TASEKO MINES LIMITED

GEOTECHNICAL DIAMOND DRILLING

ASSESSMENT REPORT

F1 to F9, Fish 1 and Fish 5 to Fish 11

MINERAL CLAIMS

FISH LAKE PROPERTY

Clinton Mining Division

British Columbia
Canada

NTS 920/5E

Latitude 51°27′ North
Longitude 123°36′ West

By
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R. J. Haslinger, P.Eng
C. M. Rebagliati, P.Eng

January 11, 1995

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1.0 SUMMARY

The Fish Lake Property, owned by Taseko Mines Limited, is located approximately 250 kilometres north of Vancouver, and 125 kilometres southwest of the community of Williams Lake, British Columbia, situated in the Clinton Mining Division. The 95 square kilometre property is comprised of 196 mineral and 9 placer claims.

Road access is via the Bella Coola Highway (Highway 20) from Williams Lake to the community of Hanceville, then southwest along a government maintained gravel road. The property is also accessible by fixed wing aircraft equipped with floats or skis to Fish Lake located approximately 10 kilometres north of Taseko Lake.

Exploration by numerous operators including Bethlehem, Cominco, Nittetsu, Quintana and Taseko Mines during the period 1960 - 1994 culminated in the discovery and definition of a Cu-Au prophyry deposit. The deposit has been defined by a cumulative total of 73, 644 meters in 238 holes and contains a geological resource of 976 million tonnes grading 0.23% copper and 0.48 grams gold/tonne.

A program of geotechnical-geological HQ diameter drilling totalling 425.48m in six holes was conducted to the south of the main deposit area during July and August, 1994. The holes were drilled to evaluate both the economic and mineral potential as well as the geological and hydrogeological conditions along the west and south sides of the proposed tailings impoundment area.

The holes intersected a bedrock sequence comprised of Miocene basalt flows and sediments as well as Upper Cretaceous Kingsvale sediments. Average bedrock permeabilities ranged from 10^{-4} to 10^{-5} cm/sec.

The proposed tailings storage facility site requires further evaluation in order to assess high permeability fracture zones and availability/continuity of low permeability glacial till materials.

2.0 INTRODUCTION

The Fish Lake copper-gold porphyry deposit lies approximately 125 km southwest of Williams Lake, BC. The Fish Lake property, covering the deposit area, incorporates a total of 196 mineral claims and 9 placer claims.

Taskeo Mines Limited conducted a 35 hole diamond drilling program on the property in 1994. This included the drilling of 29 holes in the deposit area, and 6 geotechnical-geological holes in the area of proposed tailings embankments south of Fish Lake.

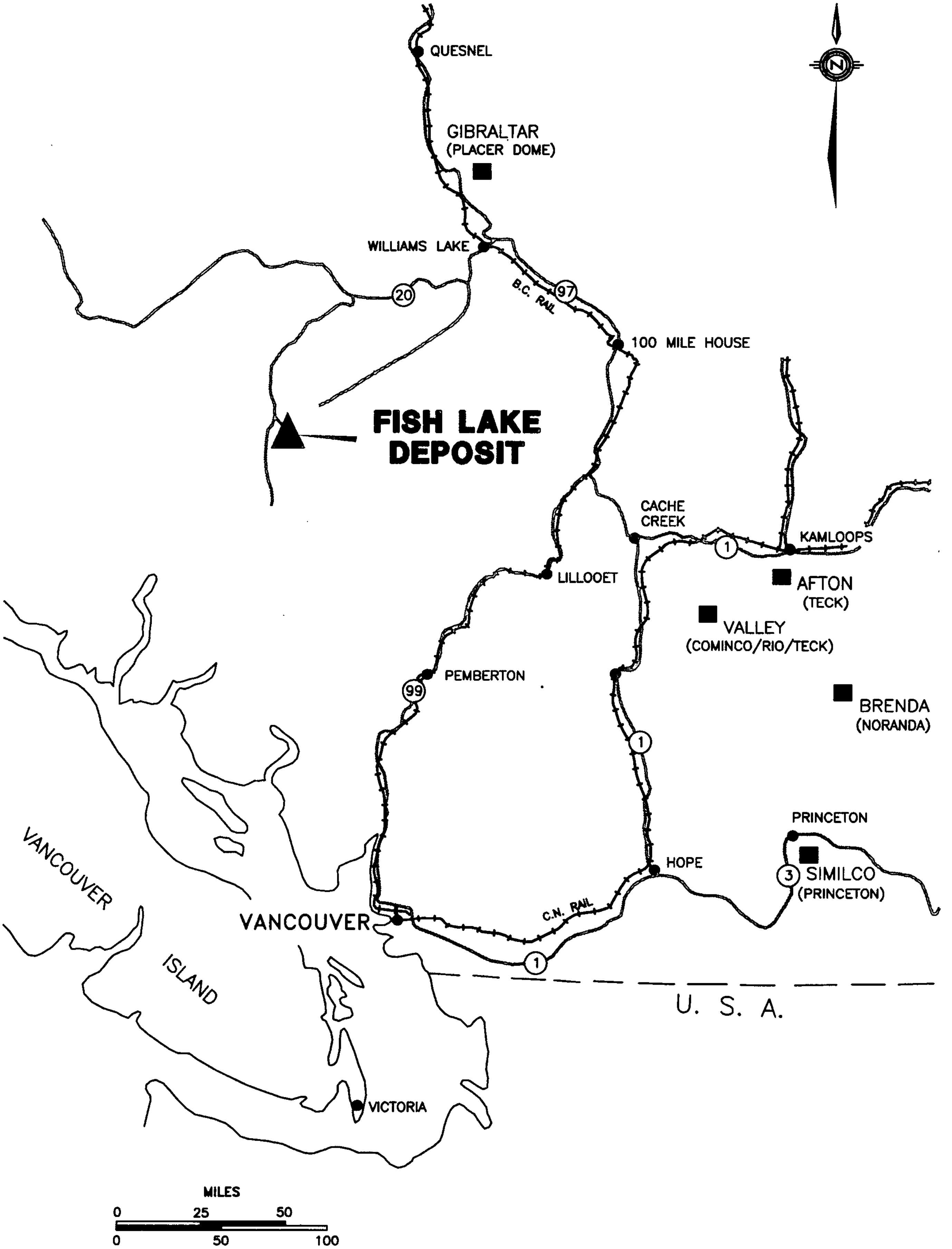
This report documents results and data collected from the 6 hole geotechnical-geological diamond drill program performed between June 23 and September 15, 1994. This 425.48m program specifically addressed proposed tailings dam embankments for hydrogeology on the Fish 1, Fish 6 and Fish 7 mineral claims. Detailed technical information for each drill hole is contained in the appended report by Knight Piésold Ltd. (Appendix II).

3.0 LOCATION AND ACCESS

The Fish Lake gold-copper deposit is located in the Clinton Mining Division of south-central British Columbia at Latitude 51°27′ North, Longitude 123°36′ West (NTS 920/5E). This site is located 250 kilometres north of Vancouver and 125 kilometres southwest of Williams Lake, British Columbia (Figure 1).

Access to the property is via the paved Bella Coola Highway (Highway 20) to Lees Corner near Hanceville about 90 kilometres west of Williams Lake. From Lees Corner the road heads southwest for about 90 kilometres along gravel logging road, and 16 kilometers south along the Fish Lake access road. The access road is maintained on a seasonal basis by Taseko Mines Limited. During the wet spring months, four-wheel drive vehicles with high ground clearance are often required. The total road distance from Williams Lake to the property is 192 kilometres.

A Turbo Beaver aircraft equipped with floats or skis can be used to access Fish Lake during summer and winter months. The Taseko Mines Limited campsite is one kilometer from the north end of Fish Lake on Fish Creek.



TASEKO MINES LIMITED
SITE LOCATION

Figure 1

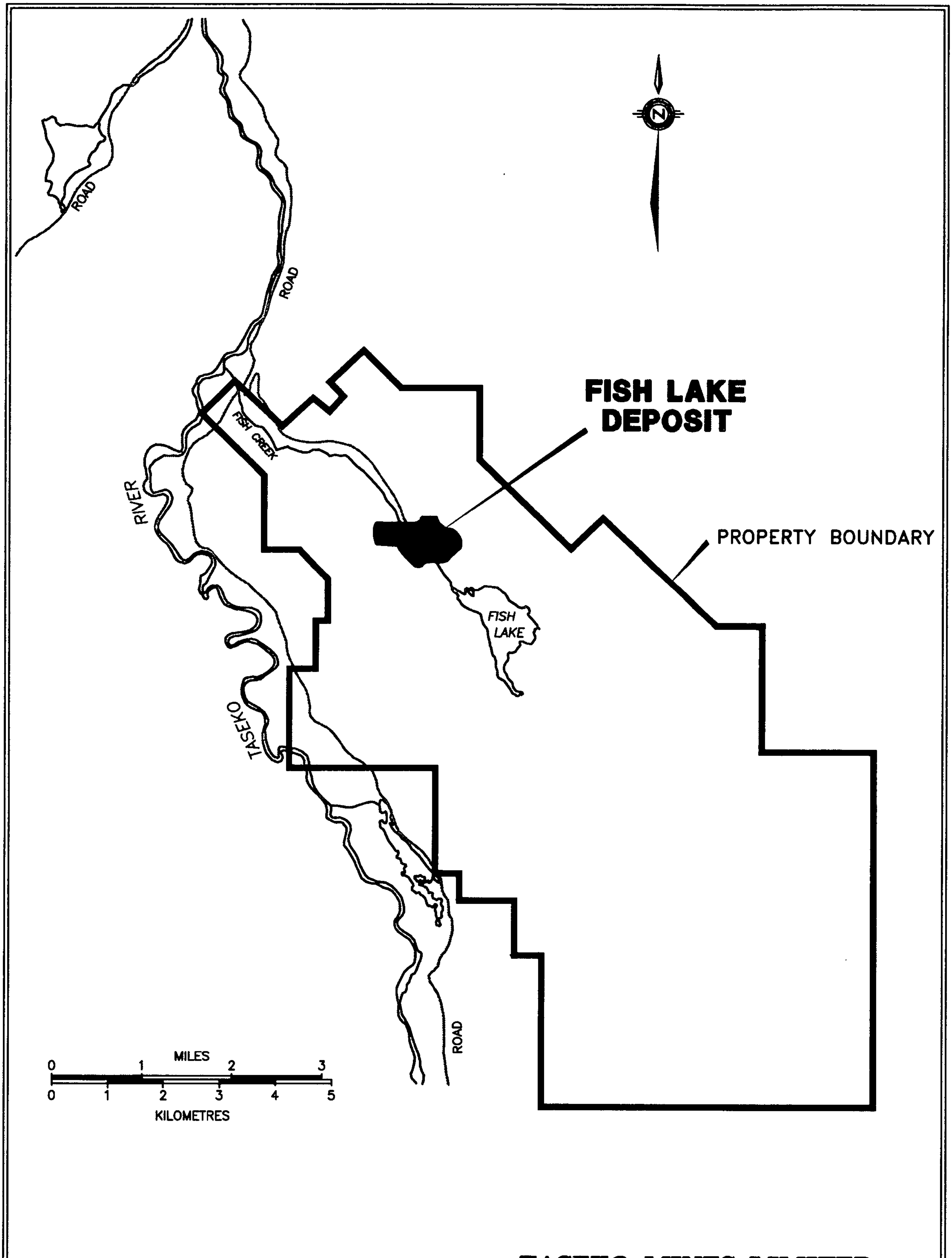
4.0 CLAIM DATA

The Fish Lake property, which is 95 square kilometres in size, is situated in the Clinton Mining Division on N.T.S. map sheet 920/5E (Figure 2). The property, owned by Taseko Mines Ltd., consists of 196 mineral claims totalling 548 units.

A list of claims data pertinent to this report appears below, with expiry dates subject to acceptance of assessment work and credits supported by this report. A complete list of claims is provided as Appendix I.

TABLE 1 - MINERAL CLAIMS REFERENCED

CLAIM NAME	TENURE NO.	UNITS	RECORD DATE	EXPIRY DATE
Fish 1	3563(1)	20	18/1/91	18/1/2000
Fish 5	314027	20	15/10/92	15/10/2000
Fish 6	314028	20	16/10/92	16/10/2000
Fish 7	314029	20	17/10/92	17/10/2000
Fish 8	314030	20	17/10/92	17/10/2000
Fish 9	314031	8	16/10/92	16/10/2000
Fish 10	314026	12	17/10/92	17/10/2000
Fish 11	314032	12	17/10/92	17/10/2000
F1	314003	1	15/10/92	15/10/2000
F2	314004	1	15/10/92	15/10/2000
F3	314005	1	16/10/92	16/10/2000
F4	314006	1	16/10/92	16/10/2000
F5	314007	1	16/10/92	16/10/2000
F6	314008	1	16/10/92	16/10/2000
F7	314009	1	16/10/92	16/10/2000
F8	314010	1	16/10/92	16/10/2000
F9	314025	1	16/10/92	16/10/2000



TASEKO MINES LIMITED
PROPERTY MAP

Figure 2

5.0 EXPLORATION HISTORY

In the early 1930's, prospectors E. Calep and C.M. Vick followed mineralized float and located exposures of pyrite and chalcopyrite-bearing diorite and feldspar porphyry dykes, approximately 1 kilometre east and 0.5 kilometres north of the Fish Lake deposit proper. In 1960, the porphyry copper potential of the area was recognized by Phelps Dodge Corporation. Early drilling results were not sufficiently encouraging and Phelps Dodge allowed the claims to lapse. In 1969, Taseko Mines Limited acquired the ground, drilled approximately 2,200 metres in 18 holes and discovered better grade mineralization. The property was then optioned to Nittetsu Mining Company Ltd. (1970) and later to Quintana Minerals Corporation, which in 1973 and in 1974 drilled approximately 6,000 metres in 23 core holes in order to test and delineate the areas of better-grade mineralization. Further work by Bethlehem Copper (1979-1981) and more recently by Cominco Ltd. (1982-1989) expanded the known deposit size. In 1990, the drill indicated resource was estimated at 203 million tonnes grading 0.24% copper and 0.48 grams gold/tonne.

During 1991 and 1992, Taseko Mines Limited, diamond drilled a total of 67,783 m in 122 holes and increased the drill indicated resource to 976 million tonnes grading 0.23% copper and .48 grams gold/tonne (1075 million tons at 0.23% copper and 0.013 oz/ton gold).

6.0 GEOTECHNICAL DRILL PROGRAM

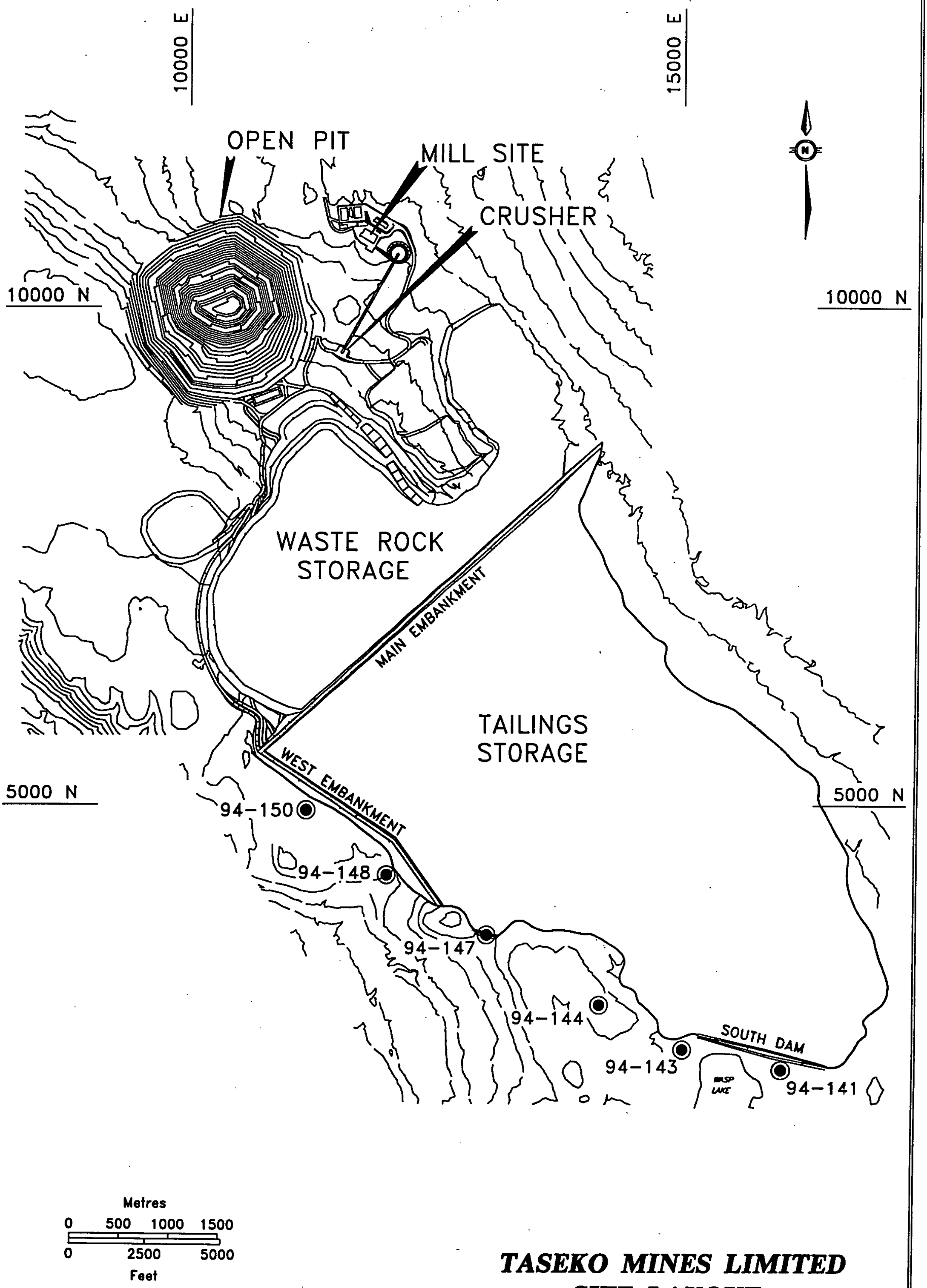
A program of diamond drilling, comprising a total of 425.48m in 6 HQ diameter holes, was completed on the Fish 1, Fish 6 and Fish 7 mineral claims during the period June 23 to September 19, 1994. The drilling was conducted with a Val d'Or 2000 hydraulic fly-rig. A detailed report providing drill logs, plans and cross sections is presented as Appendix II to this report.

The six holes were drilled as part of an investigation of bedrock and overburden foundation conditions in the West Embankment, West Saddle Dam and South Dam areas of the proposed Tailings Storage Facility.

This site is currently considered to be the optimum site available for storage of tailings from a proposed open pit mine at Fish Lake. The holes were drilled to obtain geological, permeability, seepage, construction material and stability information in the embankment areas and to provide groundwater quality monitoring wells.

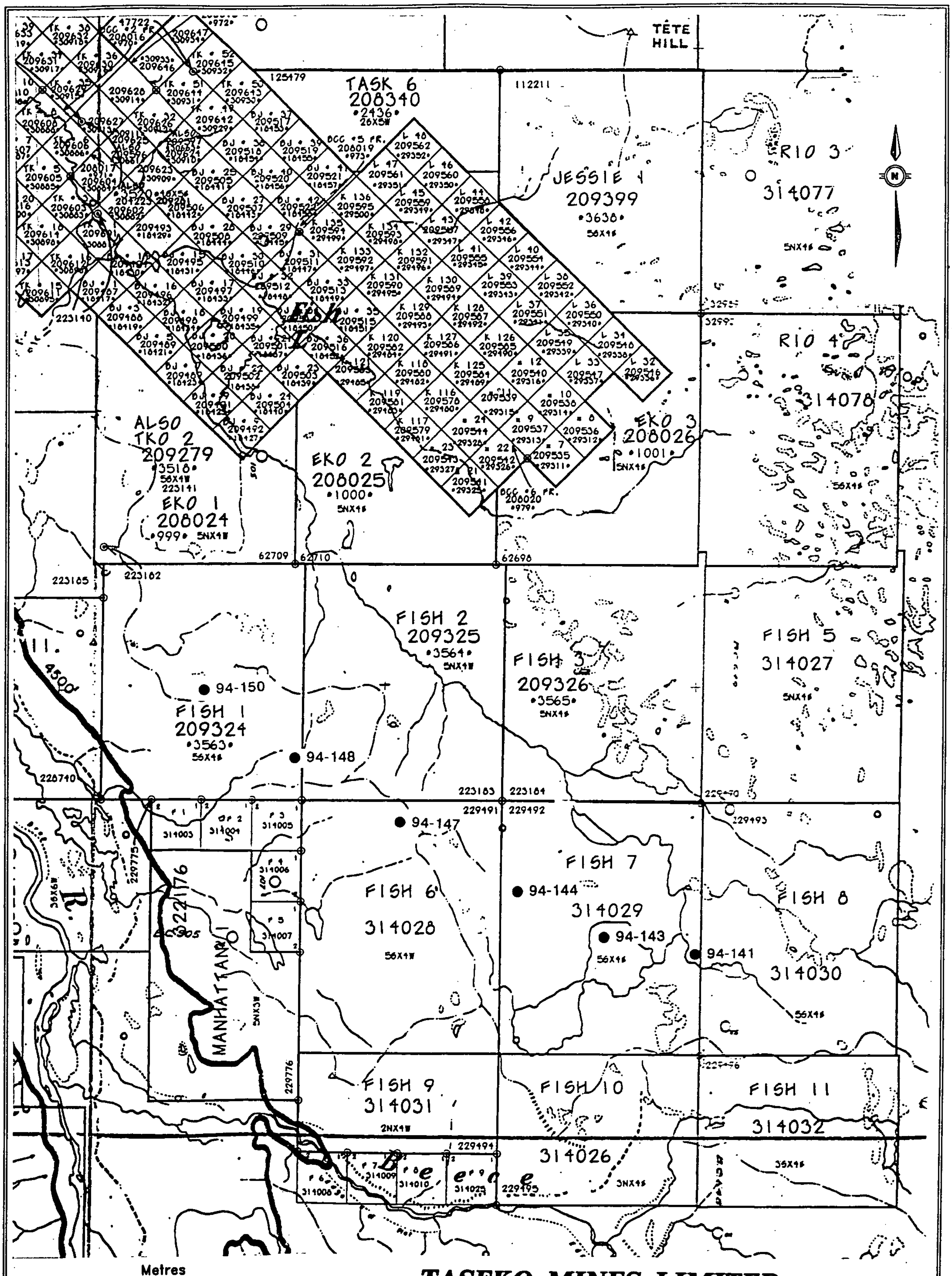
The six holes were each collared in glacial till. This till layer, comprised of brown sandy clay with gravel and cobbles, was generally thin but became thicker in topographically low areas and the area near Wasp Lake.

Underlying the glacial Miocene basalt flows and sediments were present in all holes except 94 - 141 and 94 - 143, both of which lacked Miocene sediments. Holes 94 -



TASEKO MINES LIMITED
SITE LAYOUT

Figure 3



TASEKO MINES LIMITED
CLAIM MAP

SHOWING GEOTECHNICAL DDH LOCATIONS

Figure 4

144 and 94 - 150 passed through the Miocene basalts and sediments and were terminated in Cretaceous Sedimentary rocks.

Miocene basalt flows comprised dark green/grey or maroon to dark brown/grey rock with alternating vesicular, vuggy and fine grained massive zones. Red-grey and brown discolourations were noted. Miocene sediments comprised siltstone, sandstone, claystone, conglomerate and some gravel lenses. Cretaceous sediments were comprised of argillite, argillaceous siltstone and pebble conglomerate.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The six hole geotechnical drilling program provided additional information on the geology and hydrogeology of proposed tailings dam embankments along the west and south sides of the proposed tailings impoundment area. This information was used to evaluate the performance of proposed seepage control measures and to predict seepage losses to groundwater as well as to confirm the stability of the proposed West Embankment.

If this site remains in favour as a tailings storage area, additional assessment of higher permeability fracture zones and alluvial materials may be necessary.

Identification of high permeability areas and evaluation of continuity and thickness of surficial, low permeability glacial till materials could be accomplished by employing one or more of the following methods:

1. Surface mapping to establish basalt and till distribution.
2. Test pitting to determine areas of deeper overburden.
3. Appropriate geophysical testing to evaluate continuity and thickness of glacial till.
4. Drilling to evaluate fracture zones and provide additional permeability information.

8.0 STATEMENT OF COSTS

STATEMENT OF COSTS

Fish Lake Geotechnical Drill Program
(July 26 - August 15, 1994)

Diamond Drilling (Quest Canada Drilling (1991) Inc.)		
Drill Mob-Demob	$ 6,000.00	
Direct Drilling Costs	48,154.70	
		$ 54,154.70
Engineering (Knight Piésold Ltd)		
On Site Engineering/Testwork: 200 hrs @ $65/hr	$13,000.00	
		$ 13,000.00
Helicopter (Canadian Helicopters)		
Mob-Demob: 1.4 hrs @ $850/hr	$ 1,190.00	
Drill Moves: 16.4 hrs @ $850/hr	13,940.00	
Support 26.2 hrs @ $850/hr	22,270.00	
		$ 37,400.00
Camp Costs		
Room/Board: 126 man days @ $50/day	$ 6,300.00	
		$ 6,300.00
	TOTAL COSTS	$110,854.70

NOTE:

(i) No administrative or supervisory costs have been included, in or out of the field.

(ii) Off site engineering costs and computer time have not been included.

(iii) Reclamation costs, telecommunications/courier costs, and truck/equipment rentals have not been included.

9.0 REFERENCES

CAIRA, N.M., FINDLAY, A., DELONG, R.C., AND REBAGLIATI, C.M., 1995
Fish Lake Porphyry Copper-Gold Deposit, Central British Columbia.
As yet unpublished CIM paper.

CAIRA, N.M. and PIROSH, D., 1992.
Diamond Drilling Assessment
Report on the Fish Lake Property

DELONG, R.C., HASLINGER, R.J., AND REBAGLIATI, C.M., 1995
1994 Exploration-Delineation, Geotechnical and Environmental Drilling Program on the Fish Lake Porphyry Gold Copper Deposit. Private report for Taseko Mines Limited.

SIVERTZ, W.G., 1993
Geotechnical Diamond Drilling Assessment Report EKO 1, Fish 1 to Fish 11, and F1 to F9 Mineral Claims. Fish Lake Property.

10.0 STATEMENTS OF QUALIFICATIONS

STATEMENT OF QUALIFICATIONS

I, Lena Kathryn Brommeland, of 301-335 East 14th Avenue, Vancouver, BC, do hereby certify that:

1. I am a graduate of the University of British Columbia (1989) and hold a B.Sc degree in Geology.

2. I have practised my profession continuously since graduation.

3. I am an employee of Taseko Mines Limited.

4. I hold no interest, direct or indirect, in the property securities of Taseko Mines Limited.

5. The foregoing report is based on:
    a) A study of all available company and government reports.
    b) My personal knowledge of the area.

Lena K. Brommeland.

Lena K. Brommeland, B.Sc.

Dated at Vancouver, British Columbia, this 6th day of January, 1995.

STATEMENT OF QUALIFICATIONS

I, Richard Josef Haslinger, of 821 West 19th Avenue, Vancouver, B.C., hereby certify that:

1. I am a Consulting Geological Engineer with offices at 821 West 19th Avenue, Vancouver, B.C.

2. I am a graduate of the University of British Columbia (B.A. Sc., Geological Engineering, 1986.)

3. I have practised my profession continuously since graduation, excluding the period January, 1989 to June, 1990.

4. I am a member in good standing of the Association of Professional Engineers and Geoscientists of British Columbia.

5. The foregoing report is based on:
    a) A study of all available company and government reports.
    b) My personal knowledge of the area resulting from my supervision of exploration on the property from June to October, 1994.

R.J. Haslinger, P.Eng.

Dated at Vancouver, British Columbia, this 6th day of January, 1995.

