TK-Telkwa 82 (1)A

TELKWA PROJECT

1982 GEOLOGICAL ASSESSMENT REPORT

N.T.S. Map Sheet	93 L/11	
Lat./Long.	54°35'/127°8'	
Coal Licences	Group 327	4271, 4272 4274 - 4281 4283, 6040 5305 - 5307
	Group 325	4260 - 4262 4264, 4265 4267, 4269 4270, 4282 5839
	Bulkley Valley Coal Ltd. Option	3709, 3710 3875 - 3885
Licences Held By -	Shell Canada Resources Limited	
Operated By -	Crows Nest Resources Limited	
Exploration Period -	February - March 1982 July - October 1982	
Report Date -	January, 1983	
Project Members -	Dave Handy	Project Geologist
	Steve Cameron	Geologist
	Cathy Langill	Geologist
	Ron Kostiuk	Geol. Technologist
	Pat Lockwood	Geol. Technician

1/FNc.1

4 of 7

Crows Nest Resources LIMITED
Eau Claire Place, 525 - 3rd Avenue S.W., Calgary, Alberta (403) 232-4355
P.O. Box 2699, Station M, Calgary, Alberta T2P 2M7 Telex 03-822505

February 28, 1983

Ministry of Energy, Mines & Petroleum Resources
British Columbia

Enclosed please find our report on the Telkwa Project.

This report has been prepared by Mr. D. Handy and Mr. S. Cameron, both of whom are employed by Crows Nest Resources Limited as geologists.

Mr. D. Handy, Honours B.Sc., graduated in Geology from the University of Waterloo in 1977. Prior to his graduation, Mr. Handy worked as an assistant for two geotechnical companies and after graduation as a geologist for a major company in Saskatchewan. Mr. Handy has been employed by Crows Nest Resources Limited as a Project Geologist since 1979.

Mr. S. Cameron, B.Sc., in Geology graduated from the University of Calgary in 1981. Prior to graduation Mr. Cameron worked as an assistant for a major exploration company in the North West Territories. He also worked for Crows Nest Resources Limited as a geological assistant in 1980. Mr. Cameron has been employed by Crows Nest Resources Limited as a Geologist since May 1981.

In my opinion, all of these personnel are fully qualified, by training and experience to prepare this report and this account of work done under their direct supervision.

Yours very truly

H.G. Rushton

H.G. Rushton
Vice President - Development

Enclosure

HGR/sc

TELKWA PROJECT

TABLE OF CONTENTS

1/FNc.2

LIST OF ENCLOSURES

VOLUME 1 82(2)A-1

VOLUME 2 - 7 82(3)A

1/FNc.3

LIST OF TABLES

VOLUME 1

4/FNc.4.1

LIST OF APPENDICES

VOLUME 8 82(4)A

VOLUME 9 82(2)A - 2

1/FNc.4

1.0 SUMMARY

The Telkwa Project is contained within 25 B.C. Coal Licences which cover 6,346 hectares. In addition, Shell/CNRL hold 13 licences covering 4,663 hectares under option agreements. The licences are held by Shell Canada Resources Limited and operated by its wholly owned subsidiary, Crows Nest Resources Limited.

The Telkwa licences lie in proximity to the Canadian National Railway and are 360 km east of the port of Prince Rupert. Existing infrastructure, the proximity of a coal handling port and the good quality of the coal make this project attractive.

Early Cretaceous sedimentary rocks of the Skeena Group contain significant thicknesses (single seams up to 7.6 metres, aggregate seam thicknesses of up to 30 metres) of low ash, high grade, medium to high volatile bituminous coal amenable for thermal use. Lack of outcrop exposure, complex stratigraphy and geological structure hinder exploration in the Telkwa area.

The winter drilling program was initiated to explore areas with ground conditions that are too soft for summer work, namely the Cabinet Creek area and the area north of the Telkwa River which will be referred to as Telkwa North. The summer drilling program was designed to explore for significant low ratio coal reserves believed to exist in the Goathorn Creek area based on preliminary data obtained during the 1981 field season.

The 1982 exploration program included the construction of 12.6 km of new road. Sixty five diamond drill holes and 7 rotary drill holes were completed. Four backhoe trenches were excavated. Geophysical surveys conducted included seismic refraction, EM 37 and proton magnetometer. These were run over specific problem areas of the property.

Geotechnical studies were initiated in the Goathorn Creek area. Piezometers were installed in 5 drill holes and permeability tests conducted. Loose overburden was sampled and tested from 5 drill holes.

The 1982 exploration program indicated large reserves of low-ratio coal exist in the Goathorn Creek area. Smaller reserve potential of low-ratio coal exists in the Telkwa North and Cabinet Creek areas of the Telkwa Project.

The total field expenditure for 1982 was $1,576,999. Of this total $1,403,308 is being applied to the licences covered by this report. The remainder was spent on Freehold land either owned by Shell Canada Resources Limited or under option agreement.

2.0 INTRODUCTION

2.1 Location and Access

Enclosure 1-1: Index Map

Enclosure 1-2: Access Map

The Telkwa Project is located 15 km south of the town of Smithers in West Central British Columbia; Coast Land District 5, NTS Map Sheet 93L/11. The coal licences lie north of the Telkwa River and east of Pine Creek and south of the Telkwa River along Goathorn Creek and Cabinet Creek. The centre of the licence block lies at N. Lat 54°35'/N. Long 127°8'. Smithers is 360 km from the port of Prince Rupert along the CNR line and Highway 16. The Telkwa Project is 10 km from this rail line and mostly accessible by good gravel road.

2.2 Tenure

The Telkwa Project licences are subdivided into three groups: Telkwa North, Telkwa South and Bulkley Valley Coal Limited Option.

Such a subdivision is necessary for land tenure purposes.

GROUP NUMBER	LICENCE NUMBERS
327	4271, 4272, 4274-4281, 4283, 5305-5307, 6040
325	4260-4262, 4264, 4265, 4267, 4269, 4270, 4282, 5839
Bulkley Valley Coal Limited Option	3709, 3710, 3875-3885

All licences are operated by Crows Nest Resources Limited. All licences are held by Shell Canada Resources Limited with the exception of those optioned from Bulkley Valley Coal Limited.

In addition, Shell Canada Resources Limited owns 3 freehold lots and options 2 freehold lots (Whalen Option) which are also included as part of the Telkwa Project.

Appendix 1 of this report contains a "Coal Land Disposition Map".
Appendix 2 contains a tabulation of "B.C. Coal Land Tenure Standing" for each group of licences being renewed.

3.0 REGIONAL GEOLOGY

The rocks of the Telkwa sedimentary basin consist of interbedded marine and non-marine sedimentary and volcanic strata of the Skeena Group. This group is of early Cretaceous to late Cretaceous age.

The sedimentary rocks include mudstone, siltstone, sandstone, shale, conglomerate and coal. Volcanics are grey to green basaltic to rhyolitic breccias, tuffs and flows. In addition, these sediments have been intruded by porphyritic rocks of Tertiary age.

The rocks of the Skeena Group appear similar to those of the older Bowser Lake Group but with subtle lithological and paleontological differences.

"In the late Jurassic to early Cretaceous, prior to deposition of the Skeena Group sediments, the Hazelton Group underwent a period of uplift, deformation and erosion. The Telkwa successor basin was deposited on this erosion surface. During the mid Early Cretaceous, the sea readvanced from the west, in the area of the Skeena Valley, inundating the non-marine, late Lower Cretaceous coal basins such as Telkwa and Lake Kathlyn. The sediments of the Skeena Group were derived from an uplifted Pinchi belt - Columbian

Orogen. They were deposited in a southwesterly direction, across the Skeena Arch, which apparently had little influence on the shape of the basin receiving the Skeena clastics".[1]

In the Telkwa Basin recent erosion has removed the soft coal-bearing sediments from the higher ridges leaving all or part of the sedimentary sequence preserved in the topographic lows. Outcrops are found only in certain stream valleys which have cut through the glacial drift cover. Few exposures occur away from the creeks until the higher ridges are reached and invariably these are volcanics of the Hazelton Group. The volcanic sedimentary contact over most of the basin is drift covered and heavily timbered making accurate delineation of the areal extent of the basin very difficult.

The thickness of the Skeena Group section in the Telkwa area is quite variable but probably does not exceed 500 metres. The presence of thin bentonitic beds within the lower part of the section indicates volcanism and sedimentation occurred contemporaneously in the Lower Cretaceous.

---

1 Tipper H.W. & Richards T.A., Jurassic Stratigraphy and History of North Central British Columbia, 1976, pg. 7

The geological structure of the sedimentary rocks in the Telkwa area is complex. North-south trending reverse faults and normal faults are predominant and have created large structural blocks of strata. These faults can displace strata up to 50 metres vertically. Fault zones can have splays as evidenced by repeated strata in some drill holes. Small scale faults with displacements of a few metres are widespread over the area. Every underground working in the Telkwa Basin encountered structural offsets which hindered and in some cases terminated their drivage.

4.0 TELKWA STRATIGRAPHY

4.1 General

Figure 1: Telkwa Type Section

In the Telkwa coal field the basement rocks consist of lower to middle Jurassic volcanics of the Hazelton Group. These rocks are usually weathered to a reddish-purple at the contact with the overlying sediments. Skeena sediments unconformably overlie the volcanics. The sediments consist of coal, conglomerate, sandstone, siltstone, mudstone, minor tuff and lava beds. Tertiary intrusive rocks in the form of dykes and sills have been found over the property. A large intrusive plug forms the contact with the Skeena sediments north of the Telkwa River.

The stratigraphic section varies in thickness over the Telkwa area from 0 to approximately 500 metres.

Laterally, individual beds can pinch out rapidly including coal beds as evidenced by drill hole TW 238. The majority of the stratigraphic section is composed of fine grained sediments, namely siltstone and mudstone. Several marine tongues occur throughout the continental sequence. Brown

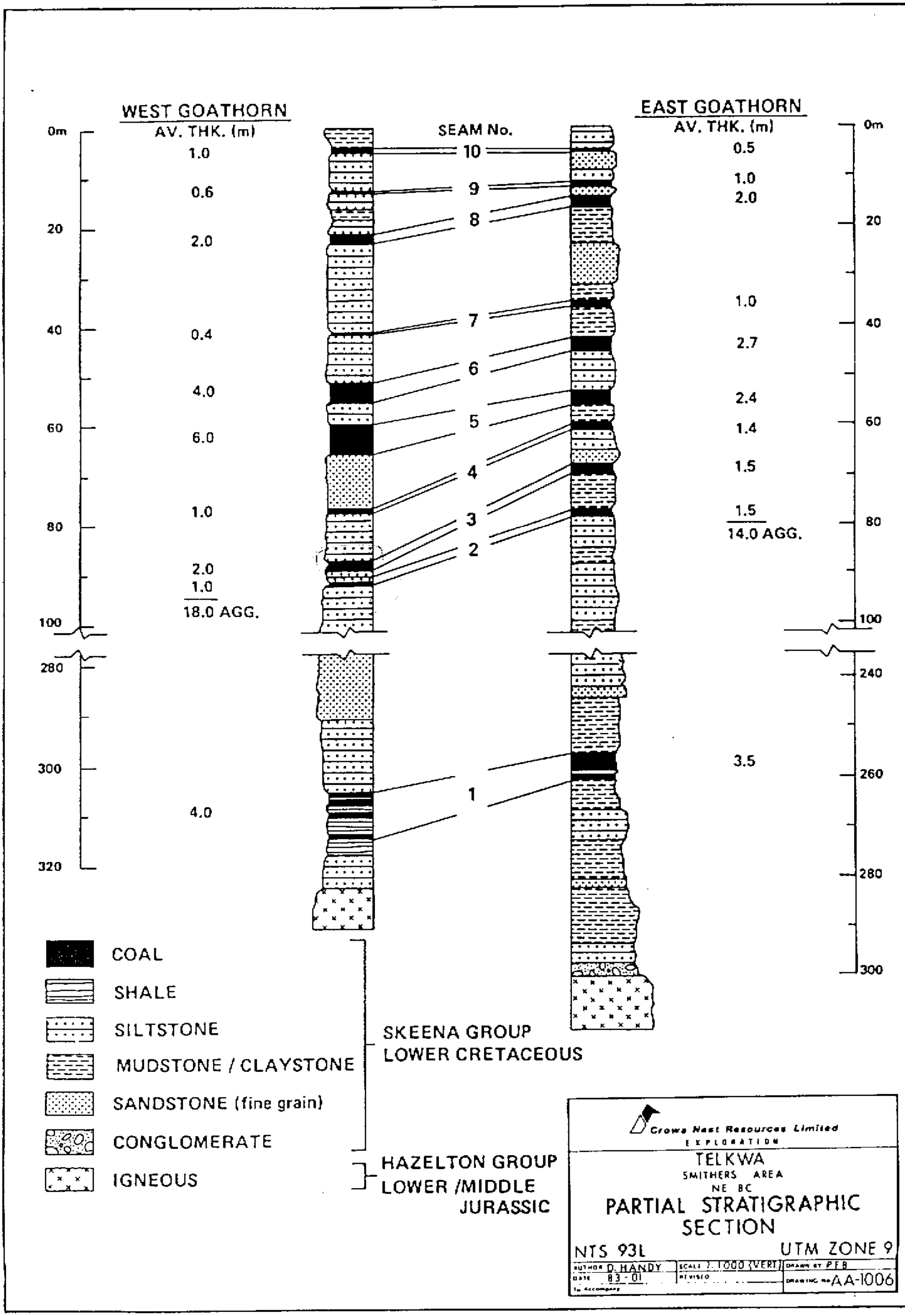

WEST GOATHORN
AV. THK. (m)
0m
20
40
60
80
100
280
300
320
1.0
0.6
2.0
0.4
4.0
6.0
1.0
2.0
1.0
18.0 AGG.
4.0
SEAM No.
10
9
8
7
6
5
4
3
2
1
EAST GOATHORN
AV. THK. (m)
0.5
1.0
2.0
1.0
2.7
2.4
1.4
1.5
1.5
14.0 AGG.
3.5
0m
20
40
60
80
100
240
260
280
300
COAL
SHALE
SILTSTONE
MUDSTONE / CLAYSTONE
SANDSTONE (fine grain)
CONGLOMERATE
IGNEOUS
SKEENA GROUP
LOWER CRETACEOUS
HAZELTON GROUP
LOWER /MIDDLE
JURASSIC
Crows Nest Resources Limited
EXPLORATION
TELKWA
SMITHERS AREA
NE BC
PARTIAL STRATIGRAPHIC
SECTION
NTS 93L
UTM ZONE 9
AUTHOR D. HANDY
DATE 83-01
SCALE 1:1000 (VERT)
DRAWN BY PFB
DRAWING No AA-1006

Figure 1

colored siderite nodules are common in the siltstone and mudstone.

At least two bentonite layers have been observed in the lower part of the section and serve as useful marker horizons. One or two zones of bi-valve fossils have been found in the drill core but using them as a correlation tool has proved unsuccessful thus far. The sediments exhibit numerous soft sediment deformation structures including rip up clasts, micro slump faults and load casts. Bioturbated zones are common.

4.2 Coal Stratigraphy

At least 14 coal seams exist in the Telkwa Basin.

Within the Goathorn Creek area 10 major correlatable seams have been found. These are numbered from 1 to 10 going stratigraphically up section. Average aggregate thickness of the upper 9 seams varies from 14 metres in the east to 18 metres in the west. East of Goathorn Creek the upper 9 seams range individually from 0.5 to 2.5 metres in thickness. West of Goathorn Creek individual coal intersections of up to 7.6 metres have been encountered.

A distinct marker horizon occurs beneath Seam 2 on the gamma ray logs. This has been used as a datum line for drill hole correlation over the entire property.

Seam 1 is situated some 300 metres below the gamma marker and averages 3.5 m in thickness.

In the Telkwa North - Avelling Hill area seams 1 to 10 have been intersected by 3 drill holes. The upper 9 seams have an aggregate thickness of up to 18 metres. At Pine Creek, some of the upper seams are present as well as Seam 1. These seams are thin (all are <2.0 m) and their lateral continuity is unknown.

Drilling at Cabinet Creek indicates the presence of Seam 1 with an average thickness of 5 metres. Upper seams were encountered in one drill hole but the seams are thin and their correlation with the Telkwa type section is uncertain.

5.0 TELKWA STRUCTURE

In the Goathorn Creek area, large north-south trending normal and reverse faults have divided the property into several stuctural fault blocks. The majority of these faults have been interpreted from drilling data and air photo interpreted lineaments. These faults occur as zones with imbricates and splays as evidenced by coal seam repeats in some drill holes. More than one period of structural deformation has occurred with younger faults transecting other older faults. It appears some of the faults originate in basement volcanics but probably not all of the fault occurrences do so.

Over the Goathorn East (east of Goathorn Creek) area, the beds maintain a strike of 350° and dip to the east within a 10° to 35° range.

The Goathorn West area shows both north-south and east-west trending normal faults cutting the stratigraphic sequence. Drilling indicates a synclinal fold in the western most block. Generally the west strata maintain a roughly east-west strike with dips to the south in the 10° to 30° range.

In the Telkwa North area, drilling data is limited. One fault block of low ratio coal has been identified on licence #4278 with a N-S strike and dips east at 10° - 15°.

In the Pine Creek area, drilling indicates a monocline with a strike of 290° and a dip of 5-10°.

At Cabinet Creek ,the strata strike at 330° and dip at 13° N-E. Drilling data is limited here also.

1/FNc.17

6.0 SUMMARY OF PREVIOUS WORK

1979 - 1:10,000 scale geological mapping
- bulldozer trenching
- road upgrading
- rotary drilling (4 holes)
- coal sampled and analyzed
- drill site reclamation

1980 - no exploration

1981 - 1:10,000 scale geological mapping
- 1:5,000 scale geological mapping
- road upgrading
- bulldozer trenching
- rotary drilling (7 holes)
- diamond drilling (1 hole)
- coal sampled and analyzed
- drill site reclamation
- geodetic location survey
- geophysical survey - EM37
- 1:5,000 scale topographical maps constructed

7.0 WORK DONE IN 1982

- 1:5,000 scale geological mapping
- backhoe trenching
- road construction and upgrading
- rotary drilling
- diamond drilling
- coal sampled and analyzed
- geophysical surveys - EM37
  - seismic
  - proton magnetometer
- geotechnical studies - piezometer installation
  - soil sampling
  - core logging
- 1:5,000 scale topographical maps constructed
- 1:10,000 scale topographical maps constructed
- 1:2,000 scale topographical maps constructed
- road and drill site reclamation

Field mapping was conducted in the Bulkley Valley Collieries open pit excavation and in the vicinity of Goathorn Creek.

Four backhoe trenches were excavated at coal exposures or coal bloom showings.

A total of 12.5 km of new road was constructed, 4.54 km on Freehold land, 7.96 km on licences covered by this report.

A total of 7.7 km of existing road was upgraded - 5.6 km on Freehold land, 2.1 km on licences covered by this report.

A total of 72 drill holes were completed on the Telkwa property during 1982.

During the winter program seven rotary drill holes were completed using a truck mounted Cyclone TH60 drill for a total of 1,435 metres. Eleven diamond drill holes were collared using a Longyear 38 wireline drill for a total of 2,532 metres.

During the summer program 54 diamond drill holes were completed using two Longyear 38 wireline drills for a total of 11,137 metres. All of the rotary drilling and 39 of the diamond drill holes are situated on licences covered by this report. The remaining holes are located on Freehold lots.

Coal samples were sent to CNRL's Fernie lab and Loring Laboratories for analyses.

All pertinent drill holes and roads were surveyed. Ground control was established for photogrammetric mapping at scales of 1:10,000, 1:5,000 and 1:2,000. A new set of 1:15,000 scale air photos was taken as well as a set of false color infra-red photographs at a scale of 1:15,000.

Computer generated topographic maps were produced at 1:5,000 scale.

Three types of geophysical surveys were utilized on the licences covered by this report. These included five EM37 transient electromagnetic soundings, 3.9 km of refraction seismic, and a 0.4 km proton magnetometer survey. Additional surveys were conducted on Freehold lots.

Four of a total of five piezometers were installed in holes on licences covered by this report. The piezometers were monitored and packer permeability tests performed. Soil and other loose overburden was sampled in five holes and sent for lab testing. Three of these holes are situated on licences covered herein.

All disturbances including new and upgraded roads, drill sites and trenching sites were recontoured and seeded.

The total cost of the 1982 exploration work was $1,576,999. Of this figure, $1,403,308 is being applied to the licences reported herein. Appendix 3 contains a copy of the Application to Extend Term of Licence which gives a detailed account of the amount and nature of expenditures applied to the three licence groups.

8.0 MINEABILITY AND RESERVES

Goathorn Creek Area

The Goathorn Creek area of the Telkwa Project is the most attractive location for low-ratio open pit mineable coal. The upper 9 coal seams generally maintain thicknesses of 0.5 metres or greater and total 14 to 18 metres of aggregate coal thickness in 85 to 100 metres of stratigraphic section. A small amount of Seam 1 should be mineable in the area of hole TW-260 in Goathorn East and in the area of hole TW-239 in Goathorn West. Goathorn East contains probably 90% of the mineable reserves in the Goathorn Creek area. Glacial fluvial erosion has removed much of the reserves in the Goathorn West area.

Using an aggregate coal thickness of seams greater than 0.3 metres per hole x an area of influence of half the distance to each adjacent hole results in an insitu reserve of 50 million tonnes for the Goathorn Creek area. Assigning a specific gravity of 1.5 g/cc to the coal results in an overburden ratio of less than 10:1 bank cubic metres waste per tonne coal. These reserves should be classified as proven.

Telkwa North - Avelling Hill

Preliminary drilling indicates a significant amount of low-ratio coal exists in the area of Licence #4278.

Using two drill holes with an average aggregate coal thickness of 10.75 m and an area of 0.85 sq. km. results in an insitu reserve of 13 million tonnes at an overburden ratio less than 10:1 m^3/tonne. These reserves should be classified as possible.

Pine Creek

Drilling in the Pine Creek area indicates Seam 1 is situated at shallow depth. Seam 1 occurs as a zone 15.85 metres thick with a total of 4.34 m of coal. Possible reserves are 9.5 million tonnes at a ratio of less than 10:1 m^3/tonne.

Cabinet Creek

Based on three drill holes which intersected Seam 1, a possible reserve of 3.3 million tonnes at an overburden ratio of less than 10:1 m^3/tonne has been calculated.

An average aggregate coal thickness of 10.75 m was used over a projected area of 0.85 sq. km. This area was determined by projecting the coal measures down dip to a cut-off level of 10:1 metres rock/metres coal.

9.0 COAL QUALITY

Coal samples were obtained from 7 rotary drill holes and 62 diamond core holes. At the time of writing of this report, analyses are still pending on 9 of the core holes. Incremental results for each hole can be found in Appendix 8. Seam by seam weighted averages for each of the exploration drilling areas follow in Tables 1 to 10.

Overall average quality has been determined for each area with exception of Cabinet Creek, the results of which are not representative of the area. All samples from this area were obtained from rotary hole cuttings and appear to be heavily contaminated. The tables labelled "Telkwa North" refer to all the drilling north of the Telkwa River.

Telkwa coal is ranked as High Volatile "A" Bituminous by ASTM standards. Preliminary results indicate it has poor rheological properties but its high calorific value, good volatility and average clean coal sulphur content of approximately one per cent render it an excellent thermal coal.

TABLE 1

COAL QUALITY

PROJECT AREA - GOATHORN EAST

BASIS - AIR DRIED
RAW COAL

DATE FEBRUARY 12, 1983
RESULTS BASED ON 299 INCREMENTAL RECORDS

SEAM	NO. OF RECORDS	VOLATILE	ASH	RESIDUAL MOISTURE	FIXED CARBON	CALORIFIC VALUE	YIELD	FSI	SULPHUR	AVERAGE THICKNESS
1	17	26.29	20.24	0.81	57.66	6443	-	-	1.47	5.13
2	27	24.86	27.19	0.87	47.09	5680	-	-	1.11	2.39
3	20	24.18	28.51	0.90	46.41	5630	-	-	1.84	2.18
4	21	26.85	19.50	0.91	52.75	6462	-	-	1.86	1.25
5	22	25.28	22.41	0.99	51.30	6167	-	-	1.17	2.56
6	20	25.31	22.10	0.92	51.67	6208	-	-	1.33	2.51
7	16	26.48	20.19	1.00	52.32	6415	-	-	2.36	1.45
8	10	27.51	13.42	1.04	58.03	7008	-	-	1.62	2.18
9	6	31.11	12.40	0.98	55.52	7191	-	-	3.01	1.52
10	6	27.16	22.85	1.12	48.87	6184	-	-	3.04	0.66

TABLE 3

COAL QUALITY

PROJECT AREA - GOATHORN WEST

BASIS - AIR DRIED
RAW COAL

DATE FEBRUARY 12, 1983
RESULTS BASED ON 48 INCREMENTAL RECORDS

SEAM	NO. OF RECORDS	VOLATILE	ASH	RESIDUAL MOISTURE	FIXED CARBON	CALORIFIC VALUE	YIELD	FSI	SULPHUR	AVERAGE THICKNESS
1	6	24.64	25.91	0.83	48.71	5889	-	-	1.94	5.84
2	2	23.20	15.47	1.13	60.19	6794	-	-	0.54	1.39
3	2	22.25	26.64	0.89	50.22	5802	-	-	2.36	2.13
4	3	23.05	18.42	0.88	57.65	6590	-	-	1.44	1.60
5	2	25.73	15.04	1.15	58.09	6833	-	-	1.29	6.02
6	3	27.24	12.75	1.08	58.94	7080	-	-	1.41	4.12
7	2	23.57	23.27	1.02	52.14	6088	-	-	4.27	0.48
8	2	22.27	17.16	1.04	59.53	6651	-	-	1.29	2.81
9	2	24.22	23.65	1.06	51.06	5983	-	-	4.72	0.80
10	2	23.99	15.47	1.13	60.19	6794	0	0	3.87	1.19

TABLE 5

COAL QUALITY

PROJECT AREA - TELKWA NORTH

BASIS - AIR DRIED
RAW COAL

DATE FEBRUARY 12, 1983
RESULTS BASED ON 26 INCREMENTAL RECORDS

SEAM	NO. OF RECORDS	VOLATILE	ASH	RESIDUAL MOISTURE	FIXED CARBON	CALORIFIC VALUE	YIELD	FSI	SULPHUR	AVERAGE THICKNESS
1	1	23.97	13.23	0.66	62.14	7283	-	-		4.55
2	2	24.44	23.88	0.69	51.00	6052	-	-		2.64
3	2	26.74	14.23	0.68	58.35	7013	-	-		1.39
4	2	27.56	10.13	0.80	61.50	7352	-	-		1.82
5	2	27.42	10.79	0.95	60.84	7276	-	-		1.62
6	3	26.51	18.91	0.78	53.79	6576	-	-		2.97
7	1	27.92	10.61	1.04	60.43	7359	-	-		1.14
8	1	21.20	35.09	0.67	43.04	5122	-	-		2.48
9	1	30.52	12.02	0.80	56.66	7354	-	-		1.03

10.0 REFERENCES

Dowling, D.B.

1915: Coal Fields of British Columbia, Canada Dept. of Mines, No. 57, Geological Series, pp. 167-189.

Handy, D.L.

1981: Geological Report - Smithers Area Coal Prospects - Crows Nest Resources Limited.

Tipper, H.W. and Richards, T.A.

1976: Jurassic Stratigraphy and History of North Central British Columbia, Geol. Serv. Can., Bulletin 270.

238
3 of 7

TK TELKWA 93A
CONFIDENTIAL
COAL QUALITY

TABLE 2

COAL QUALITY

PROJECT AREA - GOATHORN EAST

BASIS - AIR DRIED
WASHED S.G. 1.6

DATE FEBRUARY 12, 1983
RESULTS BASED ON 312 INCREMENTAL RECORDS

SEAM	NO. OF RECORDS	VOLATILE	ASH	RESIDUAL MOISTURE	FIXED CARBON	CALORIFIC VALUE	YIELD	FSI	SULPHUR	AVERAGE THICKNESS
1	17	27.75	10.30	0.90	60.95	7416	73.49	4.5	1.00	5.09
2	28	27.39	11.24	1.16	60.20	7243	64.56	1.5	0.79	2.52
3	21	27.42	11.22	1.18	60.07	7270	65.26	1.5	1.15	2.22
4	22	28.48	8.71	1.20	61.49	7428	72.18	2.0	1.12	1.36
5	23	28.33	8.34	1.33	61.90	7450	73.61	1.5	0.96	2.55
6	22	27.60	9.66	1.30	61.33	73.55	67.92	1.5	0.96	2.63
7	17	29.16	8.70	1.15	60.89	7469	76.48	2.5	1.44	1.42
8	13	28.96	7.27	1.22	62.45	7554	82.14	1.5	1.09	2.15
9	9	33.24	7.13	0.95	58.59	7648	83.35	4.0	1.69	1.31
10	8	31.20	10.20	0.91	57.59	7416	71.30	2.0	2.22	0.73

TABLE 4

COAL QUALITY

PROJECT AREA - GOATHORN WEST

BASIS - AIR DRIED
WASHED S.G. 1.6

DATE FEBRUARY 12, 1983
RESULTS BASED ON 52 INCREMENTAL RECORDS

SEAM	NO. OF RECORDS	VOLATILE	ASH	RESIDUAL MOISTURE	FIXED CARBON	CALORIFIC VALUE	YIELD	FSI	SULPHUR	AVERAGE THICKNESS
1	7	27.38	11.44	0.88	60.30	7314	62.30	4.0	1.27	6.33
2	2	24.23	9.42	1.51	64.85	7366	83.99	1.5	0.59	1.39
3	2	24.48	10.45	1.11	63.80	7331	68.99	2.0	1.44	2.13
4	3	23.61	9.94	1.17	66.93	7328	76.46	1.5	1.09	1.60
5	3	26.75	6.34	1.48	65.20	7506	82.14	1.5	0.66	6.45
6	3	28.79	6.15	1.71	63.57	7624	86.40	4.0	1.02	4.12
7	2	25.02	8.93	1.48	64.82	7402	68.21	2.0	2.75	0.48
8	2	23.26	10.56	1.23	64.50	7184	81.00	1.0	1.17	2.81
9	2	25.32	10.09	1.68	63.37	7299	63.80	2.0	2.43	0.80
10	2	26.28	9.77	1.21	62.66	7307	63.00	2.0	2.53	1.19

TABLE 6

COAL QUALITY

PROJECT AREA - TELKWA NORTH

BASIS - AIR DRIED
WASHED S.G. 1.6

DATE FEBRUARY 12, 1983
RESULTS BASED ON 25 INCREMENTAL RECORDS

SEAM	NO. OF RECORDS	VOLATILE	ASH	RESIDUAL MOISTURE	FIXED CARBON	CALORIFIC VALUE	YIELD	FSI	SULPHUR	AVERAGE THICKNESS
1	1	23.86	10.03	0.94	65.17	7625	84.00	3.5		4.55
2	2	25.77	10.03	1.04	63.16	7395	67.83	2.0		2.99
3	2	27.58	9.76	0.71	61.94	7455	78.64	3.0		2.39
4	2	27.75	8.34	0.90	62.99	7526	91.00	2.0		1.82
5	2	28.44	6.33	1.01	64.22	7690	87.74	3.0		1.63
6	3	29.03	7.35	0.93	62.69	7697	72.58	4.0		2.97
7	1	29.03	6.50	1.05	63.42	7715	90.00	2.0		1.14
8	1	26.58	9.79	0.66	62.97	7493	57.00	3.0		2.48
9	1	31.35	7.48	0.99	60.18	7770	87.00	4.0		1.03

TABLE 7

COAL QUALITY

PROJECT AREA - CABINET CREEK

BASIS - AIR DRIED
WASHED S.G. 1.6

DATE FEBRUARY 12, 1983
RESULTS BASED ON 6 INCREMENTAL RECORDS

SEAM	NO. OF RECORDS	VOLATILE	ASH	RESIDUAL MOISTURE	FIXED CARBON	CALORIFIC VALUE	YIELD	FSI	SULPHUR	AVERAGE THICKNESS
1	3	15.71	18.29	0.61	65.39	6932	19.59	1.5		4.22

BASIS - AIR DRIED
RAW COAL

SEAM	NO. OF RECORDS	VOLATILE	ASH	RESIDUAL MOISTURE	FIXED CARBON	CALORIFIC VALUE	YIELD	FSI	SULPHUR	AVERAGE THICKNESS
1	3	13.82	53.90	0.67	31.61	3327	-	-		4.22

NOTE: ALL SAMPLES FOR CABINET CREEK WERE DERIVED FROM ROTARY HOLE CUTTINGS. THE POOR QUALITY IS MOST LIKLEY THE RESULT OF LOST COAL PLUS CONTAMINATION FROM SURROUNDING ROCK.

February 12, 1983

TELKWA "OVERALL" COAL QUALITY

SPECIFIC AREA: GOATHORN EAST

AIR DRY BASIS			313 INCREMENTAL RECORDS	
	1.6 FLOAT	SD	RAW	SD
Volatiles	28.10	2.50	25.70	3.20
Ash	9.60	3.36	22.20	10.70
Moisture	1.15	0.29	0.91	0.23
Fixed Carbon	60.90	2.98	50.90	8.45
Calorific Value	7390	288	6190	1112
Yield	71.30	14.18	-	-
FSI	2.5	1.5	-	-
Sulphur	0.96	0.68	1.41	1.22
Thickness (Average)	2.20	1.40	2.20	1.40

SD — Standard Deviation

February 12, 1983

TELKWA "OVERALL" COAL QUALITY

SPECIFIC AREA: GOATHORN WEST

AIR DRY BASIS			52 INCREMENTAL RECORDS	
	1.6 FLOAT	SD	RAW	SD
Volatiles	26.70	2.03	24.70	1.82
Ash	9.40	2.20	20.70	6.51
Moisture	1.23	0.35	0.95	0.21
Fixed Carbon	62.60	2.67	53.50	5.94
Calorific Value	7380	164	6330	598
Yield	72.10	11.44	-	-
FSI	3.0	1.5	-	-
Sulphur	1.06	0.83	1.6	1.65
Thickness (Average)	2.73	0.98	2.73	0.98

SD — Standard Deviation

February 12, 1983

TELKWA "OVERALL" COAL QUALITY

SPECIFIC AREA: TELKWA NORTH

AIR DRY BASIS			20 INCREMENTAL RECORDS	
	1.6 FLOAT	SD	RAW	SD
Volatiles	27.60	2.21	25.9	2.17
Ash	8.70	2.52	18.7	7.56
Moisture	.92	.21	.78	.16
Fixed Carbon	62.60	1.72	54.40	6.01
Calorific Value	7540	210	6570	712
Yield	74.40	17.08	-	-
FSI	3.10	1.5	-	-
Sulphur	-	-	-	-
Thickness (Average)	2.47	1.01	2.47	1.01

SD — Standard Deviation

TK-Telkwa 82(4)A

OPEN FILE

238

2 of 7

KLOHN LEONOFF
CONSULTING ENGINEERS

OUR FILE: PA 1692.01 December 6, 1982

Crows Nest Resources Ltd.
Eau Claire Place
525 - 3 Avenue SW
Calgary, Alberta
T2P 2M7

Mr. M. Goldrick, P. Eng.

Telkwa Coal Project
Preliminary Hydrogeological and Geotechnical Investigation

Dear Mr. Goldrick:

We are pleased to submit three copies of our preliminary hydrogeological and geotechnical report for the Telkwa Project.

The report describes data collection in the areas of hydrogeology, including permeability tests and piezometer installations; sampling and testing of overburden till materials; and material workability with a view to excavating by means of a ripper and scraper operation.

Our preliminary conclusions based on this data are as follows:

i. Piezometric pressures on the site are high with the piezometric surface at or above the ground surface.

ii. The permeability of the coal is relatively low.

iii. The till overburden is a dense clay till in which permanent slopes of 2H:1V may be cut. Temporary slopes may be cut at 1.5H:1V or steeper, depending on slope height.

iv. The majority of materials on the site could be excavated by means of a ripper/scraper operation. The stronger rocks including the ironstones and strongly siderite cemented sandstones, will require blasting to loosen especially if bedding spacing is found to be greater than about 0.1 m.

We trust that this report is satisfactory, but should there be any queries please do not hesitate to contact us.

Yours very truly,

KLOHN LEONOFF LTD.

Hari Mittal

HARI K. MITTAL, Ph.D., P.Eng.
Project Manager

JAL/jmh

REPORT

PRELIMINARY GEOTECHNICAL AND HYDROGEOLOGICAL DATA COLLECTION STUDY

TELKWA COAL PROJECT

FOR

CROWS NEST RESOURCES LTD.

DECEMBER, 1982

PA 1692.01

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

LIST OF DRAWINGS

1.0 INTRODUCTION

Crows Nest Resources Ltd. proposes to develop a coal mine near Telkwa in the Bulkley Valley area of B.C. Two adjacent leases are currently being evaluated, the East and West Goathorn properties and as part of the resource evaluation approximately 40 drillholes were drilled during the summer of 1982.

Klohn Leonoff Ltd. was retained to collect preliminary groundwater data, to sample and perform laboratory tests upon till overburden materials and to evaluate the rock materials with regard to the possibility of excavating an open pit mine by means of ripping and scraping. Geotechnical logging of rock cores was carried out by Crows Nest Resources staff. This report presents the data collected and provides preliminary discussion of the results.

The scope of work for our investigations was described in our letters of July 8, 1982 and July 15, 1982, copies of which are given in Appendix I.

2.0 FIELD INVESTIGATION

The geotechnical and hydrogeological investigations were carried out towards the end of Crows Nest Resources' field program. Klohn Leonoff mobilized an engineer to Telkwa September 6, 1982 at which time 9 drillholes remained to be drilled. The locations of the drillholes designated DH255 to DH261 inclusive, DH264 and DH265 are shown on the site plan Drawing No. D1692-01.1.

The work carried out on site was as follows:

1. Installation of five piezometers in various coal horizons.
2. Preliminary monitoring of the piezometers.
3. Carrying out seven packer permeability tests at various horizons in the drillholes.

4. Logging and sampling of the till overburden in five drillholes.
5. Estimation of unconfined uniaxial compressive strength of typical rock types based on the Point Load Index test.

3.0 HYDROGEOLOGY

3.1 Installation of Piezometers

Four piezometers were installed in DH255, DH256, DH257, and DH258 by our engineer. A fifth instrument was installed in DH265 by Crows Nest staff following our engineer's departure from the site.

The piezometers comprise a 50 mm i.d. P.V.C. pipe with screw type couplers. The lower end of the pipe was fitted with a cap to prevent sediment entering the pipe and the lower 300 mm of the pipe was slotted using a fine hacksaw to permit groundwater to enter the pipe. The top of the piezometer protrudes above ground level and water ingress into the piezometer is prevented by a P.V.C. cap. Slots were cut into the piezometer pipe just below the cap to prevent a vacuum developing within the piezometer which would invalidate readings. The purpose of a piezometer is to measure groundwater pressures over a selected part of the formation and this is achieved by sealing the borehole above and below the piezometer tip with bentonite seals.

On completion of each drillhole fresh water was pumped down the drillstem to flush out all remaining traces of drilling mud which would affect bedrock permeability. When no further traces of drilling mud were returned to the surface installation of the piezometer commenced. Installation details for each piezometer are given in Drawings No. A1692-01.2 to .6. Following the installation of the piezometer, a falling head test was carried out to establish the permeability of the rock. Results of the falling head tests are given in Table 1.

3.2 Monitoring of Piezometers

Groundwater levels were monitored several times using an electric tape by our engineer prior to his departure from the site. All 5 piezometers were read by Crows Nest staff on completion of the field program on September 30, 1982.

The readings obtained to date are presented on Table 2.

3.3 Discussion

Piezometers require a period of time to stabilize following installation and this period varies with the permeability of the material in which the instrument is installed.

Piezometers DH 255, DH 256 and DH 257 showed an increase in water levels following installation. At the time of the last readings (September 30, 1982) DH 255 had risen 1.60 m with the piezometric surface 1.0 m above ground surface. Rises of 5.84 and 1.29 m were recorded in DH 256 and DH 257 respectively. The monitoring results suggest that piezometric pressures are high and that artesian conditions may exist.

Further monitoring of the water levels will be required before any reliable conclusion can be drawn from the piezometer readings. It may be necessary to install pressure gauges to measure high artesian pressures should they be found.

Water sampling was not carried out during this investigation because water was added to the piezometers during the falling head tests. We recommend that water samples be taken and water quality tests be carried out as part of the 1983 investigations. We also recommend that a program for regular monitoring of groundwater levels during 1983 be established.

3.4 Packer Tests

Seven packer permeability tests were carried out in DH 255 and DH 258, in order to determine coefficients of permeability (k) for the rock mass at selected locations. It was anticipated that the coal horizons are the most permeable units and therefore testing was confined to the coal seams.

When a packer test was to be carried out, drilling was interrupted when the coal seam was partially penetrated. The core barrel was then partially withdrawn from the drillhole to approximately the top of the coal seam. The inner barrel was completely withdrawn from the wire line tool and the packer equipment substituted. The packer equipment was sealed against the bit with a small packer contained within the core barrel and a larger packer extending below the barrel. The packers were then inflated using nitrogen, expanding to seal off the drillhole and the core barrel. With this completed the test was carried out. The effective test section was located between the bottom of the lower packer and the bottom of the drillhole. The test section for the tests carried out varied from 2.24 to 6.1 m in length. A "slug" type test was then carried out, a known volume of water being injected into the test section via the drill stem as quickly as possible and the dissipation of head with time as the water seeped into the rock was noted.

Mass permeabilities for the test sections were determined using standard calculation methods. Calculation sheets for the permeability tests are presented in Appendix V. The coefficient of permeability values (k) obtained are given in Table 1.

3.5 Discussion

The results of the permeability tests indicate that the coal seams have only moderate permeabilities suggesting that problems may be encountered in dewatering the pit should this be required.

Approximate values for storativity (s) were obtained while checking the calculations. The storativity values are unusually high and this is an indication that a high dissolved gas content may be present in the water.

4.0 OVERBURDEN MATERIALS

4.1 Sampling

Samples of overburden materials were taken from Drillholes 255, 256, 257, 259 and 261. The locations of the drillholes is shown on Drawing No. D1692-01.1 and logs are presented in Appendix II.

Drillholes were progressed through the overburden material by means of a tricone drilling bit. Disturbed samples of overburden were taken by driving a section of drill rod into the material by means of a 500 lb. "donut" drop hammer. The overburden proved to be dense to very dense and considerable difficulty was experienced in obtaining samples.

Sampling intervals were nominally 3.05 m (10') but locally the material was too coarse to be sampled. The bag samples were sealed to preserve the moisture content and transported to our Vancouver laboratory for inspection and testing.

4.2 Laboratory Testing

The laboratory testing program comprised the following:

- Detailed description of all samples
- Determination of water contents of all samples
- Determination of Atterberg limits for selected samples
- Grain size analysis by means of seiving and hydrometer for selected samples.

Details of the descriptions, water contents and Atterberg limits are presented on the drillhole logs presented in Appendix II. The grain size curves are presented in Appendix III.

4.3 Discussion

The overburden comprises a variable thickness of dense to very dense glacial clay till. The clay till is variable in composition from silts with some clay through to well graded sand, gravel, silt and clay mixtures. The finer materials predominate, however, although the silt and clay samples contained a small proportion of sand and well rounded fine gravels.

Atterberg limit determinations were carried out on samples from Drillholes 255 and 261. The silts and clays are of medium to low plasticity and are at water contents close to or below the plastic limit in the ground. Excessively wet material was found in two samples, but this may have been caused by contamination during sampling.

The relatively low plasticity and high density of the tills suggests that the tills have high in situ strength. We therefore anticipate that permanent slopes may be cut in the till at 2H to 1V. Temporary slopes may be cut at 1.5H to 1V or steeper than this depending on slope height. Slope angles should be reviewed in the detailed design stage. Precautions should be taken however to ensure that water bearing sand and gravel horizons are drained to prevent instability.

5.0 ROCK STRENGTH

5.1 Introduction

The Point Load Index Test has been used to determine the uniaxial compressive strength of the various rock types encountered in drillholes. The test results have been used as an index to determine the rippability of the material.

The Point Load Index was selected as a rapid, cheap field test which could be used to determine approximate uniaxial compressive strength. The test equipment comprises a simple loading frame activated by a hand operated hydraulic jack. Load is transmitted to the specimens by means of a pair of spherically truncated conical platens. The test is versatile in that specimens of core may be tested axially or diametrally in addition to random lumps of rock. No sample preparation is generally required but considerable scatter in results can be expected. The test equipment and procedure is more fully described in the paper by Broch and Franklin.*

5.2 Test Program

The test program comprised 212 samples of the major rock types encountered during the drilling program, i.e., coal, sandstone, siltstone, silty mudstone, ironstone and a porphyry which forms an igneous sill. Diametral point load tests were carried out on a number of specimens from each rock type. The load required to break the specimen and the nature of the fracture was noted.

Uniaxial compressive strength was determined from the point load test results using the following relationship.

$$I_s = 24\ P/D^2$$

Where
I_s = point load strength index
P = load at failure
D = diameter of core

Test results were grouped according to rock type, detailed lithological characteristics and type of failures. Mean compressive strength values for each group are presented in Table 3. Where very large scatter of results for the same rock types and same type of failure occurs as found with bedding plane failures in sandstone, the results have been further grouped according to approximate strength.

The field logging sheets showing individual point load index test results are given in Appendix IV.

* Broch, E. and Franklin, J.A., 1972. The Point Load Strength Test. Int. J. Rock Mech. Min. Sci. 9, pp. 669 - 697.

5.3 Discussion

The point load index tests results indicate that the majority of the rock types encountered on the site fall in the range of moderately weak to moderately strong rocks. The sandstones, mudstones and siltstones are very weak to moderately weak in the unaltered condition. These three rock types have, however, undergone a varying amount of modification due to the development of secondary siderite cementation which has increased the strength of the rock by up to four times the strength of the unaltered material. Samples of rock in which secondary cementation is well developed have uniaxial compressive strengths in the range of 50 to 100 MPa. Some of the siltstones have also been affected by growth of calcite along micro fractures. The occurrence of volcanic tuff in some of the mudstones tested increased the unconfined compressive strength of the rock.

5.4 Excavation Procedures

Two methods are currently in use for estimating workability of rock; one based on the seismic velocity of the rock mass, and the other based on uniaxial compressive strength and discontinuity spacing.

The former method is used by excavation equipment manufacturers and the latter method is widely used in Europe and South Africa. In this present study, the latter method has been used to evaluate the need for ripping and blasting. A diagram showing the workability as a function of uniaxial strength and discontinuity spacing is given in Drawing No. 1692-01.7.

The envelope for material strength for the rock types encountered at Telkwa is shown. The geotechnical logging sheets completed by Crows Nest Resources geologists indicate that fracture spacing ranges from 3.0 mm to in excess of 1,000 mm. On the basis of the test results available at the present time, 40% of materials have uniaxial strengths greater than 25 MPa. Blasting to loosen this material will be required when bedding is thicker than about 0.10 m.. The geotechnical logging sheets, however, indicate that the stronger materials are generally thinly bedded. It would therefore seem likely that the majority of the materials could be excavated by ripping.

This conclusion is based on a relatively small number of tests and on the assumption that the distribution of tests accurately represents the proportion of rock types occurring on the site. In order to establish with more accuracy the quantities of the stronger rocks requiring blasting, we suggest that a larger number of point load tests be carried out on rock samples from each drill hole. In view of the empirical nature of both methods of evaluating workability, we also suggest that the seismic velocity method be used to confirm the present conclusions.

Respectfully submitted,

KLOHN LEONOFF LTD.

PROFESSIONAL GEOLOGIST
J. ANDREW LEACH
ALBERTA

J. ANDREW LEACH, Ph.D., P.Geol.
Senior Division Engineer
Mining Services Division

THE ASSOCIATION OF
PROFESSIONAL ENGINEERS
OF ALBERTA
PERMIT NUMBER
P 433
KLOHN LEONOFF
CONSULTANTS LIMITED

TABLES

TABLE 1

PERMEABILITY TEST RESULTS

DRILL HOLE	TEST SECTION	TEST TYPE	MATERIAL	COEFFICIENT OF PERMEABILITY (k) cm/sec
255	91.7 - 93.9	Packer	Coal	5×10^{-5}
255	107.9 - 110.3	Packer	Coal	6×10^{-5}
255	114.9 - 121.0	Packer	Coal	2×10^{-6}
255	138.4 - 139.9	Piezometer	Coal	3×10^{-6}
256	157.9 - 159.4	Piezometer	Siltstone	7×10^{-7}
257	28.8 - 31.1	Piezometer	Coal	3×10^{-6}
258	44.5 - 46.3	Piezometer	Coal	5×10^{-7}
258	45.7 - 48.0	Packer	Coal	6×10^{-6}
258	50.6 - 52.9	Packer	Coal	7×10^{-7}
258	64.3 - 69.2	Packer	Coal	2×10^{-6}
258	114.9 - 121.0	Packer	Coal	2×10^{-6}

TABLE 2

PIEZOMETER READINGS

DRILLHOLE NUMBER	255	256	257	258	265
GROUND ELEVATION (m)	802.30	890.30	728.60	744.10	737.30
TIP ELEVATION (m)	663.90-662.40	732.40-731.20	699.80-697.50	699.60-698.10	674.30-673.70
DATE OF INSTALLATION	Sept. 11	Sept. 14	Sept. 15	Sept. 16	Sept. 23
GROUNDWATER ELEVATIONS (m)					
September 12, 1982	801.70				
September 14, 1982	801.80				
September 15, 1982	801.92	875.41			
September 16, 1982			727.00		
September 19, 1982	802.33	875.70	727.15		
September 20, 1982	802.40	876.48	727.12	743.93	
September 30, 1982	803.30	881.25	728.29	743.53	720.95

TABLE 3

SUMMARY OF POINT LOAD TEST RESULTS

ROCK TYPE	MEAN UNIAXIAL COMPRESSIVE STRENGTH BASED ON POINT LOAD TEST (MPa)	DESCRIPTION	N*
COAL	14	Massive	2
	5	Jointed rock, cross bedding failure	2
	1	Jointed rock, bedding failures	10
IRONSTONE	87	Massive	6
IGNEOUS INSTRUSION	91	Massive	1
SILTSTONE	68	Siderite cementation	7
	17	Calcite deposition on joints	3
	45	Sandy siltstone	5
	10	Cross bedding failures	29
	4	Bedding failures	31
SILTY MUDSTONE	52	Siderite cementation	1
	11	Massive	8
	2	Bedding failures	15
TUFFACEOUS MUDSTONE	35	Massive	3
	13	Bedding failures	4
	1	Bedding failures	5
COALY MUDSTONE	7	Massive	3
	2	Bedding failures	5
SANDSTONE	99	Siderite cementation	4
	45	Massive, some siderite cementation	7
	33	Bedding failures	4
	15	Bedding failures	5
	6	Bedding failures	13

N* - Number of Tests

APPENDIX I

LETTERS OF PROPOSAL

KLOHN LEONOFF
CONSULTING ENGINEERS

OUR FILE: AL 4703

July 15, 1982

Crowsnest Resources Ltd.
Eau Claire Place
525 - 3 Avenue SW
Calgary, Alberta
T2P 2M7

Mr. M. Goldrick, P. Eng.

Telkwa Project, Soil Sampling

Dear Sir:

Following the meeting with Frank Martonhegyi held in our office, we are please to confirm our discussion and make the following proposal for collection of preliminary soils data for the Telkwa Project.

We suggest that the till overburden should be sampled from four drillholes, two in areas where the till is thick (say 60 m thick) and two where the till is thinner (say 15 m thick). We propose that undisturbed samples be taken at 3 metre intervals through the till overburden in the four selected drillholes.

Undisturbed samples could be taken either by coring or with a split spoon sampler and we have discussed the sampling techniques with J.T. Thomas of Smithers who considers that coring should be possible in the till materials on the site.

Sampling of the till materials will be supervised by our Mr. Larssen at no additional costs to yourselves over and above those costs described in our letter of July 8, 1982. Mr. Larssen will be responsible for sealing the samples in wax to preserve their natural moisture contents, for labeling the samples and for preliminary logging of the materials. If any samples are to be taken whilst Mr. Larssen is absent from the site, he will demonstrate the correct procedures to your geologists.

All soil samples will be shipped to our Calgary laboratory where they will be examined, logged and the water contents determined. Samples will be selected for further laboratory testing. We propose that liquid and plastic limits be carried out on approximately 25 samples of soil. If granular materials are encountered, a grain size analysis will be carried out instead of liquid and plastic limits.

We propose to prepare a brief report presenting logs of the overburden portion of the drillholes sampled, results of the laboratory tests and an engineering assessment of the soil shear strength parameters and likely stable slope angles on the basis of the laboratory tests performed.

Our estimated costs for performing the work described above are as follows:

<u>Manpower Costs</u>		
Sample Collection		No Charge
Description of Samples in laboratory and two water contents per sample	50 samples @ $25/sample	$1,250
Suite of liquid and plastic limits tests or grain size analysis as appropriate	25 samples @ $30/sample	750
Preparation of report (assumed to be our addendum to the report describing hydrogeological investigation)		
Senior Engineer	6 man hours	402
Word Processing	3 man hours	114
Drafting	3 man hours	114
TOTAL ESTIMATED MANPOWER COSTS		$2,630
<u>Disbursements</u>		
Sample Transportation		$ 370
TOTAL ESTIMATED COSTS		$3,000

We trust that our proposal and cost estimates will be acceptable to you and look forward to carrying out this work for you.

Yours very truly,

KLOHN LEONOFF LTD.

J. ANDREW LEACH, Ph.D.
Senior Division Engineer
Mining Services Division

JAL/jmh

cc: F. Martonhegyi

KLOHN LEONOFF
CONSULTING ENGINEERS

OUR FILE: AL 4703

July 8, 1982

Crowsnest Resources Ltd.
Eau Claire Place
525 - 3rd Avenue SW
Calgary, Alberta
T2P 2M7

Mr. M. Goldrick, P. Eng.

Telkwa Project, Hydrogeology Studies

Dear Sir:

Further to our meeting of July 28, 1982 we have reviewed your proposed field work program for the Telkwa Project and are pleased to present our proposals for instrumentation and collection of preliminary hydrogeological data for the site.

We understand that you propose to sink forty drillholes on the East and West Goathorn Properties for the purpose of evaluating possible coal reserves. Drilling is to commence on or around July 15, 1982 and is expected to be of 8 weeks duration. We understand that two drills are to be used on a 24-hour/day basis. We understand that the field operation including the staff we assign to the project will be under the direction of your Mr. Handy.

Proposed Scope of Work

We propose to mobilize an experienced geotechnical engineer to the site to carry out the following tasks:

1. Install, test and monitor approximately six piezometers in selected drillholes.
2. Carry out packer tests in two drillholes to determine hydraulic conductivity of selected strata.
3. Collect groundwater samples for preliminary chemical analysis.

We propose that our engineer makes two visits to the site, one approximately two weeks after drilling has commenced and the second visit shortly before the completion of the drilling program. We estimate that approximately 100 man hours will be required for each site visit. The tasks to be carried out during each visit are indicated below:

Site Visit #1

(i) Install two piezometers in boreholes on the West Goathorn Property. We propose to install one instrument in one of the coal seams and the second instrument in the basal shales underlying the lower of the two coal seams.

(ii) Install two piezometers in the East Goathorn Properties.

(iii) Flush all piezometers and if practicable, collect water samples (Sampling is dependant on rate of response of the piezometers).

(iv) Carry out packer tests in selected drillhole on West Goathorn Property. Packer tests will be carried out in the two major coal seams and in other horizons.

(v) Establish procedures for monitoring groundwater levels in piezometers.

Site Visit #2

(i) Install further two or more piezometers in East Goathorn Property. It is our intention to locate piezometers in major coal seams and in other horizons which appear to be making water. One piezometer will be located at the till-bedrock contact.

(ii) Flush piezometers (including if necessary, piezometers installed on first site visit) and sample groundwater if possible.

(iii) Carry out packer tests in selected drillhole on East Goathorn Property. We propose to carry out a test in each of the coal horizons over 1.75 m in thickness and in a number of shale, siltstone and sandstone horizons.

Packer Tests

Packer tests may be carried out using double or single packer configurations. In the single packer test, the packer is passed through the outer core barrel of a wire line tool, the innner barrel having been extracted. The packer is inflated and the test carried out, the test section being between the packer and the bottom of the drillhole. When the test is completed the packer equipment is withdrawn and drilling recommenced. When the drilling has progressed to the next test location, the process is repeated. Good results are obtained from the single packer test, but it can cause major delays to the drilling programs, especially when deep drillholes are being used. In the case of the Telkwa project, there may be insufficient budget to pay for drilling delays. When 24-hour drilling is in progress, personnel for each shift would be required for carrying out the tests.

In the double packer tests configuration all the packer tests are carried out on completion of the drillhole, the test section of the drillhole being confined between the two packers. Considerable time savings are made, thus reducing drill stand-by costs. It will still be necessary to use the drilling rig for lifting the packer equipment and some delays are inevitable, although these will be kept to a minimum.

If, however, difficulties are experienced due to collapse of the drillholes, it may be necessary to use the single packer configuration and reduce the number of tests to meet budget constraints.

In order to collect reliable test data from both piezometers and packer tests, it will be necessary to identify certain drillholes prior to drilling and to ensure that only water flush drilling is used on these drillholes. We propose that our engineer will liaise with Mr. Handy on this matter.

Reporting

We propose to prepare a brief report outlining the work carried out on this project and presenting the readings obtained from the piezometers up to the time that our engineer leaves the site. The results of the packer tests will be analyzed and hydraulic conductivity values for each test section will be presented.

Recommendations for further study of the groundwater will be provided.

Cost Estimates

The charges to your project will be based on the actual hours spent on the project by Klohn Leonoff staff. Details and conditions are given on the "Schedule of Services, Charges and Conditions of Agreement" dated January, 1982. In view of the reduced costs of proposal preparation on this project, our hourly rates will be based on payroll costs plus 125% which will provide a substantial savings to Crowsnest Resources Ltd.

A summary of estimated costs is given below:

ESTIMATED COSTS

Manpower

Field Services		
Engineer to install and test piezometers, carry out packer tests and sample groundwater	200 man hours	$ 9,200.00
Office Services		
Geotechnical Engineer	20 man hours	920.00
Senior Engineer	20 man hours	1,340.00
Review	44 man hours	340.00
Drafting Services	15 man hours	770.00
Word Processing	15 man hours	770.00
TOTAL	274 man hours	$13,340.00

Disbursements

Air Travel	
Vancouver - Fort St. John return - 2 trips	$ 500.00
Local Transport	500.00
Accomodations & Meals, 20 nights @ $75.00	1,500.00
Equipment Hire	
Packer Test Equipment	600.00
Hire and Shipping	
Consummables - gas, O rings, etc.	100.00
Piezometer Tubing, 800 m @$3.5/m	2,800.00
Grout, Cement, Etc.	400.00
Chemical Analysis of Groundwater	
Samples @ $220/sample	1,320.00
Delays to Drill, 20 hours @ $100/hour	2,000.00
TOTAL ESTIMATED DISBURSEMENTS	$ 9,720.00
TOTAL ESTIMATED COSTS	$23,060.00

Staff

The project will be carried out under the supervision of Dr. J.A. Leach of our Calgary office. We propose to mobilize Mr. David Larssen, P. Eng. to carry out the field testing. Mr. Larssen is a geotechnical engineer with several years experience in hydrogeology, including instrumentation and aquifer testing. Review services for the project will be provided by Dr. Myles Parsons, P. Eng., our Senior Hydrogeologist. Resumes for the above staff are appended.

We trust that our proposal and cost estimates will be satisfactory and look forward to working with you on this project.

Yours very truly,

KLOHN LEONOFF LTD.

J. ANDREW LEACH, Ph.D.
Senior Division Engineer
Mining Services Division

JAL/jmh

APPENDIX II

OVERBURDEN DRILLHOLE LOGS

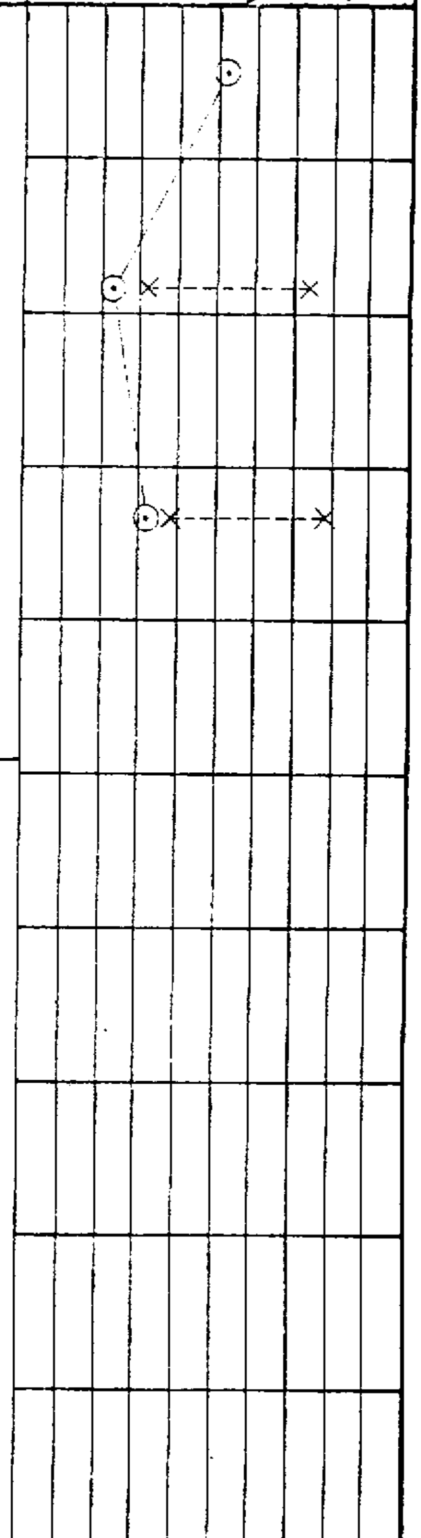
TEST HOLE LOG

SAMPLE DATA		SYMBOL	ELEV COLLAR	
WEIGHT HAMMER 63.5 Kg			ELEV GROUND 802.3 m	
HEIGHT DROP 0.76 m			CO-ORD. LOCATION	

UNCONFINED COMPRESSION kPa: 100 200 300 400 — ● FIELD VANE △ LAB VANE ■ UNCONF

PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT: 10 20 30 40

DEPTH / ELEV	O.D / I.D	BLOWS / .15m	NO.	DESCRIPTION OF MATERIAL
1.0			● B S.1	SILT - some clay - little sand - trace gravel - gravels rounded to subrounded - weathered - light brown - dense - trace of organic material - TILL
2.0			● B S.2	
3.0				
4.0			● B S.3	
5.0				
6.0				CLAYSTONE - weathered - soft - brown - bedrock NQ Coring with Longyear 38
7.0				
8.0				
9.0				
10.0				



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No.	PA 1692.01.01
PROJECT	CROWSNEST RESOURCES LTD.
LOCATION	TELKWA, B.C.
HOLE No.	DH 255
DATE	NOVEMBER 1/82 PLATE 1

K.L.C. - METRIC.

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa: 100 200 300 400 — ● FIELD VANE △ LAB VANE ■ UNCONF
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 890.3 m	
HEIGHT DROP 0.76 m					CO-ORD LOCATION	PLASTIC LIMIT x — WATER CONTENT o — LIQUID LIMIT x
DEPTH / ELEV	O.D / I.D	BLOWS / .15m	NO.		DESCRIPTION OF MATERIAL	10 20 30 40
1.0			● B S.1		WELL GRADED MIXTURE OF GRAVEL, SAND, SILT AND CLAY - gravels rounded to subrounded - light brown - dense - TILL	
2.0			● B S.2		SAND AND GRAVEL - little silt - trace clay - gravels rounded to subrounded - light brown - very dense - TILL	
3.0			● B S.3			
4.0					SAND AND GRAVEL - little silt - little clay - gravels rounded to subrounded - light brown - very dense - TILL	
	4.75 m					
					Undifferentiated bedrock NQ Coring with Longyear 38	

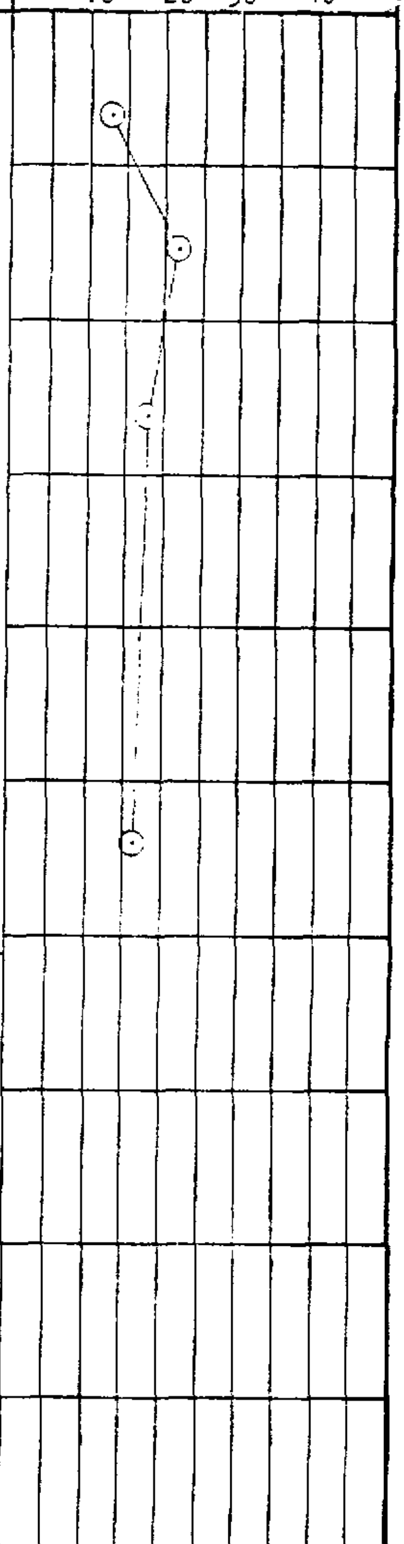
KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No.	PA 1692.01.01
PROJECT	CROWSNEST RESOURCES LTD.
LOCATION	TELKWA, B.C.
HOLE No.	DH 256
DATE	NOVEMBER 1/82 PLATE 2

K.L.C. - METRIC.

