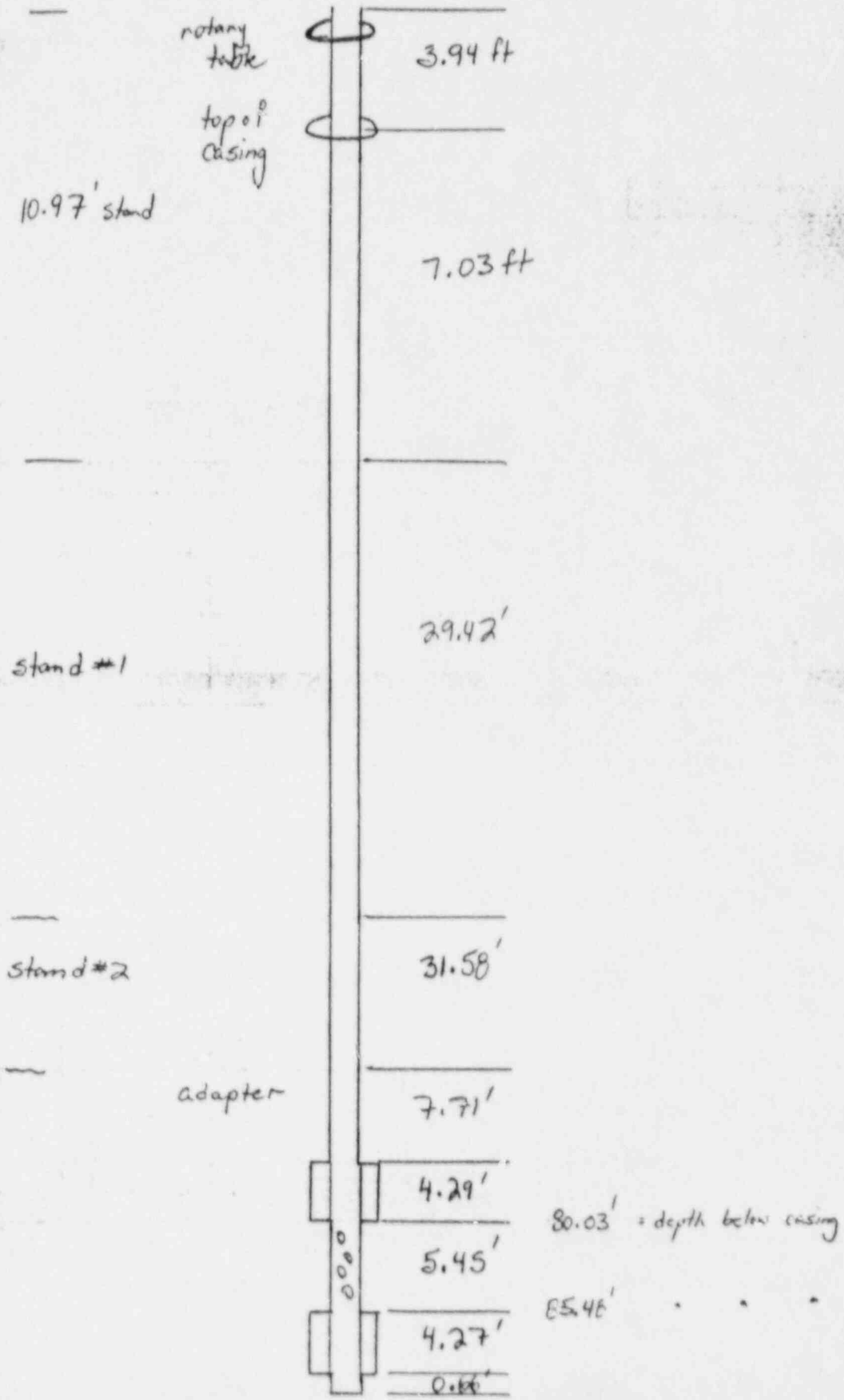
Tubing String:
Inside Diameter: 2 in.

Description of Packer in Tubing:
Top of Packer: 70 ft.
Bottom of Packer: 72.8 ft.
Tubing String ID: not applicable
Tubing String OD: " "

Static Fluid Level in Test Interval (below datum): 16.64 m
Static Fluid Level in Test Interval after minipacker inflation: 16.47 m

Static Fluid Level in Open Borehole below datum: 15.03 m
Magnitude of Slug: 5.4 m (16.47 - 11.07 m)

RMC-1 Slug Injection Test #2 82.8D



TESTING DATA:

Designation: - slug injection (test # 2)

Start Time: 11:50:00 on Dec. 18/87

Static Water Level for Test Interval: 16.64 m

Elapsed Time:	Water Level Below Datum:	Elapsed Time:	Water Level Below Datum:
	(see attached form)		

Testing Data:

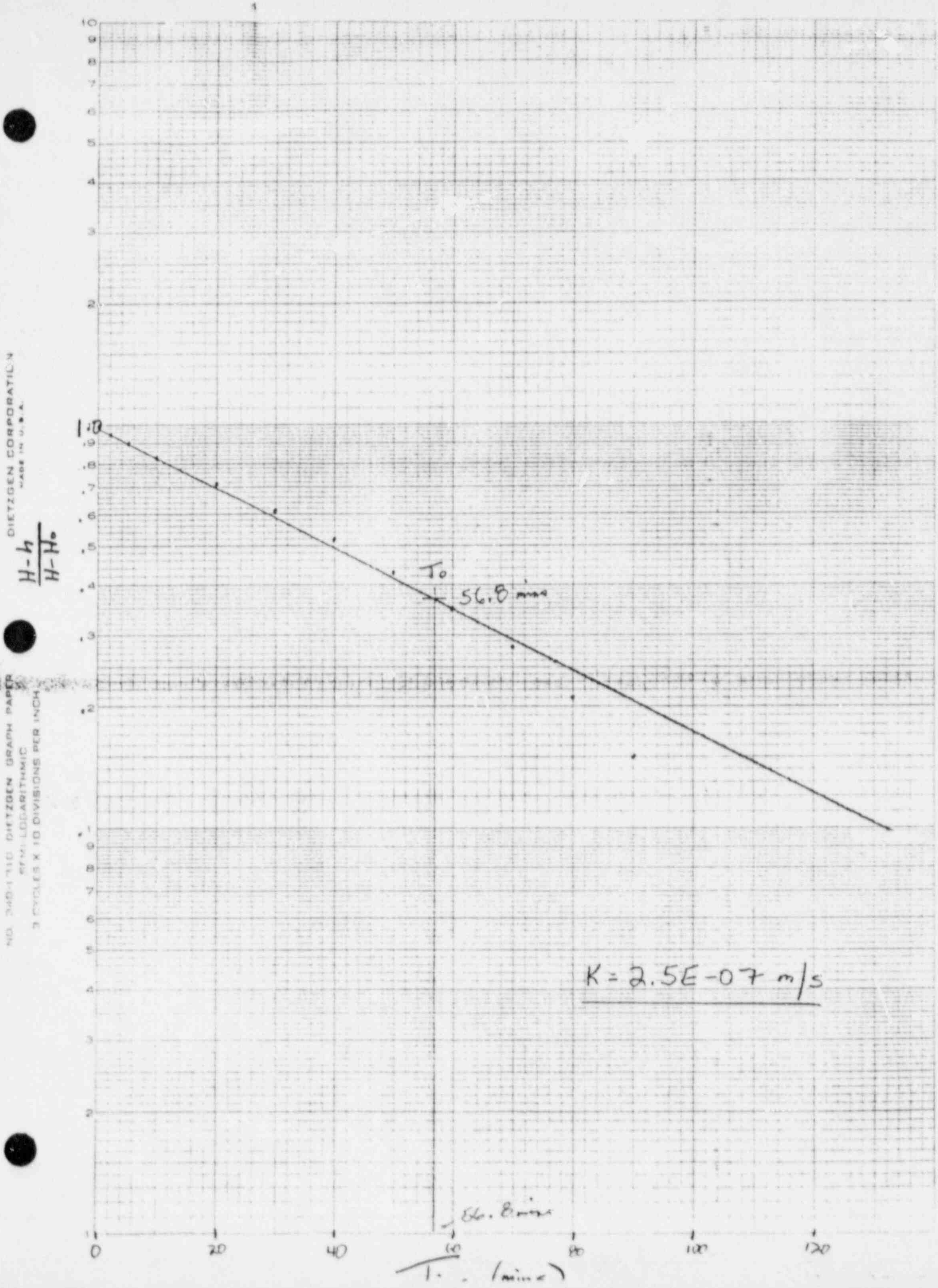
Designation: Si01

Start Time: 11:50:00

Static Water Level for Test Interval: 11.06 m

Elapsed Time:	(min)	Water Level Below Datum: (m)	$\left\lvert \frac{H-h}{H-H_0} \right\rvert$
30s	0.5	11.15 (m)	1.0
37s	0.62	11.24 "	
45s.	0.75	11.26 "	
51s	0.85	11.27 "	
60	1.0	11.28 "	0.98
1min 10 sec	1.17	11.29 "	
20s	1.33	11.30 "	
30s	1.50	11.31 "	
2 00s	2.0	11.32 "	0.97
2 45s	2.75	11.35 "	
3 00s	3.0	11.36 "	
3 30s	3.5	11.375 "	
4 00s	4.0	11.39 "	0.96
4 30s	4.5	11.405 "	
5 00s	5.0	11.42 "	
5 30s	5.5	11.435 "	
6 00s	6.0	11.45 "	0.95
7 00s	7.0	11.48 "	
8 00s	8.0	11.51 "	
9 00s	9.0	11.54 "	
10min 00 sec.	10.0	11.565	0.92
12 00 sec.	12.0	11.62	

Elapsed Time:		Water Level Below Datum (m)	$\left\lvert \frac{H-h}{H-H_0} \right\rvert$	ΔL
14:00	14.0	11.67		
17:00	17.0	11.75		
20:00	20.0	11.83	0.88	
25:00	25.0	11.[illegible]6		.13
30:00	30.0	12.09	0.83	.13
35:00	35.0	12.21		.12
40:00	40.0	12.33	0.79	.12
? ~~45:00~~	—	37		.04
? ~~50:00~~	—	40		.03
(12:50) 60:00	60.0	12.80	0.70	
1hr 10:00	70.0	13.01	0.66	.21
1hr 20:00	80.0	13.24	0.62	.23
1hr 30:00	90.0	13.43	0.58	.19
1hr 40:00	100.0	13.63	0.56	.20



$\frac{H-h}{H-H_o}$
To
56.8 min
K = 2.5E-07 m/s
56.8 min
T - (mins)
0
20
40
60
80
100
120
DIETZGEN CORPORATION
MADE IN U.S.A.
NO. 340-L310 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH

INTERA TECHNOLOGIES, INC.

Borehole: RMC-1

Test Designation: 94.0 D(91.28ft-96.73)(slug injection test#3)

Geology (formation/lithology): ____________________

CorePick from this Interval: ____________________
CorePick Designation: ____________________

Drilling Period:
From: ____________________
To: ____________________
Drilling Fluid: ____________________

Test Interval: (below top of casing)
Top: 91.28 ft.
Bottom: 96.73 ft.
Midpoint: 94.01 ft.
Interval Length: 5.45 ft.

Borehole:
Average Diameter: ____________________

Packers:
Double packer inflation pressure ~~above annulus~~: ~250 psig
Shut-in packer inflation pressure: ~250 psig

Datum Point Description: Top of tubing

Stick up from Ground Surface: 47¼ in. (top of tubing to top of surface casing)
11 ¾ in. (top of surface casing to ground surface)

Ground Surface Elevation: ________ (above sea level)

Tubing String:
Inside Diameter: 2 in

Description of Packer in Tubing:
Top of Packer: 80 ft.
Bottom of Packer: 82.8 ft
Tubing String ID: } not applicable; changed to wireline
Tubing String OD: }

Static Fluid Level in Test Interval (below datum): not available*
Static Fluid Level in Test Interval after minipacker inflation: 14.46 m

Static Fluid Level in Open Borehole below datum: not available.
Magnitude of Slug: (14.46m − 7.29m) = 7.17m

* measured 15.01 m (and dropping) before mini-packer ~~inflation~~ ~~and~~ insertion
" 14.62 m (and dropping) before mini packer inflation
" 14.46 m after mini packer inflation

INTERA TECHNOLOGIES, INC.

TESTING DATA:

Designation: 94.0D (test#3)

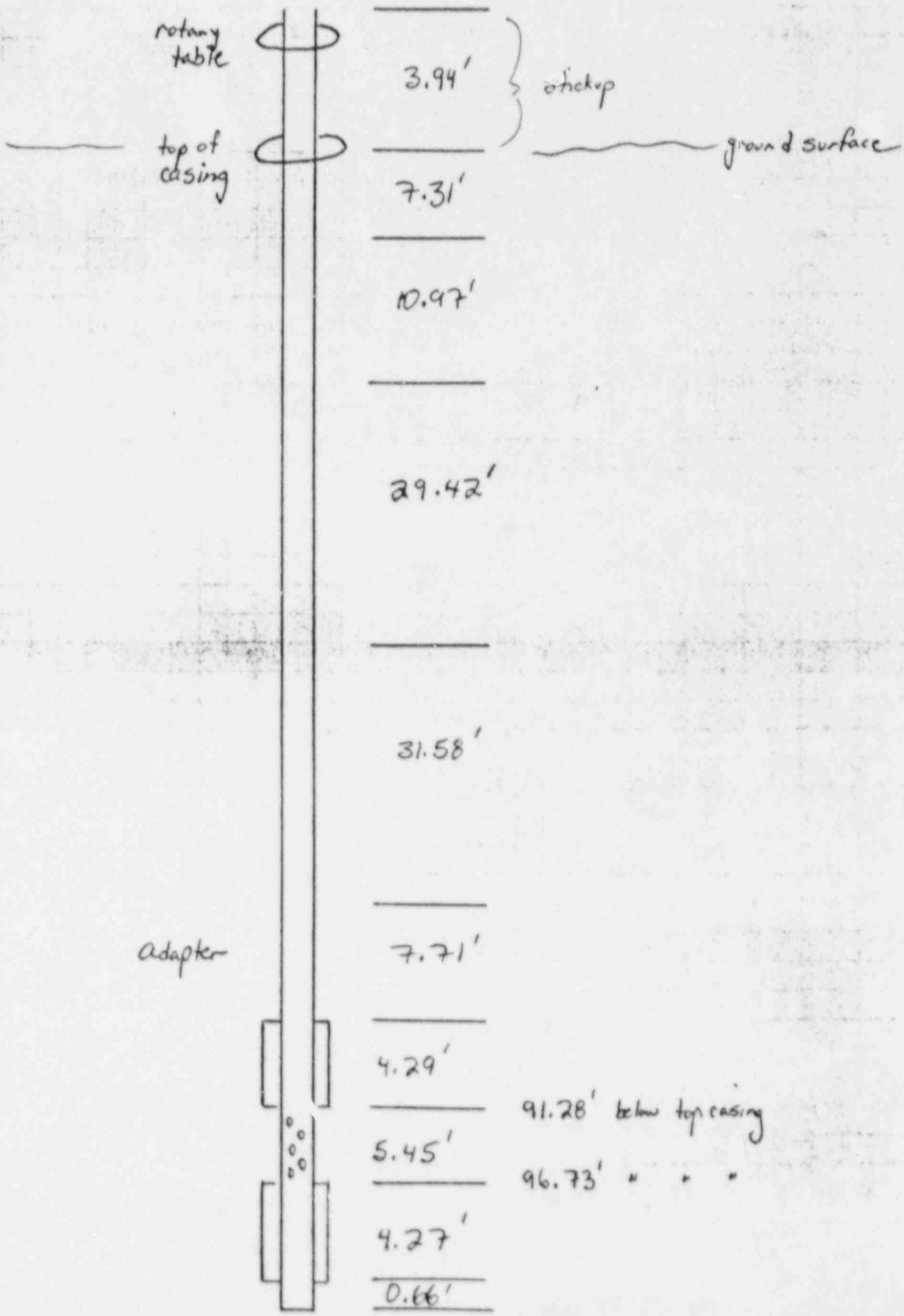
Start Time: 15:30:00

Static Water Level for Test Interval: 7.29 m

Elapsed Time: min	sec	Water Level Below Datum: m	$\frac{H-h}{H-H_o}$
0	18	7.38	1.0
0	31	7.54	
0	45	7.58	
1	00	7.62	
1	30	7.69	
2	00	7.75	0.95
2	30	7.81	
3	00	7.87	
3	30	7.93	
4	00	8.00	
4	30	8.06	
5	00	8.11	0.90
6	00	8.19	
7	00	8.30	
8	00	3.40	
9	00	8.49	
10	00	8.59	0.83
12	30	8.82	
15	00	9.05	
17	30	9.25	
20	00	9.45	0.71
25	00	9.84	
30	00	10.20	0.61

Elapsed Time: min	Sec	Water Level Below Datum:	$\frac{H-h}{H-H_o}$
35	00	10.56	
40	00	10.89	0.5
45	00	11.21	
50	00	11.52	0.4
57	00	11.92	
60	00	12.08	0.3
70	00	12.60	0.[illegible]
80	00	13.10	0.[illegible]
90	00	13.53	0.1

Slug Injection Test #3 94.0D



INTERA TECHNOLOGIES, INC.

Borehole: RMC-1

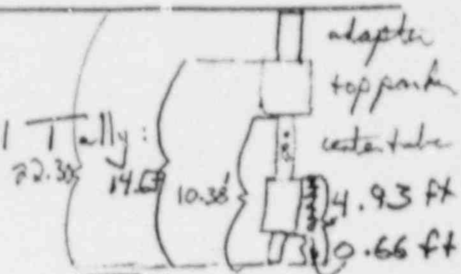
Test Designation: 102.9D (100.16 - 105.61 ft) (slug injection test 4) 87/12/19

Geology (formation/lithology): ____________

CorePick from this Interval: ____________
CorePick Designation: ____________

Drilling Period:
From: ____________
To: ____________
Drilling Fluid: ____________

Tool Tally:



Test Interval: (below top of casing)
Top: 100.16 ft
Bottom: 105.61 ft
Midpoint: 102.89 ft
Interval Length: 5.45'

Tubing Tally
Top Joint (#1) = 29.41 ft
Joint #2 = 31.60 ft
" #3 = 31.16 ft
Adapter = 7.63 ft
* the tool configuration was as used in test #1, 2, 3, 4.

Borehole:
Average Diameter: ____________

Packers:
Double packer inflation pressure ~~above annulus~~: 236 psig (total inflation pressure)
Shut-in packer inflation pressure: 238 psig

Datum Point Description: Top of tubing

Stick up from Ground Surface: 4' (top of tubing to top of surf. casing)

Ground Surface Elevation: ______ (above sea level)

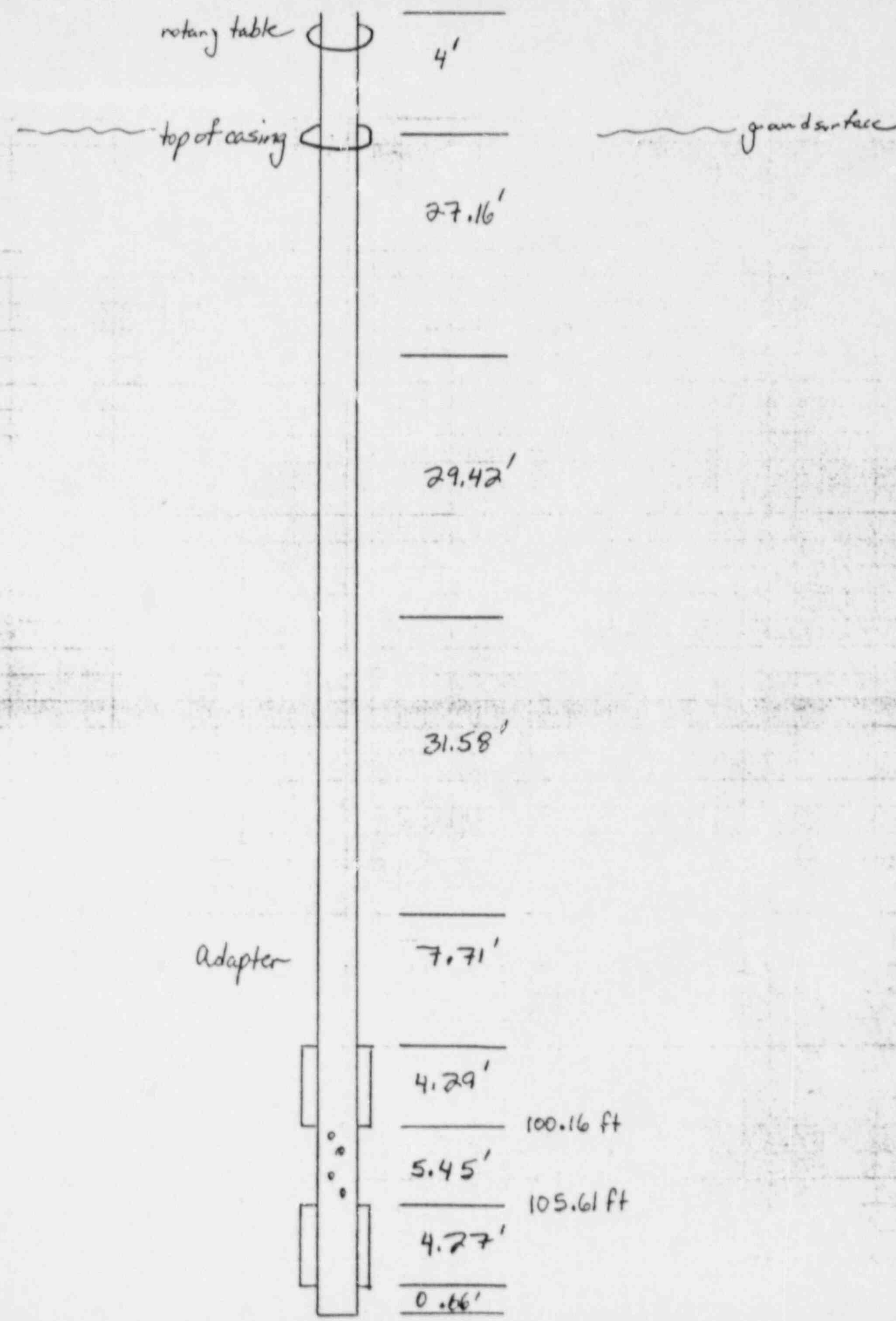
Tubing String:
Inside Diameter: 3/10 ft.