STATEMENT OF QUALIFICATIONS

I, Clarence Mark Regabliati, of the City of Vancouver, Province of British Columbia, DO HEREBY CERTIFY THAT:

1. I am a Consulting Geological Engineer with a business office at Suite 1020, 800 West Pender Street, Vancouver, B.C.

2. I am a graduate of the Provincial Institute of Mining, Haileybury, Ontario (Mining Technology, 1966).

3. I am a graduate of the Michigan Technological University, Houghton, Michigan, U.S.A. (B.Sc., Geological Engineering, 1969).

4. I am a registered member, in good standing of the Association of Professional Engineers and Geoscientists of British Columbia.

5. I have practised my profession continuously since graduation.

6. I directed the 1994 exploration program on the subject property.

C.M. REBAGLIATI

C.M. Rebagliati, P.Eng.

Dated at Vancouver, British Columbia, this 6th day of January, 1995.

APPENDIX I

CLAIMS HELD BY TASEKO MINES LIMITED

TASEKO MINES LIMITED
FISH LAKE PROJECT
MINERAL CLAIMS

NTS 92O/5E
Clinton Mining Division

Claim Name	Record Number	Tenure Number	Units	Record Date	Expiry Date
BCC-1(Fr)	969	208015	1	06-Feb-81	06-Feb-2000
BCC-2(Fr)	970	208016	1	06-Feb-81	06-Feb-2001
BCC-3(Fr)	971	208017	1	06-Feb-81	06-Feb-2001
BCC-4(Fr)	972	208018	1	06-Feb-81	06-Feb-2001
BCC-5(Fr)	973	208019	1	06-Feb-81	06-Feb-2000
BCC-6(Fr)	979	208020	1	25-Feb-81	25-Feb-2000
BJ-1	18417	209487	1	25-Jun-69	25-Jun-2000
BJ-3	18419	209488	1	25-Jun-69	25-Jun-2000
BJ-5	18421	209489	1	25-Jun-69	25-Jun-2000
BJ-7	18423	209490	1	25-Jun-69	25-Jun-2000
BJ-9	18426	209491	1	25-Jun-69	25-Jun-2000
BJ-11	18427	209492	1	25-Jun-69	25-Jun-2000
BJ-13	18429	209493	1	25-Jun-69	25-Jun-2000
BJ-14	18430	209494	1	25-Jun-69	25-Jun-2000
BJ-15	18431	209495	1	25-Jun-69	25-Jun-2000
BJ-16	18432	209496	1	25-Jun-69	25-Jun-2000
BJ-17	18433	209497	1	25-Jun-69	25-Jun-2000
BJ-18	18434	209498	1	25-Jun-69	25-Jun-2000
BJ-19	18435	209499	1	25-Jun-69	25-Jun-2000
BJ-20	18436	209500	1	25-Jun-69	25-Jun-2000
BJ-21	18437	209501	1	25-Jun-69	25-Jun-2000
BJ-22	18438	209502	1	25-Jun-69	25-Jun-2000
BJ-23	18439	209503	1	25-Jun-69	25-Jun-2000
BJ-24	18440	209504	1	25-Jun-69	25-Jun-2000
BJ-25	18441	209505	1	25-Jun-69	25-Jun-2000
BJ-26	18442	209506	1	25-Jun-69	25-Jun-2000
BJ-27	18443	209507	1	25-Jun-69	25-Jun-2000
BJ-28	18444	209508	1	25-Jun-69	25-Jun-2000
BJ-29	18445	209509	1	25-Jun-69	25-Jun-2000
BJ-30	18446	209510	1	25-Jun-69	25-Jun-2000
BJ-31	18447	209511	1	25-Jun-69	25-Jun-2000
BJ-32	18448	209512	1	25-Jun-69	25-Jun-2000
BJ-33	18449	209513	1	25-Jun-69	25-Jun-2000
BJ-34	18450	209514	1	25-Jun-69	25-Jun-2000
BJ-35	18451	209515	1	25-Jun-69	25-Jun-2000
BJ-36	18452	209516	1	25-Jun-69	25-Jun-2000
BJ-37	18453	209517	1	25-Jun-69	25-Jun-2000
BJ-38	18454	209518	1	25-Jun-69	25-Jun-2000
BJ-39	18455	209519	1	25-Jun-69	25-Jun-2000
BJ-40	18456	209520	1	25-Jun-69	25-Jun-2000
BJ-41	18457	209521	1	25-Jun-69	25-Jun-2000

TASEKO MINES LIMITED
FISH LAKE PROJECT
MINERAL CLAIMS

NTS 92O/5E
Clinton Mining Division

Claim Name	Record Number	Tenure Number	Units	Record Date	Expiry Date
BJ-42	18458	209522	1	25-Jun-69	25-Jun-2000
EKO 1	999	208024	20	02-Apr-81	02-Apr-2000
EKO 2	1000	208025	20	02-Apr-81	02-Apr-2000
EKO 3	1001	208026	20	02-Apr-81	02-Apr-2000
F1		314003	1	15-Oct-92	15-Oct-97
F2		314004	1	15-Oct-92	15-Oct-97
F3		314005	1	15-Oct-92	15-Oct-97
F4		314006	1	16-Oct-92	16-Oct-97
F5		314007	1	16-Oct-92	16-Oct-97
F6		314008	1	16-Oct-92	16-Oct-97
F7		314009	1	16-Oct-92	16-Oct-97
F8		314010	1	16-Oct-92	16-Oct-97
F9		314025	1	16-Oct-92	16-Oct-97
FL1	401	207940	16	11-Sep-79	11-Sep-2000
FL4	404	207941	16	11-Sep-79	11-Sep-2000
Fish 1*	3563	209324	20	18-Jan-91	18-Jan-2000
Fish 2*	3564	209325	20	19-Jan-91	19-Jan-2000
Fish 3*	3565	209326	20	19-Jan-91	19-Jan-2000
Fish 4*	3566	209327	20	18-Jan-91	18-Jan-2000
Fish 5		314027	20	15-Oct-92	15-Oct-97
Fish 6		314028	20	16-Oct-92	16-Oct-97
Fish 7		314029	20	17-Oct-92	17-Oct-97
Fish 8		314030	20	17-Oct-92	17-Oct-97
Fish 9		314031	8	16-Oct-92	16-Oct-97
Fish 10		314026	12	17-Oct-92	17-Oct-96
Fish 11		314032	12	17-Oct-92	17-Oct-96
K-53	29417	209563	1	17-Aug-72	17-Aug-2000
K-54	29418	209564	1	17-Aug-72	17-Aug-2000
K-55	29419	209565	1	17-Aug-72	17-Aug-2000
K-56	29420	209566	1	17-Aug-72	17-Aug-2000
K-57	29421	209567	1	17-Aug-72	17-Aug-2000
K-58	29422	209568	1	17-Aug-72	17-Aug-2000
K-59	29423	209569	1	17-Aug-72	17-Aug-2000
K-61	29425	209570	1	17-Aug-72	17-Aug-2000
K-63	29427	209571	1	17-Aug-72	17-Aug-2000
K-66	29430	209572	1	17-Aug-72	17-Aug-2000
K-68	29432	209573	1	17-Aug-72	17-Aug-2000
K-70	29434	209574	1	17-Aug-72	17-Aug-2000
K-72	29436	209575	1	17-Aug-72	17-Aug-2000
K-74	29438	209576	1	17-Aug-72	17-Aug-2000
K-76	29440	209577	1	17-Aug-72	17-Aug-2000

TASEKO MINES LIMITED
FISH LAKE PROJECT
MINERAL CLAIMS

NTS 92O/5E
Clinton Mining Division

Claim Name	Record Number	Tenure Number	Units	Record Date	Expiry Date
K-116	29480	209578	1	17-Aug-72	17-Aug-2000
K-117	29481	209579	1	17-Aug-72	17-Aug-2000
K-118	29482	209580	1	17-Aug-72	17-Aug-2000
K-119	29483	209581	1	17-Aug-72	17-Aug-2000
K-120	29484	209582	1	17-Aug-72	17-Aug-2000
K-121	29485	209583	1	17-Aug-72	17-Aug-2000
K-125	29489	209584	1	17-Aug-72	17-Aug-2000
K-126	29490	209585	1	17-Aug-72	17-Aug-2000
K-127	29491	209586	1	17-Aug-72	17-Aug-2000
K-128	29492	209587	1	17-Aug-72	17-Aug-2000
K-129	29493	209588	1	17-Aug-72	17-Aug-2000
K-130	29494	209589	1	17-Aug-72	17-Aug-2000
K-131	29495	209590	1	17-Aug-72	17-Aug-2000
K-132	29496	209591	1	17-Aug-72	17-Aug-2000
K-133	29497	209592	1	17-Aug-72	17-Aug-2000
K-134	29498	209593	1	17-Aug-72	17-Aug-2000
K-135	29499	209594	1	17-Aug-72	17-Aug-2000
K-136	29500	209595	1	17-Aug-72	17-Aug-2000
L-7	29311	209535	1	17-Aug-72	17-Aug-2000
L-8	29312	209536	1	17-Aug-72	17-Aug-2000
L-9	29313	209537	1	17-Aug-72	17-Aug-2000
L-10	29314	209538	1	17-Aug-72	17-Aug-2000
L-11	29315	209539	1	17-Aug-72	17-Aug-2000
L-12	29316	209540	1	17-Aug-72	17-Aug-2000
L-21	29325	209541	1	17-Aug-72	17-Aug-2000
L-22	29326	209538	1	17-Aug-72	17-Aug-2000
L-23	29327	209543	1	17-Aug-72	17-Aug-2000
L-24	29328	209544	1	17-Aug-72	17-Aug-2000
L-31	29335	209545	1	17-Aug-72	17-Aug-2000
L-32	29336	209546	1	17-Aug-72	17-Aug-2000
L-33	29337	209547	1	17-Aug-72	17-Aug-2000
L-34	29338	209548	1	17-Aug-72	17-Aug-2000
L-35	29339	209549	1	17-Aug-72	17-Aug-2000
L-36	29340	209550	1	17-Aug-72	17-Aug-2000
L-37	29341	209551	1	17-Aug-72	17-Aug-2000
L-38	29342	209552	1	17-Aug-72	17-Aug-2000
L-39	29343	209553	1	17-Aug-72	17-Aug-2000
L-40	29344	209554	1	17-Aug-72	17-Aug-2000
L-41	29345	209555	1	17-Aug-72	17-Aug-2000
L-42	29346	209556	1	17-Aug-72	17-Aug-2000
L-43	29347	209557	1	17-Aug-72	17-Aug-2000

TASEKO MINES LIMITED
FISH LAKE PROJECT
MINERAL CLAIMS

NTS 92O/5E
Clinton Mining Division

Claim Name	Record Number	Tenure Number	Units	Record Date	Expiry Date
L-44	29348	209558	1	17-Aug-72	17-Aug-2000
L-45	29349	209559	1	17-Aug-72	17-Aug-2000
L-46	29350	209560	1	17-Aug-72	17-Aug-2000
L-47	29351	209561	1	17-Aug-72	17-Aug-2000
L-48	29352	209562	1	17-Aug-72	17-Aug-2000
TEL-57	30661	209596	1	25-Apr-73	25-Apr-2000
TEL-59	30663	209597	1	25-Apr-73	25-Apr-2000
TEL-75	30679	209598	1	26-Apr-73	26-Apr-2000
TEL-76	30680	209599	1	26-Apr-73	26-Apr-2000
TEL-77	30681	209600	1	26-Apr-73	26-Apr-2000
TK-1	30881	209601	1	28-May-73	28-May-2001
TK-2	30882	209602	1	28-May-73	28-May-2001
TK-3	30883	209603	1	28-May-73	28-May-2001
TK-4	30884	209604	1	28-May-73	28-May-2001
TK-5	30885	209605	1	28-May-73	28-May-2001
TK-6	30886	209606	1	28-May-73	28-May-2001
TK-7	30887	209607	1	28-May-73	28-May-2001
TK-8	30888	209608	1	28-May-73	28-May-2001
TK-9	30889	209609	1	28-May-73	28-May-2001
TK-10	30890	209610	1	28-May-73	28-May-2001
TK-15	30895	209611	1	28-May-73	28-May-2000
TK-16	30896	209612	1	28-May-73	28-May-2000
TK-17	30897	209613	1	28-May-73	28-May-2000
TK-18	30898	209614	1	28-May-73	28-May-2000
TK-19	30899	209615	1	28-May-73	28-May-2000
TK-20	30900	209616	1	28-May-73	28-May-2000
TK-21	30901	209617	1	28-May-73	28-May-2000
TK-22	30902	209618	1	28-May-73	28-May-2000
TK-23	30903	209619	1	28-May-73	28-May-2000
TK-24	30904	209620	1	28-May-73	28-May-2000
TK-25	30905	209621	1	28-May-73	28-May-2000
TK-26	30906	209622	1	28-May-73	28-May-2000
TK-29	30909	209623	1	28-May-73	28-May-2001
TK-30	30910	209624	1	28-May-73	28-May-2001
TK-31	30911	209625	1	28-May-73	28-May-2001
TK-32	30912	209626	1	28-May-73	28-May-2001
TK-33	30913	209627	1	28-May-73	28-May-2001
TK-34	30914	209628	1	28-May-73	28-May-2001
TK-35	30915	209629	1	28-May-73	28-May-2001
TK-36	30916	209630	1	28-May-73	28-May-2001
TK-37	30917	209631	1	28-May-73	28-May-2001

TASEKO MINES LIMITED
FISH LAKE PROJECT
MINERAL CLAIMS

NTS 92O/5E
Clinton Mining Division

Claim Name	Record Number	Tenure Number	Units	Record Date	Expiry Date
TK-38	30918	209632	1	28-May-73	28-May-2001
TK-39	30919	209633	1	28-May-73	28-May-2000
TK-40	30920	209634	1	28-May-73	28-May-2000
TK-41	30921	209635	1	28-May-73	28-May-2000
TK-42	30922	209636	1	28-May-73	28-May-2000
TK-43	30923	209637	1	28-May-73	28-May-2000
TK-44	30924	209638	1	28-May-73	28-May-2000
TK-45	30925	209639	1	28-May-73	28-May-2000
TK-46	30926	209640	1	28-May-73	28-May-2000
TK-47	30927	209641	1	28-May-73	28-May-2000
TK-49	30929	209642	1	28-May-73	28-May-2000
TK-50	30930	209643	1	28-May-73	28-May-2000
TK-51	30931	209644	1	28-May-73	28-May-2000
TK-52	30932	209645	1	28-May-73	28-May-2000
TK-53	30933	209646	1	28-May-73	28-May-2000
TK-54	30934	209647	1	28-May-73	28-May-2000
TK-57	30937	209648	1	28-May-73	28-May-2000
TK-58	30938	209649	1	28-May-73	28-May-2000
TK-61	30941	209650	1	28-May-73	28-May-2000
TK-62	30942	209651	1	28-May-73	28-May-2000
TK-63	30943	209652	1	28-May-73	28-May-2000
TK-64	30944	209653	1	28-May-73	28-May-2000
TK-65	30945	209654	1	28-May-73	28-May-2000
TK-66	30946	209655	1	28-May-73	28-May-2000
TK-67	30947	209656	1	28-May-73	28-May-2000
TK-68	30948	209657	1	28-May-73	28-May-2000
TKO 1	3517	209278	16	09-Jan-91	09-Jan-2000
TKO 2	3518	209279	20	08-Jan-91	08-Jan-2001
TKO 3	3519	209280	8	18-Jan-91	18-Jan-2001
TKO 4	3520	209281	20	16-Jan-91	16-Jan-2001
TKO 5	3521	209282	20	17-Jan-91	17-Jan-2001
TKO 6	3522	209283	12	18-Jan-91	18-Jan-2001

Total # Mineral Claims	196
Total # Units	548

APPENDIX II

1994 GEOTECHNICAL AND HYDROGEOLOGICAL INVESTIGATIONS FOR PROPOSED TAILINGS STORAGE FACILITY,

FISH LAKE PROJECT

BY
KNIGHT PIESOLD LTD.

DRAFT

TASEKO MINES LIMITED
FISH LAKE PROJECT

1994 GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS FOR PROPOSED TAILINGS STORAGE FACILITY
(REF. NO. 1738/1)

JANUARY 5, 1995

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TASEKO MINES LIMITED
FISH LAKE PROJECT

1994 GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS FOR PROPOSED TAILINGS STORAGE FACILITY

(REF NO. 1738/1)

"THIS REPORT HAS BEEN PREPARED EXCLUSIVELY FOR TASEKO MINES LIMITED. NO THIRD PARTY SHALL BE ENTITLED TO RELY ON ANY OF THE INFORMATION, CONCLUSIONS, OPINIONS OR ANY OTHER MATTER CONTAINED IN THIS REPORT".

Association of Consulting Engineers of Canada
Association des Ingénieurs-Conseils du Canada

DRAFT

TASEKO MINES LIMITED
FISH LAKE PROJECT

1994 GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS FOR PROPOSED TAILINGS STORAGE FACILITY
(REF. NO. 1738/1)

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1994 GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS FOR PROPOSED TAILINGS STORAGE FACILITY
(REF. NO. 1738/1)

EXECUTIVE SUMMARY

The 1994 geotechnical field investigation program, carried out at the proposed tailings storage facility, comprised of a drilling program to investigate the geological and hydrogeological conditions along the west and south sides of the facility. The field investigation provided a considerable amount of data as follows:

- A thin covering of glacial till overlies bedrock along the proposed embankment alignments, and the till cover becomes thicker in topographic low areas and near Wasp Lake.

- Bedrock comprising basalt flows and Miocene Sediments were encountered near surface and had permeabilities ranging from 10^{-3} to less than 10^{-7} cm/sec. The higher permeabilities were associated with the more fractured rock which was typically encountered near the till/bedrock contact. Average bedrock permeabilities ranged from 10^{-4} to 10^{-5} cm/sec.

- Surficial mapping identified basalt flows, Miocene Sediments and Kingsvale Sediments as were encountered in the tailings facility drillholes on the eastern slope above Big Onion Lake. These geological formations are continuous through the West Ridge which separates Big Onion Lake from the tailings storage facility.

- Finite element seepage analyses were performed to determine potential seepage flow rates through rock units under the proposed West Embankment. Calculated seepage flow rates ranged between 4.5 to 29.5 ℓ/sec (71 to 468 USgpm) depending on basalt permeabilities incorporated in the model as well as variable thicknesses of low permeability surficial glacial till. A seepage collection ditch and monitoring pond located down slope of the West Ridge and above Big Onion Lake are recommended to collect potential foundation seepage during operations. Water quality monitoring of collected seepage will also be required during operations and collected water may be treated and discharged or pumped back into the tailings impoundment.

- Stability analyses, performed on the proposed final West Embankment, concluded that the embankment is stable under all possible loading conditions with high Factors of Safety.
- Surficial mapping in the South Dam area revealed significant quantities of glacial till which will be suitable for borrow material during construction of the South Dam.

SECTION 1.0 - INTRODUCTION

1.1 PROJECT DESCRIPTION

The Fish Lake project site is located approximately 125 kilometres southwest of Williams Lake, British Columbia as shown on Figure 1.1.

The Fish Lake project involves open pit mining of an estimated 675 million tonnes of copper and gold ore which will be processed by selective flotation at a production rate of approximately 60,000 tonnes per day to produce a copper-gold concentrate. Tailings solids produced from the process will be stored within an engineered tailings storage facility located south of the proposed open pit. This facility is designed to provide permanent storage for up to 800 million tonnes of tailings.

The tailings storage facility will initially comprise a zoned Main Embankment constructed of overburden and waste rock from development of the open pit and will be built across the Fish Lake valley. The Main Embankment will be raised in stages using centreline construction methods when additional tailings storage is required. The West Embankment and West Saddle Dam will be constructed in future years using similar construction methods and materials as the Main Embankment. These two dams will be located on the west side of the storage facility along the topographic ridge which separates the Fish Creek drainage from Big Onion Lake and the Taseko River. The South Dam will be constructed in the final years of operation to provide additional tailings storage capacity and will retain the supernatant pond while preserving Wasp Lake and the adjacent valley. This dam will be constructed as a water-retaining structure from locally borrowed materials.

Seepage flows from the tailings storage facility will be intercepted and returned into the tailings area via seepage collection and recycle ponds located downstream of the West Embankment, West Saddle Dam and South Dam. Underdrainage from the Main Embankment will be collected in the Open Pit/Waste Storage Recycle Sump and transferred to the mill for use as process water.

The overall site plan of the Fish Lake project is shown on Drawing No. 1737.100.

The pre-feasibility design of the tailings storage facility is presented in Knight Piésold Ltd. “Report on Site Geotechnical Considerations and Design of Tailings Storage Facility (Ref. No. 1737/1)", dated May, 1994.

Previous investigation work carried out by Knight Piésold Ltd. on the Fish Lake project includes the following:

(i) Initial overview in February 1991.

(ii) Site visit and reconnaissance followed by issuing of "Report on Preliminary Geotechnical Evaluation (Ref. No. 1731/1)", dated August, 1991.

(iii) Preliminary hydrogeological investigations at the proposed open pit with results presented in "Report on Preliminary Hydrogeological Investigations (Ref. No. 1732/2)", dated May, 1992.

(iv) Preliminary investigations in the proposed tailings impoundment site, summarized in "Report on Preliminary Geotechnical Investigations (Ref. No. 1733/1)", dated January, 1993.

(v) Evaluation of rock mass characteristics and their influence on the bulk density in the Open Pit presented in "Report on Influence of Geotechnical Factors on Bulk Density (Ref. No. 1734/1)", dated March, 1993.

(vi) Analyses of available materials for construction of the tailings facility as presented in “Report on Materials for Embankment Construction and Concrete Aggregate (Ref. No. 1737/2)”, dated February, 1994.

(vii) Design of the tailings storage facility presented in “Report on Site Geotechnical Considerations and Design of the Tailings Storage Facility (Ref. No. 1737/1)”, dated May, 1994.

(viii) Investigations within the Fish Lake deposit area for rock mass characterization and hydrogeological testing, presented in "Report on Open Pit Design (Ref. No. 1736/1)", dated March, 1994 and "Report on Open Pit Hydrogeological Investigations (Ref. No. 1736/2)", dated March, 1994.

1.2 SCOPE OF WORK

The tailings storage facility site investigation program was carried out by Knight Piésold Ltd. and Quest Canada Inc. during July and August, 1994. The program objectives were to obtain geotechnical and hydrogeological information on the foundation conditions at the West Embankment, West Saddle Dam and South Dam sites.

The scope of work for the investigation program included the following:

- HQ-size coring of overburden and bedrock.
- Geotechnical logging of overburden and bedrock.
- In-situ wireline packer permeability testing, including rising and falling head testing, in overburden and bedrock.
- Installation of 51 mm (2 inch) diameter PVC groundwater monitoring wells in the completed drillholes.
- Development of groundwater monitoring wells for water quality sampling.
- Measurement of static groundwater levels in the completed wells.
- Surficial mapping along the West Ridge between the West Embankment alignment and Big Onion Lake.
- Evaluation of the type and availability of borrow materials for construction of the South Dam.

This report forms part of the overall 1994 Knight Piésold field program which included open pit hydrogeology and dewatering investigations, open pit oriented core drilling and plant and primary crusher site foundation investigations. The results of these programs are presented in “Report on 1994 Open Pit Investigations

(Ref. No. 1738/2)", dated December, 1994. Specific design issues addressed in this report include:

- seepage potential along West Embankment ridge during operation; and
- embankment stability.

SECTION 2.0 - FIELD WORK

A total of six geotechnical drill holes were drilled along the West Embankment, West Saddle Dam and South Dam alignments to investigate the foundation conditions along the western and southern limits of the proposed tailings storage facility. The holes were located by Taseko Mines Ltd. based on co-ordinates supplied by Knight Piésold Ltd. The drillhole locations are shown on Drawing 1738.010. Drilling was performed with a Val d'Or diamond drill rig, and site access was accomplished with an A-star helicopter supplied by Canadian Helicopters Ltd. Drilling commenced at the South Dam and progressively moved northwest along the West Ridge to the West Embankment.

Drillholes 94-148 and 94-150 were drilled along the downstream toe of the West Embankment. Drillhole 94-148 was located within the valley at the south end of the West Embankment and south of the watershed divide between Fish Lake and Big Onion Lake. The hole was advanced through a thick layer of glacial till overlying Miocene sediments and basalt flow lenses to a depth of 29.3 metres (96 feet) before being abandoned due to squeezing ground conditions which prevented further penetration of the drill rods. Drillhole 94-150 was located northwest of hole 94-148 at a higher elevation along the top of the ridge. This hole also encountered thin layers of glacial till, Miocene basalt and sediments and was advanced into the underlying Kingsvale Sediments. The hole was drilled to a depth of 38.4 metres (126 feet) prior to being abandoned due to fine sand caving in and binding the drill rods and core barrel in the hole.

Drillhole 94-147 was drilled in a narrow valley at the proposed West Saddle Dam site. The hole was advanced to a depth of 94.8 m (311 feet) and encountered a thin layer of glacial till overlying Miocene basalt flows and sediments.

Drillhole 94-144 was located on the ridge separating the West Saddle Dam from the South Dam site. The hole was advanced to a depth of 140.5 metres (461 feet) through a thin veneer of glacial till covering Miocene basalt flows and sediments and into the underlying Kingsvale Sediments. Geological and hydrogeological information obtained from this hole was used to correlate the two adjacent dam site drillholes.

Drillholes 94-141 and 94-143 were located downstream of the South Dam alignment and north of Wasp Lake. These holes were drilled to investigate the hydrogeological conditions adjacent to Wasp Lake and provide foundation information for the South Dam. Holes 94-141 and 143 were advanced through a thin cover of glacial till into Miocene basalt flows to depths of 62.8 and 61.3 metres (206 and 201 feet), respectively.

In-situ permeability tests were performed in bedrock in each drillhole using packer permeability testing equipment to determine the coefficient of permeability of the foundation materials. The tests were carried out in descending stages as each hole was drilled, and each stage was defined as a test interval 10 metres (30 feet) long. The test intervals were isolated by a nitrogen inflated "through the bit" packer system and were successfully performed in holes 94-141, 143, 144, 147 and 150. Due to poorer ground conditions encountered in drillhole 94-148, the packer system could not be used and falling head tests were performed over extended test intervals.

After each drillhole was completed and all hydrogeologic testing performed, a monitoring well was installed to measure the groundwater elevation and to provide a source for groundwater sampling.

Point load tests were performed on select bedrock samples from each drillhole to determine the Uniaxial Compressive Strength (UCS) of the rock types encountered. Samples from drillhole 94-144 were not selected for testing as this drillhole was not located at a potential dam location.

The test hole and bedrock logs for each drillhole are included in Appendices A and B, respectively. Point load test results, in-situ packer permeability test results and groundwater monitoring well completion details are presented in Appendices C, D and E, respectively.

SECTION 3.0 - GEOTECHNICAL RESULTS

3.1 GENERAL

Geotechnical information was collected from the West Embankment, West Saddle Dam and South Dam sites during the field investigation program. Detailed overburden and bedrock logging was carried out at the drill rig and consisted of the following items:

- Depth and type of materials encountered.
- Core Recovery and Rock Quality Designation (RQD).
- Lithology, including rock type, foliation/bedding, hardness, structure, colour, grain size, strength and weathering.
- Rock Mass Defects, including type, shape, roughness, spacing, frequency, orientation and type of infilling materials.

The test hole logs included in Appendix A and detailed bedrock logs are included in Appendix B. Interpreted geologic sections are shown on Drawing 1738.020. The geotechnical investigation results are discussed in the sections which follow.

3.2 WEST EMBANKMENT

Drillholes 94-148 and 150 encountered glacial till of varying thickness overlying bedrock. Hole 94-148, located at the bottom of a shallow valley, encountered a thick layer of stiff, brown till and a softer grey-coloured till comprising silty clay to sandy silt and gravel with some cobbles to a depth of 9.3 metres (32 feet). A thinner veneer of coarse-grained, red/brown till was encountered in hole 94-150 to a depth of 2.7 metres (9 feet).

Below the glacial till, both drillholes encountered sequences of basalt and Miocene sediments. Hole 94-148 encountered a thin layer of siltstone overlying conglomerate and basalt. The siltstone comprised weakly indurated, brownish grey silt to fine sand, soft to very soft in places, becoming increasingly coarser and more friable with depth. The conglomerate comprised weak to strongly indurated heterolithic gravels and cobbles in a brown sandy clay to clayey sand matrix. Typically only loose gravel and cobbles were recovered during drilling as the drill fluids washed the fines away. The conglomerate was typically very weak and extremely fractured with low to negligible RQD. A thin layer of fine grained, dark grey basalt was encountered at depth within the conglomerate. The hole was cored to a depth of 29.3 metres (96 feet) before being abandoned due to fines washing out from the siltstone and conglomerate formations and seizing the drill rods.