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa 100 200 300 400 ● FIELD VANE △ LAB VANE ■ UNCONF
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 728.6 m	
HEIGHT DROP 0.76 m					CO-ORD LOCATION	PLASTIC LIMIT, WATER CONTENT, LIQUID LIMIT (x—10—20 o 30—40—x)
DEPTH / ELEV	O.D / I.D.	BLOWS / .15m	NO.		DESCRIPTION OF MATERIAL	
1.0			● B S.1		SAND - some silt - little clay - dense - TILL	
2.0			● B S.2		SAND - some silt - little clay - trace gravel - dense - TILL	
3.0			● B S.3		WELL GRADED MIXTURE OF GRAVEL, SAND, SILT AND CLAY - very dense - TILL	
4.0						
5.0					SAND - some silt - little gravel - little clay - very dense	
6.0			● B S.4			
					Undifferentiated Bedrock NQ Coring with Longyear 38	



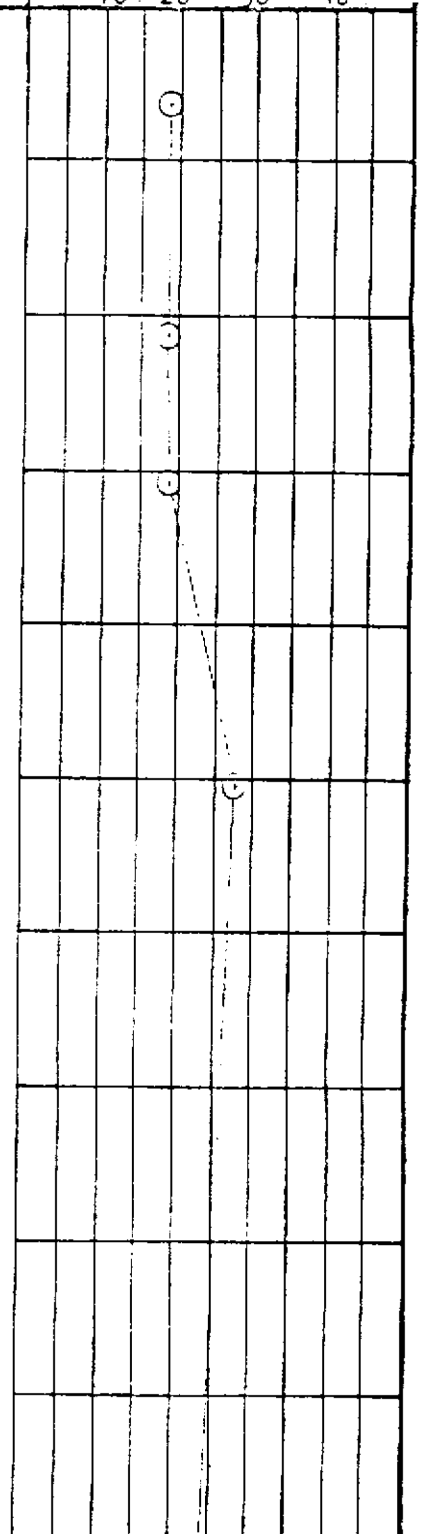
KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No.	PA 1692.01.01
PROJECT	CROSWNEST RESOURCES LTD.
LOCATION	TELKWA, B.C.
HOLE No.	DH 257
DATE	NOVEMBER 1/82 PLATE 3

K.L.C. - METRIC.

TEST HOLE LOG

SAMPLE DATA				SYMBOL		
WEIGHT HAMMER 63.5 Kg					ELEV COLLAR	UNCONFINED COMPRESSION kPa: 100 200 300 400
HEIGHT DROP 0.76 m					ELEV GROUND 747.1 m	● FIELD VANE △ LAB VANE ■ UNCONF
					CO-ORD LOCATION	PLASTIC LIMIT x — WATER CONTENT o — LIQUID LIMIT x: 10 20 30 40
DEPTH / ELEV	O.D / I.D	BLOWS / .15m	NO.		DESCRIPTION OF MATERIAL	
1.0			● B S.1		SILT - some sand - some clay - little gravel - dense - TILL	
2.0			● B S.2		SILT AND CLAY - little gravel - trace sand - dense - TILL	
3.0			● B S.3		SAND AND GRAVEL - little silt - little clay - dense - TILL	
4.0						
5.0			● B S.4		- SAND - some gravel - some silt - some clay - dense - TILL	
6.0						
7.0						
8.0						
9.0						
10.0						



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No.	PA 1692.01.01
PROJECT	CROWSNEST RESOURCES LTD.
LOCATION	TELKWA, B.C.
HOLE No.	DH 259
DATE	NOVEMBER 1/82 PLATE 4

K.L.C. - METRIC.

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa 100 200 300 400 ● FIELD VANE △ LAB VANE ■ UNCONF
WEIGHT HAMMER 63.5 Kg					ELEV GROUND 747.1 m	PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT
HEIGHT DROP 0.76 m					CO-ORD LOCATION	10 20 30 40
DEPTH / ELEV	O.D / I.D	BLOWS / .15m	NO.		DESCRIPTION OF MATERIAL	
11.0			● B S.5		GRAVEL - little silt - trace sand - very dense - TILL	
12.0						
13.0						

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No.	PA 1692.01.01
PROJECT	CROWSNEST RESOURCES LTD.
LOCATION	TELKWA, B.C.
HOLE No.	DH 259
DATE	NOVEMBER 1/82 PLATE 5

K.L.C. - METRIC.

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa
WEIGHT HAMMER 63.5 Kg					ELEV GROUND	100 200 300 400 ● FIELD VANE △ LAB VANE ■ UNCONF.
HEIGHT DROP 0.76 m					CO-ORD LOCATION	PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT
DEPTH / ELEV	O.D / I.D	BLOWS / .15m	NO.		DESCRIPTION OF MATERIAL	x 10 20 o 30 40 x
11.0						
12.0						
13.0					NO SAMPLES RECOVERED	
14.0						
15.0						
16.0						
17.0						
18.0						
19.0					CLAY AND SILT - some gravel - trace sand - medium plastic - dark brown - dense - TILL	
20.0			● B S.3			

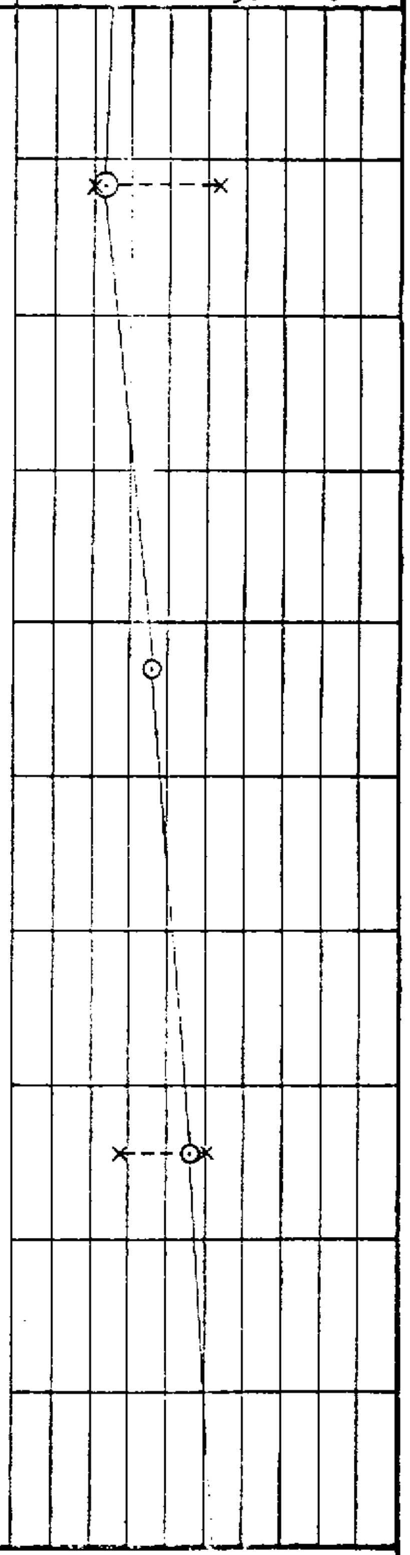
KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No.	PA 1692.01.01
PROJECT	CROWSNEST RESOURCES LTD.
LOCATION	TELKWA, B.C.
HOLE No.	DH 261
DATE	NOVEMBER 1/82 PLATE 7

K.L.C. - METRIC.

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa
WEIGHT HAMMER 63.5 Kg					ELEV GROUND	100 200 300 400 ● FIELD VANE △ LAB VANE ■ UNCONF
HEIGHT DROP 0.76 m					CO-ORD. LOCATION	PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT
DEPTH / ELEV	O.D. / I.D.	BLOWS / .15m	NO.		DESCRIPTION OF MATERIAL	x 10 20 o 30 40 x
21.0			● B S.4		SILT AND CLAY - some sand - trace gravel - medium to low plastic - dark brown - dense - TILL	
22.0						
23.0						
24.0			● B S.5		SILT AND CLAY - some sand - trace gravel - medium to low plastic - dark brown - dense - TILL	
25.0						
26.0						
27.0			● B S.6		SILT AND CLAY - some sand - trace fine gravel - low plastic - dark reddish brown - dense - TILL	
28.0						
29.0						
30.0						



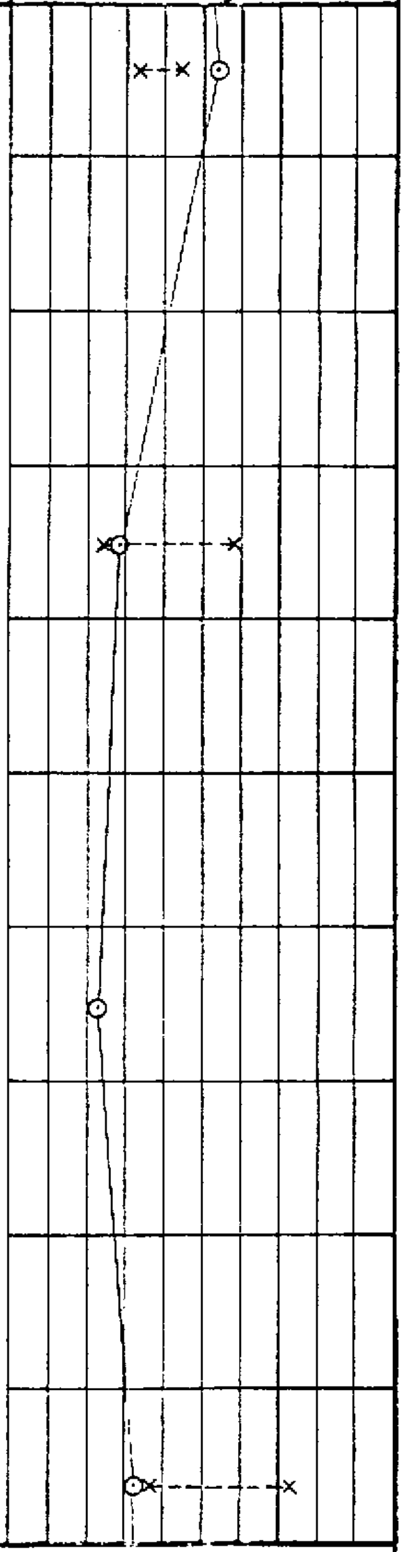
KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No.	PA 1692.01.01
PROJECT	CROWSNEST RESOURCES LTD.
LOCATION	TELKWA, B.C.
HOLE No.	DH 261
DATE	NOVEMBER 1/82 PLATE 8

K.L.C. - METRIC.

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa 100 200 300 400 ● FIELD VANE △ LAB VANE ■ UNCONF.
WEIGHT HAMMER 63.5 Kg					ELEV GROUND	
HEIGHT DROP 0.76 m					CO-ORD. LOCATION	PLASTIC LIMIT x — WATER CONTENT o — LIQUID LIMIT x
DEPTH / ELEV	O.D / I.D	BLOWS / .15m	NO.		DESCRIPTION OF MATERIAL	10 20 30 40
			● B S.7		SILT AND CLAY - trace fine sand - trace gravel - low plastic - dark reddish brown - dense - TILL	
31.0						
32.0						
33.0						
			● B S.8		CLAY AND SILT - some sand - some fine gravel - medium plastic - very dark reddish brown - dense - TILL	
34.0						
35.0						
36.0						
			● B S.9		COARSE SAND AND FINE GRAVEL - trace silt - dark reddish brown - dense - TILL	
37.0						
38.0						
39.0					CLAY AND SILT - trace sand - trace gravel - medium plastic - very dark reddish brown - dense - TILL	
40.0			● B S.10			



KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No	PA 1692.01.01
PROJECT	CROWSNEST RESOURCES LTD.
LOCATION	TELKWA, B.C.
HOLE No.	DH 261
DATE	NOVEMBER 1/82 PLATE 9

K.L.C. - METRIC.

TEST HOLE LOG

SAMPLE DATA				SYMBOL	ELEV COLLAR	UNCONFINED COMPRESSION kPa 100 200 300 400 ● FIELD VANE △ LAB VANE ■ UNCONF
WEIGHT HAMMER 63.5 Kg					ELEV GROUND	
HEIGHT DROP 0.76 m					CO-ORD LOCATION	PLASTIC LIMIT X — WATER CONTENT O — LIQUID LIMIT X
DEPTH / ELEV	O.D / I.D	BLOWS / .15m	NO.		DESCRIPTION OF MATERIAL	10 20 30 40
41.0						
42.0						
43.0			● B S.11		CLAY AND SILT - trace sand - trace gravels - medium plastic - dark reddish brown - dense - TILL	X—O----X
44.0						
45.0						
46.0					Undifferentiated Bedrock NQ Coring with Longyear 38	
47.0						
48.0						
49.0						
50.0						

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No.	PA 1692.01.01
PROJECT	CROWSNEST RESOURCES LTD.
LOCATION	TELKWA, B.C.
HOLE No.	DH 261
DATE	NOVEMBER 1/82 PLATE 10

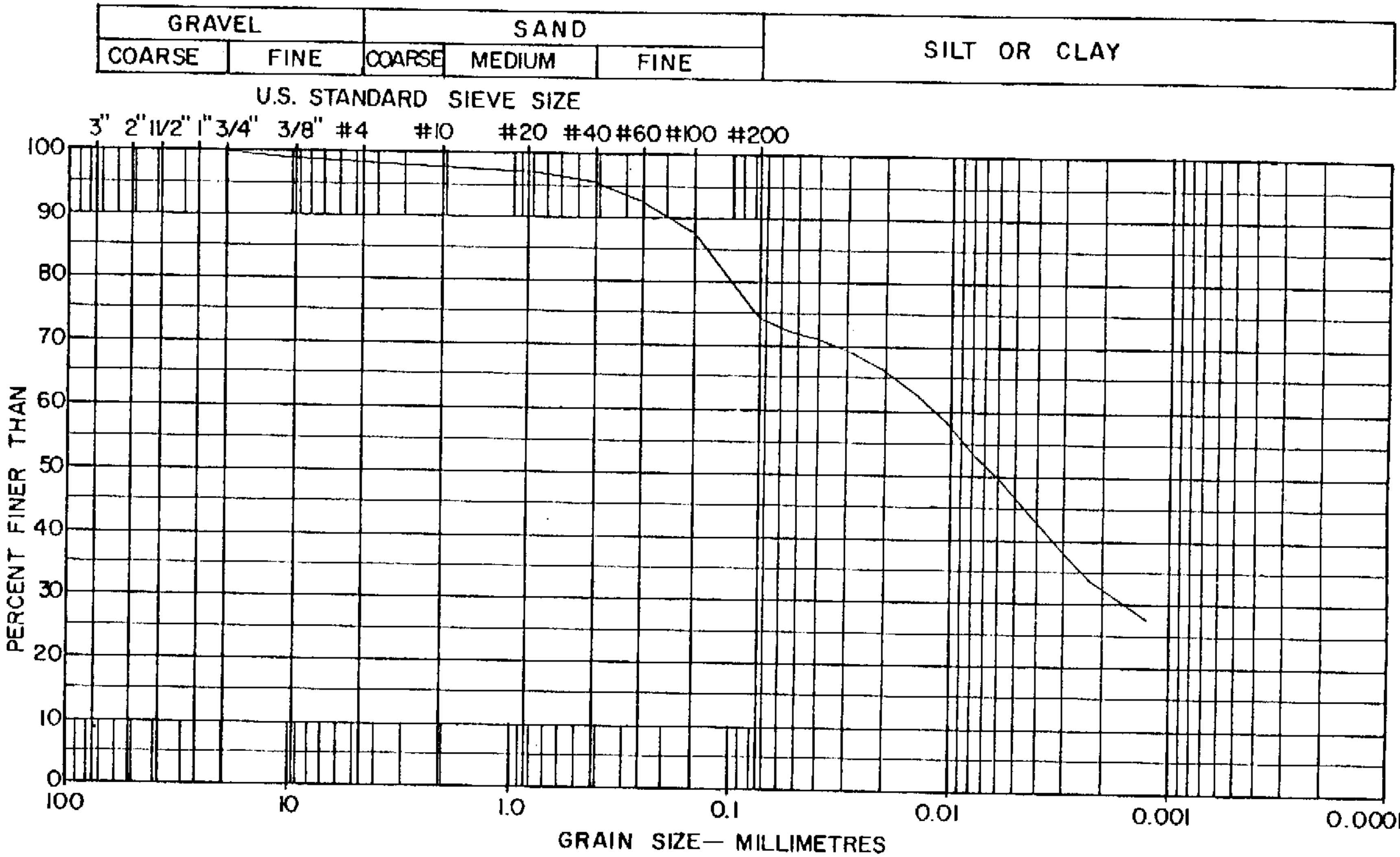
K.L.C. - METRIC.

APPENDIX III

LABORATORY TEST RESULTS

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692.02.01
PROJECT CROWSNEST RESOURCES LTD.
LOCATION TELKWA, B.C.
HOLE No. 255 DEPTH 0.5 m
DATE October 18, 1982



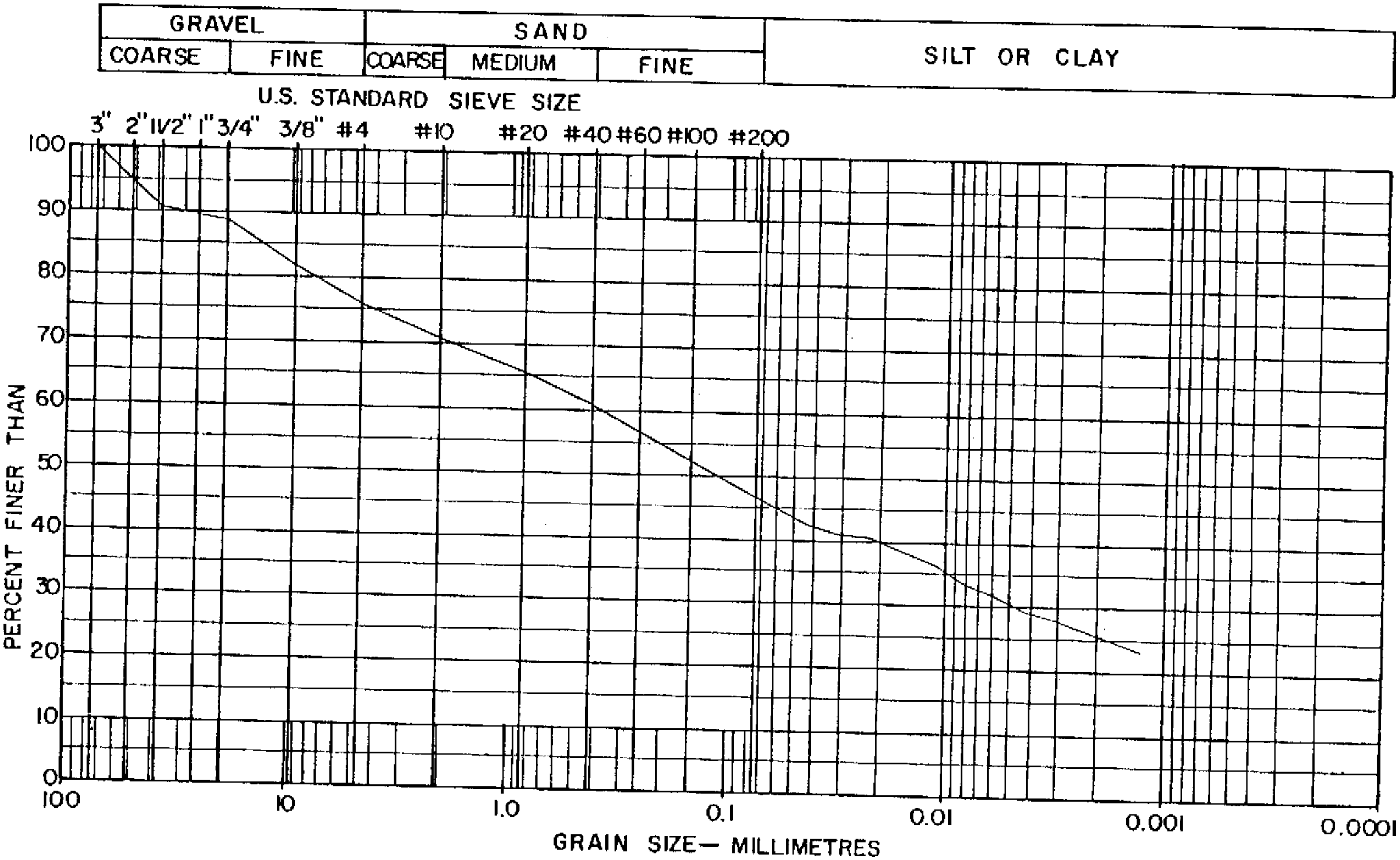
GRAIN SIZE CURVE

REMARKS:

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692.02.01
PROJECT CROWSNEST RESOURCES LTD.
LOCATION TELKWA, B.C.
HOLE No. 256 DEPTH 0.5 m
DATE October 19, 1982

GRAIN SIZE CURVE

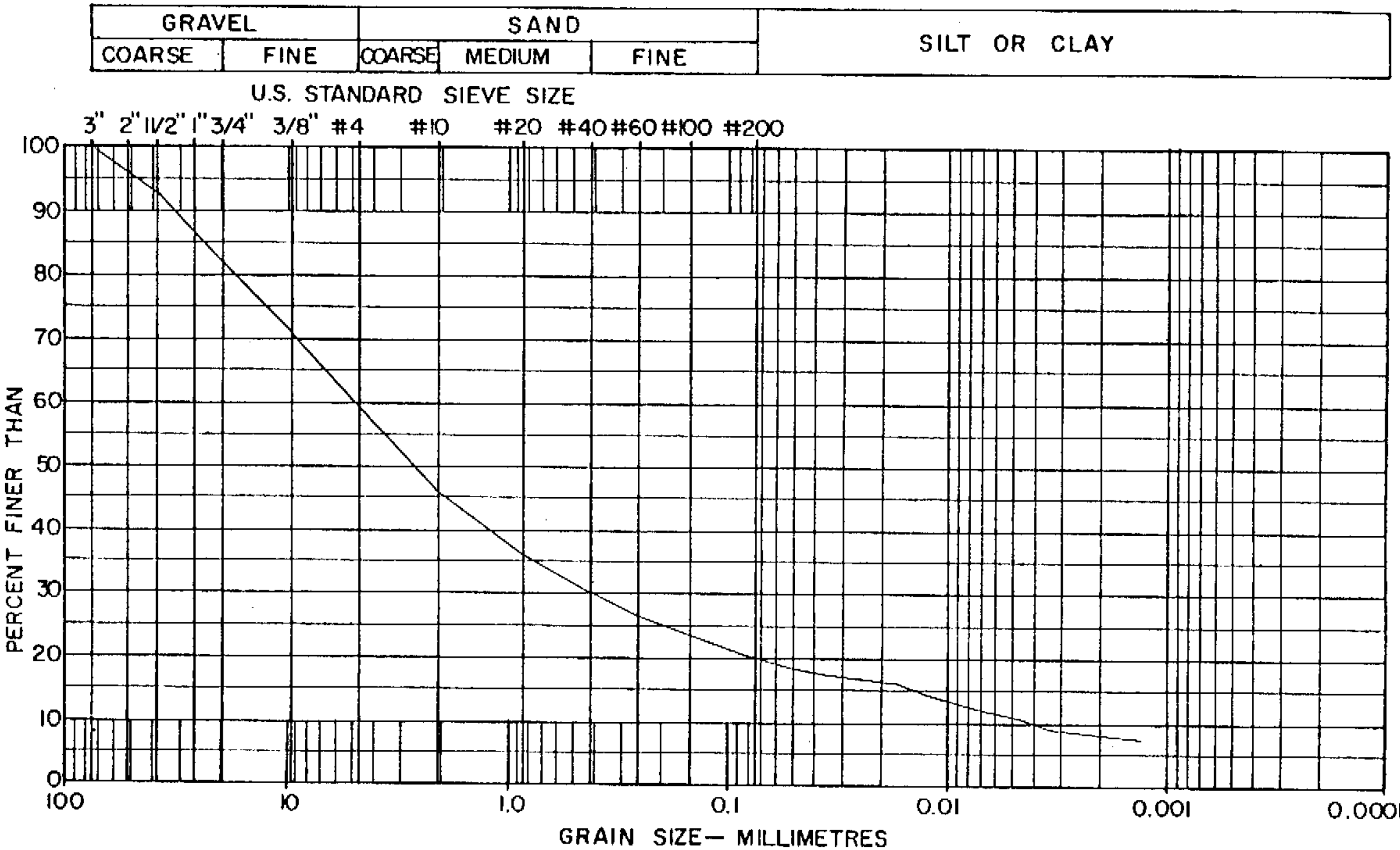


REMARKS:

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692.02.01
PROJECT CROWSNEST RESOURCES LTD.
LOCATION TELKWA, B.C.
HOLE No. 256 DEPTH 2.0 m
DATE October 19, 1982

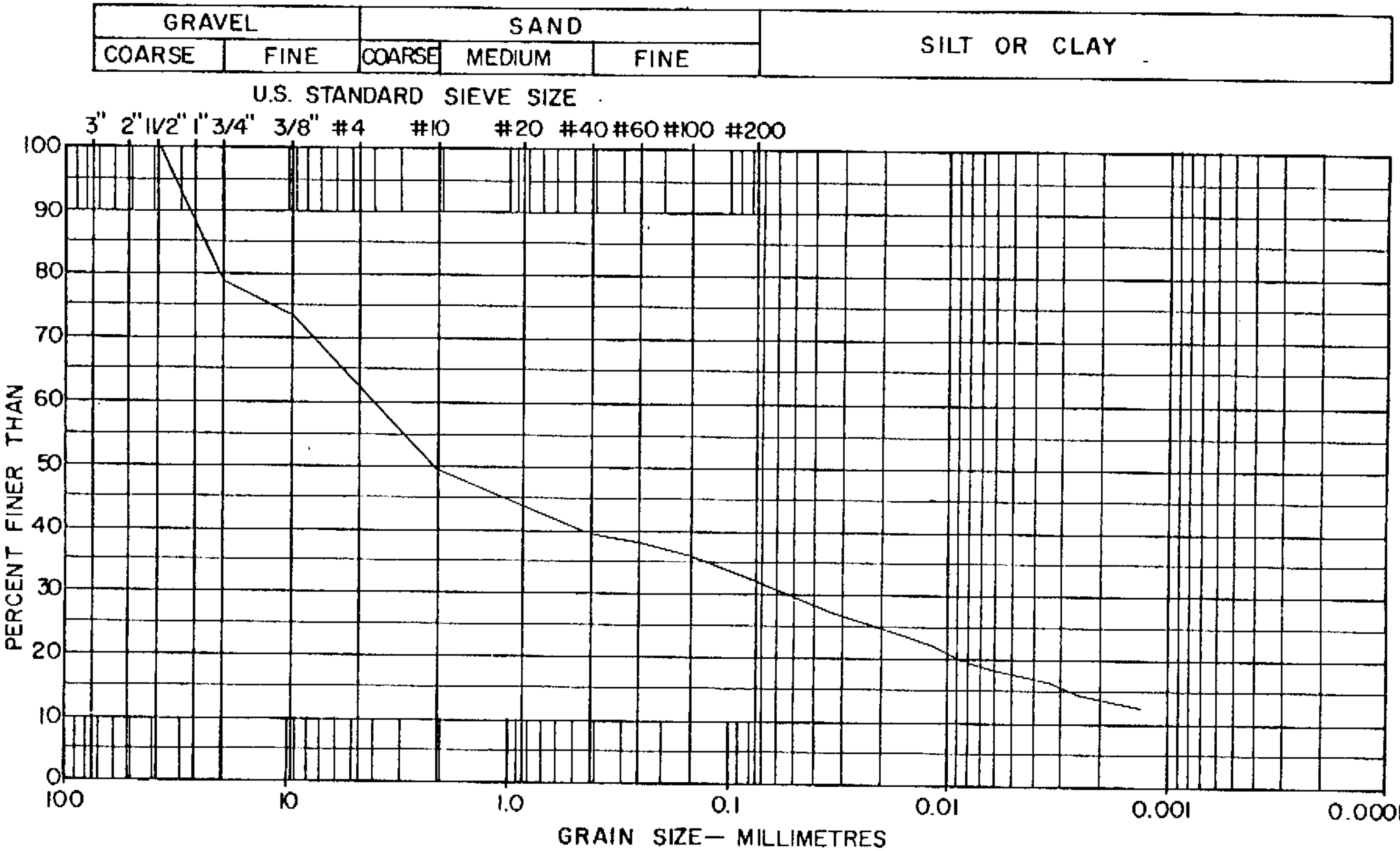
GRAIN SIZE CURVE



REMARKS: ______________________________

KLOHN LEONOFF
CONSULTING ENGINEERS

GRAIN SIZE CURVE



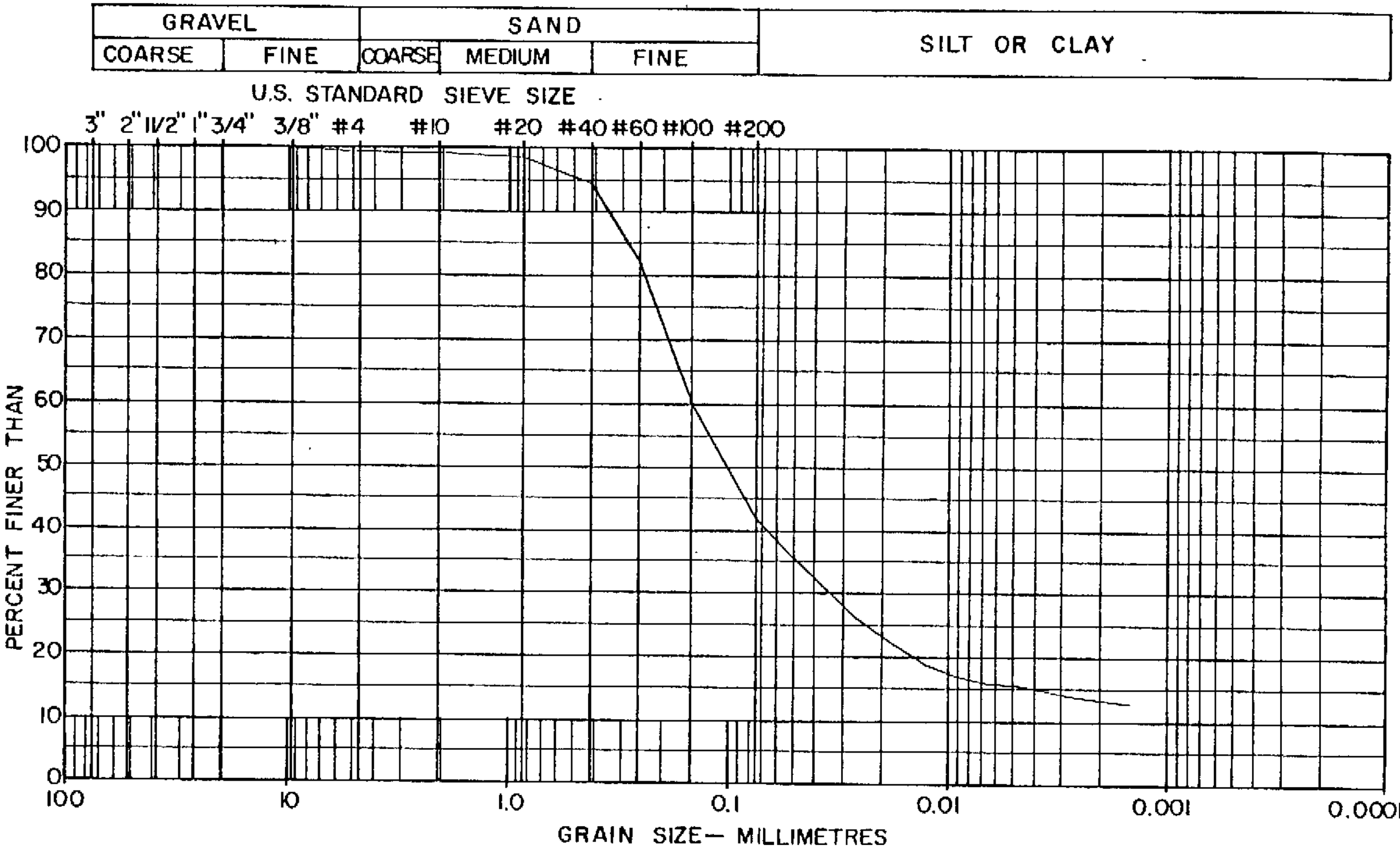
REMARKS: ______

JOB No.	PA 1692.02.01
PROJECT	CROWSNEST RESOURCES LTD.
LOCATION	TELKWA, B.C.
HOLE No. 256	DEPTH 3.0 m
DATE	October 19, 1982

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692.02.01
PROJECT CROWSNEST RESOURCES LTD.
LOCATION TELKWA, B.C.
HOLE No. 257 DEPTH 0.5 m
DATE October 19, 1982

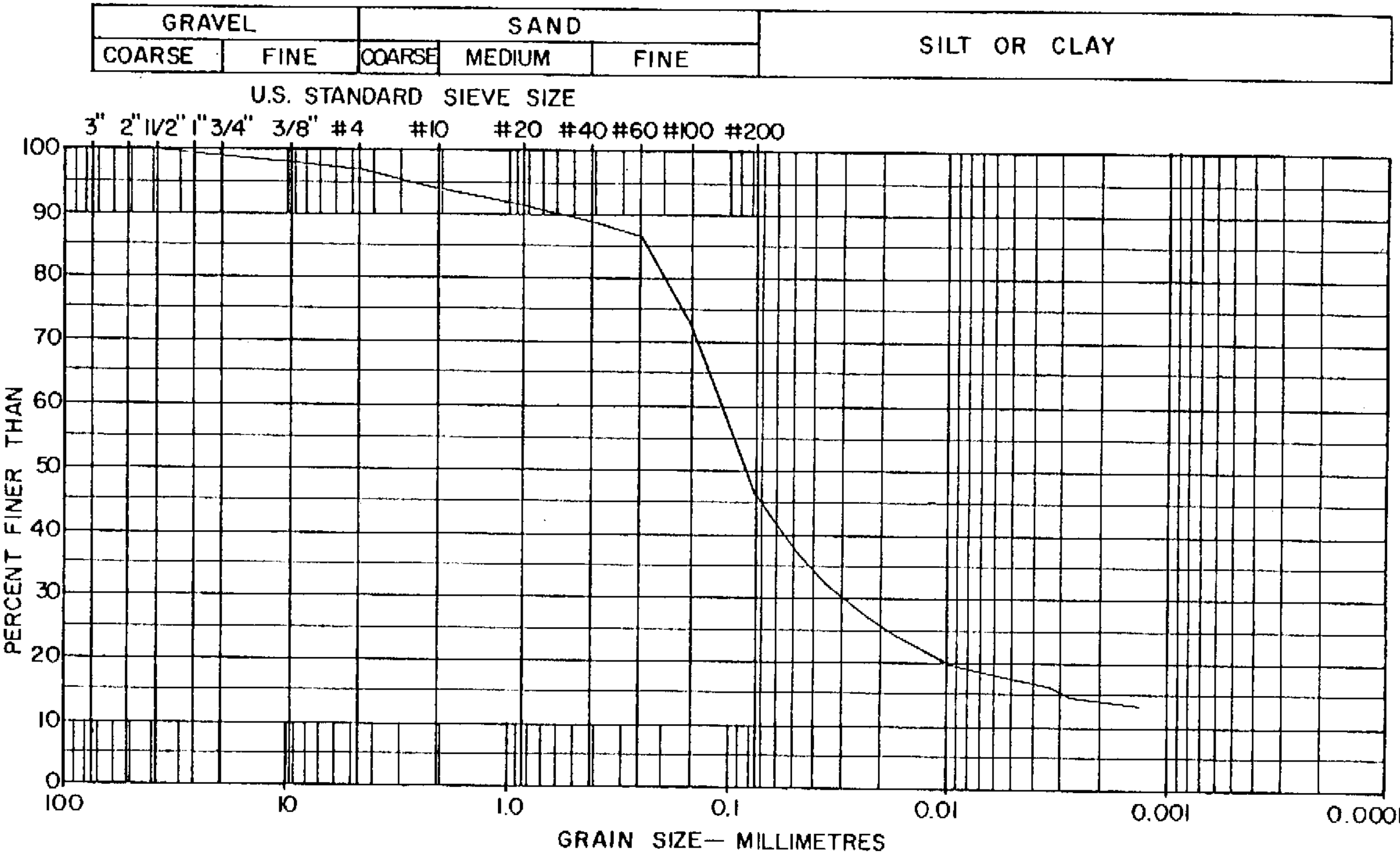
GRAIN SIZE CURVE



REMARKS:

KLOHN LEONOFF
CONSULTING ENGINEERS

GRAIN SIZE CURVE

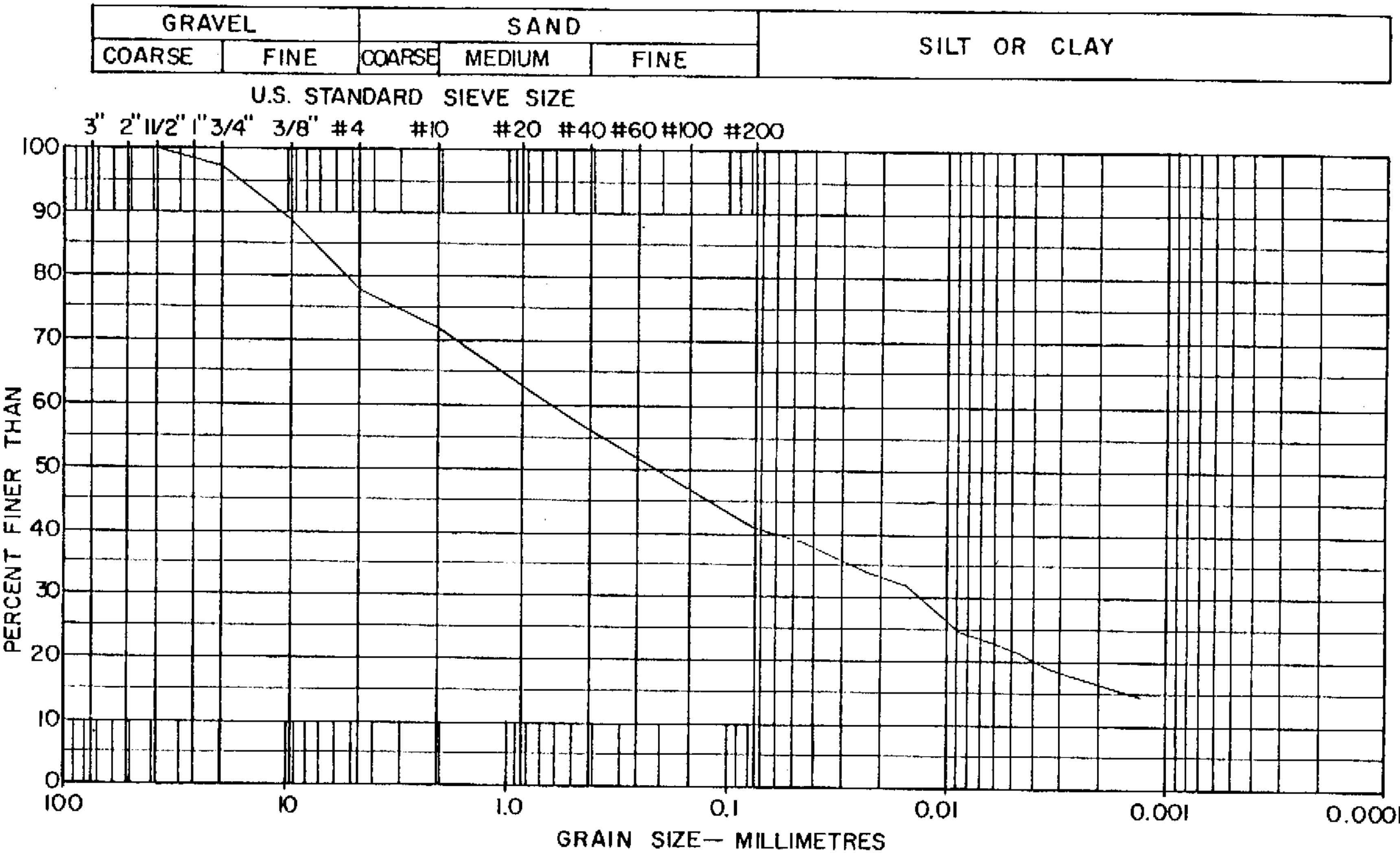


REMARKS:

JOB No. PA 1692.02.01
PROJECT CROWSNEST RESOURCES LTD.
LOCATION TELKWA, B.C.
HOLE No. 257 DEPTH 1.5 m
DATE October 19, 1982

KLOHN LEONOFF
CONSULTING ENGINEERS

GRAIN SIZE CURVE



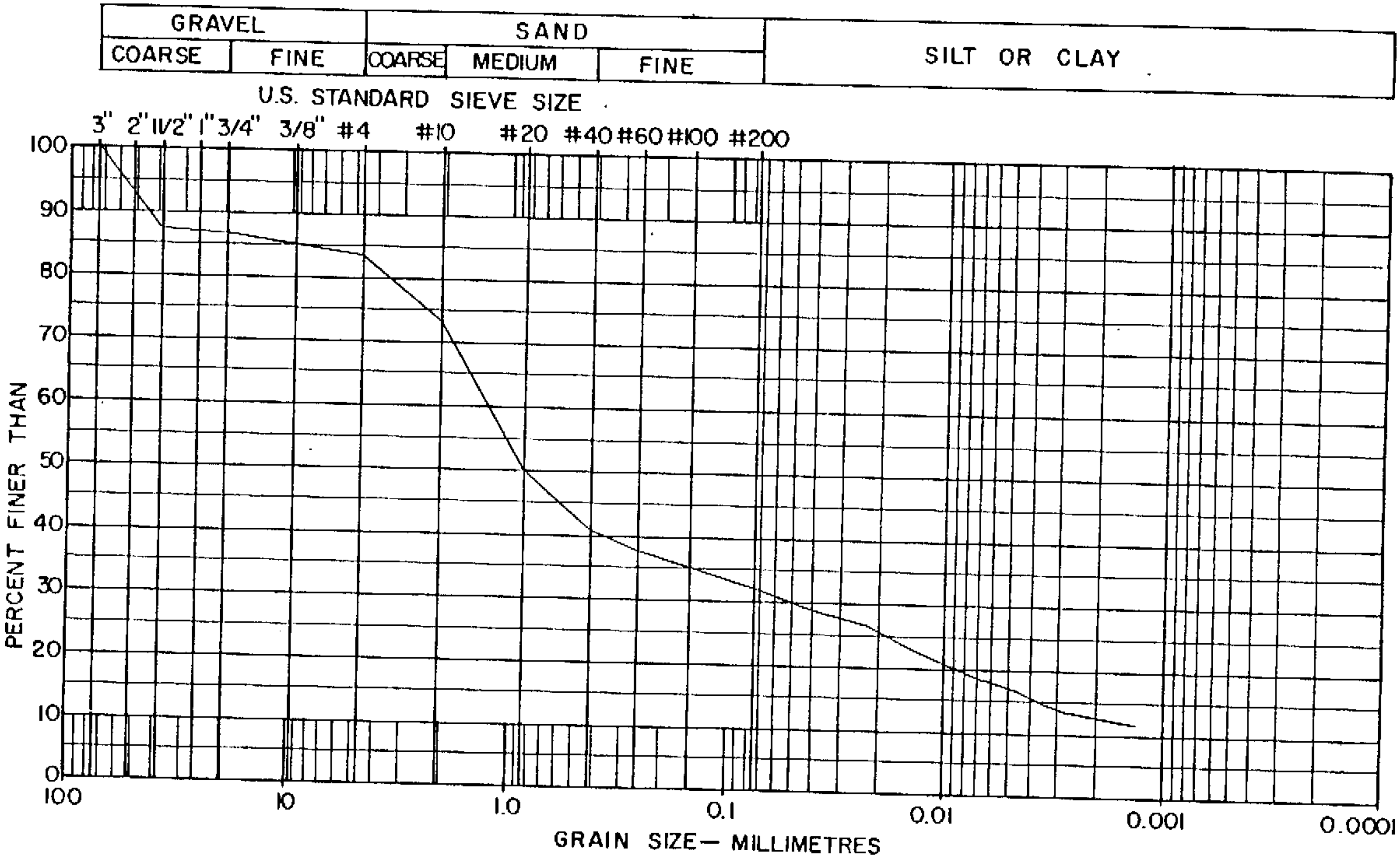
REMARKS: ______

JOB No.	PA 1692.02.01
PROJECT	CROWSNEST RESOURCES LTD.
LOCATION	TELKWA, B.C.
HOLE No.	257 DEPTH 3.0 m
DATE	October 19, 1982

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692.02.01
PROJECT CROWSNEST RESOURCES LTD.
LOCATION TELKWA, B.C.
HOLE No. 257 DEPTH 5.0 m
DATE October 19, 1982

GRAIN SIZE CURVE

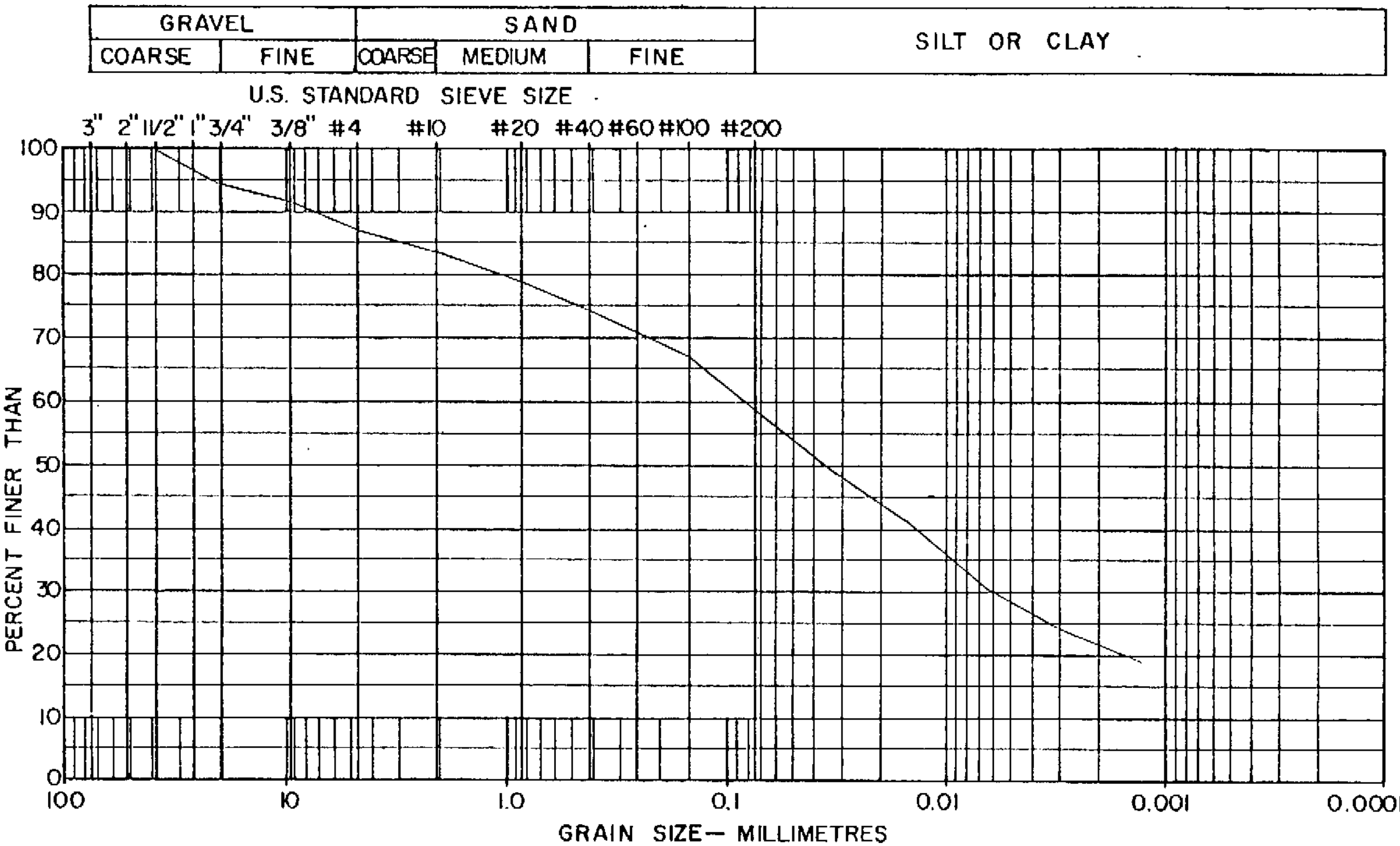


REMARKS:

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692.02.01
PROJECT CROWSNEST RESOURCES LTD.
LOCATION TELKWA, B.C.
HOLE No. 259 DEPTH 0.5 m
DATE October 18, 1982

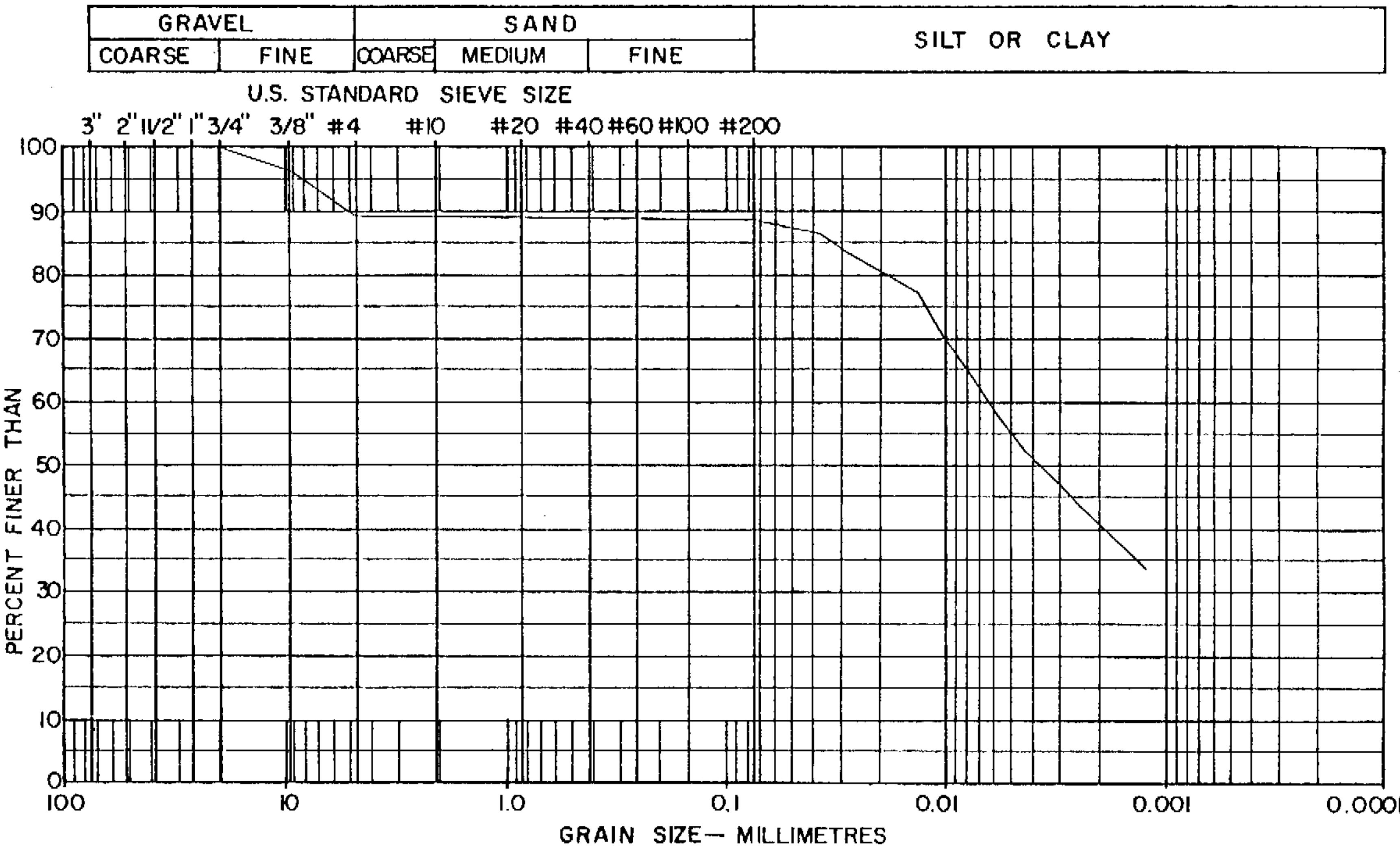
GRAIN SIZE CURVE



REMARKS:

KLOHN LEONOFF
CONSULTING ENGINEERS

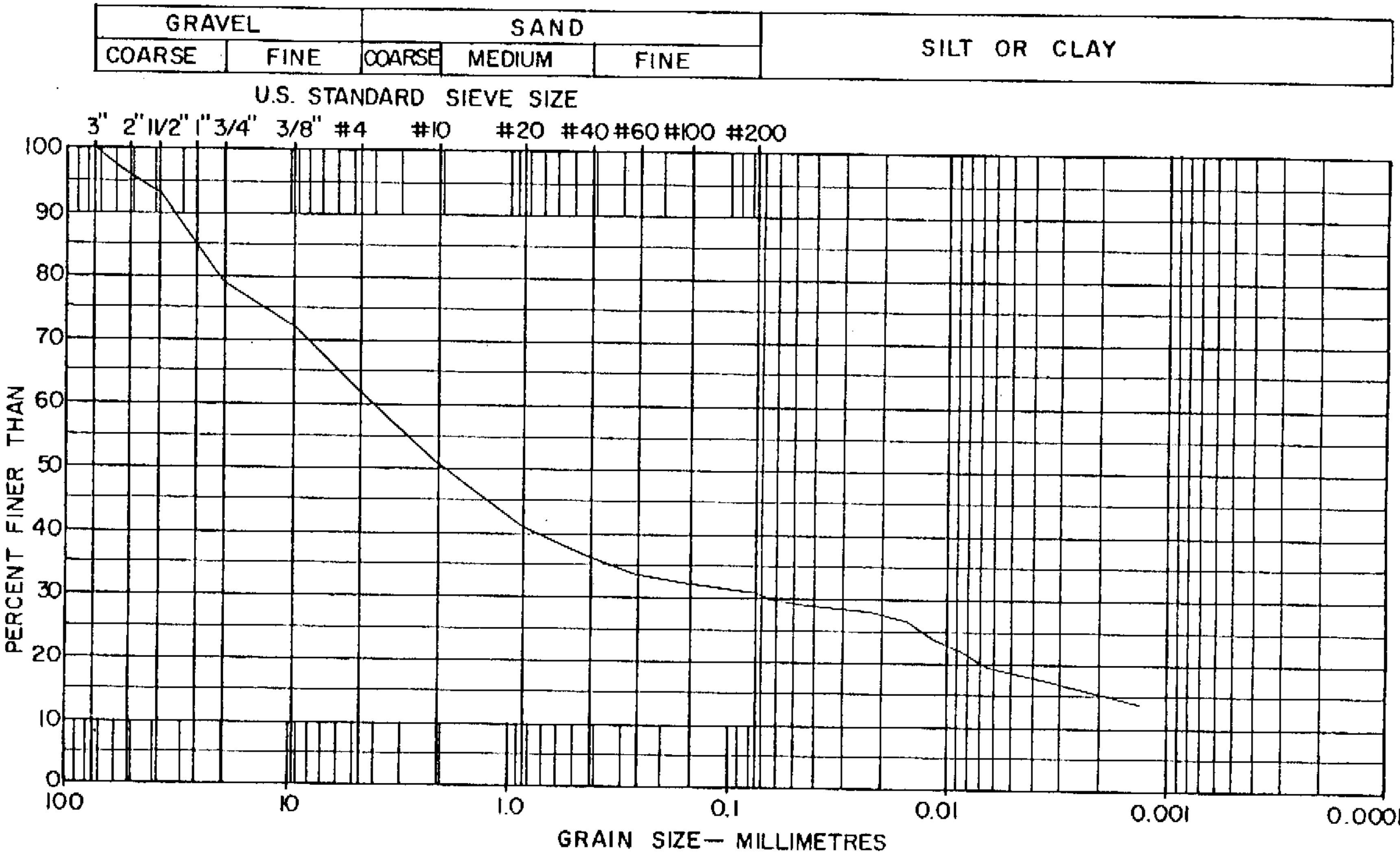
GRAIN SIZE CURVE



REMARKS: ______________________________

JOB No.	PA 1692.02.01
PROJECT	CROWSNEST RESOURCES LTD.
LOCATION	TELKWA, B.C.
HOLE No.	259 DEPTH 2.0 m
DATE	October 18, 1982

GRAIN SIZE CURVE



REMARKS:

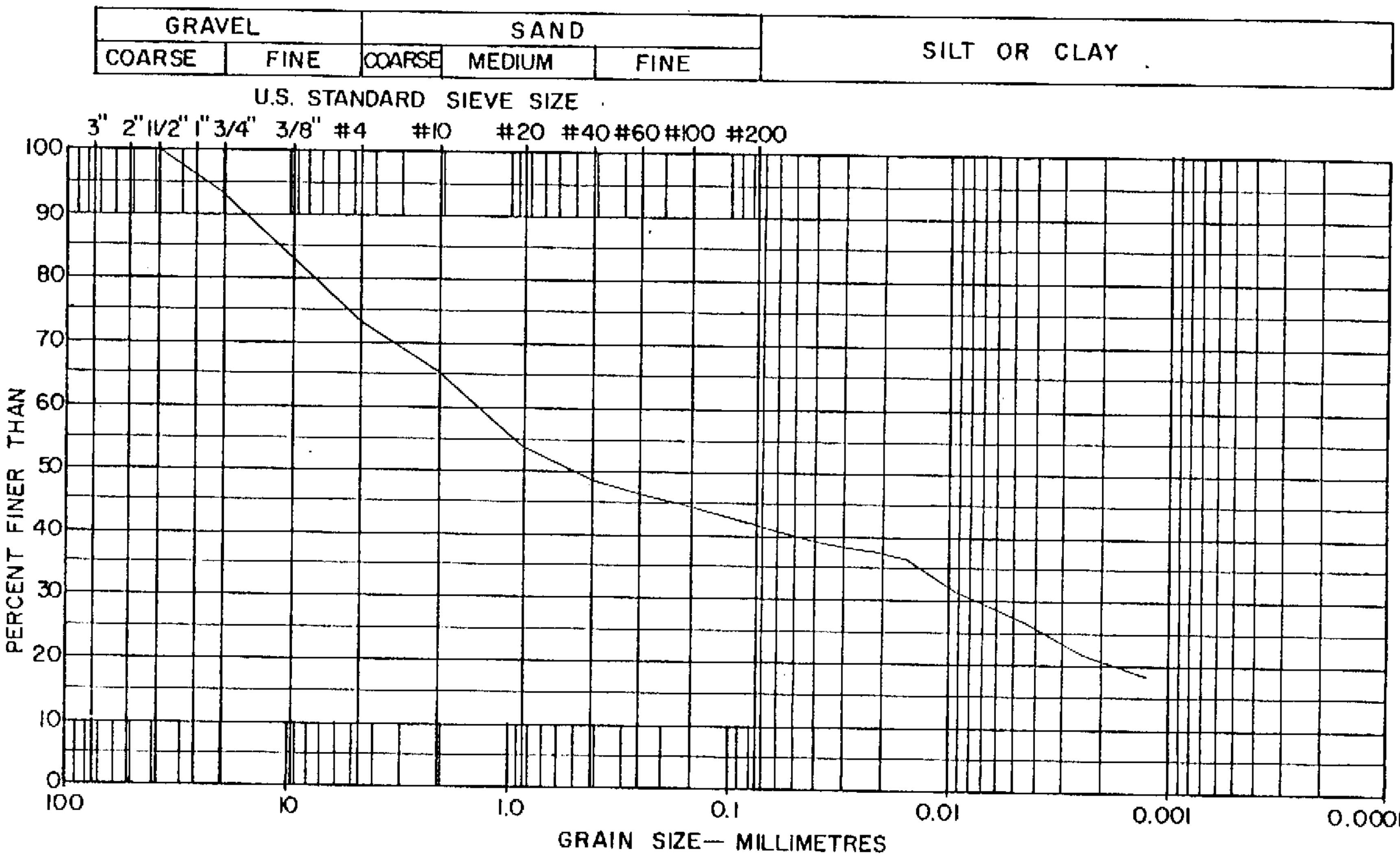
KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692.02.01
PROJECT CROWSNEST RESOURCES LTD.
LOCATION TELKWA, B.C.
HOLE No. 259 DEPTH 3.0 m
DATE October 18, 1982

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692.02.01
PROJECT CROWSNEST RESOURCES LTD.
LOCATION TELKWA, B.C.
HOLE No. 259 DEPTH 5.0 m
DATE October 18, 1982

GRAIN SIZE CURVE

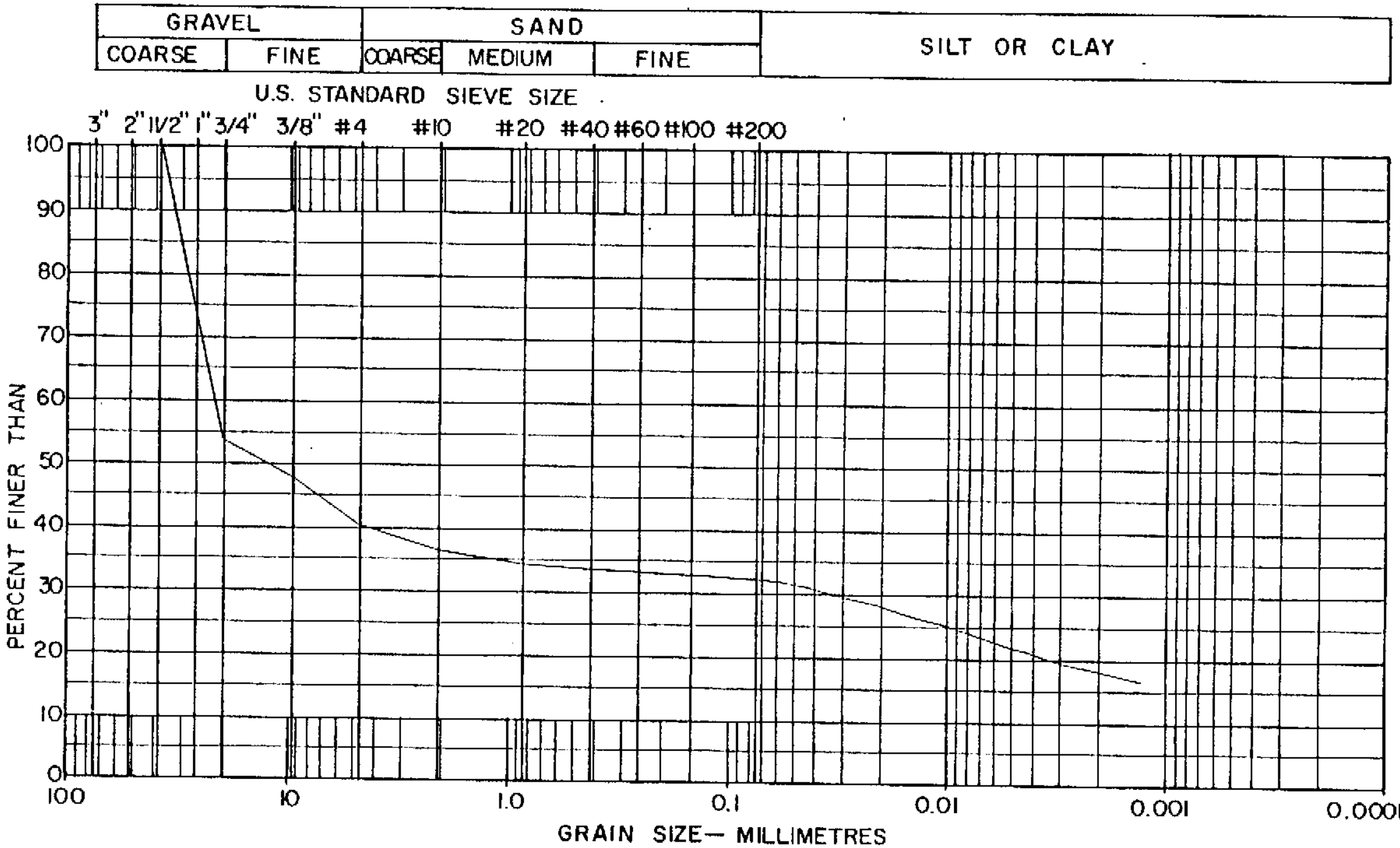


REMARKS: ______

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692.02.01
PROJECT CROWSNEST RESOURCES LTD.
LOCATION TELKWA, B.C.
HOLE No. 259 DEPTH 11.0 m
DATE October 19, 1982