Description of Packer in Tubing:
Top of Packer: 90 ft below top of tubing
Bottom of Packer: 92.8 ft " " (mini packer 2.8 ft)
Tubing String ID: not applicable } wireline used w mini packer
Tubing String OD: " " "

Static Fluid Level in Test Interval (below datum): 19.85 m (and dropping)
Static Fluid Level in Test Interval after minipacker inflation: 19.77 m

Static Fluid Level in Open Borehole below datum: not available
Magnitude of Slug: (19.85 - 13.42 m)

* slugged annulus w 8 x 5 gal buckets -
waited ≈10 minutes; measured water level in tubing string @ 19.85 m and dropping
conclusion: no leakage around top packer



rotary table
4'
top of casing
ground surface
27.16'
29.42'
31.58'
Adapter
7.71'
4.29'
100.16 ft
5.45'
105.61 ft
4.77'
0.66'

INTERA TECHNOLOGIES, INC. H-H₀ = 19.85 - 13.42 = 6.43

TESTING DATA:

Designation: Si01 of 102.90 (slug test #4 - 87/12/19)

Start Time: 09:30:00

Static Water Level for Test Interval: (~) 19.85m (and dropping)

Elapsed Time: minutes	Water Level Below Datum: m (h)	H-h / H-H₀	Elapsed Time: minutes	Water Level Below Datum: m	
09:30:00	13.42m		9:00	15.11	
15s	13.44 m		9:30	15.18	
24s	13.61 m		10:00	15.23	0.72
30s	13.69 m		11:30	15.41	
35s	13.73		12:20	15.52	
45s	13.75		12:55	15.58	
50s	13.80		13:30	15.63	
55s	13.82		14:00	15.68	
60s	13.85		15:00	15.78	
1:15 min	13.90		16:00	15.86	
1:30	13.93		17:00	15.95	
2:00	14.03		17:30	16.00	
2:25	14.14		18:00	16.03	
2:50	14.22		19:00	16.10	
3:20	14.31		20:00	16.18	0.5
4:00	14.39		22:10	16.32	
5:00	14.55	0.82	24:00	16.45	
5:30	14.64		26:10	16.57	
6:00	14.72		28:00	16.69	
6:30	14.78		30:00	16.81	
7:00	14.84		35:00	17.07	
7:30	14.92		40:00	17.31	0.40
8:30	15.05		45:00	17.53	0.3

as of 84 mins #11 JL 1st min's OK

INTERA TECHNOLOGIES, INC.

TESTING DATA: RMC-1

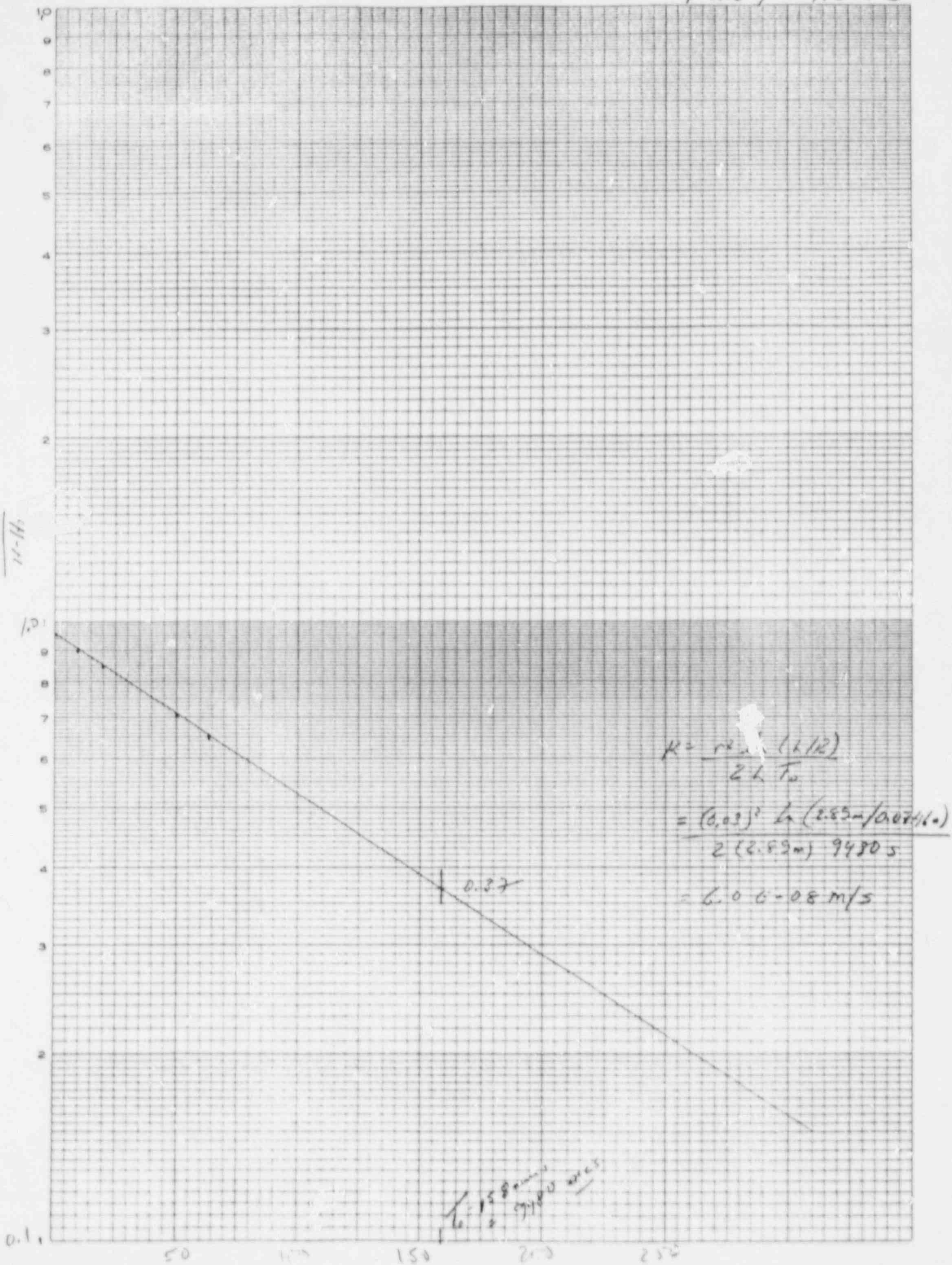
Designation: 5:01 (slugtest#4 - 87/12/19) 102.9D

Start Time: 09:30:00

Static Water Level for Test Interval: (~) 19.85m (and dropping)

Elapsed Time: minutes	Water Level Below Datum: M	Elapsed Time: minutes	Water Level Below Datum: (m)
50:00	17.74		
55:00	17.91		
60:00	18.08		
1hr 05:00	18.25		
1hr 10:00	18.37		
1hr 20:00	18.62		
1hr 30:00	18.63		

Rmc-1 110.80



K = r² ln (L/R) / 2 L T₀
= (0.03)² ln (2.83m/0.0746m) / 2 (2.83m) 9480 s
= 6.0 E-08 m/s
0.37
T₀ = 158 min = 9480 secs
H-h / H-H₀
0.1
1.0
50
100
150
200
250
T

INTERA TECHNOLOGIES, INC.

Borehole: RMC-1 87/12/19

Test Designation: 110.8D (slug injection test #5)

Geology (formation/lithology): ______

CorePick from this Interval: ______
CorePick Designation: ______

Drilling Period:
From: ______
To: ______
Drilling Fluid: ______

Test Interval: (below top of casing)
Top: 106.03 ft
Bottom: 115.52 ft
Midpoint: 110.78 ft
Interval Length: 9.49 ft

Borehole:
Average Diameter: ______

Packers:
Double packer inflation pressure ~~above annulus~~: 250 psig ~~(total)~~
Shut-in packer inflation pressure: 230 psig

Datum Point Description: top of tubing

Stick up from Ground Surface: 1.23 m

Ground Surface Elevation: ______ (above sea level)

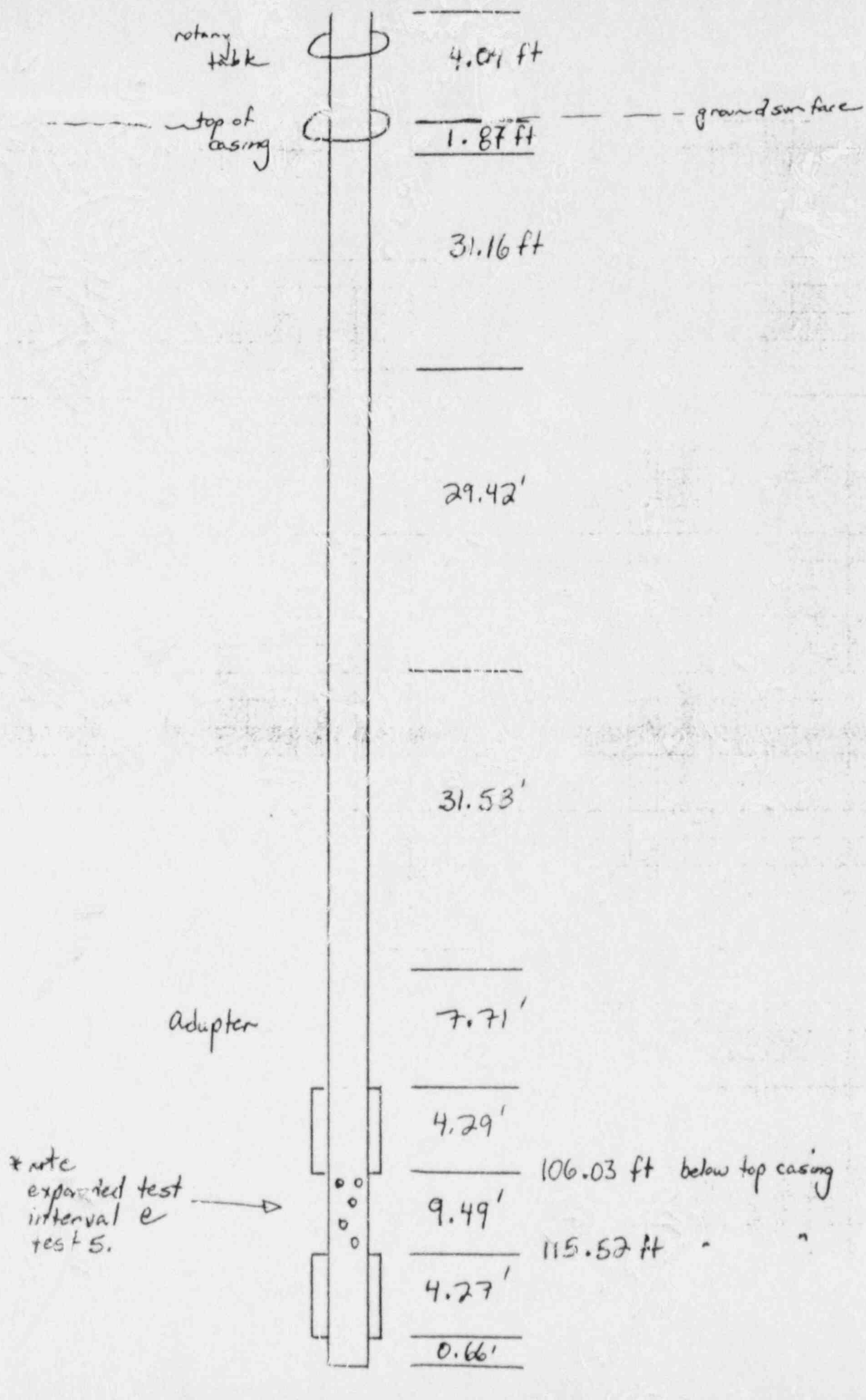
Tubing String:
Inside Diameter: 2.0 in.

Description of Packer in Tubing:
Top of Packer: 100 ft (below top of tubing)
Bottom of Packer: 102.8 ft " "
Tubing String ID: } not applicable
Tubing String OD: }

Static Fluid Level in Test Interval (below datum). 15.28 m
Static Fluid Level in Test Interval after minipacker inflation: not available

Static Fluid Level in Open Borehole below datum: not available
Magnitude of Slug: ~5.41 m

* added 5' stand 5.9'
* added 7 x 5 gal. pails to annulus and measured test interval pressure over 10 minutes, maintained 15.32 m


rotary table
4.04 ft
top of casing
ground surface
1.87 ft
31.16 ft
29.42'
31.53'
adapter
7.71'
4.29'
106.03 ft below top casing
* note expanded test interval @ test 5.
9.49'
115.52 ft " "
4.27'
0.66'

TESTING DATA: RMC-1 87/12/19

Designation: (slug injection test #5)

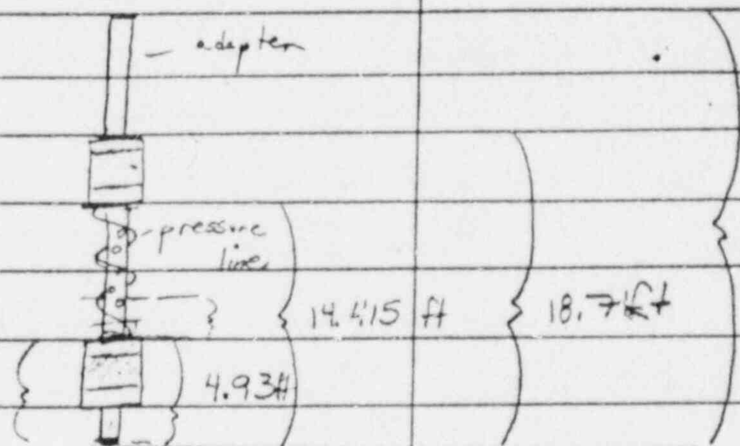
Start Time:

Static Water Level for Test Interval:

Elapsed Time:	Water Level Below Datum:	Elapsed Time:	Water Level Below Datum:

Test Tool tally:

note: this fills the tubing in lower packer during testing.



Positioning Test Tool: (for ½ foot overlap on test #4 zone)

test 4 - 28.41' stand 1

31.60' " 2

31.16' " 3

7.63' adapter

14.01' top of top packer to bottom of lower packer

113.81 ft

stickup - 4.0 ft

109.81 ft bottom of lower packer below top of casing

length of packer - 4.30 ft

105.51 ft bottom of test interval below " "

- 4.30 ft

101.21 ft

say 101.00 ft for .21' overlap

+18.71 ft

119.71 ft to bottom of tool (nipple) for 0.21' overlap on test 4.

TESTING DATA:

Designation: 110.8D slug injection test #5 (cont'd) $H - H_0 = 15.28 - 9.87 = 5.41$

Start Time: 15:50:00

Static Water Level for Test Interval: 15.28 m

Elapsed Time: minutes	Water Level Below Datum: m	Elapsed Time: minutes	Water Level Below Datum: m
0	9.87 m		
9 s	9.93	7:06	10.31
13 s	9.98	7:12	10.32
22 s	10.12	8:00	10.34
1:00 s	10.13	8:30	10.35
1:10 s	10.13	9:00	10.37
1:20 s	10.14	9:30	10.38
1:45 s	10.15	10:00	10.39 0.90
1:58 s	10.17	10:30	10.41
2:36	10.19	11:00	10.42
2:45	10.20	11:30	10.44
2:53	10.20	12:00	10.45
3:30	10.21	13:00	10.48
3:47	10.22	14:00	10.50
4:00	10.23	15:00	10.53
4:10	10.23	16:00	10.56
4:30	10.24	17:00	10.59
4:47	10.25	18:00	10.62
5:11	10.26	19:00	10.64
5:28	10.27	20:00	10.67 0.8:
6:05	10.28	22:00	10.72
6:13	10.29	24:00	10.77
6:35	10.30	26:00	10.83

INTERA TECHNOLOGIES, INC.

TESTING DATA:

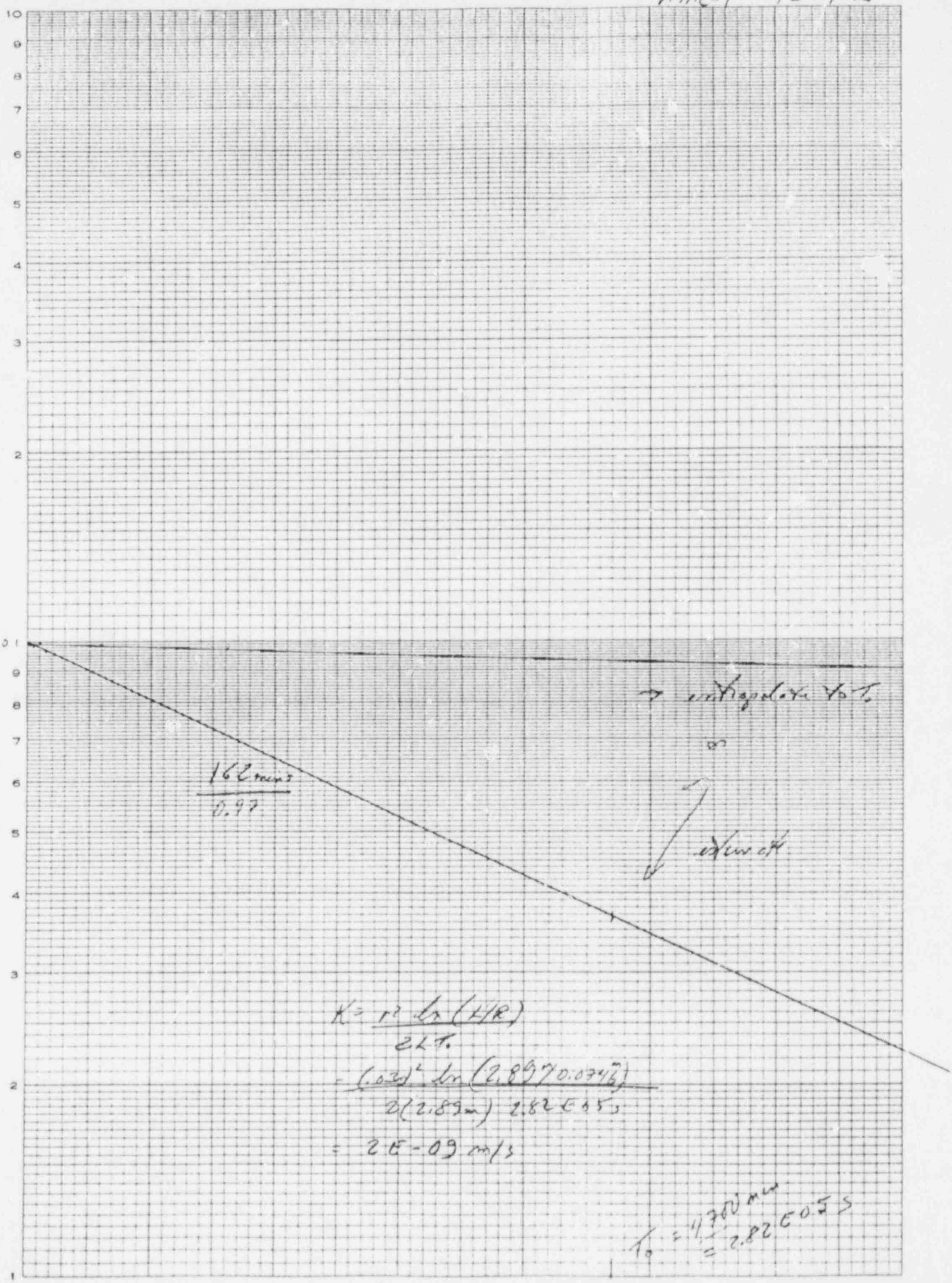
Designation: 110.8D slug injection test#5 87/12/19

Start Time: 15:50:00

Static Water Level for Test Interval:

Elapsed Time: minutes	Water Level Below Datum: m		Elapsed Time: minutes	Water Level Below Datum: m
30:00				
(36:30) 36:30	1.12			
40:00				
46:00	11.35			
50:00	11.46	0.71		
55:00				
60:00				
1hr 04:00	11.77	0.65		

RMC-1 120.1 II



1.0
162 mins
0.97
→ extrapolate to T_0
∞
estimate
$K = \frac{r^2 \ln(L/R)}{2LT_0}$
$= \frac{(.03)^2 \ln(2.89/0.0345)}{2(2.89m)\ 2.82E05s}$
$= 2E-09$ m/s
$T_0 = 4700$ min $= 2.82E05$ s

INTERA TECHNOLOGIES, INC.

Borehole: RMC-1

Test Designation: 120.1D test #6

Geology (formation/lithology): ______

CorePick from this Interval: ______
CorePick Designation: ______

Drilling Period:
From: ______
To: ______
Drilling Fluid: ______

Test Interval: (from top of casing)
Top: 115.38 ft
Bottom: 124.87 ft.
Midpoint: 120.13 ft
Interval Length: 9.49 ft

Borehole:
Average Diameter: ______

Packers:
Double packer inflation pressure ~~above annulus~~: 240 psig
Shut-in packer inflation pressure: ______

Datum Point Description: top of tubing

Stick up from Ground Surface: 5.1' from top casing to top tubing;

Ground Surface Elevation: ______ (above sea level)

Tubing String:
Inside Diameter: 2/10 ft.