Beneath the glacial till, drillhole 94-150 encountered dark grey to greenish grey coloured basalt flows which form the West Ridge. The basalt flows comprised alternating sequences of fine grained, generally massive to vesicular and vuggy rock. The massive sequences were moderately strong and more competent than the vesicular zones. The top 5.2 metres (17 feet) of the basalt, located directly below the till/bedrock contact, was highly fractured with negligible RQD and exhibited limonite stained zones throughout. Rock quality increased from fair to good with depth, with occasional fractured zones of very poor rock. Traces of dark green, weak and brittle chloritized clay or mudstone were found within some vesicles and vugs and occasionally within a matrix of vesicular basalt. This mudstone appeared waxy and may represent an ancient weathering horizon within the basalt which was heated and crystalized during emplacement of the upper basalt flow.

The green coloured Miocene conglomerate encountered in hole 94-148 was also intersected in hole 94-150 below the basalt flows to a depth of 31.6 metres (104 feet). More competent sections of conglomerate with moderate to well indurated zones of poorly sorted sands and gravels were encountered at depth. Kingsvale Sediments were encountered at 31.6 metres (104 feet) depth and comprised black argillite and Cretaceous conglomerate. These sediments were typically weak to moderately strong with good to excellent core recovery but poor RQD. The dark grey argillite was highly jointed and sheared parallel to the bedding planes. The older Cretaceous conglomerate exhibited fewer joints compared to the younger, overlying conglomerate and had moderate RQD.

3.3 WEST SADDLE DAM AND RIDGE

Drillholes 94-144 and 94-147 were drilled to investigate the geotechnical characteristics of the foundation materials of the ridge and West Saddle Dam, respectively.

Glacial till, comprising brown sandy clay with some gravel and cobbles, was encountered as a thin layer (1.8 metres) on top of the ridge in drillhole 94-144 and as a thicker layer (4.9 metres) in the base of the saddle valley in drillhole 94-147. Beneath the till, sequences of Miocene basalt flows and sediments were encountered to depths of 124.0 and 94.8 metres (407 and 311 feet) in holes 94-144 and 147, respectively. Kingsvale Sediments, comprising argillite, were also encountered below the younger Miocene sediments in drillhole 94-144.

The basalt flows comprised dark green/grey coloured rock with alternating sequences of vesicular and vuggy zones and fine-grained massive zones. Basalt encountered in the upper portion of hole 94-144 ranged from poor to good quality, moderately fractured rock with moderate RQD, and increased to extremely competent, sparsely fractured rock with high RQD at depth. Basalt encountered in drillhole 94-147 was typically very competent with few fractures and high RQD throughout, and corresponded with the competent basalt zones identified in hole 94-144 at similar elevations.

Miocene sediments were encountered beneath the basalt flows in both drillholes. The sediments comprised siltstone, sandstone, claystone, conglomerate and some gravel lenses. Poor core recovery, high defect concentrations and very low RQD values were typical characteristics of these sedimentary layers. The siltstone and sandstone were friable and the fines were generally washed away during drilling. In contrast, the claystone was more competent with moderate to high core recovery and RQD and exhibited very few joints or other defects. The conglomerate comprised consolidated gravel and cobbles in a weak sandy matrix which generally washed away during drilling.

The Kingsvale Sediments comprised argillite and were encountered below the Miocene sediments at great depth in drillhole 94-144. The argillite varied from slightly to highly fractured, low to moderate RQD rock with some slickensides on joint surfaces and calcite infilling throughout.

3.4 SOUTH DAM

Drillholes 94-141 and 94-143, located on the downstream side of the proposed South Dam alignment, encountered a thin layer of glacial till overlying dark grey coloured basalt flows. The till comprised dark brown/grey, dense sandy clay with some gravel and cobbles to depths of 5.8 and 3.1 metres (19 and 10 feet), respectively. The basalt comprised alternating sequences of moderate to strongly vesicular and vuggy zones as well as more competent, fine-grained massive zones. Characteristic red-grey and brown discolourations were evident in the weathered basalt near surface and at local intervals throughout. The basalt was moderately fractured with excellent core recovery and poor to very good RQD. RQD varied depending upon the vesicular nature of the rock and the depth within the formation, and the vesicular and vuggy sections were typically very fractured with low RQD. Occasional thin seams of indurated, weak chloritized clay or mudstone were also encountered within the basalt flows, representing a possible ancient weathering horizon. Seams up to 10 cm thick were observed, and some exhibited slickensided fracture surfaces when broken. This horizon was also observed in the basalt flows encountered in the other drillholes.

Interbedded, thin layers of well indurated but friable grey-green/brown siltstone, fine sandstone and conglomerate were also encountered at depth in hole 94-141.

3.5 SURFICIAL MAPPING AND GEOLOGICAL INTERPRETATION

The foundation investigation for the West Embankment included two days of surficial geological mapping along the West Ridge which divides the proposed tailings storage facility from Big Onion Lake. The mapping results were combined with information obtained from previous work, the 1994 tailings storage facility drilling program and airphoto interpretation to develop a geologic model of the area as discussed below and illustrated on Drawing 1738.020.

The basement rocks in the tailings storage facility area are sediments which belong to the Upper Cretaceous Kingsvale Group. The surface of these rocks forms Cretaceous paleo-topography which defines a broad basin aligned parallel to the Fish Creek valley and extends from Wasp Lake in the south to the north shore of Fish Lake. To the west, the paleo-topography rises to form a ridge beneath the existing West Ridge which divides Fish Creek and the Taseko River. To the north, just inside the boundary of the open pit, the basin ends abruptly and slopes up to surface at a steep angle of greater than 20 degrees.

A thick sequence of varved, glaciolacustrine sediments was then deposited within this basin. These sediments are 160 m (540 ft) deep near the north shore of Fish Lake, but may be much deeper to the south in the centre of the basin. Along the ridge dividing Fish Creek and the Taseko River, the glaciolacustrine deposit grades to a glaciofluvial deposit and defines the lateral extent of the glacial lake. The glaciolacustrine/glaciofluvial deposits are capped by Miocene Chilcotin Group basalt flows. In drillhole 94-147, basalt flows were also identified below the glaciolacustrine deposit which indicates the glacial sediments are conformable with the Miocene volcanic rocks. The sequence of volcanic flows is extensive, both in areal extent and in thickness. Several separate flows have been identified.

The entire area has been recently overlain by surficial glacial till and glaciofluvial deposits, with eskers in local areas.

Surficial geological mapping of the West Ridge was performed to integrate the findings from the drilling program with the surficial geology formations and confirm the geological model presented above. Glacial till deposits were encountered at the surface and comprised dense, angular gravel and cobbles in a fine grained, silty sand matrix. The till was deposited throughout the tailings storage facility area as a mantle of varying thickness (up to 20 metres) overlying bedrock. Along the east slope of Big Onion Lake, the till was also mapped from the lakeshore up to elevation 1375 metres where bedrock outcrops were observed up to elevation 1610 metres.

Two distinct Miocene basalt flows were mapped in outcrop from elevation 1505 to 1610 metres. The lower flow, ranging from at least elevation 1505 to 1515 metres, comprised massive, weakly vesiculated, dark grey, fresh basalt with columnar joints spaced at 200 mm. The upper flow, which outcropped from 1540 to 1550 metre elevation, comprised massive, moderately well vesiculated, maroon to dark brown/grey coloured weathered basalt with columnar joints spaced at 450 mm. The contact between the flows was not seen on surface, however, based on the topography and the orientation of columnar joints, the contact is inferred to be sub-horizontal.

On a bedrock knoll approximately 2.5 kilometres east of Big Onion Lake, a sequence of basalt flows overlying the basalt flows described above was encountered up to the local topographic high point of 1610 metres.

Beneath the columnar jointed basalt, additional basalt flows were encountered in outcrop. These flows were observed to overlie argillaceous siltstone (Kingsvale Sediments) between elevation 1495 and 1505 metres, although the geologic contact was concealed beneath the talus-covered slope. A 13 metre thick layer of weakly indurated Miocene conglomerate was encountered in drillhole 94-150 between these basalt and argillaceous siltstone units. Although this conglomerate layer was not seen in outcrop, well rounded gravel and cobbles were found in float on the slope below the basalt, and it is inferred that the conglomerate exists between the basalt and argillaceous siltstone outcrops on the slope but is weaker and has been eroded away.

Additional Miocene sediments were encountered near surface in drillhole 94-147 along the West Ridge and at the West Saddle Dam site. These sediments comprised similar conglomerate as encountered in hole 94-150, as well as interbedded lacustrine clay/silt/fine sand and weakly consolidated sand and gravel layers. A thin layer of Miocene basalt was encountered near the base of these sedimentary layers, indicating the sediments are the younger Miocene sediments and not the older Cretaceous Kingsvale Sediments.

Cretaceous Kingsvale Sediments comprising argillaceous siltstone and pebble conglomerate were encountered in outcrop beneath the Miocene basalt and sediments. The fine grained, dark grey argillaceous siltstone overlies the pebble conglomerate between elevation 1470 to 1495 metres. The siltstone was well indurated and strongly jointed with weak foliation and relic bedding evident. Orientations of 295°/70° and 025°/80° (strike/dip) were measured on the foliation and bedding planes. Joints were parallel to these planes, and an average joint spacing of 10 to 15 mm resulted in a crumbly, weak, poorly exposed rock mass.

A well indurated, weakly hornfelsed and slightly deformed pebble conglomerate was encountered between elevation 1375 to 1470 metres. The conglomerate contained densely packed, well rounded pebbles in a fine siltstone matrix, and zones of elliptical pebbles were evident suggesting the rock had undergone some degree of tectonic deformation. Mapped outcrops were poorly jointed, and the rock was typically hard, massive and competent.

3.6 LABORATORY TESTING

3.6.1 Overburden Material

One representative sample of glacial till was selected for laboratory testing from drillhole 94-148 (8.5 to 8.8 metres depth). This sample was typical of the overburden materials found near surface in each of the drillholes. The results of the testwork are as follows:

- Grain size distribution:
  - 27% gravel
  - 34% sand
  - 28% silt
  - 11% clay
- Natural moisture content = 4.5%

- Specific gravity = 2.75
- Void Ratio, e = 0.24
- In-situ Dry Density = 2.22 t/m^3
- Triaxial Permeability on cored sample, k = 4 x 10^{-7} cm/sec

This sample of brown, silty gravelly sand with some clay was very dense and exhibited a very low permeability. The sample is typically two to three orders of magnitude less permeable than the underlying basalt flows.

3.6.2 Point Load Testing of Bedrock

Random samples from the West Embankment, West Saddle Dam and South Dam drillholes were taken for point load testing to determine the Uniaxial Compressive Strength (UCS) of the foundation materials. In the point load test, compressive loads are applied through hardened conical points to diametrically or axially opposite sides of a core specimen until failure occurs. A good correlation exists between the Point Load Strength Index (Is), calculated as the failure load divided by the square of the core diameter, and the Uniaxial Compressive Strength (σ_c) of the material:

$$\sigma_c = K * Is$$

where K = 22 for 45 mm (NQ3) and 25 for 63.5 mm (HQ) diameter core.

A total of 43 point load tests were performed in the field on bedrock samples taken from the upper 50 metres of each hole. The majority of samples tested were basalt (35), with samples of sandstone (1), conglomerate (6) and argillite (1) tested where possible. The results show the uniaxial compressive strength of the basalt flows ranged from very weak to very strong and depended upon the vesicular or massive nature of rock. The frequency distribution of uniaxial compressive strengths for the basalt flows is given below:

UCS Designation	Drillhole No.				
	94-141	94-143	94-147	94-148	94-150
Very Weak (1-5 MPa)	1	-	2	1	-
Weak (5-25 MPa)	3	4	2	1	1
Moderate (25-50 MPa)	3	3	1	-	1
Strong (50-100 MPa)	1	1	1	-	1
Very Strong (100-200 MPa)	3	2	3	-	-
Total No.	11	10	9	2	3

The sandstone sample from hole 94-141 was weak. The conglomerate samples from holes 94-148 and 150 were strong to very strong and very weak to extremely weak, respectively. The argillite sample from hole 94-150 was very weak.

The results of the point load testing are included in Appendix C.

SECTION 4.0 - HYDROGEOLOGICAL RESULTS

4.1 GENERAL

In-situ packer testing was performed in the overburden and bedrock to determine the permeability characteristics of each material. Falling head and rising head permeability tests were carried out when packer testing could not be performed.

4.2 IN-SITU PERMEABILITY TESTING

In-situ permeability testing was carried out during drilling of each hole using an HQ wireline double packer system. The general procedure for each test was as follows:

- Core with HQ to depth required to define the test interval.
- Pull back the drill rods to expose the test interval.
- Insert the HQ wireline packer system down the drill rods and seat on the drill bit.
- Inflate the packers to isolate the test interval.
- Fill the test interval and drill rods with water and seal.
- Perform the permeability test by pumping water into the test interval at a designated pressure and record the volume of water that flows into the formation.

Each packer test comprised applying five pressure stages to the formation and measuring the corresponding flows into the formation at each stage. In the first half of the test, the pressure was increased through three stages, to a maximum pressure. In the second half of the test, the pressure was decreased in two stages, through the same pressures applied in the rising portion of the test.

A schematic figure showing the general arrangement of the test is shown on Figure 4.1. Included on this figure is a typical plot of the test results showing the relationship between the head applied to the formation and the measured flow for all five stages. In an idealized plot, the rising and falling limbs are linear from the origin, and are superimposed over one and other. In vertical boreholes this test provides information on the horizontal permeability.

Packer tests were performed in 10 metre (30 foot) intervals, unless ground or drilling conditions proved unsuitable for this approach. In such instances, falling head permeability tests were utilized. For artesian conditions, rising head tests were carried out.

The test intervals and corresponding permeability results for each drillhole are shown on Drawing No. 1738.020. A summary of the results is given on Table 4.1, and details of the results, which include plots of head versus flow for each in-situ packer test interval, are included in Appendix D.

4.2.1 West Embankment

Falling head tests and in-situ packer permeability tests were performed in drillholes 94-148 and 150, respectively.

Two falling head tests were carried out in the glacial till and Miocene sediments (siltstone, conglomerate) in drillhole 94-148. Permeability results are as follows:

Rock Type	**Permeability (cm/sec)**	**Bedrock Conditions**
Till/Siltstone	8×10^{-6}	No core recovery
Till/Siltstone	1×10^{-5}	Poor recovery/RQD

Poor core recovery and RQD was a result of the fines washing away during drilling and are not representative of the overall rock quality.

Five packer permeability tests were carried out in the Miocene basalt flows and sediments (conglomerate) and in the Kingsvale Sediments (argillite and conglomerate) in drillhole 94-150. The test results for each rock type are summarized as follows:

Rock Type	Permeability Range (cm/sec)	Bedrock Conditions
Basalt	1×10^{-3}	Moderately broken, moderate RQD
Miocene Sediments	2×10^{-6} to 1×10^{-5}	Low core recovery, poor RQD
Kingsvale Sediments	2×10^{-5}	Very broken, low to moderate RQD

A 50 percent loss of return water was observed in the basalt at 13.4 metres (44 feet) depth during drilling, and both packer tests were carried out within this zone. Although high permeabilities of 1×10^{-3} cm/sec were calculated for each test interval, these test results are indicative of the local high permeability zone and are not representative of the entire basalt rock unit.

Low RQD values for the Miocene sediments are a result of washing the fine-grained matrix during drilling and are therefore not representative of the in-situ rock quality.

4.2.2 West Saddle Dam and Ridge

Packer permeability tests were performed in the Miocene basalt and sediments (sandstone, conglomerate and lacustrine claystone) and in the Kingsvale Sediment (argillite) layers encountered in drillholes 94-144 and 147. The test results for each formation are summarized as follows:

Drillhole 94-144		
Rock Type	**Permeability Range (cm/sec)**	**Bedrock Conditions**
Basalt	9×10^{-7} to 3×10^{-4}	Very fractured and moderate RQD to few fractures and high RQD
Miocene Sediments	8×10^{-7} to 1×10^{-6}	Poor recovery/RQD
Kingsvale Sediments	1×10^{-6}	Very fractured/low RQD

Drillhole 94-147		
Rock Type	**Permeability Range (cm/sec)**	**Bedrock Conditions**
Basalt	1×10^{-8} to 8×10^{-5}	Moderate to few fractures, moderate to high RQD
Miocene Sediments	3×10^{-4} to 2×10^{-5}	Variable core recovery and RQD

The basalt was the most competent rock encountered in both drillholes. Higher permeabilities were typically encountered near surface and adjacent to sedimentary layer contacts, whereas lower permeabilities were predominant throughout the majority of the rock unit.

Permeability results for the Miocene sediments varied depending upon depth and not core recovery or RQD. The more permeable sediments were encountered in drillhole 94-147 between 50 and 95 metres depth, whereas the less permeable sediments were encountered in hole 94-144 at 113 to 124 metres depth. The Kingsvale Sediments were as impermeable as the overlying sediments encountered in hole 94-144.

A falling head test was performed in hole 94-144 in the completed groundwater monitoring well to determine the permeability of the siltstone/ sandstone layer at 57 metres depth. The test interval was defined by the monitoring well's filter sand zone from 48.8 to 70.3 metres depth and bounded by the upper grout plug and lower bentonite seal, respectively. A permeability of 8×10^{-7} cm/sec was measured from the falling head test, and this corresponded with the packer permeability test result over the same test interval. The permeability calculation using the Hvorslev method is included in Appendix D.

4.2.3 South Dam

Artesian conditions were encountered at the South Dam site in drillhole 94-141 at depth below 7.9 metres (26 feet). One packer test was carried out between 7.9 and 17.1 metres (26 to 56 feet) and rising head tests were then performed through the remainder of the hole. The permeability test results are summarized as follows:

Material Type	Permeability Range (cm/s)	Artesian Flow Rate (ℓ/min)	Bedrock Conditions
Upper Basalt	3 x 10^{-5}	0.25	Very fractured, low RQD
Miocene Sediments	2 x 10^{-4}	2.0	Poor core recovery
Lower Basalt	2 x 10^{-5} to 1 x 10^{-4}	0.2 to 1.1	Moderately fractured, moderate to high RQD

Prior to each permeability test, the artesian flow rate was measured out the top of the casing as specified in the above table. An artesian pressure head of 3.6 to 7.0 metres (5 to 10 psi) was also measured with the packer system in the first test interval.

Artesian conditions were not encountered in drillhole 94-143. A total of six in-situ packer permeability tests were carried out within the basalt, and the test results are summarized as follows:

Rock Type	Permeability Range (cm/sec)	Bedrock Conditions
Upper Basalt	1 x 10^{-4}	Very fractured, low RQD
Lower Basalt	2 x 10^{-6} to 1 x 10^{-5}	Moderately fractured, moderate to high RQD

The upper 25 metres of the hole was found to be more permeable than the lower portion of the hole, and this corresponded with the more fractured and weathered rock encountered near the surface. Moderate to high RQD corresponded with lower permeability results in the remainder of the drillhole below 25 metres depth.

SECTION 5.0 - GROUNDWATER MONITORING WELL INSTALLATIONS

Groundwater monitoring wells were installed in each geotechnical drillhole at the West Embankment, West Saddle Dam, West Ridge and South Dam sites for the on-going baseline groundwater quality sampling program.

Each well consisted of a threaded, 3.05 metre (10 foot) long, slotted Schedule 40 PVC screen placed at the bottom of the drillhole and solid riser pipe attachments extending to the surface. A mechanical Van Ruth plug was used in holes where the screen was placed well above the bottom of the hole. Each screen was surrounded by a permeable filter sand zone which was confined by an upper and lower bentonite seal. The completion zone is defined as the length of hole between these two seals. The remainder of the hole, above the upper bentonite seal, was grouted to surface to prevent inflow of surface water. A lockable steel casing protects the top of each well at the surface. Groundwater monitoring well completion details are included in Appendix E, and the completion zone depths are summarized as follows:

Hole No.	Completion Zone Depths (from ground level)
94-141	26.6 to 33.2 metres (87 to 109 feet)
94-143	27.0 to 34.2 metres (88 to 112 feet)
94-144	48.8 to 70.3 metres (160 to 231 feet)
94-147	47.7 to 58.2 metres (156 to 191 feet)
94-148	1.0 to 26.4 metres (3 to 87 feet)
94-150	17.1 to 31.3 metres (56 to 103 feet)

Each well was installed while the drill rig remained over the hole. In general, the drill rods were pulled out of the hole prior to the installation of the PVC pipes, except in cases when the hole was likely to collapse. In these cases, the lower bentonite seal, filter sand and PVC pipes were placed through the drill bit before the rods were withdrawn.

Difficulties were encountered during installation of some of the monitoring wells. The upper bentonite seal could not be installed above the filter sand zone in hole 94-144 due to the hole becoming partially blocked with sloughing material when the drill rods were withdrawn. A layer of finer-grained sand was placed on top of the filter sand zone prior to grouting the hole to ensure the filter zone would not be contaminated by the upper grout seal.

In drillhole 94-148, overburden immediately collapsed around the monitoring well pipe after the drill rods were withdrawn. The remaining voids around the well were filled with filter sand and an upper bentonite seal was installed near surface. A thin grout cap was placed above the bentonite.

Developing the groundwater monitoring wells and measuring the static water levels will be performed by Taseko Mines Limited at a future date.

SECTION 6.0 - AVAILABILITY OF CONSTRUCTION MATERIALS

Overburden materials obtained from pre-production and on-going development of the open pit will be used as construction materials for the Main Embankment, West Embankment and West Saddle Dam. These materials were investigated and tested during the 1993 open pit investigation program, and the results and construction material requirements are presented in the Knight Piésold Ltd. "Report on Materials for Embankment Construction and Concrete Aggregate (Ref. No. 1737/2)", dated February 10, 1994.

During the 1994 tailings storage facility investigation program, the availability of construction materials for the South Dam was investigated. Initial observations in the South Dam area of moderate to dense tree cover on gentle, rolling topography and frequent swampy areas around Wasp Lake indicated the presence of low permeability surficial materials. Results from the drilling program and site reconnaissance of the area close to the South Dam show the surficial geology of the area is characterized by a dense layer of glacial till overlying basalt flows. Drillholes 94-141 and 94-143, located at the South Dam site, encountered dense, dark brown sandy silty clay till with gravel and cobbles as well as grey, clayey gravel and cobble till to depths of 5.8 and 3.1 metres (19 and 10 feet), respectively.

The glacial till is pervasive throughout the area and, based upon initial calculations, is available in quantities required for construction of the South Dam. Borrow areas located within the limits of the tailings storage facility will be preferentially selected over other areas in order to reduce surface disturbance around Wasp Lake and in the adjacent valley.

SECTION 7.0 - SEEPAGE ANALYSIS

7.1 GENERAL

Seepage through the West Ridge is an important hydrogeological factor in the design of the tailings storage facility. The seepage flow rate and direction of seepage migration from the tailings facility into Big Onion Lake and the adjacent Taseko River Valley are of significant importance to the project.

During the initial years of operation of the tailings storage facility, natural hydraulic confinement due to existing groundwater levels along the topographic ridge of the Fish Creek Valley will restrict tailings solution from seeping through the West Ridge. The Fish Creek Valley is continually being recharged by groundwater which originates from higher elevations and flows down gradient to the bottom of the valley. Water levels measured in existing groundwater monitoring wells along the West Ridge and at the Main Embankment confirm the water table typically follows topography. Initially, the hydrostatic head of the tailings solution will not be great enough to overcome the influence of the regional groundwater recharging effects, and all seepage flow will therefore occur at the base of the valley through the foundation of the Main Embankment. A small amount of seepage is anticipated beneath the Main Embankment as a thick layer of low permeability glacial till blankets the valley. The abundance of lakes and ponds confirms the low permeability properties of the till. Any seepage that permeates through the till layer and into the underlying Miocene basalt flows and sediments will be transported down gradient and will be intercepted by the Open Pit groundwater depressurization wells. These wells will pump the seepage into the Open Pit/Waste Storage Recycle Sump where the water will be transferred to the mill for use in the milling process.

Construction of the West Embankment along the West Ridge will commence in Year 2. By the beginning of Year 4, the tailings solution will encroach upon the lowest point in the West Ridge and begin to overcome the natural hydraulic confinement and cause seepage to occur. Initially, seepage flows will be minimal as a thick layer of low permeability till blankets the bottom of the saddle. In addition, the length of the West Embankment and the corresponding lateral extent of the seepage path are very narrow at this time. By Year 10, seepage is expected to increase through the foundation of the West Embankment as tailings will cover the majority of the 2400 metre long portion of the West Ridge.

Foundation seepage in later years will be controlled by the horizontally deposited Miocene basalt flows and sedimentary layers that extend through the West Ridge and outcrop above Big Onion Lake. A thin blanket of glacial till covers these formations and acts as a barrier against seepage flow. The till deposit is typically thin, and airphoto analyses have revealed the till to be potentially discontinuous on steep slopes and in local areas along the West Ridge. The basalt and sedimentary layers are typically more permeable than the glacial till, and seepage is expected to be transmitted horizontally through these rock formations. Although basalt flows encountered throughout most of the tailings facility were relatively impermeable, localized fractured zones with high permeabilities were found in the West Ridge which may significantly contribute to seepage flow. The majority of flow is expected to be transmitted through conglomerate and sandstone formations.

Detailed information from the geotechnical investigations has been used to construct a groundwater seepage model of the tailings facility to estimate seepage flow through the West Embankment and foundation. Details of the analysis method, assumptions and results are discussed in the following text.

7.2 SEEPAGE ANALYSIS MODEL

A seepage model was performed using the finite element computer program SEEP/W. Two different foundation conditions were considered:

CASE I)	Thin till cover overlying a thick layer of basalt.
CASE II)	Thick till cover overlying Miocene Sediments.

Four models for Case I and two models for Case II were examined. Figure 7.1 and Table 7.1 summarize the material parameters and results for each model. These results were then applied proportionately to the localized geological conditions along the length of the embankment to determine the total amount of seepage exiting the facility.

Several different foundation conditions were included to represent the complex geology of the West Ridge. The modelled geological conditions are summarized as follows:

- Thin glacial till and low permeability basalt on the south end of the ridge.
- Thick glacial till and low permeability sediments in the base of the saddle.
- No glacial till and low permeability basalt and sediments in local areas (approximately 10%) along the north end of the ridge.
- Thin glacial till and low permeability basalt and sediments along the north end of the ridge.
- Thin glacial till, high permeability basalt and low permeability sediments along the north end of the ridge.

These analyses were extrapolated over the length of the West Ridge in order to calculate the total seepage flow through the West Embankment foundation.

The seepage model includes the zoned embankment and adjacent tailings, as shown on Figure 7.1. A tailings beach of about 60 m width has been included adjacent to the embankment. The longitudinal drain along the upstream toe and the seepage collection ditch at the downstream toe were also incorporated into the model.

The seepage analysis was carried out based on the following assumptions:

- Steady-state flow conditions.
- Homogeneous, isotropic flow conditions.

7.3 SUMMARY OF PARAMETERS

Saturated and unsaturated hydraulic conductivities were determined for each material in the embankment and foundation zones. Typically, a saturated material has a hydraulic conductivity several orders of magnitude greater than a similar unsaturated material. In assigning hydraulic conductivity values for the seepage analysis, it was assumed that partially saturated clays and fines will have a hydraulic conductivity that is two orders of magnitude lower and partially saturated sands and gravels will be three orders of magnitude lower than similar saturated materials. Hydraulic conductivities of materials that were a combination of all soil types were adjusted accordingly. Conductivity values referenced in this section pertain to saturated flow conditions.

Hydraulic conductivity values for the tailings mass, embankment and foundation were determined as follows:

- The tailings mass was sub-divided into three zones of equal thickness and decreasing hydraulic conductivity to more accurately model the consolidated, less permeable tailings with depth. In one analysis, the entire tailings mass was assigned a uniform permeability of 3×10^{-5} cm/s to model the tailings during the early years of operation when very little consolidation has occurred.