GRAIN SIZE CURVE

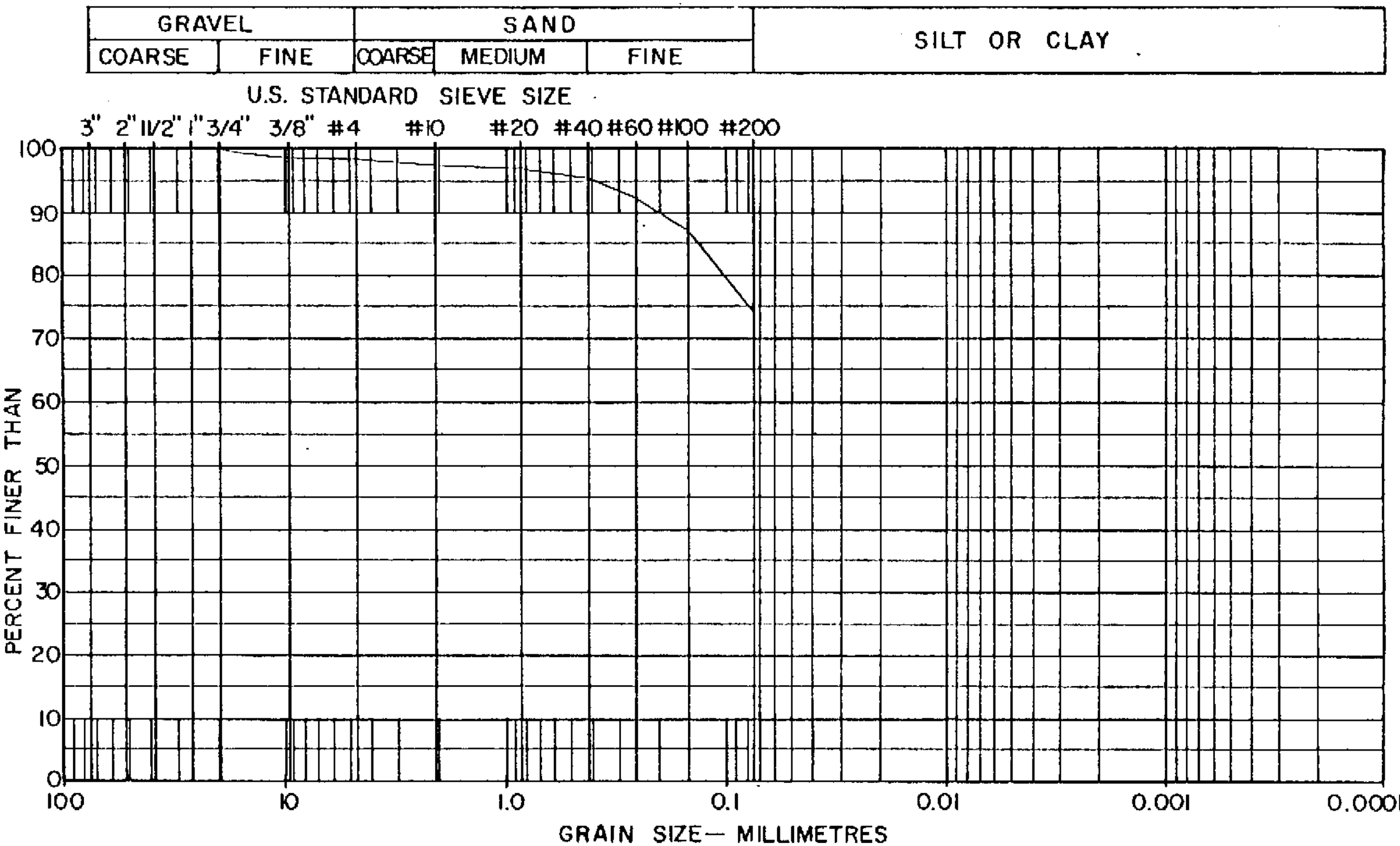


REMARKS:

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692.02.01
PROJECT CROWSNEST RESOURCES LTD.
LOCATION TELKWA, B.C.
HOLE No. DH 255 DEPTH 0.5 m
DATE OCTOBER 6/82

GRAIN SIZE CURVE



REMARKS: ____________________

APPENDIX IV

POINT LOAD TEST FIELD SHEETS

METRIC

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692 0101 ENG. N. HOOPER
PROJECT CROWS NEST RESOURCES
LOCATION TELKWA
DETAILS POINT LOAD TEST RESULTS
DATE SEPT 18/82 SHEET 1 OF 21

COMPUTATIONS

Sample	Description	Length mm	L/D	σ_u MPa	Q_u MPa	Remarks from horizontal
DH-260 6.5 m.	Silty Mudstone - thinly laminated Dip 10°. R2	70	1.59	0.2		Failed Along Bedding
DH-260 11.3 m	fine gr. SST, Thinly bedded, Partially weathered, Faulted 25° Dip R2	80	1.82	0		Failed Along bedding
DH-260 11.9	fine gr. SST, siderite in matrix R5, 17° Dip	63	1.43	9.7		Fracture ∠ 65°
DH-260 14.6	SLST to fine Grain SST, R2, Thinly bedded, 40°, Light Green	70	1.59	.10		Fract ∠ = 14°
DH-260 20.1	F.g. SST, R4, Siderite Cement Hang wall of Coal Seam Dip, 5°	80	1.82	8.9		Fract ∠ = 45° Broke along Pre-existing fracture
DH-260 23.9	COAL, R3, ~~Nonbedded~~ 5° bedding	86	1.95	0.10		broke along bedding
DH-260 23.95	COAL As above	85	1.93	0.10		broke along Bedding
DH-260 25.0	SLST thinly bedded, R3, 8° Foot wall,	~~[illegible]~~ 75	1.70	0.20		broke along bedding
DH-260 25.10	SLST, As above	75	1.70	0.20		Fract ∠ = 8°
DH-260 33.1	Silty MDST, laminated, 11° Dip R3,	77	1.75	0.60		Fract ∠ = 7° Clean break

- METRIC

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692 0101 ENG. N. Hooper
PROJECT Crows Nest Resources
LOCATION Telkwa
DETAILS Point Load Test Results
DATE Sept 18/82 SHEET 2 OF 21

COMPUTATIONS

Sample	Description	Length mm	L/D	σ_u MPa	Qu MPa	Remarks
DH260 35.2M	Siltstone R3 Thinly Bedded 12°	70	1.59	0.70		Fract ∠ = 10°
DH 260 36.9	Ironston band, R5, 13° Dip thin bedded, band is 16 cm thick.	76	1.73	9.5		Fract ∠ = 21°
DH-260 39.1	Tuffaceous - SLST black, massive no bedding, R3 → R4	80	1.82	.30		Fract ∠ = 34°
DH-260 39.19	As above	68	1.54	.25		Fract ∠ = 18°
DH-260 42.7	SLST - massive, not bedded med Grey	75	1.70	.05		Fract ∠ = 7°
DH260 46.2	SLST to Vfg SST, massive not bedded, R3	77	1.75	0.90		∠ = 15°
DH260 51.3	SLST - Massive, Black, not bedded	75	1.70	.70		21° ∠
DH260 56.3	SNDS - Siderite Cemnt, R4 No bedding, fine grain	68	1.54	8.4		40° ∠
DH260 56.9	SNDS - Light grey, fine grain, Thick bedded, 21° Dip	78	1.77	3.2		15° ∠
DH260 57.2	As above	60	1.36	3.15		∠ = 14°
DH260 62.0	MDST - silty, Dk grey to black 18° Dip, R3 → R4	66	1.50	1.05		∠ = 0°

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692 0101 ENG. N. HOOPER
PROJECT CROWS NEST RESOURCES
LOCATION TELKWA
DETAILS POINT LOAD TEST RESULTS
DATE SEPT 18/82 SHEET 3 OF 21

COMPUTATIONS

Sample	Description	Length mm	L/D	σ_u MPa	Qu MPa	Remarks
DH-260 62.10	MDST - DK grey, poorly bedding, R3	80	1.82	0.35		∠ = 23°
DH-260 68.3	IRONSTONE concretion R5	90	2.04	7.2		
DH260 70.2	MDST - Non Bedded, massive R3 DK grey,	75	1.70	.10		∠ = 0°
DH 260 74.7	SLST - Non bedded, massive DK brown, R4	72	1.63	2.65		∠ = 19°
DH 260 75.0	SLST - DK grey massive R3	70	1.59	0.05		∠ = 9°
DH 260 80.8	SLST - DK grey, massive - R2-R3 Dip = 19	80	1.82	0		∠10°
DH 260 82.8.	SLST - DK grey Massive - (R2-R3)	70	1.59	.40		30°
DH 260 86.2	SLST - As above	68	1.54	.35		31°

NB. General - DH 260 Tested within 24 hours from drilling

METRIC

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692 0101 ENG. N. Hooper
PROJECT CROWS NEST RESOURCES
LOCATION TELKWA
DETAILS POINT LOAD TEST RESULTS
DATE SEPT 18/82 SHEET 4 OF 21

COMPUTATIONS

Sample	Description	Length mm	L/D	σu MPa	Qu MPa	Remarks
DH260 90	Siltstone R5 abundant siderite in matrix approx 0.5m thick - No bedding	70mm	1.59	5.4		Failure 80° ∠
DH260 91.6m	SLST R3 No bedding, Med to DK grey,	63mm	1.43	0.2		Failure 23° ∠
DH 260 96.79	SLST - Med to DK grey, R3, 10° Dip	90	2.04	.85		Failure ∠ = 82° along fossil Bearing bedding Plain
DH 260 99.7	SLST AS ABOVE R3	77	1.75	1.0		∠ - 20° irregular Surface
DH 260 101.2	VFg SST, Thin bedded, 5° Dip Slickensided, lined with Calcite light to dark green, R3	60 / 55	1.36 / 1.25	.05 / 1.75		Broken of Joint ∠ 32° Failure ∠ 90°
DH 260 102.4	SST, fine grain, R4, Poorly bedded to massive,	87	1.98	7.35		∠ > 90°
DH 260 104.4	SLST - DK green to DK grey, R3 Dip ∠ = 5°	70	1.59	.10		Failure ∠ = 10° undulose Surface clean
DH 260 109.6	VFg SST, very thin Bedded, 32° Dip R3	90	2.04	.95		∠ 32° on Bedding
112.0	Fine Gr. SST - non bedded.	58	1.32	.1		Failed on Calcite Joint 46°

METRIC

Sample	Description	Length mm	L/D	Ju MPa	Qu MPa	Remarks
DH260 112.09	fg SST AS ABOVE R3	70	1.59	1.2		∠°63
DH260 114.4	vfg SST - thin bedded, Dip 46 R4, Light to Dk green	60	1.36	.05		Failed on bedding.
DH260 116.8	SLST to vfg SST, Hanging Wall, R3 thin bedded, 20°	70	1.59	0.4		Failed on Bedding
DH260 116.7	Ditto	65	1.48	.1		Failed on Bedding
DH260 119.20	Coal - R3, Thin bedding 30° Dip	75	1.70	.05		Failed on Bedding 30° Dip
DH260 121.30	COAL As above (Footwall of Sm is Fault Gouge) Dip = 15°	80	1.82	0.05		∠15°
DH260 122.30	Coaly Mdst - R3, Laminar Bedding DK grey to black. Dip 25°	90	2.04	2.55		∠° 26°
DH260 126.0	MDST, DK grey, laminar Bedding 10° Dip, R3, Hanging Wall	86	1.95	.25		∠ 10°
DH260 126.9	Coal, thin bedded, 15° Dip, R3	55	1.25	.05		
DH260 127.1	MDST, R3, Footwall, Dk grey, lamina 15° Dip	90	2.04	.05		∠ 20°

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692 0101 ENG. N. Hooper
PROJECT Crows Nest Resources
LOCATION Telkwa
DETAILS Point Load Test Results
DATE Sept 18/82 SHEET 5 OF 21

COMPUTATIONS

METRIC

KLOHN LEONOFF
CONSULTING ENGINEERS

COMPUTATIONS

JOB No. PA1692 0101 ENG. D. Hooper
PROJECT Crows Nest Resources
LOCATION Telkwa
DETAILS Point Load Test Results
DATE Sept 18/82 SHEET 6 OF 21

Sample	Description	Length mm	L/D	Is MPa	Qu MPa	Remarks
DH 260 129.7	SLST - R4 - non bedded,	95	2.16	2.35		∠8° Very Rough
DH260 130.1	SLST - Tuffaceous - Dk brown Non-bedded,	80	1.82	.05		∠°41, of Polished Joint
DH260 130.7	MDST - Coaly - Dip∠=9° - R3 DK gry to Black	100	2.27	.10		
DH 260 132.70	MDST - Tuffaceous - R4 - Non-bedded	75	1.70	.15		∠ 22°
DH 260 135.70	MDST - Coaly to Carbonaceous	100	2.27	.15 ✓		∠ 30°
DH 260 136.70	Limey MDST, R4, Non Bedded	75	1.70	2.75		on Small Fracture
DH260 137.50	As Above	70	1.59	1.5		∠ 14°
DH 260 140.80	SLST; Tuffaceous, Poorly Sorted 5° Dip R3	90	2.04	.80		∠ 13°
DH 260 141.30	Limey Mdst, R4, none bedded. White to Light Grey	103	2.34	4.45		∠ 30°
DH 260 142.3	Tuffaceous MDST,	60	1.36	0.10		Multiplanar fracture.
DH 260 143.4	MDST Tuffaceous, Massive	65	1.48	.10		Curved Polished

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692 0101 ENG. D. Hooper
PROJECT Crows Nest Resources
LOCATION Telkwa
DETAILS Point Load Test Results
DATE Sept 18/82 SHEET 7 OF 21

COMPUTATIONS

Depth	Description	Length mm	L/D	Is MPa	Qu MPa	Remarks
148.8 OH 260	Tuff, Med grey, R4, Massive,	65°	1.48	2.1		∠°15°
DH 260 150.3	MDST, Tuffaceous, R4, Massive Med grey	70°	1.59	4.0		∠° 40° Rough
DH 259 ~~DH 260~~ 7.0	MDST - Non bedded, Waxy, R2 ? Hang Wall	100	2.27	.10		∠ 10°
DH 259 8.7	MDST - Lamina Bedded R2 Coaly, Footwall, Dip 15°	85	1.93	0		∠10°
DH 259 12.2	SLST - Thinly bedded, R3, med to Dk grey 10° Dip	58	1.32	1.4		∠10°
DH 259 14.0	MDST - Tuffaceous - Thin Bedded 11°	95	2.16	0.9		∠10°
DH 259 19.4	MDST - Thinly bedded, R3, 12°	85	1.93	.25		small mica flake on bedding 12°
DH 259 26.6	vFg SST, R3, Thinly bedded, 13 degrees, Green, Poorly sorted	83	1.88	0.30		∠ 21°
DH 259 27.7	SST AS ABOVE	90	2.04	.70		on bedding
DH 259 35.3	SST AS Above -	75	1.70	.0		on bedding
DH 259 42.0	SST, vFg - R2 Green Dip 13° thinly bedded	44	1.11	0		Failed on bedding

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692 0101 ENG. N. Hooper
PROJECT CROWS NEST RESOURCES
LOCATION TELKWA
DETAILS POINT LOAD TEST RESULTS
DATE SEPT 18/82 SHEET 8 OF 21

COMPUTATIONS

Sample	Description	Length MM	L/D	σ_u MPa	Qu MPa	Remarks
DH259 44.8	SLST - Thinly bedded, 24° Dip R2, Hanging Wall	.45	1.02	.60		∠ 42°
DH259 48.0	MDST - Footwall R2	85	1.93	.05		∠ 10°
DH259 49.2	SLST - Thinly bedded, Med Grey R3	60	1.36	.05		∠ 10°
DH259 45.2	COAL - Dull w/ Bright, R3, Laminated 20° Dip.	65	1.48	.30		Failed on bedding
DH259 47.0	COAL, As above,	60	1.36	0.05		"
DH259 67.7	SLST, thin bedded, R2, 10° Dip	50	1.13	0		Failed on bedding
DH259 66.2	IRONSTONE BAND - 12cm thick, 10° Dip R5	100	2.27	6.5		Vertical Failure on siderite lined Joint
DH259 57.9	MDST - Footwall, Dk grey to black Dip 11° Plant Material	70	1.59	.20		on bedding
DH259 75.3	SLST - Dark Brown to Dk grey R3, Massive,	80	1.82	0		
DH259 71.9	IRONSTON BAND - R5 - Massive	95	2.16	9.1		Multi Plane Fracture
DH259 72.5	SLST - Med Grey, R3, 11° Dip	52	1.18	.25		

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692 0101 ENG. N. Hooper
PROJECT Crows Nest Resources
LOCATION Telkwa
DETAILS Point Load Test Results
DATE Sept 18/82 SHEET 9 OF 21

COMPUTATIONS

Sample	Description	Length MM	L/D	Iu MPa	Qu MPa	Remarks
DH258 14.3	SLST - Massive, Dark green, R2	100	2.27	.15		Multi Plane Fracture
DH258 24.3	SLST - As above	116	2.63	.70		Vertical ∠
DH258 29.20	SNDS - massive, medium grain light grey, R3,	90	2.04	0.15		Vertical ∠
DH258 35.1	V fg SST to SLST, massive, Non bedded	75	1.70	0.80		∠ 21°
DH258 44.0	SLST - Med grey, R4, Carbonate cement. Non bedded	90	2.04	4.35 5.70		Curved Failure Surface Conchoidal
DH258 45.9	MDST - Breccia, poorly cemented, R1, Non bedded	100	2.27	0		
DH258 50.7	SLST - Thin Bedded Hangwall 11° Dip	60	1.36	0.1		Failed on Bedding
DH258 53.0	MDST ~~SLST~~ - Footwall, thin bedded, Med grey. Carbonaceous			0.0		Failed on a Polish Joint 50° ∠
DH258 70.1	Ironstone, R5, massive, cemented by siderite	120	2.73	6.15		52° ∠
DH258 74.2	SLST - Thinly bedded, Dip 10°, R2	55	1.25	.05		Failed on Bedding
DH258 85.3	SLST R2 No Bedding - light green massive	86	1.95	.00		

METRIC

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692 0101 ENG. N. HOOPER
PROJECT CROWS NEST RESOURCES
LOCATION TELKWA
DETAILS POINT LOAD TEST RESULTS
DATE SEPT 18/82 SHEET 10 OF 24

COMPUTATIONS

Sample	Description	Length mm	L/D	Is MPa	qu MPa	Remarks
DH258 24.7	Mudstone coaly wisps R2 no bedding	100	2.27	0.05		10° ∠
DH258 100.4	SLST, thinly bedded, R3 Dip 5°	100	2.27	0		5° ∠
DH258 107.8	SLST, thinly bedded, R3, Light to med Grey, bioturbated 5° Dip	115	2.61	0.80		∠ bedding plane Failure
DH258 113.5	SLST, DK grey to black, Massive R3	80	1.82	0.10		∠ 5°
DH258 118.0	SLST - Med grey - Massive, R3	105	2.38	.30		∠ 5°
DH258 119.8	SLST - Med grey - Massive - R3	70	1.59	0.05		∠ 5°
DH258 123.60	SLST - Siderite cement, R4	80	1.82	5.75		Good clean Fracture
DH253 213.5	SST - Green, f.g., R4, Non bedded,	70	1.59	.70		Failed on Joint ∠ 80°
DH253 213.2	SST As above	60	1.36	1.75		∠ 20° Good Clean Break
DH254 31.4	Sill - igneous, Porphyry, Felsic	90	2.04	7.4		On Pre-existing Joint

METRIC

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692 0101 ENG. N. Hooper
PROJECT Crows Nest Resources
LOCATION TELKWA
DETAILS Point Load Test Results
DATE Sept 13/82 SHEET 11 OF 21

Sample	Description	Length mm.	L/D Ratio	C_u MPa	W_u MPa	Remarks
DH-208A ~~14.5~~ 5.8	SLST - thinly bedded, Dip = 15 R3, Med. to DK grey. Hanging wall of Coal	87	1.98	.40		Failed on bedding.
DH 208A 10	Coal - R2, banded. Dip = 10°	87	1.98	.40		Failed on bedding
DH 208A 12.0	Mdst - Carbonaceous, Laminated 6° Dip, R2→R3 Foot Wall	67°	1.52	.10		33° Failed on Pre-exist Joint.
DH 208A 14.0	SST - vFg gr. thinly bedded poorly sorted, 18° Dip R2→R3	85°	1.93	0.25		Failed on Joint ∠ ~~30~~ 50°
DH208A 14.7	vFg SST with SLST laminations R2-R3 Dip 20°	90	2.04	0.75		Failure on Bedding
DH 208A 18.6	SST As above Dip 20°	90	2.04	0.15		Failed on Bedding
DH 208A 25.8	SST AS Above Dip 16°, R2, Hanging wall	62	1.41	.05		Failed on Bedding.
DH 208A 27.2	COAL - R2 - 10° Dip	94	2.13	.15		Failed on Bedding
DH 208A 35.2	SLST - Finely Laminated 15° Dip R3,	84	1.91	.15		Clean Failure 10° ∠
27 - 35	MDST Hardness R1 Weathering C2 Massive	—		•0		Soft Rock
DH208A 36.0	SLST Thinly Laminated R3 - 42° Dip	61	1.38	-0		Failed on Fault Plane

COMPUTATIONS

G-25

Sample	Description	Length mm.	L/D Ratio	Cu MPa	Wu MPa	Remarks
DH 208 A 38.2	SLST to v.f. grained SSTN Medium Grey Thinly Laminated 15° Dip R4 (ONLY 100 mm THICK)	102	2.32	8.1		Clean Break 28
DH 208A 39.1	SLST Thinly bedded Dip 21° R3	80	1.82	1.35		Failed irregular surface
DH 208A 41.6	Silty MDST Non Bedded - R2	57	1.29	0.0		Failed Miserably
DH 208 41.6-44.8	Silty MDST R2 NonBedded			0.0		All zero Strength
	DH262					
DH262	NB. 38.4 To 53.1 m - ALL SOFT ROCK R2 OR LESS					Zero STRENGTH
DH262 53.1m	Silty MDST 11° Dip R2 laminar bedding	57	1.29	0.15		Failed on Bedding
DH 262 53.8	SLST Med Grey Thinly Bedded R3	105	2.38	1.95		Failed on Pre existing joint lined by Calcite
DH262 54.9	SLST Finely Laminated 80 R2-R3	72	1.64	0.40		- Rough
DH262 56.9	IRONSTONE R4 No Bedding NB ONLY 1 FT TOTAL IN 10 FT RUN	80	1.82	7.05		Broke on Pre Existing Fracture - Siderite Lined.
DH262 59.6	SLST Massive Dark Grey Poorly Bedded R3	102	2.32	0.4		- Clean Break
DH 262 62.5	SLST Massive R3-R4	77	1.75	0.85		Broke on Carbonate Lined Joint 28°

METRIC

KLOHN LEONOFF
CONSULTING ENGINEERS

COMPUTATIONS

JOB No. PA1692 01 01 ENG. N. Hooper
PROJECT CROWS NEST RESOURCES
LOCATION TELKWA
DETAILS POINT LOAD TEST RESULTS
DATE SEPT 18/82 SHEET 12 OF 21

Sample	Description	Length mm.	L/D Ratio	Q_u MPa	Qu MPa	Remarks
DH262 66.9	SLST R3 Massive	88	2.0	0.5		11°
DH262 67.9	Hanging Wall Coal Seam – R3 Silty MDST Finely Laminated 12° Dip	87	1.98	0.2		Broke on Bedding
DH262 68.0	Coal with banded calcite on bedding Dip 15° R3	62	1.41	0.35		Broke on Bedding
DH262 70.5	COAL R2 Dip 9°	74	1.68	1.3		Broke on Bedding
DH262 73.8	Footwall MDST Tuffaceous Dip 9° R3	82	1.86	0.05		Broke on Bedding
DH262 74.8	Hang wall another Coal Seam R3 MDST Tuffaceous Non Bedded	66	1.50	0.4		Clean Break 12° ∠
DH 262 76.2	COAL Banded 13° R3	102	2.32	0.1		Clean Break 56° ∠
DH 262 76.5	Foot Wall Tuffaceous MDST Non Bedded R4	79	1.79	0.5		16° Plant MH on Fracture Plain
DH262 78.3	SLST to vf grained SSST Thinly bedded R3 to R4	56	1.27	5.6		Clean 0°
DH262 79.9	Hanging Wall : SLST Thinly Bedded R3 Dip 14°	68	1.54	0.1		Broke on Pre existing Fracture 26° ∠
DH262 80.2	COAL Banded 9° Dip	60	1.36	0.45		Broke on Bedding
DH 262 81.2	MDST – Coal with Plant Frags Dip = 11° R3 – R4	69	1.57	0.25		Failed on Bedding

COMPUTATIONS

METRIC

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692 0101 ENG. N. Hooper
PROJECT Crows Nest Resources
LOCATION TELKWA
DETAILS Point Load Test Results
DATE Sept 18/82 SHEET 13 OF 21

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1652 0101 ENG. D. Hooper
PROJECT Crows Nest Resources
LOCATION TELKWA
DETAILS Point Load Test Results
DATE Sept 18/82 SHEET 14 OF 21

COMPUTATIONS

Da...	Description	Length mm.	L/D Ratio	Cu MPa	...u MPa	Remarks
DH 262 82.9	SST vfs. ~~SST~~ - R3 thinly Bedded 19° Dip	59	1.34	2.0		14° Cross Bed
DH262 84.4	Coaly MDST Black Massive Non Bedded R2	78	1.77	0.0		Broke on slickensided fracture 7°
DH262 84.7	SLST Thin bedded 18° R3-R4 SST ~~SST~~ interbeds	73	1.66	0.85		Broke on Bedding
DH262 86.0	COAL 8° Dip Dirty Dull R3	66	1.5	0.05		Broke on Bedding
DH262 86.2	Footwall 16° Tuff R3 Massive Non Bedded	66	1.5	1.25		Clean Break 0 ~~90° to Core Axis~~
DH262 88.0	SLST Laminar Bedding 12° Dip R3-4	61	1.38	1.90		Clean Break 0 ~~90~~
DH262 90.5	SST Thin Bedded 3° Dip R3 Coaly Partings along Bedding	72	1.64	0.65		Broke on Bedding
DH262 93.4	MDST Non Bedded Dark grey to Black R2 to R3	69	1.57	1.0		8°
DH262 95.3	MDST Dark Brown Thin Bedded 13° R3	79	1.79	0.15		Broke on Bedding
DH262 96.4	MDST Med Brown Bedding 15° Siderite Cemented	71	1.61	4.5		Broke on Bedding
DH262 98.1	SHALE Coaly Massive Non Bedded R2	73	1.66	0.1		Failed on Clean Fracture 14°
DH 262 97.9	Volcanic Welded TUFF Light Grey ~~Abc~~ Non Bedded Massive R5 (1.3 Metres Thick)	81	1.84	10.0		0°

G-25

Sample	Description	Length mm	L/D Ratio	Cu MPa	MPa	Remarks
DH262 99.2	TUFF some MUD and SILT in it Welded Tuff	105	2.38	4.8		Failed on Pre existing Joint 80°
DH262 104	SST abundant ash in Matrix R4 Massive Light Grey	68	1.54	2.85		340
	Note Base of Tuffaceous Rocks is at 105.2M } all 2.5 MPa or higher start of Tuffaceous Rocks is at 99.7M					
DH262 105.8m	MDST Massive R2	76	1.73	0.01		Broke on Pre existing fracture 20°
DH262 108.5	MDST silty Massive R2	68	1.54	0.05		Broke on Pre existing fracture 10°
DH262 110.3	MDST partly Tuffaceous R3	65	1.48	1.65		Broke on Bedding 15°
DH262 110.5	SST R3 medium grain carbonaceous mtl in matrix medium bedded 11° Dip	78	1.77	3.8		Failed on bedding α
DH262 113.0	MDST Tuffaceous Non Bedded R2-R3	66	1.50	2.05		Failed at 0° straight across
DH262 115.7	TUFF welded (0.6M length) Light grey Non Bedded R5	85	1.93	9.05		80° (almost along core axis)
DH262 115.4	MDST coaly R2 Non Bedded	70	1.59	0.70		Irregular Break Straight Across
DH262 118.5	MDST Tuffaceous R4 Non Bedded massive Med Grey	75	1.70	3.00		27°

COMPUTATIONS

KLOHN LEONOFF
CONSULTING ENGINEERS

METRIC

JOB No. PA1692.0101 ENG. D. Hooper
PROJECT CROWS NEST RESOURCES
LOCATION TELKWA
DETAILS POINT LOAD TEST RESULTS
DATE SEPT 12/82 SHEET 15 OF 21

Sample	Description	Length mm.	/I Ratio	σ_u MPa	MPa	Remarks
DH262 121.7	~~SS~~ SLST Laminar Bedding 14° R3 Tuffaceous	83	1.88	3.8		Broke on Bedding
DH262 122.7	MDST Tuffaceous R4 Non Bedded, Highly Fractured	91	2.07	1.05		Broke on Pre existing Fracture 70°
DH262 124.6	MDST Non Bedded R3 - R4 Bit Tuffaceous	71	1.61	0.1		Broke on Bedding 12°
DH262 124.6	MDST Non Bedded R3-4 Bit Tuffaceous (same as above)	73	1.66	0.95		Broke on Bedding 12°
NB UP TO	127.7m all same as above					
DH262 129.7	CONGLOMERATE R4 Non Bedded Below all COAL ∴ Won't be mined	76	1.73	6.2		10°

COMPUTATIONS

KLOHN LEONOFF
CONSULTING ENGINEERS

METRIC

JOB No. PA1692 0101 ENG. N. HOOPER
PROJECT CROWS NEST RESOURCES
LOCATION TELKWA
DETAILS POINT LOAD TEST RESULTS
DATE SEPT 18/82 SHEET 16 OF 21

METRIC

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692 0101 ENG. N. Hooper
PROJECT CROWS NEST RESOURCES
LOCATION TELKWA
DETAILS POINT LOAD TEST RESULTS
DATE SEPT 16/84 SHEET 17 OF 21

Sample	Description	Length mm.	L/I Ratio	C_u MPa	ω_u MPa	Remarks
DH 261 48.5m	MDST Silty Dark Grey Massive R2 - R3	83		0.2		Clean - 5°
DH261 53.6	SST Dark Green med bedded 70° R3 Weathered	66		0.25		60°
DH261 53.7	SST Dark Green med bedded 70° R3	85		1.2		35
DH261 56.6	SLST Thinly Bedded R3 light Grey 63° Dip siderite cemented	86		4.0		10°
DH261 58.5	SLST as above Thinly Bedded Dark Grey Dip 37° NO siderite	82		0.05		18° on old air slickensided Fracture
DH261 59.5	SLST as above No Siderite	92		1.00		Broke on Bedding
DH261 66.0	MDST silty R2 - R3 32° Dip no cement	88		0.85		Broke on Bedding
DH261 66.7	SST vfg slightly calcareous matrix 22° Dip	76		3.0		Broke on Bedding
DH261 68.8	SST vfg Dip 28° R4	99		2.5		Broke on Bedding
DH261 72.2	SST ~~as~~ Dip 25° R4 slightly calcareous matrix Bioturbated	88		2.8		Clean Break 38°
DH261 76.8	SST vfg med grey Dip 25° R4 slightly calcareous	88		2.3		Broke on Bedding

CONDITIONS

METRIC

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692 0101 ENG. N. HOOPER
PROJECT CROWS NEST RESOURCES
LOCATION JELKUA
DETAILS POINT LOAD TEST RESULTS
DATE SEPT 18/82 SHEET 18 OF 21

COMPUTATIONS

Sample	Description	Length mm.	[illegible] Ratio	Cu MPa	[illegible] MPa	Remarks
DH261 81.3	SST to SLST Bedding destroyed by bioturbation	88		2.25		12° Clean Break
DH261 87.0	SST with siderite cement R4 to R5 non bedded	103		5.9		32° Clean
DH261 89.5	SLST R2 – R3 med to dark grey 23° Dip	82		1.15		53° Clean
DH261 93.6	SLST to vfg SST 16° Dip R3 to R4	86		2.55		Broke on Bedding
DH261 95.1	SLST 10° R2-R3 Dark Grey			0.6		Broke on Bedding
DH261 96.7	SLST thinly bedded 21° R3	87		1.55		
DH261 98.2	MDST silty R2 20°	90		0.4		Broke on Bedding
DH261 101.2	SST sideritic R4-R5 26° Dip	110		5.95		45°
DH261 104.2	MDST silty R3 Non bedded Dark Grey Black	85		0.05		Slickensided fault plane 80
DH261 104.4	MDST silty Bedding 32°	105		0.95		10°
DH261 106.8	SST sideritic R4 to R5 Dip 12°			4.00		0°
DH261 108.9	SLST R3 Dip 29° Dark Grey	90		1.00		Failed across the bedding 12°

G-25

METRIC

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692 0101 ENG. D. HOOPER
PROJECT CROWS NEST RESOURCES
LOCATION TELKWA
DETAILS POINT LOAD TEST RESULTS
DATE SEPT 18/82 SHEET 19 OF 21

COMPUTATIONS

Sample	Description	Length mm.	L/D Ratio	C_u MPa	ω_u MPa	Remarks
DH261 111.9	SLST Dark Grey R3 Dip 28°	61		0.6		Broke on Bedding 0
DH261 111.9	SLST Dark Grey Dip 26° R3	91		1.15		5°
DH261 114.9	SLST Non Bedded Dark Grey to Black	70		0.1		20°
DH261 117.0	SLST Non Bedded Dark Grey to Black R3	92		0.8		12° Clean
DH261 124.5	MDST silty R2-R3 Non Bedded			0.05		Pre Existing Fracture 62°
DH261 125.7	MDST silty non bedded	64		0.2		Irregular Break
DH261 128.8	SST green massive fg R3	64		1.15		Irregular Break
DH261 130.4	MDST carbonaceous R2 Non Bedded			0.6		
DH261 130.4	MDST as above Hanging wall coal seam	67		0.6		Chips
DH261 136.1	COAL Dip 120	72		0.05		Broke on Bedding
DH261 136.3	MDST silty Dark Grey to Black R3 non bedded Foot Wall Coal Seam	68		0.9		~~Failed on~~ Clean Break 23
DH261 137.7	MDST as above			1.15		11° - Irregular Break

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692.0101 ENG. N. Hooper
PROJECT Crows West Resources
LOCATION Telkwa
DETAILS Point Load Test Results
DATE Sept 18/82 SHEET 20 OF 21

COMPUTATIONS

Sample	Description	Length mm.	Ratio	M.Pa	MPa	
DH261 142.3	SLST Thinly Bedded - vertical R3			0.75		Broke on bedding @ 90° (i.e. along core axis)
DH261 144	SLST Thinly Bedded - 60°	71		3.5		Failed across bedding 38°
DH261 145.4	SLST as above Dip 43°	80		0.2		Failed on Bedding 43°
DH261 156.4	SLST siderite cement possibly same as R4-R5	97		8.6		Vertical chip
DH261 156.4	Same as above	90		7.4		Clean break @
DH261 159.1	MDST silty Hanging Wall Coal Seam R3-R4 23° Dip	92		2.7		0°
DH261 160.0	COAL	69		0.05		
DH261 161.2	MDST silty Foot Wall Non Bedded R3 carbonaceous plant debris	59		1.4		17°
DH261 163.9	SLST 40° Red to Dark Grey R4	89		1.05		30°
DH261 165.8	COAL very dirty - ~~[illegible]~~ large amount of debris Dull Hard Dip 45°	81		1.40		0°
DH261 166.7	MDST Foot Wall Non Bedded	73		0.2		Pre-exist Fracture at 30°
DH261 171.3	SLST Thinly Bedded 35°	93		0.25		0°

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692.0101 ENG. D. HOOPER
PROJECT CROWS NEST RESOURCES
LOCATION TELKWA
DETAILS POINT LOAD TEST RESULTS
DATE SEPT 12/82 SHEET 21 OF 21

COMPUTATIONS

Sample	Description	Length mm.	L/D Ratio	C MPa	MPa	Inclination
DH261 176	SST fg thick bedded 30°	88		1.6		11°

APPENDIX V

PERMEABILITY TESTS CALCULATION SHEETS

COMPUTATIONS

114.9m – 121.0m.

PERMEABILITY TEST RESULT – DH 255 @ 377 to 397 ft.

Date : Sept 9/82   Time 4:18

Falling Head permeability test through packer in coal seam

ID NQ rod = 6.03 cm
Hole Dia (NQ hole) = 7.58 cm

Ground Water level = 0 ft (at ground surface)
Depth Drill Bit = 373 ft
Depth Bottom Packer = 377 ft
Depth Bottom Hole = 397 ft.   Packer Pressure = 373 x 0.433 + 80 = 241 psi

Time t (minutes)	Depth to WL below top of drill rod d (metres)	Head H_t (metres) $(3.24 - d)$	Head Ratio (H_t/H_o)
-5	3.24	0	
0	0.90	2.34 (= H_o)	1.00
1	0.93	2.31	0.987
2	0.96	2.28	0.974
3	0.98	2.26	0.966
4	1.00	2.24	0.958
6	1.04	2.20	0.940
8	1.06	2.18	0.931
12	1.10	2.14	0.914
15	1.14	2.10	0.897
20	1.19	2.05	0.876
25	1.22	2.02	0.863
30	1.27	1.97	0.842
40	1.33	1.91	0.816
50	1.38	1.86	0.795

From Plot (H_t/H_o) against t : Time Lag $T = 285$ minutes

$L = 20$ ft $= 609.6$ cm

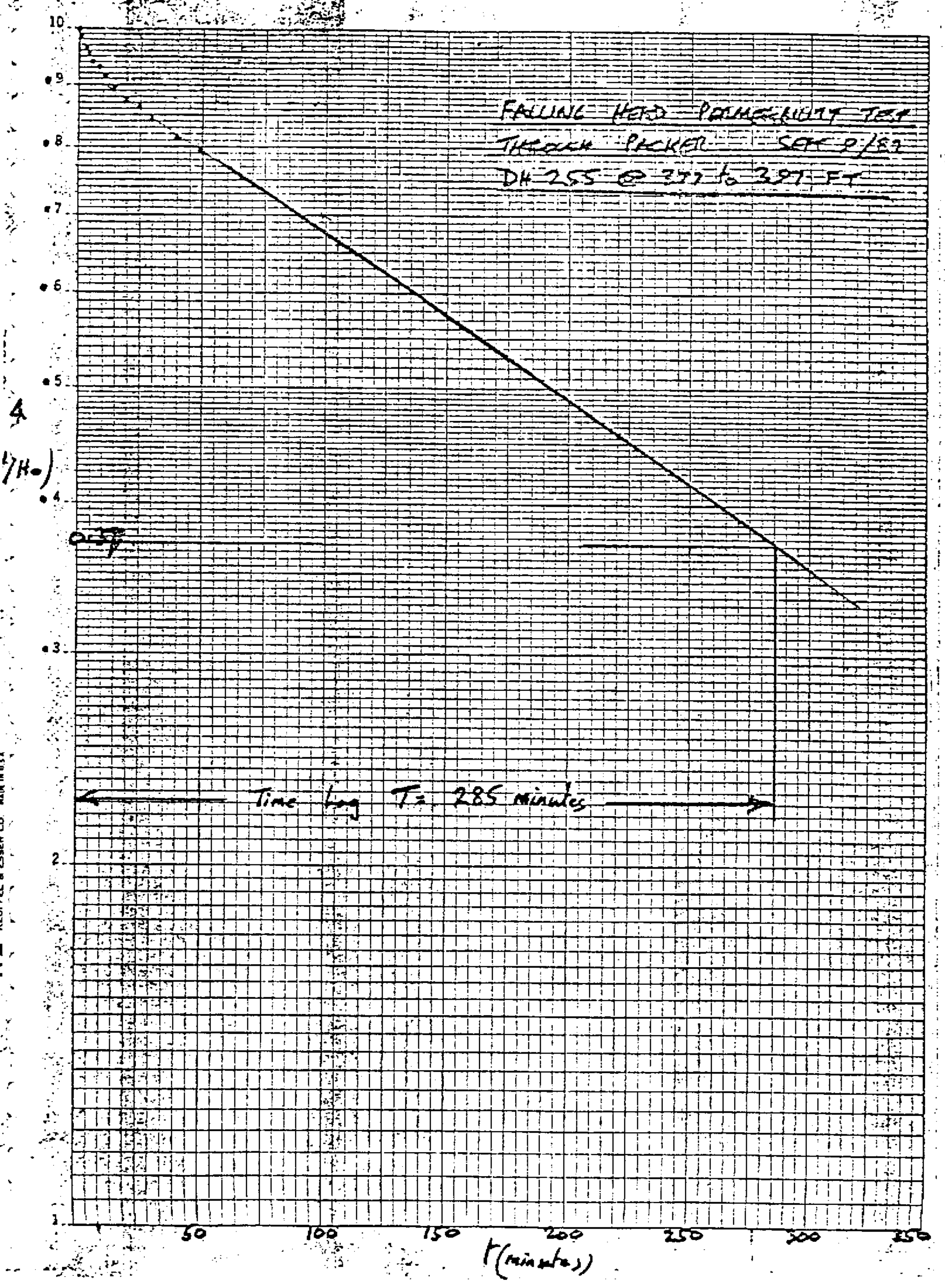
$$k_h = \frac{d^2}{8LT} \cdot \ln\left(\frac{2mL}{D}\right) = \frac{(6.03)^2}{8 \times 609.6 \times 285 \times 60} \cdot \ln\left(\frac{2 \times 1 \times 609.6}{7.58}\right) = 2.2 \times 10^{-6}$$

$$\boxed{k = 2 \times 10^{-6} \text{ cm/s}}$$

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692 0101	ENG. N. Hooper
PROJECT Crows Nest Resources	
LOCATION Telkwa	
DETAILS Permeability Test DH255	
DATE Sept 9/82	SHEET OF

METRIC



FALLING HEAD PERMEABILITY TEST
THROUGH PACKER
DH 255 @ 337 to 397 FT
Time Lag T= 285 minutes
t (minutes)
50
100
150
200
250
300
350
10
.9
.8
.7
.6
.5
.4
.3
2
1

COMPUTATIONS

PERMEABILITY TEST RESULT – DH 255 @ 354 to 362 FT

107.9 110.3

Date : Sept 9 1982 Time 1 05 pm

Falling Head permeability test through packer in coal seam

I.D. NQ drill rod : 60.3 mm
Hole Dia (NQ hole) : 75.8 mm

Ground Water level = 0 ft. (at ground surface)
Depth Drill Bit : 350 ft
Depth Bottom Packer = 354 ft
Depth Bottom Hole : 362 ft

Packer Pressure = 350 × 0.433 + 80 = 231 psi

Time t (minutes)	Depth below top of drill rod ~~casing~~ d (metres)	Head Ht (metres) (1.08 − d)	Head Ratio (H1/Ho)
−5	~~0.77~~ 1.08	0 Ground water level	
0	0	1.08 (= Ho)	1.00
1	0.10	0.98	0.907
2	0.175	0.905	0.838
4	0.290	0.79	0.731
5	0.34	0.74	0.685
9	0.45	0.63	0.583
10	0.48	0.60	0.555
15	0.61	0.47	0.435
20	0.68	0.40	0.370
25	0.73	0.35	0.324

From Plot (Ht/Ho) against t Time Lag T = 20 minutes

L = 8 ft = 243.8 cm

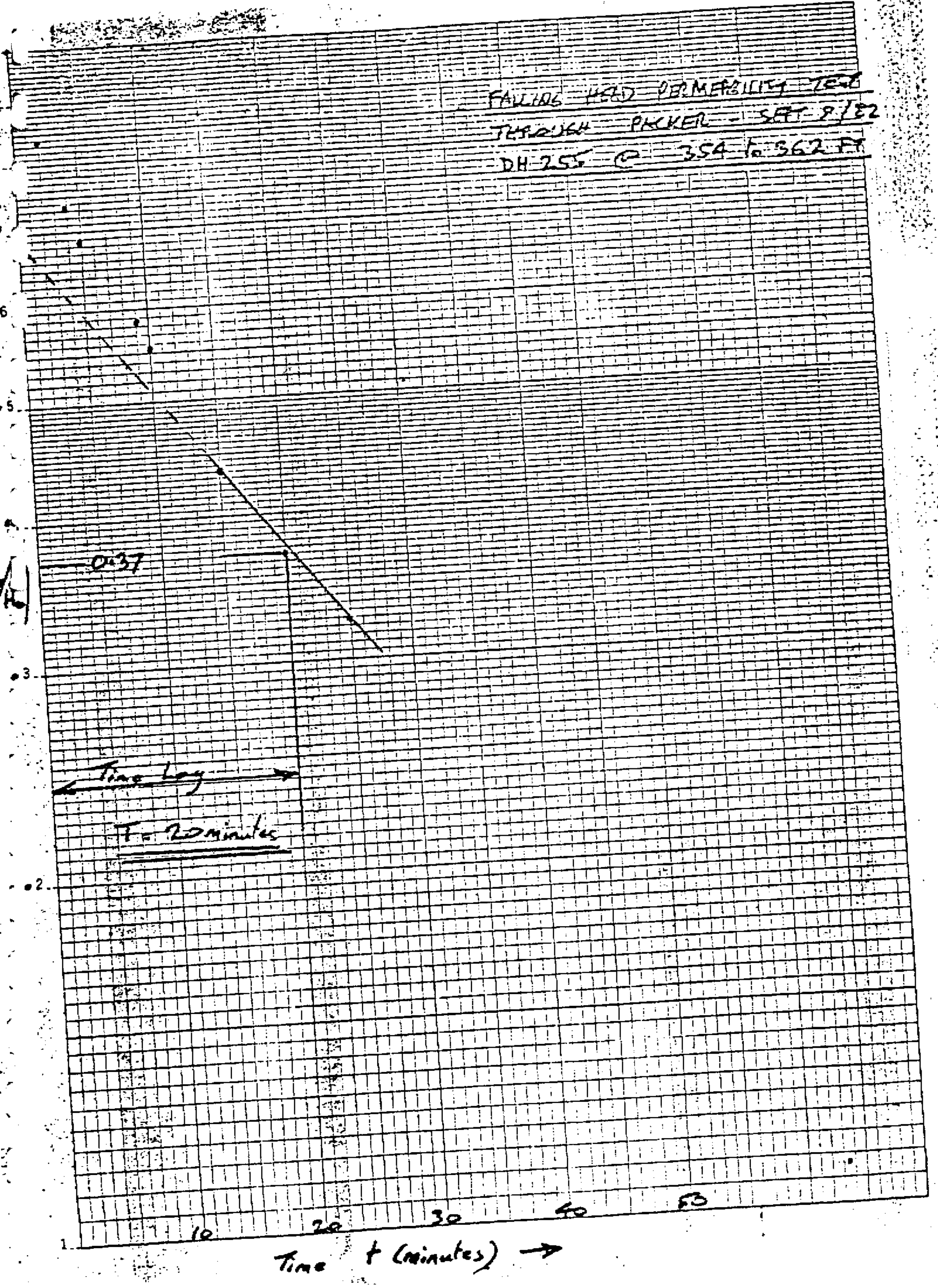
$$k_h = \frac{d^2 \cdot L_n\left(\frac{2mL}{D}\right)}{8 \cdot L \cdot T} = \frac{(6.03)^2 \times L_n\left(\frac{2\times1\times(243.8)}{7.58}\right)}{8\times(243.8)\times 20\times 60} = 6.4 \times 10^{-5}\ \text{cm/s}$$

$$\boxed{k = 6 \times 10^{-5}\ \text{cm/sec}}$$

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692 01 01	ENG. H. Hoofd
PROJECT	Crows Nest Resources
LOCATION	TELKWA
DETAILS	PERMEABILITY TEST DH 255
DATE SEPT 9/82	SHEET OF

METRIC


FALLING HEAD PERMEABILITY TEST
THROUGH PACKER - SEPT 9/82
@ 354 to 362 FT
.6
.5
.4
0.37
.3
Time Lag
T = 20 minutes
.2
1
10
20
30
40
50
Time t (minutes)

COMPUTATIONS

PERMEABILITY TEST RESULT - DH 255 @ 301 to 308 Ft. (91.7 – 93.9)

Date : Sept 9 1982 Time : 9.0 am Hole dia : NQ

Falling head permeability test through packer in coal seam

I.D. NQ drill rod = 2 3/8 inches = 60.3 mm
Hole Dia (NQ hole) = 2 63/64 inches = 75.8 mm

Ground Water level : 0 ft. (at ground surface)
Depth Drill Bit : 297 ft
Depth Bottom Packer : 301 ft Packer Pressure = (297 x 0.433 + 80) = 208 psi
Depth Bottom Hole : 308 ft.

Time 't' (minutes)	Depth below top of drill rod ~~casing~~ d (metres)	Head Ht (metres) (2.765 − d)	Ratio (Ht/Ho)
−5	2.765	0 (Ground Water Level)	
0	0.70	2.065 (= Ho)	1.000
1	0.79	1.975	0.956
2	0.89	1.875	0.908
3	0.985	1.78	0.862
4	1.06	1.705	0.825
6	1.20	1.565	0.758
8	1.31	1.455	0.704
10	1.41	1.355	0.656
12	1.50	1.265	0.612
14	1.575	1.19	0.576
20	1.755	1.01	0.489
25	1.885	0.88	0.426
30	2.03	0.735	0.356
35	2.06	0.705	0.341

From Graph Plot of (Ht/Ho) against t T = 30 minutes Basic Time Lag

$$k_h = \frac{d^2 \cdot l_n\left(\frac{2mL}{D}\right)}{8 \cdot L \cdot T} \quad \text{for} \quad \frac{mL}{D} > 4$$

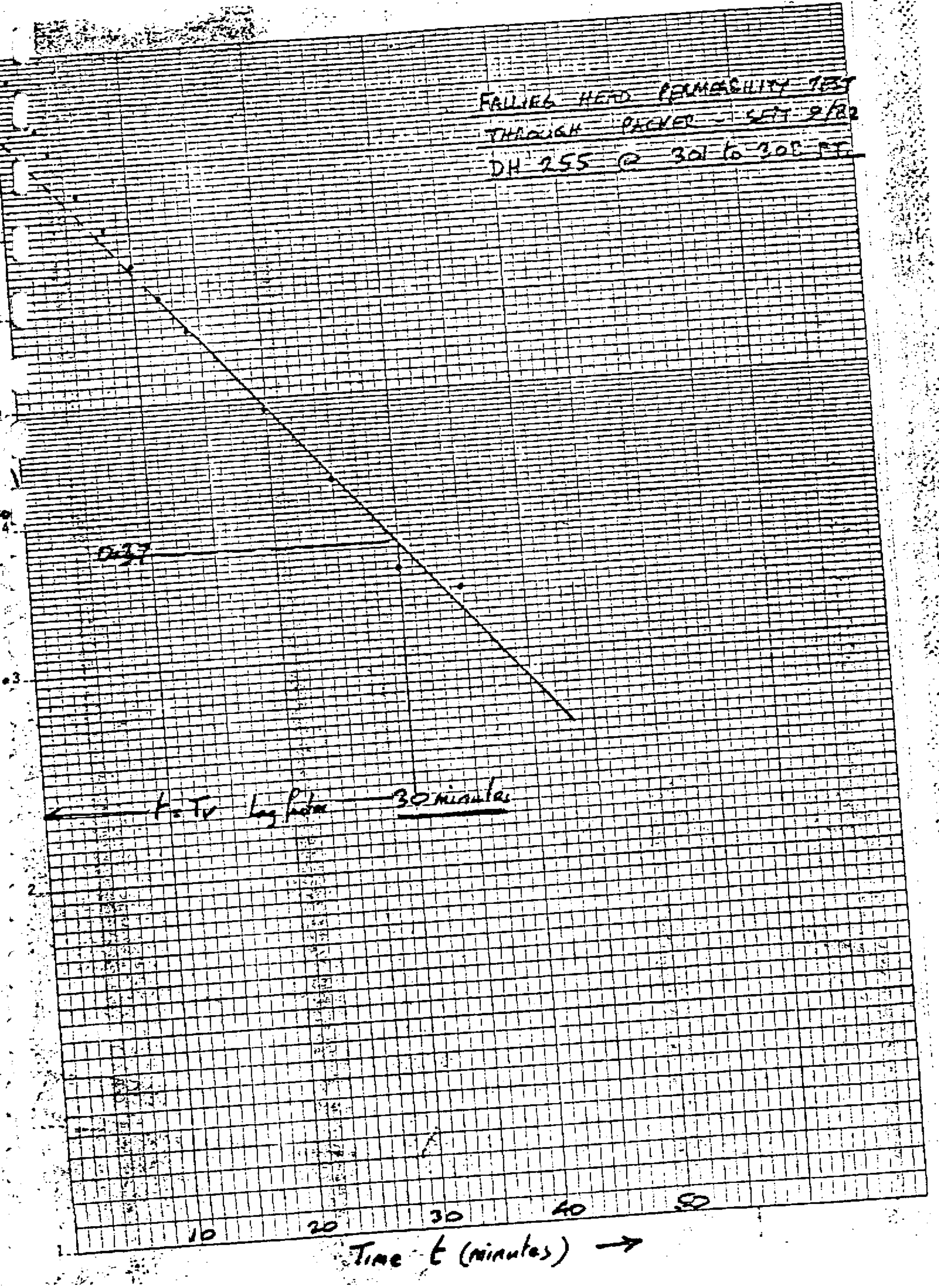
$d = 6.03$ cm
$D = 7.58$ cm
$L = 213.3$ cm (7 ft)
$T = 1800$ secs Basic Time Lag
$m = \sqrt{k_h / k_v}$ (assumed = 1)

$$= \frac{(6.03)^2 \cdot l_n\left(\frac{2 \cdot 1 \cdot 213.3}{7.58}\right)}{8 \cdot 1800 \times 213.3} = 4.77 \times 10^{-5} \text{ cm/s}$$

$$\boxed{k = 5 \times 10^{-5} \text{ cm/sec}}$$

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692 0101	ENG. N. Hooper
PROJECT	Crows Nest Resources
LOCATION	Telkwa
DETAILS	Permeability Test DH255
DATE Sept 9/82	SHEET OF


FALLING HEAD PERMEABILITY TEST
THROUGH PACKER - SEPT 9/82
DH 255 @ 301 to 308 FT.
30 minutes
4
3
2
1
10
20
30
40
50
Time t (minutes)

COMPUTATIONS

95.7 97.2

PERMEABILITY TEST RESULT - DH 258 @ 314 TO 319 FT.

Date : Sept 17, 1982 Time : 2·30 am

Falling Head Test through packer in coal seam

ID NQ rods = 6·03 cm
Hole Dia (NQ) = 7·58 cm

GWL = 0·90 m below top of pipe (ie assumed to be at G.L.)

Depth Drill Bit = 310 ft
Depth Bottom Packer = 314 ft
Depth Bottom of Hole = 319 ft. Packer Pressure = 310×0.433+80 = 214 psi

Time t (minutes)	Depth to WL below top of pipe d (metres)	Head at time t H_t $(0.90 - d)$	Head Ratio (H_t/H_o)
-5	0.900	0	
0	0.160	0.74 = H_o	1.000
1	0.215	0.685	0.925
2	0.255	0.645	0.871
3	0.300	0.600	0.811
4	0.325	0.575	0.777
5	0.350	0.550	0.743
6	0.365	0.535	0.723
8	0.405	0.495	0.669
10	0.435	0.465	0.628
15	0.500	0.400	0.540
20	0.535	0.365	0.493
25	0.570	0.330	0.446
30	0.590	0.310	0.419
35	0.605	0.295	0.398
40	0.620	0.280	0.378

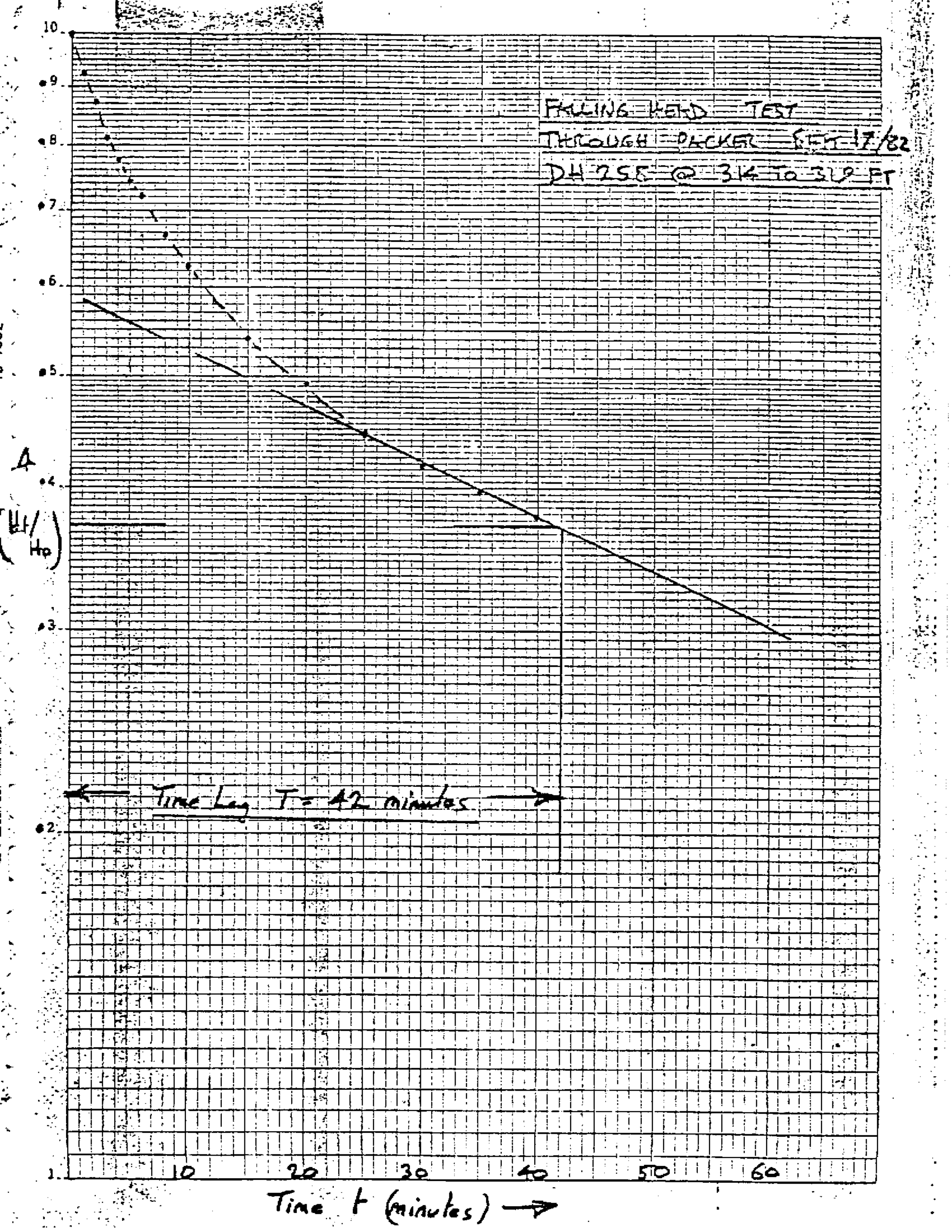
$$k_h = \frac{d^2 \cdot \ln\left(\frac{2 \times m \times L}{D}\right)}{8 \cdot L \cdot T} = \frac{(6.03)^2 \times \ln\left(\frac{2 \times 1 \times 152.4}{7.58}\right)}{8 \times 152.4 \times 42 \times 60}$$

$$\underline{k_h = 4 \times 10^{-5}\ \text{cm/sec}}$$

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692 0101	ENG. N. HOOPER
PROJECT	CROWS NEST RESOURCES
LOCATION	TELKWA
DETAILS	PERMEABILITY TEST - DH258
DATE SEPT 17 /82	SHEET OF

— METRIC


FALLING HEAD TEST
THROUGH PACKER SEPT 17/82
DH 255 @ 314 TO 319 FT
Time Lag T = 42 minutes
Time t (minutes)
10
9
8
7
6
5
4
3
2
1
10
20
30
40
50
60

COMPUTATIONS

64·3 61·2.

PERMEABILITY TEST RESULT – DH 258 @ 211 TO 227 FT

Date : Sept 16 /82 Time: 5·39 pm

Falling Head Test through Packer in coal seam.

ID NQ rods = 6·03 cm
Hole Dia (NQ) = 7·58 cm

GWL = 2·40 m below top of pipe (i.e. assumed to be at ground surface)

Depth Drill Bit = 207 ft
Depth Bottom Packer = 211 ft
Depth Bottom of Hole = 227 ft Packer Pressure = 207×0·433+80 = 170 psi

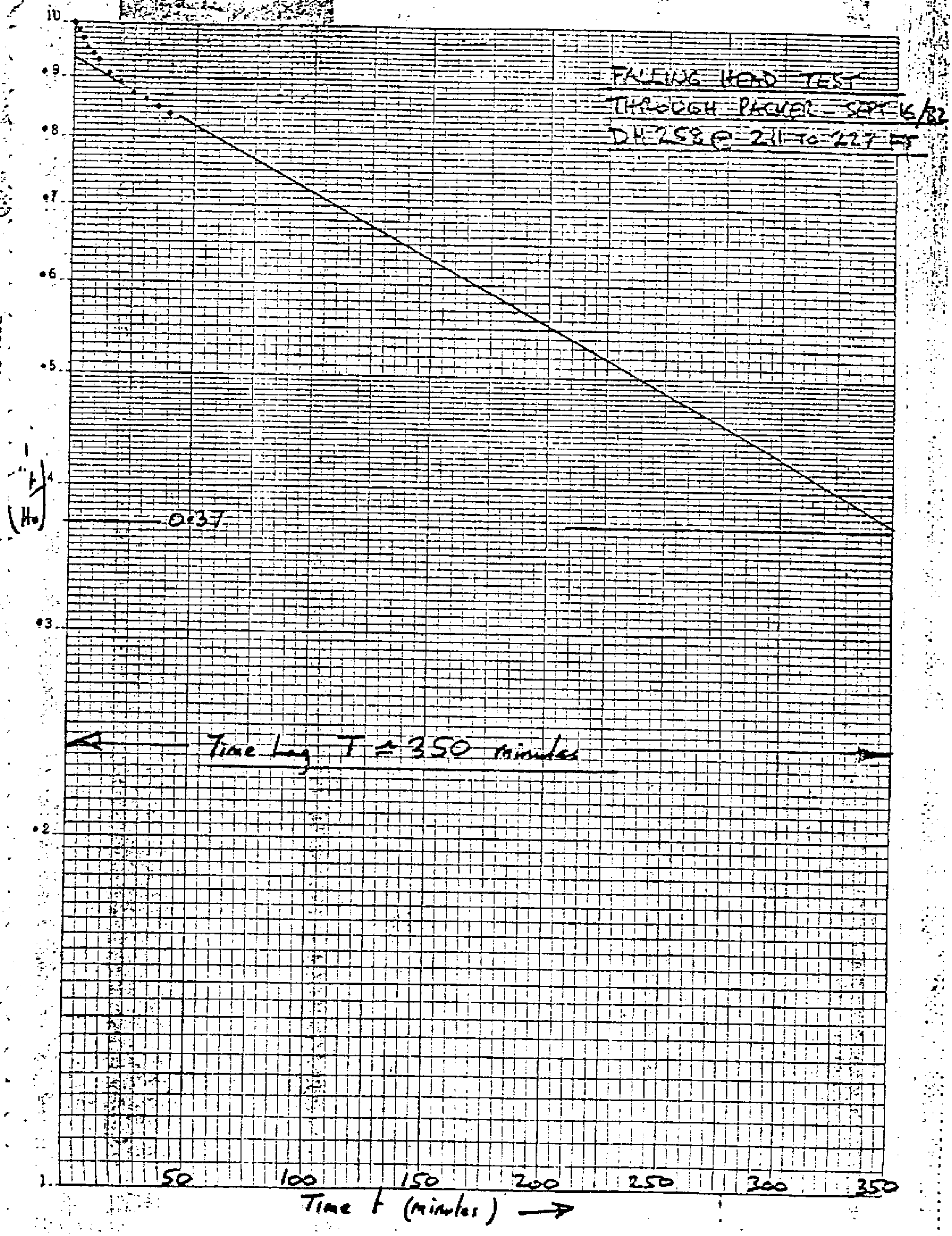
Time t minutes	Depth to WL below top of pipe d (metres)	Head at time t Ht (2·40 − d)	Head Ratio (Ht/Ho)
−5	2·40	0	
0	0·250	2·15 = Ho	1·00
1	0·265	2·135	0·993
2	0·285	2·115	0·983
3	0·300	2·100	0·976
4	0·315	2·085	0·970
7	0·365	2·035	0·946
8	0·380	2·020	0·939
10	0·400	2·000	0·930
15	0·455	1·945	0·904
20	0·485	1·915	0·890
25	0·520	1·880	0·874
30	0·545	1·855	0·863
35	0·575	1·825	0·849
40	0·595	1·805	0·839
45			
60			

$$kh = \frac{d^2 \cdot \ln\left(\frac{2 \cdot m \cdot L}{D}\right)}{8 \cdot L \cdot T} = \frac{(6{\cdot}03)^2 \times \ln\left(\frac{2 \times 1 \times 487{\cdot}7}{7{\cdot}58}\right)}{8 \times 487{\cdot}7 \times 350 \times 60}$$

$$kh = 2 \times 10^{-6} \text{ cm/sec}$$

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692 0101	ENG. N. Hooper
PROJECT	CROWS NEST RESOURCES
LOCATION	TELKWA
DETAILS	PERMEABILITY TEST DH258
DATE Sept 16 /82	SHEET OF



FALLING HEAD TEST
THROUGH PACKER - SEPT 16/82
DH 258 @ 211 to 227 FT
10
.9
.8
.7
.6
.5
.4
.3
.2
1
h/Ho
0.37
Time Lag T ≐ 350 minutes
50
100
150
200
250
300
350
Time t (minutes)

COMPUTATIONS

PERMEABILITY TEST RESULT - DH 258 @ 166 TO 173.5 FT. (50.6 – 52.9)

Date : Sept 16/82 Time : 2.20 pm

Falling Head Test through packer in coal seam (166-173 ft)

ID NQ rod = 6.03 cm.
Hole Dia (NQ hole) = 7.58 cm.