Description of Packer in Tubing:
Top of Packer: 100 ft (from top of tubing)
Bottom of Packer: 102.8 ft.
Tubing String ID: } not applicable
Tubing String OD: }

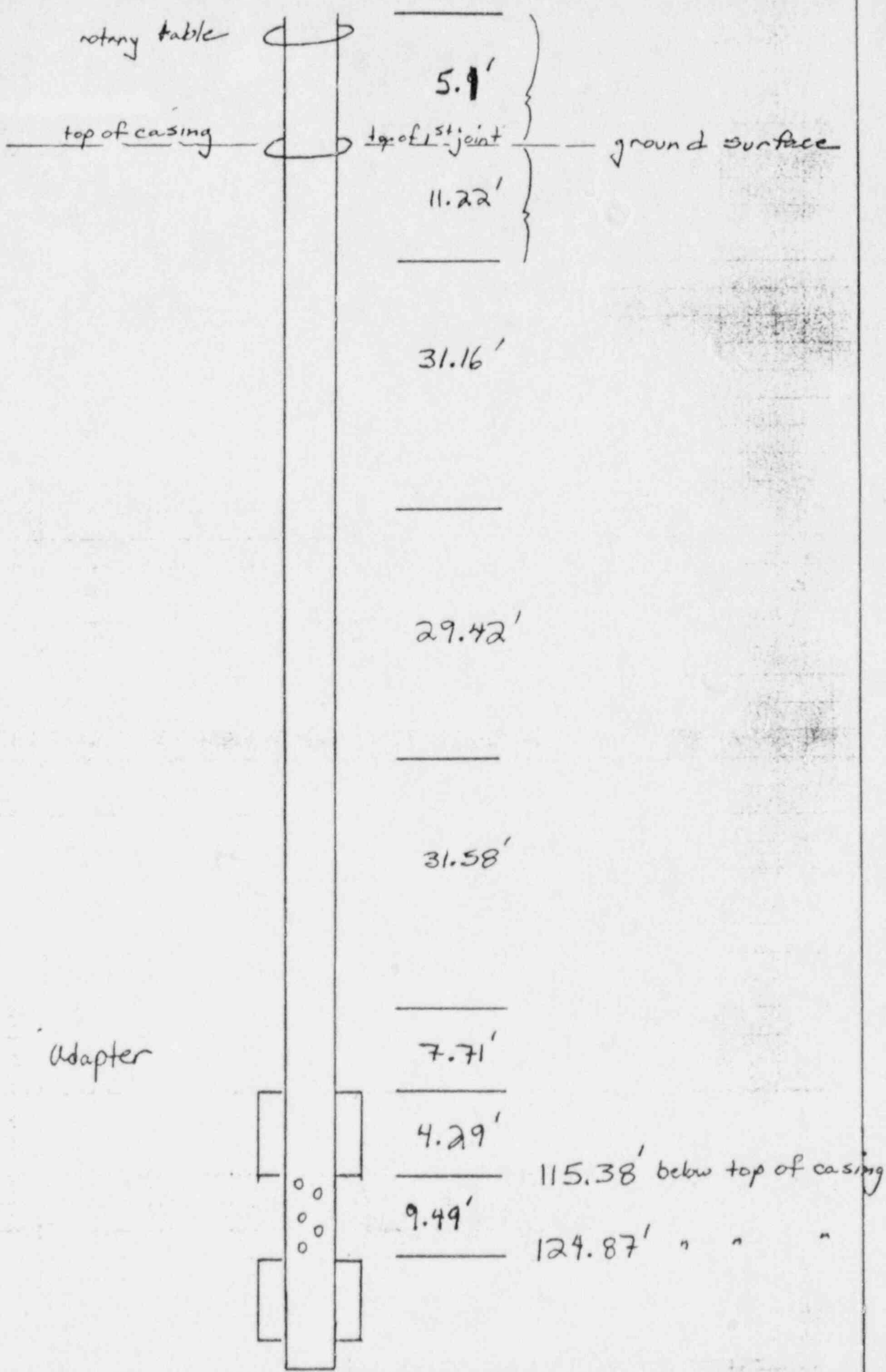
Static Fluid Level in Test Interval (below datum): 14.68 m * after 14 hrs static
Static Fluid Level in Test Interval after minipacker inflation: 14.43 m

Static Fluid Level in Open Borehole below datum: not available
Magnitude of Slug: (14.43 - 4.90 m) 9.53 m

* added: 11.22' stand

* slugged annulus w/ 7 x 5 gal. water; checked tubing string fluid level –
1 min 14.67 m
5 min 14.66 m
10 min 14.65 m

* [illegible] ID 6


rotary table
5.9'
top of casing
top of 1st joint
ground surface
11.22'
31.16'
29.42'
31.58'
Adapter
7.71'
4.29'
115.38' below top of casing
9.49'
124.87' " " "

INTERA TECHNOLOGIES, INC.

TESTING DATA:

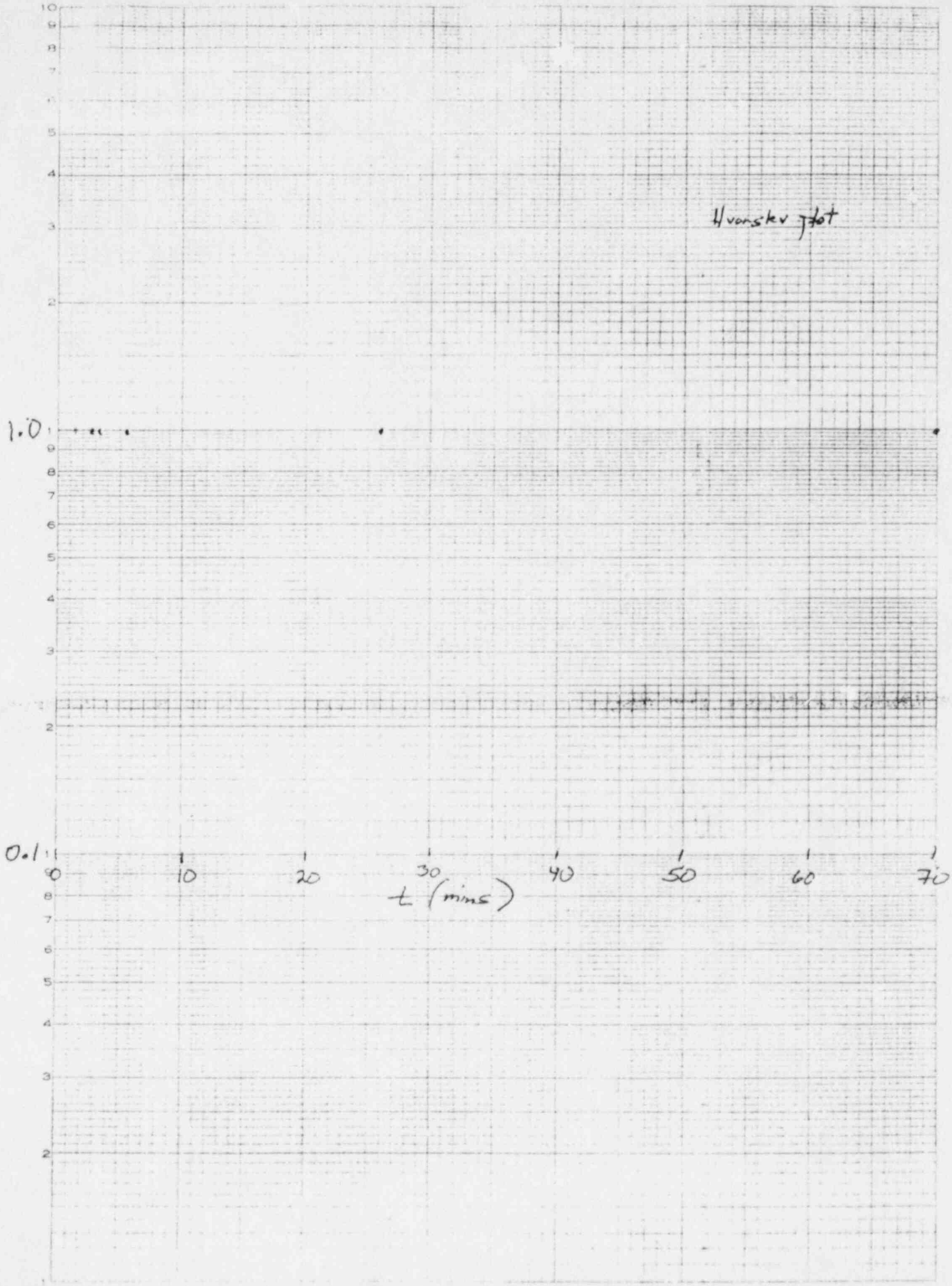
Designation: 120.1D test#6 R C-1

Start Time: 9:35:00

Static Water Level for Test Interval: 14.68m

	Elapsed Time: minutes	Water Level Below Datum: m	$\frac{H-h}{H-H_0}$	
0.13	8s	4.90		effects of minipacker deflation
0.37	22s	5.16		
0.57	34s	5.17		
0.66	40s	5.18		
0.82	49s	5.18		
0.95	57	5.18		
1.4	1m 24s	5.16	1.0	
1.5	1min 30s	5.16	1.0	
1.75	1min 45s	5.16	1.0	
2.08	2 05s	5.16	1.0	
2.57	2 34s	5.16	1.0	
2.83	2 50s	5.16	1.0	
3.17	3 10s	5.17	0.999	
3.5	3 30s	5.17	"	
4.5	4 30s	5.17	"	
5.5	5 30s	5.17	"	
6.5	6 30s	5.18	0.998	
7.5	7 30s	5.18	"	
9.	9 00s	5.18	"	
10.5	10 30s	5.19	0.997	
12	12 00s	5.19	"	
15	15 00s	5.20	0.996	
25	25min 00	5.22	0.994	

Elapsed Time: minutes	Water Level Below Datum: m	
36min 00s	5.24	0.99
45 min 00s	5.25	0.991
56 min 00s	5.27	0.98
65 min 00s	5.28	0.98
1hr 16min 00s	5.30	0.98
1hr 30min 00s	5.31	
2h 42 00s	5.45	0.97


Hvorslev plot
1.0
0.1
0
10
20
30
40
50
60
70
t (mins)

INTERA TECHNOLOGIES, INC. K: $\leq 10^{-9}$ m/s

Borehole: RMC-1

Test Designation: 133.0D (test #7)

Geology (formation/lithology): ______

CorePick from this Interval: ______
CorePick Designation: ______

Drilling Period:
From: ______
To: ______
Drilling Fluid: ______

Test Interval: (from top of casing)
Top: 124.68 ft
Bottom: 141.25 ft
Midpoint: 132.97 ft
Interval Length: 16.57 ft.

Borehole:
Average Diameter: ______

Packers:
Double packer inflation pressure ~~above annulus~~: 250 psig
Shut-in packer inflation pressure: 250 psig

Datum Point Description: Top of tubing

Stick up from Ground Surface: 6.7 ft. above top of casing

Ground Surface Elevation: ______ (above sea level)

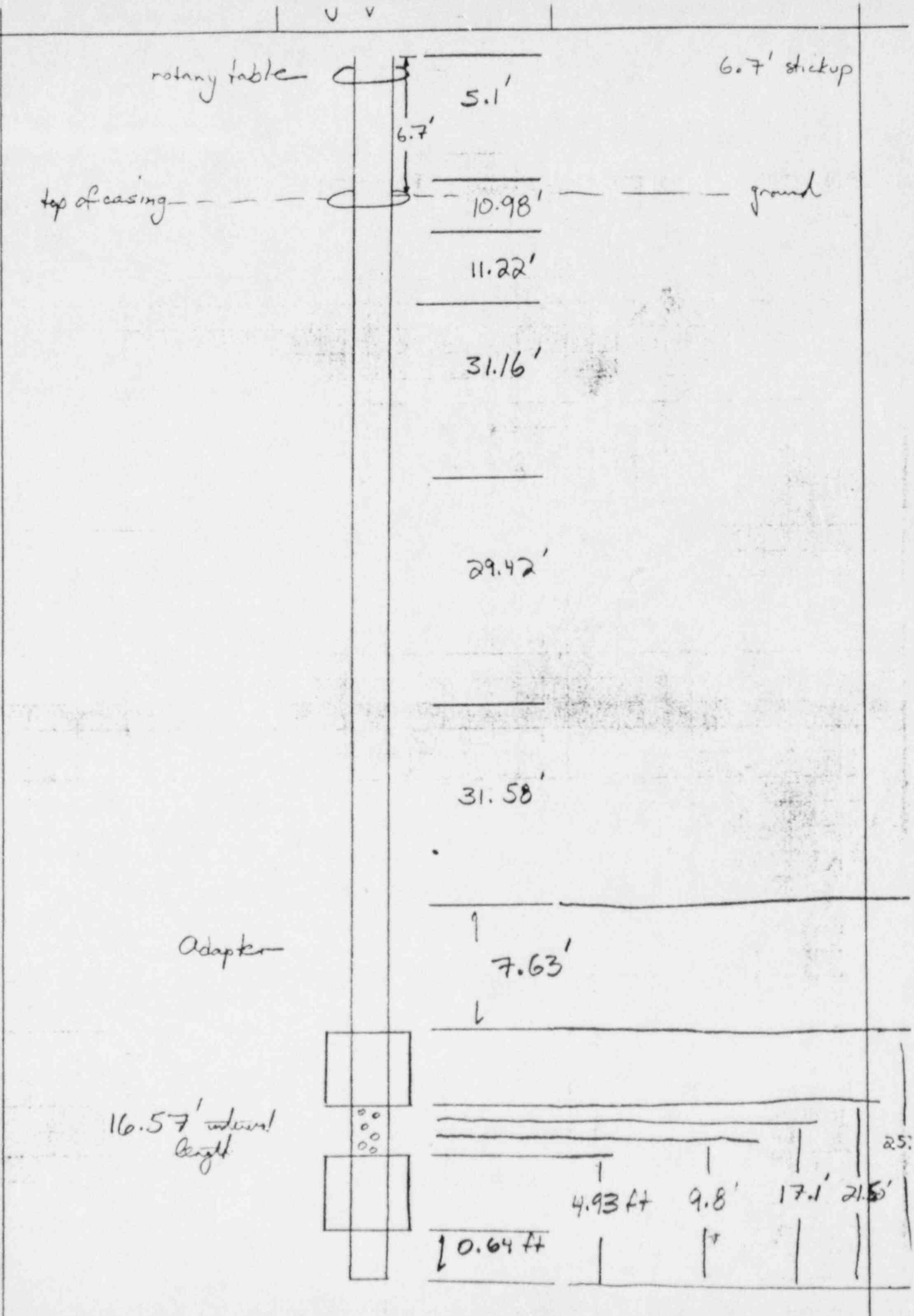
Tubing String:
Inside Diameter: 2/10 ft.

Description of Packer in Tubing: (from top of tubing)
Top of Packer: 100. ft
Bottom of Packer: 102.5 ft
Tubing String ID: } not applicable
Tubing String OD: }

Static Fluid Level in Test Interval (below datum): 14.23 m (after [illegible] following packer installation)
Static Fluid Level in Test Interval after minipacker inflation: 14.10 m

Static Fluid Level in Open Borehole below datum: not available
Magnitude of Slug: (14.10 m − 5.89 m)

• slugged interval with ~7.85 gallons of fresh water; checked test interval fluid level; after 5 minutes 14.21 m
[illegible] minutes 14.21 m
15 minutes 14.21 m


U V
rotary table
6.7' stickup
5.1'
6.7'
top of casing
ground
10.98'
11.22'
31.16'
29.42'
31.58'
Adapter
7.63'
16.57' interval length
4.93 ft
9.8'
17.1'
21.5'
0.64 ft

INTERA TECHNOLOGIES, INC.

TESTING DATA: [illegible]

8.07

Designation: 133.0D (test #7)

Start Time: 15:45:00

Static Water Level for Test Interval: 14.23 m (below tubing)

Elapsed Time: min	Water Level Below Datum: m		Elapsed Time: min	Water Level Below Datum: m
15s	6.065	} min. piston deflation		
25s	6.11			
50	6.14			
1 min 0s	6.14			
1 min 25s	6.15			
1 min 50s	6.16			
2 min 00s	6.16			
2 " 30s	6.16			
3 " 00s	6.16			
3 " 30s	6.16			
4 " 30s	6.16			
6 " 00s	6.16			
7 " 00s	6.16			
8 " 00s	6.16			
9 " 00s	6.16			
10 " 00s	6.16			
12 " 00s	6.16			
15 " 00s	6.16			
24 " 30s	6.16			
31 " 00s	6.18			
40 " 00s	6.19			
45 " 00s	6.20	0.995		

X = CC-03n-

INTERA TECHNOLOGIES, INC.

Borehole: RMC-1

Test Designation: 149.3D (test#8) slug injection

Geology (formation/lithology): ______

CorePick from this Interval: ______
CorePick Designation: ______

Drilling Period:
From: ______
To: ______
Drilling Fluid: ______

Test Interval:
Top: 141 ft
Bottom: 157.57 ft
Midpoint: 149.29 ft
Interval Length: 16.57 ft.

Borehole:
Average Diameter: 5⅞"

Packers:
Double packer inflation pressure ~~above annulus~~: 260 psig
Shut-in packer inflation pressure: 250 psig.

Datum Point Description: Top of tubing

Stick up from Ground Surface: 5.06 ft above top of casing;

Ground Surface Elevation: ______ (above sea level)

Tubing String:
Inside Diameter: 2/10 ft.

Description of Packer in Tubing:
Top of Packer: 110 ft
Bottom of Packer: 112.8 ft.
Tubing String ID: } not applicable
Tubing String OD: } "

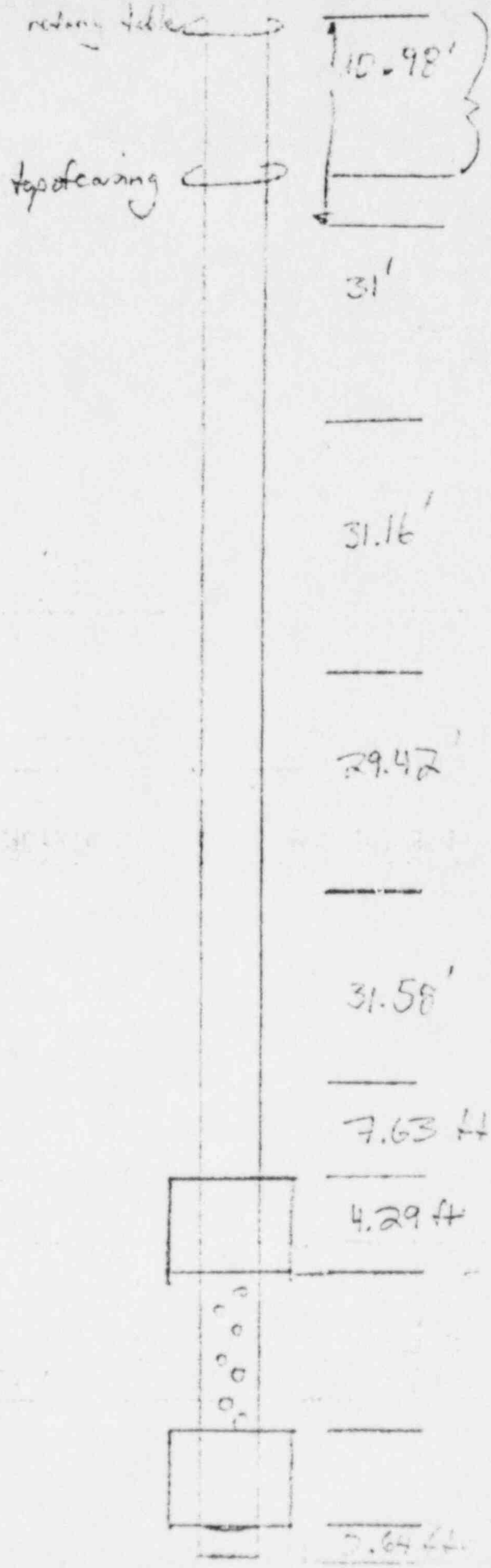
Static Fluid Level in Test Interval (below datum): 13.42 m
Static Fluid Level in Test Interval after minipacker inflation: 13.23 m

Static Fluid Level in Open Borehole below datum: not available
Magnitude of Slug: (13.23 m - 5.12 m)
= 8.11 m

@ added 7.x 5gal slug to annulus; checked tubing level
@ 1 min 13.42 m
5 min 13.43
... 13.43 ... 15 min 13.44 m

149.31'

141.20'



146.06'
141.00'
5.06' stickup

INTERA TECHNOLOGIES, INC.

TESTING DATA: RMC-1

Designation: 149.31?

Start Time: 10:45:00

Static Water Level for Test Interval: 13.42 m

Elapsed Time: min	Water Level Below Datum: m	Elapsed Time: min	Water Level Below Datum: m
0 s	5.31	13 min 00 s	5.44
25 s	5.35	14 00 s	5.44
30 s	5.36	15 00 s	5.44
40 s	5.36	20 00 s	5.44
60 s	5.37	25 00 s	5.44
1 min 30 s	5.39	30 00 s	5.44
1 45 s	5.40	40 00 s	5.45
2 00 s	5.40	50 00 s	5.45
2 15 s	—	60 00 s	5.45 0.984
2 30 s	5.41		
3 00 s	5.42		
3 30 s	5.42		
4 00 s	5.43		
4 30 s	5.43		
5 00 s	5.43		
5 30 s	5.43		
6 00 s	5.44		
7 00 s	5.44		
8 00 s	5.44		
9 00 s	5.44		
10 00 s	5.44		
11 00 s	5.44		
12 00 s	5.44		

K = ((--0)m/s

INTERA TECHNOLOGIES, INC.