- Hydraulic conductivity values for the various zones of the embankment were estimated based upon typical values for similar construction materials.

- Hydraulic conductivities for the Miocene Sediments and basalt flows in the embankment foundation were obtained from the in-situ packer permeability test results in drillholes 94-148 and 94-150. The hydraulic conductivity of glacial till was determined from laboratory permeability testing.

In Case I, a highly permeable layer of basalt was assumed to exist near surface and underlie the entire embankment section. In Case II, the embankment was founded on several layers of less permeable Miocene Sediments and a basalt seam. Figure 7.1 illustrates the differences in the foundation profiles of these two cases and presents a summary of all material parameters used for the analysis.

7.4 BOUNDARY CONDITIONS AND FLUX SECTIONS

Boundary conditions were imposed on the modelled sections to more accurately represent hydrogeologic conditions in the field. These conditions are summarized as follows:

- A no-flow boundary condition was assigned to the nodes along the left side of the model.
- A total head boundary was imposed at the tailings surface to model a supernatant pond.
- The upstream embankment toe drain was modelled by applying a no-head condition at that location.
- The seepage recovery wells, located downstream of the embankment, were modelled by assigning head values to a vertical line of nodes. The tip of the well was assumed to be at the base of the basalt layer and the water level in the well was set at the top of this layer.
- A hydrostatic pore pressure profile with the water table 5 metres below the ground surface was assigned to the right boundary of the model.

Flux sections were included in the model to estimate seepage flow across the various geological units, as well as the engineered components. Four locations, in particular, were examined closely:

- Seepage inflow to the upstream toe drain was computed.
- Seepage flow into the embankment drainage system downstream of the core zone was computed from the difference of flow rates across two flux sections. One section was made just upstream of the toe and the other was made just downstream of the toe. The difference represents the amount of seepage collected.

- A flux section around the seepage recovery wells was used to estimate the amount of possible seepage recovery from pumping the underlying basalt and/or Miocene Sediment layers.

- The amount of seepage flow which bypasses the seepage collection systems was determined further downstream of the recovery wells.

7.5 RESULTS

Seepage predominantly occurred through the highly permeable basalt layer in the foundation. Minor unsaturated flow occurred through the highly permeable waste rock zone of the embankment and exited on the downstream face. A summary of results from the seepage analyses is presented in Table 7.1.

Two cases were analyzed with low and high basalt permeabilities to determine the range of foundation seepage rates. Each case assumed a filled tailings facility with a maximum hydrostatic head. For the low permeability case, the basalt was assigned a permeability of 10^{-5} cm/sec, and a total solution flow rate of 13.3 ℓ/s (211 USgpm) was calculated from the tailings mass. Approximately 2/3 of the flow was collected in the upstream toe and embankment foundation drains, while the remainder of the solution flowed through the foundation. For the high permeability case, the basalt was assigned a permeability of 10^{-3} cm/sec, and a much larger total flow rate of 31.6 ℓ/s (500 USgpm) was calculated. In this case, less than ten percent of the flow was collected in the embankment drains, and the remainder was transferred into the foundation as seepage.

In the low permeability case, the solution flow contribution made by each of the four components is as follows:

- The upstream toe drain collected 49% (6.5 ℓ/sec or 103 USgpm).
- The embankment foundation drainage system collected 17% (2.3 ℓ/sec or 36 USgpm).

- The recovery wells collected 12% (1.6 ℓ/sec or 25 USgpm).
- Seepage loss through the foundation was 22% (2.9 ℓ/sec or 46 USgpm).

In the high permeability case, the solution flow contributions are as follows:

- The upstream toe drain collected 5% (1.6 ℓ/sec or 25 USgpm).
- The embankment foundation drainage system collected 2% (0.5 ℓ/sec or 8 USgpm).
- The recovery wells collected 45% (14.3 ℓ/sec or 227 USgpm).
- Seepage loss through the foundation was 48% (15.2 ℓ/sec or 241 USgpm).

Considering the results of these two cases, it is evident that the permeability of the basalt flows has a significant effect on the projected seepage flow rate through the foundation. Seepage from the tailings facility will begin in Year 4 and will increase to a maximum rate between 4.5 and 29.5 ℓ/sec (71 and 468 USgpm) when the tailings surface reaches its maximum elevation of 1565 metres. Of the two cases, the low permeability case likely underestimates seepage losses as it assumes there are no fractured, more permeable zones within the basalt. Alternatively, the high permeability case likely overestimates seepage losses as it assumes the basalt flows over the entire northern portion of the West Ridge are as fractured and permeable as the localized zone encountered in drillhole 94-150.

SECTION 8.0 - STABILITY ANALYSIS

8.1 GENERAL

Embankment stability analyses were performed through a section of the West Embankment to determine the Factors of Safety under static loading conditions. Both upstream and downstream failures were analyzed using the computer program SLOPE/W. A post-liquefaction case was also analyzed by assuming that the liquefied tailings mass provided no shear resistance to failure.

8.2 EMBANKMENT MODEL AND MATERIAL PARAMETERS

The embankment cross-section was taken through the valley of the West Embankment and was superimposed onto the geology profile as described in drillhole log 94-148. This section represented the most critical scenario along the length of the embankment alignment for two reasons:

1) the section was taken through the deepest part of the valley which corresponds with the largest embankment section and highest pressure heads; and

2) the geology at this section includes the thickest layer of glacial till which is the weakest unit in the geology profile.

Strength parameters used for all foundation and embankment construction materials were estimated from values typically representative of such materials. A summary of the material parameters is shown on Figure 8.1.

8.3 RESULTS

The stability of the Main Embankment is not a concern due to the massive buttressing effect of the adjacent waste dump. The South Embankment stability is also assured by the much lower embankment height and downstream construction method. However, additional analyses will be required during detailed design to confirm the stability of the South Dam.

The results of the downstream stability analysis for the West Embankment yielded a Factor of Safety of 2.0 for a circular slip failure surface that would result in a loss of freeboard and, consequently, a loss of tailings. A similar result was found for the post-liquefaction case where the tailings mass was assumed to have no strength. The embankment section does not rely on the tailings strength for stability, hence there was no reduction in the Factor of Safety for the liquefied tailings scenario. A typical failure surface is shown on a schematic section in Figure 8.1.

An analysis of failure on the upstream face of the West Embankment yielded Factors of Safety of greater than 2.0.

The stability analyses indicate that the competent foundation conditions and zoned rockfill embankment will provide secure confinement of tailings materials with adequate factors of safety against failure for all probable loading conditions.

SECTION 9.0 - CONCLUSIONS AND RECOMMENDATIONS

The 1994 site investigation program has provided additional detailed information on the geology and hydrogeology along the West Ridge and at the proposed South Dam location. This information has been integrated into a finite element seepage model which has been used to evaluate the performance of proposed seepage control measures and to predict potential seepage losses to groundwater. Additional stability analyses have also been conducted to confirm the stability of the proposed West Embankment.

The seepage analyses indicate that seepage losses to groundwater along the West Ridge will initially be negligible and will gradually increase to between about 71 and 468 USgpm during the later stages of the project. The upstream embankment toe drain is effective in intercepting tailings seepage and in reducing hydraulic gradients and corresponding flow rates through foundation materials. The embankment foundation drains allow for collection of relatively minor seepage through the embankment core zone. The recovery well system may prove to be relatively inefficient unless individual wells are located in higher permeability fracture zones or alluvial materials. The complex geology of the ridge will make it difficult to locate recovery wells in optimum locations.

It is recommended that additional seepage collection provisions be instituted in about Year 4 of operations when seepage losses through the West Ridge are projected to start. In the first 3 years of operation, the natural hydraulic confinement in the ridge will preclude seepage losses through the West Ridge. The seepage collection provisions should entail a seepage collection ditch and monitoring pond at the base of the ridge, located immediately above Big Onion Lake. Collected seepage would be monitored and either discharged if of suitable quality, treated and discharged, or pumped back to the tailings facility. The approximate location of the contingency collection and monitoring system is shown on Drawing 1737.100. The seepage collection system should be included in any water balance studies conducted during future design stages.

Also, the nature and extent of naturally dense, low permeability glacial till within the impoundment and particularly along the West Ridge should be evaluated during detailed design. Any areas where the glacial till is absent and fractured or high permeability bedrock is exposed should be delineated and capped with compacted low permeability glacial till materials to minimize seepage losses from the impoundment during on-going operation of the facility. It is recommended that surface mapping, test pitting and appropriate geophysical testing be conducted to evaluate the continuity and thickness of the surficial, low permeability glacial till materials along the West Ridge.

TABLE 4.1

TASEKO MINES LIMITED
FISH LAKE PROJECT
TAILINGS STORAGE FACILITY

SUMMARY OF IN-SITU PERMEABILITY TESTING

HOLE No.	TEST No.	TEST INTERVAL		AVERAGE PERMEABILITY, k (cm/sec)	ROCK MASS DESCRIPTION	
		(meters)	(feet)			
94-141	1	7.9 to 17.1	26.0 to 56.0	2E-05	Basalt	Alternating Low to high RQD
	2	17.8 to 26.2	58.5 to 86.0	3E-05	Basalt	Low to moderate RQD
	3	27.0 to 35.4	88.5 to 116.0	2E-04	Basalt and Sediments	High RQD in Basalt
	4	36.1 to 44.5	118.5 to 146.0	7E-05	Basalt	Moderate to high RQD
	5	45.3 to 53.6	148.5 to 176.0	2E-05	Basalt	Low to high RQD
	6	54.4 to 62.8	178.5 to 206.0	1E-04	Basalt	Moderate to high RQD
94-143	1	5.6 to 14.0	18.5 to 46.0	1E-04	Basalt	Very poor to fair RQD
	2	14.8 to 23.2	48.5 to 76.0	1E-04	Basalt	Poor to good RQD
	3	23.9 to 32.3	78.5 to 106.0	7E-06	Basalt	Fair to good RQD
	4	33.1 to 41.5	108.5 to 136.0	2E-06	Basalt	Fair to good RQD
	5	42.2 to 50.6	138.5 to 166.0	1E-05	Basalt	Poor to good RQD
	6	51.4 to 61.3	168.5 to 201.0	6E-06	Basalt	Fair to good RQD
94-144	1	20.9 to 29.3	68.5 to 96.0	3E-04	Basalt	Poor to fair RQD
	2	30.0 to 38.4	98.5 to 126.0	2E-04	Basalt	Poor to good RQD
	3	39.2 to 47.5	128.5 to 156.0	3E-05	Basalt	Fair to excellent RQD
	4	48.3 to 56.7	158.5 to 186.0	9E-07	Basalt	Excellent RQD
	5	48.8 to 70.3	160.0 to 231.0	8E-07	Basalt, Siltstone, Conglomerat	Zero recovery in Silt/Sandston
	6	66.6 to 75.0	218.5 to 246.0	5E-07	Basalt	Excellent RQD
	7	75.7 to 84.1	248.5 to 276.0	9E-06	Basalt	Poor to excellent RQD
	8	84.9 to 93.3	278.5 to 306.0	8E-07	Basalt	Good to excellent RQD
	9	94.0 to 102.4	308.5 to 336.0	2E-06	Basalt	Poor to good RQD
	10	103.2 to 111.6	338.5 to 366.0	2E-06	Basalt	Poor to good RQD
	11	112.3 to 125.3	368.5 to 411.0	1E-06	Basalt, Siltstone, Conglomerat	Very Poor RQD
	12	126.0 to 132.9	413.5 to 436.0	1E-06	Argillite (Kingsvale Sediments)	Very poor to fair RQD
94-147	1	8.7 to 17.1	28.5 to 56.0	6E-05	Basalt	Fair to good RQD
	2	15.7 to 23.2	51.5 to 76.0	<1E-07	Basalt	Good RQD,
	3	24.8 to 32.3	81.5 to 106.0	<1E-07	Basalt	Excellent RQD,
	4	33.1 to 41.5	108.5 to 136.0	<1E-07	Basalt	Good RQD,
	5	42.2 to 50.6	138.5 to 166.0	2E-04	Basalt and Silt/Sandstone	Moderate to high RQD in Basa Moderate recovery in Sediment
	6	49.1 to 58.2	161.0 to 191.0	4E-04	Siltstone and Gravel	
	7	60.5 to 68.9	198.5 to 226.0	4E-05	Glaciolacustrine Silt/Claystone	
	8	66.6 to 78.0	218.5 to 256.0	5E-05	Glaciolacustrine Sediments, Sand and Conglomerate	
	9	84.9 to 94.8	278.5 to 311.0	2E-05	Basalt and Conglomerate	Poor to good RQD
94-148	1	2.4 to 14.0	8.0 to 46.0	6E-05	Glacial Till, Siltstone and Conglomerate	
	2	3.0 to 23.2	10.0 to 76.0	1E-05	Glacial Till, Siltstone and Conglomerate	
94-150	1	5.6 to 14.0	18.5 to 46.0	1E-03	Basalt	Very poor to poor RQD
	2	11.7 to 20.1	38.5 to 66.0	1E-03	Basalt and Conglomerate	Very poor to fair RQD
	3	17.8 to 26.2	58.5 to 86.0	1E-05	Conglomerate	Very poor RQD
	4	17.8 to 32.3	58.5 to 106.0	2E-06	Conglomerate	Very poor RQD
	5	33.1 to 38.4	108.5 to 126.0	2E-05	Argillite and Conglomerate (Kingsvale Sediments)	Poor RQD

Knight Piésold Ltd.
CONSULTING ENGINEERS

TABLE 7.1

TASEKO MINES LIMITED
FISH LAKE PROJECT
TAILINGS STORAGE FACILITY

WEST EMBANKMENT SEEPAGE ANALYSIS - SUMMARY OF RESULTS

FLOW MEASUREMENT LOCATION	SEEPAGE RATES (l/sec per metre of cross-section)					
	CASE I				CASE II	
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2
Upstream Toe Drain	4E-05	6E-05	6E-06	2E-06	2E-05	2E-05
Embankment Drain	2E-05	1E-05	1E-06	0	8E-06	9E-06
Recovery Wells	1E-05	1E-05	2E-05	1E-04	1E-05	1E-05
Seepage Loss	2E-05	2E-05	1E-04	1E-04	1E-05	1E-05
Totals	9E-05	1E-04	1E-04	3E-04	5E-05	5E-05

J:\JOB\DATA\1738\TSF\WESTSEEP.WK4 03-Jan-95 04:10 PM

MODEL DESCRIPTIONS

CASE I - Foundation based on geological profile described by drill hole 94-150.
Model 1. Thin till cover exists over basalt.
Model 2. No till cover exists over basalt.
Model 3. Permeability of basalt is increased to 1E-04 cm/s.
Model 4. Permeability of basalt is increased to 1E-03 cm/s.

CASE II - Foundation based on geological profile described by drill hole 94-148.
Model 1. No modifications.
Model 2. Entire tailings mass permeability assigned a value of 3E-03 cm/s.

1733.A12

TASEKO MINES LIMITED
FISH LAKE PROJECT
PROJECT LOCATION MAP

CAD FILE: \PROJECT\1733\FIG\A12 Plot scale 1=1

Sept. 19, 1994

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

FIGURE 1.1

1738.A17

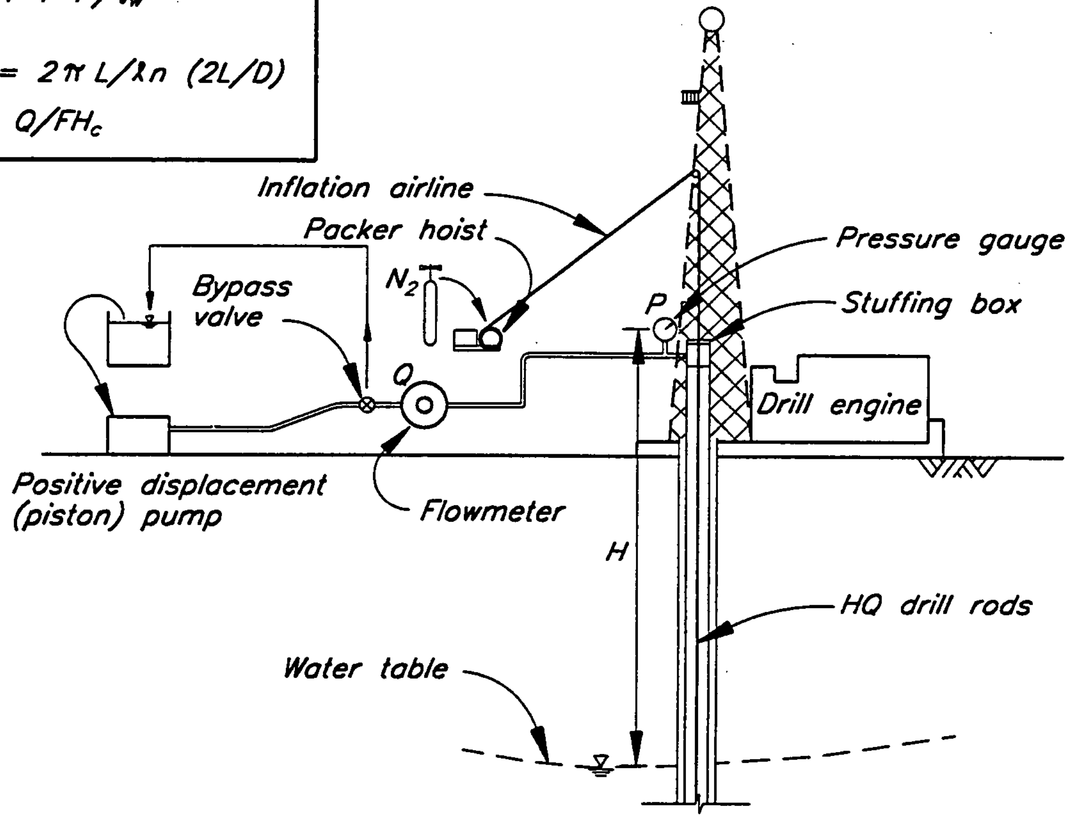
TASEKO MINES LIMITED
FISH LAKE PROJECT
IN-SITU PACKER PERMEABILITY TEST SCHEMATIC

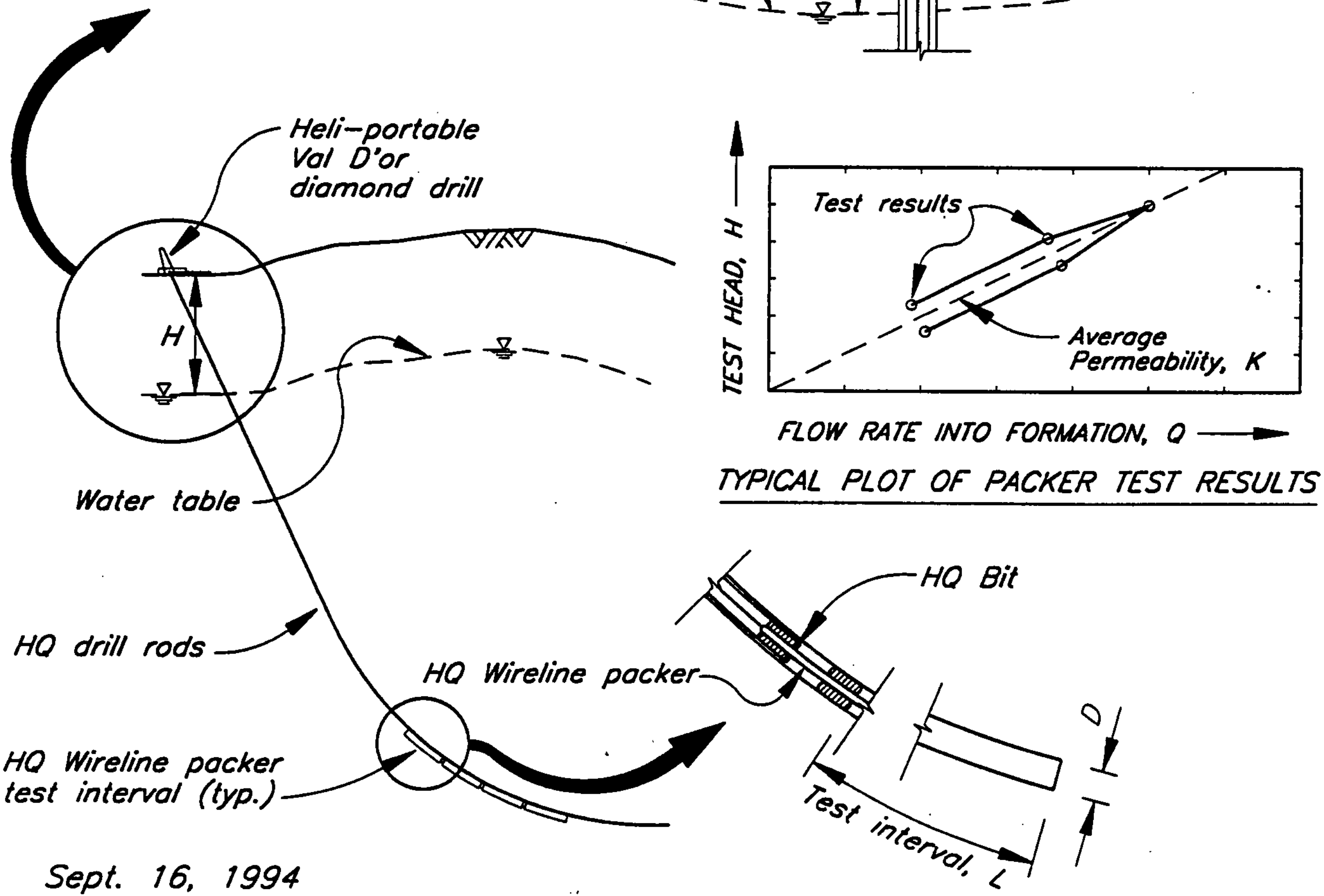
EQUATIONS

Test Head $H_c = H + P/\gamma_w$

Inflow Zone
Shape Factor $F = 2\pi L/\ln(2L/D)$

Permeability $k = Q/FH_c$





TYPICAL PLOT OF PACKER TEST RESULTS

CAD FILE: \PROJECT\1~\FIG\A17 Plot 1=1

Sept. 16, 1994
KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

FIGURE 4.1

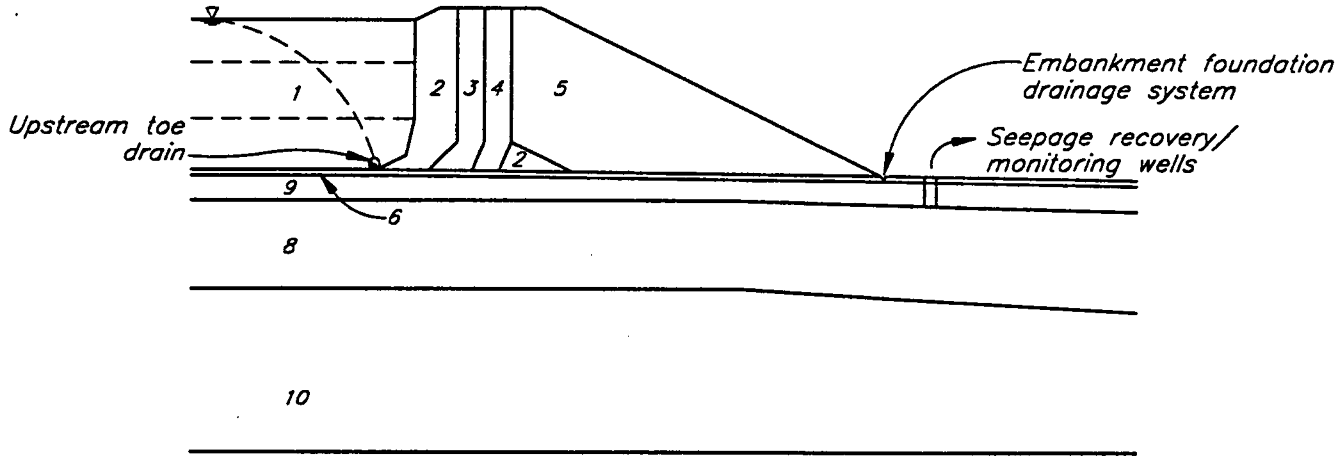
1738.A44

TASEKO MINES LIMITED

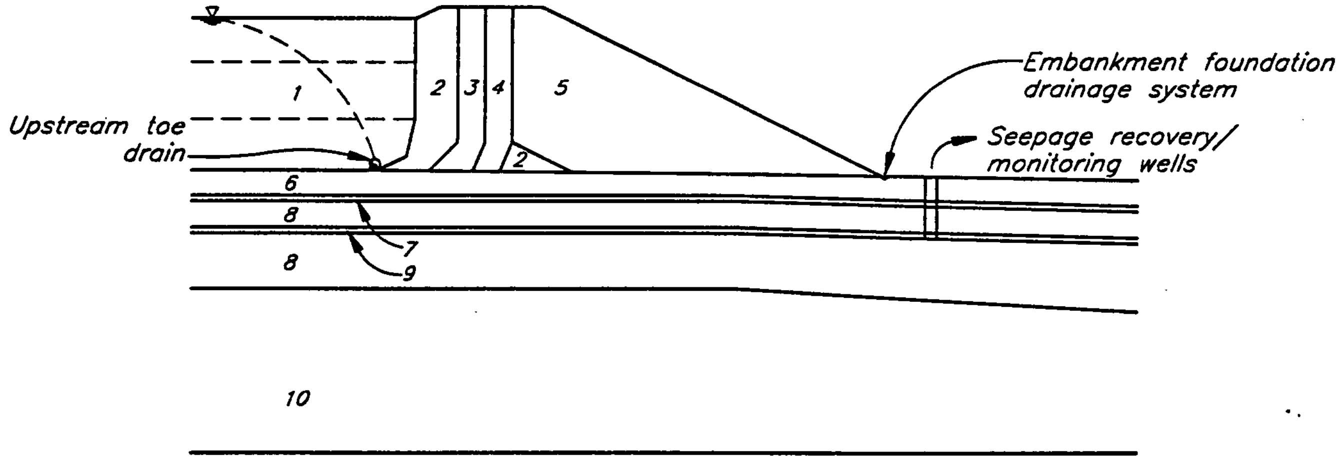
FISH LAKE PROJECT

EMBANKMENT SEEPAGE ANALYSIS

WEST EMBANKMENT SCHEMATIC SECTION



Case I Profile – Embankment Underlain By Thin Till Overlying Basalt



Case II Profile – Embankment Underlain By Till

MATERIAL		PERMEABILTY, k (cm/s)	MATERIAL		PERMEABILTY, k (cm/s)
No.	DESCRIPTION		No.	DESCRIPTION	
1*	Tailings (surface)	5×10^{-5}	5	Zone C – Waste Rock	1×10^{-1}
	(middle)	1×10^{-5}	6	Till	4.25×10^{-6}
	(base)	5×10^{-6}	7	Siltstone	1.70×10^{-5}
2	Zone B – Random Fill	1×10^{-4}	8	Sandstone/Conglomerate	1.35×10^{-5}
3	Zone S – Clay	1×10^{-7}	9	Basalt	2.40×10^{-5}
4	Zone A – Glacial Till	1×10^{-6}	10	Kingsvale Sediments	8×10^{-6}

* A 'k' value of 3×10^{-5} cm/s was used for the entire tailings mass to model initial years of unconsolidated tailings.