GWL = 0.80 m below top of pipe (ie @ Ground Surface assumed)

Depth Drill Bit = 162 ft
Depth Bottom Packer = 166 ft
Depth Bottom Hole = 173.5 ft Packer Pressure = 162×0.433+80 = 150 psi

Time t (mins)	Depth to WL below top of pipe d (metres)	Head at time t Ht (0.80 − d)	Head Ratio (Ht/Ho)
−5	0.80	0	
0	0.00	0.80 = Ho	1.000
1	0.085	0.715	0.893
2	0.145	0.655	0.819
3	0.190	0.610	0.762
4	0.225	0.575	0.719
6	0.290	0.510	0.637
8	0.345	0.455	0.569
10	0.385	0.415	0.519
16	0.460	0.340	0.425
20	0.510	0.290	0.362
25	0.540	0.260	0.325
30	0.565	0.235	0.294
35	0.585	0.215	0.269

Plot (Ht/Ho) versus t gives Time Lag T = 19 minutes

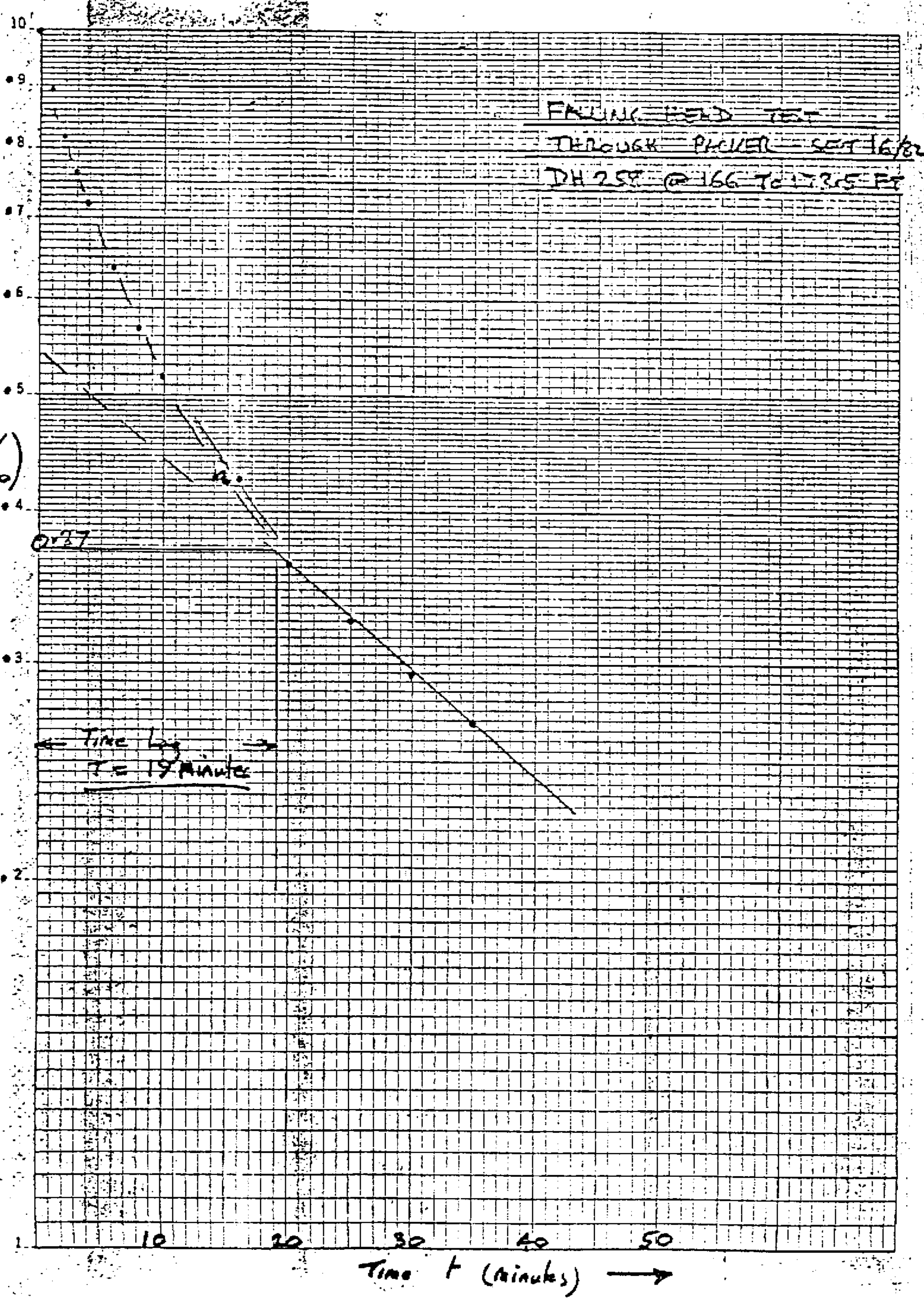
$$k = \frac{d^2 \cdot \ln\left(\frac{2 \cdot a \cdot L}{D}\right)}{8 \cdot L \cdot T} = \frac{(6.03)^2 \ln\left(\frac{2 \times 1 \times 228.6}{7.58}\right)}{8 \times 228.6 \times 19 \times 60}$$

$$\underline{\underline{kh = 7 \times 10^{-5} \text{ cm/sec}}}$$

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692 01 01	ENG. N Hoobes
PROJECT	CROUX NEST RESOURCES
LOCATION	TAKLA
DETAILS	PERMEABILITY TEST DH 258
DATE Sept 16/82	SHEET OF

METRIC



FALLING HEAD TEST
THROUGH PACKER SET 16/82
0.37
Time Lag
T = 19 Minutes
10
20
30
40
50
Time t (minutes)
.9
.8
.7
.6
.5
.4
.3
.2
1

COMPUTATIONS

PERMEABILITY TEST RESULT — DH258 @ 150 – 157.5 FT (45.7 – 48.00)

Date: Sept 16/82 Time: 11.28 am

Falling Head Test through packer in coal seam (151 – 157 ft)

ID NQ rod = 6.03 cm.
NQ Hole dia = 7.58 cm.

GWL = 2.6 m. below top of pipe (ie assumed to be at ground surface)

Depth Drill bit = 146 ft
Depth Bottom packer = 150 ft
Depth Bottom of Hole = 157.5 ft. Packer Pressure = 146 × 0.433 + 80 = 143 psi

Time t (minutes)	Depth to WL below top of pipe d (metres)	Head at time t H_t (metres) $(2.60 - d)$	Head Ratio (H_t/H_o)
−5	2.60	0	
0	0.27	2.33 = H_o	1.000
1	0.30	2.30	0.987
2	0.33	2.27	0.974
3	0.365	2.235	0.959
4	0.395	2.205	0.946
6	0.44	2.16	0.927
8	0.46	2.14	0.918
10	0.50	2.10	0.901
15	0.595	2.005	0.860
20	0.665	1.935	0.830
25	0.72	1.88	0.807
30	0.765	1.835	0.787
35	0.805	1.795	0.770
40	0.850	1.75	0.751

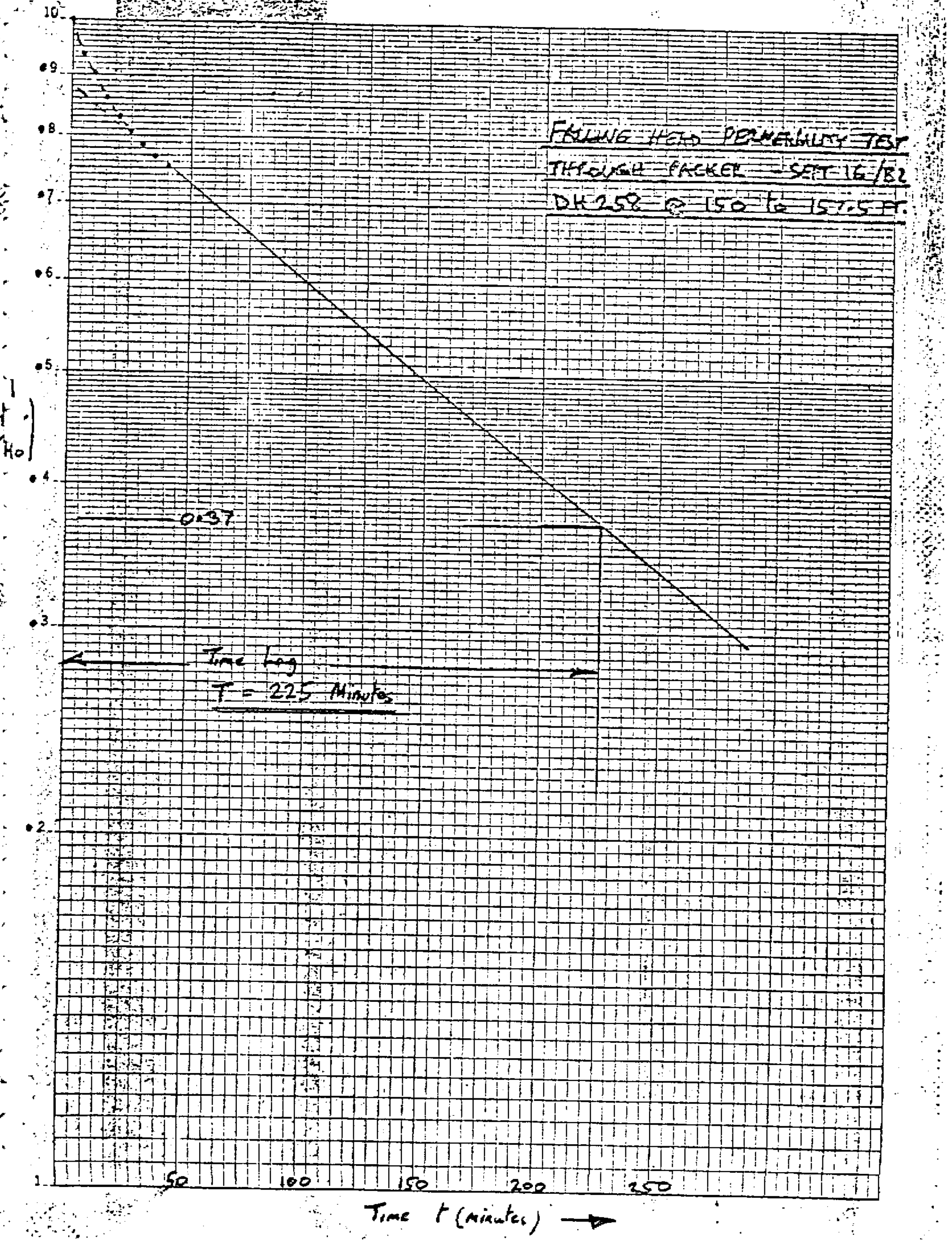
From Plot H_t/H_o versus t Time Lag T = 225 Minutes

$$k = \frac{d^2 \cdot \ln\left(\frac{2mL}{D}\right)}{8 \cdot L \cdot T} = \frac{(6.03)^2 \times \ln\left(\frac{2 \times 1 \times 228.6}{7.58}\right)}{8 \times 228.6 \times 225 \times 60} = \underline{\underline{6.0 \times 10^{-6} \text{ cm/sec.}}}$$

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PK1692 00	ENG. N Hoover
PROJECT Chas NBT Resources	
LOCATION Telkwa	
DETAILS Permeability Test DH258	
DATE Sept 16/82	SHEET OF

METRIC



FALLING HEAD PERMEABILITY TEST
THROUGH PACKER - SEPT 16/82
DH 258 @ 150 to 157.5 FT.
H/Ho
0.37
Time Lag
T = 225 Minutes
10
.9
.8
.7
.6
.5
.4
.3
.2
1
50
100
150
200
250
Time t (minutes)

COMPUTATIONS

44.5 46.3

PERMEABILITY TEST RESULT – DH 258 @ 146 TO 152 FT.

Date: Sept 19, 1982 Time: 9.40 am

Falling Head Test in Piezometer (in Coal Seam)

ID PVC Piezo Pipe = 2.54 cm.
Hole Dia @ Sand Pack = 7.58 cm

Static GWL = 0.52m below top of pipe (measured next day)

Depth Top of Sand Pack = 146 ft
Depth Top Slotted Pipe = 149 ft
Depth Bot Slotted Pipe = 151 ft
Depth Bottom Sand Pack = 152 ft.

Time t (mins)	Depth to WL below top of pipe d (metres)	Head at time t Ht (metres) $(0.59 - d)$	Head Ratio (Ht/Ho)
H500	0.59	0	
0	0.040	0.55 = Ho	1.000
1	0.045	0.545	0.99
2	0.045	0.545	0.99
3	0.050	0.540	0.98
5	0.055	0.535	0.972
10	0.065	0.525	0.954
15	0.080	0.510	0.927
20	0.095	0.495	0.900
25	0.105	0.485	0.882
30	0.115	0.475	0.863
35	0.120	0.470	0.854
40	0.125	0.465	0.845
56	0.145	0.445	0.809
85	0.175	0.415	0.754
240	0.270	0.320	0.582

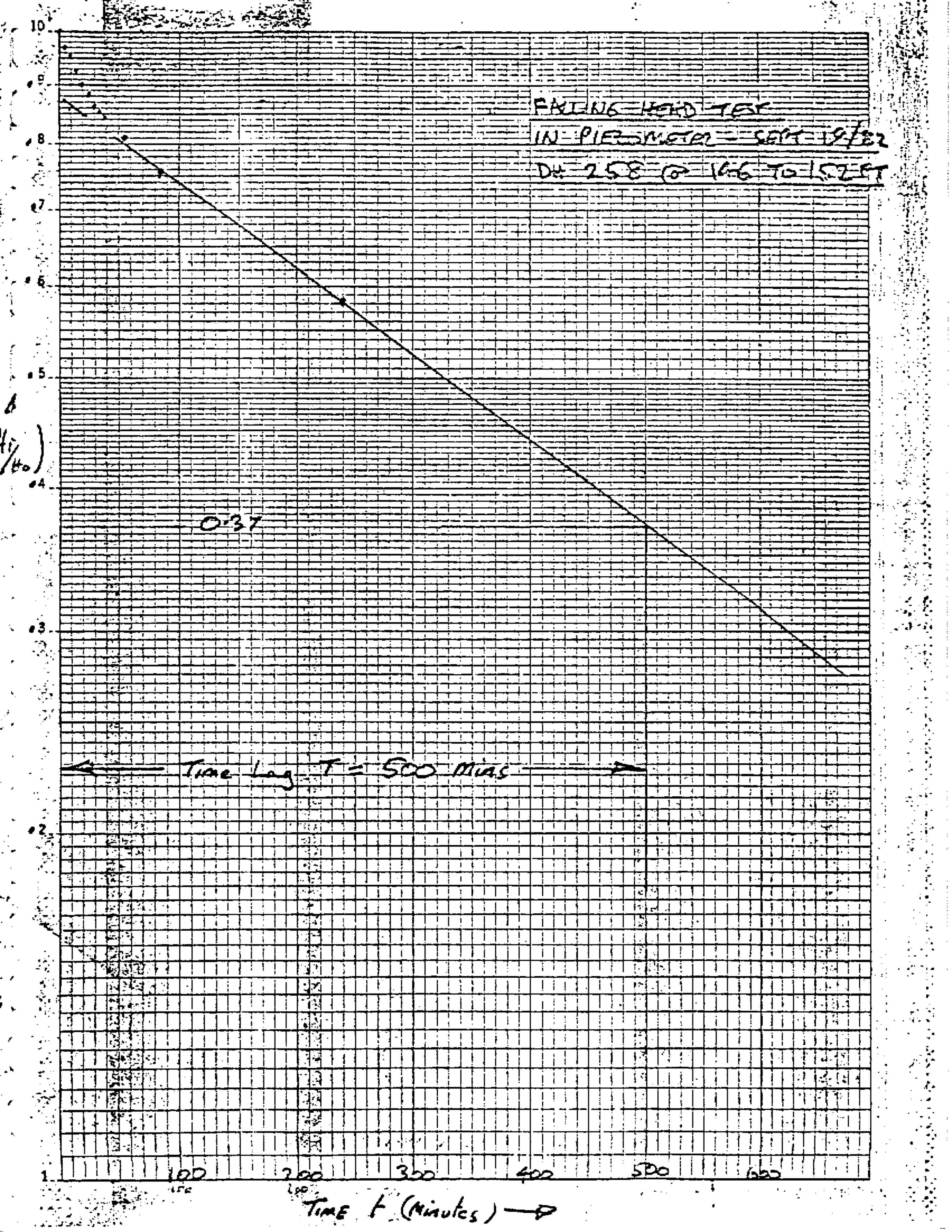
$$k = \frac{d^2 \cdot \ln\left(\frac{2 \times m \times L}{D}\right)}{8 \cdot L \cdot T} = \frac{(2.54)^2 \times \ln\left(\frac{2 \times 1 \times 182.9}{7.58}\right)}{8 \times 182.9 \times 500 \times 60}$$

$$= 5 \times 10^{-7} \text{ cm/sec.}$$

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692 01 01	ENG. D HOOPER
PROJECT CROWS NEST RESOURCES	
LOCATION TELKWA	
DETAILS PERMEABILITY TEST DH 258	
DATE Sept 19, 1982	SHEET OF

METRIC



FALLING HEAD TEST
IN PIEZOMETER - SEPT 19/82
DH 258 @ 166 TO 152 FT
0.37
Time Lag T = 500 mins
100
200
300
400
500
600
10
.9
.8
.7
.6
.5
.4
.3
.2
1
Time t (Minutes)

COMPUTATIONS

PERMEABILITY TEST RESULT – DH 257 @ 94.5 TO 102 FT

28.8 31.1

Date: Sept 19, 1982 Time: 8.0 am

Falling Head Test in Piezometer (in Coal Seam)

ID PVC Piezometer Pipe = 2.54 cm
Hole Dia NQ at piezo = 7.58 cm

G.W.L. = 1.81 m below top of pipe (at time of test)

Depth Top of Sand Pack = 94.5 ft
Depth Top of Slotted Section = 97 ft
Depth Bot of Slotted Section = 99 ft
Depth Bot of Sand Pack = 102 ft.

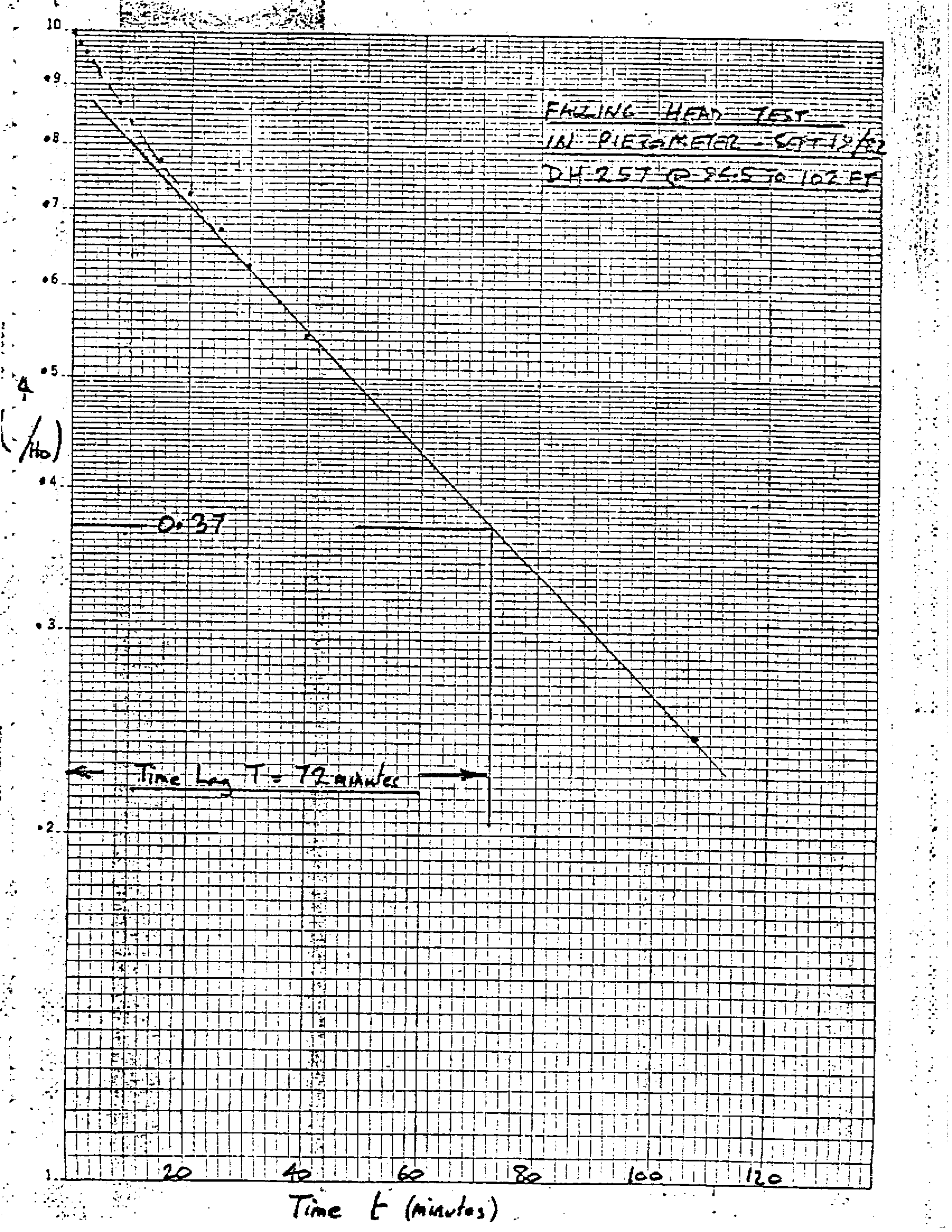
Time t (minutes)	Depth WL below top of pipe d (metres)	Head at time t Ht (metres) (1.81 − d)	Head Ratio (Ht/Ho)
-5	1.81	0	
0	0.210	1.60 = Ho	1.000
1	0.245	1.565	0.978
2	0.305	1.535	0.959
3	0.330	1.505	0.940
4	0.380	1.480	0.925
6	0.420	1.430	0.894
8	0.470	1.390	0.869
10	0.570	1.340	0.837
15	0.655	1.240	0.775
20		1.155	0.722
25	0.735	1.075	0.672
30	0.810	1.000	0.625
35	0.880	0.930	0.581
40	0.940	0.870	0.543
107	1.420	0.390	0.244

$$k_h = \frac{d^2 \ln\left(\frac{2 \times m \times L}{D}\right)}{8 \cdot L \cdot T} = \frac{(2.54)^2 \times \ln\left(\frac{2 \times 1 \times 228.6}{7.58}\right)}{8 \times 228.6 \times 72 \times 60} = \underline{3 \times 10^{-6} \text{ cm/sec}}$$

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA 1692 01 01	ENG. N. Hooper
PROJECT	CROWS NEST RESOURCES
LOCATION	TELKWA
DETAILS	PERMEABILITY TEST – DH 257
DATE Sept 19 1982	SHEET OF

METRIC


FALLING HEAD TEST
IN PIEZOMETER - SEPT 19/82
DH 257 @ 85.5 to 102 FT
10
.9
.8
.7
.6
.5
.4
.3
.2
1
h/Ho
0.37
Time Lag T = 72 minutes
20
40
60
80
100
120
Time t (minutes)

COMPUTATIONS

157.9 159.4

PERMEABILITY TEST RESULT - DH 256 @ 518 TO 523 FT

Date : Sept 19, 1982 Time : 12.00 (mid day)

Falling Head Test in Piezometer (just above coal seam 527-532.5')

ID PVC Piezo Pipe = 2.54 cm.
Hole Dia @ Sand Pack = 7.58 cm.

Static GWL = 15.55 m below top of pipe

Depth Top Sand Pack = 518 ft
Depth Top Slotted Pipe = 520 ft
Depth Bot Slotted Pipe = 522 ft
Depth Bottom Sand Pack = 523 ft.

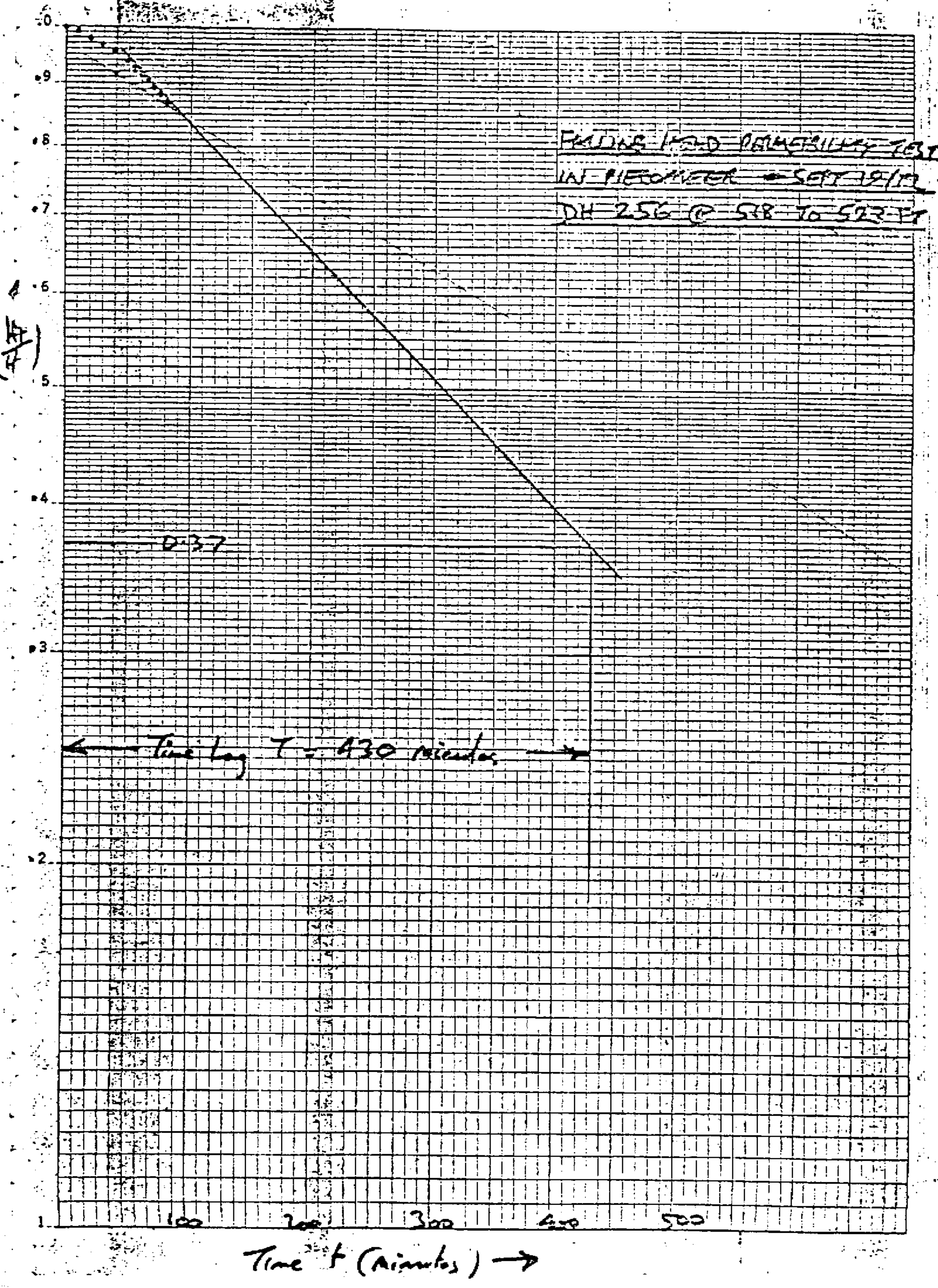
Time t (minutes)	Depth to WL below top of pipe d (metres)	Head at time t Ht (metres) (15.55 − d)	Head Ratio (Ht/Ho)
−5	15.550	0	
0	1.95	13.6 = Ho	1.000
2	1.97	13.57	0.998
4	2.00	13.55	0.996
9	2.085	13.46	0.99
14	2.175	13.37	0.983
20	2.25	13.30	0.978
24	2.31	13.24	0.973
29	2.40	13.15	0.967
34	2.48	13.07	0.961
39	2.55	13.00	0.956
42	2.61	12.94	0.951
44	2.66	12.89	0.948
49	2.775	12.77	0.939
54	2.91	12.64	0.929
59	3.07	12.48	0.917
64	3.24	12.31	0.905
69	3.425	12.125	0.891
74	3.595	11.955	0.879
79	3.77	11.78	0.866

$$k = \frac{(2.54)^2 \times \ln\left(\frac{2 \times 1 \times 152.4}{7.58}\right)}{8 \times 152.4 \times 60 \times 43} = 7 \times 10^{-7}\ \text{cm/sec}$$

NB (in Siltstone Not Coal!)

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. PA1692 0101	ENG. N HOOPER
PROJECT	CROWS NEST RESOURCES
LOCATION	TELKWA
DETAILS	PERMEABILITY TEST - DH 256
DATE Sept 19 1982	SHEET OF


FALLING HEAD PERMEABILITY TEST
IN PIEZOMETER - SEPT 19
DH 256 @ 518 To 523 Ft
0·37
Time Lag T = 430 minutes
1.0
·9
·8
·7
·6
·5
·4
·3
·2
1
100
200
300
400
500
Time t (minutes) →

COMPUTATIONS

PERMEABILITY TEST RESULT - DH 255 @ 454 to 459 Ft

Date: Sept 12, 1982 Time 9.20 a.m. Hole dia NQ

Falling Head Permeability test in piezometer in Coal seam

I.D. Piezometer PVC pipe = 2.54 cm
Hole Diameter at sand pack = 7.58 cm

Ground Water level = 0.6 m below ground surface
Depth Top of Sand Pack = 454 ft
Depth Bottom Sand Pack = 459 ft > L = 5 ft.
Depth Bottom Piezometer = 458 ft
Depth Top Piezometer slotted section = 456 ft.

Time 't' (mins)	Depth below top of standpipe to GWL d (metres)	Head Ht (metres) (2.23 - d)	Head Ratio (Ht/Ho)
-5	2.23	0	
0	0.33	1.90 (= Ho)	1.00
1	0.385	1.845	0.97
2	0.425	1.805	0.95
3	0.460	1.77	0.93
4	0.495	1.73	0.91
6	0.570	1.66	0.87
8	0.620	1.61	0.847
10	0.670	1.56	0.821
15	0.780	1.45	0.763
20	0.885	1.345	0.708
25	0.975	1.255	0.66
30	1.055	1.175	0.618
35	1.145	1.085	0.571
40	1.190	1.04	0.547
45	1.250	0.98	0.516
50	1.290	0.94	0.495
55	1.345	0.885	0.466
60	1.385	0.845	0.445

KLOHN LEONOFF
CONSULTING ENGINEERS

JOB No. 7A 1692 010	ENG. N. HOOPER
PROJECT CROWS NEST RESOURCES	
LOCATION TELKWA	
DETAILS PERMEABILITY TEST DH 255	
DATE SEPT 12/82	SHEET 1 OF 2

METRIC

COMPUTATIONS

138.4 139.9

PERMEABILITY TEST RESULT - DH 255 @ 454 to 459 ft.

(CONTINUED)

$$k_h = \frac{d^2 \cdot \ln\left(\frac{2 \cdot m \cdot L}{D}\right)}{8 \cdot L \cdot T}$$

d = 2.54 cm
D = 7.58 cm
L = 152.4 cm
m = 1
T = 110 minutes = 6600 secs

$$= \frac{(2.54)^2 \cdot \ln\left(\frac{2 \times 1 \times 152.4}{7.58}\right)}{8 \times 152.4 \times 6600}$$

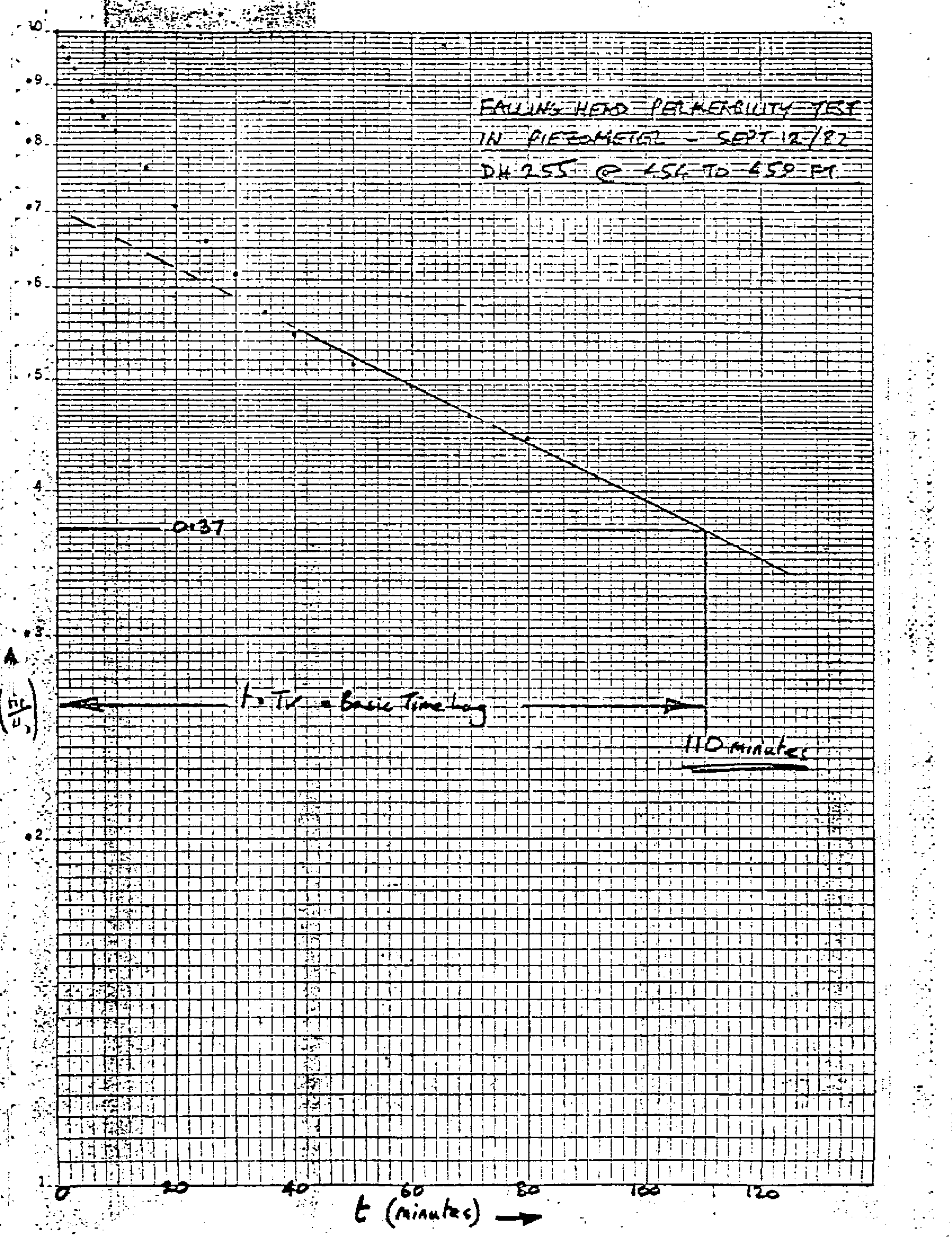
$$= 2.96 \times 10^{-6} \text{ cm/s}$$

$$\boxed{k_h = 3 \times 10^{-6} \text{ cm/s}}$$

KLOHN LEONOFF
CONSULTING ENGINEERS

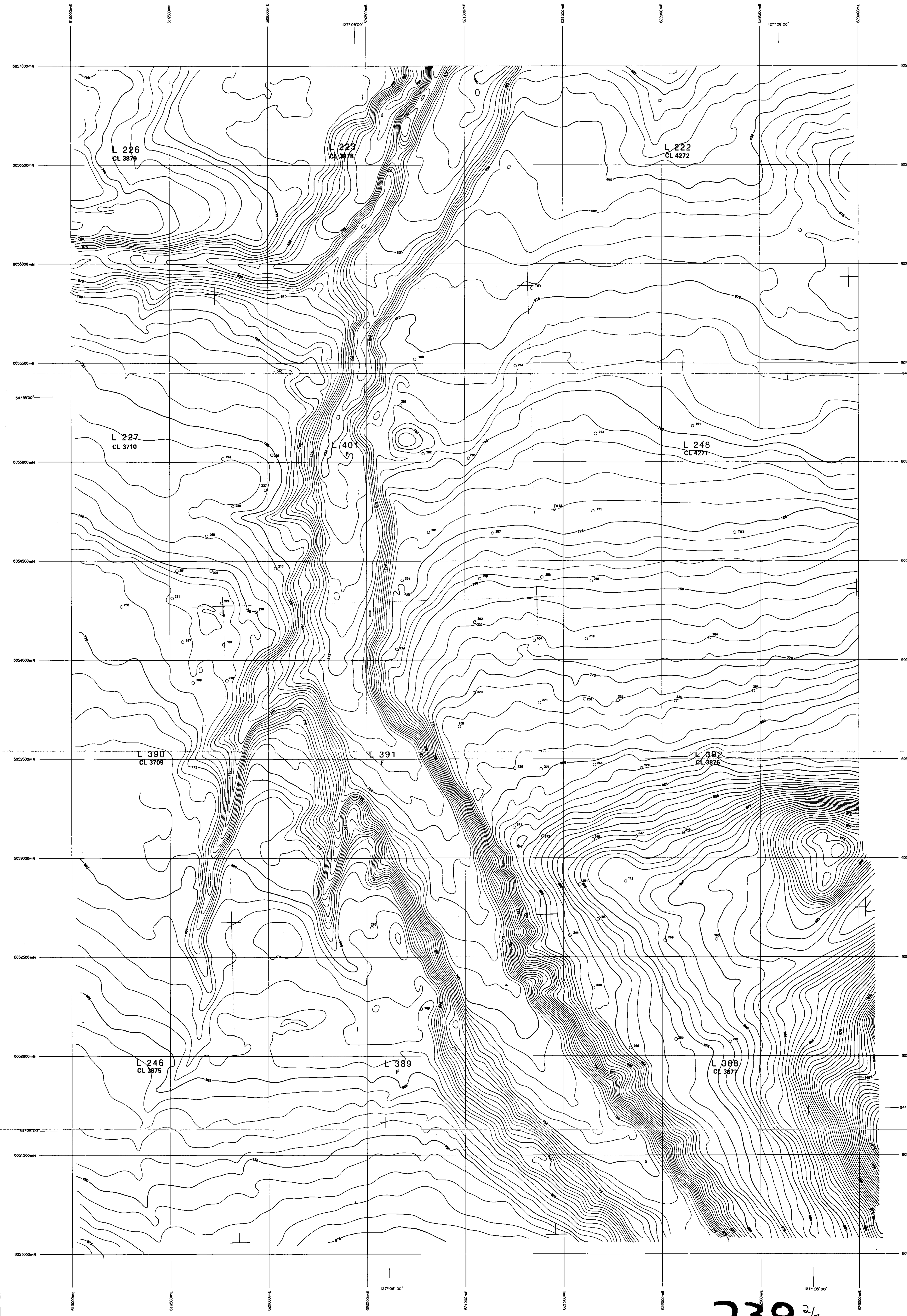
JOB No. PA 1692 0101	ENG. N Hooper
PROJECT	Crows Nest Resources
LOCATION	Telkwa
DETAILS	Permeability Test DH 255
DATE Sept 12/82	SHEET 2 OF 2

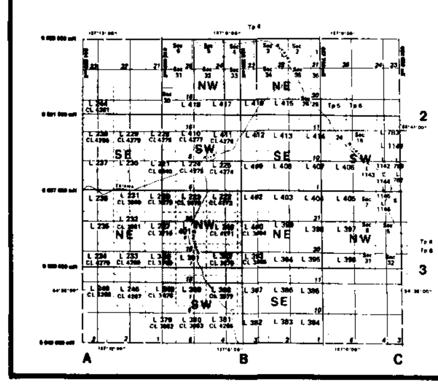
METRIC



FALLING HEAD PERMEABILITY TEST
IN PIEZOMETER - SEPT 12/82
DH 255 @ 456 TO 459 FT
0.37
t = TL = Basic Time Lag
110 minutes
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
20
40
60
80
100
120
t (minutes)

DRAWINGS





MAP PROJECTION: UNIVERSAL TRANSVERSE MERCATOR
CENTRAL MERIDIAN REFERENCE 129° W. U.T.M. Zone 9

SURVEY NOTE:
Coordinates are on U.T.M. Grid (Zone 9) and are derived from Government control stations Blitzen, Podre, and Tack. Elevations are on Geodetic Datum and are derived from BM 79HA369 = 538.922 metres via reciprocal trigonometric levelling.

SCALE 1:10000

CONTOUR INTERVAL: 5 METRES

238 2/7

TK-Telkwa 82(2)A *(4)

Crows Nest Resources Limited
EXPLORATION

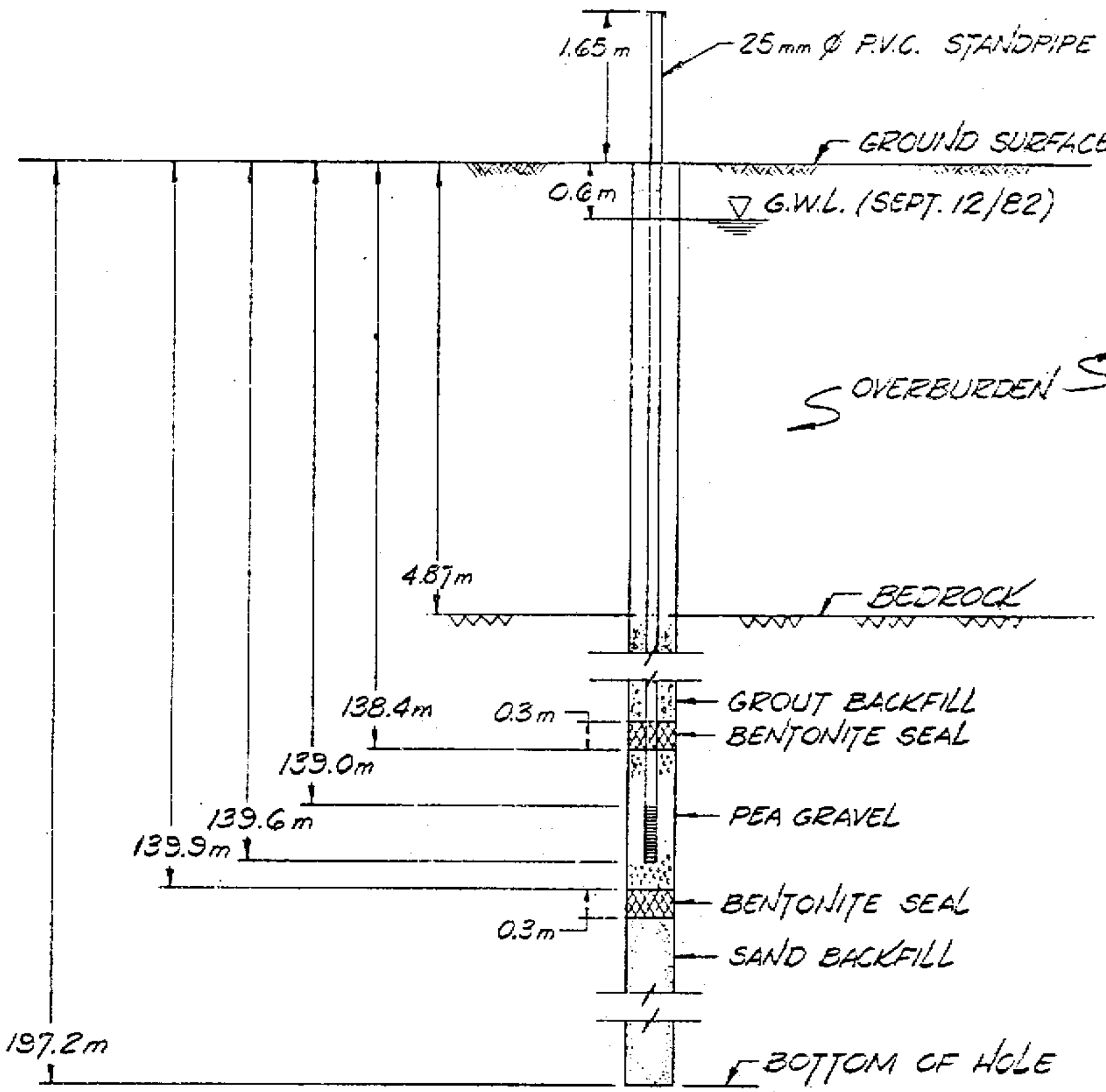
TELKWA PROJECT AREA
N.E. BRITISH COLUMBIA

COMPUTER GENERATED TOPOGRAPHY 1979, 81, 82 DRILL HOLE LOCATIONS

N.T.S. 93L/11		U.T.M. ZONE 9
AUTHOR: DIGITECH	SCALE: 1:10 000	ENCLOSURE No:
DATE: 82 10 20	REVISED:	DRAWING No: TW3T6
To Accompany		

1

TW2T6



PIEZOMETER INSTALLED IN COAL SEAM

GROUND ELEVATION	802.30 m.
BEDROCK ELEVATION	797.43 m.
BASE OF UPPER SEAL	663.90 m.
LENGTH OF TIP	1.50 m.
TOP OF LOWER SEAL	662.40 m.

SCALE N.T.S.

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

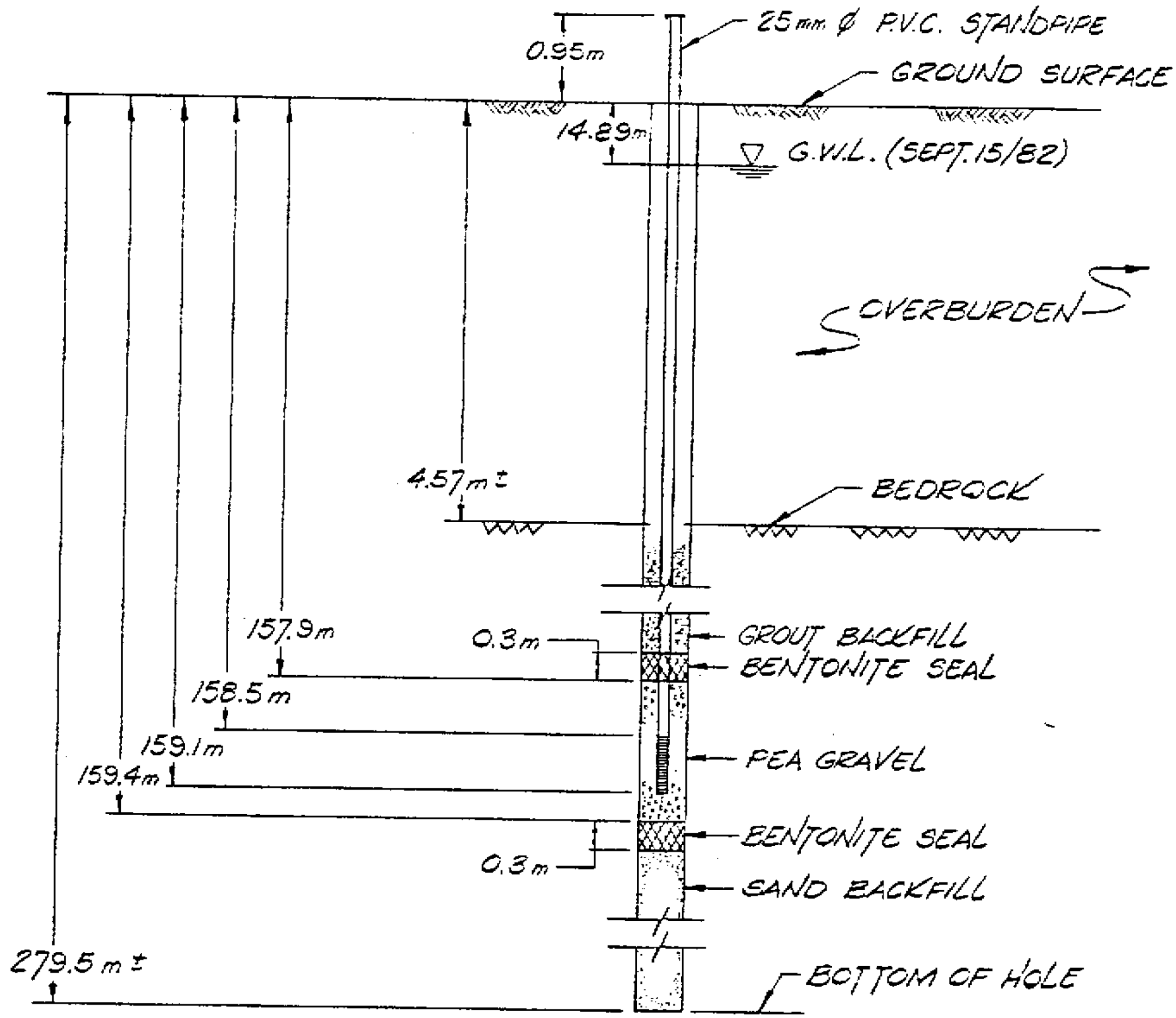
PROJECT: TELKWA COAL PROJECT

TITLE: DETAILS OF PIEZOMETER INSTALLATION - DRILLHOLE 255

CLIENT: CROWS NEST RESOURCES

DATE OF ISSUE	PROJECT No.	DWG. No.	REV.
DEC. 6/82	1692	A 1692-01.2	

APPROVED



COAL SEAM FROM 160.3 - 162.1 m.
PIEZOMETER IS JUST ABOVE
COAL SEAM.

GROUND ELEVATION	890.30 m.
BEDROCK ELEVATION	885.73 m.
BASE OF UPPER SEAL	732.40 m.
LENGTH OF TIP	1.50 m.
TOP OF LOWER SEAL	730.90 m.

SCALE N.T.S.

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

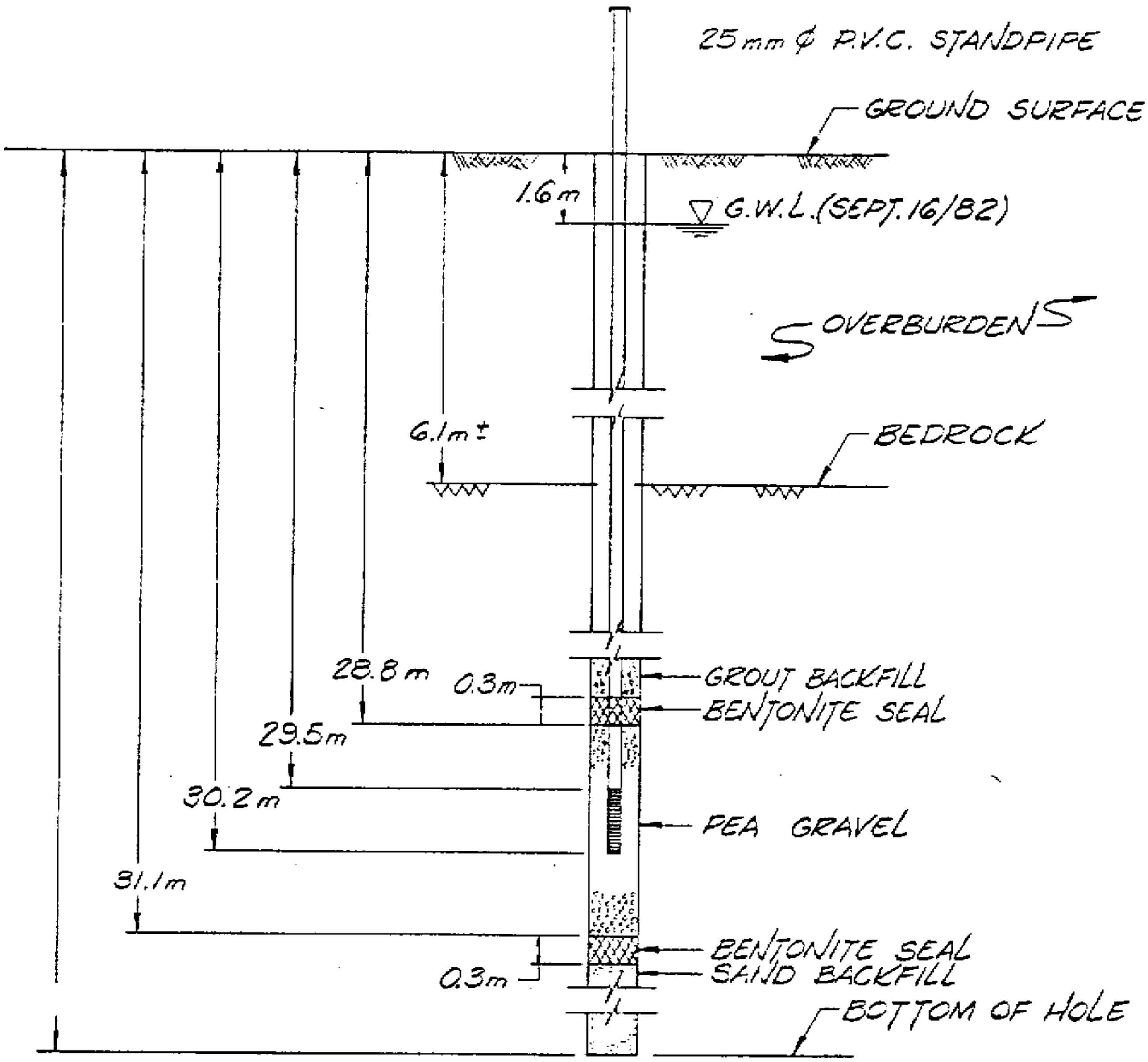
PROJECT: TELKWA COAL PROJECT

TITLE: DETAILS OF PIEZOMETER INSTALLATION - DRILLHOLE 256

CLIENT: CROWS NEST RESOURCES

DATE OF ISSUE	PROJECT No.	DWG. No.	REV.
DEC. 6/82	1692	A 1692-01.3	

APPROVED



PIEZOMETER INSTALLED IN COAL SEAM

GROUND ELEVATION	728.60 m.
BEDROCK ELEVATION	722.50 m.
BASE OF UPPER SEAL	699.80 m.
LENGTH OF TIP	2.30 m.
TOP OF LOWER SEAL	697.50 m.

SCALE N.T.S.

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

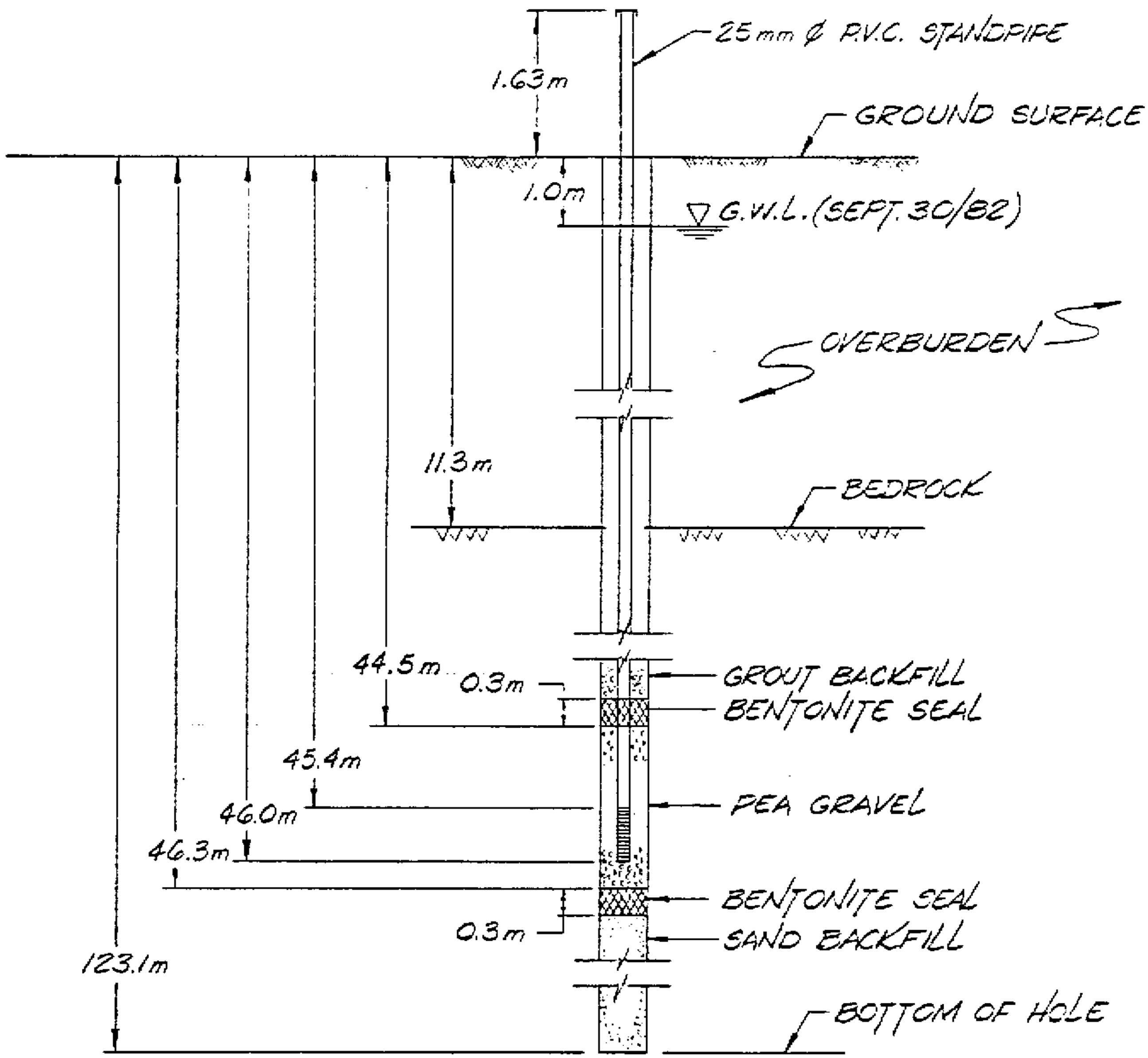
PROJECT: TELKWA COAL PROJECT

TITLE: DETAILS OF PIEZOMETER INSTALLATION - DRILLHOLE 257

CLIENT: CROWS NEST RESOURCES

DATE OF ISSUE	PROJECT No.	DWG. No.	REV.
DEC. 6/82	1692	A 1692-01.4	

APPROVED



GROUND ELEVATION	744.10 m.
BEDROCK ELEVATION	732.80 m.
BASE OF UPPER SEAL	699.60 m.
LENGTH OF TIP	1.80 m.
TOP OF LOWER SEAL	697.80 m.

PIEZOMETER INSTALLED IN COAL SEAM

SCALE N.T.S.

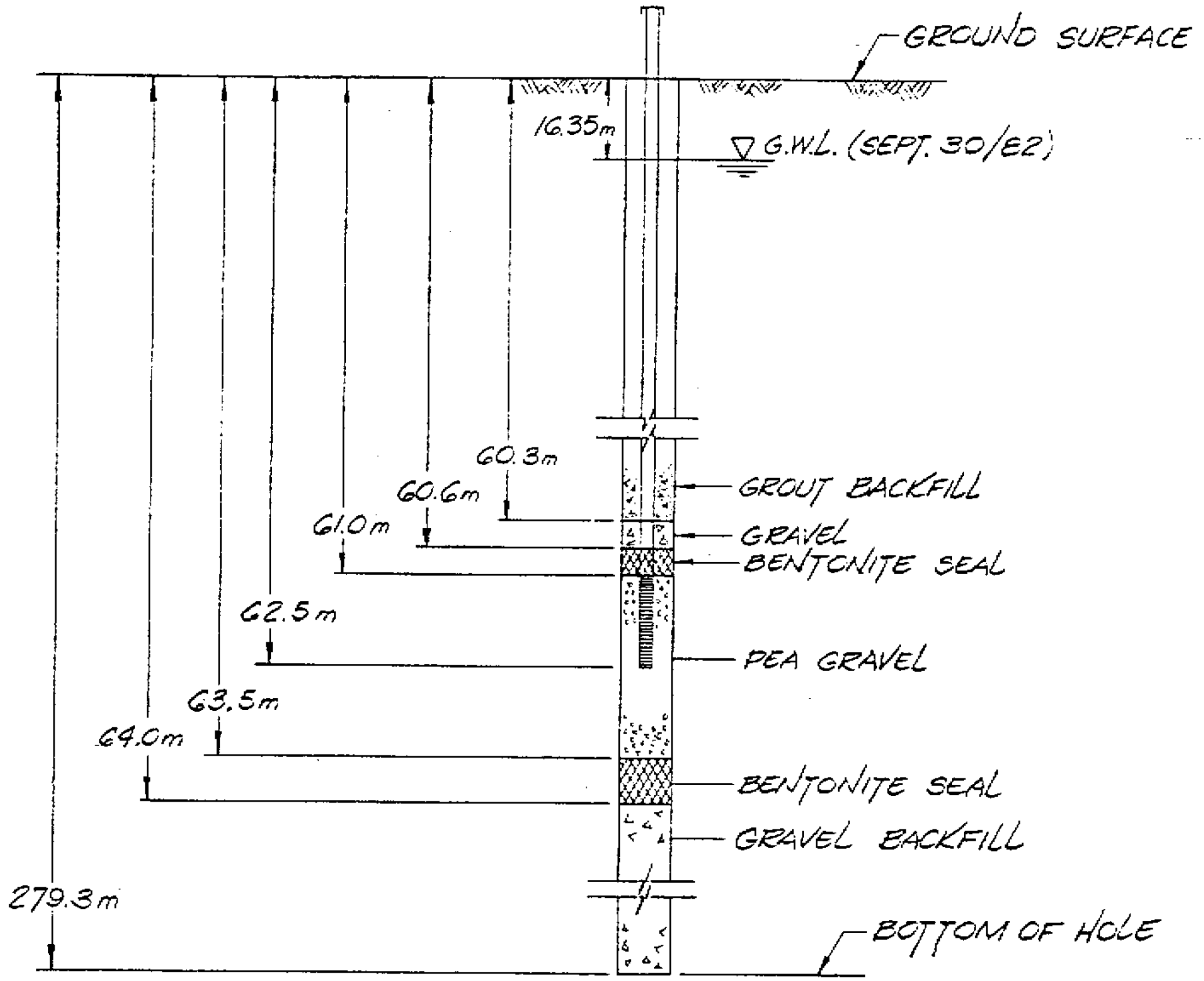
KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

PROJECT: TELKWA COAL PROJECT

TITLE: DETAILS OF PIEZOMETER INSTALLATION - DRILLHOLE 255

CLIENT: CROWS NEST RESOURCES

DATE OF ISSUE	PROJECT No.	DWG. No.	REV.
DEC. 6/82	1692	A1692-01.5	
APPROVED			



PIEZOMETER INSTALLED
IN COAL SEAM

GROUND ELEVATION	737.30 m.
BEDROCK ELEVATION	UNKNOWN
BASE OF UPPER SEAL	676.30 m.
LENGTH OF TIP	2.50 m.
TOP OF LOWER SEAL	673.80 m.