Borehole: RMC-1

Test Designation: 161.4 D (test#4)

Geology (formation/lithology): ______

CorePick from this Interval: ______
CorePick Designation: ______

Drilling Period:
From: ______
To: ______
Drilling Fluid: ______

Test Interval: (below top of casing)
Top: 153.08ft
Bottom: 169.65 ft
Midpoint: 161.37ft
Interval Length: 16.57ft

Borehole:
Average Diameter: drilled 5 7/8

Packers:
Double packer inflation pressure ~~above annulus~~: 270 psig
Shut-in packer inflation pressure: 250psig

Datum Point Description: top of tubing

Stick up from Ground Surface: 4.95 ft

Ground Surface Elevation: ______ (above sea level)

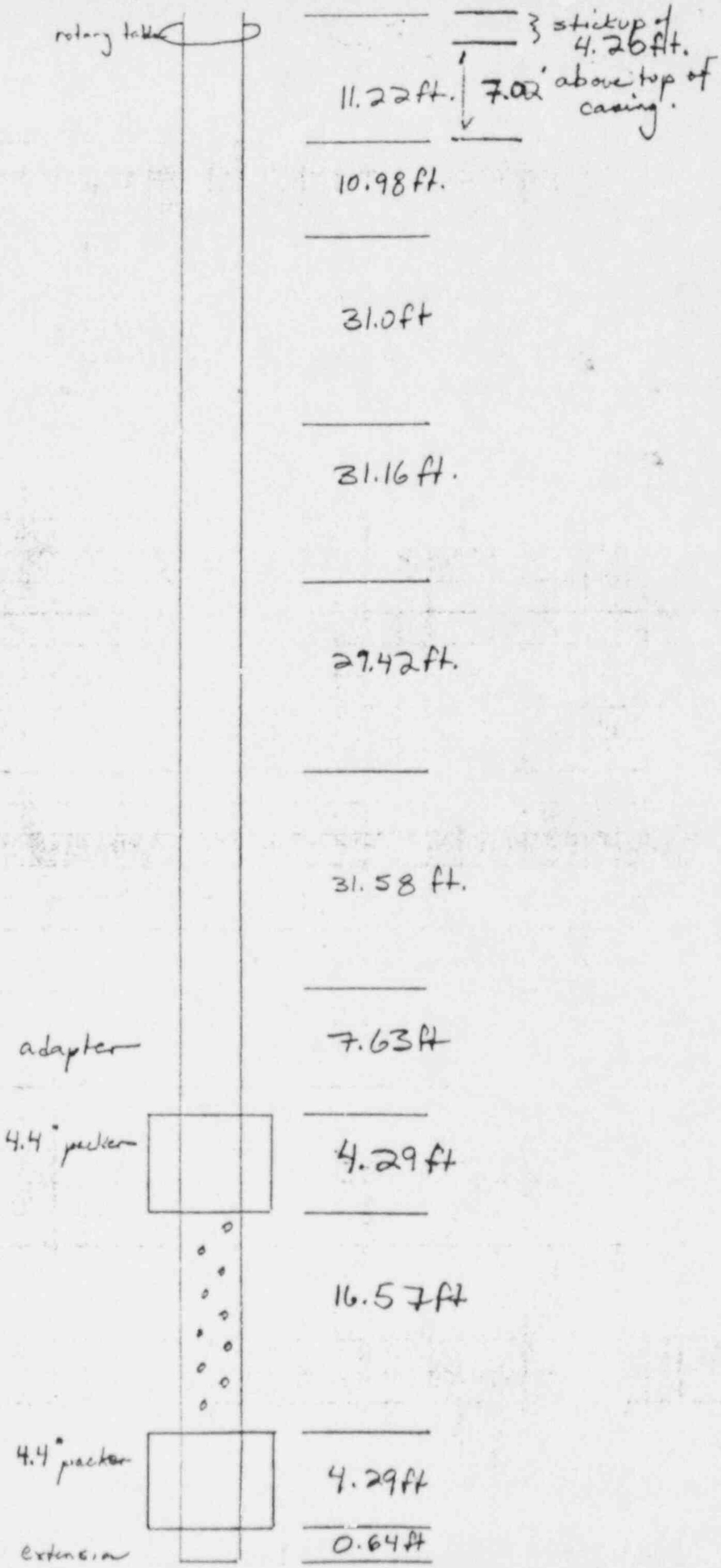
Tubing String:
Inside Diameter: 2/10 ft.

Description of Packer in Tubing:
Top of Packer: 110ft
Bottom of Packer: 112.8ft.
Tubing String ID: 2 not applicable - used wireline
Tubing String OD: 3 "

Static Fluid Level in Test Interval (below datum): 13.38 m * meas. 15 - after packer inflation
Static Fluid Level in Test Interval after minipacker inflation: 13.15 m * after 10 minutes following inflation

Static Fluid Level in Open Borehole below datum: not available
Magnitude of Slug: (13.15m - 5.1m) 8.05 m

* Slug made with 7x 5gal freshwater; measured after 1 min - 13.37 m, 10 min - 13.37 m



rotary table
stickup of 4.26 ft.
11.22 ft.
7.02' above top of casing.
10.98 ft.
31.0 ft
31.16 ft.
29.42 ft.
31.58 ft.
adapter
7.63 ft
4.4" packer
4.29 ft
16.57 ft
4.4" packer
4.29 ft
extension
0.64 ft

INTERA TECHNOLOGIES, INC.

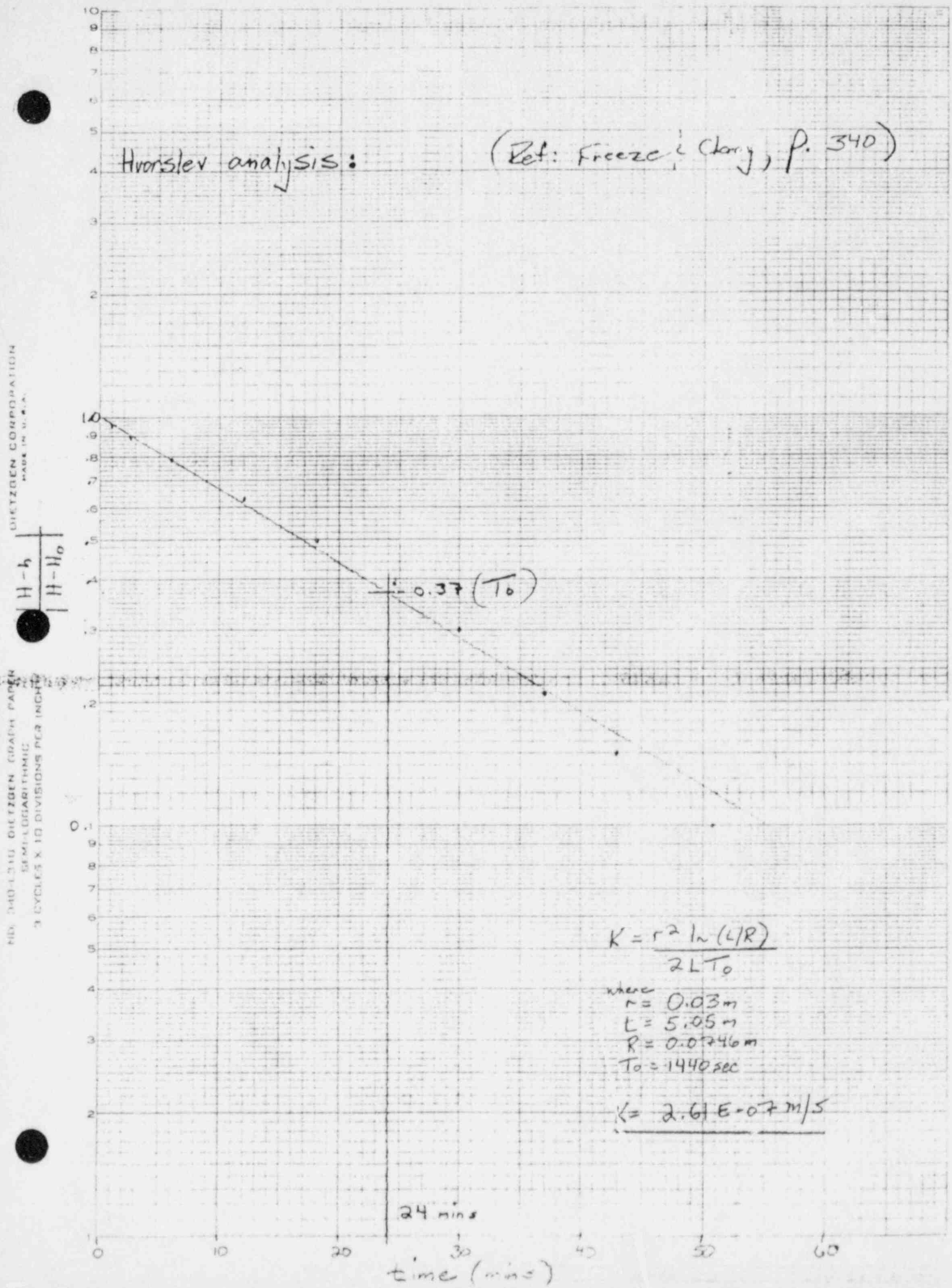
TESTING DATA:

Designation: 161.4D (tubing)

Start Time: 12:38:00

Static Water Level for Test Interval: ~ 13.38 m below top tubing

Elapsed Time: min	Water Level Below Datum: M	Elapsed Time: min	Water Level Below Datum: M
0	5.01	50 min 00s	5.29
8 s	5.10	60 " 00s	5.29
12 s	5.19	70 " 00s	5.29
15 s	5.23	80 " 00s	5.30
20 s	5.24	90' 00"	5.30 0.75
30 s	5.24	monitoring stopped —	
37 s	5.25	very low permeability	
1m 10 s	5.25	7cm = ~1%	
1m 23 s	5.26	815cm	
1 45 s	5.26		
2 30 s	5.26		
4 00 s	5.27		
5 00 s	5.27		
6m 00 s	5.27		
7m 00s	5.27		
8m 00s	—		
9 00s	5.28		
10 00s	5.28		
15 00s	5.28		
20 00s	5.28		
25 00s	5.28		
30 00s	5.28		
40 00s	5.29		


Hvorslev analysis:
(Ref: Freeze & Cherry, p. 340)
0.37 (To)
24 mins
time (mins)
(H-h)/(H-Ho)
K = r² ln (L/R) / 2LTo
where
r = 0.03m
L = 5.05m
R = 0.0746m
To = 1440 sec
K = 2.61 E-07 m/s
NO. 340-L310 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH
DIETZGEN CORPORATION
MADE IN U.S.A.

RMC-2 76.0D

From Hvorsler plot:

Estimate T_o > 7560 min.
> 453600 sec.

$$K = \frac{r^2 \ln(L/R)}{2 L T_o}$$

$$= \frac{r^2 \ln(L/R)}{2L} \Big/ T_o$$

$$= (3.75594E{-04}) / T_o$$

$K_{max} = 8.3E{-10}$ m/s

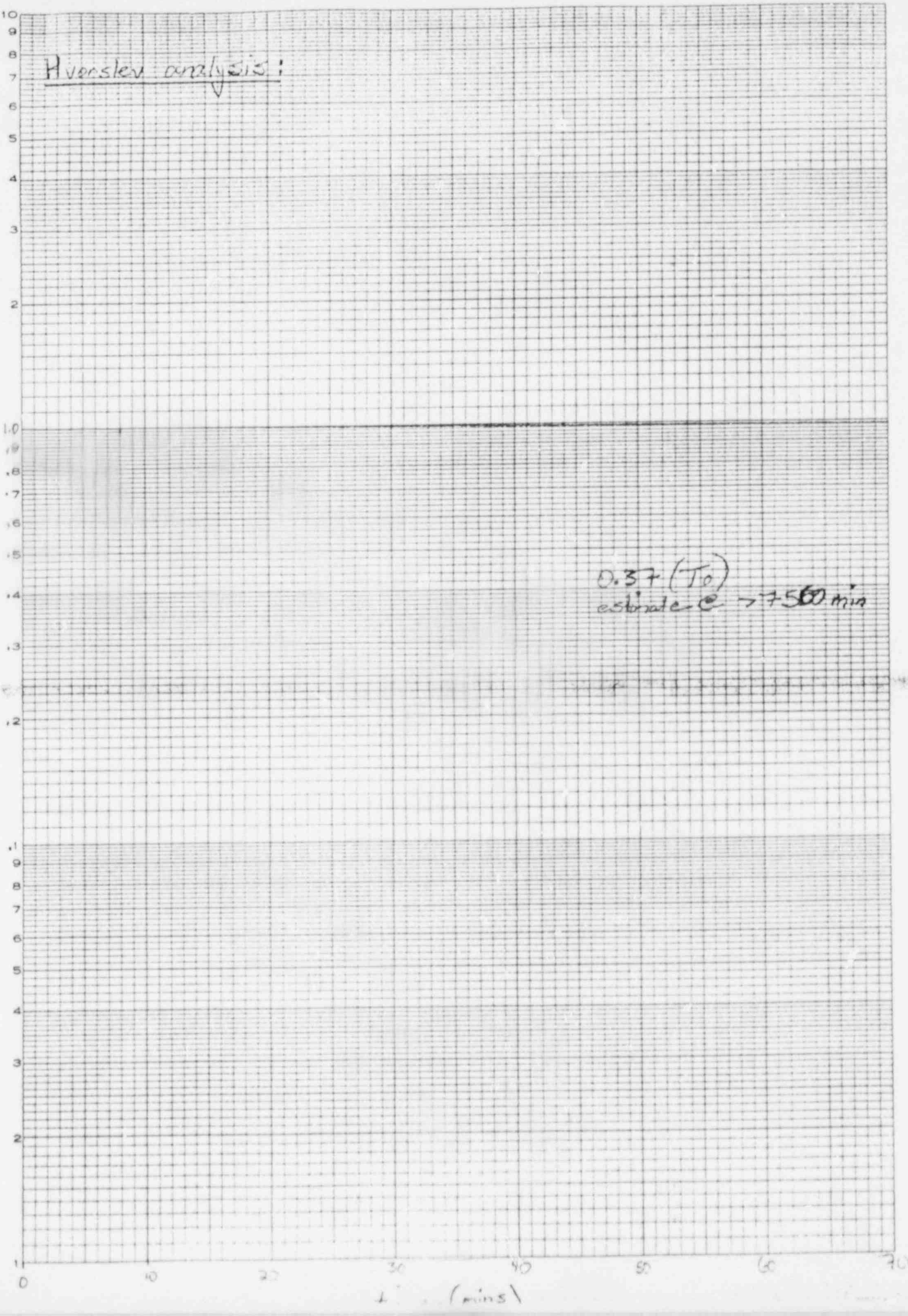
RMC-2 92.3D

*Note: No response measured after 30 minutes of monitoring.
- Hydraulic conductivity of this zone is therefore <8.3 E-10 m/s, based on a comparison of recovery in zone 76.0D

RMC-2 112.4D

- measured 2cm recovery in 90mins = .39%

Estimate T_o >14539 min
>8723[illegible] sec.


Hvorslev analysis:
0.37 (To)
estimate @ → 7560 min
$\frac{H-h}{H-H_0}$
t (mins)
0
10
20
30
40
50
60
70

RMC-2 112.4D (cont'd)

$$K = \frac{r^2 \ln (L/R)}{2L} \Big/ T_0$$

$$= 3.75594E-04 m / T_0$$

$K_{max} = 4.3E-10$ m/s

RMC-2 134.6D

Estimate $T_0 > 945$ min
> 56700 sec

$$K = \frac{r^2 \ln (L/R)}{2L} \Big/ T_0$$

$$= 3.75594E-04 m / T_0$$

$K_{max} = 6.6E-09$ m/s

RMC-2 147.4 D

Estimate $T_0 > 2860$ min
> 171612 sec.

$K_{max} = 2.2E-09$ m/s

KMC #2

40

- 52.58 } 60.90 — 2.6 E-07 m/s

60

- 67.72
- ~~69.15~~ } 76.00 — $\leq 10^{-9}$ m/s

80

- 84.29 } - 84.0 } 92.30 — $\leq 10^{-9}$ m/s

100

- 100.57
- 104.08 } 112.40 — $\leq 10^{-9}$ m/s

120

- 120.68
- 126.28 } 134.60 — $\approx 10^{-9}$ m/s

140

- 139.15
- 142.85 } 147.40 — $\leq 10^{-9}$ m/s
- 155.72

160

L'Dan

INTERA TECHNOLOGIES, INC.

Borehole: RMC - 2

Test Designation: 60.9D (test #6)

Geology (formation/lithology): ______

CorePick from this Interval: ______
CorePick Designation: ______

Drilling Period:
From: ______
To: ______
Drilling Fluid: ______

Test Interval: (below top of casing)
Top: 52.58 ft
Bottom: 69.15 ft
Midpoint: 60.87 ft
Interval Length: 16.57 ft

Borehole:
Average Diameter: ______

Packers:
Double packer inflation pressure ~~above annulus~~: 260 psig
Shut-in packer inflation pressure: 250 psig

Datum Point Description: Top of tubing

Stick up from Ground Surface: 7' from top of casing

Ground Surface Elevation: ______ (above sea level)

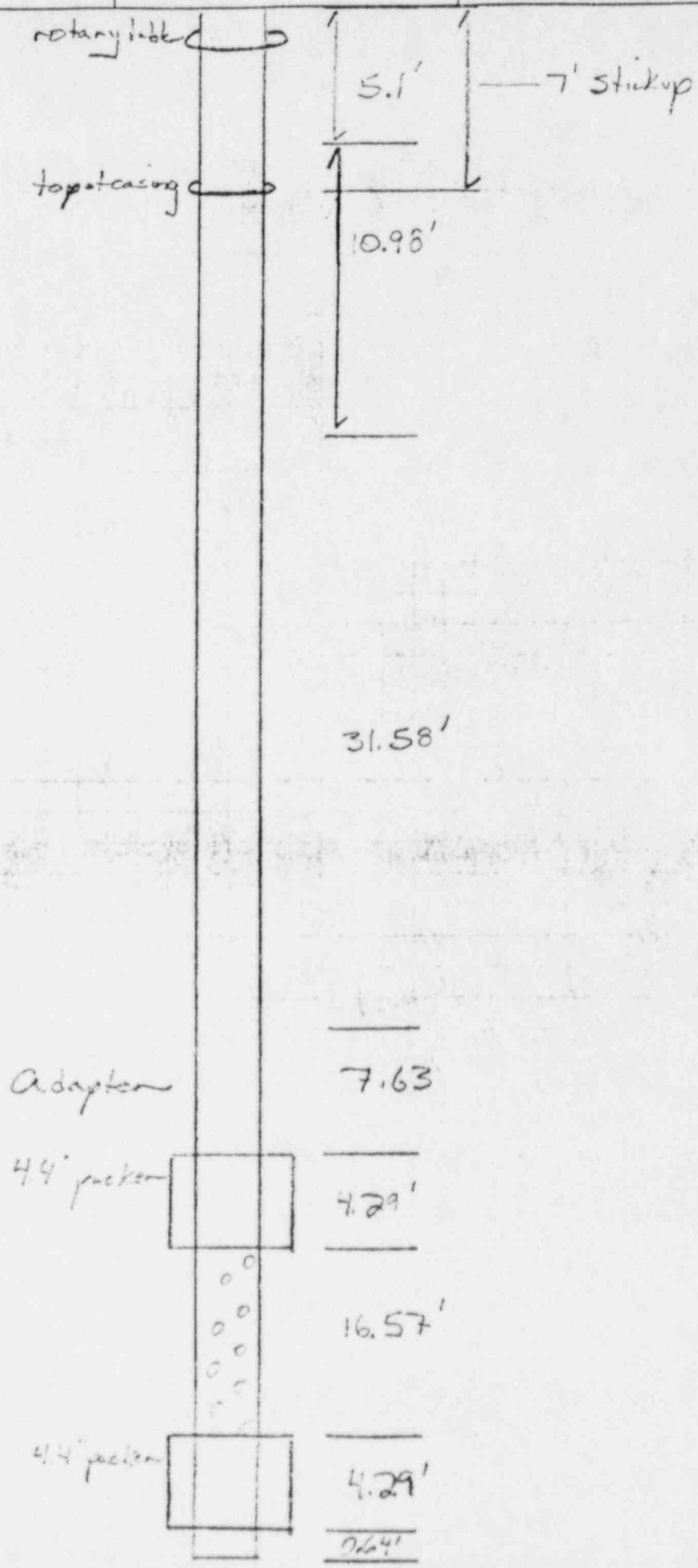
Tubing String:
Inside Diameter: 3/10 ft.

Description of Packer in Tubing:
Top of Packer: 32 ft
Bottom of Packer: 32.8 ft
Tubing String ID: } not applicable
Tubing String OD: }

Static Fluid Level in Test Interval (below datum): 9.90 m (* measured @ 09:30 on 8/7/...)
Static Fluid Level in Test Interval after minipacker inflation: 7.43 m (7.52 m @ t=0 prior to start of test)

Static Fluid Level in Open Borehole below datum: not available
Magnitude of Slug: (7.43 m - 1.26 m) = 6.17 m

* ... slugging annulus ... 2 X 5 gal. ; tubing fluid level slowed ... [illegible] ... suspect ... communication around top packer


rotary table
5.1'
7' stickup
top of casing
10.98'
31.58'
adapter
7.63
4.4" packer
4.29'
16.57'
4.4" packer
4.29'
0.64'

RMC-2

INTERA TECHNOLOGIES, INC.

TESTING DATA:

Designation: 60.9D

Start Time: 17:15:00

Static Water Level for Test Interval: not available

Elapsed Time: min	Water Level Below Datum: m	H-h/H-H₀
0	1.57	1.0
10 s	1.60	0.995
20 s	1.63	
30 s	1.65	
40 s	1.72	
50 s	1.81	
60 s	1.85	0.95
1 m 10 s	1.87	
1 m 20 s	1.91	
1 m 30 s	1.95	
1 m 40 s	(—)	
1 m 50 s	(—)	
2 m 00	(—)	
2 m 30 s	2.19	0.897
3 m 00 s	2.26	
3 m 15 s	2.33	
3 m 30 s	(2.—)	
4 m 00 s	2.47	
4 m 15 s	2.52	
4 m 30 s	2.56	
4 m 45 s	2.62	
5 min 00 s	2.66	
5 m 15 s	2.70	

Elapsed Time: min	Water Level Below Datum: m	
5 m 30 s	2.75	
5 m 45 s	2.79	
6 m 00 s	2.83	0.7[illegible]
6 m 15 s	2.88	
6 m 30 s	2.92	
7 min 00 s	3.00	
7 m 30 s	3.09	
8 min 00 s	3.16	
8 m 30 s	3.24	
9 min 00 s	3.33	
10 min 00 s	3.47	
10 " 40 s	3.57	
11 " 00 s	3.64	
12 " 00 s	3.76	0.[illegible]
13 " 00 s	3.90	
14 " 30 s	4.10	
16 " 00 s	4.29	
17 " 00 s	4.42	
18 " 00 s	4.53	0.[illegible]
20 " 00 s	(—)	
22 " 00 s	4.99	
24 " 30 s	5.27	0.[illegible]
26 " 00 s	5.39	

INTERA TECHNOLOGIES, INC.