Jan. 6, 1995

KNIGHT PIESOLD LTD.
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FIGURE 7.1

CAD FILE: \PROJECT\1738\FIG\A44 Plot scale 1=1

TASEKO MINES LTD.
FISH LAKE PROJECT
EMBANKMENT STABILITY
WEST EMBANKMENT SCHEMATIC SECTION

Factor of Safety:

- ● Static =2.0
- ● Post Earthquake =2.0

MATERIAL		PROPERTIES	
No.	DESCRIPTION	UNIT WT (t/m^3)	PHI (ϕ')
1*	Tailings (surface)	1.92	30
	(middle)	1.94	30
	(base)	1.95	30
2	Zone B – Random Fill	2.16	38
3	Zone S – Clay	2.16	32
4	Zone A – Glacial Till	2.16	38
5	Zone C – Waste Rock	2.16	40
6	Till	1.84	35
7	Siltstone	2.32	38
8	Sandstone/Conglomerate	2.50	38
9	Basalt	2.50	42
10	Kingsvale Sediments	2.50	40

* A tailings ϕ_{ru} =0° and unit wt. = 1.66 tonnes/m^3 used for post earthquake analysis

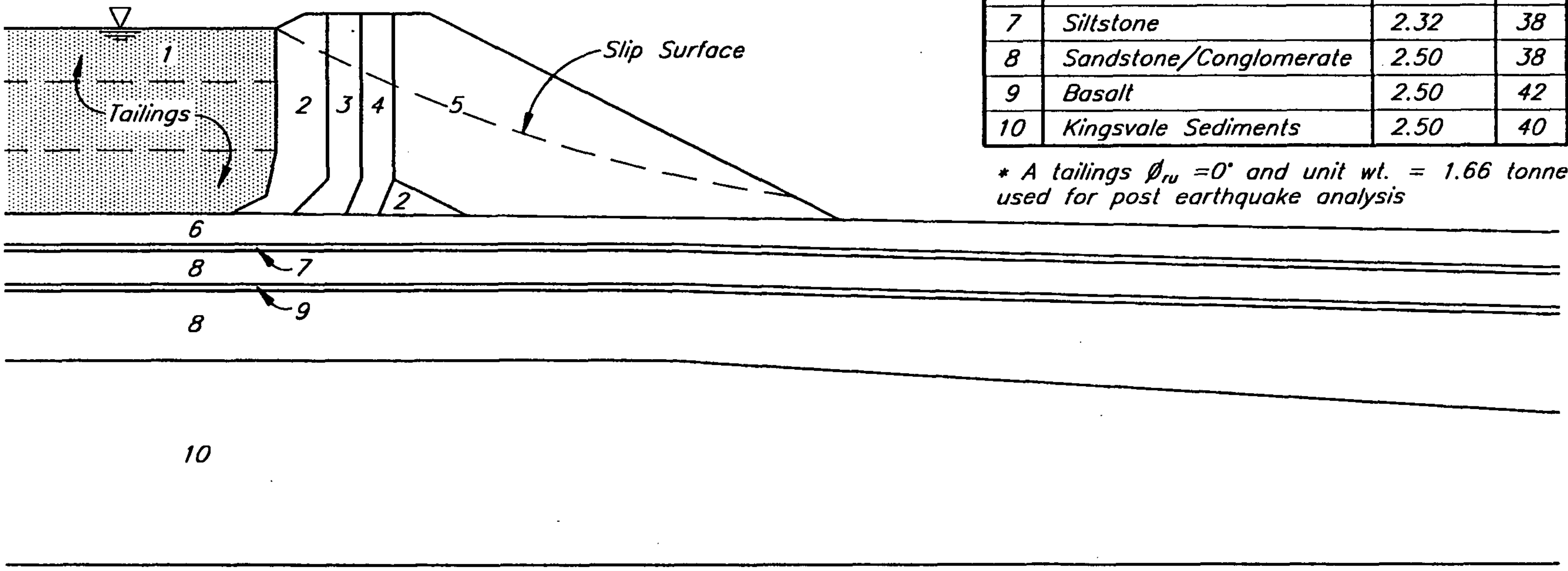
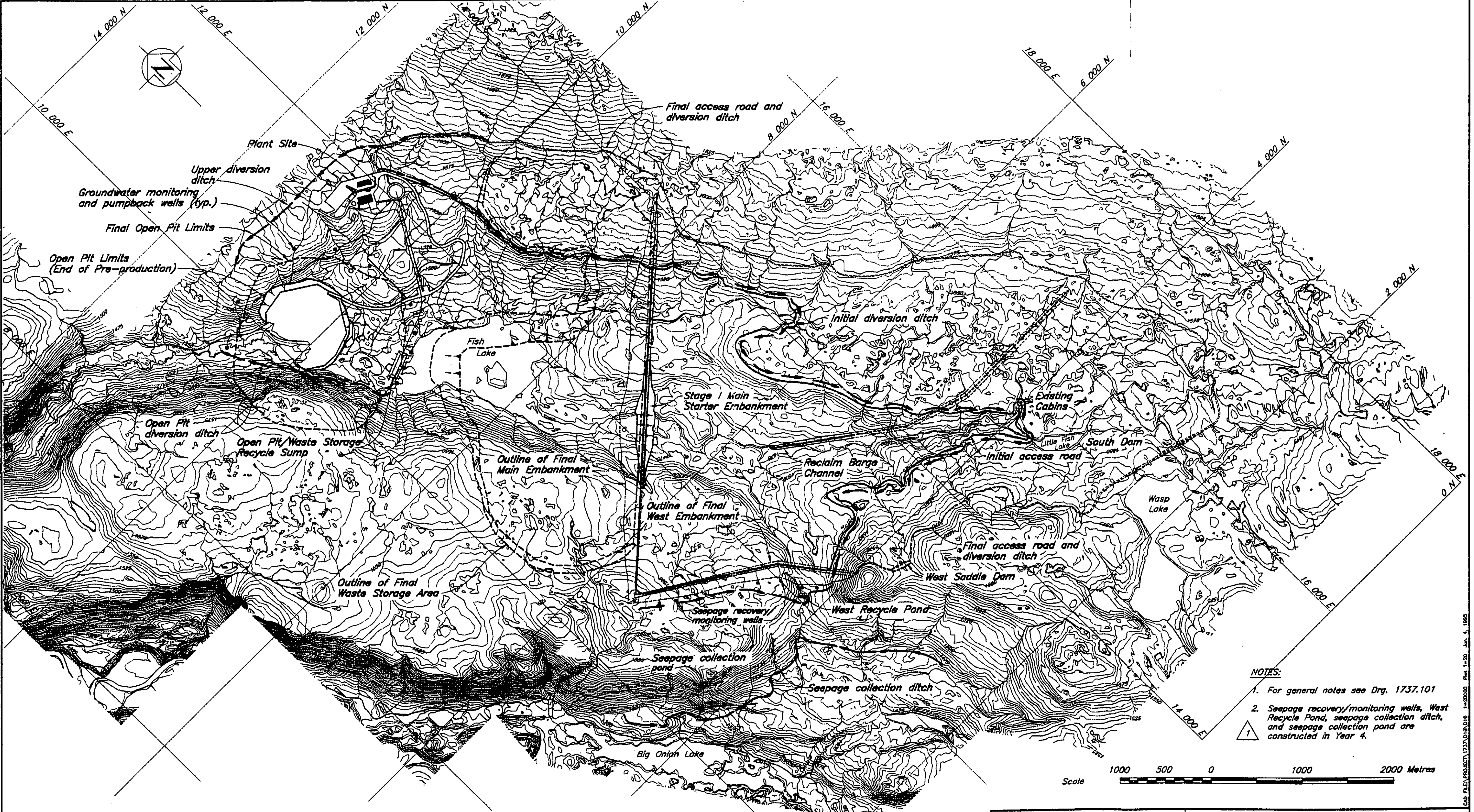


FIGURE 8.1

Nov. 23, 1994
KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

1738.A42



NOTES:

1. For general notes see Drg. 1737.101
2. Seepage recovery/monitoring wells, West Recycle Pond, seepage collection ditch, and seepage collection pond are constructed in Year 4. △1

KNIGHT PIESOLD LIMITED
CONSULTING ENGINEERS - VANCOUVER, B.C.

PROFESSIONAL ENGINEER
K. J. BROUWER
PROVINCE OF BRITISH COLUMBIA

K. Brouwer

DESIGNED DGSA/KGB
DRAWN BMC/NSD
CHECKED KGB
APPROVED KJB

TASEKO MINES LIMITED

FISH LAKE PROJECT

TAILINGS STORAGE FACILITY
OVERALL SITE PLAN

DATE FEB. 10, 1994
SCALE AS SHOWN
DRG. NO. 1737.100
REV. 1

REV.	DATE	DESCRIPTION	APPROVED
1	JAN. 6, 1995	TOPOGRAPHY AND WEST RIDGE SEEPAGE CONTROL MEASURES ADDED	KJB
0	JULY 21, 1994	ISSUED FOR PRE-FEASIBILITY STUDY	

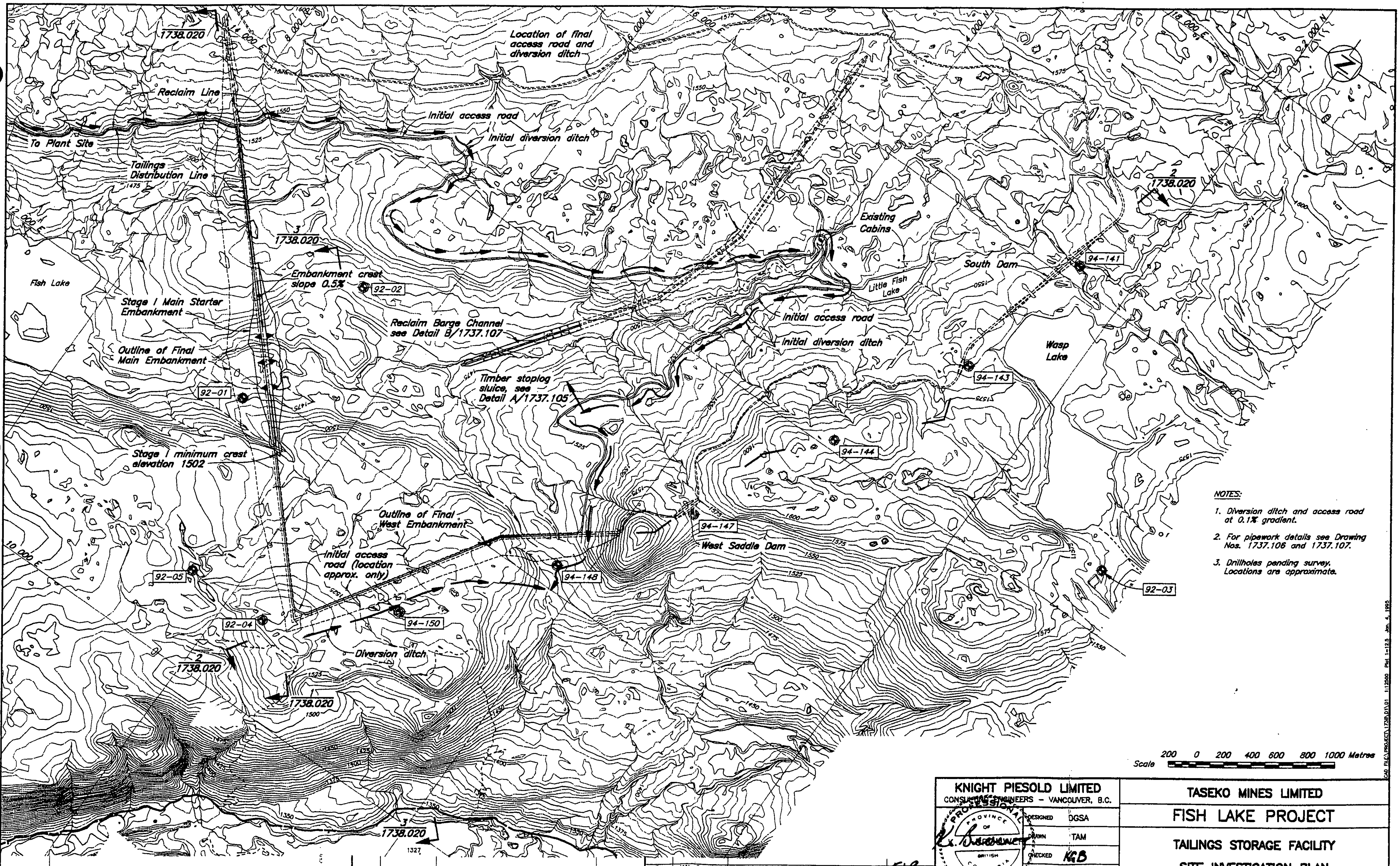
REVISIONS

REV.	DATE	DESCRIPTION	APPROVED

REVISIONS

DRG. NO.	DESCRIPTION

REFERENCE DRAWINGS



NOTES:

1. Diversion ditch and access road at 0.1% gradient.
2. For pipework details see Drawing Nos. 1737.106 and 1737.107.
3. Drillholes pending survey. Locations are approximate.

CAD FILE:\PROJECT\1738\D1\D1 1:12500 Plot 1=12.5 Jan. 4, 1995

DRG. NO.	DESCRIPTION

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	APPROVED

REVISIONS

REV.	DATE	DESCRIPTION	APPROVED
0	JAN. 6, 1995	ISSUED FOR REPORT	KJB

REVISIONS

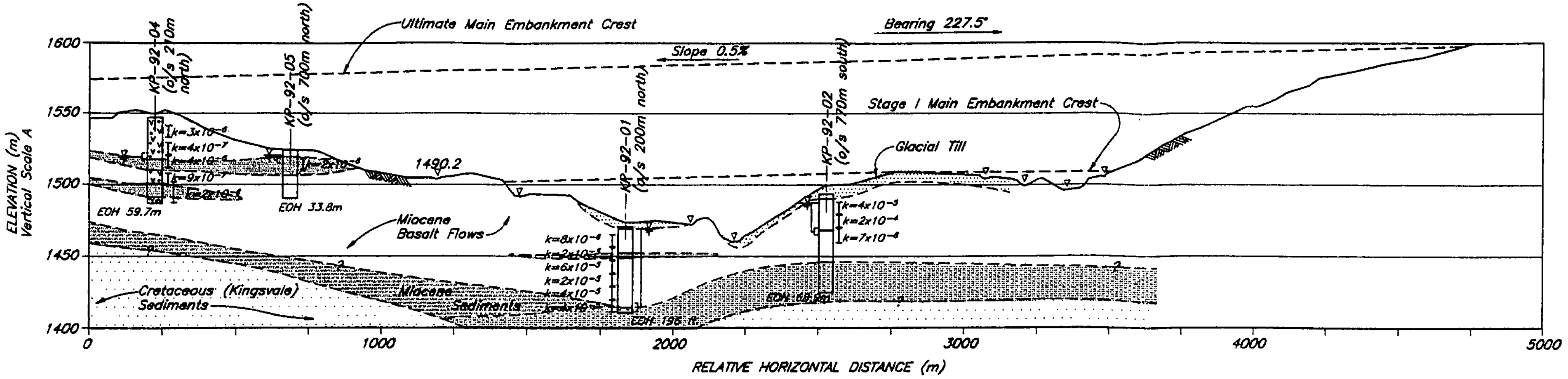
KNIGHT PIESOLD LIMITED
CONSULTING ENGINEERS - VANCOUVER, B.C.

K. Brouwer

DESIGNED DGSA
DRAWN TAM
CHECKED KGB
APPROVED KJB

TASEKO MINES LIMITED
FISH LAKE PROJECT
TAILINGS STORAGE FACILITY
SITE INVESTIGATION PLAN

DATE JAN. 6, 1995
SCALE AS SHOWN
DRG. NO. 1738.010
REV. 0



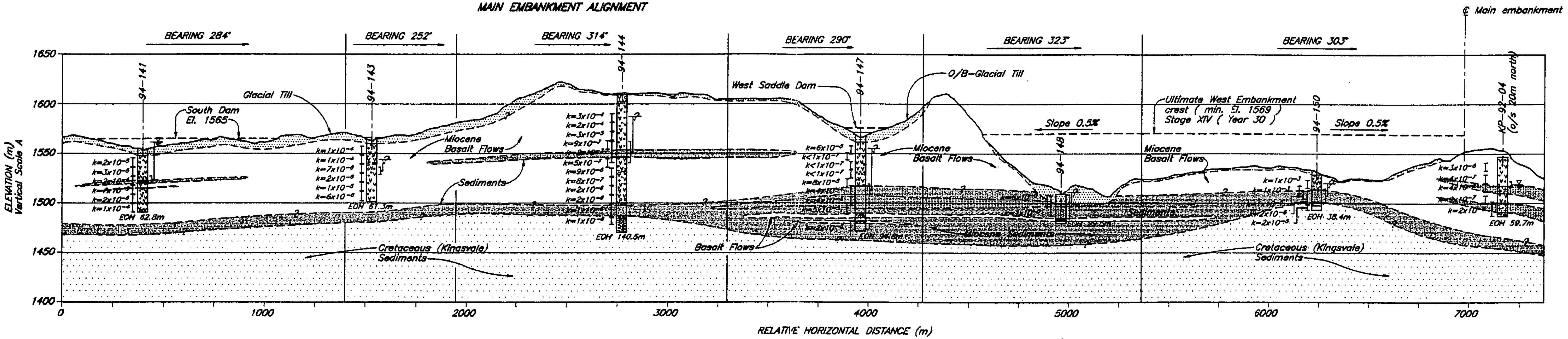
SECTION 1 / 1738.010
MAIN EMBANKMENT ALIGNMENT

MATERIAL DESCRIPTIONS:

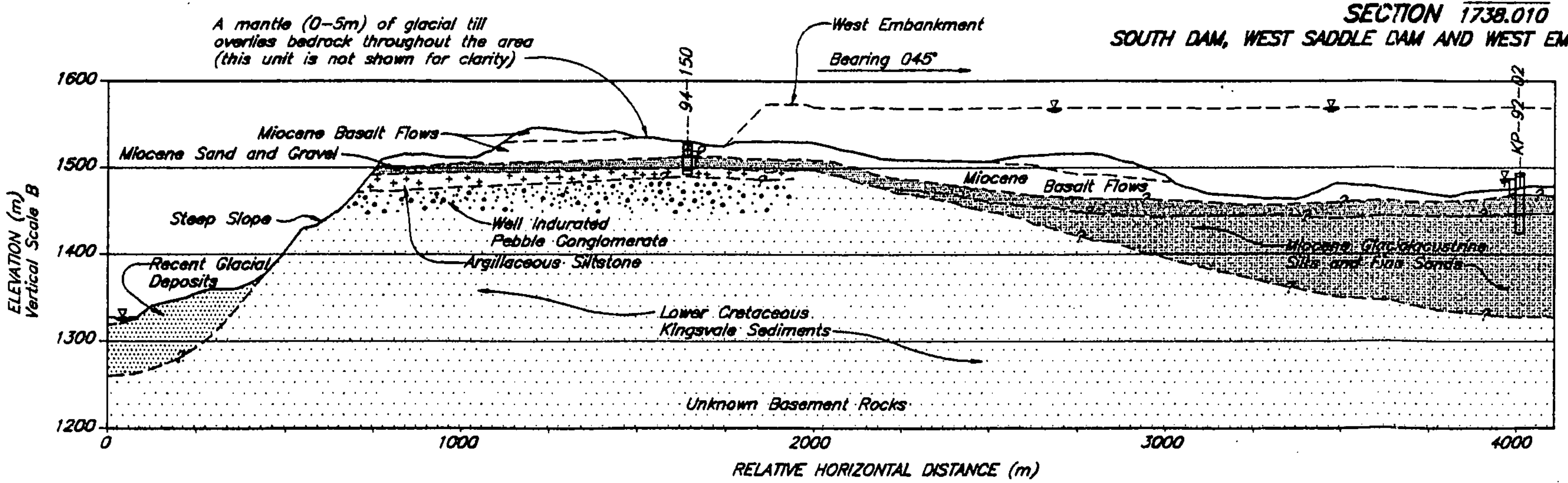
▒	OVERBURDEN:	Glacial till – angular to sub-rounded gravel to cobbles in a matrix of brown, stiff to very stiff, fine sandy silt.
☐	MIOCENE BASALT FLOW:	Basalt – black to grey, massive to heavily fractured, non-vesicular to highly vesicular, contains flow top breccias.
▨	MIOCENE SEDIMENTS:	Glacial lacustrine silts and fine sands – light grey, stiff to very stiff, well sorted and varved.
▩	MIOCENE SEDIMENTS:	Sandstone to conglomerate – poorly indurated, rounded, fluvially deposited, generally coarse grained (med. sand or larger) to cobbles.
░	OLDER SEDIMENTS (KINGSVALE GROUP):	Siltstone – argillaceous, well indurated, sheared and Conglomerate – well indurated, competent, massive.

NOTE:

1. Detailed drill logs are included in Knight Piesold Ltd. reports 1733/1 and 1738/1.

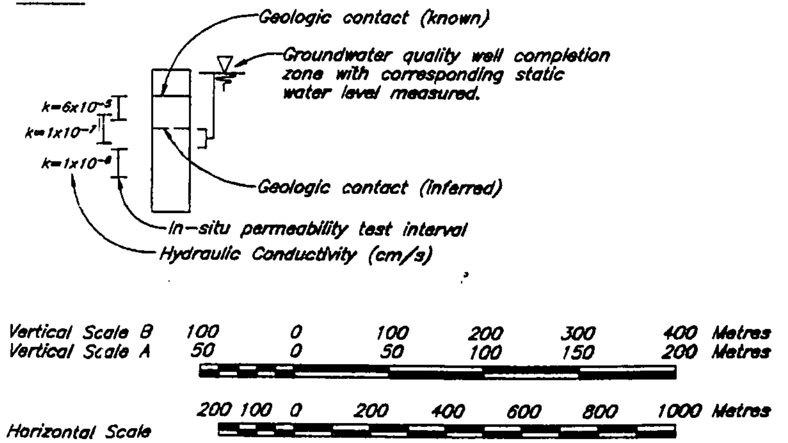


SECTION 2 / 1738.010
SOUTH DAM, WEST SADDLE DAM AND WEST EMBANKMENT ALIGNMENTS



SECTION 3 / 1738.010
WEST RIDGE

LEGEND



DRG. NO.	DESCRIPTION
REFERENCE DRAWINGS	

REV.	DATE	DESCRIPTION	APPROVED
REVISIONS			

REV.	DATE	DESCRIPTION	APPROVED
0	JAN. 6, 1995	ISSUED FOR REPORT	KJB
REVISIONS			

KNIGHT PIESOLD LIMITED
CONSULTING ENGINEERS – VANCOUVER, B.C.

J. BROUWER
ENGINEER

DESIGNED DC/KGB
DRAWN TAM/NSD
CHECKED KGB
APPROVED KJB

TASEKO MINES LIMITED

FISH LAKE PROJECT

TAILINGS STORAGE FACILITY
GEOLOGIC SECTIONS

DATE JAN. 6, 1995 | SCALE AS SHOWN | DRG. NO. 1738.020 | REV. 0

CAD FILE\PROJECT\1738\02\02 1=1000 Plot 1=10 Jan. 4, 1995

APPENDIX A

TEST HOLE LOGS

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

DRILLHOLE LOG

DRILL HOLE No. 94-141
SHEET 1 of 2

PROJECT Fish Lake
PROJECT No. 1738
TOTAL LENGTH 62.79 m
DATE DRILLED July 26-28/94
ELEVATION approx. 1552 m
AZIMUTH -
LOGGED BY DGSA
LOCATION N 2400 E 16120
ANGLE FROM HORIZ. -90°

NOTES
Water loss, type and size of hole, drilling method, groundwater level, etc.

Heli-portable Val D'or diamond drill.

Set HW casing to 2.4 m.

Core HQ from 2.4 m with polymer.

Total casing set to 6.7 m.

Core HQ with water only from 6.7 m.

Drop in hydraulic feed pressure at 32.3-33.8 m.

Hole Artesian.

Packer Test at 7.9-17.1 m only.

RISING HEAD TESTS
17.8-26.2 m
27.0-35.4 m
36.1-44.5 m
45.3-53.6 m
54.4-62.8 m

Artesian flow ceased after packer inflated at 7.9 m only.

Samples:

94-141/1 = Till 2.70-3.96 m

94-141/2 = 12.17-12.45 m

94-141/3 = 19.66-20.00 m

94-141/4 = 21.50-21.80 m

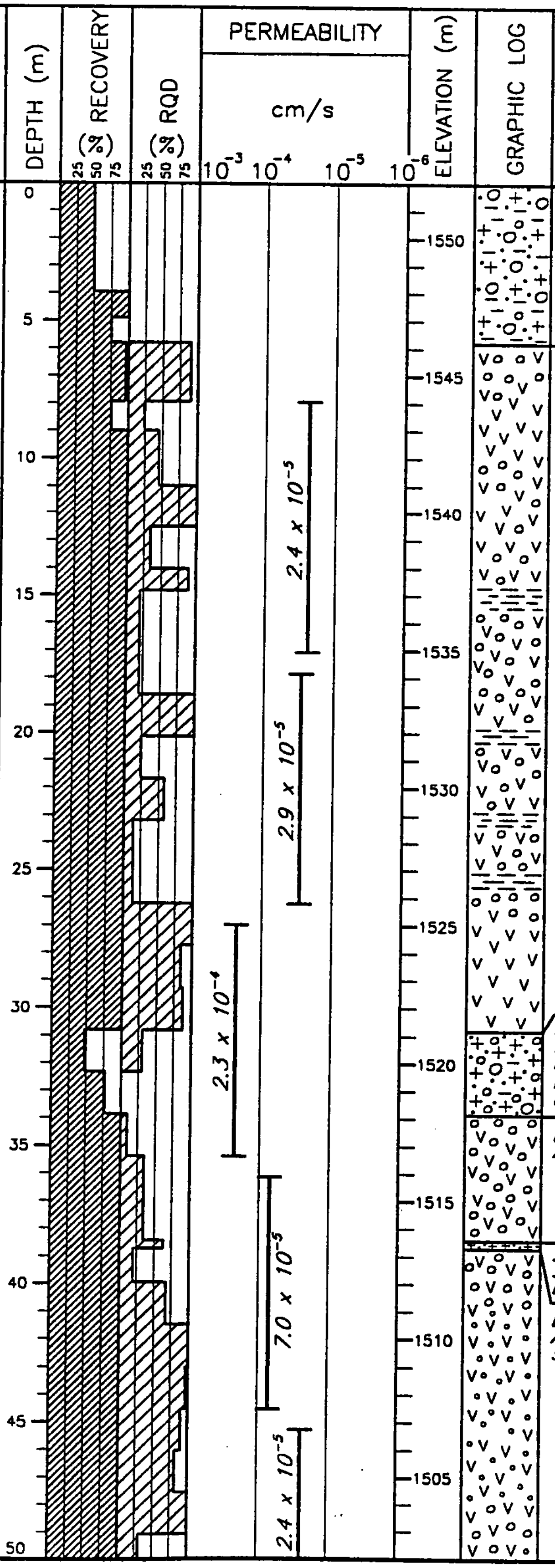
94-141/5 = 28.50-28.70 m

94-141/6 = 38.80-39.00 m

94-141/7 = 48.80-49.00 m

94-141/8 = 51.00-51.20 m

94-141/9 = 59.52-59.74 m



DESCRIPTION AND CLASSIFICATION OF MATERIAL

OVERBURDEN:
*Dark brown sandy silty clay with some cobbles and coarse gravel, dense - med. dense, **GLACIAL TILL.***

BASALT:
Dark grey, fine grained layers of alternating weak-mod.-strongly vesicular and vuggy sections. Also massive sections more competent and strong, generally fractured. Discolored reddish brown at 15.1 m and 20.1 m. Some chlorite staining to vescicles. Green chloritized/clay/mudstone seams at 15.2-15.7 m, 20.8 m (200-300 mm wide), 22.3 m (50 mm) and at 23.5 and 23.6 m.

SILTSTONE-FINE SANDSTONE:
*Interbedded sediments, greyish green - greyish brown well indurated but friable interbedded with dark brown **WACKESTONE/CONGLOMERATE,** trace clay, sand, gravel, occasional cobble.*

BASALT:
As above, mod.-strongly vesicular to massive, mod. strong - strong.

SILTSTONE-FINE SANDSTONE:
Seam at 38.4-39.0 m, reddish-greyish brown, well indurated but friable, trace gravel.

BASALT:
As above. Dark green waxy clay/mudstone seam 56.2-56.7 m.