SCALE N.T.S.

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

PROJECT: TELKWA COAL PROJECT

TITLE: DETAILS OF PIEZOMETER INSTALLATION - DRILLHOLE 265

CLIENT: CROWS NEST RESOURCES

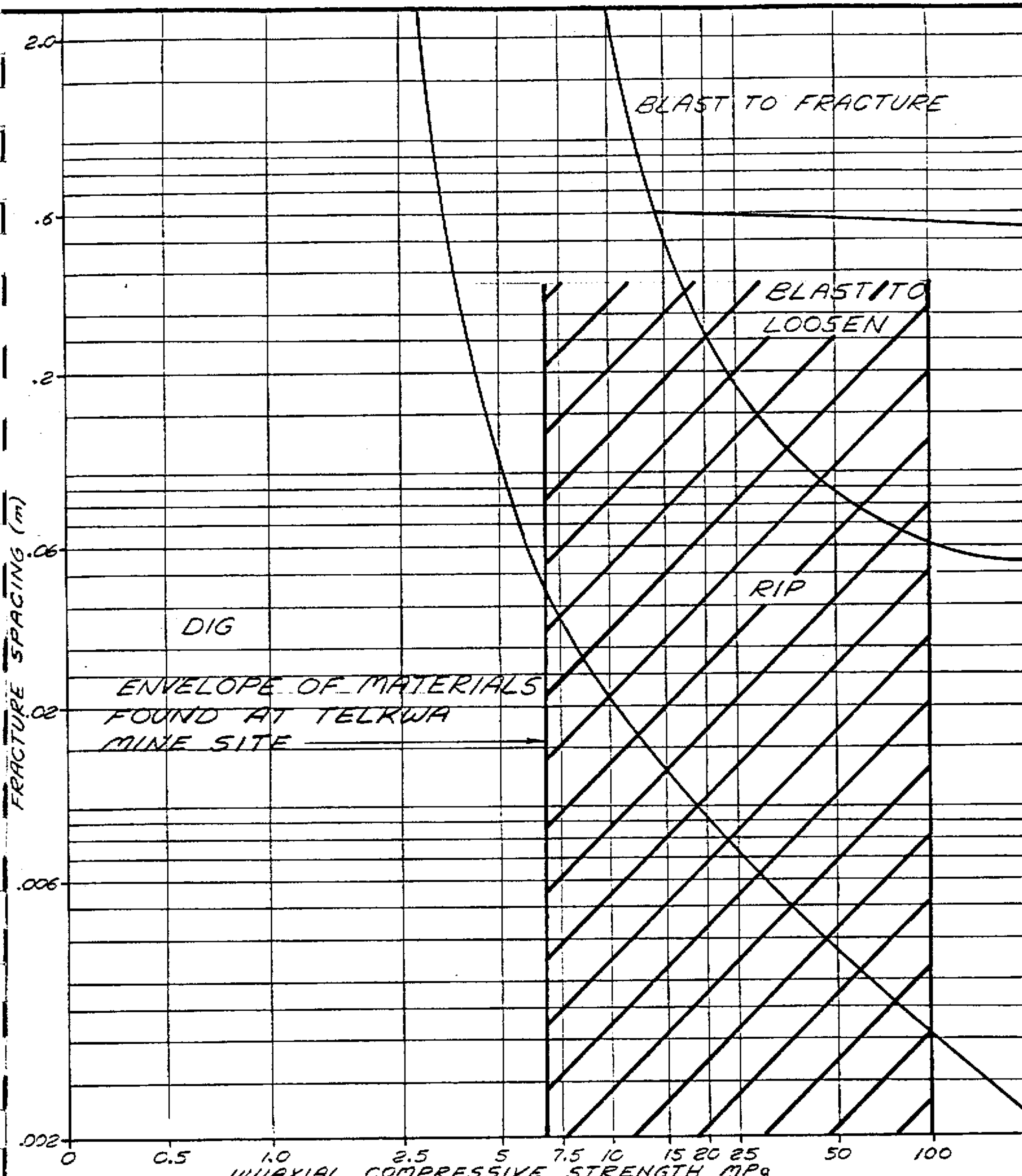
DATE OF ISSUE: DEC. 6/82

APPROVED:

PROJECT No.: 1692

DWG. No.: A 1692-01.6

REV.:



KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

PROJECT	TELKWA COAL MINE
TITLE	MATERIAL WORKABILITY

CLIENT:	DATE OF ISSUE	PROJECT No.	DWG. No.	REV.
CROWS NEST RESOURCES LTD.	DEC. 6/ 82	1692	A 1692-01.7	
	APPROVED			

GEOPHYSICAL SURVEYS
TELKWA COAL PROJECT
TELKWA, B.C.

Prepared For

CROWS NEST RESOURCES LTD.

CALGARY, ALBERTA

Prepared By

GEO-PHYSI-CON CO. LTD.
CALGARY, ALBERTA

November 1982
82-39

TABLE OF CONTENTS

1.0 INTRODUCTION

This report presents the results of geophysical surveys carried out for Crows Nest Resources by Geo-Physi-Con Co. Ltd. during the period of August 3 to 20, 1982. The location of the surveys at the Crows Nest Resources Coal Property just outside of Telkwa, B.C., are shown in Figure 1.

The area was characterized by coal bearing sedimentary rocks lying over volcanic basement and under a highly variable thickness of overburden. The survey objectives were then:

1) to map the thickness of overburden (depth to sedimentary rocks) using refraction seismic methods. Drill holes in the area reported changes in depths to bedrock from 10 to 60 metres.

2) to map the top of the volcanic basement to determine the approximate thickness of the overlying sedimentary coal bearing sequences using transient electromagnetic soundings.

3) to map the course of intrusive dykes seen to be outcropping at the site and to map the areal extent of burned coal seams using magnetic methods.

A test survey was performed in areas having drill hole control to assess the ability of each of the geophysical techniques to meet the specific objectives. Once it was determined that the objectives could be met, a full survey was undertaken.

2.0 LOGISTICS

A four-man crew performed the refraction seismic and magnetic surveys. The crew included a project geophysicist, a senior technician and two junior technicians from Geo-Physi-Con. For the transient electromagnetic survey a five man crew was required. A Crows Nest Resources employee assisted in the line slashing for transmitter loops.

The crew lodged at commercial facilities in Smithers, B.C. and commuted daily to the survey site. Two trucks were rented from Budget Rentals in Smithers. Explosives and storage magazines were obtained through Bema Industries, also located in Smithers. The survey line and site locations are shown in Figures 2 to 4.

3.0 REFRACTION SEISMIC SURVEY

3.1 Data Acquisition

A total of 5.7 km was surveyed using refraction seismic methods. Of this total, approximately 1 km was surveyed on the east side of Goathorn Creek, while the remainder of the survey was carried out on the west side. The survey line locations are shown in Figure 2.

A 2.5 km test survey was carried out along lines West 5 and East 7. After preliminary field interpretation of the test program data, it was decided by Dave Handy and Steve Cameron of Crows Nest Resources to proceed with a routine refraction seismic program. The routine program consisted of just over 4 km of survey line. All of these lines were located on the west side of Goathorn Creek (Figure 2).

Compression type seismic energy was generated with explosives placed in shallow (0.5 metre) holes. The seismic data was recorded with a GeoMetrics ES1210-F 12 channel signal enhancement seismograph. The manufacturer's specifications for this instrument are included in Appendix A.

A seismic spread of 12 geophones was used with 20 metre spacing between the geophones. For each spread of 12 geophones, arrivals were recorded from shot locations 20 and 220 metres from the end of the cable, as well as from one to three interior shots. The purpose of the end shots was to obtain arrivals refracted from bedrock at most geophones. The purpose of the interior shots was to provide control in the variation in overburden velocity. A typical shooting arrangement for two adjacent spreads is illustrated in Figure 5.

3.2 Method of Interpretation

In seismic refraction surveys the data obtained consists of travel time of compressional waves, from source (explosive charges) to detectors (surface geophones). The paths of the seismic waves are illustrated in Figure 6.

The data was processed using the plus-minus (delay-time) method of analysis. The method is briefly illustrated in Figure 7 for the two-layer case. First, arrival times corrected for any large elevation differences along the spread are plotted as a function of distance (7d). The differences in arrival times for each geophone from shots offset from the ends of each spread (in-line and end shots for each partial spread) are then plotted versus distance (7b). On this plot geophones recording arrivals refracted from the bedrock fall on a straight line with a slope of $2/V_2$, where V_2 is the compressional seismic velocity of the bedrock. For each geophone that recorded arrivals refracted from the bedrock, the delay time (defined and plotted in Figure 7d) is computed. The depth to bedrock is related to the delay-time by the function shown in Figure 7c.

Critical to the accurate determination of depth to refractors are the delay-time, the values of overburden velocity, V_1, and the travel time from the shot to the furthest geophone, T-total. These parameters are derived from the time distance plot (7a).

An interactive computer program developed by J.H. Scott, U.S. Bureau of Mines, et.al. (1972), to a large extent, handles the delay time analysis. The computer analysis has the advantage in that the layer thicknesses and velocities given by the delay-time method are checked and improved using ray tracing procedures. Also, data from two or more laterally continuous spreads may be analyzed simultaneously allowing greater continuity in the interpretation.

Surface elevations were determined from a 1:5000 topography map supplied by Crows Nest Resources.

For the purpose of this survey, there was a practical limit to the depth of exploration. Where bedrock existed well below this limit (beyond about 70 metres), the shooting arrangement did not always produce sufficiently overlapped data for analysis by the delay-time method. In these areas (e.g. West 4 , Spread 1, Figure 12) a minimum depth calculation was performed. In this procedure the arrivals from the long offset shots at the last geophones are assigned to the bedrock layer. This assumes that the last geophone is actually the first refraction observed from the bedrock surface. With the aid of the ray trace portions of the computer program, a minimum depth to the bedrock surface can be determined.

3.3 Results

The refraction seismic program was planned to determine the depth to the coal bearing sedimentary sequences. A total of 6 lines were surveyed with 5 lines, numbered West 1 to 5, being surveyed on the west side of Goathorn Creek and one line on the east side (numbered East 7). With the exception of West 1, spread 5 and spreads 1 to 3, East 7, all of the lines were analyzed using a three-layer model. On the remaining lines a two-layer model was used.

The three-layer model consisted of two soil horizons and a bedrock surface. The upper soil layer velocity ranged from 700 to 950 m/sec and represents unconsolidated unsaturated materials. The second soil layer velocity ranged from 2090 to 2250 m/sec and represents materials which are more dense than the first layer and which may or may not be saturated. The bedrock velocity ranged between 3000 and 3500 m/sec. This velocity is representative of sedimentary type rocks.

For the two-layer model the first layer velocity varied between 500 and 900 m/sec and is representative of unconsolidated materials. The second layer velocity was between 2770 and 3000 m/sec. This velocity is representative of sedimentary type rocks.

It was found that the bedrock became very deep along portions of some of the lines. In these areas, a minimum depth to bedrock was calculated using the ray tracing procedures in the computer program. It should be noted that this is the minimum depth only at which rock could occur. It is likely that the true depth will be even greater.

Generally, it is seen that rock is a lot shallower (3m-20m) on the east side of the property than on the west. The bedrock on the west is undulating beneath overburden varying from 10m to over 100m in thickness. A contour map of overburden thickness was prepared for lines surveyed on the west side of Goathorn Creek (Figure 8). From the contour map it is readily seen that at the west end of the survey lines rock occurs at depths of 50m to 100m. In the centre portion of the survey lines sedimentary rock lies at depths of 20m to 30m. A more detailed description of all lines surveyed follows.

West 1

The depth to bedrock profile for line West 1 is shown in Figure 9. Four seismic spreads were run along the line and an additional spread about 150m to the north by DH240. Preliminary interpretation indicated rock occurred at greater depths along the main line than reported in DH240. To check the accuracy of the seismic survey, an additional seismic spread was run by the drill hole. The seismic results, as shown in Figure 9, match quite closely the drilling results. It is expected that there is significant change in bedrock depth in this area.

From station 100 to 300 bedrock is deep with depths between 65 and 85m being calculated. From station 300 to 500 there is a general decrease in bedrock depth with rock occuring at 20m. For the remainder of the line rock occurs from 20 to 40m except between 700 and 850 where there is a bedrock high with rock occuring at about 15m.

West 2

The depth to bedrock profile calculated using the refraction seismic data is shown in Figure 10. Five seismic spreads were surveyed for a total length of 1.1 km.

There are two drill holes located along this line. The first drill hole (DH242) is located at station 820 and reported depth to bedrock as 25m. The second drill hole (DH239) is located at station 1040 and reported depth to bedrock as 12.8m.

From station 0 to 450, the minimum depth to bedrock has been calculated. Depth to bedrock in this area varies from 115m to 80m. At about station 450 the bedrock depth decreases with the depth to bedrock varying from 50m to 10m along the remainder of the line.

West 3

The depth to bedrock profile calculated from the refraction seismic data is shown in Figure 11. Five seismic spreads were surveyed for a total length of 1.1 km.

There are two drill holes located along this line. The first drill hole (DH236) is located at station 880 and reported depth to bedrock as 15.3m. The second drill hole (DH237) is located at station 1040, about 20m north of the actual survey line. This hole encountered bedrock at 28m depth.

From station 0 to 500 the minimum depth to bedrock has been calculated. Bedrock in this area varies from 60 to 100 metres. From station 500 to 600 there is a general decrease in bedrock depth from 60 to 20 metres depth. For the remainder of the line rock occurs quite close to the surface with depths between 10 and 40 metres being calculated.

West 4

The depth to bedrock profile calculated from the refraction seismic data is shown in Figure 12. Four seismic spreads were surveyed for a total length of about 900m.

There are three drill holes located along this line. The first drill hole (DH260) is located at 320, about 20m north of the actual survey line, and reported depth to bedrock as 49m. This drill hole had been drilled after the seismic field program. The second drill hole (DH234) is located at 570, reported depth to bedrock as 22m. The third drill hole (DH210) located at 900, reported depth to bedrock as 31m.

From station 0 to 180 it was impossible to calculate a reasonable bedrock depth so that one is not given in this area. From station 180 to 400, the bedrock is deep with rock varying in depth from 40m to 70m. From station 400 to 500 there is a general decrease in bedrock depth with rock occurring between 20m and 30m. There is a deepening of rock between station 650 and 820, where depth to rock varies between 50m and 60m. The rock then becomes shallower with a depth of 25m being calculated at station 900.

West 5

The depth to bedrock profile calculated from the refraction seismic data is shown in Figure 13. Three seismic spreads were surveyed for a total length of about 700m.

There are two drill holes near this line. The first drill hole (DH231) is located at 310, about 20m north of the survey line, and reported depth to bedrock as 51.8m. The second drill hole (DH226) is located at 560, 10m south of the survey line, and reported depth to bedrock as 46.9m.

The refraction seismic survey shows that from station 0 to 220 a minimum depth to bedrock has been calculated. The minimum depth to bedrock in this area varies from 60m to over 100m. From station 220 to 420 the bedrock surface is uniform with the depth to bedrock varying from 50m to 60m. At about station 420 there is an abrupt decrease in bedrock depth with depths of about 30m being calculated. From station 500 to the end of the line, there is a deepening trend with depths to bedrock in excess of 80m being calculated.

East 7

The depth to bedrock profile from the refraction seismic data is shown in Figure 14. Due to the nature of road access, this line is broken into 2 segments. The first segment is 700m long and includes three seismic spreads. Along this portion of line there are three drill holes. The first (DH229) located at 0, about 20m south of the line, has a depth to bedrock of 6.3m. The second drill hole (DH227) is located at 500 and reported depth to bedrock as 11.1m. The third drill hole (DH225) located at 640, reported depth to bedrock as 7.3m. The depth to bedrock along this portion of line has been calculated using a two-layer model. The results indicate that depths to rock of between 3m and 8m occur from station 0 to 450. From station 450 to 700, a three-layer model has been used with rock occurring between 8m and 20m.

The second segment along line East 7 is located close to DH208. The depths calculated along this line are between 10m and 15m. These results do not match the drill hole which indicated depth to bedrock is 43m.

4.0 TRANSIENT ELECTROMAGNETIC SOUNDINGS

4.1 Data Acquisition

A total of 7 transient electromagnetic soundings were taken using the Geonics EM37. The manufacturer's specifications for the instrument are included in Appendix A. The purpose of the survey was to map the interface between coal bearing sedimentary rocks and the volcanic basement.

A test program was carried out over drill holes with known depth to the volcanic basement (drill holes 202, 225, 209 and 236, Figure 2). After preliminary field interpretation of the test results, it was decided by Dave Handy of Crows Nest Resources to proceed with a small scale program. The program consisted of 3 additional soundings to be taken on new coal claims to the north-east where there is very limited drilling.

A square non-grounded transmitter loop, was used with either 200m or 400m sides. The loop size used for each sounding is shown in Table 1. A multi-turn coil located in the centre of the loop was used as a sensor. A typical transmitter loop and receiver loop configuration is illustrated in Figure 15.

All of the sites had road access. However, a walking trail was slashed to accommodate the placement of the transmitter loop.

4.2 Method of Interpretation

The general principles of transient electromagnetic soundings is discussed in the Company's technical note found in Appendix B.

The method of data interpretation was to calculate apparent resistivities from the measurements of the time derivative of the vertical magnetic field taken at the center of the transmitter loop. The apparent resistivity values were then plotted versus the square root of time on bi-logarithmic graph paper. The apparent resistivity curves were subsequently matched to theoretical model curves to derive the resistivity stratification of the subsurface.

Figure 16 shows an example of field data taken at Loop 2, DH225, and its match to a theoretical curve. The right ascending branch of both of the curves indicate that highly resistive basement rock (volcanics) are present beneath the overlying sediments.

4.3 Results

A test program using the transient electromagnetic (TEM) system was carried out at four drill hole locations. In addition three other locations were tested where no drill hole information was available.

The geological logs indicate the presence of an altered volcanic layer of unknown thickness between sediments and volcanic basement. Resistivity logs reveal no resistivity contrast between sediments and underlying altered volcanics. Since there is no resistivity contrast between these layers, sedimentary rocks and altered volcanics are treated as one layer. A contrast of at least one order of magnitude is expected between the altered and fresh volcanics. The data has been modelled using this assumption. The depths determined by TEM soundings are then the depths to the fresh volcanic (resistive basement).

The accuracy of determining the depth to the resistive layer (fresh volcanics) is believed to be better than 15%. The difference between results of TEM soundings and depth to the bottom of sediments obtained from drill hole data is due to the presence of the altered volcanics zone.

The results of interpretation of TEM soundings are summarized in Table 1. A detailed description of curves obtained is given below. The transmitter loop locations are shown in Figures 2 to 4.

Loop #1

This sounding was taken at DH202 with a transmitter loop size of 400m x 400m. The curve obtained shows the presence of a conductor over resistive basement. The total depth to the resistive basement was calculated to be 280m.

Loop #2

This sounding was taken at DH225 with a transmitter loop size of 400m x 400m. The curve obtained shows the presence of a conductor over resistive basement. The total depth to the resistive basement was determined to be 320m.

TABLE 1

Comparison of Results of Interpretation TEM Soundings with Drilling Data

Loop #	Loop Size	Drill Hole	Depth to the Resistive Basement by TEM Soundings	Depth to the Altered Volcanics by Drilling Data	Depth Drilled within Altered Volcanics
1	400m^2	202	280	277	20
2	400m^2	225	320	280	5
3	200m^2	209	200	122	22
4	300m^2	236	220	180	-
5	400m^2	-	600	-	-
6	400m^2	-	300	-	-
7	400m^2	-	220	-	-

Loop #3

This soundings was taken at DH209 with a transmitter loop size of 200m x 200m. The curve shows a layered electrical structure with alternating occurrence of resistive and conductive strata. The total depth to the resistive basement is estimated to be about 190m.

Loop #4

This sounding was taken at DH236 with a transmitter loop size of 300m x 300m. The curve shows the presence of a conductor over resistive bedrock. The total depth to the resistive basement was determined to be 220m.

Loop #5

This sounding was taken with a transmitter loop size of 400m x 400m (Figure 3). The curve shows a relatively homogeneous resistivity throughout the section. The total depth to the resistive basement was estimated to be about 600m.

Loop #6

This sounding was taken with a transmitter loop size of 400m x 400m (Figure 3). The curve shows the presence of a conductive layer over resistive basement. The total depth to the resistive basement was determined to be about 300m.

Loop #7

This sounding was taken with a transmitter loop size of 400m x 400m (Figure 3). The curve shows an existence of an intermediate conductive layer of resistivity of about 10 ohm-m, the lowest resistivity encountered at the Telkwa area. The total depth to volcanic basement is about 220m.

5.0 MAGNETIC SURVEY

5.1 Data Acquisition

A total of just over 4.0km was surveyed using magnetic methods on three grids in the Telkwa project area, Figure 2.

Lines were slashed and chained by Geo-Physi-Con personnel using machetes and hip chains. The total magnetic field was measured using the Geometrics G-816 portable proton magnetometer. The manufacturer's specifications are included in Appendix A.

Grid A was located on the west side of Goathorn Creek just above the Bulkley Valley Collieries buildings (Figure 2). The purpose of measurements over this grid was to follow a dyke which outcrops on the valley wall. A 300m baseline was set up running approximately east to west. From this north to south crosslines were set up 300m south and 200m north of the baseline. Readings were taken at 10m intervals and reduced to 5m where an anomalous zone was encountered.

Grid B was also located on the west side of Goathorn Creek (Figure 2). The purpose of measurements over this grid was to determine if any magnetic anomaly could be detected along a burnt coal seam (clinker) which outcrops along the valley wall. This grid consisted of four north to south running lines, approximately 150m to 200m in length.

Grid C was located by DH112. Intrusive dyke material was encountered in the core of this drill hole and measurements were made over the grid to determine if magnetics could be used to delineate the intrusive rocks. The grid consisted of 2 north to south lines (50m apart and approximately 200m long) and a 100m long east to west baseline (Figure 2).

5.2 Method of Interpretation

The earth's magnetic field resembles the field of a large bar magnet located in the centre of the earth. The flux lines of the earth's magnetic field are shown in Figure 17. Important characteristics of the earth's field are that they are near horizontal at the equator and near vertical at the poles. Also, the intensity of the field is approximately twice as large at the poles as at the equator.

Superimposed on the spatial variation of the earth's magnetic field are variations in time. Significant time variations with periods of seconds, minutes and hours are mainly due to solar winds or diurnal variations.

Base stations were set upon each grid. All measurements were tied back into the base station data to correct for diurnal variations. The simplest way to apply the correction is to make each intersection agree by linearly distributing the error as a function of time on each traverse line and holding the base station values fixed. Once all the data has been corrected they are plotted in plan view and contoured. From these contour maps magnetic anomalies can be outlined.

5.3 Results

The total magnetic field has been measured on three small grids labelled A-C in the Telkwa coal project area. The preliminary results were encouraging but it was decided not to proceed with a full program at this time. For a full scale program, an alternate surveying procedure would be required. For example, lines would have to be chained and slashed by local line cutters before the program begins. This would greatly reduce survey costs. It is readily apparent from the magnetic survey results that this area has a low magnetic relief.

Grid A

Grid A is located on the west side of Goathorn Creek (Figure 2). The purpose of this grid was to follow a dyke which outcrops on the valley wall. The results had been corrected for diurnal variations and are contoured (Figure 18).

The 58060 gamma contour has arbitrarily been chosen to represent a magnetic anomaly. Using this contour value there are two anomalies occurring in the grid area. The first is a NW-SE running structure and the second a magnetic high on the north end of the survey lines by DH240.

The first anomaly is seen in all survey lines and starts at the approximate location of the outcropping dyke on the valley wall (Line 3E, 2+00S). Seismic line West 1 runs down the baseline intersecting Line 0+00E at approximately station 680. From the seismic depth calculations there is a basement high which corresponds to the magnetic anomaly. Depth to bedrock in this zone is in the order of 15 to 20 metres. There are two possible explanations for this anomaly. The first is that the anomaly is a result of intrusive materials at depth or it is the basement high which may or may not represent the dyke.

The second magnetic anomaly occurring at the north end of the survey lines is due to a basement high. Seismic refraction and drill hole information indicate that rock is close at about 20m depth. There was no intrusive material reported in DH240.

Grid B

Grid B is located on the west side of Goathorn Creek, being partially over an area of exposed clinker (Figure 2). The results have been corrected for diurnal variations and are plotted in the form of a contoured map (Figure 19).

In this area Lines 20 and 21 are over the exposed clinker while Lines 22 and 23 are on lower benches. From the contour map it is evident that the readings over the clinker are in the order of 500 to 600 gammas higher than lines run below the outcropping. It is believed that the higher magnetic readings are due to the presence of the clinker in the grid area.

Grid C

Grid C is located on the east side of Goathorn Creek near DH112 (Figure 2). The drill hole core had revealed intrusive dyke material and the grid was set up to determine if magnetics could delineate any intrusive materials.

The results have been corrected for diurnal variations and are plotted in the form of a contour map, Figure 20. It is readily seen from the contour map that there is a very little magnetic relief (20-30 gammas) and no apparent structure can be interpreted from the map. It is concluded that the magnetic survey could not positively identify the presence or absence of intrusive material at Grid C.

6.0 SUMMARY OF RESULTS

Three geophysical methods were tested in the Telkwa coal project area. Refraction seismic was used to map the depth to bedrock (depth to coal bearing sedimentary rocks). Transient electromagnetic soundings were used to map the depth to volcanic basement. Magnetics were used to delineate the occurrences intrusive materials and clinker which outcrops in the area.

It has been shown that refraction seismic works quite well in this area with calculated depths corresponding to drilling results (within 10%). It can, therefore, be assumed the accuracy of the survey to be ±10%. The results show that generally bedrock is much shallower on the east side of the property than on the west. The first 400 to 500 metres along lines surveyed on the west side of the creek show rock to be deep (50m - 100m). Closer to the valley wall, rock becomes shallower (20m - 50m).

The use of transient electromagnetic soundings has had marginal success in determining the depth to resistive volcanic basement. A major problem for the interpretation of the data is the presence of an altered volcanic zone between the sedimentary units and volcanic basement. There is no resistivity contrast between overlying sedimentary units and altered volcanics. Therefore, these layers must be treated as one strata. No resistivity logs have been recorded to the fresh volcanics to give an indication of its true resistivity. An assumption that a contrast of at least one order of magnitude between altered and fresh volcanics was made to interpret the data. The accuracy of determining the depths to the resistor (fresh volcanics) is believed to be $\pm15\%$.

In general, the results show that the depth to fresh volcanics is between 250 and 350 over most of the area surveyed (Table 1). In one sounding, Loop 5, this interface is substantially deeper with a depth of 600m being expected.

The results from the magnetic survey indicate modest success in delineating intrusive dyke material and burnt coal seams. Grid A has outlined a NW-SE running structure which, along with seismic refraction, indicates shallow bedrock which may or may not be associated with an outcropping dyke on the valley wall. Grid B shows that in areas where the burnt coal seams outcrop readings of 500 to 600 gammas higher than background are obtained. The magnetic survey could not positively identify the presence or absence of intrusive material at Grid C.

7.0 RECOMMENDATIONS

The refraction seismic survey adequately determined depth to bedrock at the site. The method can be routinely used to profile the bedrock surface. The siting of drill holes and the interpretation of the bedrock profile between drill holes can often benefit from such a survey.

The transient electromagnetic survey was performed at a number of isolated site locations. This was essentially a test program. This type of surveying could be beneficial prior to drilling in areas of little geological control. The method can also be used to produce a continuous profile to aid in the interpretation of discernible subsurface features between drill holes. This may reduce the number of drill holes required.

The magnetic survey was run over three grids. At each of these grids the objective was to delineate the extent of known structures expected to cause magnetic anomalies. The extent of the structures at two of the grids could be determined from the magnetic data. It is not expected that magnetic data could unambiguously determine the location and type of structure without other geological or geophysical information. However, reconnaissance survey can be expected to easily locate areas of interest having magnetic anomalies, since the magnetic gradient is low in the Telkwa area.

Respectfully submitted,

GEO-PHYSI-CON CO. LTD.

THE ASSOCIATION OF
PROFESSIONAL ENGINEERS,
GEOLOGISTS and GEOPHYSICISTS
OF ALBERTA
PERMIT NUMBER
P [illegible]
Geo Physi Con Co.
Ltd.

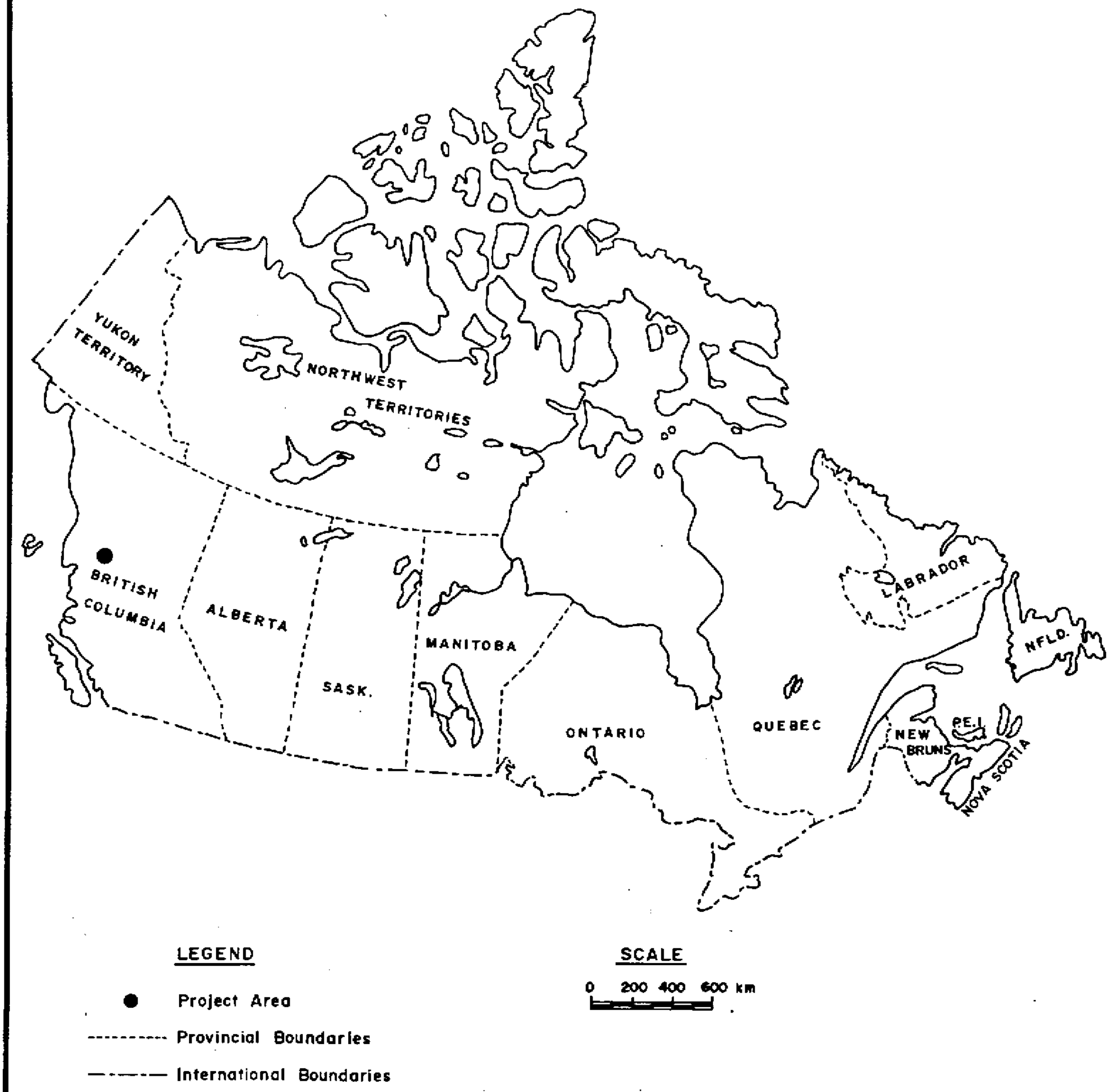
Per:

Michael Pesowski, B. Sc.

Review Per:

A. N. Sartorelli, P.Eng.
Senior Geophysicist

Calgary, Alberta
November 1982
82-39



GEO·PHYSI·CON

ENGINEERING GEOPHYSICAL CONSULTANTS

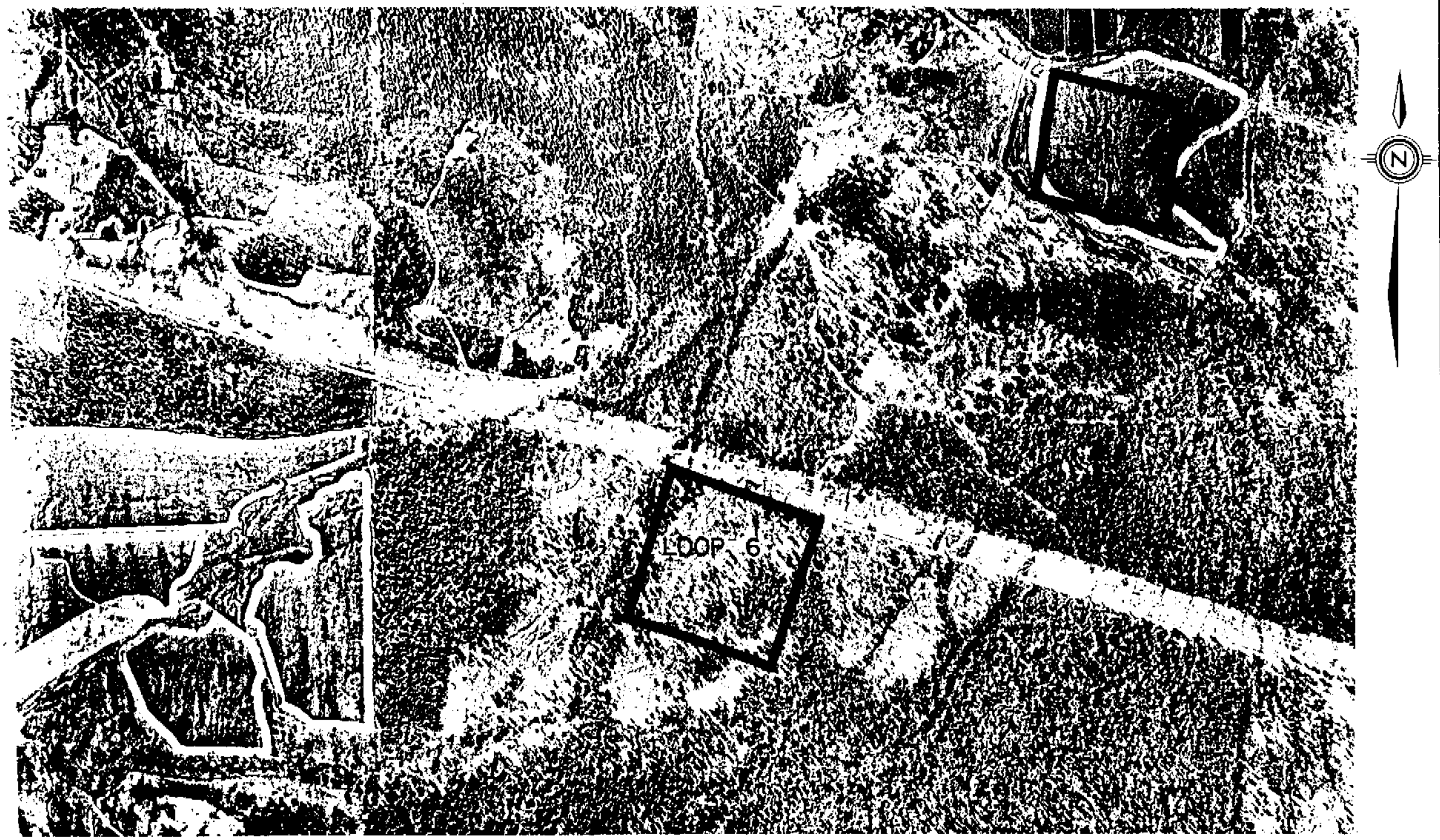
CROWS NEST RESOURCES LTD.

TELKWA COAL PROJECT

PROJECT LOCATION

82-39

Figure 1



GEO·PHYSI·CON

ENGINEERING GEOPHYSICAL CONSULTANTS

CROWS NEST RESOURCES LTD.
TELKWA COAL PROJECT

T - LOOP LOCATIONS

82-39

Figure 3

GEO·PHYSI·CON

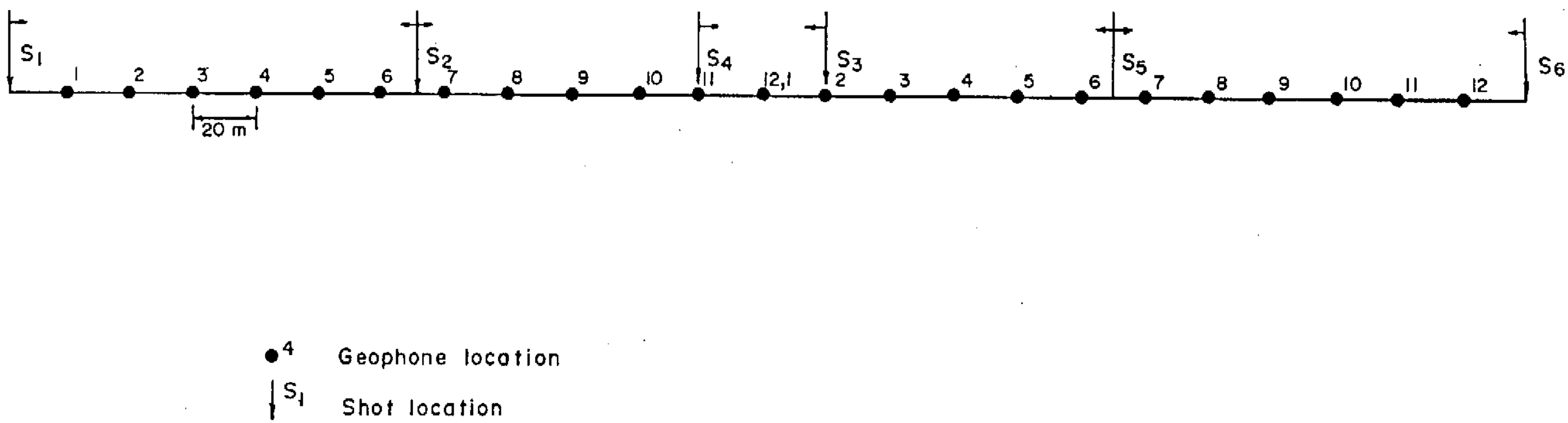
ENGINEERING GEOPHYSICAL CONSULTANTS

CROWS NEST RESOURCES LTD.
TELKWA COAL PROJECT

T- LOOP LOCATIONS

82-39

Figure 4



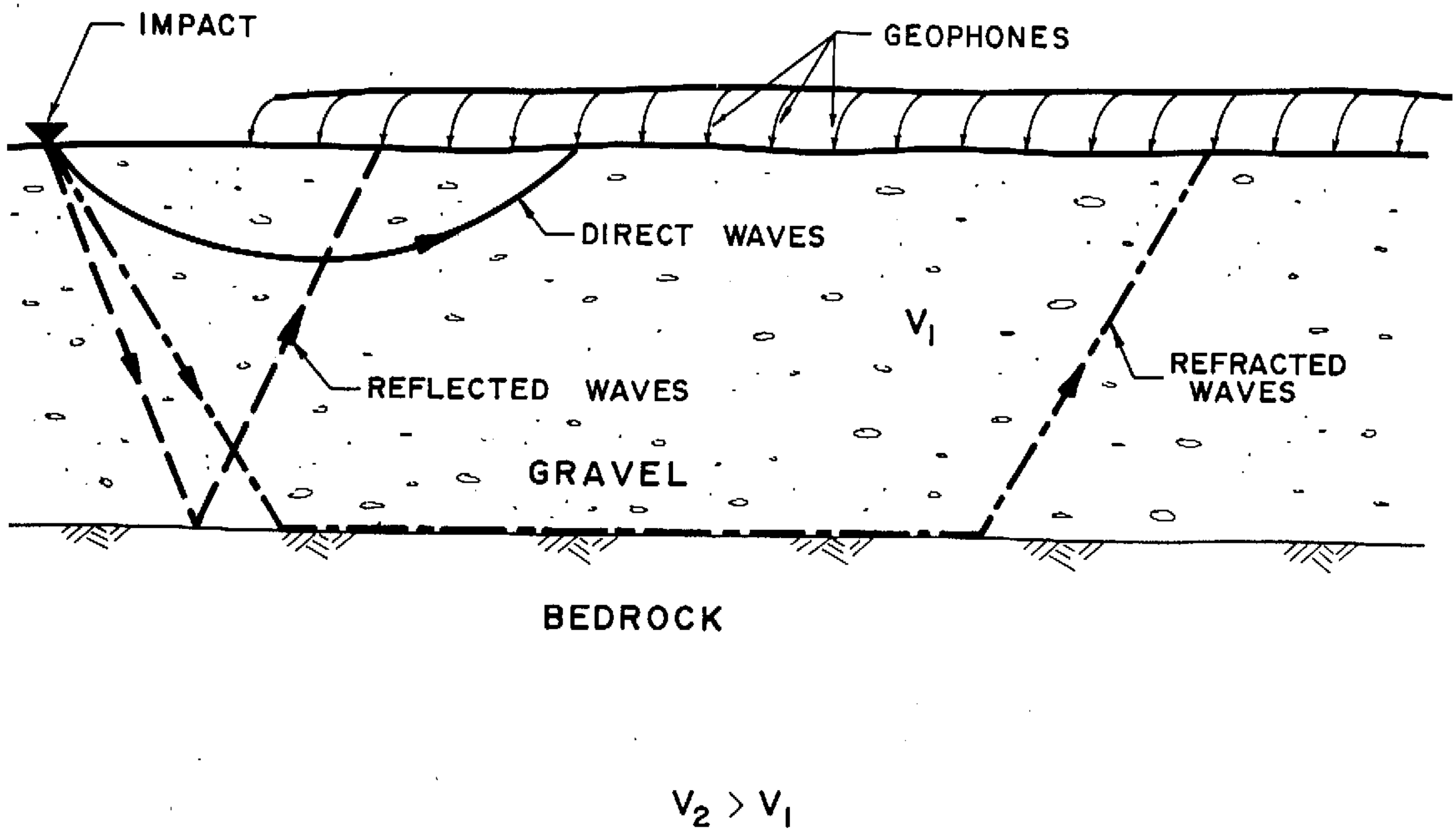
GEO-PHYSI-CON

ENGINEERING GEOPHYSICAL CONSULTANTS

GEOPHONE AND SHOT LOCATIONS

82-39

Figure 5



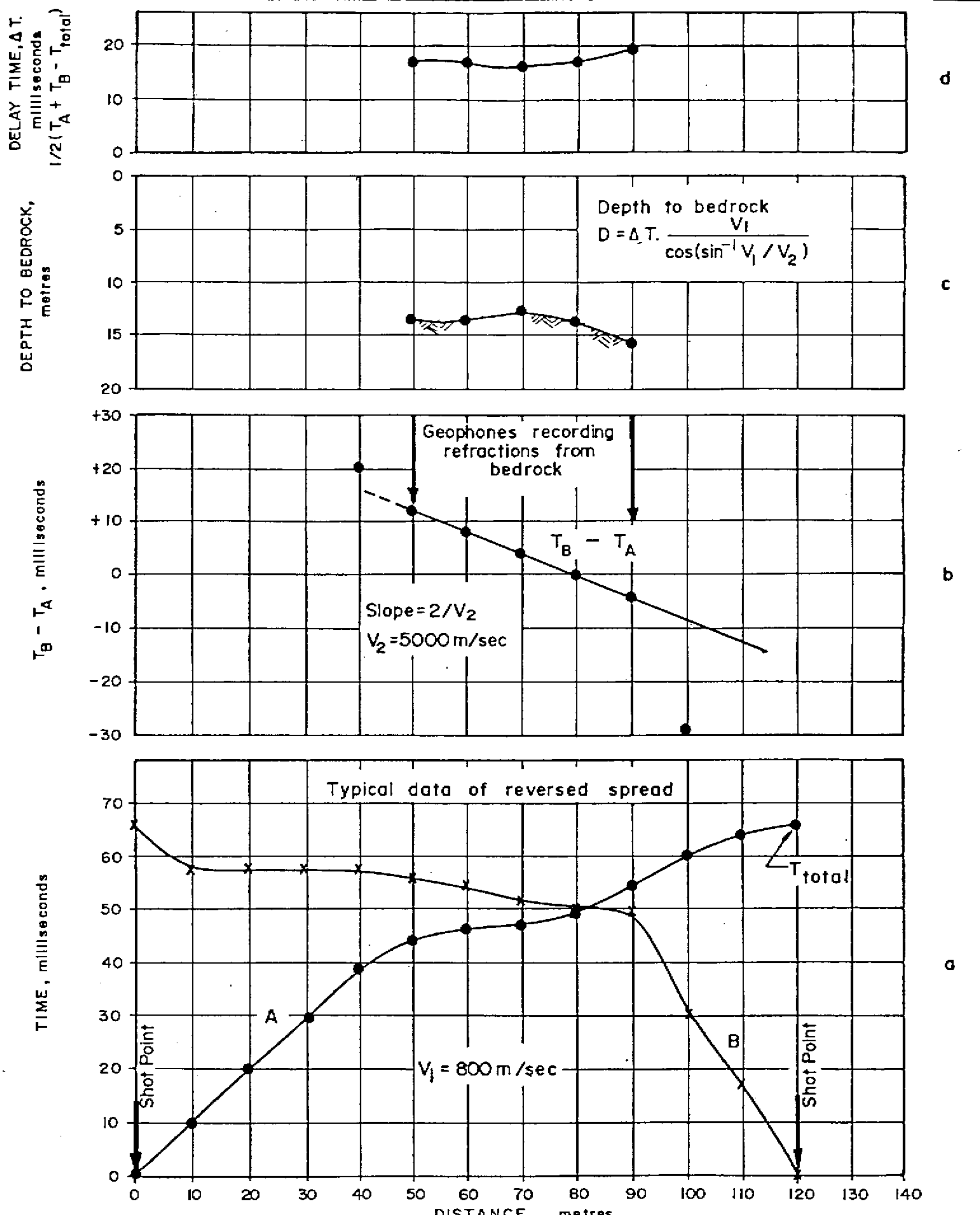
GEO-PHYSI-CON

ENGINEERING GEOPHYSICAL CONSULTANTS

PATHS OF SEISMIC WAVES

82-39

Figure 6



GEO-PHYSI-CON

ENGINEERING GEOPHYSICAL CONSULTANTS

TYPICAL
REVERSE SEISMIC REFRACTION DATA
AND ANALYSIS

82-39

Figure 7

GEOPHYSICAL SURVEYS

TELKWA COAL PROJECT

TELKWA, B.C.

Prepared For

CROWS NEST RESOURCES LTD.

CALGARY, ALBERTA

Prepared By

GEO-PHYSI-CON CO. LTD.
CALGARY, ALBERTA

November 1982
82-39

$33,000

Seismic = 67% (3.845 / 5.7 km

$22,110

$17,700

EM-37 = 71% (5/7

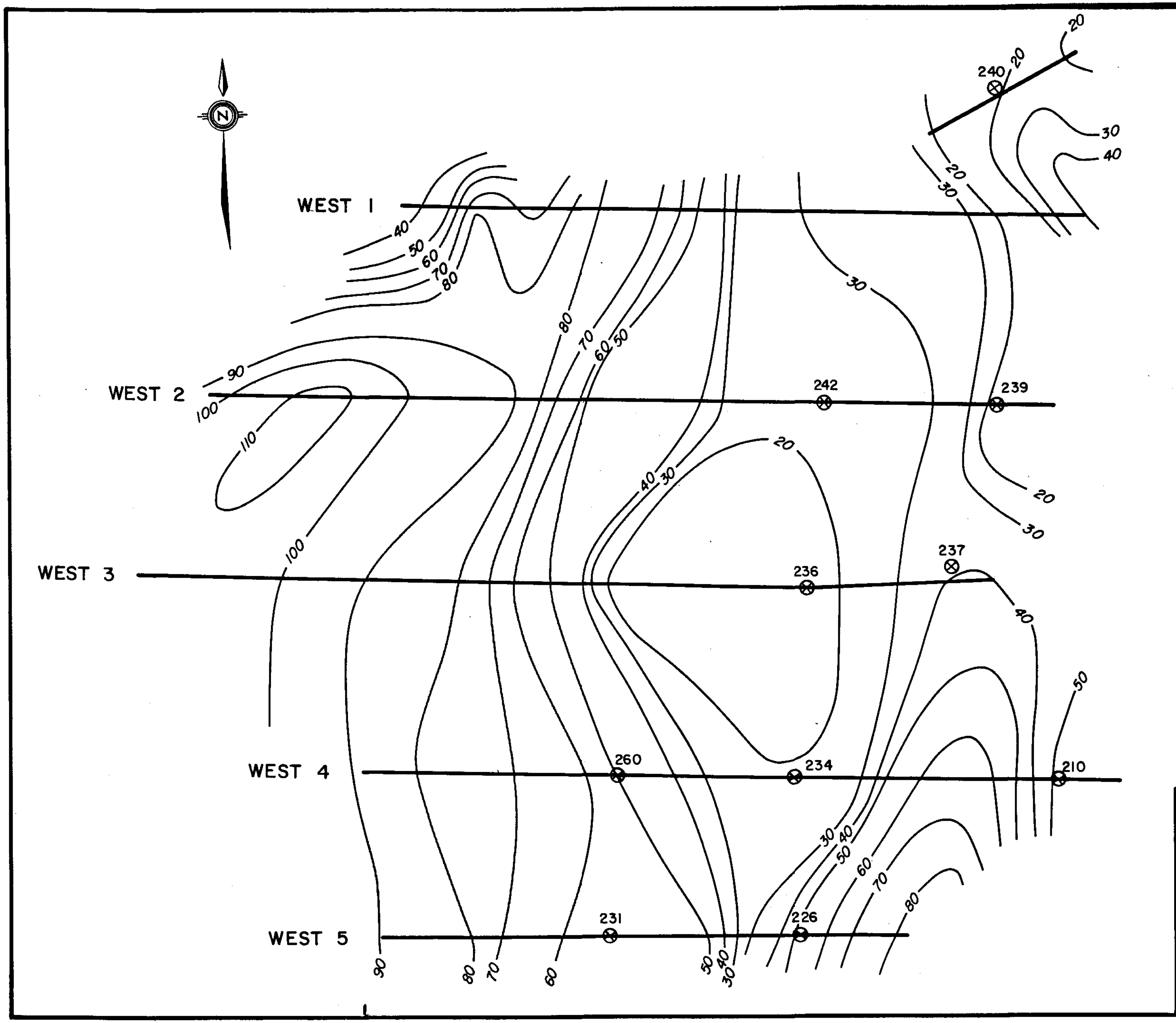
= $12,567

Mag = 10% .4 / 4 km

$6,500

$650

Total = 58,242.50



LEGEND

50 Contour Line (metres)

Survey Line

⊗ 260 Drill Hole and Number

Road

NOTE

Contour Interval : 10 metres

SCALE 1 : 5000

0 100 200 metres

00 238 1/7 a

GEO-PHYSI-CON

ENGINEERING GEOPHYSICAL CONSULTANTS

CROWS NEST RESOURCES LTD.
TELKWA COAL PROJECT
OVERBURDEN THICKNESS
CONTOUR MAP

82-39 Figure 8

LEGEND

Ground Surface
Refractor Surface (calculated, inferred)
Minimum Depth Calculation (see text)
Bedrock Surface (calculated, inferred)

890 m/s Velocity in Metres per Second

overburden
bedrock
Drill Hole

SCALE

Horizontal 1 cm = 20 m
Vertical 1 cm = 10 m

00 238 1/1 b

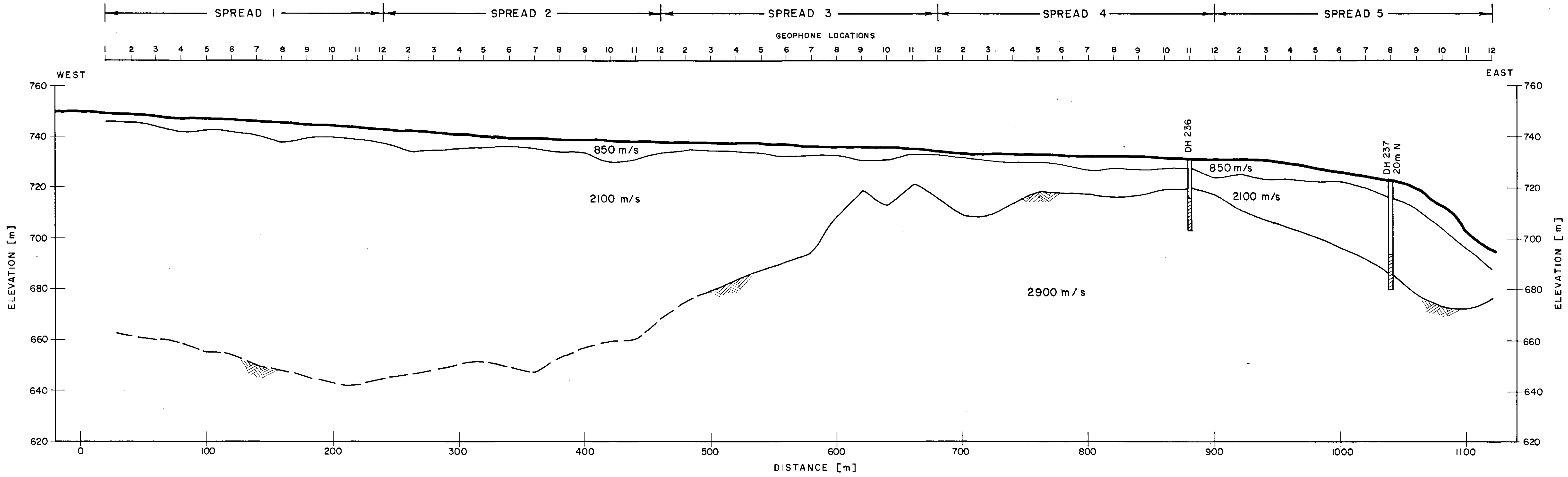
GEO-PHYSI-CON
ENGINEERING GEOPHYSICAL CONSULTANTS

CROWS NEST RESOURCES LTD.
TELKWA COAL PROJECT
BEDROCK PROFILE
LINE WEST 1

82-39

Figure 9

SPREAD 1
SPREAD 2
SPREAD 3
SPREAD 4
SPREAD 5
GEOPHONE LOCATIONS
WEST
EAST
DH 242
DH 239
750 m/s
2090 m/s
3050 m/s
ELEVATION [m]
DISTANCE [m]
LEGEND
Ground Surface
Refractor Surface (calculated, inferred)
Minimum Depth Calculation (see text)
Bedrock Surface (calculated, inferred)
750 m/s Velocity in Metres per Second
overburden
bedrock
Drill Hole
SCALE
Horizontal 1 cm = 20 m
Vertical 1 cm = 10 m
00 238 1/7 c
GEO-PHYSI-CON
ENGINEERING GEOPHYSICAL CONSULTANTS
CROWS NEST RESOURCES LTD.
TELKWA COAL PROJECT
BEDROCK PROFILE
LINE WEST 2
82-39
Figure 10



LEGEND

Ground Surface

Refractor Surface (calculated, inferred)

Minimum Depth Calculation (see text)

Bedrock Surface (calculated, inferred)

850m/s Velocity in Metres per Second

overburden / bedrock Drill Hole

SCALE

Horizontal 1 cm = 20m

Vertical 1 cm = 10m

00 238 1/7 d

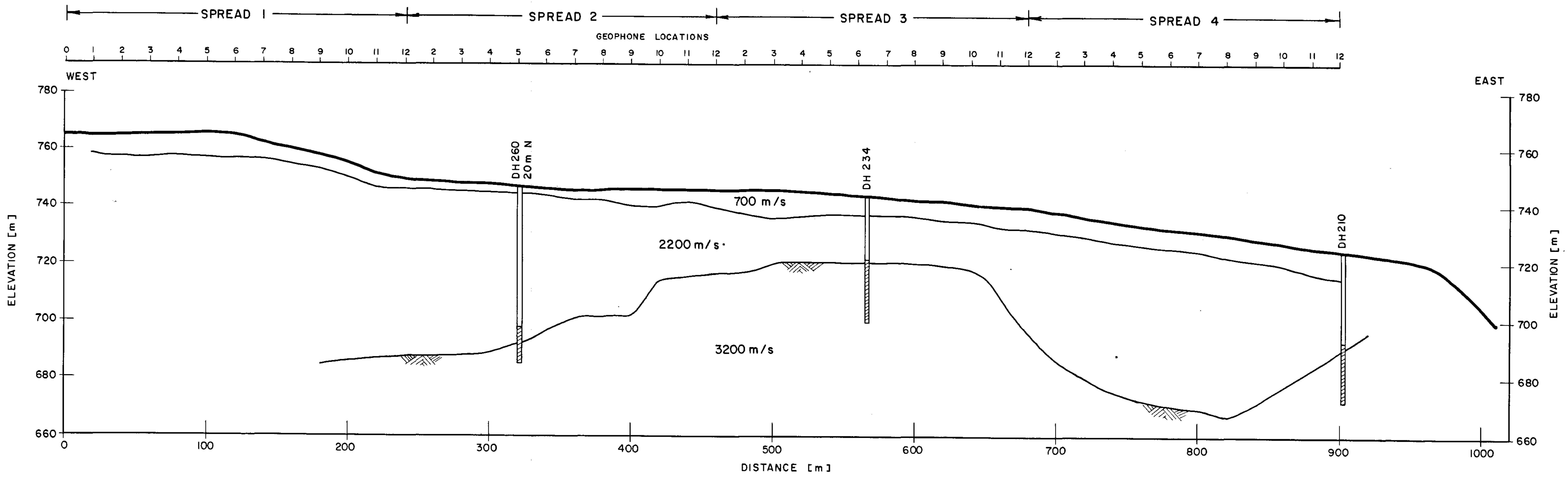
GEO·PHYSI·CON

ENGINEERING GEOPHYSICAL CONSULTANTS

CROWS NEST RESOURCES LTD.
TELKWA COAL PROJECT
BEDROCK PROFILE
LINE WEST 3

82-39

Figure 11



LEGEND

Ground Surface

Refractor Surface (calculated, inferred)

Minimum Depth Calculation (see text)

Bedrock Surface (calculated, inferred)

700 m/s Velocity in Metres per Second

overburden
bedrock
Drill Hole

SCALE

Horizontal 1 cm = 20 m

Vertical 1 cm = 10 m

00 238 1/7 e

GEO-PHYSI-CON

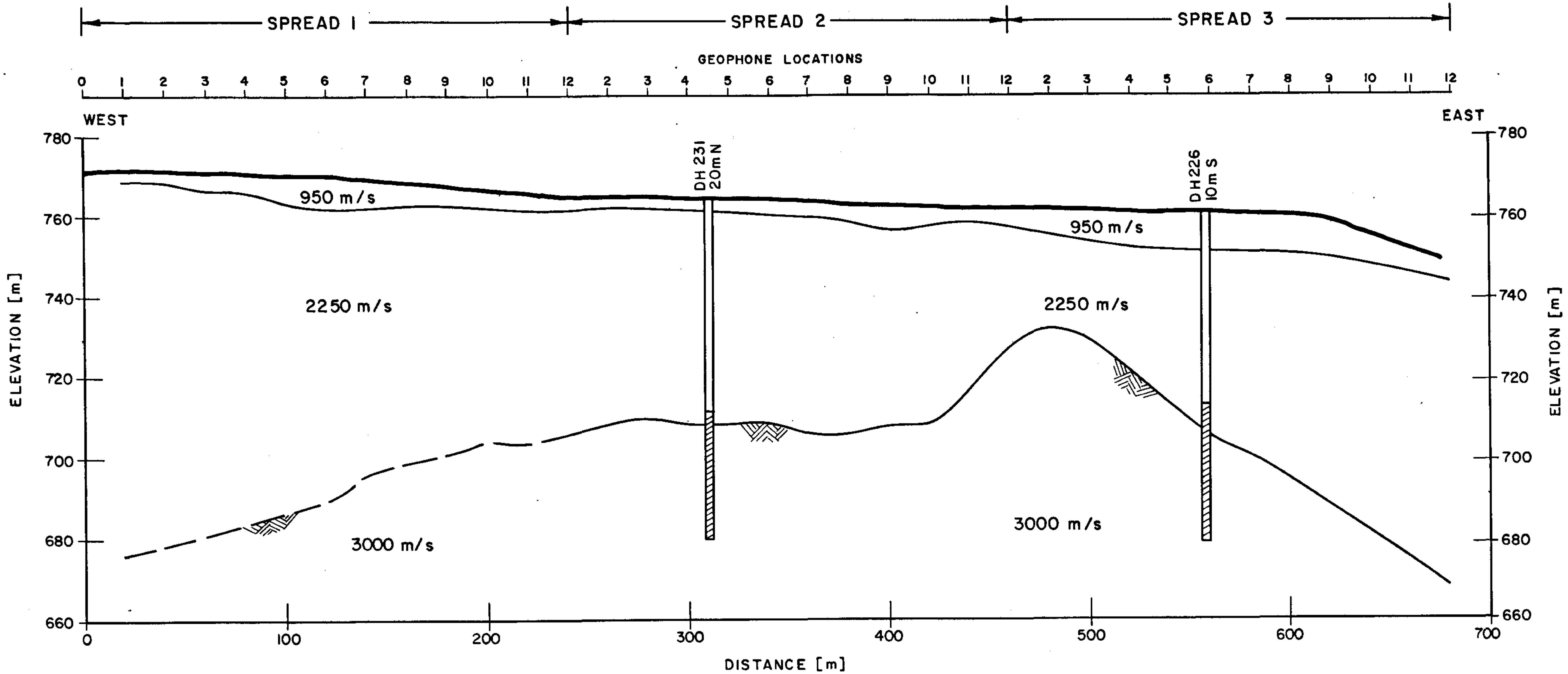
ENGINEERING GEOPHYSICAL CONSULTANTS

CROWS NEST RESOURCES LTD.
TELKWA COAL PROJECT

BEDROCK PROFILE
LINE WEST 4

82-39

Figure 12



LEGEND

- Ground Surface
- Refractor Surface (calculated, inferred)
- Minimum Depth Calculation (see text)
- Bedrock Surface (calculated, inferred)

950 m/s Velocity in Metres per Second

overburden
bedrock
Drill Hole

SCALE

Horizontal 1 cm = 20 m
Vertical 1 cm = 10 m

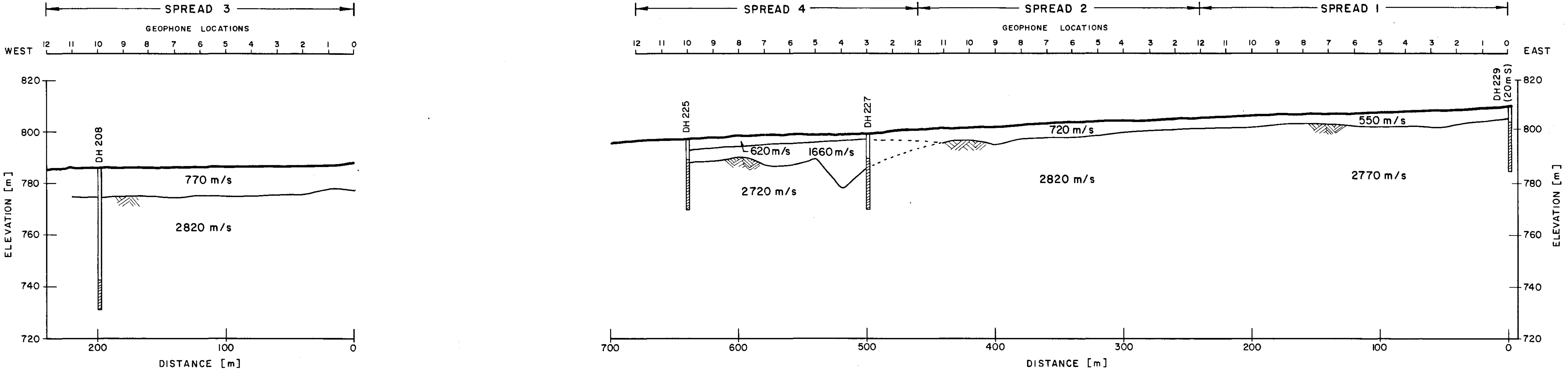
00 238 1/7 f

GEO-PHYSI-CON
ENGINEERING GEOPHYSICAL CONSULTANTS

CROWS NEST RESOURCES LTD.
TELKWA COAL PROJECT
BEDROCK PROFILE
LINE WEST 5

82-39

Figure 13



LEGEND

- Ground Surface
- Refractor Surface (calculated, inferred)
- Minimum Depth Calculation (see text)
- Bedrock Surface (calculated, inferred)