TESTING DATA: Rm-2

Designation: 62.77

Start Time: 17:15:00

Static Water Level for Test Interval: not available

Elapsed Time: minutes	Water Level Below Datum: m		Elapsed Time: minutes	Water Level Below Datum: m
27 min 30 s	5.50			
29 " 00 s	5.63			
30 " 00 s	5.72	0.30		
31 " 00 s	5.80			
32 " 00 s	5.88			
35 " 00 s	6.11			
37 " 00 s	6.25	0.21		
38 " 00 s	6.31			
39 " 00 s	6.39			
41 " 00 s	6.51			
43 " 00 s	6.65	0.15		
45 " 00 s	6.76			
47 " 00 s	6.86			
49 " 00 s	6.97			
51 " 00 s	7.07	0.08		
53 " 00 s	7.17			
55 " 00 s	7.27			
57 " 00 s	7.35			
60 " 00 s	7.50	0.005		

end of test

INTERA TECHNOLOGIES, INC.

Borehole: RMC-2

Test Designation: 76.0D (test #5)

Geology (formation/lithology): ______

CorePick from this Interval: ______
CorePick Designation: ______

Drilling Period:
From: ______
To: ______
Drilling Fluid: ______

Test Interval:
Top: 67.72
Bottom: 84.29
Midpoint: 76.01
Interval Length: 16.57 m

Borehole:
Average Diameter: ______

Packers:
Double packer inflation pressure ~~above annulus~~: 260 psig
Shut-in packer inflation pressure: 250 psig

Datum Point Description: top of tubing

Stick up from Ground Surface: 5.2 ft from top of casing to top tubing.

Ground Surface Elevation: ______ (above sea level)

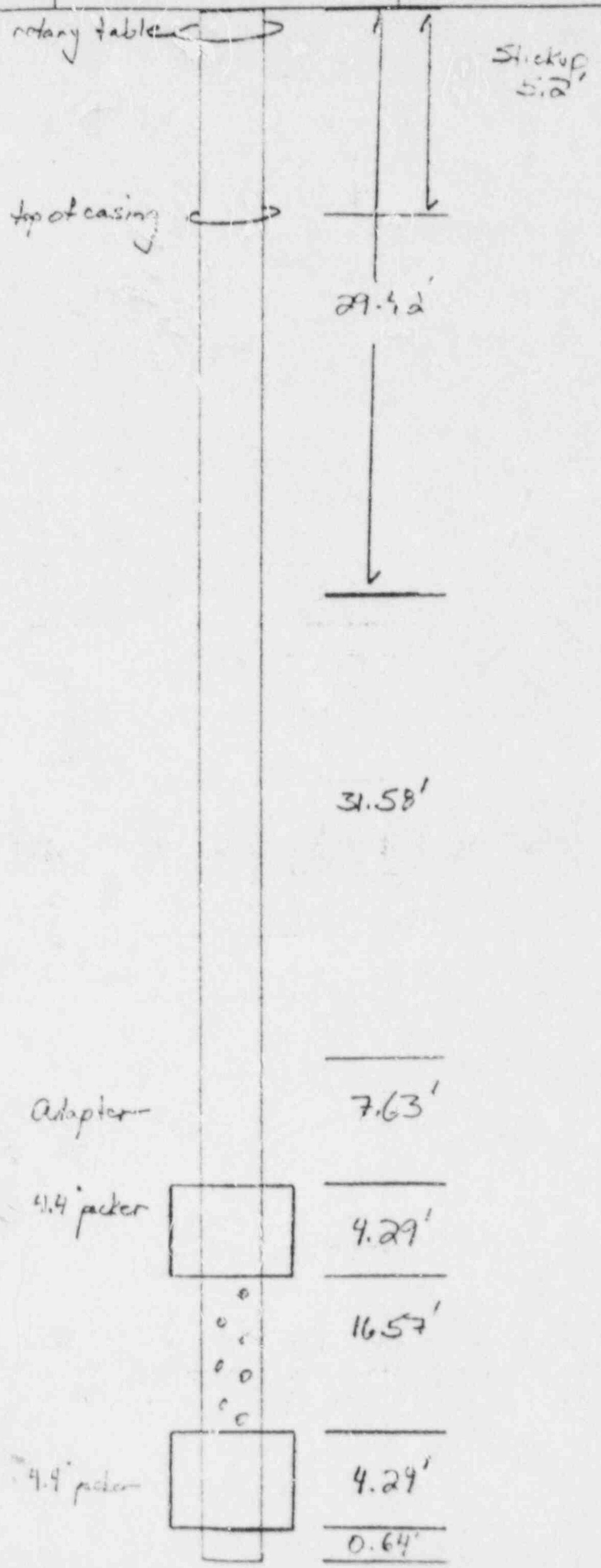
Tubing String:
Inside Diameter: 3/10 ft

Description of Packer in Tubing:
Top of Packer: 50 ft from top casing
Bottom of Packer: 52.5 ft " "
Tubing String ID: } not applicable
Tubing String OD: }

Static Fluid Level in Test Interval (below datum): 4.62 m
Static Fluid Level in Test Interval after minipacker inflation: 4.34 m

Static Fluid Level in Open Borehole below datum: not available
Magnitude of Slug: 2.39 m

* slugged annulus w 7 x 5 gal fresh water (annulus level [illegible]) ; monitored tubing water level over 15 minutes ; after 1 minute 4.61 m
5 min 4.59 m – [illegible]
15 minute 4.54 m packer –


rotary table
Stickup 5.2'
top of casing
29.42'
31.58'
adapter
7.63'
4.4" packer
4.29'
16.57'
4.4" packer
4.29'
0.64'

RMC-2

INTERA TECHNOLOGIES, INC.

K ≤ 10^{-9} m/s

TESTING DATA:

Designation: 76.0D (test #5)
Start Time: 15:45:00
Static Water Level for Test Interval: 4.62 m

Elapsed Time: min	Water Level Below Datum: m		Elapsed Time: min	Water Level Below Datum: m
0 s	0.39	} minipacker deflation		
10 s	0.59			
20 s	0.59			
30 s	0.59			
40 s	"			
50 s	"			
60 s	"			
1 min 20 s	0.59			
1 min 40 s	0.59			
1 min 50 s	0.59			
2 min 00 s	0.59			
4 min 00 s	0.59			
6 min 00 s	0.59			
8 min 00 s	0.59			
10 min 00 s	0.595			
15 min 00 s	0.596			
20 min 00 s	0.597			
30 min 00 s	0.60			
End of Test				

* measured annulus level at end of test = 4.61 m below top of casing

INTERA TECHNOLOGIES, INC.

Borehole: RMC-2

Test Designation: 92.3D (test #4)

Geology (formation/lithology): ______

CorePick from this Interval: ______
CorePick Designation: ______

Drilling Period:
From: ______
To: ______
Drilling Fluid: ______

Test Interval. (below top of casing)
Top: 84 ft
Bottom: 100.57 ft
Midpoint: 92.29 ft
Interval Length: 16.57 ft.

Borehole:
Average Diameter: ______

Packers:
Double packer inflation pressure ~~above annulus~~: 260 psig
Shut-in packer inflation pressure: 250 psig

Datum Point Description: top of tubing

Stick up from Ground Surface: 5' above top of casing

Ground Surface Elevation: ______ (above sea level)

Tubing String:
Inside Diameter: 2/10'

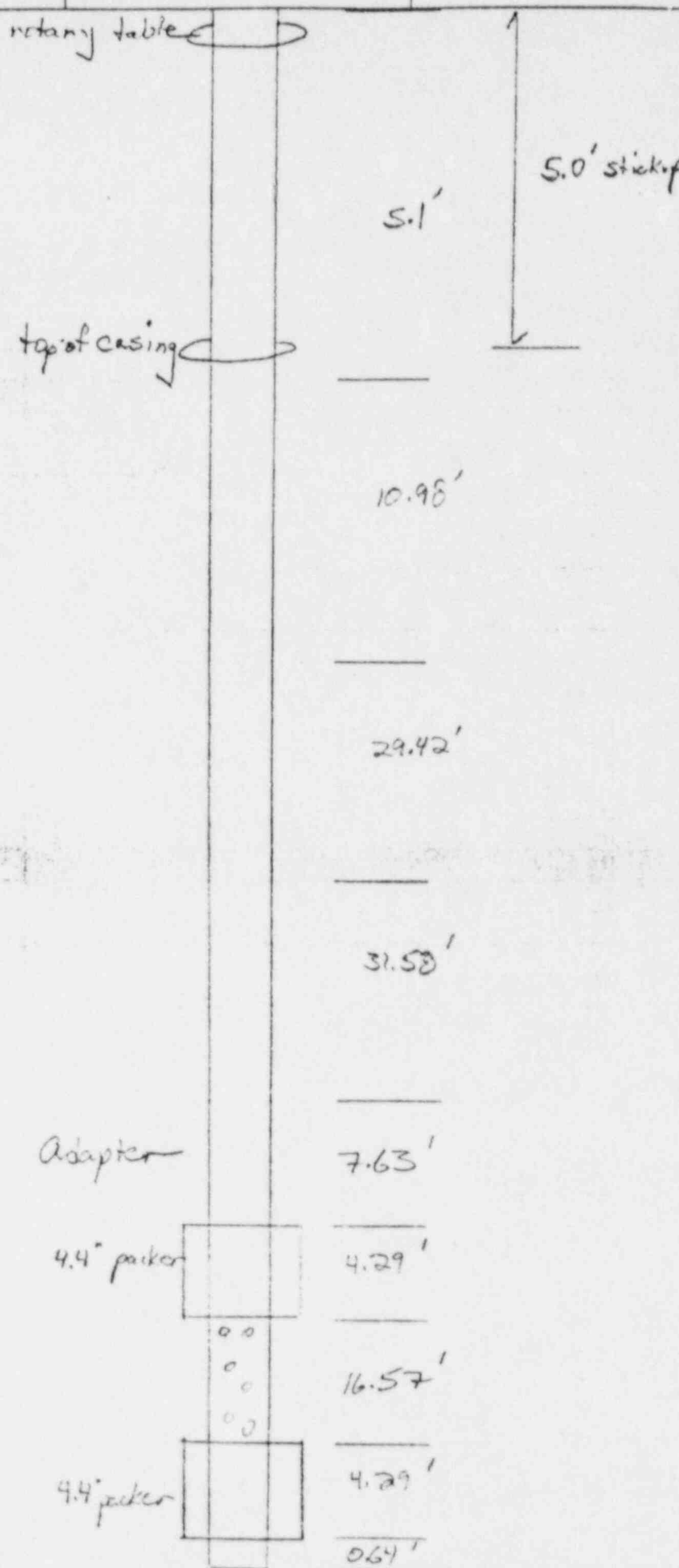
Description of Packer in Tubing:
Top of Packer: 70 ft
Bottom of Packer: 72.8 ft
Tubing String ID: } not applicable
Tubing String OD: }

Static Fluid Level in Test Interval (below datum): 5.46 m
Static Fluid Level in Test Interval after minipacker inflation: 5.25 m

Static Fluid Level in Open Borehole below datum: not available
Magnitude of Slug: (5.25 - 0.16 m) = 5.09 m

* Slugged annulus with 7×5 gals. freshwater; monitored water level in tubing;
0 min = 5.67 m
after 1 min = 5.65 m
= 5.60 m
= 5.52 m

+ annulus level dropping 2 m over 15 minutes


rotary table
5.0' stickup
5.1'
top of casing
10.98'
29.42'
31.58'
Adapter
7.63'
4.4" packer
4.29'
16.57'
4.4" packer
4.29'
0.64'

INTERRA TECHNOLOGIES, INC

TESTING DATA:

Designation: 92.3D (test 4)
Start Time: 14:30:00
Static Water Level for Test Interval:

Elapsed Time: minutes	Water Level Below Datum: m
0	0.35
10 s	0.38
20 s	0.38
30 s	0.38
40 s	0.38
50 s	0.38
1 00 s	0.38
1m 15 s	0.38
1m 30 s	0.38
2m 00 s	0.38
3m 00 s	0.38
5m 00 s	0.38
7m 00 s	0.38
10m 00 s	0.38
15 min 00 s	0.38
22 min 00 s	0.38
30 min 00 s	0.38

end of test

no recovery –

INTERA TECHNOLOGIES, INC.

Borehole: RMC-2

Test Designation: 112.4D (test #3)

Geology (formation/lithology): ______

CorePick from this Interval: ______
CorePick Designation: ______

Drilling Period:
From: ______
To: ______
Drilling Fluid: ______

Test Interval:
Top: 104.08 ft
Bottom: 120.65 ft
Midpoint: 112.37 ft
Interval Length: 16.57 ft

Borehole:
Average Diameter: 5 7/8 in (reamed)

Packers:
Double packer inflation pressure ~~above annulus~~: 260 psig
Shut-in packer inflation pressure: 250 psig

Datum Point Description: Top of tubing

Stick up from Ground Surface: 5.1' from top of casing

Ground Surface Elevation: ______ (above sea level)

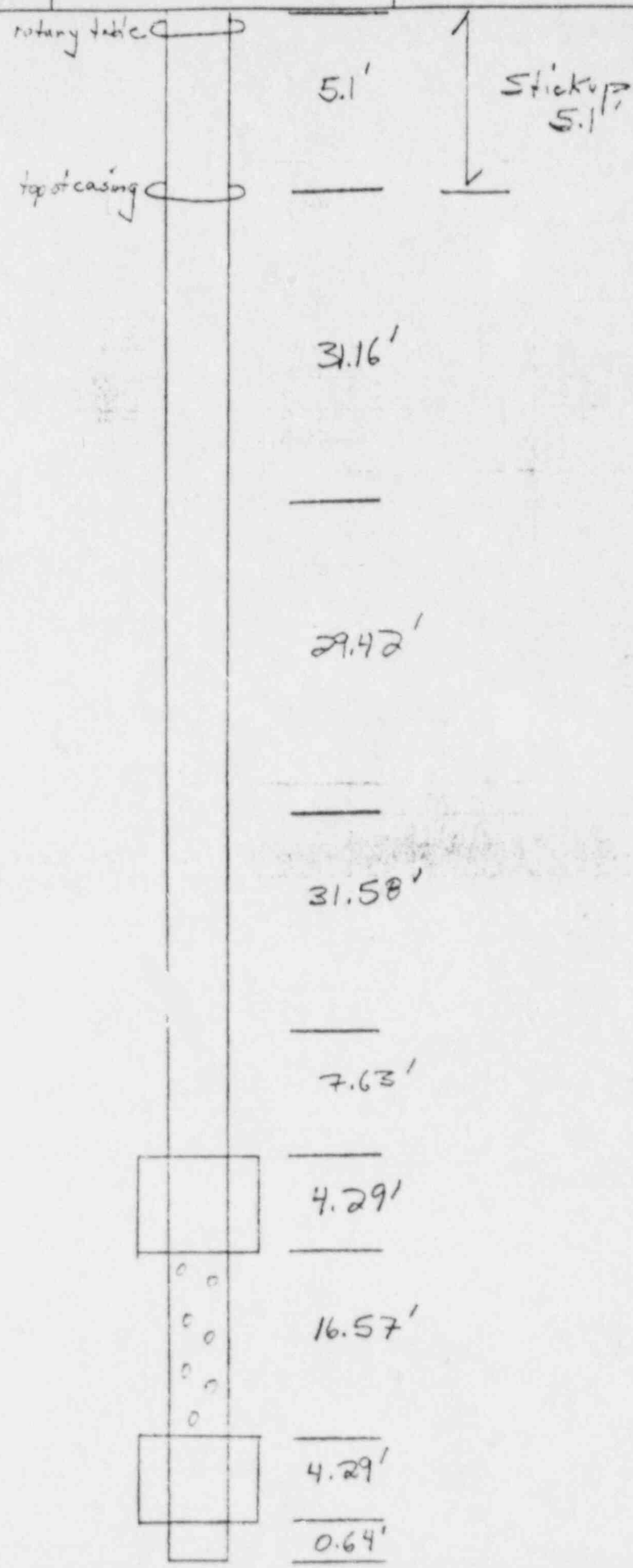
Tubing String:
Inside Diameter: 3/10 ft.

Description of Packer in Tubing:
Top of Packer: 80 ft
Bottom of Packer: 82.8 ft
Tubing String ID: } not applicable
Tubing String OD: } "

Static Fluid Level in Test Interval (below datum): 5.68 m
Static Fluid Level in Test Interval after minipacker inflation: 5.37 m

Static Fluid Level in Open Borehole below datum: not available
Magnitude of Slug: (5.37 m − 0.36 m) = 5.01 m

* slugged annulus with 7 × 5 gal. freshwater; measured test zone water level
after 1 min 5.67 m
5 min 5.61 m
10 min 5.58 m
15 min


rotary table
5.1'
Stickup 5.1'
top of casing
31.16'
29.42'
31.58'
7.63'
4.29'
16.57'
4.29'
0.64'

KMC-2

INTERA TECHNOLOGIES, INC.

TESTING DATA:

Designation: 112.40 (test 3)

Start Time: 11:50:00

Static Water Level for Test Interval: 5.68m

Elapsed Time: min	Water Level Below Datum: M	Elapsed Time: min	Water Level Below Datum: M
0 s	0.36	60" 00s	0.59
15 s	0.56	1hr 10' 00s	0.60
25 s	0.57	1hr 20" 00s	0.60
40 s	0.58	1hr 30 00s	0.60
60s	0.58	end of test	2cm / 5.1cm = 0.4% recovery
1min 20s	0.58		
1' 40s	0.58		
2" 00s	0.58		
2' 30s	0.58		
3' 00s	0.58		
3' 30s	0.58		
4" 00s	0.58		
5' 00s	0.58		
6' 00s	0.58		
7' 00s	0.58		
8" 00s	0.58		
9" 00s	0.58		
10' 00s	0.58		
15" 00s	0.58		
20' 00s	0.58		
30' 00s	0.58		
40' 00s	0.59		
50' 00s	0.59		

INTERA TECHNOLOGIES, INC.

Borehole: RMC-2 87/12/21

Test Designation: 134.6D (test#1)

Geology (formation/lithology): ______

CorePick from this Interval: ______
CorePick Designation: ______

Drilling Period:
From: ______
To: ______
Drilling Fluid: ______

Test Interval: (below top casing)
Top: 126.28'
Bottom: 142.85'
Midpoint: 134.57'
Interval Length: 16.57'

+ reviewed core logs — shale dominant @ 128.5'.
- try to set packer for top of interval @ ~ 128.5'.

Borehole:
Average Diameter: 5 7/8 in. (reamed)

Packers:
Double packer inflation pressure ~~above annulus~~: 280 psig.
Shut-in packer inflation pressure: 250 psig

Datum Point Description: top of tubing

Stick up from Ground Surface: 5.1' top casing to top tubing; 5m to top tubing ~~from~~ ground surface

Ground Surface Elevation: ______ (above sea level)

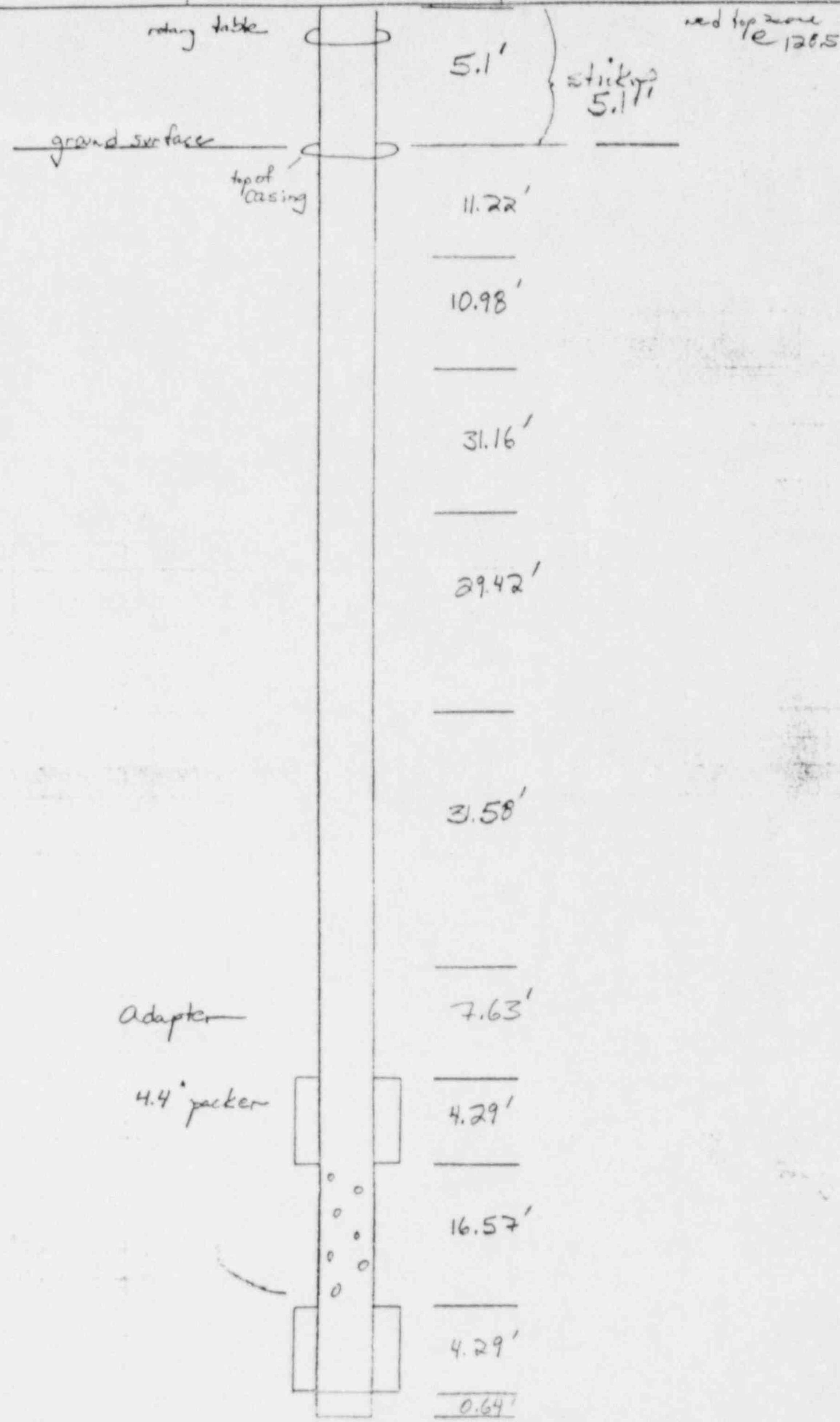
Tubing String:
Inside Diameter: 2/12 ft.