CAD FILE:\PROJECT\17 18 Scale 1:250 Plot 1=0.25

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

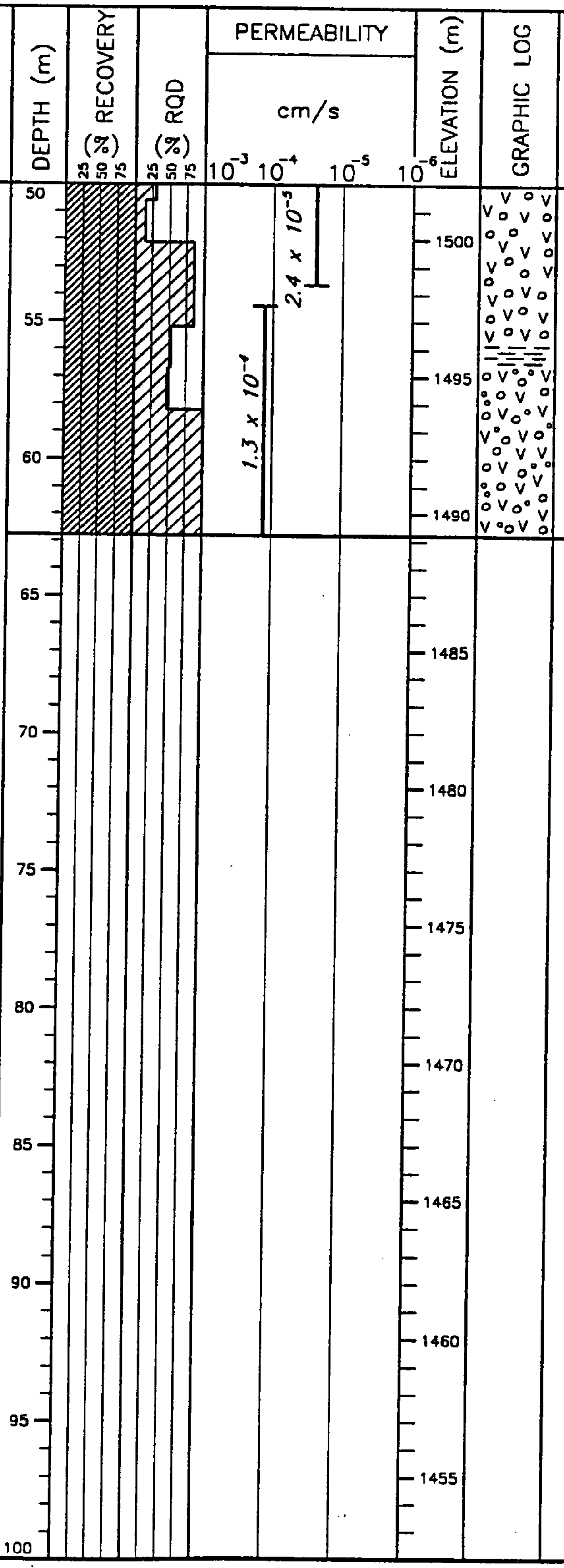
DRILLHOLE LOG

DRILL HOLE No. 94-141
SHEET 2 of 2

PROJECT Fish Lake
PROJECT No. 1738
TOTAL LENGTH 62.79 m
DATE DRILLED July 26-28/94
ELEVATION approx. 1552 m
AZIMUTH –
LOGGED BY DGSA
LOCATION N 2400 E 16120
ANGLE FROM HORIZ. -90°

NOTES
Water loss, type and size of hole, drilling method, groundwater level, etc.

Heli-portable Val D'or diamond drill.



DESCRIPTION AND CLASSIFICATION OF MATERIAL

BASALT:
As above. Dark green waxy clay/mudstone seam 56.2-56.7 m.

E.O.H. 62.79 (206 ft)

CAD FILE\PROJECT\17 19 Scale 1:250 Plot 1=0.25

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

DRILLHOLE LOG

DRILL HOLE No. 94-143
SHEET 1 of 2

PROJECT Fish Lake
PROJECT No. 1738
TOTAL LENGTH 61.26 m
DATE DRILLED July 29-31/94
ELEVATION approx. 1562 m
AZIMUTH –
LOGGED BY DGSA
LOCATION N 2650 E 15050
ANGLE FROM HORIZ. -90°

NOTES
Water loss, type and size of hole, drilling method, groundwater level, etc.

Heli-portable Val D'or diamond drill.

Set HW casing to 3.0 m.

Core with HQ from 3.0-4.9 m with polymer.

Core HQ with water only from 4.9 m.

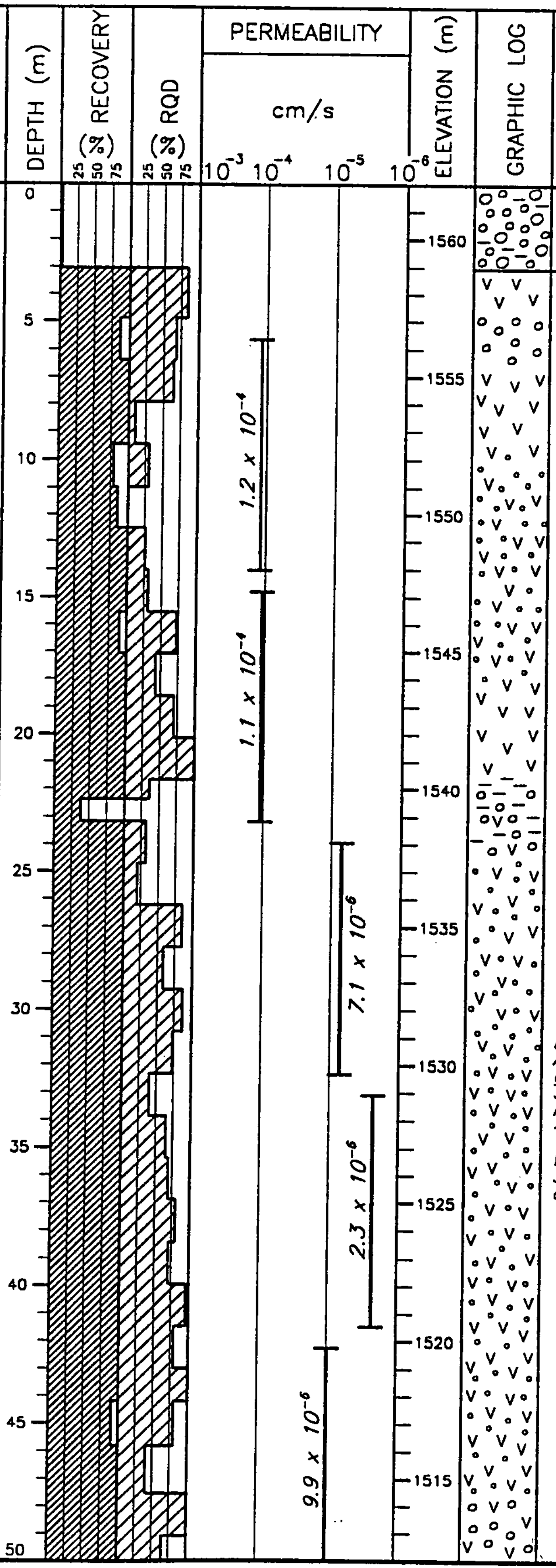
Return water changed from grey - dark brown at 15.5-17.1 m, no brown material recovered, possible wash out of fines.

Loss of drill feed pressure at 23.2 m.

Core tube stuck in rods 58.2-59.7 m, rods pulled to recover core, some loss.

Samples of glacial till for index testing not taken as no fines recovered from drilling.

Rock generally same as 94-141, no rock samples taken.



DESCRIPTION AND CLASSIFICATION OF MATERIAL

OVERBURDEN:
Gravel and cobbles, heterolithic, trace grey clay, no fines recovered, ***GLACIAL TILL.***

BASALT:
Alternating layers of weakly to mod. and highly vesicular and vuggy with massive zones generally more competent, dark grey, fine grained, mod. strong - strong. Some fractured zones. Occasional discoloration from dark grey - reddish grey below. Occasional dark green waxy clay/mudstone to vesicles.

BASALT:
Black-red highly weathered flow top at 22.4-23.2 m with trace clay/mudstone to vesicles.

BASALT:
As above, mod.-strongly vesicular zone inundated with green-dark green waxy clay/mudstone at 23.2-23.6 m, 36.9-38.9 m, 50.6-50.8 m with waxy clay/mudstone veins randomly between 26.2 m and 36.1 m from 30-100 mm, 45.3 m and 56.3-56.7 m.

Waxy clay/mudstone through matrix and in seams 30-80 mm wide and hairline veins. Massive zones more competent and less weathered with some chloritized sections.

CAD FILE:\PROJECT\1 A10 Scale 1:250 Plot 1=0.25

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

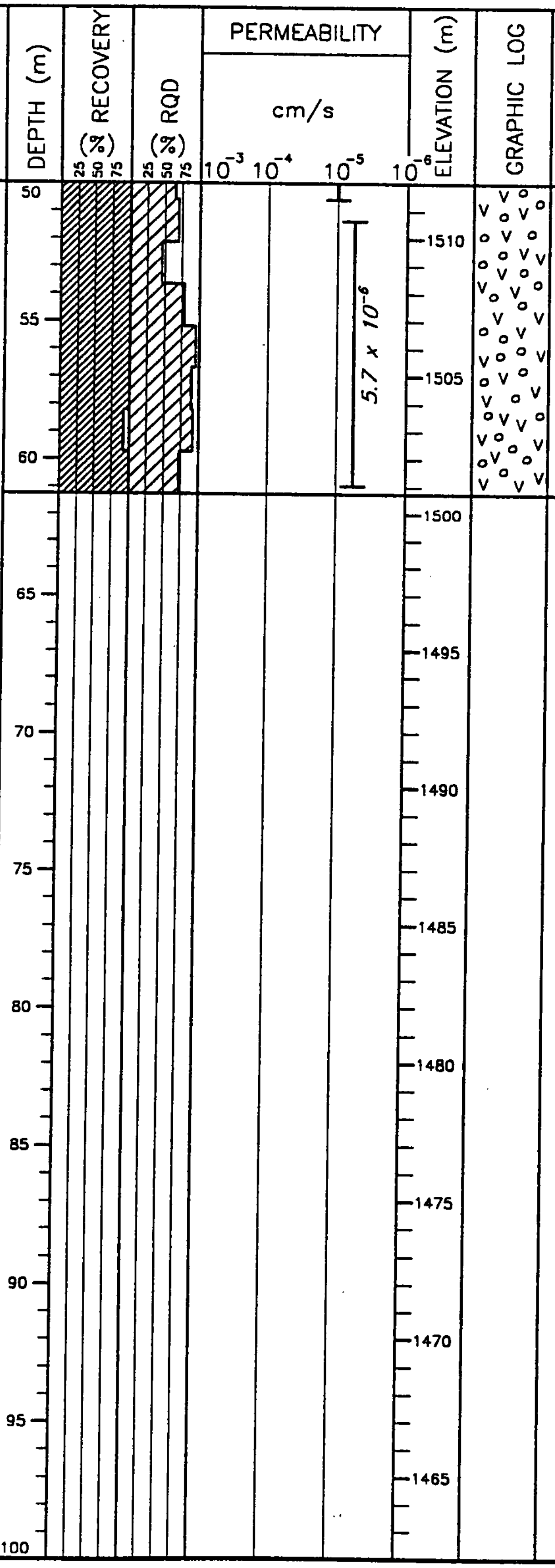
DRILLHOLE LOG

DRILL HOLE No. 94-143
SHEET 2 of 2

PROJECT Fish Lake
PROJECT No. 1738
TOTAL LENGTH 61.26 m
DATE DRILLED July 29-31/94
ELEVATION approx. 1562 m
AZIMUTH -
LOGGED BY DGSA
LOCATION N 2650 E 15050
ANGLE FROM HORIZ. -90°

NOTES
Water loss, type and size of hole, drilling method, groundwater level, etc.

Heli-portable Val D'or diamond drill.



DESCRIPTION AND CLASSIFICATION OF MATERIAL

BASALT:
As above.

E.O.H. 61.26 m (201 ft)

CAD FILE:\PROJECT\1 A11 Scale 1:250 Plot 1=0.25

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

DRILLHOLE LOG

DRILL HOLE No. 94-144
SHEET 1 of 3

PROJECT Fish Lake
PROJECT No. 1738
TOTAL LENGTH 140.51 m
DATE DRILLED August 2-6/94
ELEVATION approx. 1610 m
AZIMUTH -
LOGGED BY DGSA
LOCATION N 3100 E 14050
ANGLE FROM HORIZ. -90°

NOTES
Water loss, type and size of hole, drilling method, groundwater level, etc.

Heli-portable Val D'or diamond drill.

Set HW casing to 1.8 m with polymer.

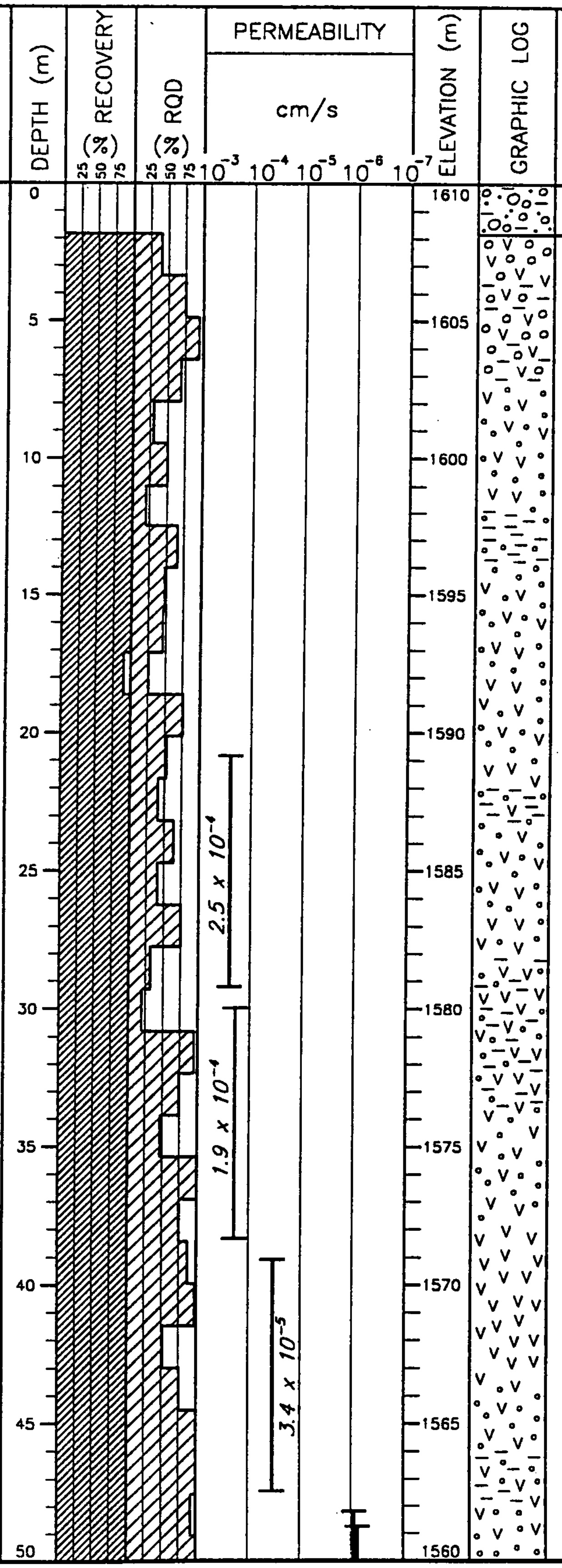
Core HQ casing to 1.8 m with polymer.

Core HQ from 1.8 m with water only.

100% loss of return water at 12.5 m onwards.

Loss of drill head pressure at 17.7-18.9 m and 77.1 m.

Falling Head Test carried out in completed monitoring well between completion zones at 48.8-70.1 m.



DESCRIPTION AND CLASSIFICATION OF MATERIAL

OVERBURDEN:
Glacial till, sandy clay, gravel and cobbles.

BASALT:
Alternating layers of dark grey - dark greenish grey weakly vesicular - mod. and highly vesicular and vuggy with some generally more competent massive zones. Fine grained, mod. - strong, SW-FS with zones of mod. - highly vesicular inundated with green - dark green waxy clay/mudstone, in vesicles and generally through matrix. Occasional light tan clay/mudstone on joints and in matrix, soft. Also some greenish brown mudstone seams to 250 mm wide, but generally 20-50 mm.

CAD FILE:\PROJECT\12\ .12 Scale 1:250 Plot 1=0.25

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

DRILLHOLE LOG

DRILL HOLE No. *94-144*
SHEET *2* of *3*

PROJECT *Fish Lake*
PROJECT No. *1738*
TOTAL LENGTH *140.51 m*
DATE DRILLED *August 2-6/94*
ELEVATION *approx. 1610 m*
AZIMUTH *-*
LOGGED BY *DGSA*
LOCATION N *3100* E *14050*
ANGLE FROM HORIZ. *-90°*

NOTES
Water loss, type and size of hole, drilling method, groundwater level, etc.

Heli-portable Val D'or diamond drill.

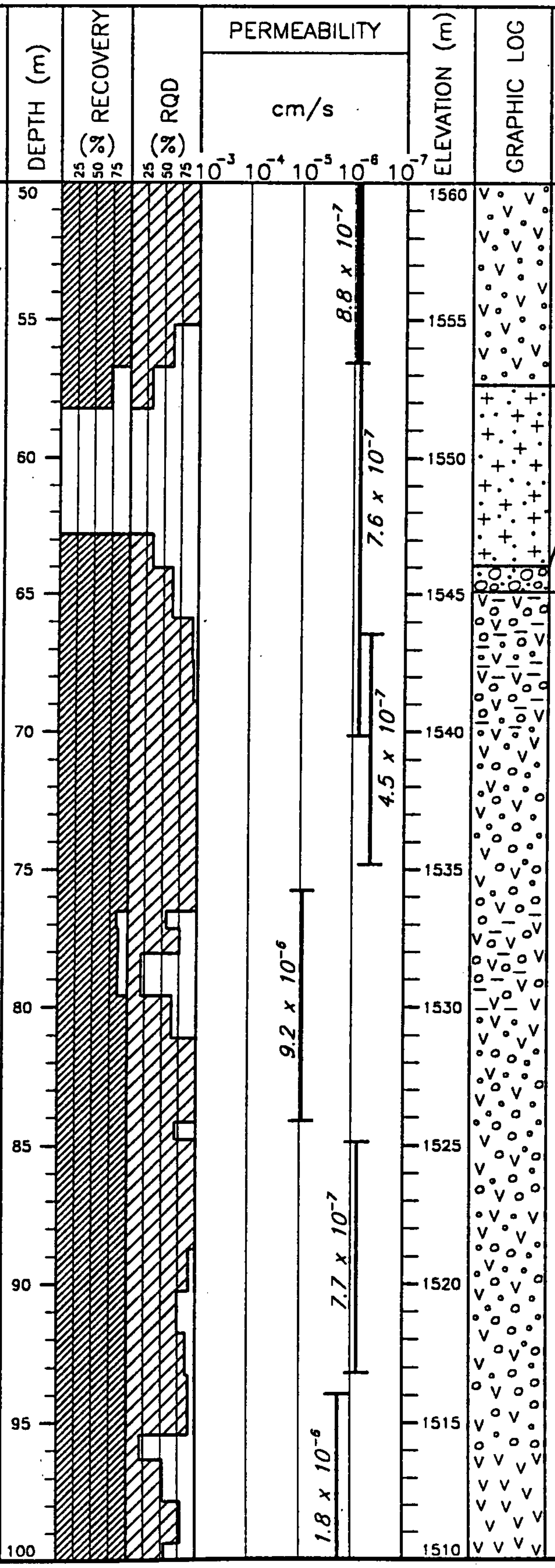
Polymer used at 84.1 m to stabilize hole after packer test.

Core HQ with water only from 87.1 m.

Drill rods pulled to recover core tube from 91.7 m.

Polymer used at 125.3 m after Packer Test. Core HQ with water only from 128.0 m.

Hole flushed for 10-15 min. before each Packer Test.



DESCRIPTION AND CLASSIFICATION OF MATERIAL

approx. 1610 m

BASALT:
As above.

SILTSTONE-SANDSTONE:
Greenish brown - brownish red silt - fine sand, trace gravel, well indurated but friable. Zero recovery 58.2-62.8 m, ***SAND/SILT*** *most likely washed away.*

CONGLOMERATE:
Round - subround fine, coarse gravel, cobbles, loose, sandy matrix washed away by drilling.

BASALT:
Alternating layers of dark grey - dark greenish grey massive - weakly and mod. - highly vesicular and vuggy as above. Fine grained, mod. strong - strong, inundated in zones by dark green. Waxy clay/mudstone through matrix and in seams 30-80 mm wide and hairline veins. Massive zones more competent and less weathered with some chloritized sections.

CAD FILE:\PROJECT\1738 18 Scale 1:250 Plot 1=0.25

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

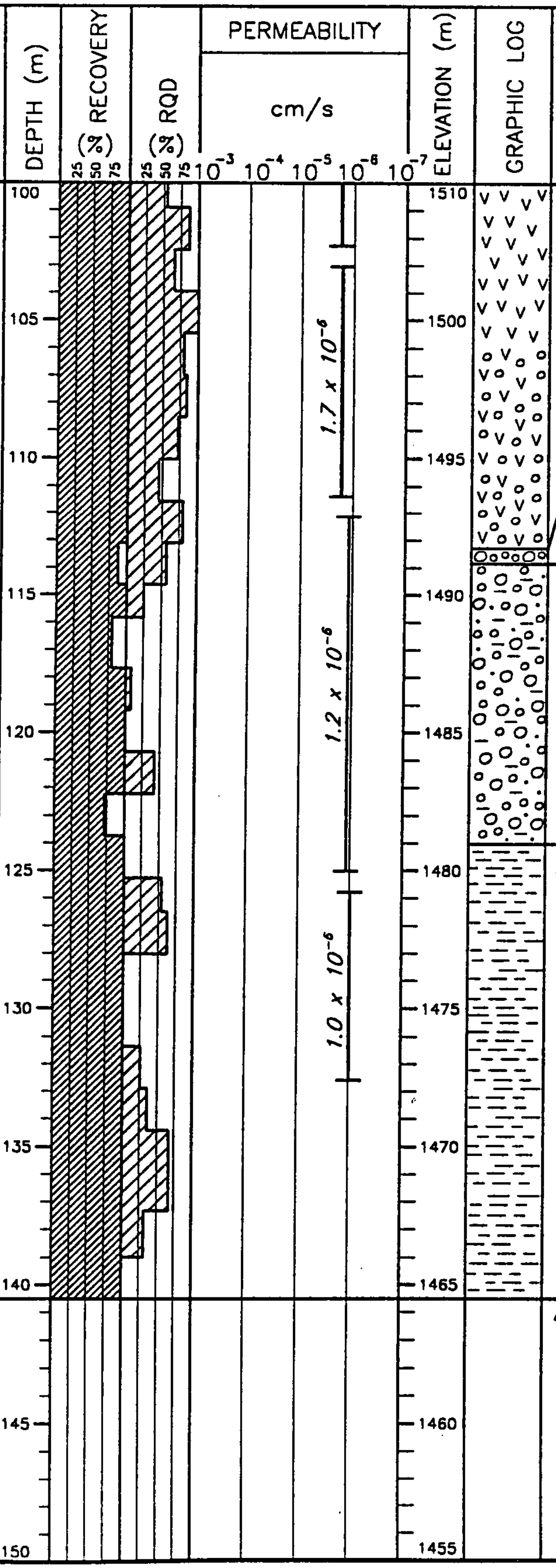
DRILLHOLE LOG

DRILL HOLE No. 94-144
SHEET 3 of 3

PROJECT Fish Lake
PROJECT No. 1738
TOTAL LENGTH 140.51 m
DATE DRILLED August 2-6/94
ELEVATION approx. 1610 m
AZIMUTH -
LOGGED BY DGSA
LOCATION N 3100 E 14050
ANGLE FROM HORIZ. -90°

NOTES
Water loss, type and size of hole, drilling method, groundwater level, etc.

Heli-portable Val D'or diamond drill.



DESCRIPTION AND CLASSIFICATION OF MATERIAL

BASALT:
As above.

GREYWACKE SANDSTONE:
Greenish brown, fine grained, well indurated but friable, poorly graded gravel, trace of cobbles.

CONGLOMERATE:
Greenish brown - greenish grey, weakly - mod. indurated gravel and cobbles, some sand, poorly graded, some sandy matrix recovered but generally little or no fines recovered, fractured - loose clasts, some green chloritic clay/mud-stone.

ARGILLITE:
Dark greenish grey-black, laminated - bedded, occasional light grey, high calcite content, fractured with some more competent less fractured zones, weak - mod. strong. Jointing generally smooth - slickensides. Kingvale Sediments.

E.O.H. 140.51 m (461 ft)

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KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

DRILLHOLE LOG

DRILL HOLE No. 94-147
SHEET 1 of 2

PROJECT Fish Lake
PROJECT No. 1738
TOTAL LENGTH 94.79 m
DATE DRILLED August 8-10/94
ELEVATION approx. 1568 m
AZIMUTH –
LOGGED BY DGSA
LOCATION N 3650 E 13050
ANGLE FROM HORIZ. -90°

NOTES
Water loss, type and size of hole, drilling method, groundwater level, etc.

Heli-portable Val D'or diamond drill.

Set with casing to 6.4 m.

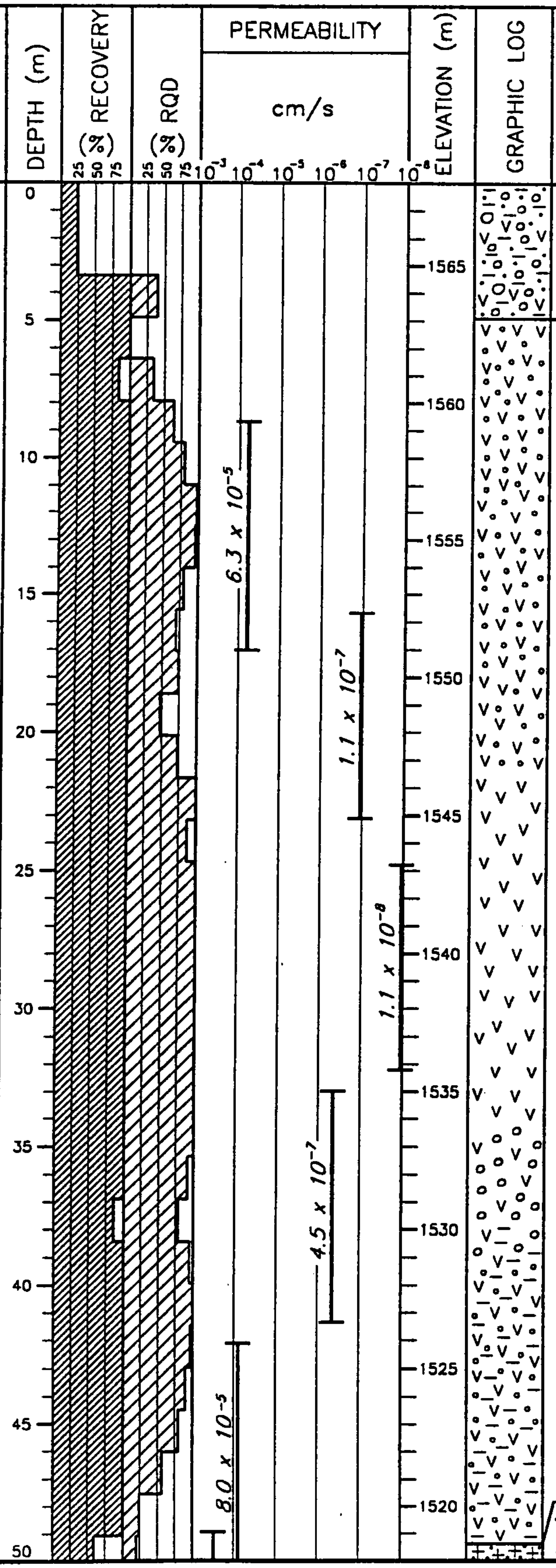
Core HQ from 2.7-7.9 m with polymer.

Core HQ with water only from 7.9 m.

Grey sand washed out of overburden in top 6.4 m and accumulated around casing on surface.