720 m/s Velocity in Metres per Second

overburden / bedrock — Drill Hole

SCALE

Horizontal 1 cm = 20 m
Vertical 1 cm = 10 m

00 238 9

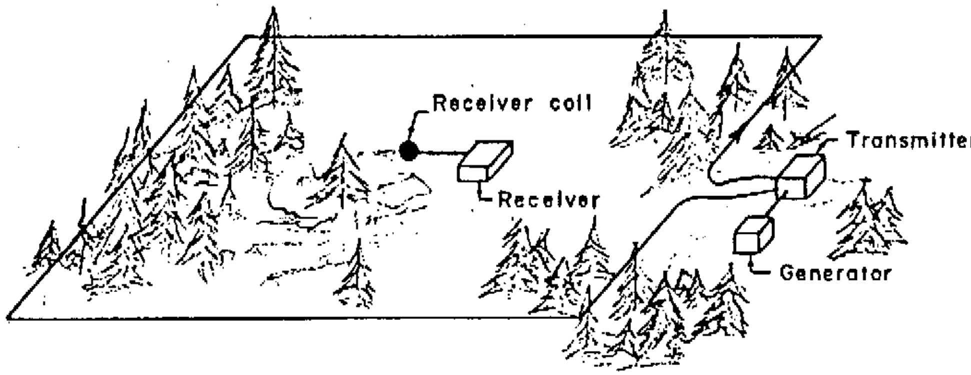
GEO-PHYSI-CON
ENGINEERING GEOPHYSICAL CONSULTANTS

CROWS NEST RESOURCES LTD.
TELKWA COAL PROJECT

BEDROCK PROFILE
LINE EAST 7

82-39

Figure 14



GEO·PHYSI·CON

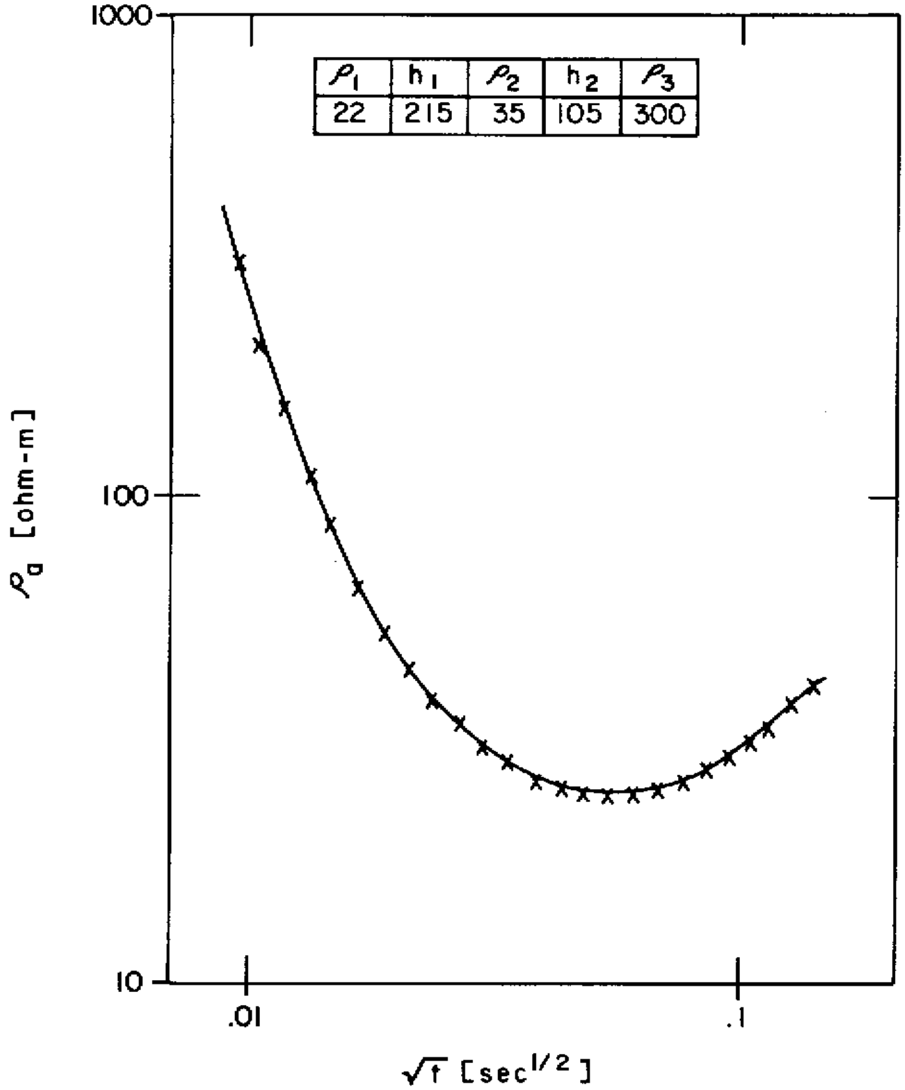
ENGINEERING GEOPHYSICAL CONSULTANTS

CROWS NEST RESOURCES LTD.
TELKWA PROJECT

EM 37 TRANSMITTER-RECEIVER CONFIGURATION

82-39

Figure 15



Model Curve

x x Data Points

GEO·PHYSI·CON

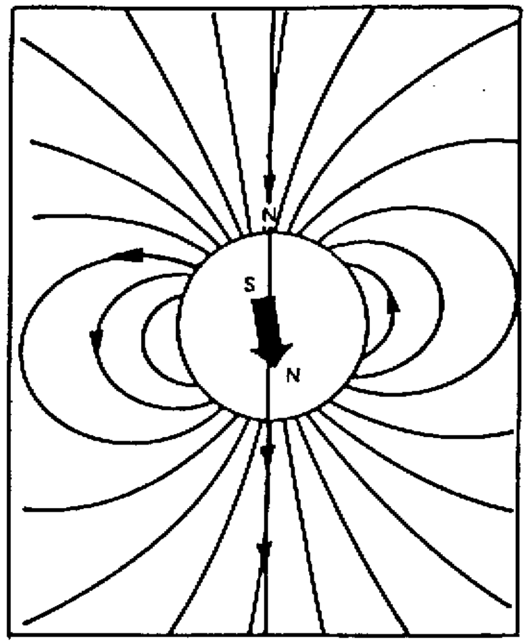
ENGINEERING GEOPHYSICAL CONSULTANTS

CROWS NEST RESOURCES LTD.
TELKWA COAL PROJECT

EXAMPLE OF
MEASURED AND MODEL CURVES

82-39

Figure 16



GEO-PHYSI-CON

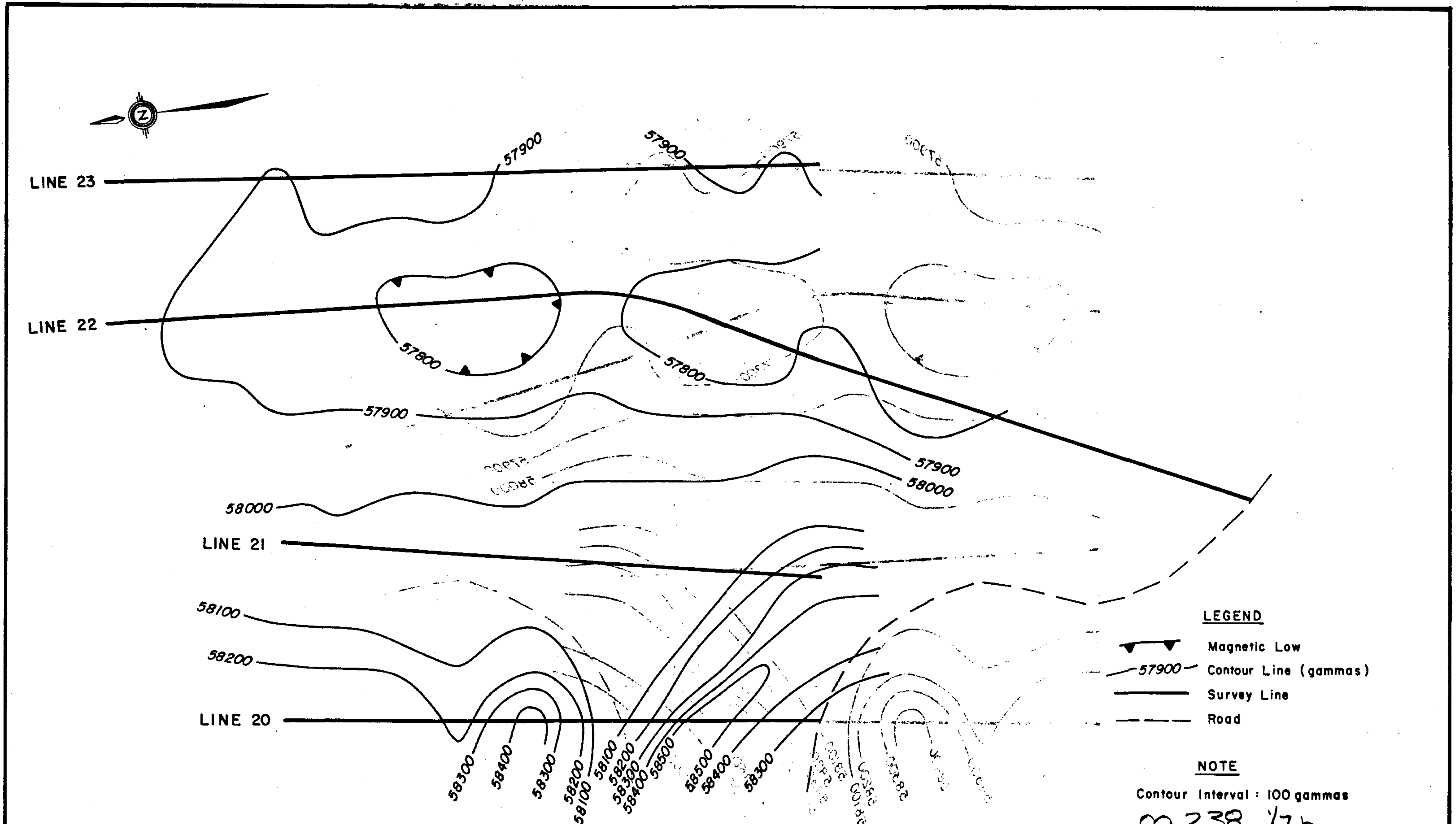
ENGINEERING GEOPHYSICAL CONSULTANTS

CROWS NEST RESOURCES LTD.
TELKWA COAL PROJECT

EARTH'S MAGNETIC FIELD

82-39

Figure 17



00 238 1/7b

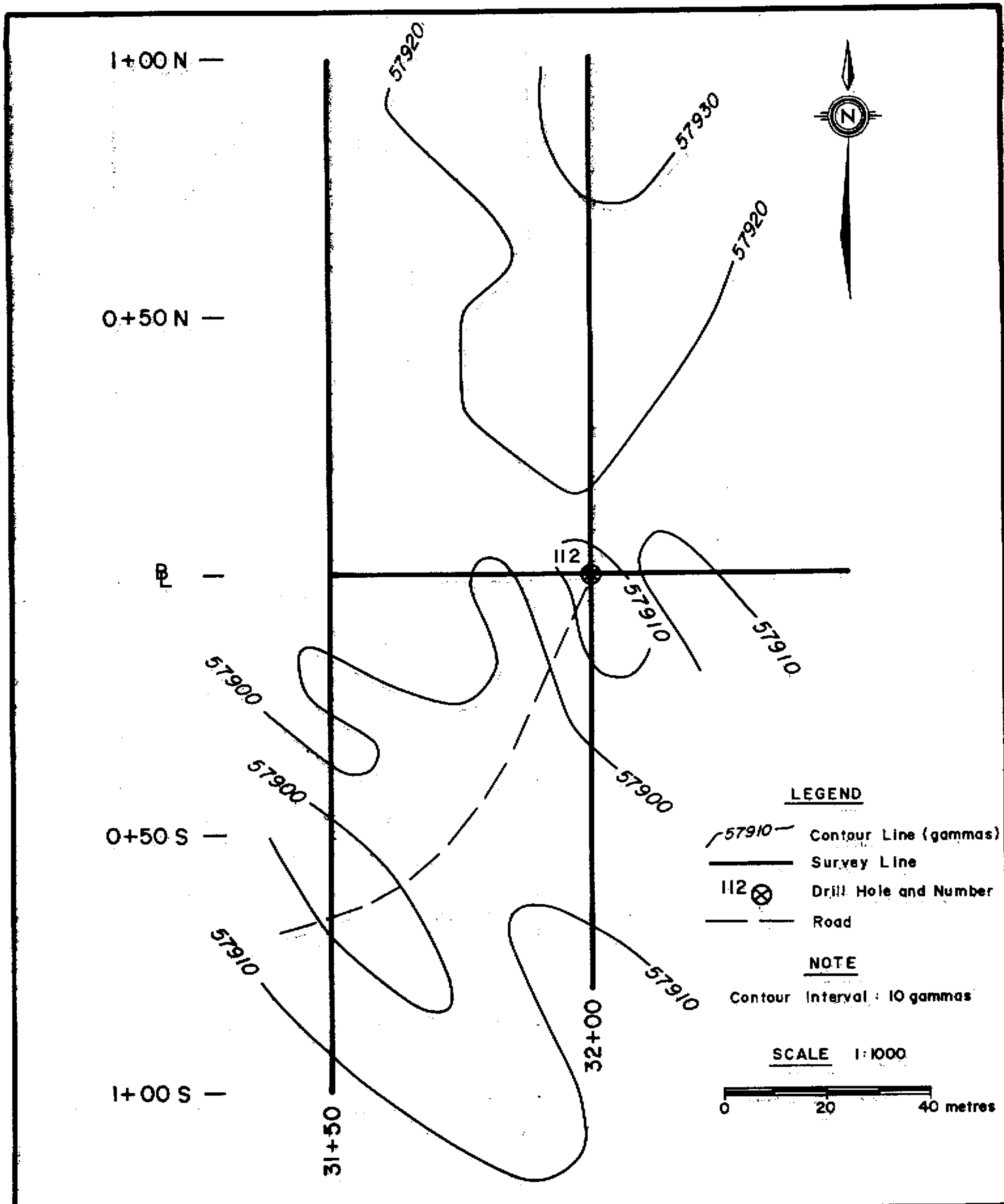
SCALE 1:1000
0 20 40 metres

GEO-PHYSI-CON
ENGINEERING GEOPHYSICAL CONSULTANTS

CROWS NEST RESOURCES LTD.
TELKWA COAL PROJECT
PROTON MAGNETOMETER
CONTOUR MAP
GRID B

82-39

Figure 19



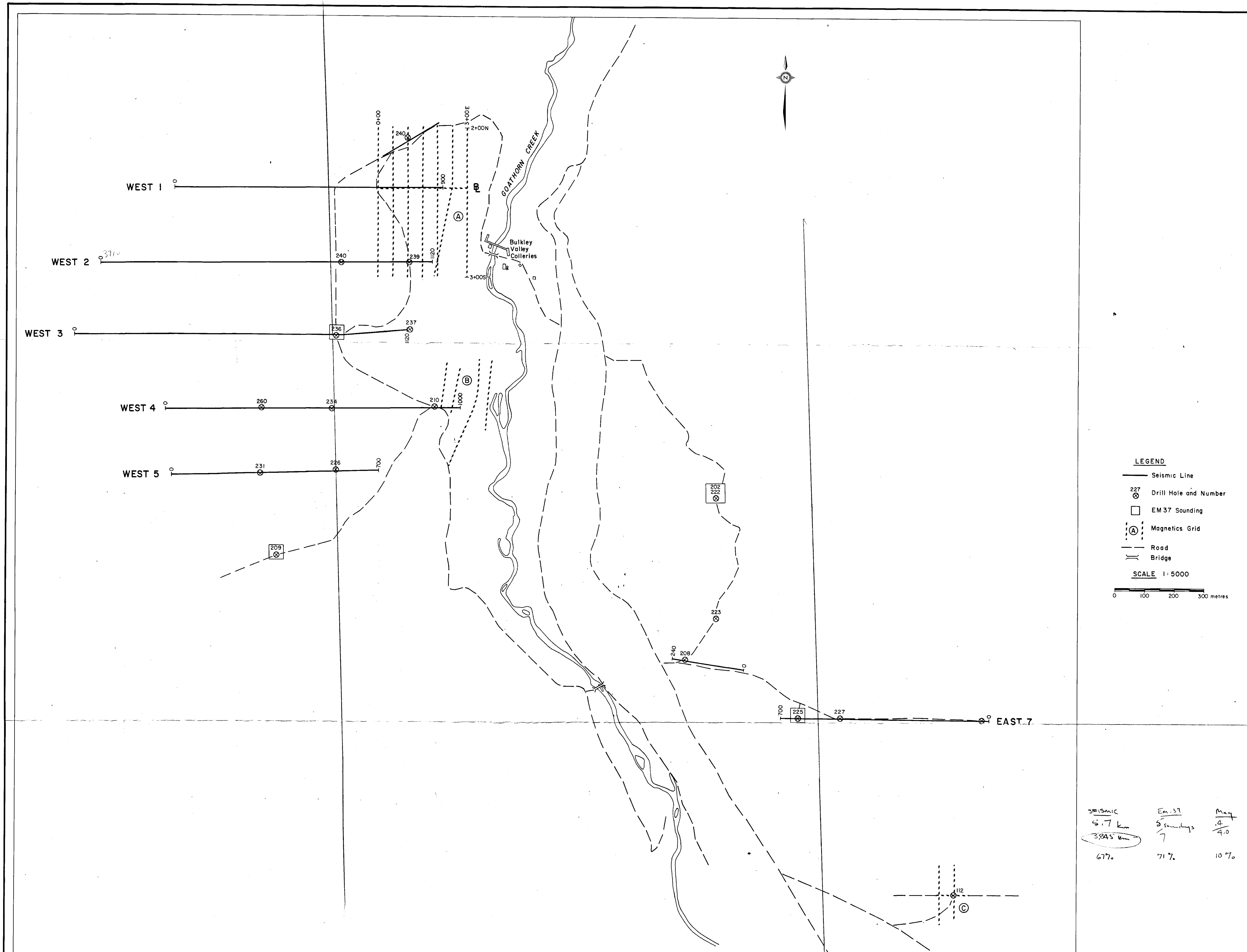
GEO-PHYSI-CON

ENGINEERING GEOPHYSICAL CONSULTANTS

CROWS NEST RESOURCES LTD.
TELKWA COAL PROJECT
PROTON MAGNETOMETER
CONTOUR MAP
GRID C

82-39

Figure 20



238 1/7 ①

GEO·PHYSI·CON
ENGINEERING GEOPHYSICAL CONSULTANTS

CROWS NEST RESOURCES LTD.
TELKWA COAL PROJECT
LINE LOCATION MAP

82-39 Figure 2

238 1/1 (2)

GEO-PHYSI-CON
ENGINEERING GEOPHYSICAL CONSULTANTS

CROWS NEST RESOURCES LTD.
TELKWA COAL PROJECT
PROTON MAGNETOMETER
CONTOUR MAP
GRID A

82-39

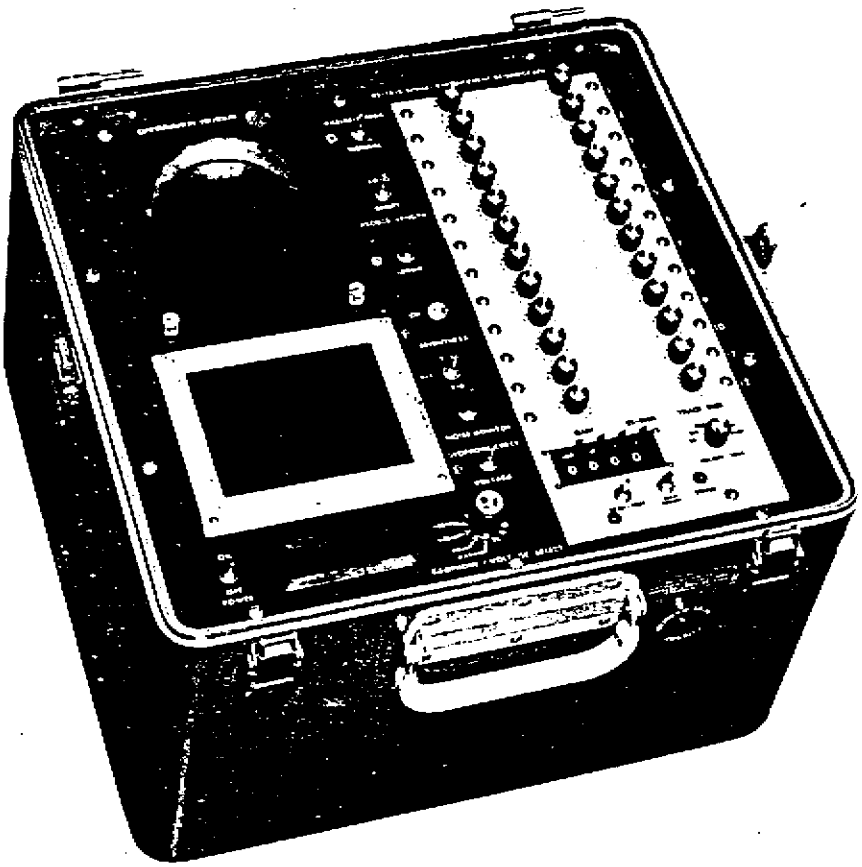
Figure 18

APPENDIX A

geoMetrics/nimbus

MULTICHANNEL SIGNAL
ENHANCEMENT SEISMOGRAPH
MODEL ES-1210

Preliminary Data Sheet



* *Signal enhancement* for greater sensitivity, improved waveform definition, and more accurate time measurements. Operates under high noise conditions and surveys to greater depths without explosives.

* *Multichannel oscillograph* provides permanent records on high-contrast, sunlight proof, reproducible paper with wiggle trace or variable area format.

* *Daylight-visible CRT monitor* displays the signal stored in memory.

* Compact, lightweight and portable. Ruggedly packaged in weatherproof case.

* Optional digital magnetic tape recorder for computer compatible data storage.

The Nimbus ES-1210 Multichannel Signal Enhancement Seismograph is unique in its combination of CRT display, signal enhancement and oscillograph recording in a single small field instrument. Simple to use yet powerful in performance, this new instrument is ideally suited for all shallow geologic investigations for mining, construction and geologic exploration.

Nimbus ES-1210

SPECIFICATIONS

Basic refraction and reflection system includes: 12-channel exploration seismograph, 12-volt battery pack, 110/220 volt charger, power cord, hammer switch, and instruction manual.

Signal Enhancement:	samples, digitizes, and stores signal in a random access memory. Repeated signals are added while random noise is cancelled or limited.
Memory Size:	10 bits by 1024 words on each channel.
Sample Interval:	switch selectable 50, 100, 200, 500, 1000, or 2000 microseco
Record Length:	switch selectable 50, 100, 200, 500, 1000, or 2000 milliseco
CRT Display:	5" diagonal measurement CRT, daylight visible without hoods, switch selectable time lines, camera compatible, and displays wiggle trace or variable area record display.
Oscillograph:	permanent record of all 12 channels simultaneously on 4" wide electrosensitive paper. Record will not fade in light, and reproduces on copying machines.
Noise Monitor:	ambient vibrations displayed on CRT allowing timing of energ source during quiescent periods and the optimization of gain adjustments.
Timing:	crystal controlled, .01% accurate, time lines are switch selectable on CRT and high or low resolution on oscillographic record.
Precision Delay:	postpones start of record up to 9.999 seconds in one millisecond increments.
Digital Meter:	indicates battery voltage, geophone resistance on each chann power supply voltages.
Digital Output:	a panel connector to allow digital recording of signal store in memory on optional digital recorder Model G-724S.
Record Initiation:	by contact closure, saturated NPN transistor, or negative 5-volt pulse.
Standard Size/Weight: (seismograph)	14 X 15 X 15 inches (36 X 38 X 40 cm) lid closed 38 pounds (17 kg)
Power Requirements:	12 volts, 3.5 amperes
Seismograph Case:	Heavy duty aluminum with lid and water tight seal.

geoMetrics, INC. A SUBSIDIARY OF EG&G
395 JAVA DRIVE
SUNNYVALE, CA. 94086 U.S.A.
TEL: (408) 734-4616
CABLE: "GEOMETRICS"
TELEX NO: 357-435

geoMetrics SERVICES (CANADA) LTD.
436 LIMESTONE CRESCENT
DOWNSVIEW (TORONTO).
ONTARIO, CANADA
TEL: (416) 661-1966
TELEX NO: 06-22694

geoMetrics INTERNATIONAL CORP.
80 ALFRED ST.,
MILSON'S POINT
SYDNEY NSW 20
AUSTRALIA
TEL: 929-9942
TELEX NO: 790-2

WORLD-WIDE AGENTS: EUROPE • SCANDINAVIA • UNITED KINGDOM • JAPAN • SO. AFRICA • SO. AMERI

GEONICS LIMITED

EM37 Ground Transient Electromagnetic System Technical Specifications

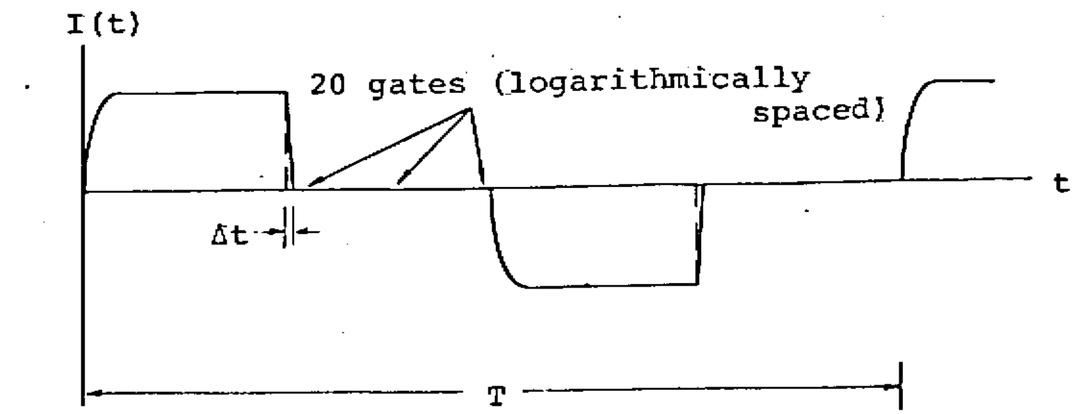
Transmitter

Current Waveform	- See Fig. A 1
Repetition rate	- 3Hz or 30Hz in countries using 60Hz power line frequency; 2.5Hz or 25Hz in countries using 50Hz power line frequency; all four base frequencies are switch selectable.
Turn-off time (Δt)	- fast linear turn-off of maximum 300 μsec. at 20 amps into 300x600m loop. Decreases proportionally with current and (loop area)$^{\frac{1}{2}}$ to minimum of 20 μsec. Actual value of Δt read on front panel meter.
Transmitter loop	- any dimensions from 40x40m to 300x600m maximum at 20 amps. Larger dimensions at reduced current. Transmitter output voltage switch adjustable for smaller loops. Value of loop resistance read from front panel meter; resistance must be greater than 1 ohm on lowest voltage setting to prevent overload.
Transmitter protection	- circuit breaker protection against input overvoltage; instantaneous solid state protection against output short circuit; automatically resets on removal of short circuit. Input voltage, output voltage and current indicated on front panel meter.
Transmitter output voltage	- 150 volts (zero to peak) maximum; 20 volts (zero to peak) minimum
Transmitter output power	- 2.8 kw maximum
Transmitter wire supplied	- 1800m. #10 copper wire PVC insulated with nylon jacket; transmitter wire contained on 6 reels (supplied); 2 reel winders supplied.
Transmitter motor generator	- 5 HP Honda gasoline engine coupled to 120 volt, 3 phase, 400Hz alternator. Approximately 8 hours continuous operation from full (built-in) fuel tank.

Receiver

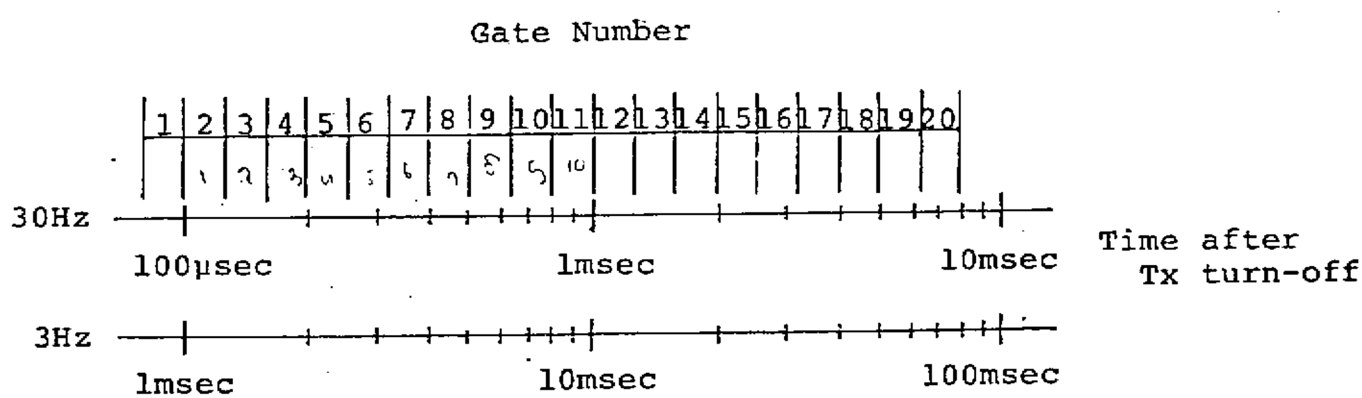
Measured quantity	-	time rate of decay of magnetic flux along 3 axes.
Sensors	-	two air cored coils of bandwidths 11 and 50 kHz respectively; each 66cm dia.x4x5cm cross-section. Low frequency coil for general use, high frequency coil for shallow sounding.
Time channels	-	20 time channels with locations and widths as shown in Fig.A2. Successive operation at 30Hz, then 3Hz, effectively gives 30 channels covering range from 80 μsec. to 80 msec.
Output display	-	4 figure digital LED plus sign; display also shows channel number and gain.
Integration time	-	2^n cycles at 30Hz; n=4,6,8,10,12,14 (switch selectable); similar integration times at other base frequencies.
Receiver noise	-	approximately 1.5×10^{-10} volt/m^2/turn of receiver coil at last gate at 30Hz with integration time of 34 seconds. Noise will be higher during intense local spherics activity.
Output connector	-	all 20 channels available in analogue format from output connector at 5 volts fsd level.
Synchronization to Tx	-	any of the following (switch selectable) (1) reference cable (2) primary pulse (3) 27 MHz radio link (40 channels) (4) high stability (oven controlled) quartz crystals.
Noise rejection circuitry	-	with any of (1)-(3) above, entire system is automatically synchronized to 50/60Hz power line frequency when such interference exists in survey area; selective clipping of atmospheric noise pulses at all times. Audio output of Rx coil (transmitter pulse blanked out) is available on built-in loud speaker for ready identification of interference.
Receiver batteries	-	12 volt rechargeable Gel-cells; either 9 hours continuous operating time at 17°C (battery weight

Receiver batteries (continued)	-	battery weight 7.6 kg, 20 amp hour) or 2.5 hours continuous operating time (battery weight 2.6 kg, 6 amp hour). Two sets of batteries and a battery charger supplied to permit charging of spare set from transmitter motor-generator during survey.



Transmitter Current Waveform

FIG.A1



Gate Location and Widths (30 and 3Hz)

FIG.A2

geoMetrics

Instrument Division

PORTABLE PROTON MAGNETOMETER
MODEL G-816

Data Sheet
August 1974

- ★ 1 gamma sensitivity and repeatability
- ★ Very small size and weight: less than 12 lbs complete with batteries and sensor
- ★ Over 10,000 readings per set of alkaline "D" cell (flashlight) batteries
- ★ Provision to attach sensor to carrying harness for use without staff
- ★ Pushbutton operation—numeric display directly in gammas
- ★ Total field measurements—independent of orientation—no calibration—no leveling

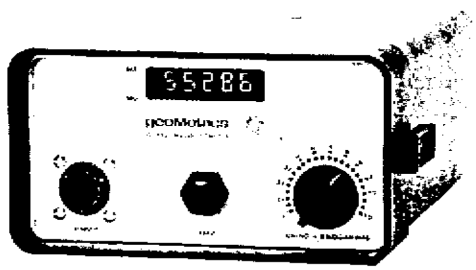
The Model G-816 is a complete portable magnetometer for all man-carry field applications. As an accurate yet simple to operate instrument, it features an outstanding combination of one gamma sensitivity and repeatability, compact size and weight, operation on standard universally available flashlight batteries, ruggedized packaging and very low price.

The G-816 magnetometer allows precise mapping of very small or large amplitude anomalies for ground geophysical surveys, or for detail follow-up to aeromagnetic reconnaissance surveys. It is a rugged, lightweight, and versatile instrument, equally well suited for field studies in geophysics, research programs or other magnetic mapping application where low cost, dependable operation and accurate measurements are required.

For marine, airborne or ground recording systems consider GeoMetrics Models G-801, G-803, and G-826.

"Hands-free" Back Pack Sensor

Based upon the principle of nuclear precession (proton) the G-816 offers absolute drift-free measurements of the total field directly in gammas. (The proton precession method is the officially recognized standard for measurement of the earth's magnetic field.) Operation is worldwide with one gamma sensitivity and repeatability maintained throughout the range. There is no temperature drift, no set-up or leveling required, and no adjustment for orientation, field polarity, or arbitrary reference levels. Operation is very simple with no prior training required. Only 6 seconds are required to obtain a measurement which is always correct to one gamma, regardless of operator experience. Only the Proton Magnetometer offers such repeatability—an important consideration even for 10 gamma survey resolution.



Complete Field Portable System

The Model G-816 comes complete, ready for portable field operation and consists of:

1. Electronics console with internally mounted and easily replaced "D" cell battery pack.
2. Proton sensor and signal cable for attachment to carrying harness or staff.
3. Adjustable carrying harness.
4. 8 foot collapsible aluminum staff.
5. Instruction manual, complete set of spare batteries, applications manual, and rugged field suitcase.

Price and lease rates on the G-816 magnetometer are available upon request.

SPECIFICATIONS

Sensitivity: ±1 gamma throughout range

Range: 20,000 to 90,000 gammas (worldwide)

Tuning: Multi-position switch with signal amplitude indicator light on display

Gradient Tolerance: Exceeds 300 gammas/ft (increased gradient tolerance to 800 gammas/ft upon request)

Sampling Rate: Manual push-button, one reading each 6 seconds

Output: 5 digit numeric display with readout directly in gammas

Power Requirements: Twelve self-contained 1.5 volt "D" cell, universally available flashlight-type batteries. Charge state or replacement signified by flashing indicator light on display.

Battery Type		Number of Readings
Alkaline	over	10,000
Premium Carbon Zinc	over	4,000
Standard Flashlight	over	1,500

NOTE: Battery life decreases with low temperature operation.

Temperature Range: Console and sensor: -40° to +85°C

Battery Pack: 0° to +50°C (limited use to -15°C; lower temperature battery belt operation—optional)

Accuracy (Total Field): ±1 gamma through 0° to +50°C temperature range

Sensor: High signal, noise cancelling, interchangeably mounted on separate staff or attached to carrying harness

Size: Console: 3.5 x 7 x 10.5 inches (9 x 18 x 27 cm)
Sensor: 4.5 x 6 inches (11 x 15 cm)
Staff: 1 inch diameter x 8 ft lenght (3 cm x 2.44 m)

Weight:

	lbs.	Kgs.
Console (w/batteries):	5.5	2.4
Sensor & signal cable:	4	1.8
Aluminum staff:	2	0.9
Total:	11.5	5.1

All magnetometers and parts are covered by a one year warranty beginning with the date of receipt but not to exceed fifteen months from the shipping date.

APPENDIX B

TRANSIENT ELECTROMAGNETIC SOUNDING

TECHNICAL NOTE
GEO-PHYSI-CON CO. LTD.
CALGARY, ALBERTA

INTRODUCTION

Electromagnetic transient methods for geoelectric sounding have been used for many years in the U.S. and the U.S.S.R. for mapping structures for hydrocarbon and geothermal exploration. The depth of exploration required for these objectives generally is in excess of 1 kilometre. Transient soundings for shallow exploration (< 1 km) was till recently not possible, due to the lack of an instrument with the necessary specifications. The situation has changed since the Geonics EM37 became commercially available. There are several important exploration objectives for shallow exploration using transient methods, such as:

1) structural mapping in coal, oil sands and oil shales
2) structural mapping and target detection for mineral exploration
3) hydrogeological investigations (e.g. buried channels)
4) deep permafrost mapping for static correction to seismic reflection data
5) exploration in general civil construction

Transient Electromagnetic System

A transient system consists of a transmitter (T) and receiver (R). Different arrays of T and R may be used as shown in Figure 1. The physical basis of the method will be illustrated for the array of a non-grounded transmitter. Suppose that the non-grounded loop is energized by current pulses (Figure 2a). During time-on, when the current is constant in the loop, the magnetic field is invariant with time. There are no induced currents in the surrounding medium at this time. When the transmitter current is switched off induced currents arise in the medium due to rapid changes of the magnetic field in accordance with Faraday's Law. In the interval of time-off, the induced currents in the ground are the only sources for the secondary magnetic field shown in Figure 2c. The behavior of the ground currents is considered in more detail below.

Behavior of Eddy Currents

The first instant after the transmitter current is switched off the eddy current intensity is highest near the ground surface under the transmitter loop. As a result, the electromotive force in the receiver coil depends mainly on the resistivity of the upper layer. Therefore, the depth of investigation initially is very small. With increasing time, the behavior of eddy currents can be described by diffusion type equations.

Figure 3 illustrates the essential behavior of the distribution of maximum current intensity as a function of time. It shows that with increasing time the current maximum occurs at increasing depth. As a result, the electromotive force measured in the receiver, due to the eddy currents, will reflect more the properties of deeper layers. The depth of investigation then increases as a function of time.

More detailed analysis shows that with increasing time, most currents for a layered media are concentrated in the basement and the fields caused by them correspond to the field of a half-space with a resistivity equal to that of the basement. In the limit (late time) all layers above the basement become transparent. Thus, measuring the transient electromagnetic response as a function of time yields information about the electrical properties of a section.

Definition of Apparent Resistivities - Apparent Resistivity Curves

As is known in electrical exploration with Schlumberger and magneto-telluric soundings, data interpretation is facilitated by the introduction of apparent resistivity. The same is true in transient EM soundings. Instead of working with transient behavior of the electromotive force, the data are converted to apparent resistivity. There are, in transient soundings, several ways to define the apparent resistivity. For most applications the apparent resistivity is defined from the following simple equation:

$$\rho_a = \left\{ \frac{\dot{B}^{un}_{z_{l.s.}}(t)}{\dot{B}_z(t)} \right\}^{2/3} \qquad [1]$$

where ρ_a is the apparent resistivity at time t

$\dot{B}^{un}_{z_{l.s.}}(t)$ is the time derivative of the vertical magnetic field over uniform half-space at "late stage"

$\dot{B}_z(t)$ is the time derivative of the vertical magnetic field measured at time t

$\dot{B}^{un}_{z_{l.s.}}(t)$ is given by:

$$\dot{B}^{un}_{z_{l.s.}}(t) = \frac{\mu^{5/2} M}{20\pi^{3/2} t^{5/2} \rho^{3/2}} \qquad [2]$$

where μ is magnetic susceptibility,

M is transmitter dipole moment

t is time

ρ is half-space resistivity

Equations 1 and 2 clearly allow inversion of the field for apparent resistivities. Examples of apparent resistivity curves for uniform half-space and 2-layer curves are given in

Figures 4, 5 and 6. On the vertical axis is plotted the ratio, ρ_a / ρ_1, the apparent resistivity, ρ_a, and the resistivity of the first layer, ρ_1. The parameters τ_1/r and τ_1/h_1 are plotted on the horizontal axis for uniform ground and layered halfspace, respectively,

where

$$\tau_1 = \sqrt{2\pi \rho_1 t \, 10^7}$$

h_1 is thickness of first layer

and r is radius of T loop if measurements with R are made in the centre

In transient EM the parameter τ_1 plays a role similar to skin depth in frequency domain sounding.

The behavior of the apparent resistivity curves for uniform ground will now be briefly discussed:

a) With increasing time, the apparent resistivity gradually approaches the true resistivity of the half-space. For example, when $\tau_1/r > 10$, the apparent resistivity, for all practical purposes, equals ρ_1.

b) With decreasing time, at values of $\tau_1/r < 10$, the apparent resistivity increases due to the fact that the field behavior has not reached "late stage", while the definition of apparent resistivity remains based on "late stage". The information on the curve, however, is usuable since the field behavior is known at all times.

Very often, for measurements in the loop centre and for transmitter loops of dimensions of a few hundred metres, "early stage" behavior is generally observed in a few time gates only. For example, a 200 m by 200 m loop over uniform ground of resistivity of 100 ohm-m yields a value of $\tau_1/r=10$ at t=0.16 milliseconds (first 3 gates for the EM37). For a 100 m by 100 m T loop, the behavior of the field in the first gate will already correspond to "late stage" behavior for 100 ohm-m ground. Of course, for more conductive ground and for larger transmitter loop dimensions, "late stage" will commence at later times.

The interpretation of transient soundings is based on the analysis of apparent resistivity curves for 2-, 3-, 4-, and 5-layered curves. Along with inversion methods using large sections of curves, many emperical techniques for deriving parameters of the geoelectric section from parts of the curves have been developed and tested by geophysicists in the U.S.S.R. To illustrate the behavior of two-layer apparent resistivity curves, consider Figures 5 and 6. Figure 5 corresponds to the case where the basement is more resistive ($\rho_2/\rho_1 > 1$) and Figure 6 shows curves for a more conductive ($\rho_2/\rho_1 < 1$) basement.

The behavior of the main features of the curves are:

a) With increasing time, ρ_a approaches the resistivity of basement. At early stage, all curves merge into one curve corresponding to the behavior of a curve for uniform half-space of resistivity ρ_1.

b) In the intermediate range of time, one can distinguish part of the curve corresponding to upper layer conductance, S, for $\rho_2/\rho_1 >> 1$. At this stage of time the apparent resistivity is defined by the conductance, S, of the upper layer.

c) For more conductive basement ($\rho_2/\rho_1 < 1$) there is a range of time where the field is mainly defined by the thickness of the upper layer.

In both cases the curves illustrate the main idea of transient soundings for obtaining parameters of a section regardless of separation of transmitter and receiver.

Geo-Physi-Con has now several albums of master curves available for 2-, 3- and 4-layer curves, as well as the ability to compute curves for n-layer sections.

Advantages of Transient Electromagnetic Soundings over other Electrical Methods

It can be shown that the transient electromagnetic method has the following advantages:

a) Measurements are made in the absence of the primary field. As a comparison, one of the main problems in harmonic frequency sounding in the low frequency part of the spectrum, is accurate compensation for the primary field.

b) In transient soundings, the depth of investigation is defined by time and in principle does not depend on separation of T-R array. This fact makes it possible to perform soundings with an array comparable in size to the depth of exploration. This is a principle difference between transient methods on the one hand, and direct current and harmonic frequency sounding on the other hand. In direct current and harmonic frequency sounding the separation of the T-R array usually must be several times larger than the depth of exploration. Transient soundings, therefore, have the capability of higher lateral resolution than other electrical methods.

c) The magnetic field measured in transient methods, in a certain time range, is more sensitive to changes of the electrical properties of a section. In particular, if the basement is very resistive, it can be shown that the vertical component of the magnetic field at late stage is proportional to S^3,

where $S = H/\rho_l$

and H is thickness to resistive layer

and ρ_l is longitudinal resistivity of section above the resistive basement

As a comparison, in Schlumberger soundings and magnetotelluric methods, the measured parameter in certain ranges of spacing or frequency, is only inversely proportional to S(1/S). Thus, the same change in conductance leads to much larger changes in the measured field in transient methods than in other electrical sounding methods. Transient soundings, therefore, have the capability of mapping smaller structures on resistive basement.

Case History

To illustrate transient sounding in practice, part of the results of a recently conducted survey for the purpose of delineating a sedimentary basin will be discussed in this section. The sedimentary basin is intersected by volcanics(eruptives) and a crystalline basement underlies both the sedimentary and volcanic rocks. The exploration objectives were:

a) to determine the thickness of the sedimentary section (depth to crystalline basement),

b) to map the lateral boundaries of volcanic and sedimentary rock, and

c) to map faulting in the basement.

Survey Method

Transmitter loops of dimensions of 100 m by 100 m were laid out. The locations of T loops along a cross-section are shown in Figure 7. Measurements were made with the receiver coil in the centre only and a reference cable was used for synchronization. In Figures 8 and 9, experimental sounding curves at location A and B (Figure 9) are plotted. On these figures, the apparent resistivity is plotted as a function of the square root of time. The time range over which measurements were made varies from 0.089 x 10^{-3} sec to 6 x 10^{-3} sec. The experimental data points are superimposed on the best fit theorectical master curves. The parameters of the master curves define the geoelectric section. The geologic cross-section derived from the various soundings is given in Figure 7. In addition to the geologic cross-section the longitudinal resistivity, ρ_ℓ , above the basement is shown. It was computed from the relation:

$$\rho_\ell = \frac{H}{\frac{H_1}{\rho_1} + \frac{H_2}{\rho_2}}$$

where H is total thickness of sedimentary section,

and H_1, H_2 are thicknesses of layer 1 and 2, respectively

The behavior of ρ_ℓ shows a relatively constant value of about 20 ohm-m from Station 2200m to Station 1200m. From Station 1200m to 200m, ρ_ℓ increases to a maximum value of about 60 ohm-m. The increase in ρ_ℓ at Station 1200m was interpreted as the contact of sedimentary and volcanic rock. This interpretation was consistent with the information obtained from two drill holes placed on the cross-section. The drill holes did not penetrate into basement rocks.

From these surveys the following observations were made about transient EM soundings:

a) The excellent fit between experimental data points and theorectical master curves over sedimentary sections was a general condition. Distortions of the curves over volcanic sections were not major even near contacts and faults.

b) The range of equivalence of parameters of "master curves" was briefly investigated on the data from this survey. In Figure 10, several master curves are shown with the experimental data points. Curve 1 is the best fit. For the model of curve 3 the first two layers have been replaced with one layer of thickness H_1+H_2, and of resistivity $\frac{\rho_1+\rho_2}{2}$. The behavior of curve 3 can be seen not to fit the experimental data in early time; at late time the curve fit the experimental data well. The reasons for agreement at late time are that, with increasing time, the field is mainly determined by currents in the basement and depth to basement and conductance of layers above basement is the same for the models of curve 1 and 3. On the other hand, at early time the field is mainly determined by currents in the sedimentary section and the sedimentary section has different resistivities in the models of curve 1 and 3. In the model of curve 2 the thickness of the sedimentary section has been changed by 50 metres (30 percent), and now the apparent resistivities measured at late time deviate from the apparent resistivities computed from the model. The limited experience along with theoretical analysis of apparent resistivity curves shows, that in the transient method the principle of equivalence manifests itself in a narrower range of geoelectric parameters than encountered in other electrical sounding methods.

References

1. Geonics Limited
   Applications of Transient Electromagnetic Techniques
   Technical Note TN-7

2. Kaufman , A.A. and G.M. Morozova
   The theoretical basis of Transient Sounding in the Near Zone
   Publishing House "Science" Academy of Sciences, U.S.S.R.,
   Siberia Branch, Novosobirsk, 1970
   English translation: G.S.C., Ottawa, Canada, 1979

3. Keller, G.V. and F.C. Frischknecht
   Electrical Methods in Geophysical Prospecting
   Pergamon Press, New York, 1966

4. Spies., B.
   TEM in Australian Conditions
   PH.D. Thesis, MacQuainie University, Australia, 1980

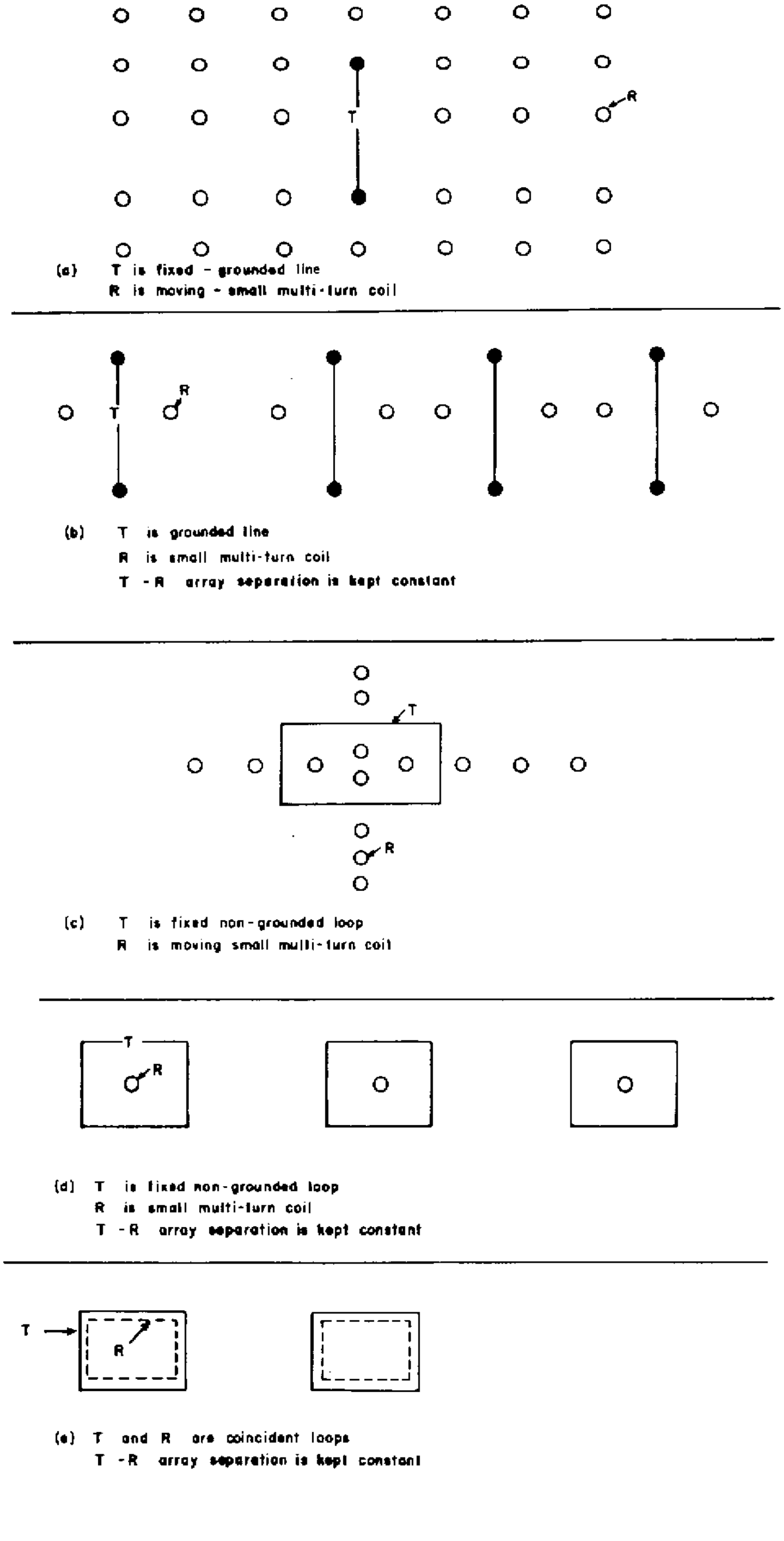


FIGURE 1
Different arrays of T-R in use in transient EM

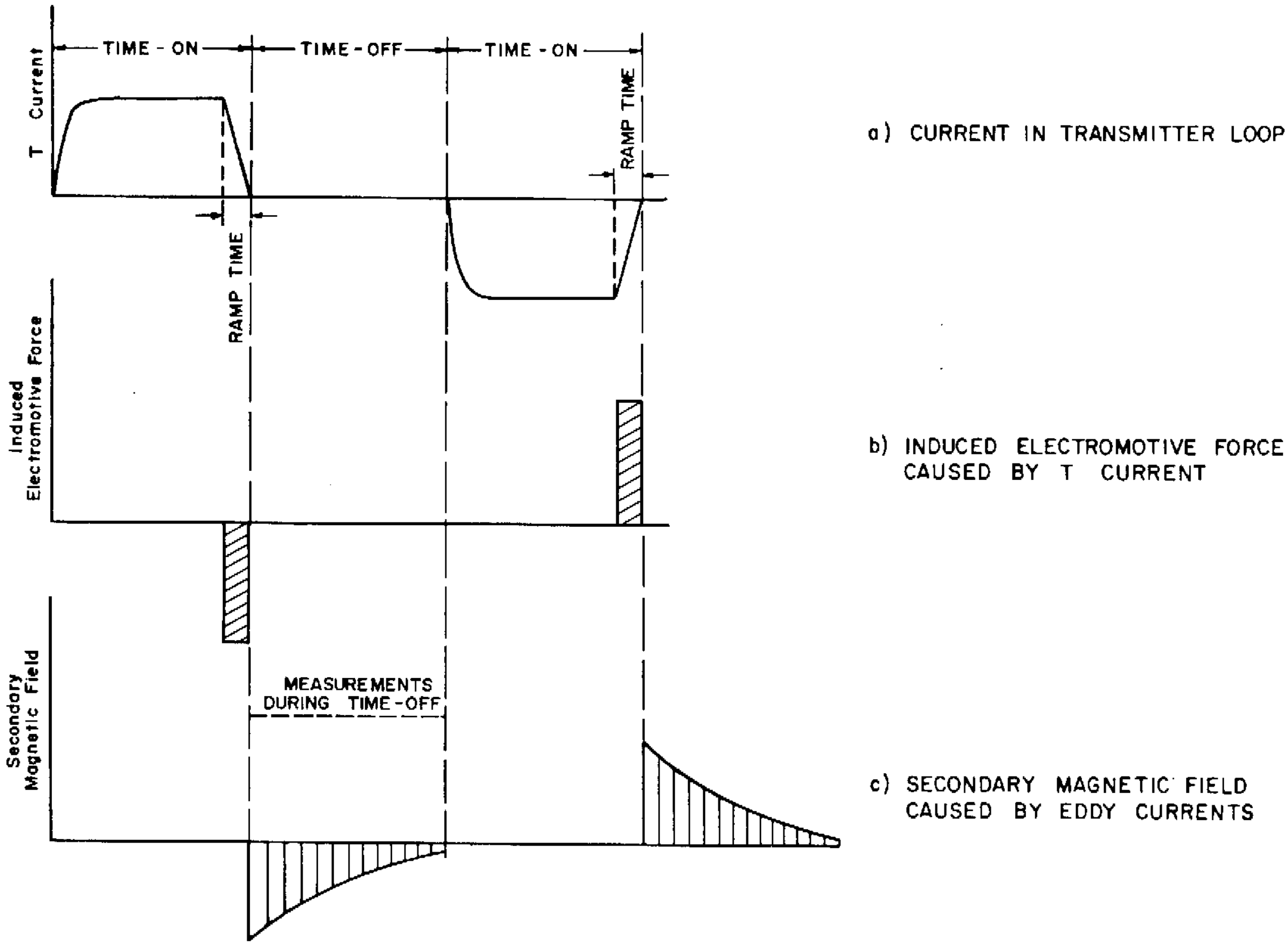


FIGURE 2
System Waveforms

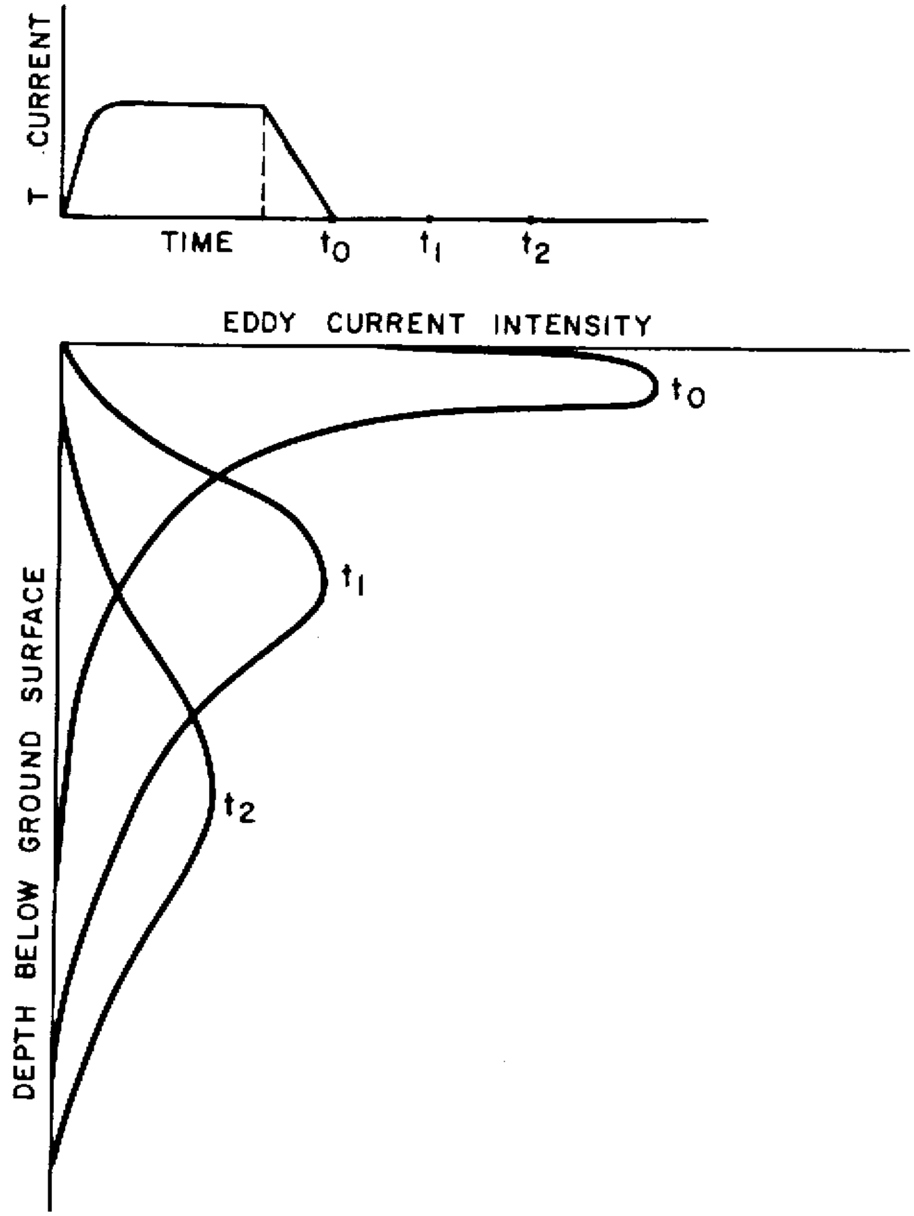


FIGURE 3
Schematic illustration of maximum current intensity in vertical plane

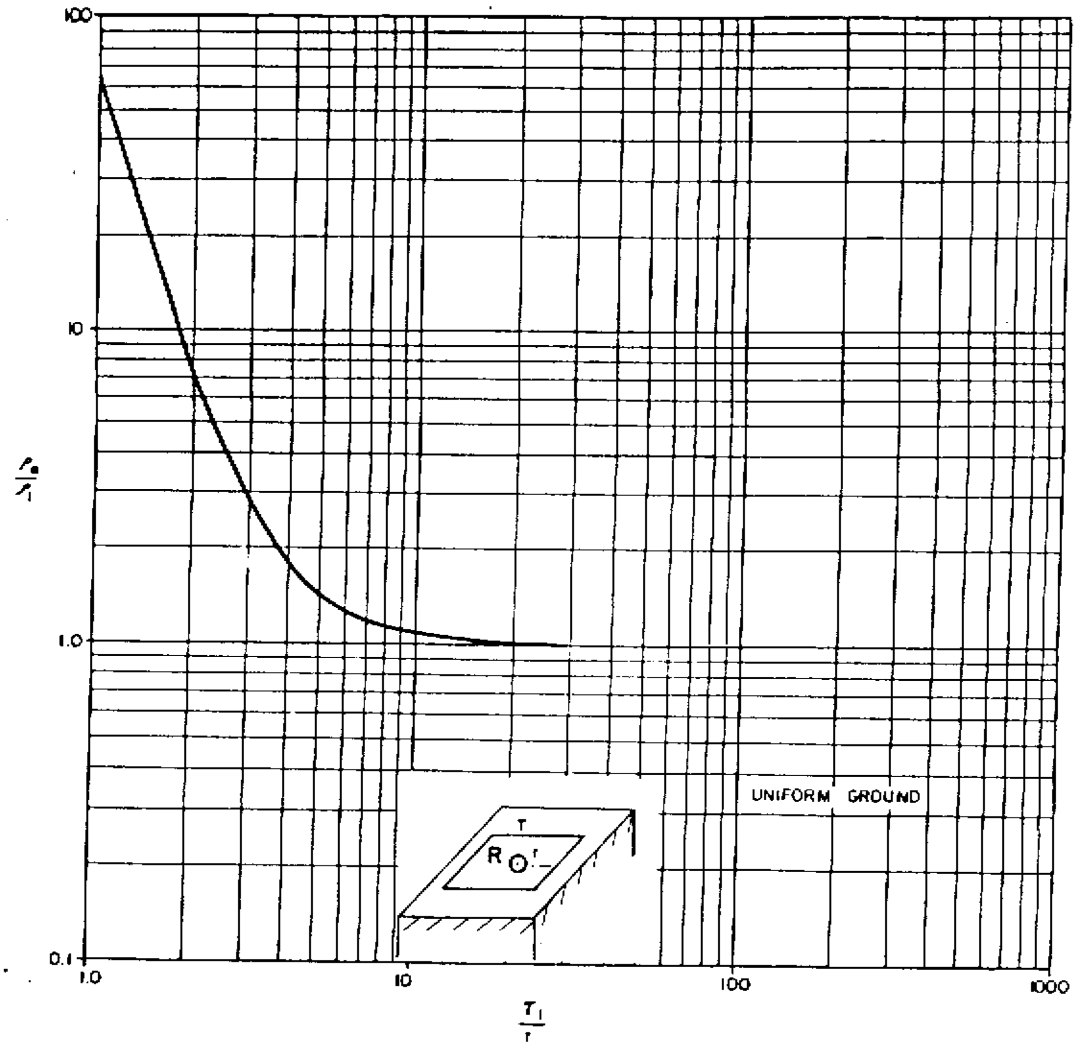


FIGURE 4
Apparent resistivity curve for homogeneous ground

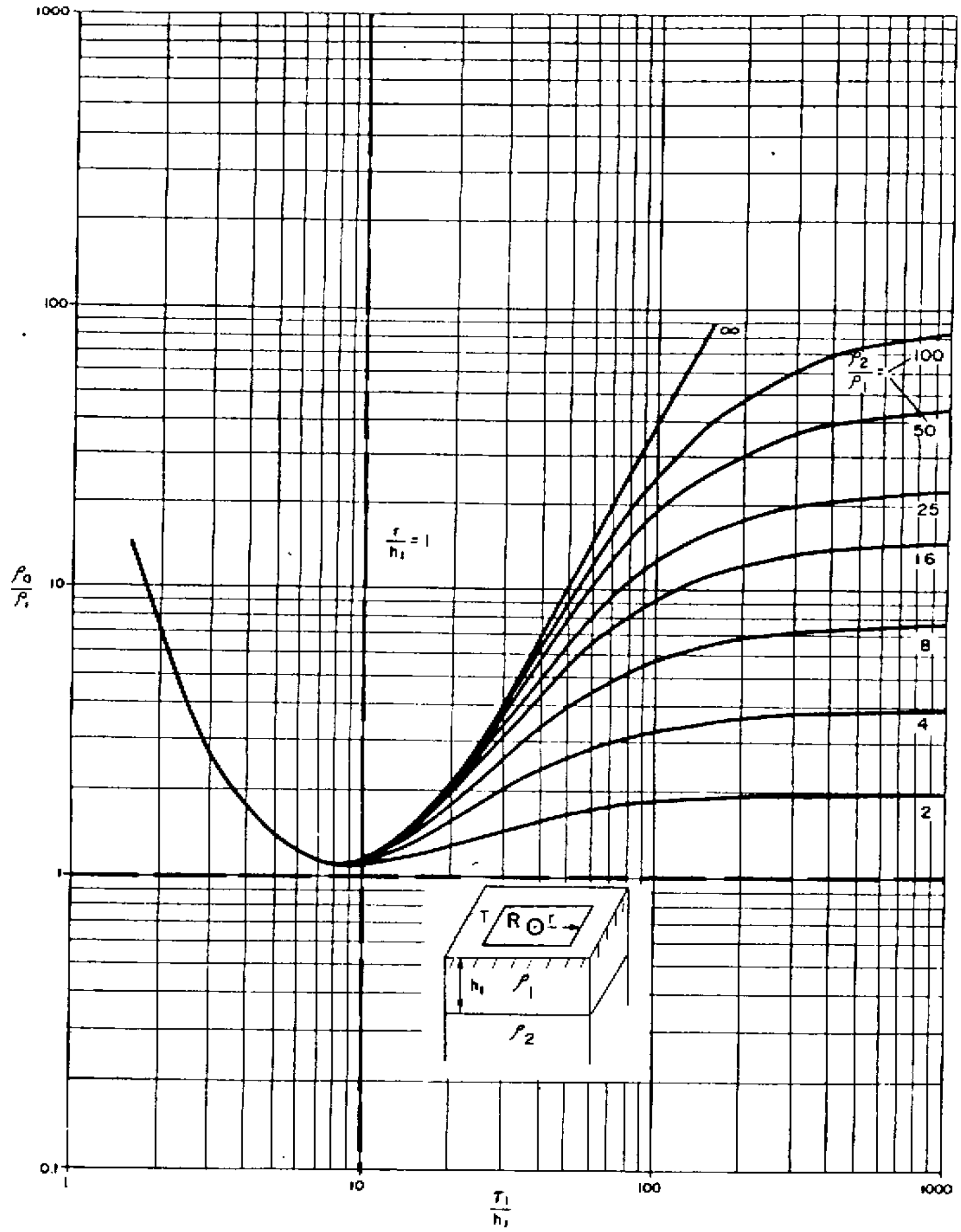


FIGURE 5
Apparent resistivity curves over two-layered ground ($\rho_2/\rho_1>1$)