Description of Packer in Tubing:
Top of Packer: 90 ft. from top tubing
Bottom of Packer: 92.8 ft " "
Tubing String ID: } not applicable
Tubing String OD: } "

Static Fluid Level in Test Interval (below datum): 4.91 m * monitored over 30 minutes after 4.4" packer inflation
Static Fluid Level in Test Interval after minipacker inflation: 4.56 m

Static Fluid Level in Open Borehole below datum: 7.33 m below top casing
Magnitude of Slug: (4.56 m − 0.27 m) 4.29 m

* slugged interval ≈ 7 x 5 gals. water after monitoring stable tubing level; [illegible] 15 minutes; 1 min ~4.90 m
5 min 4.81 m
15 min 4.79 m


rotary table
need top zone @ 126.5'
5.1'
stickup 5.1'
ground surface
top of casing
11.22'
10.98'
31.16'
29.42'
31.58'
Adapter
7.63'
4.4" packer
4.29'
16.57'
4.29'
0.64'

INTERA TECHNOLOGIES, INC.

TESTING DATA: RMC-2 87/12/21

Designation: 134.6D (test #1)

Start Time: 17:27:00

Static Water Level for Test Interval: 4.91m

Elapsed Time: min	Water Level Below Datum: M	Elapsed Time: min	Water Level Below Datum: m
0s	0.19m		
15s	0.25m		
25s	0.40m		
40s	0.50m		
50s	0.50m		
60s	0.51m		
1m 34s	0.51m		
2m 45s	0.52m		
3m 20s	0.52m		
4m 00s	0.52m		
6m 00s	0.53m		
8m 00s	0.53m		
10m 00s	0.53m		
15m 00s	0.55m		
20m 00s	0.57m		
30m 00s	0.57m		

~ 2% recovery / 30 minutes

INTERA TECHNOLOGIES, INC.

Borehole: BMC-2

Test Designation: 147.4D (test #2) Bottom Hole Test

Geology (formation/lithology):

CorePick from this Interval:
CorePick Designation:

Drilling Period:
From:
To:
Drilling Fluid:

Test Interval: (below top casing)
Top: 139.15'
Bottom: 155.72'
Midpoint: 147.44'
Interval Length: 16.57'

Borehole:
Average Diameter:

Packers:
Double packer inflation pressure ~~above annulus~~: 270 psig
Shut-in packer inflation pressure: 250 psig

Datum Point Description: Top of tubing

Stick up from Ground Surface: 5 cm (ground to top casing)

Ground Surface Elevation: (above sea level)

Tubing String:
Inside Diameter: 2/12 ft.

Description of Packer in Tubing:
Top of Packer: 100 ft
Bottom of Packer: 102.8 ft
Tubing String ID: } ~~not applicable~~
Tubing String OD: }

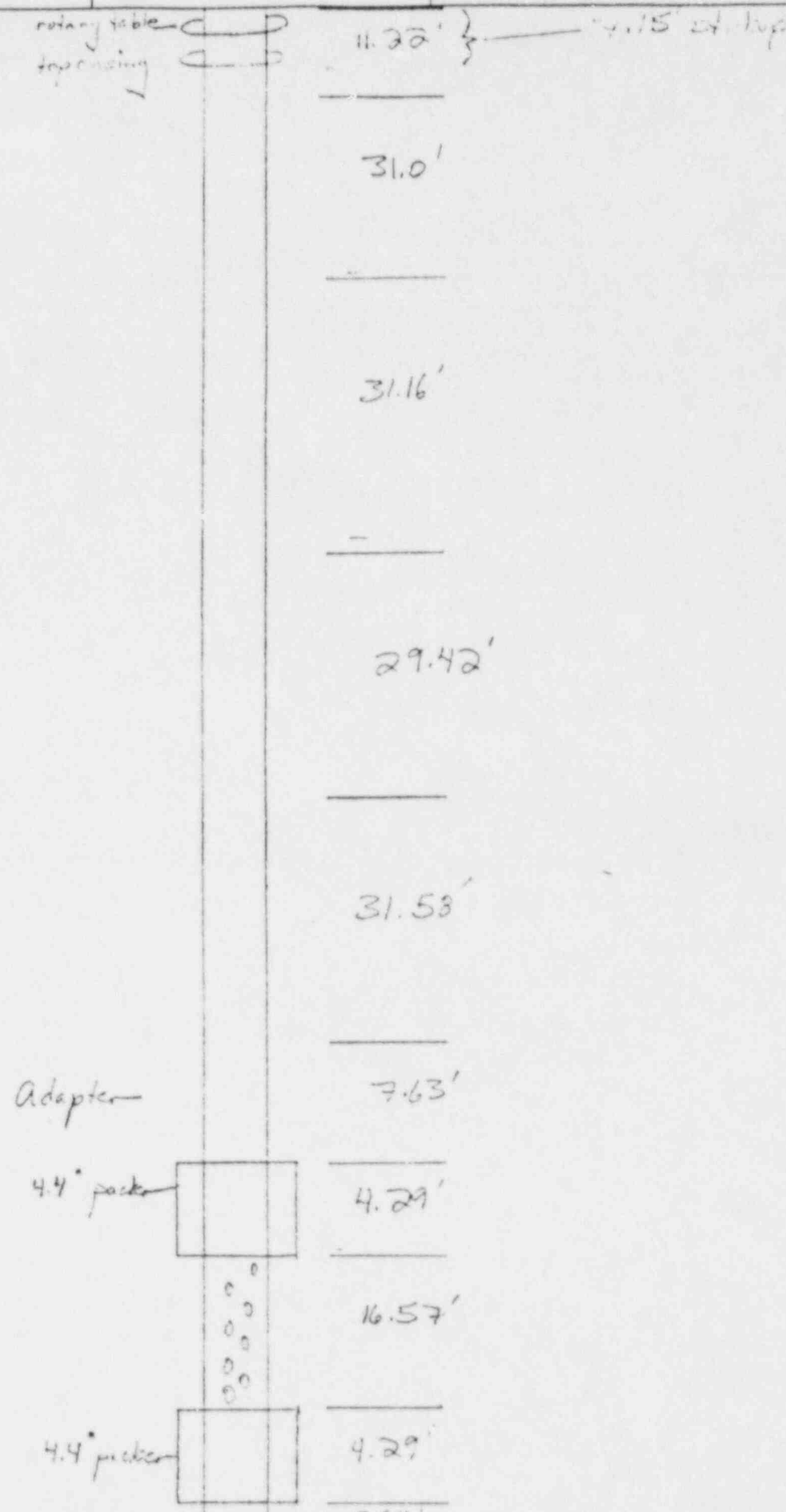
Static Fluid Level in Test Interval (below datum): 7.44 m * measured ~15 mins after packer in tubing

Static Fluid Level in Test Interval after minipacker inflation: 7.18 m

Static Fluid Level in Open Borehole below datum: 8.75 m below top tubing ≈ 5.1' stickup above casing.

Magnitude of Slug: (7.18 - 2.67 m) = 4.51 m

* slugged annulus with 7 x 5 gal [illegible] water; measured test interval level after 1 min 7.43 m
[illegible] 7.42 m } indicates some communication


rotary table
top casing
11.22'
31.0'
31.16'
29.42'
31.53'
Adapter
7.63'
4.4" packer
4.29'
16.57'
4.4" packer
4.29'
0.64'

INTERA TECHNOLOGIES, INC.

TESTING DATA: RMC-2

Designation: 147.40 ([illegible])

Start Time: 10:25 [illegible]

Static Water Level for Test Interval: 7.44m (below top tubing)

Elapsed Time: min	Water Level Below Datum: m	Elapsed Time: min	Water Level Below Datum: m
0	2.68		
[illegible]	2.80		
15s	2.90		
[illegible]	2.90		
[illegible]	2.90		
[illegible]	2.90		
1m 30s	2.90		
1m 45s	2.[illegible]		
2m 00s	[illegible]		
[illegible]	2.90		
[illegible]	2.90		
6" 00s	2.90		
8" 00s	2.90		
[illegible] 00s	2.90		
[illegible] 00s	2.91		
[illegible]	[illegible].91		
20" 00s	2.92		
25" 00s	2.92		
30" 00s	2.93		

— End of Test

3cm/454cm = 0.7% recovery

– v. low permeability

APPENDIX VII

EQUIVALENT HYDRAULIC CONDUCTIVITY CALCULATIONS

Equivalent Hydraulic Conductivity Calculations.

Vertical $K_z = \frac{d}{\sum_{i=1}^{N} d_i/K_i}$ | Horizontal $K_x = \frac{K_i d_i}{d}$

where d = total thickness considered from top of 1st Tres Hermanos sandstone.

RMC #1

i	d (ft)	d (m)	di (ft)	di (m)	Depth (ft)	K (m/s)
					66-75	4E-07
1	14	4.27	14	4.27	75-80	"
					80-85.5	8E-08
2	25	7.62	11	3.35	85.5-91	"
					91-97	2.5E-07
3	34	10.36	9	2.74	97-100	"
4	40	12.19	6	1.83	100-106	3.4E-07
5	49	14.93	9	2.74	106-115	6E-08
					115-124	E-09
					124-141	E-09
					141-149	E-09
6	103	31.39	54	16.46	149-153	"
					153-169	E-09

Fig $^{11}Z_6$ | KMC #1

1 $K_z = \frac{4.27\,m}{4.27\,m / 4E{-}07\,m/s} = 4E{-}07\,m/s$

1+2 $K_z = \frac{7.62\,m}{1.07E07 + \frac{3.35\,m}{8E{-}08\,m/s}} = 1.8E{-}07\,m/s$

1+2+3 $K_z = \frac{10.36\,m}{1.07E07_s + 4.19E07_s + \frac{2.74\,m}{2.5E{-}07\,m/s}} = 1.63E{-}07\,m/s$

1+2+3+4 $K_z = \frac{12.19\,m}{1.07E07_s + 4.19E07_s + 1.1E07_s + \frac{1.83\,m}{3.4E{-}07}} = 1.77E{-}07$

1-5 $K_z = \frac{14.93}{1.07E07 + 4.19E07 + 1.1E07 + 5.38E06 + \frac{2.74}{6.0E{-}08}} = 1.3E{-}07$

1-6 K_z = (4 take 1m of 10^{-9})

1m $\frac{15.93}{1.07E07 + 4.19E07 + 1.1E07 + 5.38E06 + 4.57E07 + \frac{1}{1E{-}09}}$ = 1.43E-08

(1.07E07 + 4.19E07 + 1.1E07 + 5.38E06 + 4.57E07 = 1.15E08)

2m $\frac{16.93}{(1.15E08) + \frac{2}{1E{-}09}} = 8E{-}09$

K_x

1 $K_x = \frac{4.0E{-}07\,m/s \times 4.27\,m}{4.27\,m} = 4.0E{-}07\,m/s$

1+2 $K_x = \frac{(4.0E{-}07 \times 4.27) + (8.0E{-}08 \times 3.35)}{7.62} = \frac{1.96E{-}06}{7.62} = 2.59E{-}07$

1+2+3 $K_x = \frac{(1.96E{-}06) + (1.5E{-}07 \times 2.74)}{10.36} = 2.55E{-}07$

1-4 $K_x = \frac{(2.645E{-}06) + (3.4E{-}07 \times 1.83)}{12.19} = 2.68E{-}07$

1-5 K_x $\frac{(3.27E{-}06) + (6.0E{-}08 \times 2.74)}{14.93} = 2.3E{-}07$

1-6 K_x @ 1M $\frac{(3.43E{-}06) + (1.0E{-}09 \times 1)}{15.93}$ 2.15E-07

2M $\frac{(3.43E{-}06) + (1.0E{-}09 \times 2)}{16.93}$ 2.03E-07

i	d ft	d m	d_i ft	d_i m	Dep + Lh (ft)	K m/s
1	42	12.8	42	12.8	22 - 64	2.6E-07
	139	42.36	97	29.57	6" - TD(161)	≤ E-09

K_z

i

1 $K_z = \dfrac{12.8\,m}{\dfrac{12.8\,m}{2.6E\text{-}07\,m/s}} = 2.6\,E\text{-}07\,m/s$

1+1m of 2 K_z $\dfrac{13.8\,m}{(4.92E07) + \frac{1}{1E\text{-}09}} = 1.32E-08\,m/s$

1+2m of 2 $K_z = \dfrac{14.8\,m}{(4.92E07) + \frac{2}{1E\text{-}09}} = 7.2E-09\,m/s$

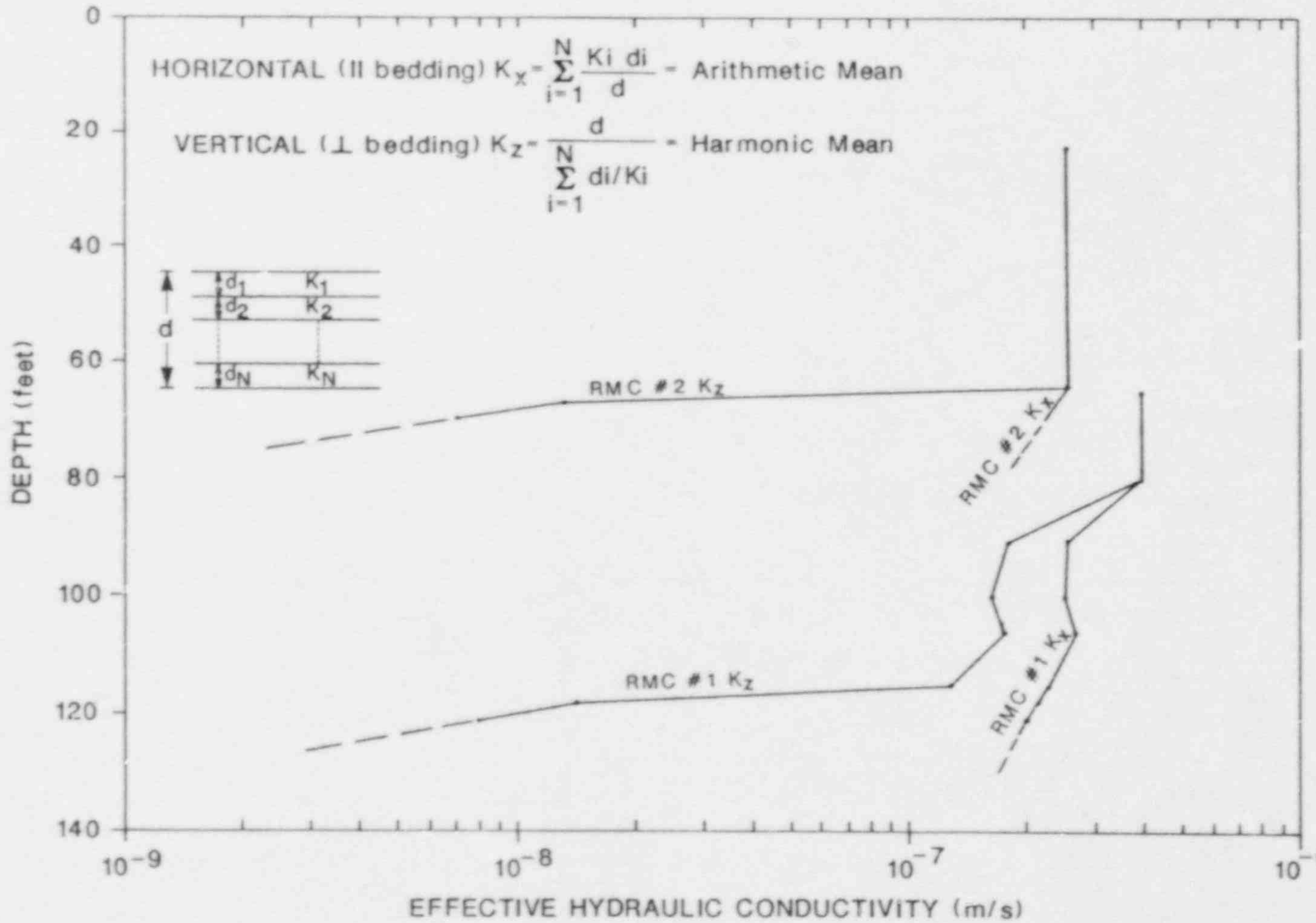
K_x

i

1 $K_x = \dfrac{12.8\,m \times 2.6E\text{-}07\,m/s}{12.8\,m} = 2.6E\text{-}07\,m/s$

1+1m of 2 $K_x = \dfrac{(12.8\,m \times 2.6E\text{-}07) + (1 \times E\text{-}09)}{13.8\,m} = 2.41E\text{-}07\,m/s$

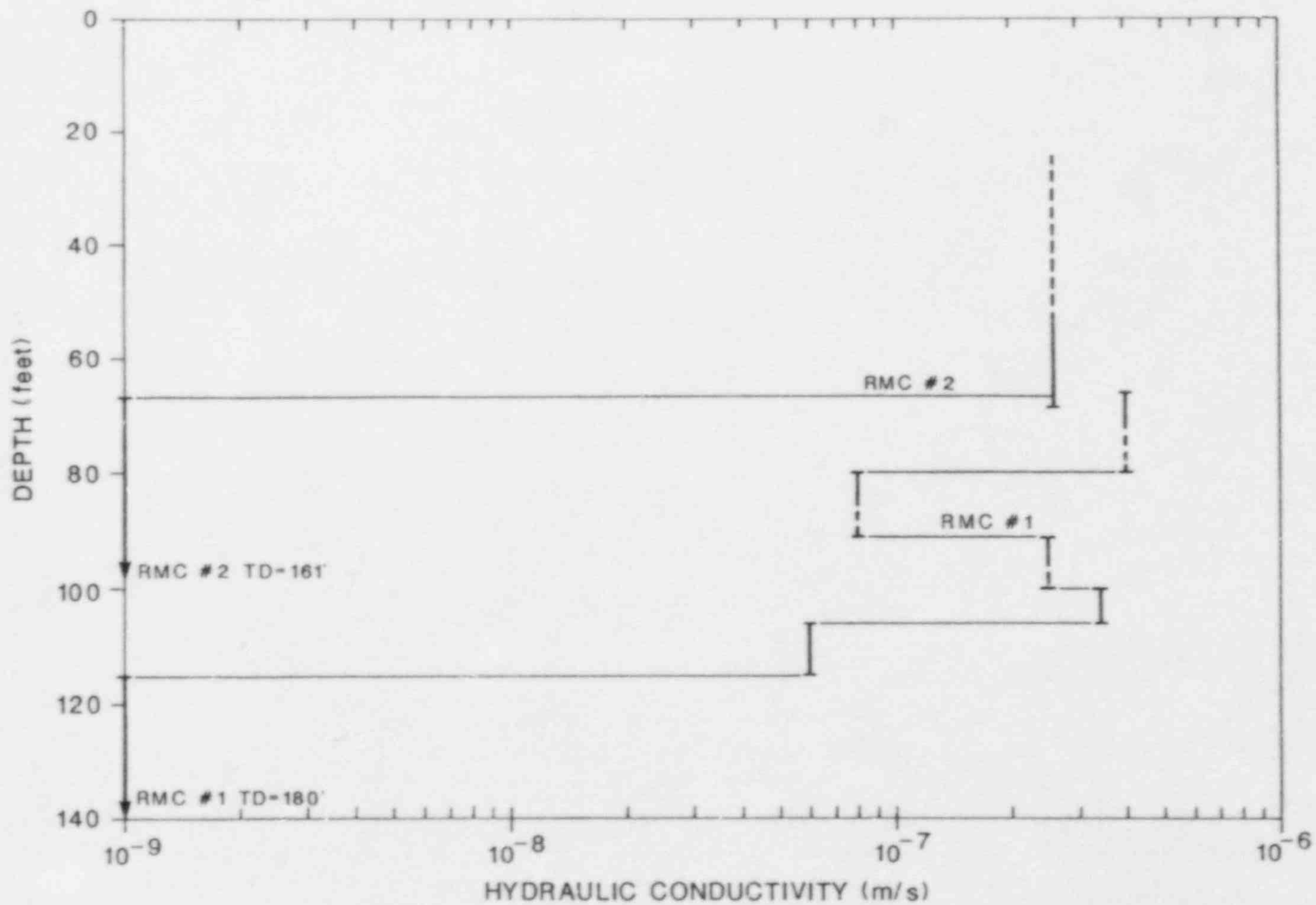
1+2m of 2 $K_x = \dfrac{(12.8\,m \times 2.6E\text{-}07) + (2 \times 1E\text{-}09)}{14.8\,m} = 2.25E\text{-}07\,m/s$



INTERA Technologies

Core Holes RMC #1 & RMC #2 Effective Hydraulic Conductivity (thickness weighted)

110000 1/29/88



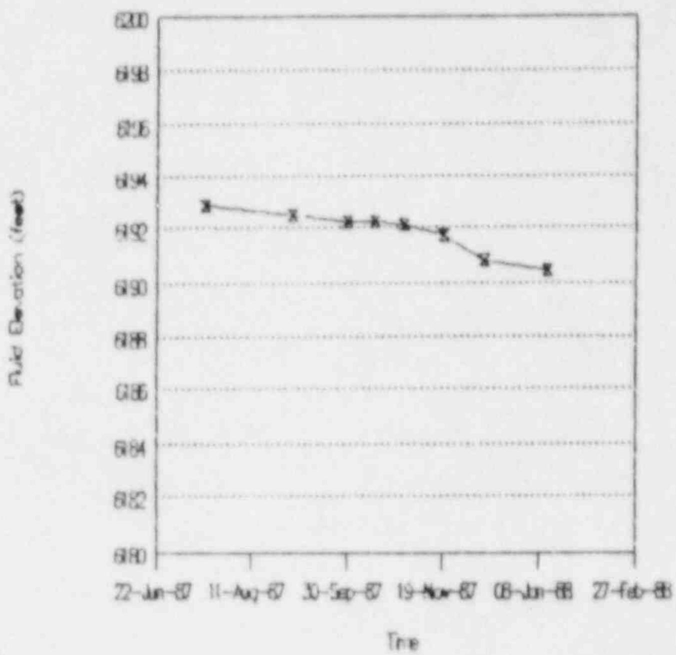
INTERA Technologies | Straddle Packer Tests Core Holes RMC #1 & RMC #2