PACKER TESTS
8.7-17.1 m
66.6-78.0 m
78.8-87.2 m
84.9-94.8 m

FALLING HEAD TESTS
15.7-23.2 m
24.8-32.3 m
33.1-41.5 m
42.2-50.6 m
49.1-58.2 m
60.5-68.9 m



DESCRIPTION AND CLASSIFICATION OF MATERIAL

OVERBURDEN:
Brown sandy clay, some gravel, trace cobbles, dense with green clay and basalt clasts at lower contact, ***GLACIAL TILL.***

BASALT:
Alternating layers of dark grey, weakly vesicular to mod. and strongly and vuggy vesicular, fine grained with massive sections more competent. Zones of mod. - strongly vesicular inundated with green - dark green, weak waxy clay/mudstone through matrix, well indurated, and in seams 10-90 mm wide between 35.4 and 47.5 m.

SILTSTONE-FINE SANDSTONE:
Well indurated but friable, greenish brown. Bedding approx. 90° to core axis. Drill breaks along bedding planes.

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KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

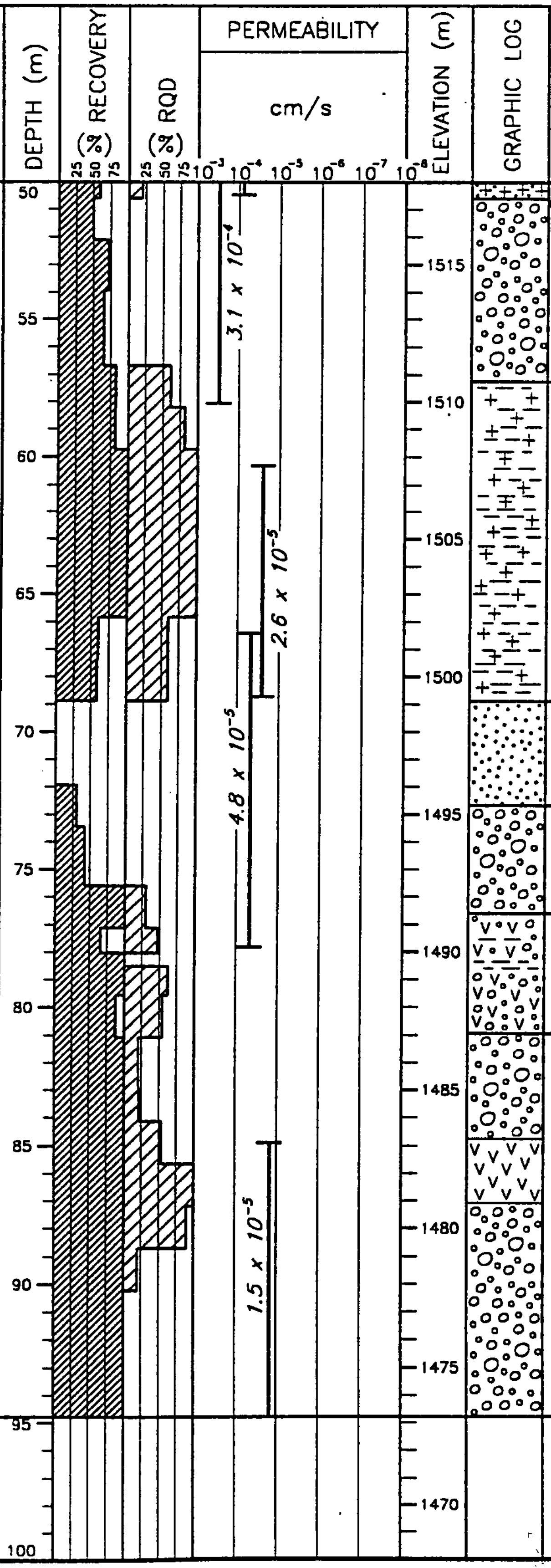
DRILLHOLE LOG

DRILL HOLE No. *94-147*
SHEET *2* of *2*

PROJECT *Fish Lake*
PROJECT No. *1738*
TOTAL LENGTH *94.79 m*
DATE DRILLED *August 8-10/94*
ELEVATION *approx. 1568 m*
AZIMUTH *-*
LOGGED BY *DGSA*
LOCATION N *3650* E *13050*
ANGLE FROM HORIZ. *-90°*

NOTES
Water loss, type and size of hole, drilling method, groundwater level, etc.

Heli-portable Val D'or diamond drill.



DESCRIPTION AND CLASSIFICATION OF MATERIAL

SILTSTONE–FINE SANDSTONE:
As above.

GRAVEL:
Loose coarse and fine gravel, some cobbles, trace siltstone-sandstone clasts, generally heterolithic.

GLACIOLACUSTRINE SILTSTONE – CLAYSTONE:
Soft, well indurated, varved, light grey-beige silty CLAYSTONE to dark grey – greenish grey – greenish brown CLAYSTONE. Drill induced breaks only. Bedding planes approx. 90° to core axis. Becoming denser and more clayey with depth.

SAND/SANDSTONE:
Greenish brown fine sand – weak sandstone, mod. indurated, poor recovery.

CONGLOMERATE:
Loose heterolithic fine and coarse gravel, trace cobbles, no fines recovered, trace silty sand – sandy clay.

BASALT:
Dark grey, med. grained, massive – v. weak vesicular, mod. strong interbedded with loose gravel and occasional green waxy clay/mudstone.

CONGLOMERATE:
Dark greenish grey, poorly sorted, weakly – well indurated, rounded, subrounded and subangular clasts, heterolithic set in weak dark green clay/mudstone and sandstone interbedded with massive BASALT flows. Competent conglomerate mod. strong – strong.

E.O.H. 94.79 m (311 ft)

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21 Scale 1:250 Plot 1=0.25

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

DRILLHOLE LOG

DRILL HOLE No. 94-148
SHEET 1 of 1

PROJECT Fish Lake
PROJECT No. 1738
TOTAL LENGTH 29.26 m
DATE DRILLED August 11-12/94
ELEVATION approx. 1502 m
AZIMUTH -
LOGGED BY DGSA
LOCATION N 4200 E 12150
ANGLE FROM HORIZ. -90°

NOTES
Water loss, type and size of hole, drilling method, groundwater level, etc.

Heli-portable Val D'or diamond drill.

Set with HW casing to 3.0 m with polymer.

Core HQ from 0.6 m with polymer.

Core HQ with water only from 12.5 m.

FALLING HEAD TESTS
2.4-14.0 m
3.0-23.2 m

Hole flushed for 10-15 min. before each Falling Head Test.

Core HQ with polymer from 16.2-29.3 m.

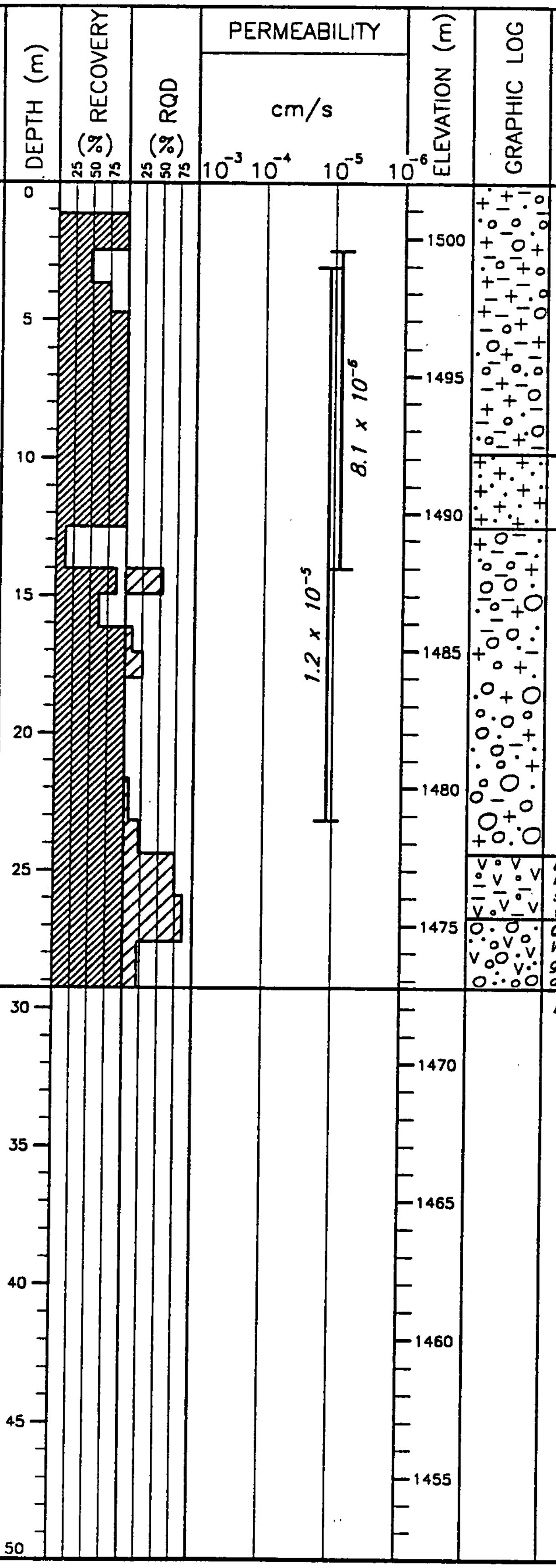
Silt - fine sand washed up casing to surface from zone 9.4-12.5 m continuously.

Hole making high volume of sand, squeezing and very tight on rods.

Hole lost at 29.3 m due to sand sticking to rods.

Samples:

94-148/1 = 4.8-5.5 m
94-148/2 = 6.4-7.2 m
94-148/3 = 8.5-8.8 m
94-148/4 = 9.8-10.5 m
94-148/5 = 10.5-10.9 m



DESCRIPTION AND CLASSIFICATION OF MATERIAL

GLACIAL TILL:
Brown silty clay, trace sand, gravel and cobbles, subangular - subrounded, stiff - v. stiff and well indurated to 6.4 m, interbedded with soft silty clay, trace sand, gravel and cobbles, partially intact at 2.4-3.7 m. Brown clayey sand - silty sand - sandy silt with gravel and cobbles, v. stiff - hard, competent and well indurated 6.4-9.8 m with drill breaks perp. to core axis.

SILTSTONE:
Brownish grey silt - fine sand, med. dense, soft v. soft becoming coarser to sandy siltstone and weakly indurated. Sandy sections more friable. No bedding evident.

CONGLOMERATE:
Round - subround - subangular gravel and cobbles, heterolithic, weakly - well indurated with brown - greyish brown - brownish green sandy clay - clayey sand matrix. Well indurated zones more competent. Some weathered vesicular basalt fragments and occasional basalt boulder present, mod. - highly weathered and limonite stained towards base. Generally comprised of loose gravels and cobbles with loss of fine sands from matrix between 14.0-16.2 m and 18.0-24.4 m.

BASALT:
Dark grey, fine grained, weakly vesicular to massive, mod. strong, conglomerate zone 30 mm at 24.8 m and mudstone vein 40-70 mm at 25.3 m.

CONGLOMERATE:
Weakly - well indurated greenish brown sandy matrix with gravel and cobbles, broken zones with some loose gravel and cobbles, heterolithic, some limonite staining, basalt clasts.

E.O.H. 29.26 m (96 ft)

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KNIGHT PIESOLD LTD.
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DRILLHOLE LOG

DRILL HOLE No. 94-150
SHEET 1 of 1

PROJECT Fish Lake
PROJECT No. 1738
TOTAL LENGTH 38.4 m
DATE DRILLED August 13-15/94
ELEVATION approx. 1525 m
AZIMUTH –
LOGGED BY DGSA
LOCATION N 4950 E 11250
ANGLE FROM HORIZ. -90°

NOTES
Water loss, type and size of hole, drilling method, groundwater level, etc.

Heli-portable Val D'or diamond drill.

Set HW casing to 3.7 m with polymer.

Core HQ from 1.8 m with polymer.

Core HQ with water only from 9.4 m.

Hole flushed for 10 min. prior to first Packer Test.

50% loss of return water at 13.4 m.

Packer set at 17.8 m for test nos. 3 and 4.

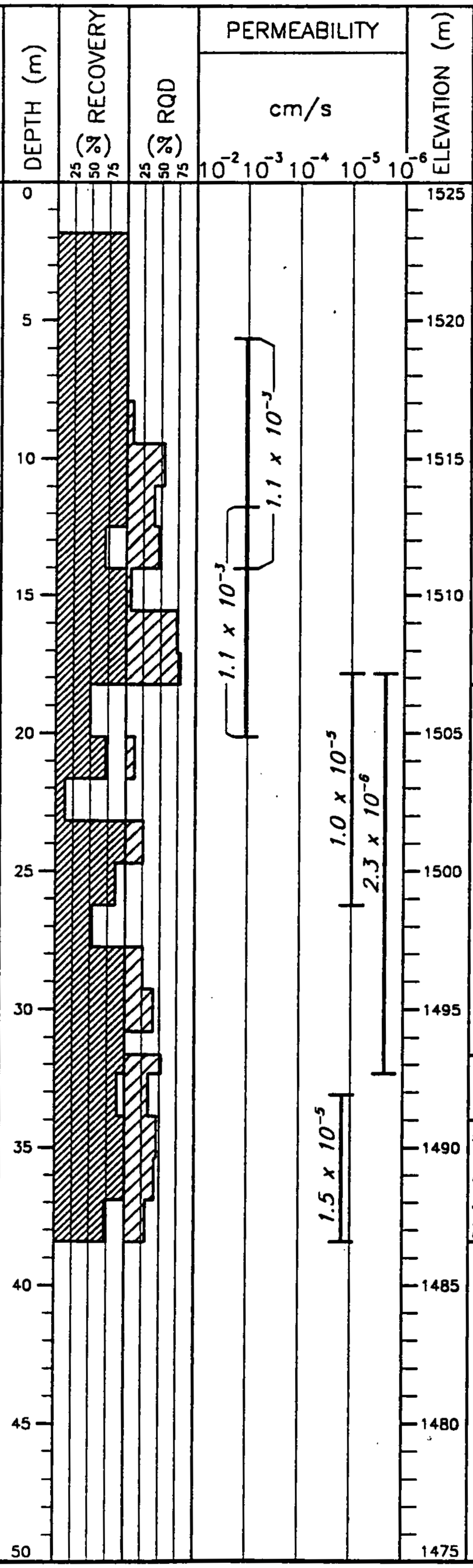
Hole squeezing at 18.3-26.2 m.

Samples:
94-150/1 = 29.3-29.5 m
94-150/2 = 33.1-33.2 m
94-150/3 = 34.0-34.2 m

Rods removed overnight to change worn out bit. After re-installed the core tube got stuck in the core barrel by green sand at approx. 30 m.

No green sand recovered or flushed to surface during drilling. Sand more than likely washed out of loose gravel and conglomerate zones, bridging hole.

Hole lost at 38.4 m completely sanded in from 29.2-38.4 m.



DESCRIPTION AND CLASSIFICATION OF MATERIAL

OVERBURDEN:
Gravel and cobbles set in a reddish brown stiff sand clay to brownish grey sandy clay, trace silt, stiff – v. stiff, competent, ***GLACIAL TILL.***

BASALT:
Dark grey – greenish grey, fine grained weakly – strongly vesicular and vuggy but mostly massive and competent, mod. strong. Fractured zones in 2.7-7.9 m becoming less fractured below. Contact with till is mod. – highly weathered with some greenish black mudstone inundating matrix. Some soft turquoise green infill to vesicles, clay at 3.4-4.9 m. Trace dark green clay/mudstone on fractures and occasionlly in matrix.

CONGLOMERATE:
Subangular, rounded – subrounded gravel, trace cobble clasts heavily limonite stained generally loose and broken with a greenish sandy matrix, mostly washed away. Intact conglomerate occasionally present in weakly – mod. indurated sections, which is more competent. Matrix generally poorly sorted. Very little recovery of fines.

ARGILLITE:
Dark grey – black, mudstone – Argillite, highly jointed and sheared parallel to bedding. Bedding approx. parallel to core axis. Kingsvale Sediments.

CONGLOMERATE:
Poorly sorted, round to well-rounded heterolithic clasts, green – greenish grey, black argillitic and dark – light grey in a greenish grey med. grained sandy matrix, locally crumbly and sheared with calcite veins and trace quartz in thin strings.
Kingsvale Sediments.

E.O.H. 38.4 m (126 ft)

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APPENDIX B

EXPLORATORY DRILLING
BEDROCK LOGS

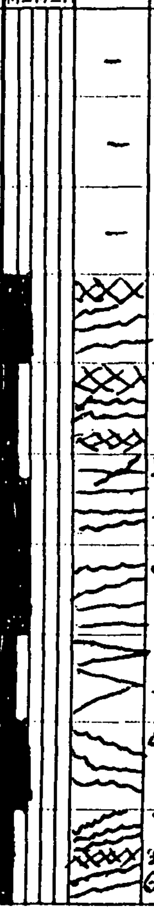
KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 1 OF 4

PROJECT FISH LAKE
DATE JULY 27/94
LOGGED BY DGSA
DRILL HOLE No. 94-141
CONTRACTOR QUEST CANADA
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
E

	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY /ft	DEFECT DESCRIPTION Type, shape, roughness, infilling
13	3.96	-	Approx 50%	-	-	-	GLACIAL TILL, dark brown, sandy silty clay with some cobbles and coarse gravel, dense-med. dense. 2.49-3.96m		-	-	-	-
16	4.88	-	Approx 100%	-	-	-	GLACIAL TILL; dark brown-grey, silty sand with some coarse gravel, trace cobbles and clay, dense		-	-	-	-
19	5.78	-	Approx 75%	-	90°	-	GLACIAL TILL, greenish brown mudstone set in sandy matrix, dense, SW, trace gravel, cobbles		-	-	-	Drill induced breaks.
26	7.92	-	96%	9%	-	R3 -R4	BASALT, Dark grey-brown, fine grained, mod. vesicular and vuggy inter-bedded with lighter grey less vesicular section, FS-SW, mod.-strong, some calcite			60-90°	2-3	Fractured to 6.1m otherwise drill induced breaks with some irreg. rough joints
29.5	9.0	-	76%	24%	-	R3	BASALT, As Above, mod.-strongly vesicular, fractured zones, weaker than above, FS-SW, some calcite			80-90°	>10	Irreg. rough joints and drill breaks, some siltstone infill at joint 7.5m.
36	10.97	-	100%	45%	-	R3 R4	BASALT As Above to 10m then very few vesicles/ massive, dark grey, FS-SW, mod. strong-strong, vesicles small with some chlorite staining.			90-70° 70-90°	>10 2-3	Irreg. rough joints with siltstone/ mudstone, 1cm thick on joints at 9.75m
41	12.49	-	100%	100%	-	R4	BASALT, Dark grey, fine-v. fine grained massive, fresh, strong, some chlorite phenocrysts			80-90°	2-3	rough irreg. joints with numerous drill breaks.
46	14.02	-	100%	34%	-	R3 R4	BASALT, As Above to 12.8m, then mod.-strongly ves. and vuggy, fractured, fine grained dark grey with some chlorite staining to vesicles.			60-80°	10	Rough irreg. joints, siltstone/mudstone seam, irreg. @ 13.45m, 7cm wide
48.7	14.85	-	100%	89%	-	R3	BASALT, Dark grey, fine grained, massive, weakly vesicular, F-FS, mod. strong, some chlorite infilled vesicles.			45-50° 90°	2-3	Rough irreg. joints with chlorite on face.
61.0	18.59	-	100%	20%	-	R3	BASALT, As Above, mod.-strong vesicular, FS-SW, discoloured reddish brown over 10cm @ 15.1m Siltstone/mudstone, green in 5cm zones and vesicles			70° 30-90° 60-80°	10	Random rough irreg. fractures, hairline joints also random, siltstone/mudstone on joint @ 18.1m (possible drill breaks).



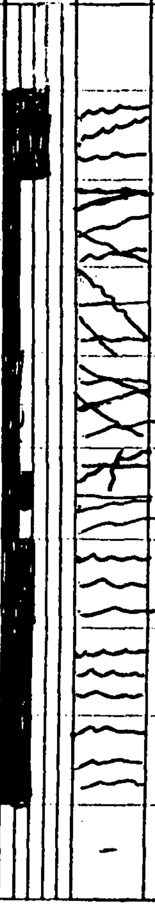
KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 2 OF 4

PROJECT FISH LAKE
DATE JULY 27/94
LOGGED BY DGSA
DRILL HOLE No. 94-141
CONTRACTOR QUEST CANADA
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 206 ft.
ANGLE FROM HORIZ.
BEARING
COORDINATES N
E

	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft).	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	/ft DEFECT FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
61	18.59	Continued					15.2—15.7m, mod. strong, less vesicular in lower 50 cm, more competent. Fractured 15—17.5m					
66	20.11	-	100%	100%	-	R4 -R5	BASALT, dark grey, fine grained massive, fresh, strong - v. strong, no vesicles, some chlorite phenocrysts			60 -80°	1	Rough irreg. joints, possible drill breaks.
71	21.6	-	100%	24%	-	R3	BASALT, dark grey - reddish brown, mod.-strongly ves. and vuggy, fine grained, SW, Green Siltstone/mudstone seam 20-30cm wide @ 20.83 m			30 -90°	5- 10	Random irreg. fractures at all angles to core axis. Vesicles infilled with red clay lower 70cm, drill breaks.
76	23.16	-	100%	58%	-	R3	BASALT, As Above, Greenish Siltstone/mudstone Seam 5cm wide @ 22.26m.			50 -90°	5- 10	As Above with red clay infilled vesicles along 70% of length.
86	26.21	-	100%	14%	-	R3	BASALT, As above but dark grey and fractured Siltstone/mudstone seam, green, laminated @ 23.45, 23.58m Less vesicular between 24.1m and 24.31m.			50 -90°	5- 10	As Above with some green siltstone/ mudstone to vesicles, some red clay and chlorite.
91	27.74	-	100%	100%	-	R3 -R4	BASALT, As Above but fine grained, @ 26.8-27.4 dark grey massive, F-FS.			70 -90°	10 1-2 10	Random drill breaks in vesicular section with good recovery in massive, rough irreg.
96	29.26	-	100%	84%	-	R3 -R4	BASALT, As Above (23.16-26.21m), less vesicular @ 27.74-28 m, mod.-strongly ves. & vuggy to 2cm below fractured in lower 1.2m			90°	2-3	Frequent random drill breaks partic. @ vuggy section perp. to core axis.
101	30.78	-	100%	88%	-	R3 -R4	BASALT, As Above (21.6-23.16 m), dark grey			90°	2-3	Rough irreg. drill breaks.
106	32.3	-	47%	30%	90°	-	SEDIMENTS, siltstone/silt, greyish green - greyish brown, Fine sand with silt v. stiff but breaks easily. Siltstone - fine sandstone.			90°	2-3	Smooth irreg. drill breaks along bedding planes.
111	33.83	-	77%	-	90°	-	As Above interbedded with dark brown, dense - v. dense wackestone/conglomerate with trace clay, sand, coarse gravel, occ. cobble. Basalt interface at 33.5m.		-	-	-	As Above in siltstone with rough irreg. contact at interface.



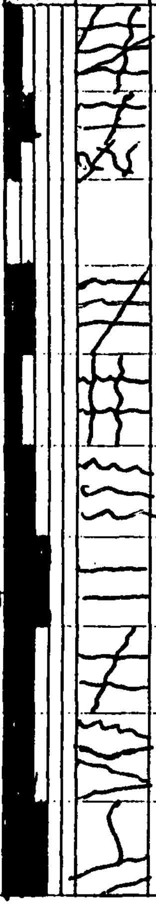
KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 3 OF 4

PROJECT Fish Lake
DATE July 27/94
LOGGED BY DGSA
DRILL HOLE No. 94-141
CONTRACTOR Quest Canada
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
E

	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
Depth (ft).	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm)	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	/ft DEFECT FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
116	35.36	-	100%	Approx 10%	-	R3 -R4	Basalt, fine grained, mod-strongly vesicular, dark grey, mod. strong-strong, vugs to 2cm, some chlorite staining in vugs, F-FS.			30 -90°	>10	Random drill induced (?) fractures in mod.-strongly ves. and vuggy basalt
126	38.4	-	100%	34%	-	R3 -R4	BASALT, Dark grey, fine grained, extremely weakly vesicular - mod. vesicular, fresh-FS, extremely weakly in upper 1.7m, small vesicles at 35.71-35.96m, broken/ fractured in lower 1.2m, mod-strongly vesicular 37-38.4m. some chlorite and calcite staining in vesicles in lower 1.2m			10 -90°	3 10	Rough irreg. fractures in upper 1.7m, random fractures below
127	39.0	-	100%	63%	90°	R3	SEDIMENTS, Siltstone/v. fine sandstone, reddish-greyish brown, trace coarse gravel, dense-v. dense, med. strong, well indurated but friable			90° -30°	2	Rough - smooth drill breaks along bedding planes (?) occ. oblique fracture
131	39.92	-	100%	Approx 20%	-	R3 -R4	BASALT As Above (33.83 - 35.36m).			0 - 90°	>10	As Above (33.83 - 35.36m).
136	41.45	-	100%	67%	-	R3 -R4	BASALT As Above (33.83-35.36m) with occ. vesicles up to 2cm with less vesicular sections.			90°	3-4	Rough irreg. breaks, random in upper 40 cm, 90° breaks in remainder (poss. drill 'breaks)
141	42.98	-	100%	100%	-	R4	BASALT, Dark grey, fine grained, massive, occ. ves., slight chlorite phenocrysts, strong, fresh, more competent			90°	<1	Very few fractures but several drill induced.
146	44.5	-	100%	97%	-	R4	BASALT, As Above.			30° -80°	2-3	Rough irreg joint with others drill induced.
151	46.02	-	100%	90%	-	R4	BASALT, As Above			50 -70°	2-3	As Above
156	47.55	-	100%	82%	-	R4	BASALT, As Above with chlorite stained joints and some infilling to vesicles. Infilled vug 10cm x 2cm @ 46.40m			0 - 50°	1-2	Undulating vertical rough joint some chlorite on face, others drill induced.

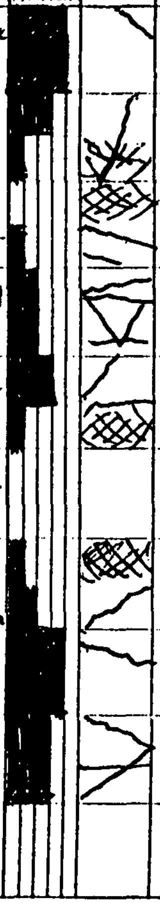


KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 4 OF 4

PROJECT Fish Lake
DATE July 28/94
LOGGED BY DGSA
DRILL HOLE No. 94-141
CONTRACTOR Quest
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 206 ft
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
E



	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm)	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY /ft	DEFECT DESCRIPTION Type, shape, roughness, infilling
161	49.2	-	100%	100%	-	R4	BASALT, As Above, dark grey, fine grained massive strong, fresh, competent			40°	<1	Drill breaks only, 1 chlorite infilled vein 0.5cm wide @ 47.9m.
166	50.6	-	100%	30%	-	R4 - R3	BASALT, As Above to 49.5m, then mod.-strongly ves., brecciated, some chlorite infilled vesicles.			- 0°-90°	1 >10	Numerous random fractures in mod.-strongly vesicular section. Vein at 30° infilled with soft talcy substance.
171	52.12	-	100%	15%	-	R3 - R4	BASALT, Dark grey, mod.-strongly vesicular, fresh, some chloritized vesicles, mod. strong, fractured. Lower 27 cm occ. ves., competent, strong, fresh, dark grey			- 70°	>10 2	Numerous random fractures in brecciated zone. Rough irreg joints in less ves. zone.
181	55.17	-	100%	86%	-	R4	BASALT, As Above (47.55-49.07m), occ. chloritized vesicle. Weakly vesicular feeder dyke at side of core @ 54.9m			90°-40°	1-2	Drill breaks, rough irreg. side joints at 54.9m with some chlorite staining.
186	56.7	-	100%	53%	-	R4 -R3	BASALT, As Above (50.6-52.12) with occ. vesicle infilled with soft substance (talc?), greenish white, brec. zone of mod-strongly vesicular basalt with some dark green laminated mudstone from 56.2-56.7m. waxy clay/mudstone			50-90°	1-2 >10	Drill breaks in upper 1m with random breaks in brecciated zone.
191	58.2	-	100%	48%	-	R3 -R4	BASALT, Dark grey, fine grained, weak-mod. ves. with some chlorite in vesicles and phenocrysts brecc. zone above 58m, extremely few vesicles below to lm			0-90°	>10 1-2	Brecciated zone with rough irreg. fractures, rough irreg. fracture in less vesicular zone. 10cm wide green mudstone @ 57.6m
196	59.74	-	100%	100%	-	R4	BASALT, As Above (47.55-49.07)			60°	1	2mm wide dark green siltstone/mudstone seam/veins at 59.4 and 58.77m.
206	62.79	-	100%	100%	-	R4	BASALT, As Above to 62.06 then mod.-strong vesicular and vuggy to 15mm.			60-90°	2	Drill breaks, particularly in vuggy zone, rough irreg.
							E.O.H. 206 ft (62.79m).					