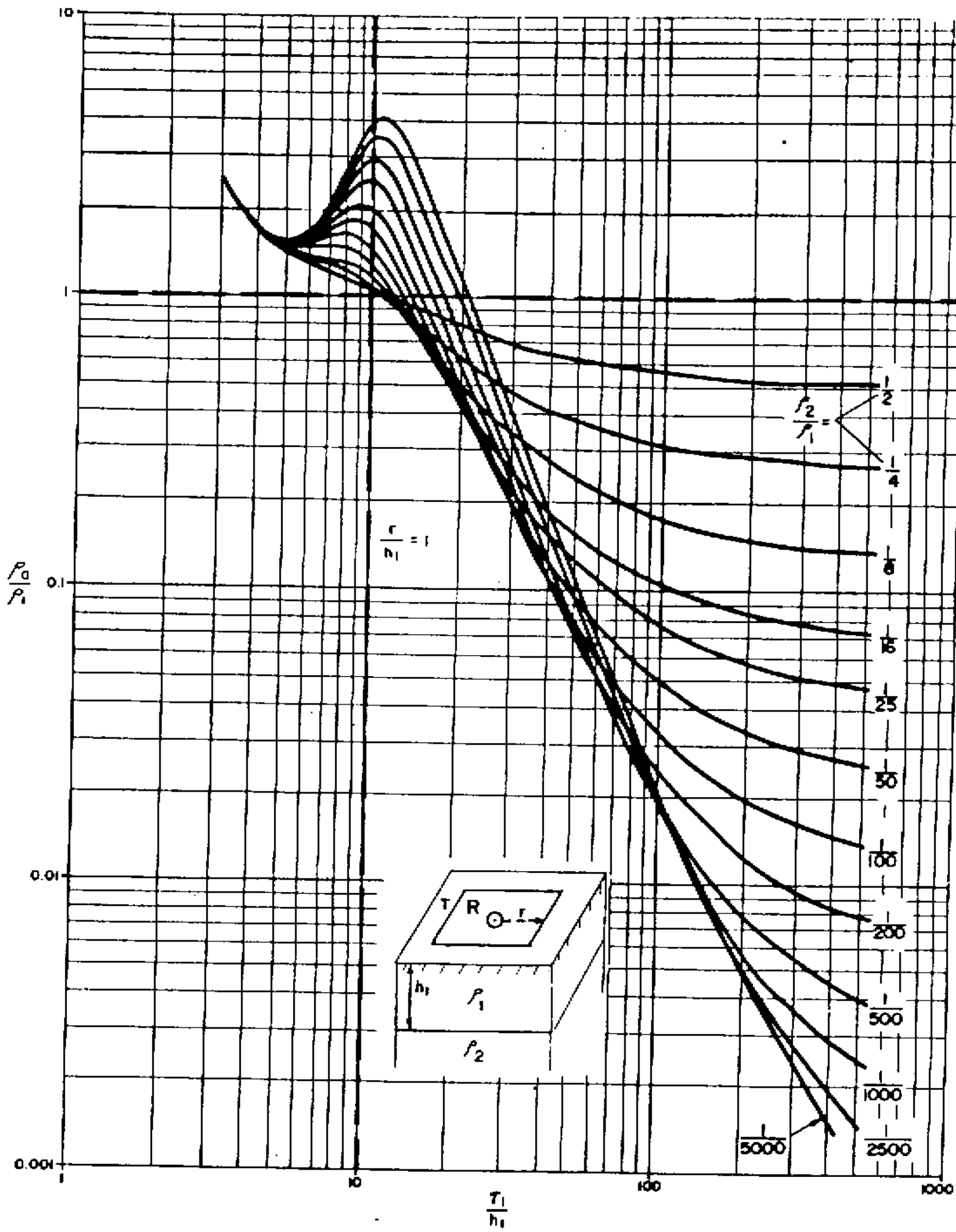


FIGURE 6
Apparent resistivity curves for two-layered ground ($\rho_2/\rho_1<1$)

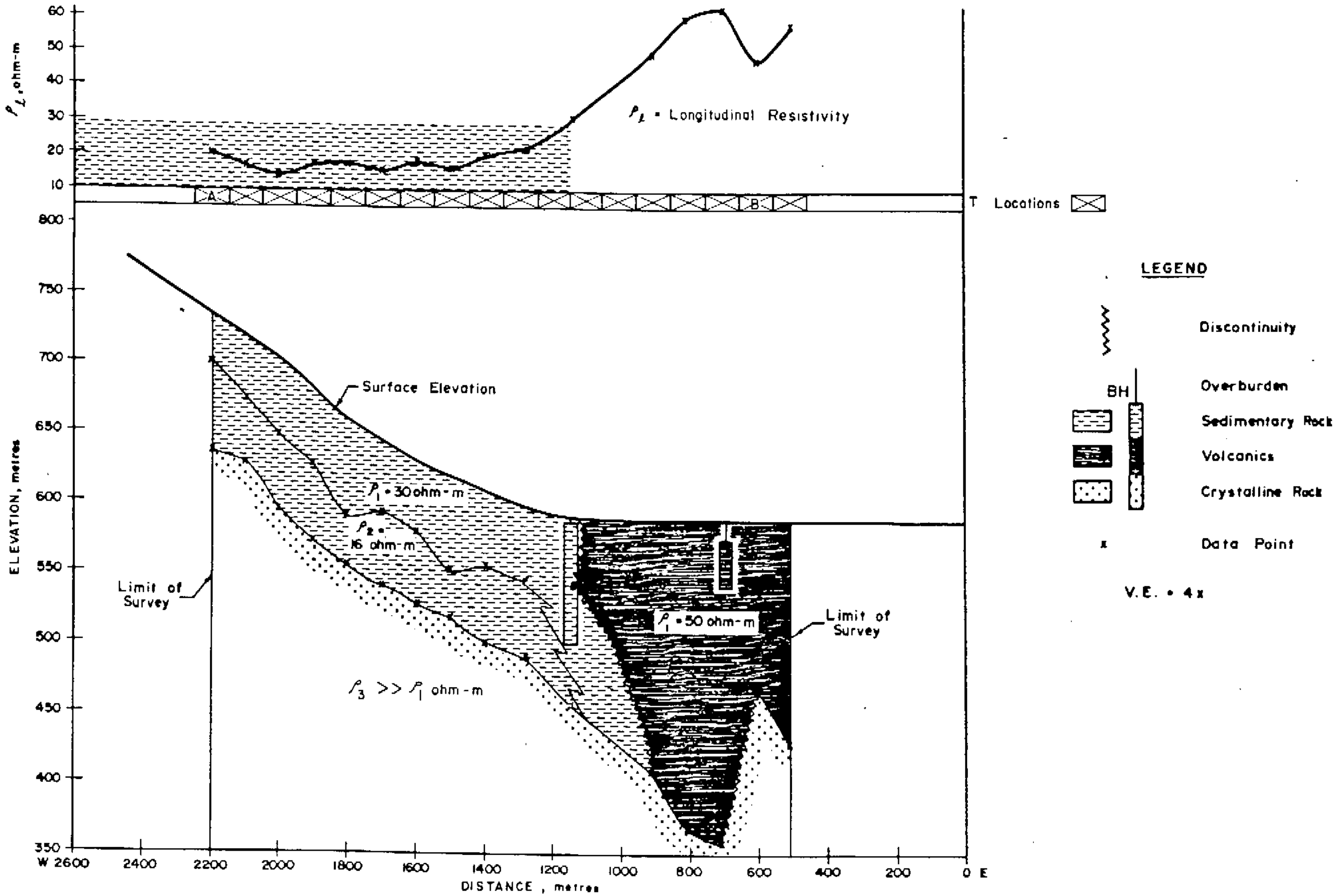


FIGURE 7 Geologic section derived from transient EM soundings

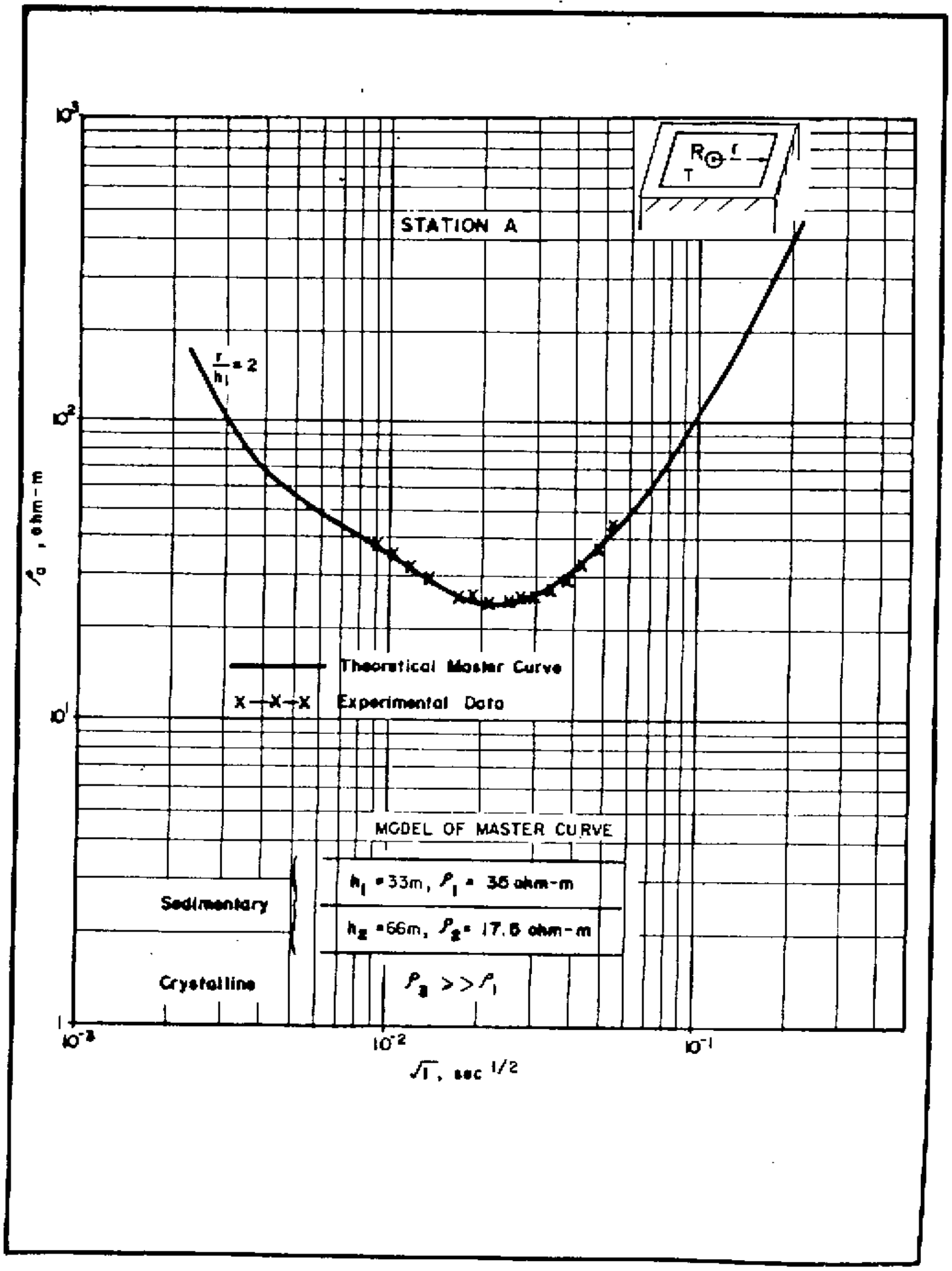


FIGURE 8
Experimental data superimposed on "best fit" theoretical master curve for Station A along section shown on Figure 7

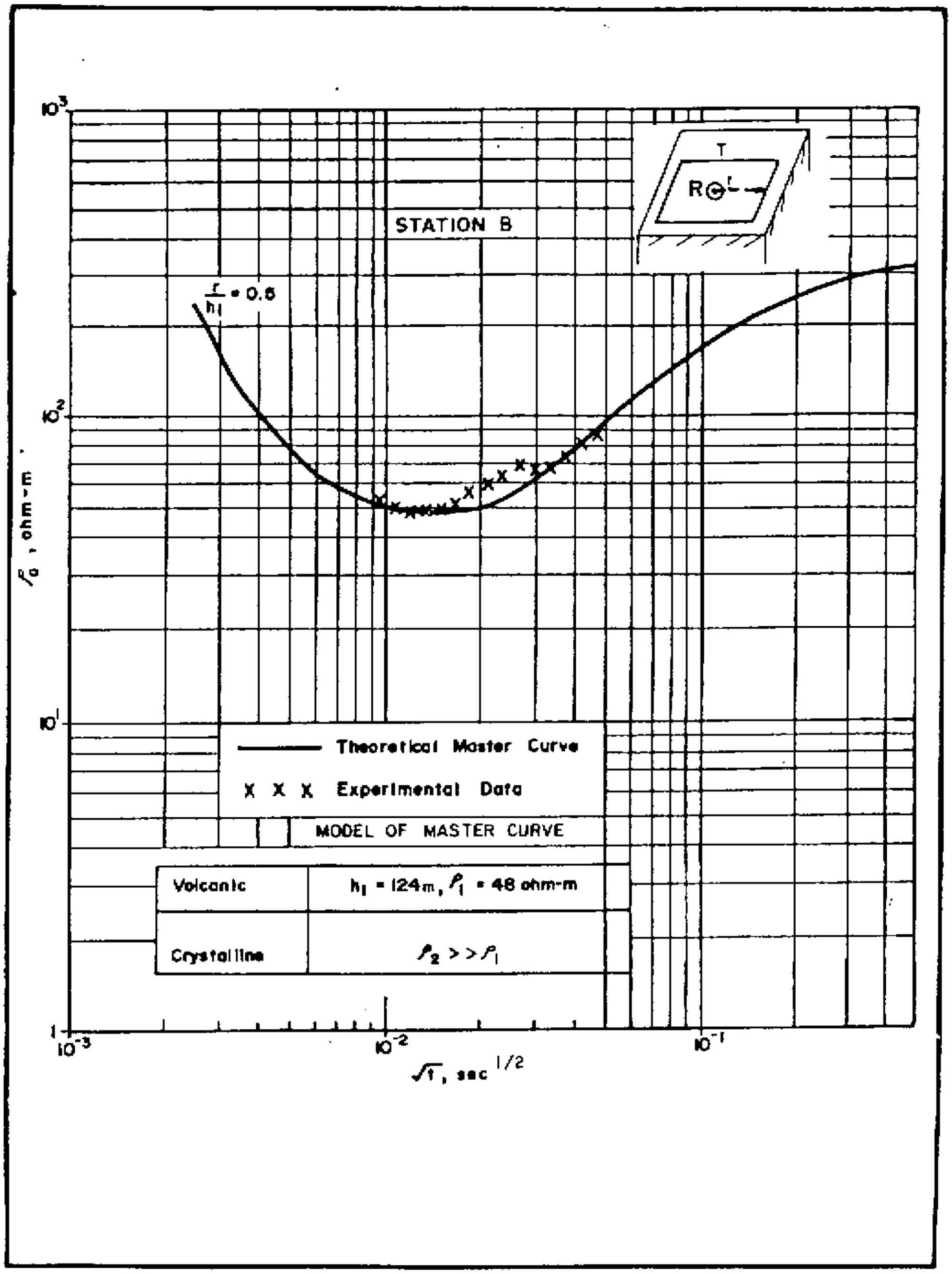


FIGURE 9
Experimental data superimposed on "best fit" theoretical master curve for Station B along section shown on Figure 7

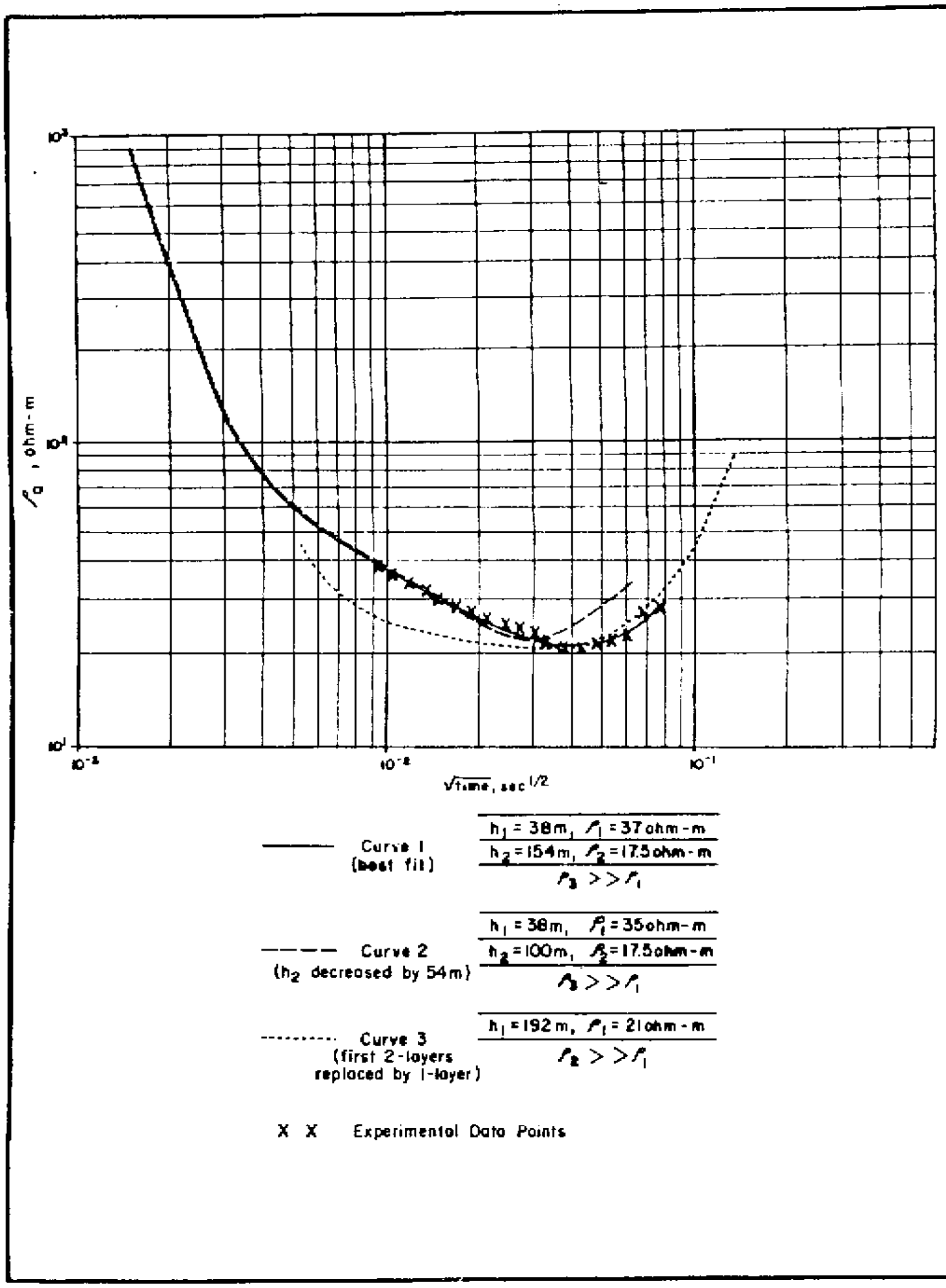


FIGURE 10
Experimental data superimposed on several theoretical master curves to illustrate the principle of equivalence for transient sounding

TK: Telkwa/ 93L 41A

CONFIDENTIAL

238

5 of 7

Crows Nest Resources

LIMITED

TK Telkwa 82(4)A

ID TW-101

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
168.19	168.68	RAW	.69	10.70	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
168.19	168.68	WASH	.64	5.92	30.73	62.71	7871	.57	5.0	75.00

~~CONFIDENTIAL~~

00238
5 of 7

ID TW-104

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
12.01	13.32	RAW	.72	25.43	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
12.01	13.32	WASH	.65	6.44	35.64	57.27	7739	2.30	6.5	65.00
20.39	21.55	RAW	.75	17.10	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
20.39	21.55	WASH	.60	7.34	35.67	56.39	7637	1.41	4.5	79.00
23.41	25.82	RAW	.66	19.59	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
23.41	25.82	WASH	1.26	8.68	29.21	60.85	7327	.66	1.0	76.00

ID TW 105

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
34.56	35.33	RAW	.95	13.76	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
34.56	35.33	WASH	.68	7.61	33.78	57.93	7535	1.77	2.0	85.00
36.24	38.22	RAW	1.00	16.11	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
36.24	38.22	WASH	.72	7.09	31.93	60.26	7565	1.42	2.5	77.00
94.49	99.70	RAW	.82	56.91	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
94.49	99.70	WASH	.91	20.45	25.85	52.79	6376	.53	2.5	22.00

ID TW-107

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FST	YIELD
21.06	28.36	RAW	1.22	12.18	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
21.06	28.36	WASH	1.87	6.80	26.36	64.97	7307	.52	.0	81.00
131.37	133.32	RAW	.70	16.48	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
131.37	133.32	WASH	1.52	7.03	26.03	65.42	7599	1.39	2.5	68.00
134.48	139.38	RAW	.66	30.78	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
134.48	139.38	WASH	1.05	11.96	25.99	61.00	7586	.97	3.0	48.00
157.28	159.71	RAW	.90	32.99	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
157.28	159.71	WASH	.70	11.91	29.21	58.18	7308	1.07	3.5	53.00

ID TW-112

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
98.00	98.60	RAW	1.09	21.37	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
98.00	98.60	WASH	.90	12.14	30.50	56.46	7037	1.78	1.5	77.00
104.60	105.40	RAW	.98	16.62	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
104.60	105.40	WASH	.77	9.05	33.61	56.57	7418	2.44	1.5	80.00
107.10	109.00	RAW	1.07	14.68	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
107.10	109.00	WASH	.98	8.29	30.28	60.45	7430	1.35	1.0	82.00
127.70	128.70	RAW	.99	15.07	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
127.70	128.70	WASH	1.04	8.02	30.63	60.31	7498	1.36	3.0	88.00
134.30	136.90	RAW	1.04	11.10	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
134.30	136.90	WASH	2.09	6.19	28.57	63.15	7544	.75	1.0	79.00
145.10	147.60	RAW	1.15	15.84	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
145.10	147.60	WASH	1.57	6.09	29.24	63.10	7611	.56	1.5	88.00
151.75	153.20	RAW	1.12	8.35	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
151.75	153.20	WASH	1.72	5.33	29.11	63.84	7663	.98	1.5	91.00
160.10	161.60	RAW	.90	25.85	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
160.10	161.60	WASH	1.45	5.24	29.67	63.64	7908	.70	1.5	65.00
168.40	170.10	RAW	.98	14.65	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
168.40	170.10	WASH	1.40	5.62	29.95	63.03	7673	.53	1.0	85.00
192.50	194.80	RAW	.80	42.54	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
192.50	194.80	WASH	1.19	9.73	27.94	61.14	7416	1.16	1.0	47.00
202.20	203.40	RAW	.82	14.25	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
202.20	203.40	WASH	1.21	10.31	27.58	60.90	7318	1.07	1.0	83.00
209.10	209.80	RAW	.73	31.97	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
209.10	209.80	WASH	.86	16.49	28.63	54.02	6911	1.67	1.0	63.00
210.40	212.25	RAW	.74	21.92	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
210.40	212.25	WASH	1.01	9.29	29.25	60.45	7513	.83	3.0	77.00
217.65	218.55	RAW	.92	13.47	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
217.65	218.55	WASH	1.17	6.19	28.87	63.77	7786	.64	1.5	80.00

ID TW-201

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
129.35	134.20	RAW	.72	20.60	24.46	54.22	6464	NO.DATA	NO.DATA	RAW
129.35	134.20	WASH	1.01	16.36	24.70	57.93	6918	NO.DATA	3.0	80.00
141.80	142.60	RAW	.67	38.27	23.31	37.75	4706	NO.DATA	NO.DATA	RAW
141.80	142.60	WASH	1.01	18.62	25.17	55.20	6586	NO.DATA	1.5	48.00

ID TW-202

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
56.90	57.20	RAW	.75	17.08	26.44	55.73	6763	NO.DATA	NO.DATA	RAW
56.90	57.20	WASH	.99	10.87	28.32	59.82	7291	NO.DATA	1.0	78.00
58.40	59.25	RAW	.76	21.38	24.74	53.12	6301	NO.DATA	NO.DATA	RAW
58.40	59.25	WASH	1.24	9.93	26.18	62.65	7323	NO.DATA	1.0	77.00
66.70	70.10	RAW	.83	27.91	23.46	47.80	5751	NO.DATA	NO.DATA	RAW
66.70	70.10	WASH	1.16	9.22	27.05	62.57	7397	NO.DATA	1.5	67.00

ID TW-204

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
193.30	194.40	RAW	.73	22.05	27.79	49.43	6250	NO.DATA	NO.DATA	RAW
193.30	194.40	WASH	1.10	7.66	31.86	59.38	7427	NO.DATA	5.5	71.00
210.70	212.90	RAW	.78	9.52	28.12	61.58	7339	NO.DATA	NO.DATA	RAW
210.70	212.90	WASH	1.18	5.27	28.89	64.66	7690	NO.DATA	2.0	89.00
319.40	321.00	RAW	.91	16.34	28.93	53.82	6609	NO.DATA	NO.DATA	RAW
319.40	321.00	WASH	.98	8.97	29.21	60.84	7433	NO.DATA	3.0	78.00

ID TW-205

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
136.32	141.25	RAW	.66	53.67	13.89	31.78	3420	NO.DATA	NO.DATA	RAW
136.32	141.25	WASH	.61	19.26	13.70	66.43	6816	NO.DATA	.5	15.00

ID TW-206

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
189.88	193.90	RAW	.68	43.90	13.58	41.84	4433	NO.DATA	NO.DATA	RAW
189.88	193.90	WASH	.72	23.57	14.44	61.27	6422	NO.DATA	.5	35.00

ID TW-207

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
138.08	141.79	RAW	.66	65.04	14.00	20.30	2006	NO.DATA	NO.DATA	RAW
138.08	141.79	WASH	.48	11.30	19.76	68.46	7642	NO.DATA	7.0	9.00

ID TW-208

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
132.00	136.63	RAW	.55	17.93	26.96	54.56	6644	NO.DATA	NO.DATA	RAW
132.00	136.63	WASH	.97	9.75	24.70	64.58	7443	NO.DATA	4.0	75.00
217.50	223.70	RAW	.79	14.78	26.02	58.41	6980	NO.DATA	NO.DATA	RAW
217.50	223.70	WASH	.87	8.59	26.85	63.69	7556	NO.DATA	4.5	79.00
224.40	224.70	RAW	.78	25.90	24.66	48.66	5813	NO.DATA	NO.DATA	RAW
224.40	224.70	WASH	.98	12.34	26.40	60.28	7186	NO.DATA	4.5	65.00
225.90	227.20	RAW	.87	17.56	26.00	55.57	6631	NO.DATA	NO.DATA	RAW
225.90	227.20	WASH	.90	10.17	27.23	61.70	7398	NO.DATA	5.5	73.00
233.41	234.41	RAW	.69	35.18	22.11	41.81	4981	NO.DATA	NO.DATA	RAW
233.41	234.41	WASH	.86	18.57	24.86	55.71	6613	NO.DATA	3.5	78.00

ID TW-208A

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
6.34	9.58	RAW	.90	44.72	20.49	33.89	4116	.84	NO.DATA	RAW
6.34	9.58	WASH	1.14	7.46	29.05	62.35	7476	.65	2.5	48.00
10.68	11.28	RAW	.99	19.41	29.74	49.86	6393	2.97	NO.DATA	RAW
10.68	11.28	WASH	.96	10.52	30.56	57.96	7306	2.04	2.5	68.00
25.68	26.10	RAW	.87	11.23	30.15	57.75	7244	2.13	NO.DATA	RAW
25.68	26.10	WASH	.82	8.68	30.03	60.47	7505	1.74	5.0	90.00
26.50	27.08	RAW	.92	15.06	25.43	58.59	6883	2.67	NO.DATA	RAW
26.50	27.08	WASH	1.04	10.40	26.29	62.27	7281	1.69	1.0	83.00
31.56	31.90	RAW	1.40	28.34	23.57	46.69	4793	2.62	NO.DATA	RAW
31.56	31.90	WASH	1.13	13.40	30.46	55.01	7109	1.59	3.5	50.00
32.84	33.50	RAW	1.75	28.04	27.79	42.42	5462	.68	NO.DATA	RAW
32.84	33.50	WASH	1.90	10.63	29.03	58.44	7182	.81	1.5	54.00

ID TW-209

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
NDAT	NDAT	RAW	.53	68.50	15.28	15.69	1708	NO.DATA	NO.DATA	RAW
NDAT	NDAT	WASH	1.49	14.53	21.59	62.39	6823	NO.DATA	.0	14.00

ID TW-210

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
39.90	44.20	RAW	.74	17.57	25.21	56.48	6583	NO.DATA	NO.DATA	RAW
39.90	44.20	WASH	1.11	9.30	27.01	62.58	7342	NO.DATA	1.5	76.00
147.50	152.80	RAW	.57	36.54	22.48	40.41	4886	NO.DATA	NO.DATA	RAW
147.50	152.80	WASH	.93	10.51	27.19	61.37	7323	NO.DATA	5.0	46.00
158.30	158.70	RAW	.65	36.36	23.48	39.51	4718	NO.DATA	NO.DATA	RAW
158.30	158.70	WASH	.96	19.35	24.97	54.72	6472	NO.DATA	3.0	45.00
163.80	164.40	RAW	.62	46.94	20.90	31.54	3820	NO.DATA	NO.DATA	RAW
163.80	164.40	WASH	1.06	17.64	26.51	54.79	6628	NO.DATA	5.0	34.00

ID TW-211

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
18.08	21.95	RAW	.55	41.13	18.36	39.96	4640	NO.DATA	NO.DATA	RAW
18.08	21.95	WASH	.71	12.09	22.61	64.59	7471	NO.DATA	6.0	33.00
31.00	32.00	RAW	.56	42.85	18.73	37.86	4316	NO.DATA	NO.DATA	RAW
31.00	32.00	WASH	1.01	14.60	21.87	62.52	7135	NO.DATA	5.0	27.00
43.00	45.00	RAW	.85	52.96	17.49	28.70	3312	NO.DATA	NO.DATA	RAW
43.00	45.00	WASH	.99	14.25	23.25	61.51	7169	NO.DATA	7.5	15.00
48.76	50.00	RAW	.82	61.91	14.90	22.37	2354	NO.DATA	NO.DATA	RAW
48.76	50.00	WASH	1.01	16.82	22.42	59.75	6935	NO.DATA	7.5	11.00

ID TW-212

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
22.25	24.91	RAW	.83	45.90	17.83	35.44	4151	NO.DATA	NO.DATA	RAW
22.25	24.91	WASH	.92	15.25	23.41	60.42	7049	NO.DATA	1.0	46.00
36.58	38.54	RAW	.84	32.89	22.41	43.86	5218	NO.DATA	NO.DATA	RAW

ID TW-213

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
16.54	19.97	RAW	.93	16.32	26.14	56.61	6776	NO.DATA	NO.DATA	RAW
16.54	19.97	WASH	1.03	8.52	27.40	63.05	7522	NO.DATA	2.5	78.00

ID TW-214

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
178.37	179.40	RAW	.80	12.02	30.52	56.66	7354	NO.DATA	NO.DATA	RAW
178.37	179.40	WASH	.99	7.48	31.35	60.18	7770	NO.DATA	4.0	87.00
188.28	190.76	RAW	.67	35.09	21.20	43.04	5122	NO.DATA	NO.DATA	RAW
188.28	190.76	WASH	.66	9.79	26.58	62.97	7493	NO.DATA	3.0	57.00
224.50	228.40	RAW	.51	18.94	26.26	54.29	6695	NO.DATA	NO.DATA	RAW
224.50	228.40	WASH	.67	6.22	30.06	63.05	7900	NO.DATA	5.5	74.00
236.52	241.25	RAW	.63	17.85	27.05	54.37	6614	NO.DATA	NO.DATA	RAW
236.52	241.25	WASH	.56	9.83	27.72	61.89	7507	NO.DATA	4.5	68.00
244.88	245.68	RAW	.59	17.08	27.02	55.31	6686	NO.DATA	NO.DATA	RAW
244.88	245.68	WASH	.55	9.09	29.01	61.35	7479	NO.DATA	4.5	80.00
246.74	249.18	RAW	.72	33.87	22.80	42.61	5061	NO.DATA	NO.DATA	RAW
246.74	249.18	WASH	1.06	10.75	24.85	63.34	7352	NO.DATA	1.5	56.00

ID TW-215

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
79.84	80.82	RAW	.66	13.23	23.97	62.14	7283	NO.DATA	NO.DATA	RAW
79.84	80.82	WASH	.94	10.03	23.86	65.17	7625	NO.DATA	3.5	84.00

ID TW-216

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
19.91	21.05	RAW	1.04	10.61	27.92	60.43	7359	NO.DATA	NO.DATA	RAW
19.91	21.05	WASH	1.05	6.50	29.03	63.42	7715	NO.DATA	2.0	90.00
21.64	25.55	RAW	1.05	18.36	27.10	53.49	6508	NO.DATA	NO.DATA	RAW
21.64	25.55	WASH	1.21	6.86	28.30	63.63	7653	NO.DATA	2.5	72.00
27.66	29.50	RAW	.98	12.12	28.67	58.23	7160	NO.DATA	NO.DATA	RAW
27.66	29.50	WASH	1.05	6.66	29.01	63.28	7681	NO.DATA	3.5	86.00
36.12	37.18	RAW	.91	10.09	26.88	62.12	7358	NO.DATA	NO.DATA	RAW
36.12	37.18	WASH	1.11	8.25	26.49	64.15	7526	NO.DATA	1.5	91.00
48.17	52.13	RAW	.86	24.94	24.43	49.77	6083	NO.DATA	NO.DATA	RAW
48.17	52.13	WASH	1.38	10.01	27.38	61.23	7419	NO.DATA	3.0	66.00

ID TW-218

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
35.15	35.72	RAW	.87	20.60	23.89	54.64	6407	NO.DATA	NO.DATA	RAW
35.15	35.72	WASH	1.01	13.95	25.71	59.33	7018	NO.DATA	1.0	71.00
46.95	48.34	RAW	.91	9.03	25.77	64.29	7430	NO.DATA	NO.DATA	RAW
46.95	48.37	WASH	.96	5.91	27.69	65.44	7702	NO.DATA	2.0	90.00
49.56	50.08	RAW	.73	21.00	26.84	51.43	6378	NO.DATA	NO.DATA	RAW
49.56	50.08	WASH	.69	12.29	30.38	56.64	7249	NO.DATA	6.5	68.00
52.82	54.56	RAW	.74	10.15	27.98	61.13	7349	NO.DATA	NO.DATA	RAW
52.82	54.56	WASH	.77	8.41	28.53	62.29	7527	NO.DATA	2.5	91.00
59.93	61.32	RAW	.75	10.58	26.88	61.79	7373	NO.DATA	NO.DATA	RAW
59.93	61.32	WASH	.96	8.36	27.31	63.37	7567	NO.DATA	2.0	89.00
60.08	60.66	RAW	.65	19.05	26.00	54.30	6603	NO.DATA	NO.DATA	RAW
60.08	62.66	WASH	.63	10.72	27.29	61.36	7387	NO.DATA	3.5	73.00
72.48	76.01	RAW	.65	16.97	25.57	56.81	6737	NO.DATA	NO.DATA	RAW
72.48	76.01	WASH	1.03	9.53	26.41	63.03	7424	NO.DATA	2.5	76.00

ID TW-219

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
118.86	119.12	RAW	.71	42.30	NDAT	NDAT	NDAT	1.35	NO.DATA	RAW
118.86	119.12	RAW	.79	41.60	21.60	36.01	4527	1.35	NO.DATA	RAW
118.86	119.12	WASH	1.19	18.62	26.08	54.11	6629	1.29	1.0	46.00
120.16	120.76	RAW	.58	56.83	NDAT	NDAT	NDAT	.28	NO.DATA	RAW
120.16	120.76	RAW	.74	56.12	16.96	26.18	3165	.28	NO.DATA	RAW
120.16	120.76	WASH	1.33	15.44	26.70	56.53	6883	.52	1.0	30.00
123.43	124.46	RAW	.75	27.38	NDAT	NDAT	NDAT	.62	NO.DATA	RAW
123.43	124.46	RAW	.73	27.33	26.40	45.54	5682	.62	NO.DATA	RAW
123.43	124.46	WASH	1.90	13.70	27.78	56.62	6966	.62	1.0	61.00
139.39	139.85	RAW	.61	24.07	NDAT	NDAT	NDAT	3.07	NO.DATA	RAW
139.39	139.85	RAW	.60	24.37	27.04	47.99	6099	3.07	NO.DATA	RAW
139.39	139.85	WASH	.88	11.69	29.08	58.35	7288	1.88	1.0	59.00
141.39	142.42	RAW	.65	16.26	NDAT	NDAT	NDAT	.86	NO.DATA	RAW
141.39	142.42	RAW	.61	15.79	27.12	56.48	6803	.86	NO.DATA	RAW
141.39	142.42	WASH	1.19	9.21	27.28	62.32	7443	.70	1.0	79.00
144.55	144.92	RAW	.58	33.91	NDAT	NDAT	NDAT	1.85	NO.DATA	RAW
144.55	144.92	RAW	.55	33.46	27.16	38.83	4884	1.85	NO.DATA	RAW
144.55	144.92	WASH	1.17	17.00	26.30	55.53	6768	1.38	1.0	34.00
148.78	149.11	RAW	.70	38.40	NDAT	NDAT	NDAT	1.27	NO.DATA	RAW
148.78	149.11	RAW	.54	36.85	24.24	38.37	4971	1.27	NO.DATA	RAW
148.78	149.11	WASH	.88	18.89	28.60	53.39	6662	1.42	1.0	55.00
151.15	152.10	RAW	.61	15.19	NDAT	NDAT	NDAT	.66	NO.DATA	RAW
151.15	152.10	RAW	.45	14.71	29.30	55.54	6860	.66	NO.DATA	RAW
151.15	152.10	WASH	.85	8.34	29.45	61.36	7524	.60	2.5	82.00
152.57	153.68	RAW	.70	23.97	NDAT	NDAT	NDAT	.50	NO.DATA	RAW
152.57	153.68	RAW	.65	24.47	24.67	50.21	6051	.50	NO.DATA	RAW
152.57	153.68	WASH	1.05	12.99	27.10	58.86	7074	.53	1.5	72.00
154.82	155.34	RAW	.58	18.28	NDAT	NDAT	NDAT	2.89	NO.DATA	RAW
154.82	155.34	RAW	.50	17.88	28.72	52.90	6621	2.89	NO.DATA	RAW
154.82	155.34	WASH	.98	10.71	29.44	58.87	7330	1.26	2.5	78.00
275.50	277.19	RAW	.87	13.45	NDAT	NDAT	NDAT	1.50	NO.DATA	RAW
275.50	277.19	RAW	.59	13.61	28.48	57.32	7128	1.50	NO.DATA	RAW
275.50	277.19	WASH	.92	9.67	29.26	60.15	7530	.77	5.0	83.00
280.27	281.18	RAW	.75	13.46	NDAT	NDAT	NDAT	NO.DATA	NO.DATA	RAW
280.27	282.07	RAW	.43	12.04	27.87	59.66	7303	1.00	NO.DATA	RAW
280.27	282.07	WASH	.80	8.83	28.34	62.03	7562	4.79	4.5	87.00
281.30	282.07	RAW	.75	10.90	NDAT	NDAT	NDAT	NO.DATA	NO.DATA	RAW
282.54	282.78	RAW	.64	25.74	NDAT	NDAT	NDAT	.90	NO.DATA	RAW
282.54	282.78	RAW	.45	24.82	27.40	47.33	5880	.90	NO.DATA	RAW
282.54	282.78	WASH	.62	9.96	28.75	60.67	7409	.60	3.5	60.00
283.49	284.34	RAW	.70	16.94	NDAT	NDAT	NDAT	.61	NO.DATA	RAW
283.49	284.34	RAW	.50	16.63	28.49	54.38	6805	.61	NO.DATA	RAW
283.49	284.34	WASH	.61	8.46	29.83	61.10	7604	.93	6.0	63.00

ID TW-220

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
33.00	33.86	RAW	1.52	19.80	28.47	50.21	6422	2.05	NO.DATA	RAW
33.00	33.86	WASH	.99	7.62	32.77	58.62	7594	3.19	4.0	74.00
42.35	43.22	RAW	1.35	10.12	32.87	55.66	7386	2.42	NO.DATA	RAW
42.35	43.22	WASH	.99	7.46	35.05	56.50	7645	2.31	7.0	90.00
44.45	46.69	RAW	1.08	14.40	28.22	56.30	6924	1.27	NO.DATA	RAW
44.45	46.69	WASH	1.29	6.97	29.67	62.07	7628	.96	2.0	80.00
67.05	68.34	RAW	1.22	18.15	28.10	52.53	6631	1.63	NO.DATA	RAW
67.05	68.34	WASH	1.05	9.11	31.45	58.39	7473	1.73	3.5	78.00
71.86	74.19	RAW	1.47	40.54	20.18	37.81	4566	.83	NO.DATA	RAW
71.86	74.19	WASH	1.14	8.63	28.86	61.37	7475	4.48	2.0	52.00
75.00	75.54	RAW	1.10	11.26	30.15	57.49	7277	2.00	NO.DATA	RAW
75.00	75.54	WASH	1.02	6.72	32.00	60.26	7714	.48	2.5	83.00
82.14	83.95	RAW	1.30	11.67	27.84	59.19	7072	.48	NO.DATA	RAW
82.14	83.95	WASH	1.16	7.51	28.71	62.62	7568	1.80	2.0	86.00
85.24	86.30	RAW	1.26	22.02	24.04	52.68	6165	1.07	NO.DATA	RAW
85.24	86.30	WASH	1.29	11.06	26.65	61.00	7184	.61	1.0	68.00
231.20	235.44	RAW	.78	19.15	26.89	53.18	6576	1.43	NO.DATA	RAW
231.20	235.44	WASH	.77	7.72	29.74	61.77	7708	.91	6.0	71.00
236.12	237.22	RAW	1.10	16.43	27.15	55.32	6770	.37	NO.DATA	RAW
236.12	237.22	WASH	.78	7.97	29.52	61.73	7655	.41	7.5	78.00
242.80	243.85	RAW	.66	39.86	NDAT	NDAT	NDAT	.20	NO.DATA	RAW
242.80	243.85	RAW	1.13	39.71	20.43	38.73	4544	.20	NO.DATA	RAW
242.80	243.85	WASH	.85	19.47	23.93	55.75	6532	.28	2.0	35.00

ID TW-221

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
196.44	200.84	RAW	1.21	14.82	26.62	57.35	6969	3.36	NO.DATA	RAW
196.44	200.84	WASH	.69	7.16	27.91	64.24	7712	1.75	4.5	84.00
202.70	203.10	RAW	.95	26.48	26.67	45.90	5841	5.24	NO.DATA	RAW
202.70	203.10	WASH	.70	16.59	28.38	54.33	6867	1.03	6.5	66.00
210.25	212.10	RAW	1.16	24.91	25.18	48.75	5894	.35	NO.DATA	RAW
210.25	212.10	WASH	.93	11.12	27.08	60.87	7302	.40	4.0	65.00
218.60	219.10	RAW	.99	30.12	23.75	45.14	5385	.53	NO.DATA	RAW
218.60	219.10	WASH	.89	13.86	25.55	59.70	7050	.56	3.0	58.00

1D TW-222

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
16.60	17.66	RAW	1.38	16.45	27.57	54.60	6675	1.83	NO.DATA	RAW
16.60	17.66	WASH	1.38	9.38	29.65	59.59	7351	1.42	2.5	76.00
23.78	24.43	RAW	1.25	15.94	25.95	56.86	6730	4.38	NO.DATA	RAW
23.78	24.43	WASH	1.19	9.49	28.04	61.28	7346	2.38	1.0	77.00
25.70	27.24	RAW	1.17	6.67	28.94	63.22	7598	1.07	NO.DATA	RAW
25.70	27.24	WASH	1.35	5.52	29.80	63.33	7676	.96	1.5	90.00
34.17	37.14	RAW	1.54	15.57	25.96	56.93	6738	.57	NO.DATA	RAW
34.17	37.14	WASH	1.71	7.51	28.87	61.91	7438	.52	2.0	84.00
37.84	39.64	RAW	1.06	6.94	29.37	62.63	7573	.81	NO.DATA	RAW
37.84	39.64	WASH	1.27	4.63	29.64	64.46	7769	.83	2.0	92.00
56.70	57.12	RAW	1.12	16.60	27.19	55.09	6752	2.92	NO.DATA	RAW
56.70	57.12	WASH	1.51	10.99	27.91	59.59	7245	2.07	1.5	81.00
58.09	59.25	RAW	1.28	15.11	26.95	56.66	6801	1.62	NO.DATA	RAW
58.09	59.25	WASH	1.46	9.38	26.77	62.39	7348	1.03	1.5	82.00
67.14	69.99	RAW	.90	23.60	24.88	50.62	6065	.51	NO.DATA	RAW
67.14	69.99	WASH	1.25	9.59	27.09	62.07	7407	.45	1.0	73.00

ID TW-223

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
18.94	22.27	RAW	1.19	40.03	23.19	35.59	4544	1.86	NO.DATA	RAW
18.94	22.27	WASH	1.51	8.50	29.98	60.01	7447	1.52	1.5	52.00
44.96	45.36	RAW	.91	31.94	33.19	33.96	4684	2.30	NO.DATA	RAW
44.96	45.36	WASH	1.48	11.66	28.86	58.00	7214	1.58	2.5	46.00
46.00	47.92	RAW	1.20	25.99	23.51	49.30	5866	1.56	NO.DATA	RAW
46.00	47.92	WASH	1.79	10.99	25.64	61.58	7203	1.05	1.0	68.00
48.33	49.22	RAW	.99	39.84	25.82	33.35	4306	2.35	NO.DATA	RAW
48.33	49.22	WASH	1.44	10.37	27.02	61.17	7283	1.12	1.0	43.00
53.76	54.22	RAW	.92	39.19	22.70	37.19	4765	3.41	NO.DATA	RAW
53.76	54.22	WASH	1.37	18.42	26.89	53.32	6667	1.91	1.0	RAW
55.95	56.60	RAW	.93	31.56	28.41	39.10	4906	.58	NO.DATA	RAW
55.95	56.60	WASH	1.62	12.02	27.79	58.57	7121	.52	1.0	48.00
57.08	57.40	RAW	.99	17.41	26.65	54.95	6598	.82	NO.DATA	RAW
57.08	57.40	WASH	1.39	10.39	27.13	61.09	7295	.71	1.0	81.00
154.92	157.16	RAW	.84	11.21	28.31	59.64	7293	1.58	NO.DATA	RAW
154.92	157.16	WASH	.98	7.17	29.04	62.81	7680	.86	5.0	88.00
157.34	160.46	RAW	.93	21.11	26.46	51.50	6348	.76	NO.DATA	RAW
157.34	160.46	WASH	.71	10.60	28.87	59.82	7367	.52	5.0	72.00
163.05	163.94	RAW	1.41	19.57	27.87	51.15	6364	.42	NO.DATA	RAW
163.05	163.94	WASH	1.19	9.32	29.55	59.94	7475	.36	6.5	72.00

ID TW-224

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
206.98	210.80	RAW	1.01	13.11	25.98	59.90	7160	2.15	NO.DATA	RAW
206.98	210.80	WASH	.66	7.73	27.16	64.45	7654	1.27	4.5	85.00
212.28	213.25	RAW	.89	24.25	27.93	46.93	5880	.67	NO.DATA	RAW
212.28	213.25	WASH	.58	14.89	27.74	56.79	7010	.58	7.5	72.00
217.65	218.58	RAW	.65	25.80	NDAT	NDAT	NDAT	NO.DATA	NO.DATA	RAW
217.65	219.98	RAW	.59	34.50	24.16	40.75	4911	.27	NO.DATA	RAW
217.65	219.98	WASH	.79	14.19	26.25	58.77	7018	.36	4.5	53.00
218.58	218.76	RAW	.62	77.51	NDAT	NDAT	NDAT	NO.DATA	NO.DATA	RAW
218.76	219.98	RAW	.71	30.04	NDAT	NDAT	NDAT	NO.DATA	NO.DATA	RAW
223.80	224.45	RAW	.95	28.56	25.48	45.01	5354	.32	NO.DATA	RAW
223.80	224.45	WASH	.87	12.29	25.13	61.71	7181	.41	2.0	55.00

ID TW-225

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
13.62	14.10	RAW	1.10	18.77	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
13.62	14.10	RAW	1.11	18.72	28.94	51.23	6615	2.30	NO.DATA	RAW
13.62	14.10	WASH	.98	9.64	31.43	57.95	7479	1.44	4.5	74.00
14.55	15.81	RAW	.89	17.94	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
14.55	15.81	RAW	1.22	17.77	24.47	56.54	6627	2.81	NO.DATA	RAW
14.55	15.81	WASH	1.48	10.23	25.84	62.45	7302	.84	1.0	80.00
16.59	16.88	RAW	.85	27.71	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
16.59	16.88	RAW	1.12	27.90	25.80	45.18	5592	3.08	NO.DATA	RAW
16.59	16.88	WASH	1.11	9.93	26.87	62.09	7374	1.23	1.0	59.00
22.28	22.78	RAW	.81	36.32	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
22.28	22.78	RAW	.98	36.30	24.49	38.23	5050	10.28	NO.DATA	RAW
22.28	22.78	WASH	1.03	19.91	28.13	50.93	6577	1.90	1.0	51.00
24.37	25.22	RAW	.88	14.93	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
24.37	25.22	RAW	1.38	14.72	30.40	53.50	6897	1.44	NO.DATA	RAW
24.37	25.22	WASH	1.84	7.71	30.89	59.56	7541	.98	3.5	82.00
26.64	28.84	RAW	.88	41.74	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
26.64	28.84	RAW	1.34	41.39	23.20	34.07	4460	4.99	NO.DATA	RAW
26.64	28.84	WASH	1.19	13.08	30.02	55.71	7145	1.64	2.5	43.00
29.64	33.07	RAW	.74	28.34	24.93	45.99	5650	1.76	NO.DATA	RAW
29.64	33.07	WASH	1.06	9.48	28.56	60.90	7421	.63	1.0	63.00
33.68	34.27	RAW	.73	19.22	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
33.68	34.27	RAW	1.15	19.50	26.68	52.67	6323	1.19	NO.DATA	RAW
33.68	34.27	WASH	1.66	9.16	26.24	62.94	7406	.83	1.0	73.00
190.65	192.77	RAW	.68	9.41	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
190.65	192.77	RAW	1.06	9.48	28.31	61.15	7464	.56	NO.DATA	RAW
190.65	192.77	WASH	1.31	6.54	28.25	63.90	7762	.53	4.0	89.00
193.01	194.34	RAW	.97	20.67	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
193.01	194.34	RAW	.78	20.85	27.66	50.71	6415	2.49	NO.DATA	RAW
193.01	194.34	WASH	1.20	10.78	28.87	59.15	7432	1.33	3.5	67.00
271.76	273.86	RAW	.87	12.30	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
271.76	273.86	RAW	.80	12.26	27.89	59.05	7219	1.88	NO.DATA	RAW
271.76	273.86	WASH	1.13	6.53	27.59	64.75	7822	.88	4.0	85.00
274.14	274.46	RAW	.87	17.32	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
274.14	274.46	RAW	.72	17.16	30.02	52.10	6398	.73	NO.DATA	RAW
274.14	274.46	WASH	1.37	6.51	27.65	64.47	7746	.74	4.0	76.00

ID TW-226

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
145.12	146.23	RAW	.79	11.53	NDAT	NDAT	NDAT	NO.DATA	NO.DATA	RAW
145.12	147.76	RAW	.57	14.29	26.28	58.86	6999	2.71	NO.DATA	RAW
145.12	147.76	WASH	.59	8.21	26.61	64.59	7569	1.37	3.5	83.00
146.52	146.72	RAW	.74	14.33	NDAT	NDAT	NDAT	NO.DATA	NO.DATA	RAW
147.08	147.76	RAW	.56	17.42	NDAT	NDAT	NDAT	NO.DATA	NO.DATA	RAW
149.53	154.36	RAW	1.01	34.93	23.15	40.91	4974	.81	NO.DATA	RAW
149.53	154.36	WASH	.87	14.26	27.45	57.42	6945	.83	5.5	49.00
157.62	158.12	RAW	1.01	37.97	22.98	38.04	4468	.36	NO.DATA	RAW
157.62	158.12	WASH	.64	14.32	26.13	58.91	6948	.51	4.5	40.00

ID TW-227

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
10.86	11.27	RAW	1.13	15.79	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
10.86	11.27	RAW	1.40	15.67	29.35	53.58	6877	3.21	NO.DATA	RAW
10.86	11.27	WASH	1.20	11.43	31.47	55.90	7279	3.11	3.0	84.00
22.62	25.51	RAW	.75	14.36	28.30	56.32	6936	.45	NO.DATA	RAW
22.62	25.51	WASH	1.21	6.27	30.48	62.04	7655	.51	2.0	81.00
26.06	27.13	RAW	1.03	20.59	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
26.06	27.13	RAW	1.45	20.45	25.76	52.34	6400	2.18	NO.DATA	RAW
26.06	27.13	WASH	1.37	9.34	29.82	59.47	7393	1.15	1.0	79.00
29.23	29.74	RAW	.85	9.57	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
29.23	29.74	RAW	1.21	9.43	31.44	57.92	7323	1.39	NO.DATA	RAW
29.23	29.74	WASH	1.44	2.88	32.05	63.63	7974	.61	2.0	84.00
61.16	61.51	RAW	.83	26.43	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
61.16	61.51	RAW	1.05	26.01	31.66	41.28	5646	2.75	NO.DATA	RAW
61.16	61.51	WASH	1.08	15.23	29.50	54.19	6996	.70	2.5	65.00
218.24	220.12	RAW	.67	11.67	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
218.24	220.12	RAW	1.00	11.55	28.49	58.96	7313	1.41	NO.DATA	RAW
218.24	220.12	WASH	1.30	8.58	28.84	61.28	7560	1.06	6.0	88.00
221.70	227.83	RAW	.84	20.91	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
221.70	227.83	RAW	.95	20.61	26.10	52.34	6446	2.24	NO.DATA	RAW
221.70	227.83	WASH	1.11	9.44	29.31	60.14	7493	1.24	5.0	72.00
228.28	228.62	RAW	.84	36.13	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
228.28	228.62	RAW	.95	36.07	22.50	40.48	4970	.47	NO.DATA	RAW
228.28	228.62	WASH	1.28	11.01	27.51	60.20	7353	.69	6.0	46.00
229.44	230.67	RAW	.82	18.44	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
229.44	230.67	RAW	1.08	18.29	26.18	54.45	6521	.40	NO.DATA	RAW
229.44	230.67	WASH	1.32	8.51	24.82	65.35	7547	.42	5.5	72.00
236.56	237.10	RAW	.97	45.19	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
236.56	237.10	RAW	1.17	45.03	19.73	34.07	4106	.26	NO.DATA	RAW
236.56	237.10	WASH	1.43	17.57	26.97	54.03	6711	.40	4.0	28.00

1D TW-228

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
143.60	145.64	RAW	.90	10.96	NDAT	NDAT	NDAT	NO.DATA	NO.DATA	RAW
143.60	149.15	RAW	.47	21.16	25.53	52.84	6361	1.96	NO.DATA	RAW
143.60	149.15	WASH	.60	9.13	27.64	62.63	7469	1.54	4.5	74.00
145.97	146.56	RAW	.74	19.85	NDAT	NDAT	NDAT	NO.DATA	NO.DATA	RAW
146.73	149.15	RAW	.68	28.32	NDAT	NDAT	NDAT	NO.DATA	NO.DATA	RAW
150.24	151.66	RAW	.96	24.92	24.60	49.52	5911	.44	NO.DATA	RAW
150.24	151.66	WASH	.91	16.01	26.40	56.68	6790	.50	3.5	66.00

ID TW-229

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
78.60	79.20	RAW	.76	14.22	30.98	54.04	7051	3.61	NO.DATA	RAW
78.60	79.20	WASH	1.09	9.19	31.85	57.87	7494	2.26	3.5	85.00
85.99	87.13	RAW	1.07	14.38	29.37	55.18	7014	2.87	NO.DATA	RAW
85.99	87.13	WASH	1.12	7.24	31.87	59.77	7644	1.77	3.0	83.00
92.67	94.88	RAW	1.05	13.17	27.29	58.49	7101	4.12	NO.DATA	RAW
92.67	94.88	WASH	1.21	7.67	28.90	62.22	7587	1.58	1.0	84.00
97.56	97.94	RAW	1.05	6.67	30.74	61.54	7722	1.70	NO.DATA	RAW
97.56	97.94	WASH	1.22	4.03	32.23	62.52	7926	1.35	2.0	92.00
98.18	99.43	RAW	.92	17.17	27.90	54.01	6685	3.10	NO.DATA	RAW
98.18	99.43	WASH	1.52	7.22	29.23	62.03	7540	.91	1.0	79.00
105.06	107.90	RAW	1.06	18.34	25.49	55.11	6554	.49	NO.DATA	RAW
105.06	107.90	WASH	1.40	7.71	28.79	62.10	7509	.59	1.0	77.00
109.26	109.55	RAW	.91	19.92	27.44	51.73	6415	1.96	NO.DATA	RAW
109.26	109.55	WASH	1.23	8.88	30.26	59.63	7439	1.27	1.5	79.00
109.76	110.08	RAW	1.00	11.72	27.61	59.67	7232	1.14	NO.DATA	RAW
109.76	110.08	WASH	1.05	9.99	29.38	59.58	7391	.95	2.5	93.00
122.39	123.74	RAW	1.02	13.31	26.98	58.69	7059	1.20	NO.DATA	RAW
122.39	123.74	WASH	1.29	9.70	27.24	61.77	7388	NO.DATA	1.0	86.00
123.74	123.93	RAW	1.07	80.16	8.75	10.02	741	4.93	NO.DATA	RAW
123.74	123.93	WASH	NO.DATA	NO.DATA	NDAT	NDAT	NDAT	NO.DATA	.0	.00
123.93	125.48	RAW	.79	29.25	23.64	46.32	5576	1.42	NO.DATA	RAW
123.93	125.48	WASH	1.35	11.03	26.46	61.16	7253	.78	1.0	64.00
131.36	132.55	RAW	.90	18.57	28.13	52.40	6637	1.42	NO.DATA	RAW
131.36	132.55	WASH	1.26	11.62	29.91	57.21	7263	1.26	3.0	84.00
142.47	144.79	RAW	.85	31.55	23.46	44.14	5415	3.87	NO.DATA	RAW
142.47	144.79	WASH	1.24	15.78	26.99	55.99	6854	2.04	1.0	50.00
145.76	146.78	RAW	.81	25.12	25.35	48.72	6032	1.37	NO.DATA	RAW
145.76	146.78	WASH	1.25	7.37	28.70	62.68	7612	1.27	2.0	62.00
162.29	163.32	RAW	.88	16.02	25.54	57.56	6794	1.39	NO.DATA	RAW
162.29	163.32	WASH	1.18	10.19	26.21	62.42	7345	1.14	1.0	79.00
163.64	163.95	RAW	.87	20.66	23.58	54.89	6380	1.56	NO.DATA	RAW
163.64	163.95	WASH	1.29	11.20	25.14	62.37	7214	1.37	1.5	77.00
170.77	171.30	RAW	.72	29.68	24.88	44.72	5450	.48	NO.DATA	RAW
170.77	171.30	WASH	.92	14.21	27.47	57.40	6954	.52	1.5	64.00
173.27	174.89	RAW	.86	12.27	27.14	59.73	7123	.49	NO.DATA	RAW
173.27	174.89	WASH	1.36	3.97	29.68	64.99	7120	.53	1.5	81.00
182.59	183.14	RAW	.97	23.08	25.20	50.75	6151	.81	NO.DATA	RAW
182.59	183.14	WASH	1.13	13.10	26.84	58.93	7091	.62	1.0	71.00
183.54	183.70	RAW	.88	85.86	8.49	4.77	NDAT	.21	NO.DATA	RAW
183.54	183.70	WASH	NO.DATA	NO.DATA	NDAT	NDAT	NDAT	NO.DATA	.0	.00
183.70	184.36	RAW	.82	62.74	15.76	20.68	2286	.58	NO.DATA	RAW
183.70	184.36	WASH	1.00	15.42	25.87	57.71	6904	.67	1.0	20.00
184.51	184.88	RAW	.79	87.84	8.49	2.88	NDAT	.15	NO.DATA	RAW
184.51	184.88	WASH	NO.DATA	NO.DATA	NDAT	NDAT	NDAT	NO.DATA	.0	.00
184.88	186.30	RAW	.61	53.34	18.26	27.79	3457	.62	NO.DATA	RAW
184.88	186.30	WASH	1.18	16.91	25.86	56.05	6797	.73	1.0	33.00
188.50	189.56	RAW	.61	14.31	28.74	56.34	6920	.59	NO.DATA	RAW
188.50	189.56	WASH	1.04	8.41	28.92	61.63	7525	.53	2.5	80.00
190.14	199.90	RAW	.64	36.62	21.36	41.38	4934	.32	NO.DATA	RAW
190.14	199.90	WASH	1.15	15.41	25.08	58.36	6907	.43	1.0	49.00

ID TW-231

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
97.79	98.97	RAW	1.30	28.34	24.54	45.82	5529	3.96	NO.DATA	RAW
97.79	98.97	WASH	1.29	9.28	27.24	62.19	7330	2.37	1.5	64.00
105.58	105.90	RAW	1.48	24.80	22.79	50.93	5877	6.84	NO.DATA	RAW
105.58	105.90	WASH	1.05	11.20	24.66	63.09	7155	3.89	1.0	63.00
106.60	107.24	RAW	1.12	20.99	25.59	52.30	6093	1.08	NO.DATA	RAW
106.60	107.24	WASH	1.41	8.94	25.27	64.38	7394	1.05	2.0	69.00
109.71	110.24	RAW	1.20	20.94	25.66	52.20	6198	3.47	NO.DATA	RAW
109.71	110.24	WASH	1.22	7.06	26.36	65.36	7549	2.25	1.5	67.00
115.57	117.56	RAW	1.24	17.04	21.82	59.90	6652	1.07	NO.DATA	RAW
115.57	117.56	WASH	1.23	11.36	23.35	64.06	7125	1.10	1.0	81.00
135.01	135.44	RAW	1.21	26.92	23.56	48.31	5703	5.05	NO.DATA	RAW
135.01	135.44	WASH	1.10	8.74	25.91	64.25	7431	2.83	2.5	60.00
144.99	148.22	RAW	1.03	15.53	24.74	58.70	6751	1.37	NO.DATA	RAW
144.99	148.22	WASH	1.47	6.47	27.06	65.00	7578	.94	1.5	82.00
148.92	149.34	RAW	1.05	19.46	21.37	58.12	6422	.55	NO.DATA	RAW
148.92	149.34	WASH	1.52	9.34	23.05	66.09	7299	.59	1.0	79.00
166.17	167.14	RAW	1.10	11.32	22.89	64.69	7258	1.03	NO.DATA	RAW
166.17	167.14	WASH	1.27	7.40	23.66	67.67	7577	.80	1.0	86.00
169.28	170.23	RAW	1.04	49.00	17.96	32.00	3754	2.58	NO.DATA	RAW
169.28	170.23	WASH	.81	17.29	24.74	57.16	6759	1.31	4.0	26.00
170.89	171.16	RAW	.96	30.08	21.33	47.63	5469	1.80	NO.DATA	RAW
170.89	171.16	WASH	.80	14.13	22.67	62.40	7079	1.29	2.0	65.00
176.74	178.90	RAW	.98	28.63	21.53	48.86	5643	1.52	NO.DATA	RAW
176.74	178.90	WASH	.79	9.16	25.36	64.49	7462	1.41	2.5	68.00
179.83	180.26	RAW	.74	38.84	19.61	40.81	4621	.54	NO.DATA	RAW
179.83	180.26	WASH	.86	13.62	24.20	61.32	7018	.70	1.0	45.00
181.01	182.11	RAW	1.03	11.13	24.23	63.61	7182	.60	NO.DATA	RAW
181.01	182.11	WASH	1.47	8.18	24.54	65.81	7498	.77	1.5	89.00
305.76	306.68	RAW	.89	19.69	26.44	52.98	6700	3.95	NO.DATA	RAW
305.76	306.68	WASH	.69	11.13	28.67	59.51	7536	1.80	5.0	76.00
306.98	307.99	RAW	.89	43.44	20.43	35.24	4380	2.31	NO.DATA	RAW
306.98	307.99	WASH	.75	14.87	26.59	57.79	7176	.95	3.5	27.00
309.64	310.45	RAW	.91	44.49	22.25	32.35	4319	3.59	NO.DATA	RAW
309.64	310.45	WASH	.59	17.56	30.44	51.41	6964	2.29	6.5	42.00
313.98	314.98	RAW	.85	38.15	21.54	39.46	4820	2.69	NO.DATA	RAW
313.98	314.98	WASH	.70	18.14	28.21	52.95	6809	1.62	6.0	40.00