110000 1/29/88

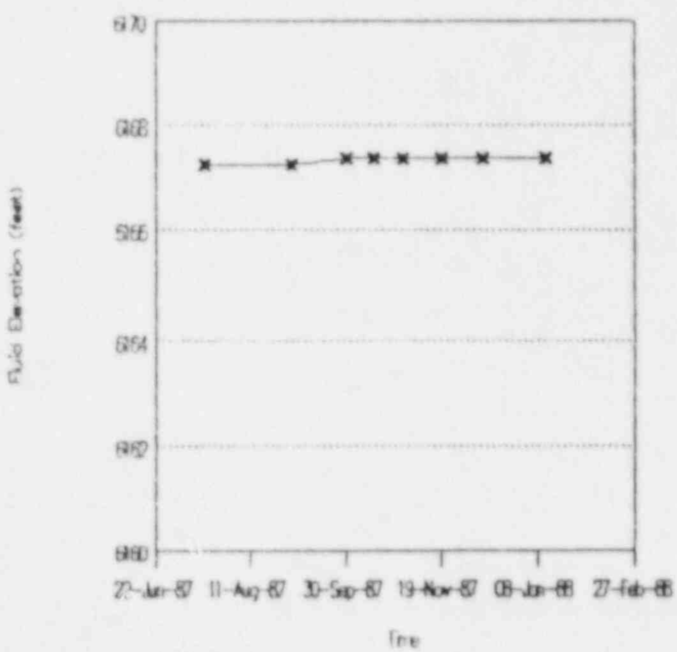
APPENDIX RII

WATER LEVELS IN TAILINGS DAM AND SAND BEACH PIEZOMETERS

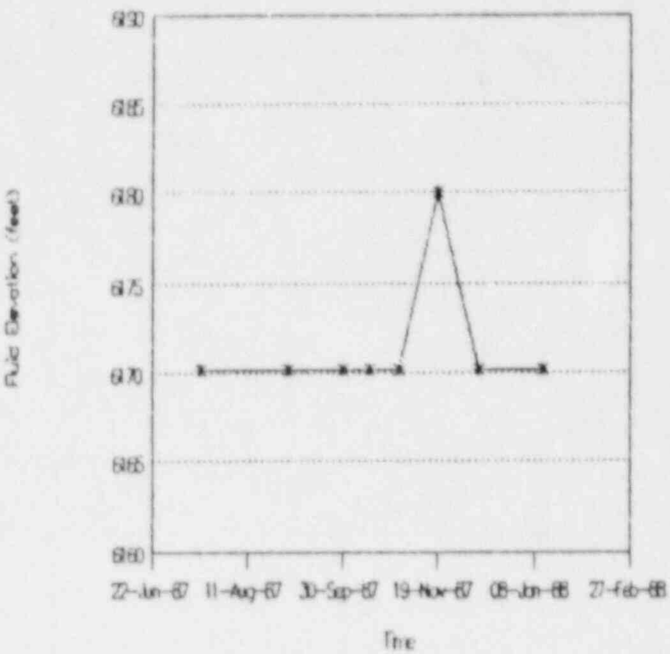
Tailings Dam Piezometer #5



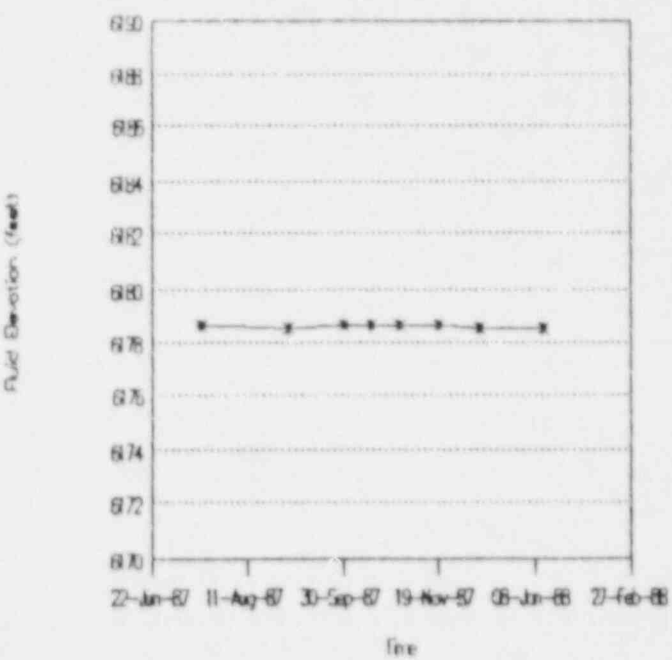
Tailings Dam Piezometer #7



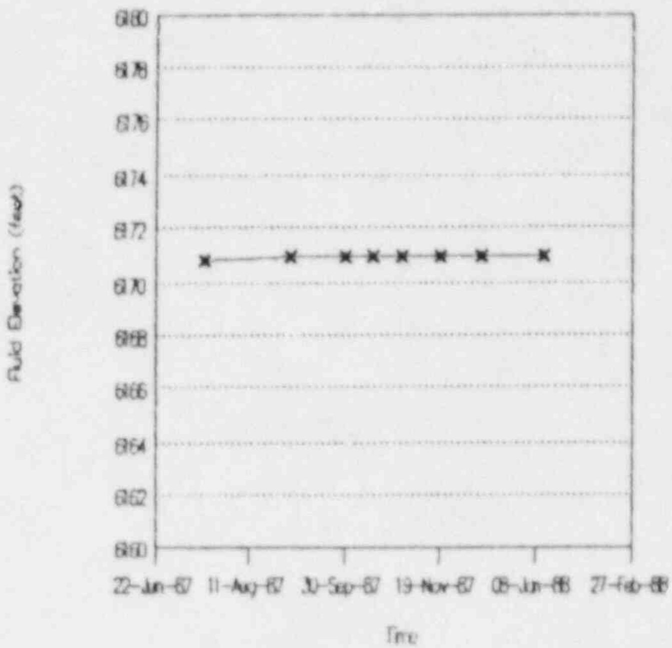
Tailings Dam Piezometer #10



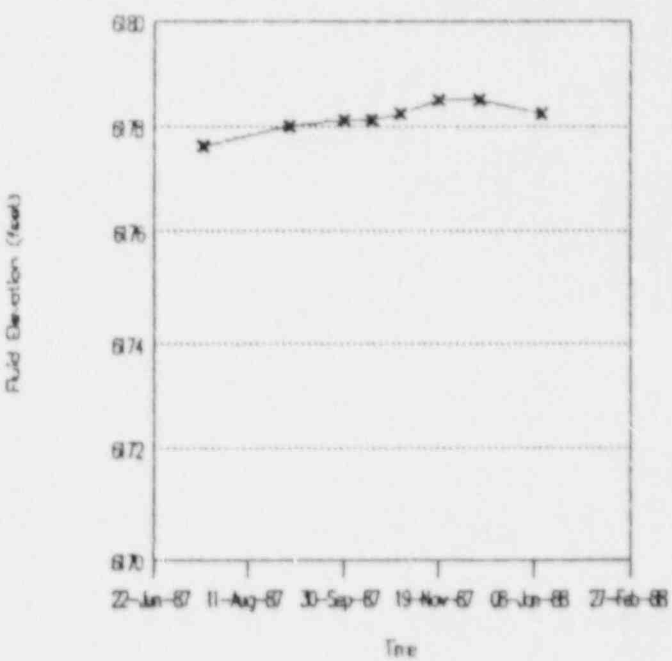
Tailings Dam Piezometer #15



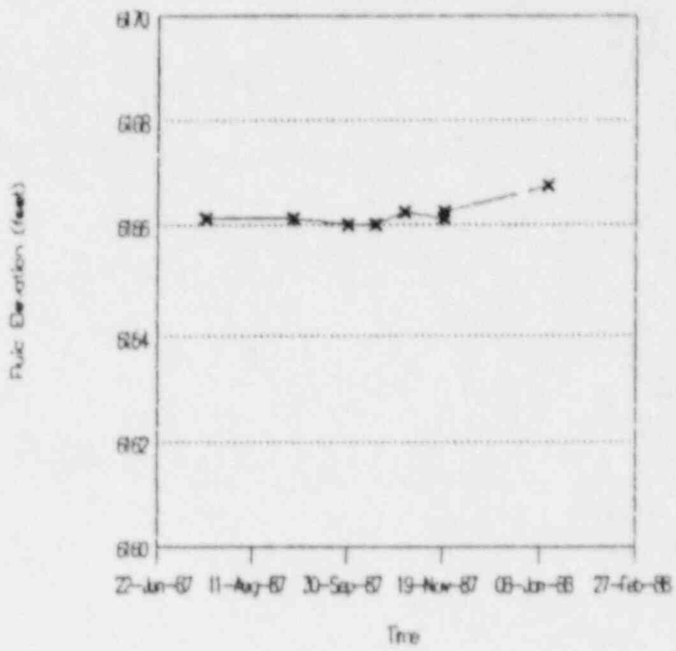
Tailings Dam Piezometer #16



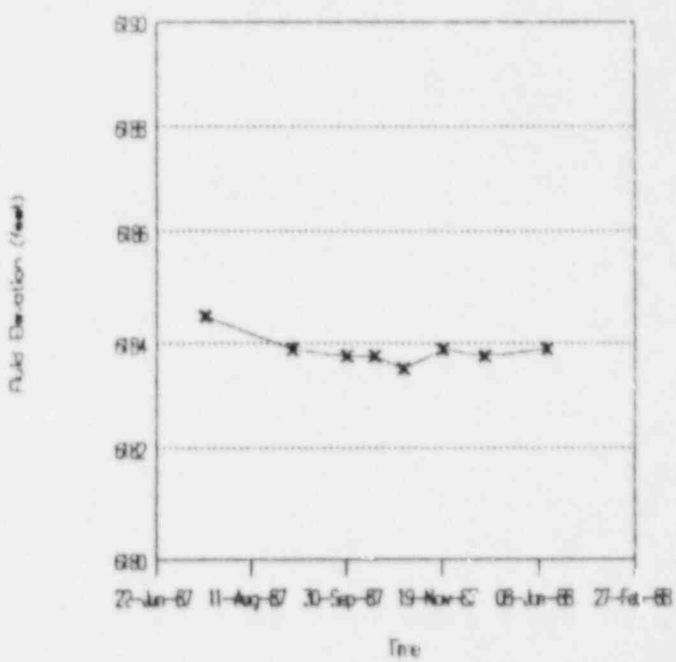
Tailings Dam Piezometer #17



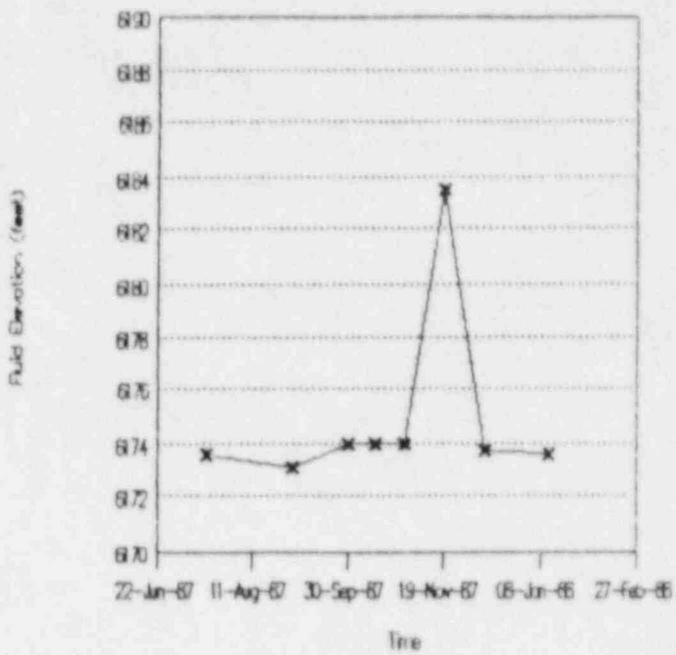
Tailings Dam Piezometer #18



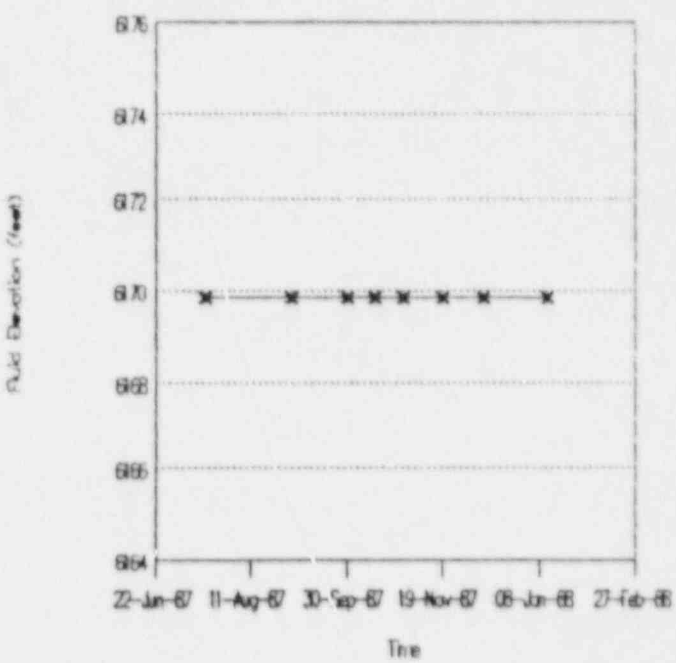
Tailings Dam Piezometer #19



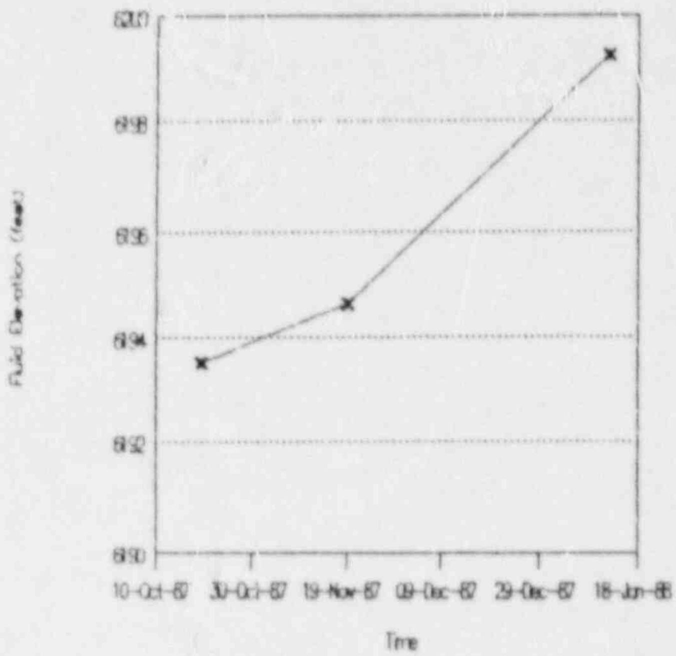
Tailings Dam Piezometer #20



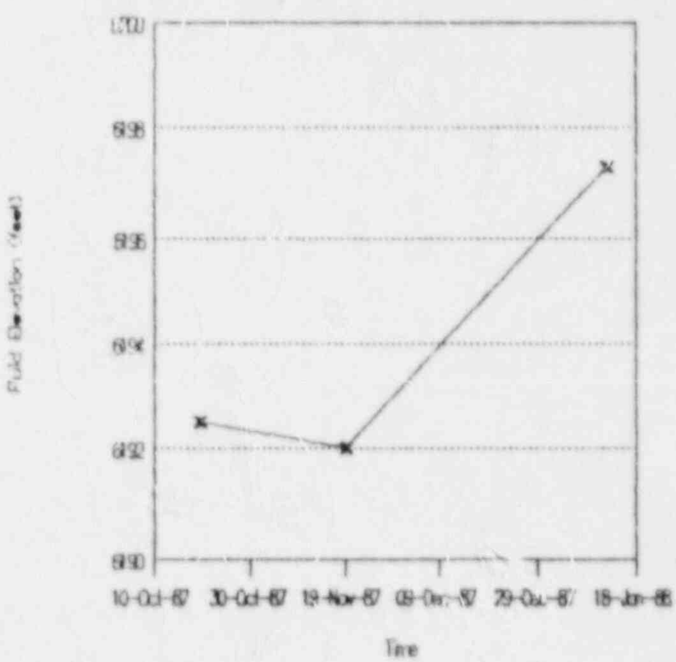
Tailings Dam Piezometer #21



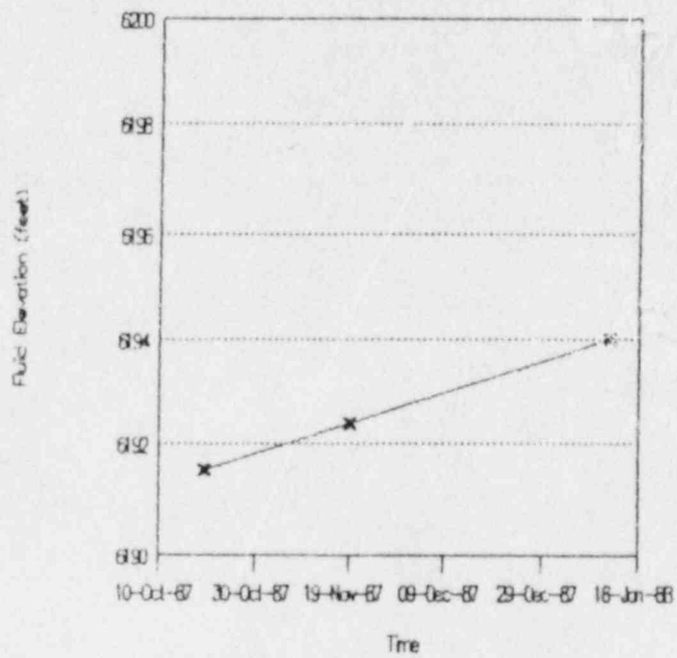
Sand Beach Piezometer P1



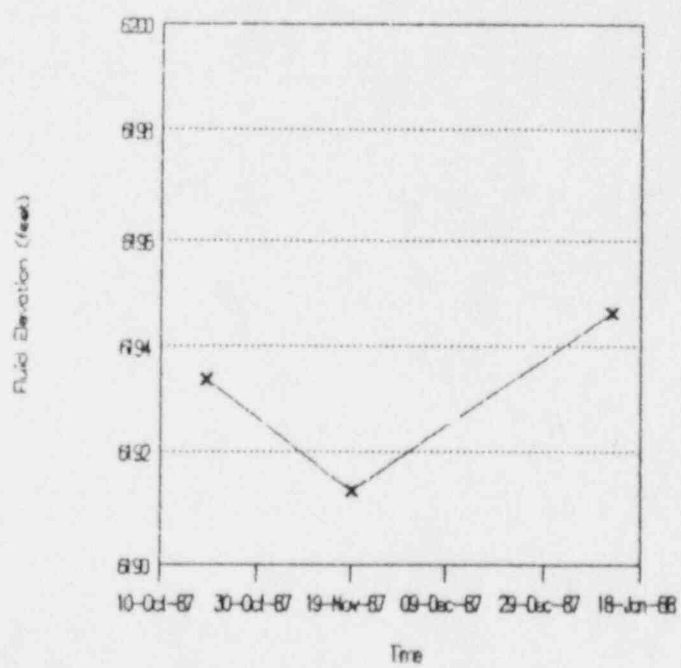
Sand Beach Piezometer P2



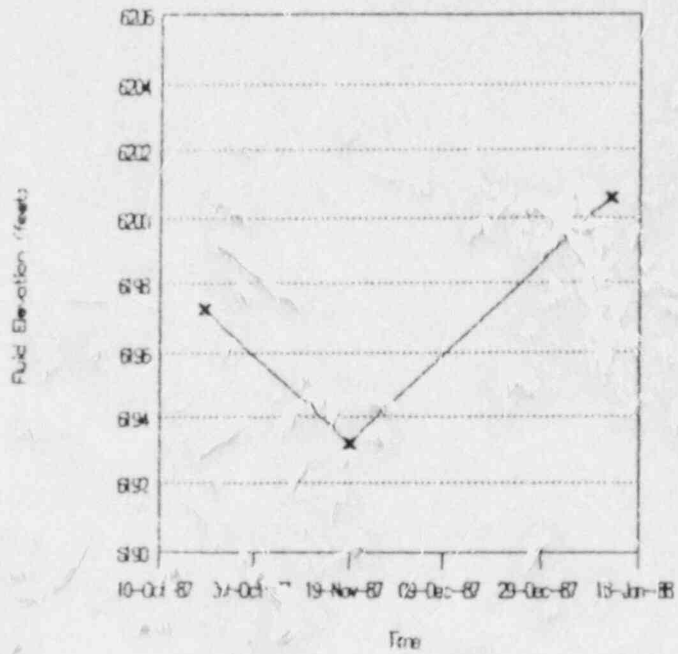
Sand Beach Piezometer P3



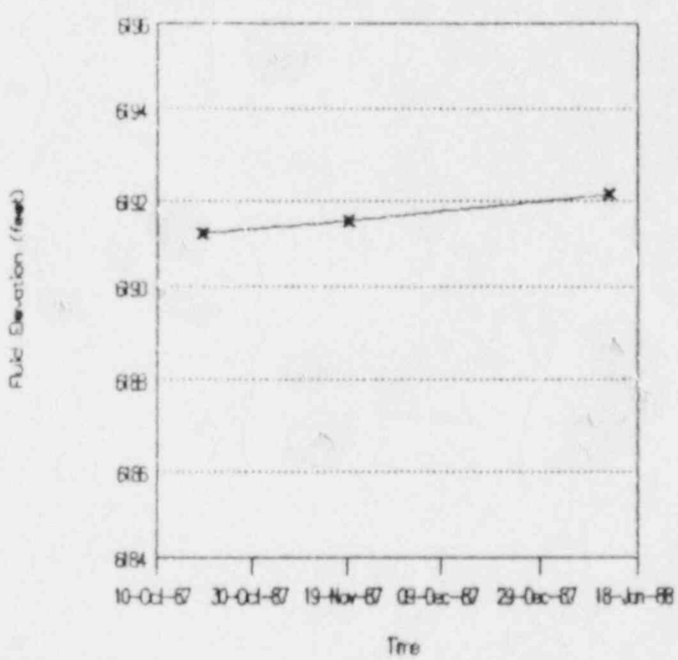
Sand Beach Piezometer P4



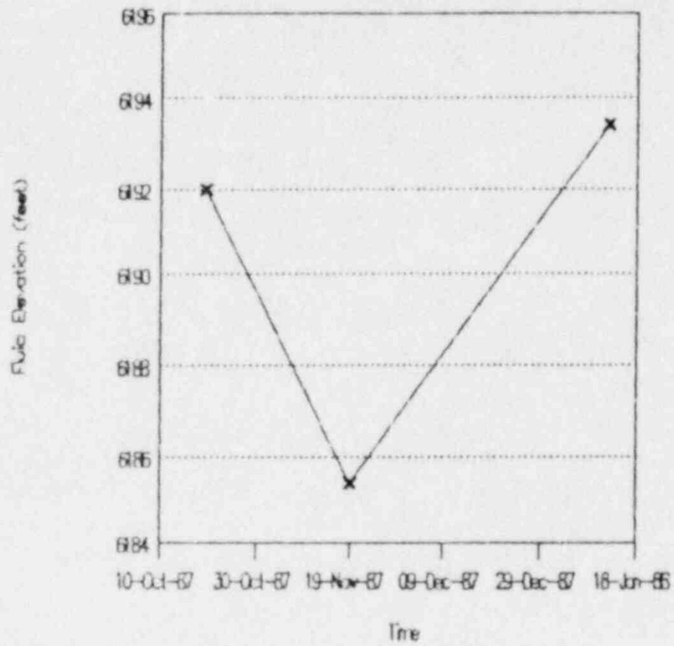
Sand Beach Piezometer P5



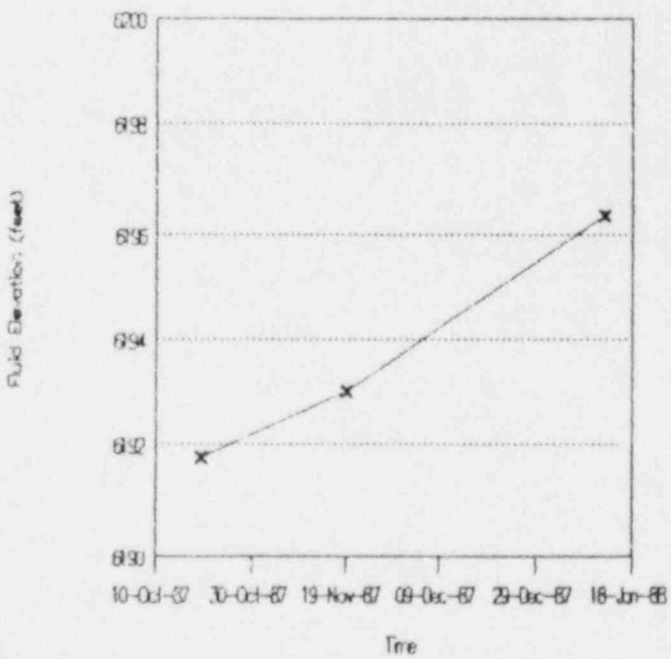
Sand Beach Piezometer P6



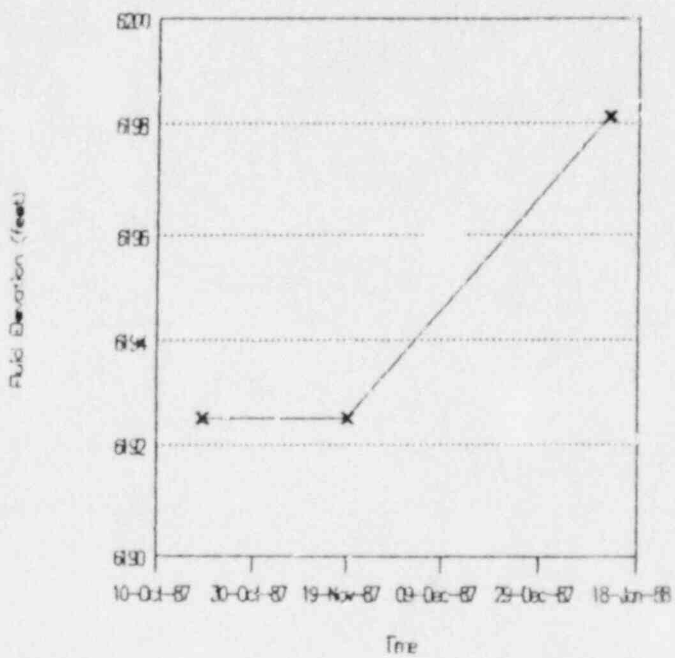
Sand Beach Piezometer P7



Sand Beach Piezometer P8



Sand Beach Piezometer P9



APPENDIX RIII

ANALYSIS OF PRECIPITATED SALTS

RADIAN CORPORATION

...e 1 RAS - Austin REPORT Work Order # 87-05-025

...ived: 05/06/87 07/31/87 15:37:29

...RT TO Intera Technologies
6850 Austin Center Bl. #300
Austin, TX 78731

PREPARED BY Radian Analytical Services
8501 Mo-pac Bl.
PO Box 201088
Austin, TX 78720-1088

CERTIFIED BY

...EN David Graham

ATTEN

PHONE 512-454-4797

CONTACT GIBSON

...IENT INTERA SAMPLES 6

...PANY Intera Technologies

...ITY

...ID precipitated salt/soils

...KEN

...ANS SGP

...PE

... #

...ICE under separate cover

Footnotes and Comments

* Indicates a value less than 5 times the detection limit. Potential error for such low values ranges between 50 and 100%.

@ Indicates that spike recovery for this analysis on the specific matrix was not within acceptable limits indicating an interferent present.

...PLE IDENTIFICATION

TEST CODES and NAMES used on this report

AL E	Aluminum, ICPES
CA E	Calcium, ICPES
CD E	Cadmium, ICPES
CL IC	Chloride, IC
CR E	Chromium, ICPES
CU E	Copper, ICPES
D3050P	Digestion,method 3050, ICP
FE E	Iron, ICPES
K E	Potassium, ICPES
MG E	Magnesium, ICPES
MN E	Manganese, ICPES
NA E	Sodium, ICPES
NI E	Nickel, ICPES
PB 210	Lead 210
PREP W	Special preparation
RA 226	Radium 226
SO4 IC	Sulfate, IC
TH 230	Thorium 230
U E	Uranium, ICPES
V E	Vanadium, ICPES
ZN E	Zinc, ICPES

RADIAN CORPORATION

RAS - Austin REPORT Work Order # 87-05-025

Received: 05/06/87

Results By Test

SAMPLE Sample Id	Test: AL E ug/ml	Test: CA E ug/ml	Test: CD E ug/ml	Test: CL IC mg/L	Test: CR E ug/ml
01	16000 ug/g	4400 ug/g	5.4 ug/g	1300 ug/g	30 ug/g
02	18000 ug/g	3600@ ug/g	4.4 ug/g	490 ug/g	26 ug/g
03	23000 ug/g	6800 ug/g	2.0 ug/g	170* ug/g	26 ug/g
04	20000 ug/g	3700 ug/g	3.1 ug/g	370 ug/g	25 ug/g
05	18000 ug/g	4500 ug/g	5.6 ug/g	530 ug/g	26 ug/g
06	13000 ug/g	5500 ug/g	3.6 ug/g	160* ug/g	19 ug/g

SAMPLE Sample Id	Test: CU E ug/ml	Test: D3050P date complete	Test: FE E ug/ml	Test: K E ug/ml	Test: MG E ug/ml
01	71 ug/g	05/08/87	44000 ug/g	2200 ug/g	9400 ug/g
02	62 ug/g	05/08/87	37000@ ug/g	2100@ ug/g	9000@ ug/g
03	40 ug/g	05/08/87	11000 ug/g	60* ug/g	8300 ug/g
04	53 ug/g	05/08/87	22000 ug/g	750 ug/g	8200 ug/g
05	68 ug/g	05/08/87	41000 ug/g	2200 ug/g	9000 ug/g
06	52 ug/g	05/08/87	30000 ug/g	1700 ug/g	6100 ug/g

RADIAN CORPORATION

RAS - Austin REPORT Work Order # 87-05-025

Received: 05/06/87

Results By Test

SAMPLE Sample Id	Test: MN E ug/ml	Test: NA E ug/ml	Test: NI E ug/ml	Test: PB 210 pCi/	Test: PREP W date complete
01	820 ug/g	19000 ug/g	24 ug/g	25.6(2.1) pCi/g	05/14/87
02	740@ ug/g	19000@ ug/g	21 ug/g	10.5(1.9) pCi/g	05/14/87
03	580 ug/g	9800 ug/g	25 ug/g	49.9(3.0) pCi/g	05/14/87
04	610 ug/g	11000 ug/g	22 ug/g	35.4(2.6) pCi/g	05/14/87
05	770 ug/g	17000 ug/g	22 ug/g	20.0(1.7) pCi/g	05/14/87
06	500 ug/g	11000 ug/g	15 ug/g	26.7(2.3)	05/14/87

SAMPLE Sample Id	Test: RA 226 pCi/	Test: SO4 IC mg/L	Test: TH 230 pCi/	Test: V E ug/ml	Test: V E ug/ml
01	61.4 (.7) pCi/g	400,000 ug/g	1.1 (0.7) pCi/g	630 ug/g	1000 ug/g
02	41.4 (.8) pCi/g	490,000 ug/g	1.0 (0.8) pCi/g	780 ug/g	830@ ug/g
03	77.8 (.8) pCi/g	310,000 ug/g	3.3 (1.5) pCi/g	540 ug/g	370 ug/g
04	236.7 (3) pCi/g	390,000 ug/g	2.1 (1.2) pCi/g	510 ug/g	720 ug/g
05	36.7 (.8) pCi/g	590,000 ug/g	1.8 (0.9) pCi/g	630 ug/g	960 ug/g
06	50.0(1.2) pCi/g	340,000 ug/g	0.4 (0.4) pCi/g	430 ug/g	690 ug/g

RAS - Austin REPORT Work Order # 87-05-025

:.ed: 05/06/87 Results By Test

SAMPLE / sample id	Test: ZN E ug/ml
01	110 ug/g
02	100 ug/g
03	89 ug/g
04	90 ug/g
05	110 ug/g
06	77 ug/g

RADIAN CORPORATION

Page 1 RAS - Austin REPORT Work Order # 87-05-025

Received: 05/06/87 07/31/87 15:37:29

REPORT TO: Intera Technologies, 6850 Austin Center Bl. #300, Austin, TX 78731

PREPARED BY: Radian Analytical Services, 8501 Mo-pac Bl., PO Box 201088, Austin, TX 78720-1088

CERTIFIED BY [signature]

ATTEN: David Graham

ATTEN:

PHONE: 512-454-4797

CONTACT: GIBSON

CLIENT: INTERA SAMPLES: 6

COMPANY: Intera Technologies

FACILITY:

WORK ID: precipitated salt/soils

TAKEN:

TRANS: SGP

TYPE:

P.O. #:

INVOICE: under separate cover

Footnotes and Comments

* Indicates a value less than 5 times the detection limit. Potential error for such low values ranges between 50 and 100%.

@ Indicates that spike recovery for this analysis on the specific matrix was not within acceptable limits indicating an interferent present.

SAMPLE IDENTIFICATION

01
02
03
04
05
06

TEST CODES and NAMES used on this report

AL E	Aluminum, ICPES
CA E	Calcium, ICPES
CD E	Cadmium, ICPES
CL IC	Chloride, IC
CR E	Chromium, ICPES
CU E	Copper, ICPES
D3050P	Digestion method 3050, ICP
FE E	Iron, ICPES
K E	Potassium, ICPES
MG E	Magnesium, ICPES
MN E	Manganese, ICPES
NA E	Sodium, ICPES
NI E	Nickel, ICPES
PB 210	Lead 210
PREP W	Special preparation
RA 226	Radium 226
SO4 IC	Sulfate, IC
TH 230	Thorium 230
U E	Uranium, ICPES
V E	Vanadium, ICPES
ZN E	Zinc, ICPES

SAMPLE Sample Id	Test: AL E ug/ml	Test: CA E ug/ml	Test: CD E ug/ml	Test: CL IC mg/L	Test: CR E ug/ml
01	16000 ug/g	4400 ug/g	5.4 ug/g	1300 ug/g	30 ug/g
02	18000 ug/g	3600@ ug/g	4.4 ug/g	490 ug/g	26 ug/g
03	23000 ug/g	6800 ug/g	2.0 ug/g	170* ug/g	26 ug/g
04	20000 ug/g	3700 ug/g	3.1 ug/g	370 ug/g	25 ug/g
05	18000 ug/g	4500 ug/g	5.6 ug/g	530 ug/g	26 ug/g
06	13000 ug/g	5500 ug/g	3.6 ug/g	160* ug/g	19 ug/g

SAMPLE Sample Id	Test: CU E ug/ml	Test: D3050P date complete	Test: FE E ug/ml	Test: K E ug/ml	Test: MG E ug/ml
01	71 ug/g	05/08/87	44000 ug/g	2200 ug/g	9400 ug/g
02	62 ug/g	05/08/87	37000@ ug/g	2100@ ug/g	9000@ ug/g
03	40 ug/g	05/08/87	11000 ug/g	60* ug/g	8300 ug/g
04	53 ug/g	05/08/87	22000 ug/g	750 ug/g	8200 ug/g
05	68 ug/g	05/08/87	41000 ug/g	2200 ug/g	9000 ug/g
06	52 ug/g	05/08/87	30000 ug/g	1700 ug/g	6100 ug/g

RADIAN CORPORATION

RAS - Austin REPORT Work Order # 87-05-025

...ed: 05/06/87 Results By Test

SAMPLE ...le Id	Test: MN E ug/ml	Test: NA E ug/ml	Test: NI E ug/ml	Test: PB 210 pCi/	Test: PREP W date complete
01	820 ug/g	19000 ug/g	24 ug/g	25.6(2.1) pCi/g	05/14/87
02	740@ ug/g	19000@ ug/g	21 ug/g	10.5(1.9) pCi/g	05/14/87
03	580 ug/g	9800 ug/g	25 ug/g	49.9(3.0) pCi/g	05/14/87
04	610 ug/g	11000 ug/g	22 ug/g	35.4(2.6) pCi/g	05/14/87
05	770 ug/g	17000 ug/g	22 ug/g	20.0(1.7) pCi/g	05/14/87
06	500 ug/g	11000 ug/g	15 ug/g	26.7(2.3)	05/14/87

SAMPLE ...le Id	Test: RA 226 pCi/	Test: SO4 IC mg/L	Test: TH 230 pCi/	Test: U E ug/ml	Test: V E ug/ml
01	61.4 (.7) pCi/g	400,000 ug/g	1.1 (0.7) pCi/g	630 ug/g	1000 ug/g
02	41.4 (.8) pCi/g	490,000 ug/g	1.0 (0.8) pCi/g	780 ug/g	830@ ug/g
03	77.8 (.8) pCi/g	310,000 ug/g	3.3 (1.5) pCi/g	540 ug/g	370 ug/g
04	236.7 (3) pCi/g	390,000 ug/g	2.1 (1.2) pCi/g	510 ug/g	720 ug/g
05	36.7 (.8) pCi/g	590,000 ug/g	1.8 (0.9) pCi/g	630 ug/g	960 ug/g
06	50.0(1.2) pCi/g	340,000 ug/g	0.4 (0.4) pCi/g	430 ug/g	690 ug/g

RADIAN CORPORATION

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Received: 05/06/87

RAS - Austin REPORT

Results By Test

Work Order # 87-05-025

SAMPLE Sample Id	Test: ZN E ug/ml
01	110 ug/g
02	100 ug/g
03	89 ug/g
04	90 ug/g
05	110 ug/g
06	77 ug/g

APPENDIX RIV

GAMMA SURVEY RESULTS FOR BACKGROUND SITES AND TRAVERSES AT EDGE OF TAILINGS

REM

RADIANT ENERGY MANAGEMENT

LYDA W. HERSLOFF, Ph.D.
Health Physicist

FILE COPY

December 13, 1987

Gerry Grisak
Intera Technologies, Inc.
Suite 300
6850 Austin Center Blvd.
Austin, TX 78731

Dear Gerry,

As per our proposal, the gamma survey for the background areas and the two traverses were completed during the week of December 6, 1987. Also, the majority of the primary grid was surveyed for external gamma exposure during this past week. Unfortunately, the gamma survey of the primary grid was not completed as a result of the weather.

The attached tables give the gamma survey results as completed.

The ten soil samples collected at the ten background locations and twenty soil samples, ten taken from each of the traverses, were taken to Hazen Research for analyses. I believe I misinterpreted the section of the "radiological survey plan" on page 3 which addresses the soil sampling scheme along the traverses. During this past week, soil samples were collected at 100 foot intervals out to 1000 feet with only gamma readings taken at "background gamma levels" beyond 1000 feet. The additional background soil samples along the traverses will therefore be collected at the time the primary grid survey is completed. Because of my misinterpretation of the soil sampling regime, my proposal budget for only 5 soil samples for each traverse (10 total) was underestimated by $830.00 (cost for 20 additional soil samples from the traverses @ $41.50 each). I sincerely hope my confusion does not cause you too many problems.

If you have any questions, please call me at (303)642-7530.

Sincerely,

Lyda

Lyda W. Hersloff

10854 DIANE DR. GOLDEN, Co. 80403 (303) 642-7530

BASELINE AND TRAVERSE GAMMA

uR/hr, 1 meter

Baseline	1m	South	1m	[3] Corrected	East	1m	Corrected
[1] 1-B	15	[2] S-0	70	31	[4] E-0	65	39
2-B	15	S-1	65	24	E-1	40	21
3-B	16	S-2	55	31	E-2	55	39
4-B	12	S-3	45	22	E-3	38	18
5-B	12	S-4	42	21	E-4	42	23
6-B	13	S-5	40	24	E-5	32	18
7-B	13	S-6	34	21	E-6	28	18
8-B	15	S-7	27	20	E-7	26	19
9-B	15	S-8	22	16	E-8	20	17
10-B	22	S-9	22	18	E-9	20	18
		S-10	19	17	E-10	16	
		S-11	17		E-11	16	
		S-12	14		E-12	14	
		S-13	15		E-13	16	
		S-14	13		E-14	14	
		S-15	14		E-15	14	

[1] starting at the windmill (Meyers) and going counter clockwise

[2] starting at tailings and going south with samples every 100 feet

[3] corrected for shine from tailings pile

[4] starting at tailings and going east with samples every 100 feet

APPENDIX RV

Ra^{226} AND EMANATION COEFFICIENTS FOR SLIMES AND WASTE ROCK SAMPLES

Rogers & Associates Engineering Corporation

REPORT OF RADIUM AND EMANATION COEFFICIENT MEASUREMENTS
(LAB PROCEDURE RAE-SQAP-3.1)

CONTRACT C8700/13

BY RYB

SAMPLE IDENTIFICATION Uranium Tailings

SUBMITTED BY Intera Technologies DATE RECEIVED 1-May-87

SAMPLE NUMBER	MOISTURE (DRY WT. %)	RADON EMANATION COEFFICIENT[a]	RADIUM[a] (pCi/gram)	COMMENTS
S-1	25.3	0.34 ± 0.02	76 ± 1	
S-2	43.2	0.28 ± 0.02	122 ± 1	
S-3	45.8	0.34 ± 0.02	74 ± 1	
S-4	39.1	0.29 ± 0.02	43 ± 1	
S-5	86.8	0.25 ± 0.01	601 ± 4	
S-6	44.0	0.34 ± 0.02	65 ± 1	

[a] UNCERTAINTIES BASED ON GAMMA-RAY COUNTING STATISTICS ONLY.

RAE

POST OFFICE BOX 330
SALT LAKE CITY • UTAH 84110
(801) 263-1600

Post Office Box 3300
Salt Lake City, Utah 84110-0330
(801) 263-1600

November 20, 1987

FILE COPY

Mr. Andrew Backus
Intera Tech
6850 Austin Center Blvd., Suite 300
Austin, TX 78731

C8700/20

Dear Andy:

We have completed the radium and radon emanation test results. They are listed below.

Sample ID	Moisture (Dry St. %)	Radon Emanation Coefficient	Radium (pCi/gram)
WR-101	14.8	0.36 ± 0.02	56 ± 1
102	12.0	0.37 ± 0.02	49 ± 1
103	13.9	0.45 ± 0.02	51 ± 1
104	8.0	0.39 ± 0.02	51 ± 1
105	10.5	0.38 ± 0.02	52 ± 1
106	14.9	0.33 ± 0.01	65 ± 1
107	10.9	0.43 ± 0.02	68 ± 1
108	13.7	0.39 ± 0.02	44 ± 1
109	13.7	0.40 ± 0.01	62 ± 1
110	10.4	0.39 ± 0.02	54 ± 1
111	37.3	0.30 ± 0.02	59 ± 1

We will be shipping your samples back to you in a few weeks. If you have any questions, please contact kirk Nielson or me.

Sincerely yours,

Renee Y. Bowser /b

Renee Y. Bowser
Lab Supervisor

RYB/b

RECEIVED NOV 30 1987 INTERA TECHNOLOGIES