ID TW-232

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
10.99	12.73	RAW	1.23	13.80	28.08	56.89	6967	1.48	NO.DATA	RAW
10.99	12.73	WASH	1.29	8.73	29.17	60.81	7390	1.11	1.0	82.00
31.95	33.34	RAW	.88	34.57	23.96	40.59	5128	5.83	NO.DATA	RAW
31.95	33.34	WASH	1.48	7.04	31.36	60.12	7570	1.41	4.0	59.00
46.04	48.10	RAW	.91	19.75	26.67	52.67	6392	2.19	NO.DATA	RAW
46.04	48.10	WASH	1.55	9.55	29.19	59.71	7323	1.56	1.5	77.00
52.60	55.72	RAW	.92	44.94	20.09	34.05	4176	.59	NO.DATA	RAW
52.60	55.72	WASH	1.47	6.83	29.22	62.48	7605	.53	1.0	43.00
58.24	58.65	RAW	.99	19.25	28.28	51.48	6282	1.86	NO.DATA	RAW
58.24	58.65	WASH	1.47	10.96	27.56	60.01	7238	1.12	1.0	75.00
60.35	62.40	RAW	1.20	15.36	27.54	55.90	6835	1.39	NO.DATA	RAW
60.35	62.40	WASH	1.38	4.87	30.54	63.21	7761	1.13	3.5	82.00
73.24	74.36	RAW	1.02	22.03	27.03	49.92	6305	4.11	NO.DATA	RAW
73.24	74.36	WASH	1.19	10.18	31.07	57.56	7339	2.92	4.0	66.00
90.73	94.44	RAW	1.40	27.43	24.10	47.07	5723	1.85	NO.DATA	RAW
90.73	94.44	WASH	1.43	7.48	28.61	62.48	7539	.75	2.0	60.00
97.07	97.72	RAW	.89	39.52	20.79	38.80	4611	.38	NO.DATA	RAW
97.07	97.72	WASH	1.56	6.91	27.60	63.93	7517	.46	2.0	60.00
152.70	153.10	RAW	.78	24.34	28.90	45.98	5980	5.86	NO.DATA	RAW
152.70	153.10	WASH	.99	7.39	32.66	58.96	7622	1.87	6.5	61.00
154.51	157.24	RAW	.97	14.10	27.39	57.54	6995	1.62	NO.DATA	RAW
154.51	157.24	WASH	1.21	6.92	28.05	63.82	7663	.92	2.0	83.00
171.15	172.56	RAW	1.02	48.34	18.94	31.70	3890	1.15	NO.DATA	RAW
171.15	172.56	WASH	1.15	9.73	28.22	60.90	7429	1.31	2.5	46.00
178.25	178.59	RAW	1.09	13.43	28.83	56.65	7156	1.65	NO.DATA	RAW
178.25	178.59	WASH	.89	6.24	30.71	62.16	7790	1.23	3.5	86.00
178.90	179.62	RAW	1.11	20.39	24.89	53.61	6354	1.83	NO.DATA	RAW
178.90	179.62	WASH	.98	11.19	26.07	61.76	7271	1.00	1.0	75.00
179.62	179.97	RAW	1.00	54.09	17.89	27.02	3338	2.27	NO.DATA	RAW
179.62	179.97	WASH	.89	20.73	26.01	52.37	6450	1.08	1.0	32.00
179.97	181.79	RAW	1.10	7.39	27.55	63.96	7614	.79	NO.DATA	RAW
179.97	181.79	WASH	1.33	4.58	27.98	66.11	7860	.67	1.5	86.00
290.67	290.92	RAW	.76	33.06	26.98	39.20	5315	1.78	NO.DATA	RAW
290.67	290.92	WASH	.62	11.05	28.00	60.34	7395	1.59	3.5	58.00
291.15	292.28	RAW	.75	24.12	24.10	51.03	6089	1.81	NO.DATA	RAW
291.15	292.28	WASH	.96	13.47	25.07	60.50	7095	1.45	2.0	76.00
306.55	307.05	RAW	.76	44.12	19.91	35.21	4199	.30	NO.DATA	RAW
306.55	307.05	WASH	.84	17.37	25.96	55.83	6735	.36	5.5	29.00
346.95	347.30	RAW	.88	44.66	21.38	33.08	4034	.60	NO.DATA	RAW
346.95	347.30	WASH	.99	17.63	27.09	54.29	6693	.42	7.5	30.00
347.85	348.35	RAW	1.00	57.67	18.80	22.53	2677	.20	NO.DATA	RAW
347.85	348.35	WASH	1.05	11.40	27.04	60.51	7275	.53	7.0	18.00
349.03	349.30	RAW	1.02	45.98	21.80	31.20	3878	.42	NO.DATA	RAW
349.03	349.30	WASH	.97	16.69	27.69	54.65	6795	.61	4.5	32.00

ID TW-234

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
21.76	28.40	RAW	1.14	9.08	29.82	59.96	7466	1.64	NO.DATA	RAW
21.76	28.40	WASH	1.49	5.46	31.10	61.95	7704	1.09	6.0	91.00
29.89	36.16	RAW	.96	16.54	27.50	55.00	6752	2.06	NO.DATA	RAW
29.89	36.16	WASH	1.42	5.35	29.31	63.92	7720	1.05	3.0	79.00
44.50	45.58	RAW	.94	15.64	24.04	59.38	6878	1.67	NO.DATA	RAW
44.50	45.58	WASH	1.83	7.40	25.31	65.46	7530	1.11	1.5	82.00
46.60	47.04	RAW	.86	26.95	21.07	51.12	5806	2.31	NO.DATA	RAW
46.60	47.04	WASH	1.61	14.54	21.83	62.02	6894	1.84	1.0	62.00
57.86	58.24	RAW	.78	31.83	24.49	42.90	5329	1.91	NO.DATA	RAW
57.86	58.24	WASH	1.24	12.45	27.97	58.34	7146	1.98	2.0	59.00
178.30	180.36	RAW	.77	17.06	25.32	56.85	6740	2.08	NO.DATA	RAW
178.30	180.36	WASH	1.08	7.57	26.08	65.27	7630	1.15	2.5	76.00

ID TW-235

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
116.38	117.00	RAW	.60	52.78	16.79	29.83	3388	2.82	NO.DATA	RAW
116.38	117.00	WASH	1.36	12.85	24.96	60.83	6974	.95	1.5	28.00
134.92	135.65	RAW	1.37	13.23	25.50	59.90	6934	.87	NO.DATA	RAW
134.92	135.65	WASH	1.59	5.06	27.39	65.96	7622	.55	1.5	91.00
136.07	137.44	RAW	1.06	29.05	23.43	46.46	5518	3.33	NO.DATA	RAW
136.07	137.44	WASH	1.13	11.53	28.02	59.32	7137	2.01	1.0	60.00
154.68	155.12	RAW	.74	42.16	29.62	27.48	3831	1.55	NO.DATA	RAW
154.68	155.12	WASH	.93	19.26	28.42	51.39	6616	2.04	3.0	26.00
155.27	157.43	RAW	.97	62.89	15.71	20.43	2274	1.68	NO.DATA	RAW
155.27	157.43	WASH	1.24	16.75	28.66	53.35	6741	1.10	2.0	20.00
167.96	168.16	RAW	.81	37.02	23.95	38.22	4940	6.00	NO.DATA	RAW
167.96	168.16	WASH	.89	19.06	27.45	52.60	6659	2.93	1.5	45.00
168.61	169.32	RAW	.74	27.52	26.08	45.66	5585	.76	NO.DATA	RAW
168.61	169.32	WASH	1.23	14.29	26.90	57.58	6940	.94	1.0	68.00
169.56	169.94	RAW	.72	25.71	22.53	51.04	5945	.38	NO.DATA	RAW
169.56	169.94	WASH	1.22	14.85	23.44	60.49	6907	.51	1.5	71.00
173.40	174.24	RAW	.75	28.93	22.50	47.82	5622	.45	NO.DATA	RAW
173.40	174.24	WASH	1.49	15.66	24.35	58.50	6825	.46	1.0	69.00
174.68	175.02	RAW	.73	36.92	22.99	39.36	4855	.57	NO.DATA	RAW
174.68	175.02	WASH	1.19	20.82	24.45	53.54	6415	.57	1.0	55.00
175.64	176.20	RAW	.96	38.73	19.50	40.81	4629	5.23	NO.DATA	RAW
175.64	176.20	WASH	.96	15.47	24.96	58.61	6843	2.45	1.0	47.00

ID TW-237

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
128.84	131.29	RAW	.95	14.41	25.10	59.54	6904	2.66	NO.DATA	RAW
128.84	131.29	WASH	1.01	7.56	26.07	65.36	7589	1.64	2.5	82.00
133.60	133.93	RAW	.80	29.31	26.37	53.52	5569	8.64	NO.DATA	RAW
133.60	133.93	WASH	.74	16.05	28.89	54.32	6902	4.48	7.5	56.00
134.84	135.78	RAW	.93	23.91	25.00	50.16	6081	2.35	NO.DATA	RAW
134.84	135.78	WASH	.96	14.88	27.03	57.13	6960	1.36	6.0	69.00
136.53	136.83	RAW	.76	20.55	28.19	50.50	6278	3.92	NO.DATA	RAW
136.53	136.83	WASH	.80	10.13	28.51	60.56	7402	2.97	7.0	68.00
136.83	138.04	RAW	.82	32.62	22.64	43.92	5221	3.56	NO.DATA	RAW
136.83	138.04	WASH	.71	10.79	27.06	61.44	7300	2.34	4.5	54.00
139.34	142.71	RAW	.81	42.10	21.03	36.06	4329	.34	NO.DATA	RAW
139.34	142.71	WASH	1.03	14.12	26.06	58.79	6969	.52	3.0	40.00

ID TW-239

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
40.76	42.94	RAW	1.02	12.97	28.23	57.78	7161	1.89	NO.DATA	RAW
40.76	42.94	WASH	.85	6.28	29.86	63.01	7750	1.44	4.0	83.00
43.99	45.74	RAW	.93	21.86	27.57	49.64	6298	3.44	NO.DATA	RAW
43.99	45.74	WASH	.75	11.89	31.35	55.91	7304	2.46	6.5	74.00
47.63	48.07	RAW	.93	25.89	27.42	45.76	5908	1.03	NO.DATA	RAW
47.63	48.07	WASH	.94	16.00	29.52	53.54	6860	.29	6.5	68.00
49.14	50.46	RAW	1.31	19.12	26.47	53.10	6509	.45	NO.DATA	RAW
49.14	50.46	WASH	1.28	13.85	27.67	57.20	7004	.46	4.0	84.00
56.56	57.14	RAW	1.13	36.32	22.57	39.98	4839	.36	NO.DATA	RAW
56.56	57.14	WASH	1.17	16.74	26.24	55.85	6734	.48	1.5	48.00
89.75	90.19	RAW	1.05	42.82	27.50	28.63	3574	.62	NO.DATA	RAW
89.75	90.19	WASH	1.05	14.70	28.37	55.80	6890	.93	6.5	29.00

ID TW-241

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
8.80	8.96	RAW	.69	50.53	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
8.80	8.96	RAW	.85	50.09	24.47	24.59	3035	.41	NO.DATA	RAW
8.80	8.96	WASH	NO.DATA	NO.DATA	NDAT	NDAT	NDAT	NO.DATA	.0	.00
10.82	11.10	RAW	.81	15.08	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
10.82	11.10	RAW	1.12	15.30	27.90	55.68	6903	1.14	NO.DATA	RAW
10.82	11.10	WASH	1.09	11.18	27.63	60.10	7274	.95	1.0	88.00
12.04	12.24	RAW	.88	23.90	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
12.04	12.24	RAW	1.24	23.78	24.30	50.68	6070	4.20	NO.DATA	RAW
12.04	12.24	WASH	1.25	12.90	26.14	59.71	7065	1.37	1.0	73.00
15.27	15.55	RAW	.56	31.34	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
15.27	15.55	RAW	.89	31.51	33.20	34.40	4738	1.81	NO.DATA	RAW
15.27	15.55	WASH	1.06	11.08	29.61	58.25	7262	1.64	1.0	32.00
16.70	16.90	RAW	1.31	35.11	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
16.70	16.90	RAW	1.37	35.92	24.58	38.13	4813	4.02	NO.DATA	RAW
16.70	16.90	WASH	1.20	13.52	27.63	57.65	6995	3.17	1.0	45.00
28.14	28.70	RAW	.98	32.27	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
28.14	30.82	RAW	.99	25.88	28.12	45.01	5593	.85	NO.DATA	RAW
28.14	30.82	WASH	1.60	7.80	27.31	63.29	7455	.74	1.0	59.00
29.01	29.47	RAW	1.13	31.52	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
29.71	30.82	RAW	1.08	27.15	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
31.06	31.90	RAW	1.02	25.32	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
31.06	31.90	RAW	1.34	25.42	24.45	48.79	5810	.52	NO.DATA	RAW
31.06	31.90	WASH	1.38	13.77	25.52	59.33	6936	.38	1.0	70.00
32.68	32.96	RAW	.91	30.98	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
32.68	32.96	RAW	1.17	31.34	27.15	40.34	4921	.50	NO.DATA	RAW
32.68	32.96	WASH	1.34	17.62	26.38	54.66	6565	.54	1.0	41.00
34.56	35.08	RAW	.84	17.03	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
34.56	35.08	RAW	1.10	17.44	27.03	54.43	6559	1.32	NO.DATA	RAW
34.56	35.08	WASH	1.40	10.62	25.93	62.05	7278	.99	1.0	86.00

ID TW-243

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
18.96	20.18	RAW	1.05	17.31	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
18.96	20.18	RAW	1.43	17.25	26.33	54.99	6601	2.07	NO.DATA	RAW
18.96	20.18	WASH	1.43	8.98	27.79	61.80	7372	1.45	1.0	80.00
36.10	37.64	RAW	1.14	13.34	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
36.10	37.64	RAW	1.41	13.45	27.42	57.72	6968	.54	NO.DATA	RAW
36.10	37.64	WASH	1.47	5.62	29.29	63.62	7681	.56	2.0	84.00
38.14	38.96	RAW	.98	19.25	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
38.14	38.96	RAW	1.19	19.20	26.10	53.51	6495	2.20	NO.DATA	RAW
38.14	38.96	WASH	1.35	11.64	27.80	59.21	7223	.78	1.0	78.00
39.52	40.28	RAW	1.05	22.37	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
39.52	40.28	RAW	1.15	22.20	24.22	52.43	6257	1.79	NO.DATA	RAW
39.52	40.28	WASH	1.42	12.63	26.83	59.12	7101	1.27	1.0	72.00
43.88	44.39	RAW	.86	9.81	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
43.88	44.39	RAW	1.12	9.95	30.55	58.38	7414	1.67	NO.DATA	RAW
43.88	44.39	WASH	1.03	6.54	32.00	60.43	7728	1.53	2.5	85.00
62.76	63.08	RAW	.89	45.70	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
62.76	63.08	RAW	1.06	45.78	20.96	32.20	3993	.93	NO.DATA	RAW
62.76	63.08	WASH	1.42	8.34	28.52	61.72	7481	.82	1.0	42.00
65.62	66.35	RAW	.93	31.51	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
65.62	66.35	RAW	1.12	31.52	23.99	43.37	5232	.57	NO.DATA	RAW
65.62	66.35	WASH	1.19	12.56	26.69	59.56	7065	.58	1.0	58.00
67.74	68.00	RAW	.76	35.33	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
67.74	68.00	RAW	.98	35.68	25.74	37.60	4623	.72	NO.DATA	RAW
67.74	68.00	WASH	1.30	21.03	25.60	52.07	6359	.61	1.0	45.00
68.65	69.26	RAW	.66	19.54	NDAT	NDAT	NDAT	NO.DATA	.0	RAW
68.65	69.26	RAW	1.13	19.93	25.41	53.53	6412	3.11	NO.DATA	RAW
68.65	69.26	WASH	1.18	11.60	25.99	71.67	7176	1.16	1.0	77.00

ID TW-244

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
68.26	69.36	RAW	.84	16.30	26.78	56.08	6615	1.67	NO.DATA	RAW
68.26	69.36	WASH	1.13	9.57	25.01	64.29	7389	1.19	2.0	82.00
70.60	71.12	RAW	1.02	22.12	26.96	49.90	6101	1.95	NO.DATA	RAW
70.60	71.12	WASH	1.02	9.97	24.89	64.12	7370	1.38	1.5	67.00
71.54	71.98	RAW	.97	25.99	28.99	44.05	5510	1.90	NO.DATA	RAW
71.54	71.98	WASH	NO.DATA	NO.DATA	NDAT	NDAT	NDAT	NO.DATA	NO.DATA	RAW
76.60	78.32	RAW	.68	27.17	31.47	40.68	5219	1.57	NO.DATA	RAW
76.60	78.32	WASH	.96	12.46	27.37	59.21	7170	1.64	2.0	51.00
79.75	80.48	RAW	.78	20.45	26.58	52.19	6445	5.08	NO.DATA	RAW
79.75	80.48	WASH	.89	8.03	29.61	61.47	7582	1.39	4.0	77.00
82.52	84.06	RAW	.69	21.08	27.48	50.75	6295	2.13	NO.DATA	RAW
82.52	84.06	WASH	.71	9.57	27.64	62.08	7468	1.65	3.5	77.00
87.97	88.30	RAW	.77	33.35	20.48	45.40	5189	.67	NO.DATA	RAW
87.97	88.30	WASH	1.21	17.06	23.88	57.85	6676	.54	1.0	59.00

ID TW-245

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
41.67	42.42	RAW	1.19	22.91	27.37	48.53	6160	3.22	NO.DATA	RAW
41.67	42.42	WASH	1.23	9.92	31.47	57.38	7367	2.18	1.5	75.00
49.72	50.73	RAW	.95	13.97	32.72	52.36	7044	3.75	NO.DATA	RAW
49.72	50.73	WASH	1.22	6.90	34.87	57.01	7703	2.17	4.5	76.00
63.71	64.70	RAW	.87	11.83	34.37	52.93	7267	2.24	NO.DATA	RAW
63.71	64.70	WASH	1.08	6.29	36.97	55.66	7790	1.69	7.0	87.00
66.55	67.74	RAW	.85	11.85	33.12	54.18	7239	2.07	NO.DATA	RAW
66.55	67.74	WASH	1.23	6.92	35.21	56.64	7690	1.67	6.0	84.00
69.88	72.16	RAW	.92	9.97	30.24	58.87	7331	2.11	NO.DATA	RAW
69.88	72.16	WASH	1.24	6.91	30.66	61.19	7642	1.47	1.0	90.00
76.64	78.99	RAW	.74	15.14	28.83	55.29	6848	1.83	NO.DATA	RAW
76.64	78.99	WASH	1.13	7.28	29.56	62.03	7591	1.08	1.5	80.00
118.55	119.76	RAW	.85	16.86	28.57	53.72	6774	2.58	NO.DATA	RAW
118.55	119.76	WASH	1.28	7.06	30.47	61.18	7675	1.76	3.5	76.00
125.51	125.78	RAW	.73	13.15	30.13	55.99	7142	1.59	NO.DATA	RAW
125.51	125.78	WASH	1.07	4.97	31.80	62.16	7868	1.25	2.0	79.00
126.11	128.32	RAW	.62	12.33	27.87	59.18	7115	.69	NO.DATA	RAW
126.11	128.32	WASH	1.40	7.55	27.46	63.59	7537	.66	1.0	86.00
149.60	149.95	RAW	.85	42.12	23.41	33.62	4530	2.31	NO.DATA	RAW
149.60	149.95	WASH	.84	17.39	29.97	51.80	6907	1.47	6.0	39.00
151.31	152.55	RAW	.70	13.35	27.30	58.65	7072	.95	NO.DATA	RAW
151.31	152.55	WASH	1.11	8.71	27.33	62.85	7545	.79	1.0	85.00
153.39	154.29	RAW	.90	37.11	22.64	39.35	4906	2.24	NO.DATA	RAW
153.39	154.29	WASH	.93	9.91	28.30	60.86	7453	1.09	1.0	50.00
157.55	158.03	RAW	.65	29.98	27.30	42.07	5602	2.28	NO.DATA	RAW
157.55	158.03	WASH	.82	15.92	29.57	53.69	6987	1.73	2.5	62.00
158.36	162.74	RAW	1.02	28.29	26.31	44.38	5622	.86	NO.DATA	RAW
158.36	162.74	WASH	1.05	6.96	29.84	62.15	7671	.68	2.5	60.00
163.41	163.99	RAW	.71	37.71	24.47	37.11	4691	.98	NO.DATA	RAW
163.41	163.99	WASH	.92	14.06	27.66	57.36	7020	.62	2.0	47.00
165.32	165.72	RAW	.75	63.46	19.76	16.03	2214	.58	NO.DATA	RAW
165.32	165.72	WASH	1.08	21.49	29.12	48.31	6395	.84	6.5	13.00
166.40	166.90	RAW	.76	17.79	26.69	54.76	6719	1.37	NO.DATA	RAW
166.40	166.90	WASH	1.05	12.56	27.11	59.28	7157	1.03	1.0	83.00

ID TW-246

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
79.82	82.22	RAW	.72	18.04	25.74	55.50	6485	1.26	NO.DATA	RAW
79.82	82.22	WASH	1.25	9.60	25.57	63.58	7358	1.10	1.0	75.00
88.63	91.67	RAW	.63	22.25	27.53	49.59	6038	1.21	NO.DATA	RAW
88.63	91.67	WASH	1.38	9.90	28.13	60.59	7311	1.32	2.5	69.00
94.68	96.75	RAW	.74	36.90	28.12	34.24	4539	2.32	NO.DATA	RAW
94.68	96.75	WASH	1.05	11.03	26.76	61.16	7262	1.43	2.5	46.00
101.68	102.10	RAW	.86	35.93	19.62	43.59	5064	.46	NO.DATA	RAW
101.68	102.10	WASH	1.23	20.41	22.94	55.42	6420	.54	1.5	45.00
105.20	105.91	RAW	.71	39.38	23.78	36.13	4413	.68	NO.DATA	RAW
105.20	105.91	WASH	1.04	15.27	25.74	57.95	6958	.70	2.5	43.00

ID TW-247

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
115.16	115.70	RAW	.85	15.02	31.03	53.10	6952	2.50	NO.DATA	RAW
115.16	115.70	WASH	1.07	10.03	30.75	58.15	7454	2.12	1.5	86.00
120.55	121.56	RAW	1.00	13.48	32.33	53.19	7126	2.74	NO.DATA	RAW
120.55	121.56	WASH	1.29	7.59	33.17	57.95	7633	1.79	5.0	83.00
123.30	124.12	RAW	.88	17.23	30.74	51.15	6494	1.95	NO.DATA	RAW
123.30	124.12	WASH	1.34	5.91	30.38	62.37	7743	1.19	3.5	73.00
145.04	146.31	RAW	.87	18.89	27.45	52.79	6491	2.49	NO.DATA	RAW
145.04	146.31	WASH	1.30	8.30	28.54	61.86	7484	1.39	2.5	77.00
154.06	157.12	RAW	.70	18.84	25.60	54.86	6469	.68	NO.DATA	RAW
154.06	157.12	WASH	1.24	7.72	27.72	63.32	7511	.74	1.0	81.00
182.27	182.61 NDAT	RAW	.75	20.84	24.31	54.10	6492	3.35	NO.DATA	RAW
182.27	NDAT	WASH	1.20	11.53	25.21	62.06	7324	1.66	1.0	79.00
191.25	191.84	RAW	.80	38.84	26.34	34.02	4541	5.50	NO.DATA	RAW
191.25	191.84	WASH	1.09	14.65	27.85	56.41	7012	3.54	1.0	37.00
193.29	194.20	RAW	.86	21.15	25.05	52.94	6339	.76	NO.DATA	RAW
193.29	194.20	WASH	1.10	10.39	26.61	61.90	7375	.65	1.0	75.00
194.98	196.53	RAW	.82	12.10	27.16	59.92	7218	1.67	NO.DATA	RAW
194.98	196.53	WASH	1.00	8.63	26.71	63.66	7539	1.03	1.0	89.00
199.44	199.84	RAW	.58	31.32	30.23	36.87	4913	1.57	NO.DATA	RAW
199.44	199.84	WASH	1.01	12.60	28.20	58.19	7238	1.31	1.0	46.00
203.73	204.38	RAW	.62	24.12	27.39	47.87	6135	.92	NO.DATA	RAW
203.73	204.38	WASH	.94	14.82	28.74	55.50	7065	1.51	1.0	78.00
204.78	206.43	RAW	.78	19.84	27.75	51.63	6488	.93	NO.DATA	RAW
204.78	206.43	WASH	1.02	8.69	29.52	60.77	7562	.89	3.5	77.00
207.94	208.36	RAW	.80	33.52	22.82	42.86	5173	.40	NO.DATA	RAW
207.94	208.36	WASH	1.01	14.49	26.40	58.10	6995	.40	1.5	56.00
211.80	212.10	RAW	.85	35.19	21.43	42.53	4980	.53	NO.DATA	RAW
211.80	212.10	WASH	1.05	17.34	24.09	55.52	6784	.65	1.0	56.00

ID TW-249

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
151.95	152.45	RAW	1.53	29.77	25.24	43.46	5500	3.16	NO.DATA	RAW
151.95	152.45	WASH	.88	12.81	29.13	57.18	7098	2.01	1.0	61.00
156.74	157.66	RAW	.90	16.40	29.18	53.52	6904	5.79	NO.DATA	RAW
156.74	157.66	WASH	.60	8.63	33.37	57.40	7612	2.21	4.0	80.00
161.38	163.29	RAW	1.02	11.55	28.84	58.59	7232	1.84	NO.DATA	RAW
161.38	163.29	WASH	.71	6.32	29.95	63.02	7718	1.49	1.5	87.00
180.50	181.97	RAW	1.04	16.65	29.00	53.31	6745	2.07	NO.DATA	RAW
180.50	181.97	WASH	.57	8.52	30.96	59.95	7577	1.67	5.0	78.00
189.94	192.20	RAW	.92	12.31	27.07	59.70	7108	.64	NO.DATA	RAW
189.94	192.20	WASH	1.53	7.17	27.83	63.47	7571	.55	1.5	86.00
192.91	193.84	RAW	.91	12.93	27.75	58.41	7166	1.11	NO.DATA	RAW
192.91	193.84	WASH	1.37	9.78	28.21	60.64	7421	1.03	2.0	89.00
194.58	195.21	RAW	.85	11.57	28.30	59.28	7239	1.22	NO.DATA	RAW
194.58	195.21	WASH	1.34	5.10	28.80	64.76	7824	1.18	1.0	53.00
212.78	214.83	RAW	.95	27.29	23.13	48.63	5806	1.47	NO.DATA	RAW
212.78	214.83	WASH	1.56	10.28	26.17	61.99	7358	1.05	1.0	72.00
220.13	221.17	RAW	.66	24.98	27.37	46.99	5961	1.90	NO.DATA	RAW
220.13	221.17	WASH	1.12	12.86	28.56	57.46	7197	1.49	3.5	70.00
228.91	229.55	RAW	.91	43.52	19.31	36.26	4348	NO.DATA	NO.DATA	RAW
228.91	229.55	WASH	1.30	14.07	24.08	60.55	7041	1.13	1.0	42.00

ID TW-250

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
52.42	52.88	RAW	1.00	30.51	29.53	38.96	4780	.67	NO.DATA	RAW
52.42	52.88	WASH	1.14	9.36	27.33	62.17	7360	.61	1.0	50.00
69.62	70.02	RAW	.96	44.56	21.09	33.39	4046	2.08	NO.DATA	RAW
69.62	70.02	WASH	1.02	9.92	26.75	62.31	7359	1.74	2.5	46.00
74.43	76.30	RAW	1.04	11.42	25.39	62.15	7093	.50	NO.DATA	RAW
74.43	76.30	WASH	1.45	5.52	25.61	67.42	7653	.50	2.0	83.00
83.96	86.15	RAW	.90	14.39	25.42	59.29	6888	.39	NO.DATA	RAW
83.96	86.15	WASH	1.40	7.00	26.65	64.95	7549	.56	1.5	80.00
90.06	91.26	RAW	.95	14.82	24.90	59.33	6930	7.45	NO.DATA	RAW
90.06	91.26	WASH	1.17	4.98	27.77	66.08	7790	1.30	2.5	74.00
106.01	107.01	RAW	.79	16.89	24.83	57.49	6779	1.37	NO.DATA	RAW
106.01	107.01	WASH	.95	10.89	26.04	62.12	7326	.86	1.0	84.00
107.35	107.90	RAW	.76	16.89	25.36	56.99	6729	1.41	NO.DATA	RAW
107.35	107.90	WASH	.77	10.56	25.47	63.20	7375	1.28	1.0	83.00
118.57	119.27	RAW	.85	26.66	23.53	48.96	5929	2.86	NO.DATA	RAW
118.57	119.27	WASH	.78	17.64	24.76	56.82	6772	2.65	1.0	77.00
120.37	120.68	RAW	.75	33.71	21.90	43.64	5200	.51	NO.DATA	RAW
120.37	120.68	WASH	1.00	11.07	25.80	62.13	7294	.61	2.5	58.00
121.90	122.36	RAW	.65	40.27	27.15	31.93	4065	.49	NO.DATA	RAW
121.90	122.36	WASH	1.39	16.66	26.36	55.59	6757	.74	2.0	41.00
126.69	127.09	RAW	.80	54.89	17.63	26.68	3150	.33	NO.DATA	RAW
126.69	127.09	WASH	NO.DATA	NO.DATA	NDAT	NDAT	NDAT	NO.DATA	.0	.00

ID TW-250A

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
34.19	35.90	RAW	1.22	11.25	26.38	61.15	7143	.55	NO.DATA	RAW
34.19	35.90	WASH	1.87	3.77	27.84	66.52	7776	.51	2.0	85.00

ID TW-251

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
64.96	65.51	RAW	.84	24.28	29.15	45.73	5922	4.90	NO.DATA	RAW
64.96	65.51	WASH	.85	8.70	30.62	59.83	8039	1.86	1.5	63.00
77.44	79.88	RAW	.95	9.36	29.59	60.10	7438	3.04	NO.DATA	RAW
77.44	79.88	WASH	.90	5.24	29.90	63.96	7789	.92	1.5	89.00
100.60	101.68	RAW	.79	21.36	26.57	51.28	6326	2.36	NO.DATA	RAW
100.60	101.68	WASH	.77	8.97	29.10	61.16	7466	1.65	2.0	74.00
107.18	107.42	RAW	.66	11.95	29.32	58.07	7299	3.84	NO.DATA	RAW
107.18	107.42	WASH	.64	5.24	32.10	62.02	7866	1.70	4.0	82.00
107.86	110.32	RAW	1.16	11.16	27.06	60.62	7179	.72	NO.DATA	RAW
107.86	110.32	WASH	.91	5.89	28.13	65.07	7669	.65	1.0	84.00
117.72	119.53	RAW	1.02	11.59	27.91	59.48	7233	.49	NO.DATA	RAW
117.72	119.53	WASH	.83	5.32	29.50	64.35	7785	.51	2.0	86.00
120.89	121.65	RAW	.92	14.38	28.39	56.31	7060	1.87	NO.DATA	RAW
120.89	121.65	WASH	.77	6.46	31.16	61.61	7775	1.44	3.5	84.00
121.65	121.84	RAW	.77	59.48	17.43	22.32	2986	2.12	NO.DATA	RAW
121.65	121.84	WASH	.75	20.03	29.37	49.85	6564	1.97	5.0	17.00
121.84	122.64	RAW	.79	7.47	29.64	62.10	7657	1.28	NO.DATA	RAW
121.84	122.64	WASH	.58	5.03	31.43	62.96	7871	1.18	3.0	93.00
128.74	129.69	RAW	.77	20.83	27.50	50.90	6251	2.15	NO.DATA	RAW
128.74	129.69	WASH	.96	10.53	27.41	61.10	7378	1.30	1.0	67.00
131.08	131.97	RAW	.79	42.03	22.44	34.74	4364	4.18	NO.DATA	RAW
131.08	131.97	WASH	.82	10.48	28.03	60.67	7398	2.20	1.0	40.00
134.12	135.80	RAW	.55	40.21	23.10	36.14	4596	2.92	NO.DATA	RAW
134.12	135.80	WASH	.84	15.08	29.06	55.02	7013	1.71	1.0	47.00
267.65	269.36	RAW	.69	16.79	26.62	55.90	6806	.66	NO.DATA	RAW
267.65	269.36	WASH	.53	10.66	27.08	61.73	7407	.66	5.0	81.00
275.61	277.88	RAW	.51	23.39	25.39	50.71	6267	1.59	NO.DATA	RAW
275.61	277.88	WASH	.41	10.84	28.77	59.98	7432	1.05	7.0	68.00
280.04	280.84	RAW	.74	19.73	28.32	51.21	6466	.32	NO.DATA	RAW
280.04	280.84	WASH	.52	11.25	28.49	59.74	7420	.37	3.5	77.00
284.75	285.40	RAW	.70	56.39	17.51	25.40	3018	.13	NO.DATA	RAW
284.75	285.40	WASH	.56	15.94	25.87	57.63	6912	.29	3.5	17.00

ID TW-253

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
36.83	37.83	RAW	.70	15.21	28.29	55.80	6876	2.86	NO.DATA	RAW
36.83	37.83	WASH	1.09	9.52	28.15	61.24	7450	1.45	2.0	79.00
51.20	51.58	RAW	.80	30.58	23.57	45.05	5429	2.63	NO.DATA	RAW
51.20	51.58	WASH	1.11	16.98	24.60	57.31	6755	1.11	1.0	58.00
54.12	54.57	RAW	1.00	37.35	23.92	37.73	4788	1.56	NO.DATA	RAW
54.12	54.57	WASH	.96	18.24	28.41	52.39	6673	1.67	5.5	47.00
55.47	55.79	RAW	.54	57.43	18.86	23.17	2845	.39	NO.DATA	RAW
55.47	55.79	WASH	.95	17.48	27.58	53.99	6676	.96	5.5	26.00
73.65	73.99	RAW	.89	32.70	22.36	44.05	5210	1.72	NO.DATA	RAW
73.65	73.99	WASH	1.03	17.98	23.40	57.59	6624	1.05	1.0	51.00
77.46	77.88	RAW	.98	37.06	22.68	39.28	4734	6.18	NO.DATA	RAW
77.46	77.88	WASH	1.30	12.80	25.43	60.47	7090	2.23	1.0	44.00
154.12	154.57	RAW	.61	26.64	25.13	47.62	5901	3.10	NO.DATA	RAW
154.12	154.57	WASH	.75	10.65	28.54	60.06	7429	1.80	3.0	65.00
213.72	NDAT	RAW	.82	58.33	21.77	19.08	2507	37.64	NO.DATA	RAW
213.72	NDAT	WASH	NO.DATA	NO.DATA	NDAT	NDAT	NDAT	NO.DATA	NO.DATA	RAW
213.72	214.46	RAW	.73	26.31	22.41	50.55	6027	2.96	NO.DATA	RAW
213.72	214.46	WASH	.89	18.10	24.02	56.99	6788	1.96	1.5	74.00
227.91	229.91	RAW	1.07	16.17	23.01	59.75	6787	2.55	NO.DATA	RAW
227.91	229.91	WASH	.99	8.81	25.03	65.17	7478	1.20	1.5	79.00
248.07	249.34	RAW	.80	18.96	22.30	57.94	6598	1.69	NO.DATA	RAW
248.07	249.34	WASH	.79	7.56	24.69	66.96	7663	1.68	3.0	78.00
256.46	260.42	RAW	.84	9.93	23.23	66.00	7399	.65	NO.DATA	RAW
256.46	260.42	WASH	1.49	5.15	24.53	68.83	7797	.59	1.5	89.00
269.60	269.96	RAW	.71	10.35	22.64	66.30	7418	2.15	NO.DATA	RAW
269.60	269.96	WASH	1.06	6.08	23.27	69.59	7783	1.42	1.0	88.00
278.20	280.02	RAW	.87	18.89	22.09	58.15	6603	1.29	NO.DATA	RAW
278.20	280.02	WASH	1.55	10.60	22.83	65.02	7338	.73	1.5	81.00
283.37	285.13	RAW	.72	31.45	20.68	47.15	5468	2.45	NO.DATA	RAW
283.37	285.13	WASH	1.22	15.47	23.37	59.94	7008	1.55	2.0	62.00
286.72	287.11	RAW	.70	49.56	18.08	31.66	3740	1.31	NO.DATA	RAW
286.72	287.11	WASH	1.02	16.18	23.45	59.35	6956	1.06	2.0	29.00
299.84	301.97	RAW	.79	24.15	22.49	52.57	6175	.99	NO.DATA	RAW
299.84	301.97	WASH	.98	10.30	24.38	64.34	7505	1.72	1.5	70.00
306.64	308.38	RAW	.77	24.77	23.33	51.13	6086	1.68	NO.DATA	RAW
306.64	308.38	WASH	.80	13.25	25.55	60.40	7252	1.52	3.0	73.00

ID TW-254

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
137.44	137.94	RAW	1.60	23.10	25.47	49.83	6016	2.51	NO.DATA	RAW
137.44	137.94	WASH	1.42	13.79	27.19	57.60	6929	1.23	1.5	69.00
151.00	153.30	RAW	1.26	24.14	25.94	48.66	5874	.23	NO.DATA	RAW
151.00	153.30	WASH	1.29	12.79	28.03	57.89	7010	1.18	1.5	65.00
156.24	156.78	RAW	1.13	43.19	18.86	36.82	4348	.84	NO.DATA	RAW
156.24	156.78	WASH	1.19	20.34	24.51	53.96	6369	.85	1.5	47.00
175.80	176.42	RAW	.92	13.05	30.65	55.38	7016	1.51	NO.DATA	RAW
175.80	176.42	WASH	1.00	8.99	30.83	59.18	7417	1.37	1.5	90.00
177.64	178.08	RAW	.70	39.65	22.50	37.15	4585	1.80	NO.DATA	RAW
177.64	178.08	WASH	1.16	18.60	26.80	53.44	6528	1.19	1.0	50.00
179.80	180.51	RAW	.82	30.54	26.29	42.35	5316	3.67	NO.DATA	RAW
179.80	180.51	WASH	1.05	12.62	27.36	58.97	7071	1.45	1.0	50.00
181.76	182.90	RAW	.85	17.73	25.64	55.78	6581	.56	NO.DATA	RAW
181.76	182.90	WASH	1.39	9.05	26.75	62.81	7335	.56	2.0	80.00
199.90	200.68	RAW	.92	22.43	25.48	51.17	6201	1.79	NO.DATA	RAW
199.90	200.68	WASH	.99	15.69	26.56	56.76	6855	1.65	1.0	79.00

ID TW-255

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
107.35	108.56	RAW	.80	14.21	28.01	56.98	7027	2.31	NO.DATA	RAW
107.35	108.56	WASH	1.07	8.10	29.71	61.12	7552	1.33	3.0	86.00
114.27	115.21	RAW	.64	29.11	23.51	46.74	5697	3.90	NO.DATA	RAW
114.27	115.21	WASH	1.17	5.21	29.65	63.97	7807	.92	1.5	70.00
120.61	121.44	RAW	.89	27.22	23.13	48.76	5820	.76	NO.DATA	RAW
120.61	121.44	WASH	1.10	12.97	26.70	59.23	7106	.45	1.0	67.00
123.69	124.88	RAW	.86	9.92	30.35	58.87	7478	.97	NO.DATA	RAW
123.69	124.88	WASH	1.05	5.90	30.62	62.43	7805	.86	2.5	89.00
127.14	127.49	RAW	.54	53.57	20.60	25.29	3353	1.45	NO.DATA	RAW
127.14	127.49	WASH	1.02	21.61	27.06	50.31	6384	1.44	1.0	21.00
131.42	131.96	RAW	.50	35.58	25.62	38.30	5091	3.20	NO.DATA	RAW
131.42	131.96	WASH	.75	17.12	27.86	54.27	6838	1.81	1.5	49.00
137.64	139.41	RAW	.58	22.55	26.88	49.99	6136	.84	NO.DATA	RAW
137.64	139.41	WASH	.87	10.41	28.76	59.96	7365	.73	3.0	79.00
139.76	140.48	RAW	.83	29.25	23.51	46.41	5612	.58	NO.DATA	RAW
139.76	140.48	WASH	.95	13.79	26.35	58.91	7034	.64	1.5	67.00
140.85	141.20	RAW	.79	29.66	25.12	44.43	5475	.77	NO.DATA	RAW
140.85	141.20	WASH	.84	18.28	26.09	54.79	6587	.65	2.0	65.00
142.08	142.52	RAW	.67	16.06	26.64	56.63	6825	1.12	NO.DATA	RAW
142.08	142.52	WASH	.83	11.90	26.33	60.94	7232	.95	1.0	88.00

ID TW-257

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
27.70	28.36	RAW	.81	20.87	28.96	49.36	6231	2.43	NO.DATA	RAW
27.70	28.36	WASH	1.03	6.67	32.24	60.06	7642	1.81	1.0	77.00
29.01	30.35	RAW	.97	14.46	28.00	56.57	6922	1.94	NO.DATA	RAW
29.01	30.35	WASH	1.10	7.89	29.81	61.20	7529	1.48	2.0	85.00
33.45	34.20	RAW	1.02	17.75	26.15	55.08	6526	.48	NO.DATA	RAW
33.45	34.20	WASH	1.74	8.61	27.41	62.24	7359	.54	6.5	75.00

ID TW-258

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
44.80	47.44	RAW	1.19	10.32	28.74	59.75	7356	.91	NO.DATA	RAW
44.80	47.44	WASH	1.28	8.63	29.36	60.73	7479	.83	1.5	95.00
49.48	52.00	RAW	1.15	18.71	25.30	54.84	6580	1.67	NO.DATA	RAW
49.48	52.00	WASH	1.31	11.73	27.28	59.68	7188	.97	1.0	85.00
57.51	58.99	RAW	1.08	34.04	24.77	40.11	5069	4.00	NO.DATA	RAW
57.51	58.99	WASH	.94	12.12	30.71	56.23	7187	1.29	1.0	61.00
59.66	60.19	RAW	.98	30.30	21.48	47.24	5574	.72	NO.DATA	RAW
59.66	60.19	WASH	1.20	13.53	25.48	59.79	7020	.63	1.0	62.00
61.23	61.53	RAW	1.00	27.19	21.70	50.11	5770	.37	NO.DATA	RAW
61.23	61.53	WASH	1.61	22.34	22.54	53.51	6184	.40	1.0	72.00
62.43	63.07	RAW	.75	47.19	23.21	28.85	3560	.37	NO.DATA	RAW
62.43	63.07	WASH	NO.DATA	NO.DATA	NDAT	NDAT	NDAT	NO.DATA	.0	.00
65.16	67.37	RAW	.85	36.05	24.79	38.31	5009	1.44	NO.DATA	RAW
65.16	67.37	WASH	1.71	11.53	30.22	56.54	7228	1.88	2.5	60.00
68.41	68.75	RAW	.79	34.91	22.09	42.21	5036	.51	NO.DATA	RAW
68.41	68.75	WASH	1.38	13.97	25.01	59.64	6970	.72	1.0	53.00
70.49	71.25	RAW	.90	32.12	23.53	43.45	5414	1.06	NO.DATA	RAW
70.49	71.25	WASH	1.11	14.27	28.18	56.44	7016	.90	1.0	61.00
81.05	81.48	RAW	1.10	19.70	26.43	52.77	6564	1.35	NO.DATA	RAW
81.05	81.48	WASH	1.26	10.35	28.83	59.56	7349	1.12	1.0	73.00
83.17	83.81	RAW	1.11	18.18	23.76	56.95	6538	.46	NO.DATA	RAW
83.17	83.81	WASH	1.53	11.93	25.18	61.36	7062	.39	1.0	78.00
95.32	96.13	RAW	.98	19.65	32.92	46.45	5920	.39	NO.DATA	RAW
95.32	96.13	WASH	1.31	8.28	29.35	61.06	7439	.46	1.5	61.00
96.98	98.06	RAW	.88	23.41	25.01	50.70	6069	.44	NO.DATA	RAW
96.98	98.06	WASH	1.29	8.29	26.92	63.50	7028	.44	2.0	75.00
98.70	99.50	RAW	.73	18.46	28.13	52.65	6443	.82	NO.DATA	RAW
98.70	99.50	WASH	1.26	8.54	27.40	62.80	7129	.86	1.0	80.00

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
6.84	8.94	RAW	.99	27.71	24.26	47.04	5639	1.12	NO.DATA	RAW
6.84	8.94	WASH	1.38	8.68	28.02	61.92	7388	.75	1.5	64.00
18.67	22.44	RAW	.73	21.34	25.25	52.68	6169	.45	NO.DATA	RAW
18.67	22.44	WASH	1.43	6.25	28.37	63.95	7586	.49	1.5	71.00
23.15	24.50	RAW	.69	8.87	28.39	62.05	7414	.67	NO.DATA	RAW
23.15	24.50	WASH	1.50	3.66	29.06	65.78	7829	.60	1.0	87.00
44.60	45.10	RAW	.59	40.63	21.31	37.47	4580	1.16	NO.DATA	RAW
44.60	45.10	WASH	1.30	17.70	25.11	55.89	6705	1.05	1.0	42.00
46.32	47.53	RAW	.63	16.53	25.57	57.27	6780	2.13	NO.DATA	RAW
46.32	47.53	WASH	1.23	9.32	26.96	62.49	7400	1.32	1.0	80.00
48.13	48.50	RAW	.61	10.81	26.74	61.84	7312	.92	NO.DATA	RAW
48.13	48.50	WASH	1.28	8.29	26.39	64.04	7540	.83	1.0	92.00
48.65	48.97	RAW	.86	34.69	25.78	38.67	4680	1.84	NO.DATA	RAW
48.65	48.97	WASH	1.15	12.93	27.14	58.78	7037	1.73	1.0	46.00
56.75	57.33	RAW	.84	25.47	30.53	43.16	5501	1.00	NO.DATA	RAW
56.75	57.33	WASH	1.14	9.12	30.70	59.04	7413	.89	2.5	57.00

ID TW-260

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
21.04	21.30	RAW	.92	23.86	31.32	43.90	5547	.48	NO.DATA	RAW
21.04	21.30	WASH	1.22	11.85	30.21	56.72	7112	.56	4.5	62.00
22.65	24.66	RAW	1.23	13.89	26.63	58.25	6899	.37	NO.DATA	RAW
22.65	24.66	WASH	1.48	9.06	26.83	62.63	7374	.37	1.5	85.00
116.46	116.80	RAW	.57	29.78	32.57	37.08	5269	3.77	NO.DATA	RAW
116.46	116.80	WASH	1.01	12.07	31.85	55.07	7330	1.11	7.0	46.00
117.02	119.46	RAW	.72	23.71	27.39	48.18	6170	2.30	NO.DATA	RAW
117.02	119.46	WASH	.98	11.25	30.46	57.31	7437	.83	3.5	70.00
119.90	121.01	RAW	.82	23.76	27.06	48.36	6159	.32	NO.DATA	RAW
119.90	121.01	WASH	.93	11.70	30.40	56.97	7376	.33	6.0	66.00
125.95	126.68	RAW	.74	30.94	25.12	43.17	5387	.27	NO.DATA	RAW
125.95	126.68	WASH	.95	17.60	27.38	54.07	6792	.32	3.5	57.00

ID TW-262

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
74.09	75.85	RAW	.82	35.90	24.55	38.73	4938	.54	NO.DATA	RAW
74.09	75.85	WASH	.98	11.44	29.64	57.94	7300	.64	5.5	50.00
79.80	80.46	RAW	.53	37.71	24.29	34.47	4616	.26	NO.DATA	RAW
79.80	80.46	WASH	.95	20.75	26.53	51.77	6425	.34	1.5	49.00

ID TW-267

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
40.31	41.44	RAW	1.15	29.35	21.46	48.04	5491	.48	NO.DATA	RAW
40.31	41.44	WASH	1.51	8.97	24.97	64.55	7425	.66	1.5	62.00
59.62	60.35	RAW	.92	21.63	24.62	52.83	6322	4.10	NO.DATA	RAW
59.62	60.35	WASH	1.03	10.98	25.80	62.19	7327	3.20	2.0	72.00
66.20	67.26	RAW	.76	15.34	26.54	57.36	6973	2.30	NO.DATA	RAW
66.20	67.26	WASH	1.09	9.14	27.75	62.02	7524	2.00	4.5	45.00
78.14	79.04	RAW	.81	21.26	24.34	53.59	6332	5.79	NO.DATA	RAW
78.14	79.04	WASH	1.15	9.61	24.77	64.47	7397	2.90	1.5	75.00
81.46	82.65	RAW	.83	27.24	23.44	48.49	5724	3.78	NO.DATA	RAW
81.46	82.65	WASH	1.30	10.25	25.32	63.13	7285	2.69	2.5	62.00
88.37	89.01	RAW	.80	25.74	23.57	49.89	5925	7.31	NO.DATA	RAW
88.37	89.01	WASH	1.10	10.69	25.71	62.50	7276	3.07	2.5	59.00
94.68	98.30	RAW	.93	17.22	22.52	59.33	6651	1.41	NO.DATA	RAW
94.68	98.30	WASH	1.93	10.12	23.22	64.73	7216	1.21	1.0	81.00
120.40	120.92	RAW	.86	20.26	23.58	55.30	6406	3.62	NO.DATA	RAW
120.40	120.92	WASH	1.34	9.08	24.28	65.30	7378	2.69	1.5	75.00
126.54	128.60	RAW	.96	18.84	24.02	56.18	6486	.92	NO.DATA	RAW
126.54	128.60	WASH	1.45	7.25	25.24	66.06	7509	.98	2.0	80.00
130.80	136.57	RAW	1.36	13.40	23.80	61.44	6920	.46	NO.DATA	RAW
130.80	136.57	WASH	1.82	6.84	24.46	66.88	7528	.41	1.0	87.00
141.38	142.32	RAW	.87	9.35	23.80	65.98	7478	1.05	NO.DATA	RAW
141.38	142.32	WASH	1.67	7.25	24.02	77.06	7579	.80	1.5	93.00
143.04	143.74	RAW	.73	32.12	20.79	46.36	5327	1.41	NO.DATA	RAW
143.04	143.74	WASH	1.34	13.21	22.24	63.21	7008	1.31	1.0	53.00
144.32	144.68	RAW	.61	27.43	25.19	46.77	5598	1.57	NO.DATA	RAW
144.32	144.68	WASH	.95	15.92	24.00	59.13	6825	1.06	2.5	63.00
145.19	145.49	RAW	.73	24.47	23.25	51.55	5902	1.87	NO.DATA	RAW
145.19	145.49	WASH	1.13	14.16	21.39	63.32	6998	1.26	1.0	66.00
146.37	146.68	RAW	.54	44.08	24.57	30.81	3815	1.43	NO.DATA	RAW
146.37	146.68	WASH	1.41	14.38	26.08	58.13	6956	2.04	4.5	29.00
150.67	152.77	RAW	.79	24.60	23.00	51.61	5965	3.22	NO.DATA	RAW
150.67	152.77	WASH	1.56	11.77	23.58	63.09	7196	1.48	1.5	70.00
154.56	155.81	RAW	1.36	11.26	23.53	63.85	7199	.48	NO.DATA	RAW
154.56	155.81	WASH	1.76	9.07	23.96	65.21	7370	.39	1.5	93.00

ID TW-268

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
102.95	103.55	RAW	.81	18.61	27.25	53.33	6683	.41	NO.DATA	RAW
102.95	103.55	WASH	1.05	14.16	27.81	56.98	7057	.41	2.0	87.00
105.00	106.10	RAW	.67	38.46	23.24	37.63	4798	1.82	NO.DATA	RAW
105.00	106.10	WASH	.99	14.29	28.53	56.19	7092	.50	3.0	47.00
106.44	106.75	RAW	.58	22.79	29.24	46.81	6229	1.26	NO.DATA	RAW
106.44	106.75	WASH	1.07	10.21	32.02	56.70	7475	.61	8.5	67.00
107.58	110.48	RAW	.77	33.07	23.58	42.58	5328	.36	NO.DATA	RAW
107.58	110.48	WASH	1.29	15.14	27.61	55.96	6955	.43	3.5	61.00
110.72	112.04	RAW	.59	42.62	22.20	34.59	4499	1.39	NO.DATA	RAW
110.72	112.04	WASH	1.06	18.54	28.77	51.63	6686	.58	5.5	54.00
115.53	115.75	RAW	.38	56.01	22.94	20.67	2699	.60	NO.DATA	RAW
115.53	115.75	WASH	1.11	14.80	28.64	55.45	6910	.44	3.5	19.00
117.96	119.16	RAW	.58	49.19	19.24	30.99	3788	5.28	NO.DATA	RAW
117.96	119.16	WASH	.79	14.75	26.73	57.73	7012	4.90	1.0	40.00
120.68	121.05	RAW	.96	17.80	25.14	56.10	6758	1.83	NO.DATA	RAW
120.68	121.05	WASH	.94	13.10	25.90	60.06	7192	1.22	1.0	88.00
137.90	138.38	RAW	.82	29.47	24.43	45.28	5662	3.50	NO.DATA	RAW
137.90	138.38	WASH	.75	15.78	27.19	56.28	6980	2.67	1.0	64.00
139.43	140.78	RAW	.91	13.38	25.94	59.77	7081	1.79	NO.DATA	RAW
139.43	140.78	WASH	1.15	9.08	26.95	62.82	7465	1.12	1.0	86.00
141.73	142.09	RAW	.87	16.56	25.36	57.21	6758	1.71	NO.DATA	RAW
141.73	142.09	WASH	1.11	10.86	24.80	63.23	7342	1.16	1.0	87.00
142.71	143.13	RAW	.74	30.28	24.67	44.31	5321	1.22	NO.DATA	RAW
142.77	143.13	WASH	1.06	13.03	25.44	60.47	7078	1.10	1.0	60.00
148.40	148.98	RAW	.77	37.63	22.40	39.20	4882	3.08	NO.DATA	RAW
148.40	148.98	WASH	1.04	19.50	25.50	53.96	6589	1.64	1.0	48.00
151.20	151.62	RAW	.64	17.02	29.42	52.92	6737	2.55	NO.DATA	RAW
151.20	151.62	WASH	.86	9.46	29.80	59.88	7472	1.74	5.5	80.00
151.84	153.22	RAW	.86	20.03	25.51	53.60	6401	.48	NO.DATA	RAW
151.84	153.22	WASH	1.43	9.95	26.30	62.32	7486	.52	1.0	79.00
156.12	156.70	RAW	.94	20.91	23.33	54.82	6426	3.42	NO.DATA	RAW
156.12	156.70	WASH	1.20	10.80	25.76	62.24	7275	1.20	1.0	72.00
266.40	266.60	RAW	.58	46.44	21.19	31.79	4167	1.72	NO.DATA	RAW
266.40	266.60	WASH	.69	24.72	26.96	47.63	6247	.81	7.0	29.00
266.82	267.31	RAW	.52	16.94	27.23	55.31	6833	.69	NO.DATA	RAW
266.82	267.31	WASH	.95	11.11	27.64	60.30	7389	.63	3.5	82.00
267.64	268.67	RAW	.67	19.49	27.48	52.36	6657	1.44	NO.DATA	RAW
267.64	268.67	WASH	.90	11.34	29.05	58.71	7410	.99	5.5	77.00
275.97	277.88	RAW	.44	18.73	26.43	54.40	6698	2.33	NO.DATA	RAW
275.97	277.88	WASH	.88	9.09	28.40	61.63	7592	1.19	5.0	74.00
278.10	279.02	RAW	.45	34.60	24.77	40.18	5211	1.06	NO.DATA	RAW
278.10	279.02	WASH	.76	15.39	30.39	53.46	7038	1.25	6.0	53.00
279.88	281.60	RAW	.39	27.45	27.09	45.07	5683	1.88	NO.DATA	RAW
279.88	281.60	WASH	.71	12.11	28.93	58.25	7352	1.09	6.0	62.00
281.98	282.20	RAW	.33	13.30	28.69	57.68	7078	.90	NO.DATA	RAW
281.98	282.20	WASH	.99	6.87	28.06	64.08	7784	.90	5.0	83.00
283.04	284.11	RAW	1.00	27.37	24.90	46.73	5715	.39	NO.DATA	RAW
283.04	284.11	WASH	.98	10.40	27.73	60.89	7424	.48	5.5	63.00
288.36	289.46	RAW	.92	44.56	19.84	34.68	4176	.26	NO.DATA	RAW
288.36	289.46	WASH	1.02	18.37	24.86	55.75	6664	.37	4.5	30.00

ID TW-271

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
20.68	21.20	RAW	1.19	40.35	21.24	37.22	4521	4.42	NO.DATA	RAW
20.68	21.20	WASH	.82	19.55	27.34	52.29	6485	1.30	4.0	33.00
39.86	40.95	RAW	1.03	13.72	26.55	58.70	7027	.48	NO.DATA	RAW
39.86	40.95	WASH	1.22	9.41	27.62	61.75	7408	.37	1.0	81.00
46.02	49.11	RAW	.97	12.27	27.83	58.93	7198	.49	NO.DATA	RAW
46.02	49.11	WASH	1.04	7.30	29.79	61.87	7640	.50	3.5	80.00
53.21	54.24	RAW	.79	42.05	21.41	35.75	4325	.38	NO.DATA	RAW
53.21	54.24	WASH	.95	16.88	26.42	55.75	6734	.48	1.0	47.00
217.52	218.30	RAW	.78	22.22	24.99	52.01	6427	1.73	NO.DATA	RAW
217.52	218.30	WASH	.89	16.48	26.86	55.77	6956	.74	2.5	76.00

ID TW-271A

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
4.78	6.40	RAW	1.42	14.05	25.66	58.87	6864	.52	NO.DATA	RAW
4.78	6.40	WASH	2.11	6.64	27.01	64.24	7478	.50	2.0	87.00

ID TW-272

TOP	BASE	ANAL	RM.ADB	ASH.ADB	VOL.ADB	CARB.AD	CAL.GM	SULPHUR.ADB	FSI	YIELD
42.94	44.10	RAW	.78	16.32	27.26	55.64	6771	3.15	NO.DATA	RAW
42.94	44.10	WASH	.79	8.18	29.96	61.07	7544	1.47	2.5	81.00
53.95	56.56	RAW	.87	14.69	27.17	57.27	6889	.90	NO.DATA	RAW
53.95	56.56	WASH	1.04	7.89	28.39	62.68	7498	.76	1.0	80.00
59.12	59.64	RAW	.90	32.32	23.67	43.11	5300	.44	NO.DATA	RAW
59.12	59.64	WASH	.78	3.90	31.20	64.12	7897	.56	2.0	56.00
83.88	84.18	RAW	.68	32.77	20.66	45.89	5273	.38	NO.DATA	RAW
83.88	84.18	WASH	.89	14.98	24.83	59.30	6886	.46	1.5	43.00
87.43	87.90	RAW	.85	44.57	5.88	48.70	3982	.42	NO.DATA	RAW
87.43	87.90	WASH	.64	14.19	6.40	78.77	6998	.69	.0	28.00
88.08	88.84	RAW	.77	13.35	25.93	59.95	7066	1.05	NO.DATA	RAW
88.08	88.84	WASH	1.17	8.52	27.48	62.83	7463	.79	1.5	86.00

To: CROWSNEST RESOURCES LTD.,
525 - 3rd Avenue S.W.,
Calgary, Alberta T2P 2M7

ATTN: T. Cole

File No. 23118
Date February 24, 1982
Samples Coal Ash
P.O. # CN 20928

Certificate of ASSAY
LORING LABORATORIES LTD.

Page # 7

SAMPLE No.	OXIDIZING ATMOSPHERE I.D. (F^o)	H=W (F^o)	H=½W (F^o)	Fluid (F^o)
"Ash Fusion Analysis"				
Clean Coal				
TV-81D-112				
1001	2628	+2650	+2650	+2650
1002	2408	2533	+2650	+2650
1003	+2650	+2650	+2650	+2650
1004	+2650	+2650	+2650	+2650
1005	+2650	+2650	+2650	+2650
1006	+2650	+2650	+2650	+2650
1007	2368	2388	2418	2453
1008	2413	2448	2493	2573
1009	+2650	+2650	+2650	+2650
1010	+2650	+2650	+2650	+2650
1011	+2650	+2650	+2650	+2650
1012	+2650	+2650	+2650	+2650
1013	+2650	+2650	+2650	+2650
1014	+2650	+2650	+2650	+2650

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.
Pulps Retained one month unless specific arrangements made in advance.

To: CROWSNEST RESOURCES LTD.,
525 - 3rd Avenue S.W.,
Calgary, Alberta T2P 2M7

ATTN: T. Cole

File No. 23248-1
Date March 23, 1982
Samples Coal

P.O. # CN 20928

Certificate of ASSAY
LORING LABORATORIES LTD.

Page # 1

SAMPLE No.	GEISELER PLASTICITY TESTS						
"Clean Coal"	DDPM	START TEMP (°C)	DDPM	MAXIMUM TEMP (°C)	DDPM	RANGE TEMP (°C)	RANGE
81-1164+1165	1	437	2	448	0	479	42
81-1182-1185	1	430	8	448	0	478	48
81-1168+1169	1	441	1	450	0	478	37

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.
Pulps Retained one month unless specific arrangements made in advance.

To: CROWSNEST RESOURCES LTD.,
525 - 3rd Avenue S.W.,
Calgary, Alberta T2P 2M7

ATTN: T. Cole

File No. 23118-1
Date March 5, 1982
Samples Coal Ash

P.O. # CN 20928

Certificate of ASSAY
LORING LABORATORIES LTD.

Page # 1

SAMPLE No.	TELKWA 1.60 FLT 1001	1002	1003	1004	1005
"Analysis of Ash"					
%					
SiO2	67.46	51.32	50.72	59.72	60.96
Al2O3	12.49	16.64	26.46	22.68	27.60
TiO2	1.44	1.57	2.42	2.36	1.58
Fe2O3	9.72	21.16	9.72	8.15	2.36
CaO	2.94	2.52	2.94	1.74	1.99
MgO	.82	.86	1.33	.75	.55
Na2O	.57	.65	.92	.81	.97
K2O	.24	.24	.30	.24	.42
P2O5	.02	.72	.69	.53	1.17
SO3	2.15	2.15	2.48	1.42	.82
Undetermined	-2.15	-2.17	-2.02	-1.60	-1.58

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.
Pulps Retained one month unless specific arrangements made in advance.

D. Endelt

To: CROWSNEST RESOURCES LTD.,
525 - 3rd Avenue S.W.,
Calgary, Alberta T2P 2M7

ATTN: T. Cole

File No. 23118-2
Date March 23, 1982
Samples Coal
P.O. # CN 20928

Certificate of ASSAY
LORING LABORATORIES LTD.

SAMPLE No.	% H2O	% C	% H	% N	% Ash	% S	% O (diff)
Comp -1.60 Flt "Ultimate Analysis" "Air Dried" TW-81D-112							
1001	.90	70.85	4.08	.51	12.14	1.78	9.74
1002	.77	70.04	4.45	.72	9.05	2.44	12.53
1003	.98	72.37	4.40	.72	8.29	1.35	11.89
1004	1.04	72.84	4.55	.72	8.02	1.36	11.47
1005	2.09	73.00	4.36	1.11	6.19	.75	12.50
1006	1.57	73.50	4.31	.70	6.09	.56	13.27
1007	1.72	74.50	4.34	1.09	5.33	.98	12.04
1008	1.45	74.54	4.63	.80	5.24	.70	12.64
1009	1.40	74.66	4.41	.79	5.62	.53	12.59
1010	1.19	72.71	4.23	.58	9.73	1.16	10.40
1011	1.21	72.36	4.24	.76	10.31	1.07	10.05
1012	.86	65.29	4.25	.55	16.49	1.67	10.89
1013	1.01	71.96	4.57	.77	9.29	.83	11.57
1014	1.17	74.50	4.58	.69	6.19	.64	12.23

* Hydrogen & Oxygen do not include H & O in sample moisture.

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.
Pulps Retained one month unless specific arrangements made in advance.