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 1 OF 5

PROJECT FISH LAKE
DATE JULY 29/94
LOGGED BY DGSA
DRILL HOLE No. 94-143
CONTRACTOR QUEST CANADA
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
E

	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY /ft	DEFECT DESCRIPTION Type, shape, roughness, infilling
10	3.05	–	2%	–	–	–	GLACIAL TILL, Cored cobbles and gravels with. trace of grey clay, no fines recovered.		–	–	–	
16	4.87	–	100%	84%	–	R3 -R4	BASALT, Dark grey, fine grained, massive, sw, oc. chlorite phenocrysts and vesicles			80 -90°	<1	Rough irreg. fractures approx perp to core axis.
21	6.4	–	87%	68%	–	R3 -R4	BASALT, Dark grey, fine grained, mod-strongly ves. and vuggy to 1cm, sw-FS, some calcite infilled ves., weaker dark brown zone at 6.4m.			10 -90°	2-3 1	As Above, single near vertical rough irreg. fracture near top.
26	7.42	–	100%	65%	–	R3 -R4	BASALT, As Above to 7.4m then massive, similar to 3.05-4.87m but fractured, sw, mod-strong			90° 30-90°	>10	Rough irreg. drillbreaks above with random irreg. rough fractures with some limonite staining
31	9.05	–	100%	10%	–	R3 -R4	BASALT, As Above (3.05-4.87) but fractured with slight greenish staining on faces and trace calcite			40 -90°	>10	Rough irreg. random fractures with trace limonite
36	10.97	–	79%	30%	–	R3 -R4	BASALT, Dark grey, fine grained, massive, s.w., strong, to 10.2m with possible washout of brown clay @ 9.9m. Below 10.2m fractured mod.-strongly vesicular			80 -90°	1-3 >10	Rough irreg. fractures with some brown clay at 9.9m and trace limonite. Random rough irreg. fractures.
41	12.5	–	85%	0%	–	R3	BASALT, Dark grey, fine grained, s.w. mod-highly vesicular and vuggy to 3-4cm, mod. strong, some brown staining and crystallisation on vesicles.			0 - 90°	5-10	Rough random irreg. fractures, trace limonite.
46	14.02	–	100%	26%	–	R3	BASALT, Massive as above (3.05-4.87) to 13.0m, sw-FS. with med.-highly vesicular and fractured below, ves. 0.5-2cm and limonite stained, as above			45 -90°	1 >10	Rough irreg. joints with slight limonite staining in massive with random rough irreg. fractures below, also limonite
51	15.54	–	100%	31%	–	R3	BASALT, As Above but more competent with less vesicles, s.w., green mudstone infilling ves. in places, ves. to 3cm. x 1cm.			30- 90°	5-6	Random rough irreg. fractures, highly fractured.
56	17.07	–	90%	72%	–	R3 -R4	BASALT, As Above, weakly ves. and vuggy, sw. mod. strong, less vesicular and competent, massive in lower 0.6m Loss of fine particles at 16.3m with vein (10cm)			40 -90°	2-3 1	Random rough irreg. fractures in ves. zone with planar rough in massive

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 2 OF 5

PROJECT FISH LAKE
DATE JULY 29/94, JULY 30/94
LOGGED BY DGSA
DRILL HOLE No. 94-143
CONTRACTOR QUEST CANADA
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
E

	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm)	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY /ft	DEFECT DESCRIPTION Type, shape, roughness, infilling
56	17.07	Continued.					green mudstone with trace of greenish brown clay @ top, fractured, otherwise no fines, possible washout of sand.					
61	18.6	–	100%	43%	–	R4	<u>BASALT</u>, Dark grey, fine grained, massive with fractured zones, S.W., white staining on joints occ. with limonite occ. ves. with weakly vesicular at 18.6m			60° 20-90°	5-10 3-4	Planar rough with rough irreg in fract. zones and in massive @ 18m
66	20.11	–	100%	70%	–	R4	<u>BASALT</u>, As Above, more competent, fractured in upper 30cm with less staining towards base.			70-90°	>10 2-3	Planar rough fractures with rough irreg. in fractured zone.
71	21.64	–	100%	100%	–	R4	<u>BASALT</u> As Above, competent, SW-FS., strong, occ. ves. in lower 40cm infilled with white crystal.			80°	1	Single joint, planar rough, two others drill induced.
73.4	22.36	–	100%	36%	–	R3	<u>BASALT</u>, Massive as above to 22.0m, weakly-mod. ves., grey and greyish red to 22.2m, mod. strong, SW. fine-med. grained, zones of green mudstone throughout			30-80° 0-90°	1 >10	Rough planar joints in massive basalt at top of run. Fractured basalt in lower 36cm with rough irreg. joints.
76.0	23.16	-	38%	0%	–	–	<u>BASALT</u>, HW, weakly vesicular basalt flow top, fractured, black-red with trace of light tan - dark green clay/mudstone, occ. in clasts.			-90°	>10	Green mudstone clasts have smooth, waxy slikensides, shiny surfaces. Basalt broken into irreg. clasts
81.0	24.69	–	100%	32%	-	R2 -R3	<u>BASALT</u>, Dark grey, fine grained, mod.-strongly ves. and vugs to 1cm, HW., fractured, inundated in upper 40cm with dark green mudstone also in random zones and ves.			80° 0°-90°	2-5 >10	Random rough irreg. breaks, planar rough in mudstone inundated zone. Slight limonite at Top.
86.0	26.21	-	100%	20%	–	R3	<u>BASALT</u>, Grey, fine grained, weak-mod. ves. and vuggy to ~~2~~.6cm, mod. strong-strong, S.W., fractured			0-90°	7-10	Random rough irreg. breaks throughout.
91.0	27.74	–	100%	85%	–	R4	<u>BASALT</u>, As Above but only weakly vesicular, ves. to 0.5cm, mudstone vein 3cm wide at 26.3m competent.			30° 90°	1-2	Planar rough- irreg. rough joints
96.0	29.26	–	100%	59%	–	R3	<u>BASALT</u>, As Above but reddish grey with dark green mudstone veins @ 28.11, 28.46m, infilling ves becoming massive in lower 30cm, SW-FS.			0-90°	3-4 1-2	Random rough irreg. fractures throughout.

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CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 3 OF 5

PROJECT FISH LAKE
DATE JULY 30/94
LOGGED BY DGSA
DRILL HOLE No. 94-143
CONTRACTOR QUEST CANADA
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
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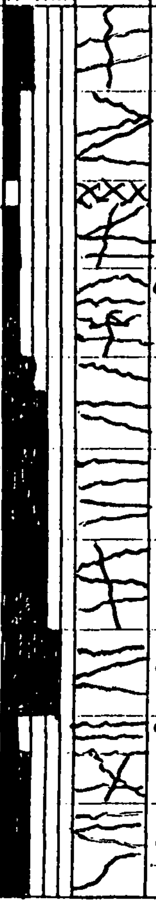


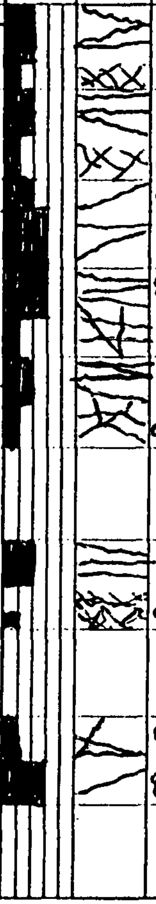
	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	/ft DEFECT FREQUENCY	DEFECT DESCRIPTION Type, shap roughness, infilling
101	30.78	-	100%	87%	-	R3	BASALT, Massive as above to 29.6m, below mod.-highly vesicular and vuggy to 1cm, fractured, red-grey in lower 80cm.			0 -90°	1-2	Planar rough fractures, Opening 2mm at green mudstone joint @ 30m.
106	32.31	-	100%	73%	-	R3	BASALT, Dark grey-reddish grey, mod.-strongly ves. to 2cm, fine grained, mod. strong, SW-FS. dark green mudstone veins @ 31 and 31.5m			10-90°	3-5	Rough irreg joints and fractures with occ. dark green mudstone on faces. Gap. 2-5mm @ mudstone.
111	33.83	-	100%	40%	-	R2 -R3	BASALT, As Above, highly fractured in upper 20cm up to 5cm. Dark green mudstone vein @ 32.76m, 6cm wide.			10-90°	>20 7-10	As Above Gap 5-10mm. at joints
116	35.35	-	100%	65%	-	R2 -R3	BASALT, As Above but only dark grey, mudstone vein 3cm @ 34.1m and 6cm dia @ 34.15m.			60-90° 0-90°	3 5-7	As Above Gap 4-5mm. at joints.
121	36.86	-	100%	69%	-	R3	BASALT, Dark greenish grey, weakly vesicular, ves. to 2-3cm, SW.-FS., dark green mudstone seam up to 7cm @ 36.2m and 10cm @ 36.1m (R2)			80-90° 60-90°	3-5 1-2	As Above. smooth planar/slickensides at mudstone seam approx. perp to core axis. Joint gap 2-3mm.
126	38.4	-	100%	80%	-	R3 -R4	BASALT, As Above, inundated with dark green (R2) mudstone in ves. and vugs to 37.4m, SW-FS., less vesicular and more competent below.			80-90°	1-2	Rough irreg. fractures approx perp to core axis with trace dark green mudstone on faces. Joint gap 1-2mm
131	39.92	-	100%	71%	-	R3 -R4	BASALT, As Above, weak-mod. vesicular + vugs to 2cm, inundated with dark green mudstone to 38.9m.			30 -90°	1 1-2	As Above with occ. oblique joints Joint gap 1-5mm.
136	41.45	-	100%	96%	-	R4	BASALT, Massive, fine grained, occ. ves. to 6mm slightly chloritized, strong, darker greyish green in lower 20cm			80-90°	1	Rough irreg. - rough planar, some green mudstone on fractures Gap 1-3mm.
141	42.97	-	100%	79%	-	R3	BASALT, fine grained, mod.-highly vesicular to 1cm occ. green mudstone infill to vesicles, mod. strong, S.W.			90° 10-90°	8-10 2-3	Rough irreg. fractures approx perp to core axis (drill breaks) and parallel to core axis in lower 60cm. Gap 3-4mm
145	44.19	-	100%	100%	-	R3 -R4	BASALT, mod.-strong As Above, becoming massive in lower 60cm with chlorite phenos.			80 -90°	4	Rough irreg. fractures in vesicular zone perp. to core axis and rough irreg. and undulate joint in massive. Gap 2-5mm.

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 4 OF 5

PROJECT FISH LAKE
DATE JULY 30/94 - 31/94
LOGGED BY DGSA
DRILL HOLE No. 94-143
CONTRACTOR QUEST CANADA
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH
ANGLE FROM HORIZ. -90
BEARING
COORDINATES N
E



DEPTH (ft)	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS			
	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT ORIENTATION	/ft DEFECT FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
150.3	45.82	-	90%	80%	-	R2-R3	BASALT, Massive as above becoming vesicular in lower 90cm, weak-mod. ves. with some green mudstone infill to ves. and 30cm seam @ 45.34m, weak.	70-90° 0-90°	3 >10	Planar rough fractures in massive, gap 2mm, random irreg. in vesicular, highly fractured in lower 20cm
156	47.55	-	100%	40%	-	R3	BASALT, Dark greenish grey, mod.-highly ves. + vuggy, fine grained interbedded with 20cm of massive @ 47.9m, occ. green mudstone to ves., SW-FS	45-90° 0-90°	1-2 >10	Planar rough-smooth fractures in upper 90cm with random rough irreg below. Bottom 40cm highly fractured.
161	49.07	-	100%	100%	-	R4	BASALT, Highly ves. + vuggy, SW-FS, in upper 30cm, less ves. with depth to massive as above @ 48.5m Vugs 4cm x 2cm some infill green mudstone (R2)	80-90° 80°	1-2	Planar-irreg. rough fractures in vuggy zone with planar smooth below.
166	50.59	-	100%	65%	-	R4 R3-R4	BASALT, Massive as above, fine grained, F.S. to 50cm, chlorite phenos. Below weakly ves., SW, mod. strong, vesicles to 3mm.	80-90° 0-90°	1 >10	Planar smooth-rough fractures in massive, gaps 2-3mm, rough irreg. fracture in vesicular, random, mod. fractures.
171	52.12	-	100%	7%	-	R2-R3 R3	BASALT, Inundated with light-dark green clay/mudstone SW-FS, highly chloritized in upper 14cm, dark green. Below reddish/purpleish grey-dark grey mod-highly vesicular and vuggy to 1cm, occ. infilling ves. with dark green mudstone. Becoming less vesicular to bottom, S.W., trace limonite.	80-90° 0-90°	1-2 5-7	Planar smooth-rough fractures at mudstone/basalt interface, gap to 2mm Rough irreg. random breaks in bottom 50cm with some green mudstone on faces.
176	53.64	-	100%	46%	-	R3	BASALT, Dark grey, weakly vesicular, mod. strong, SW becoming mod.-highly vesicular + vuggy @ 53.2m. Highly weathered and fractured below, clasts 3cm + fines, more competent and very weakly vesicular in bottom 30cm.	70-90° 0-90°	1-2	Planar-rough to rough irreg. fractures in weakly vesicular, gaps to 5mm. Random fractures in highly weathered zone.
181	55.17	-	100%	78%	-	R4	BASALT, Dark grey, weak-mod. vesicular and vuggy, strong, F.S. vugs to 2cm x 1cm, some dark green mudstone (R2) on fract. and occ in vugs. Becoming less vesicular and massive in lower 70cm.	60-80° 80°	4-5 1-2	Rough irreg. fractures in weak-med. ves. zone, gaps to 4mm Planar smooth in less vesicular.

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CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

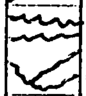
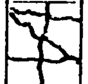
PROJECT No. 1738
SHEET 5 OF 5

PROJECT FISH LAKE
DATE JULY 31/94
LOGGED BY DGSA

DRILL HOLE No. 94-143
CONTRACTOR QUEST CANADA
CORE SIZE HQ

REF. EL.
BEDROCK EL.
TOTAL LENGTH

ANGLE FROM HORIZ. -90
BEARING
COORDINATES N
E

DEPTH (ft)	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY /ft	DEFECT DESCRIPTION Type, shape, roughness, infilling
186	56.69	-	100%	95%	-	R4	BASALT, As Above weakly ves., F.S. becoming mod.-highly ves., ves. 5-10mm. Less ves. - massive in lower 60cm, occ. dark green mudstone in vesicles.			80-90° 30°	1 1-2	Rough irreg. joints in weakly ves. with planar joints in more competent massive. Gap 1-2mm.
191	58.21	-	100%	89%	-	R4	BASALT, Massive - weakly ves. - massive with occ. ves. Dark green mudstone (R2) veins @ 56.3m (30cm) perp. to core axis and between 56.3-56.7 @ 20°			90° 10-90°	1-2	As Above, Planar rough in massive Zone.
196	59.74	-	92%	92%	-	R4	BASALT, Massive as above (10cm) becoming increasing ves. to weak-mod., F.S. strong, occ. vesicles filled with dark green mudstone (R2)			40-90° 90	1-2	Planar rough in competent section with rough irreg in weak-mod. Some green mudstone on joint surfaces
201	61.26	-	100%	72%		R4	BASALT, Dark greenish grey, extremely weakly ves. - massive, ves. to 4mm with 10cm vuggy basalt on top, some green phenos, F.S. strong, fine grained			45° 0-90°	1	Rough irreg. fractures in ves. zone with rough planar in more competent massive.

E.O.H. 201 ft (61.26 m).

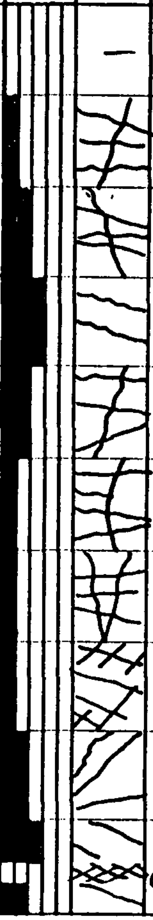
KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 1 OF 10

PROJECT FISH LAKE
DATE AUG 2/94
LOGGED BY DGSA
DRILL HOLE No. 94-144
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 140.51 m
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
E

	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY #/ft	DEFECT DESCRIPTION Type, shape, roughness, infilling
6	1.83	–	0%	–	–	–	GLACIAL TILL, light brown sandy clay with some coarse gravel, cobbles and boulders		–	–	–	
11	3.35	–	100%	40%	–	R3	BASALT, dark grey, Mod. ves., fine grained, SW-MW mod. strong, becoming less vesicular to bottom			30 -90°	3-4	Rough irreg. joints with some light brown clay infill to 2mm wide (similar to till above)
16	4.87	–	100%	75%	–	R3 -R4	BASALT, As above to 3.7m, then extremely weakly ves. strong, S.W., fine grained, dark greenish grey, more competent			30 -90°	1-2	Planar rough joints with some light brown clay infill to lower joints
21	6.40	–	100%	94%	–	R3 -R4	BASALT, As above to 5.94m then, reddish grey, Mod.-strongly ves. + vuggy, fine grained, SW-MW, occ. calcite			60 -70°	1-2	Rough irreg. joints in reddish grey zone with some light brown clay infill to joints (1-2mm) and vesicles
26	7.92	–	100%	69%	–	R3 -R4	BASALT, As above, reddish grey to 6.8M – grey, less ves., fine grained, SW-MW, strong, light brown clay seam (R1) 20cm at 6.5m (clay/mudstone)			90° 20-60°	2-3	Planar rough with hard clay/mudstone infill in joints (2-3mm), planar rough also with slight soft clay.
31	9.45	–	100%	30%	–	R3 -R4	BASALT, Dark grey-greenish grey, weak-extremely weakly ves. to 8.3m then mod. ves. greenish grey occas. red, SW-MW, strong			70-90°	3-4	As Above with single undulating joint at 10° in less ves., rough irreg in increasingly vesicular basalt.
36	10.97	–	100%	5%	–	R4	BASALT, very weakly - mod., dark grey, vesicular, reddish grey at 10.5m with light brown clay/mudstone inundating matrix over 15cm, MW, strong			10-90°	2-3	Planar rough joints in more competent, weakly ves. with rough irreg. in reddish grey zone, joints (2-3mm) + clay/mudstone
41	12.5	–	100%	20%	–	R3	BASALT, very weakly ves. in top 40cm, fractured then reddish grey inundated as above, mod. strong, MW. clay/mudstone in vesicles and in matrix in places			40 -60°	>10	Random planar-irreg. fractures Top 40cm Planar rough below with random fract. in inundated basalt.
46	14.02	–	100%	66%	–	R1 -R4	BASALT, weak ves., reddish grey inundated with light brown mudstone at 12.6m, weak-mod. ves. below, vugs 3cm×1cm Calcite filled vugs at 13.5m, dark grey, M.W., mudstone (R1)			50 -70°	1-2	Rough irreg. fract at mudstone/basalt contact Planar-irreg. rough joints, clay/mudstone to 5mm on some joints.
51	15.54	–	100%	48%	–	R4	BASALT, Dark grey, vuggy to 14.6m, 4cm×4cm, some calcite, fractured to 8-10cm at 14.7m with trace of light brown mudstone. Weakly ves. in lower 1m.			50° 0-90°	1-2 >20 2-3	Planar rough in vuggy section trace mudstone + limonite. Fractured zone 30cm wide at 14.7m

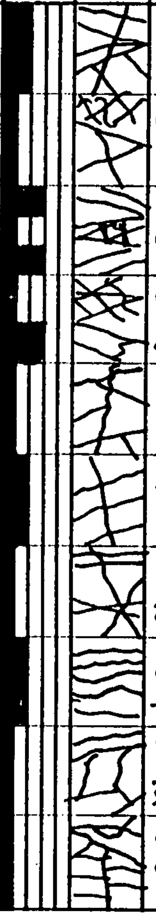


KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 2 OF 10

PROJECT FISH LAKE
DATE AUG 2/94
LOGGED BY DGSA
DRILL HOLE No. 94-144
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 140.51 m
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
E



DEPTH (ft)	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm)	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY /ft	DEFECT DESCRIPTION Type, shape, roughness, infilling
56	17.07	-	100%	46%	-	R4	BASALT, Dark grey, fine grained, s.w. strong, occ. vug to 1cm at top becoming very weakly vesicular - massive below.			40° 20-80°	2-3	Planar rough joints with some limonite staining + mudstone on faces.
61	18.59	-	90%	26%	-	R1 -R4	BASALT, As above, fractured. Also some clasts to 5cm of light brown mudstone (R1), very weak in upper 30cm intermixed with fragmented basalt			0-90° 30-80°	>15	Planar rough - planar smooth joints with dark brown sandy clay on faces.
66	20.12	-	100%	76%	-	R3 -R4	BASALT, As Above (51-56ft) with fractured MW-HW zone at 19.1-19.4m with ≈ horiz. calcite veins to 3 mm, heavily limonite stained with fract. zone + mudstone			70-80° 0-90°	1 >10 1-2	Planar rough-smooth joints in massive Rough irreg. in fractured zone, some platy limonite on 2 joints between 19.5-20.1m
71	21.64	-	100%	53%	-	R4	BASALT Dark grey, fine, fractured + limonite stained in top 60cm to 7cm clast size below weakly vesic, strong, ves. to 3mm occ. 5mm, SW-MW			0-90° 40-80°	>20 1-2	Random Fractures at top Planar smooth - rough joints, trace limonite in ves. + matrix with mudstone
76	23.16	-	100%	41%	-	R3 -R4	BASALT, Dark grey in top 50cm + lower 30cm, fine, mod.-strong S.W., weakly-v. weakly ves. interbedded with reddish grey mod. ves. + soft mudstone seams at 21.8-22.7m			0-90°	>10	Rough irreg. random fractures throughout with mudstone fragments on faces, occas. calcite infilled vesicle and hairline vein
81	24.69	-	100%	64%	-	R3 -R4	BASALT, weak-mod. ves., dark grey, fine, s.w., mod-strong, interbedded with light tan waxy mudstone, soft, broken between 23.4 and 23.55m			70°	1-2	Planar rough-irreg in mod. vesic. with some mudstone on faces, occas. infilling of ves. with mudstone + calcite.
86	26.21	-	100%	41%	-	R3 -R4	BASALT, weak-mod. ves. as above with occ. hairline mudstone vein (R2)			90° 20-70°	2-3	Planar rough-irreg. with reddish clay (mudstone), very weak on faces.
91	27.74	-	100%	75%	-	R3 -R4	BASALT, As above with highly vuggy zone of 30cm + dark green brown mudstone seam (R1) 25cm long at 27.4m, some chlorite infill to ves. + vugs			80 -90°	3-4	Planar rough joints in weakly vesic. Rough irreg. in vuggy zone, smooth irreg. breaks in mudstone, some limonite
96	29.26	-	100%	32%	-	R3	BASALT, Dark grey, mod-strongly vesic. + vugs, SW. Fract greenish brown mudstone seam 7cm wide at 29.15m with some infill to ves. with calcite. Basalt brownish grey lower 50cm			90° 30-90°	4-5	Rough irreg. joints in strongly vesic. with planar rough in mod. zone + trace mudstone
101	30.78	-	100%	20%	-	R3	BASALT, Dark greenish grey, massive, SW-MW, occas. calcite filled ves. in top 30cm. Brownish grey weak vesic. with 10cm mudstone vein, also on joint at 30.7m			40° 0-90°	5 5-10	Rough irreg. joints in weak vesic., planar rough-smooth in massive, trace limonite on joint faces.

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 3 OF 10

PROJECT FISH LAKE
DATE AUG 2/94
LOGGED BY DGSA
DRILL HOLE No. 94-144
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 140.51m
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
E

	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	/ft DEFECT FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
106	32.31	–	100%	95%	–	R3	BASALT, Dark greenish grey, fine grained with occ. vesicles, some infilled with soft ~~grey~~ chlorite, greenish brown clay/mudstone vein (1cm) at 31.5m, SW, weak. vesic 31.35-31.5m			40 -90°	1	Planar rough joints with some limonite stains on face and occas. in hairline fractures.
111	33.83	–	100%	74%	–	R3	BASALT, As Above, massive, occas. chlorite filled ves. underlain by greyish brown, SW, weak-mod ves. interbedded with light brown-green mudstone also in ves. in lower 70cm			90° 0-90°	<1 >10	Fractures in massive - drill induced with random rough factures and joints at basalt/mudstone interface. limonite in mod. ves.
116	35.65	–	100%	47%	–	R2 -R3	BASALT, Greyish brown-grey, SW, weakly ves - vuggy (3cm) at bottom 50cm. Upper 70cm interbedded basalt and mudstone soft, broken in veins and ves. all mod-highly fractured.			40 -70° 0-90°	5-7 >10	Rough random irreg. fractures throughout but particularly in vuggy section. Some limonite staining in rock structure, occ. calcite veins
121	36.88	–	100%	100%	–	R4	BASALT, Dark grey Massive, fine grained, FS-F, strong trace brown silty clay on only joint at 35.9m. Occas. soft chlorite infilled ves. to 10mm			80°	<1	Single rough irreg. joint, others drill induced.
126	38.4	–	100%	75%	–	R4	BASALT, As Above, F.S., vesicles to 5mm			70-90° 10° 60-90°	1-2	Planar rough-smooth joints with some limonite staining, black haematite and occ. trace light brown clay/mudstone
131	39.93	–	100%	88%	–	R3 -R4	BASALT, As Above, becoming more vesicular with depth to mod. vesic., ves. infilled with talc and dark green chloritized clay (38.75-39.78m), waxy, empty ves. in lower 15cm			10° 10-90°	1	Planar rough to rough irreg. joints with occ. light brown and chloritized clay/mudstone on joints.
136	41.45	–	100%	98%	–	R3 -R4	BASALT, Dark greenish grey, fine grained, weakly vesic., occ. chloritized clay/mudstone to ves. and vein to 2cm. More vuggy in lower 60cm, F.S., mod-strong, competent			80 -90°	1	Rough irreg. joints approx. perp to core axis, occ. dark green vein 10-20° to core axis.
141	42.98	–	100%	52%	–	R4	BASALT, Dark greenish grey-grey, occ. ves. at top becoming massive, strong, fine grained, FS-SW, fractured along joints in lower 70cm			0-20° 70°	<1 2-3	Fract. along joints planar rough-smooth, occ. undulating, dark brown hard mudstone infill to 3mm.
146	44.5	–	100%	76%	–	R4	BASALT, Massive as above, occ. ves. to 2mm from 43.8-44.2m, extremely weakly vesicular.			10°	<1	Planar rough joint, dark brown hard mudstone on surface, gap 1-2mm
151	46.02	–	100%	100%	–	R3 -R4	BASALT, Weak-mod. ves., dark greenish grey, FS-F, quartz infill around ves. + occas. chloritic mudstone (R2) in ves.			80 -90°	<1	Rough irreg. fracture approx perp to core axis, others all drill induced some with mudstone area.

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 4 OF 10

PROJECT FISH LAKE
DATE AUG 3/94
LOGGED BY DGSA
DRILL HOLE No. 94-144
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 140.51 m
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
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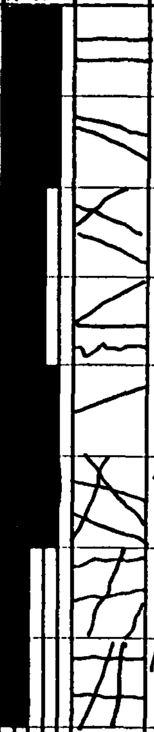
DEPTH (ft)	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
156	47.55	-	100%	100%	-	R3 - R4	BASALT, weakly ves. - massive, dark greenish grey, occ. chloritized mudstone infill, F.S. - F, mod. strong - strong			90°	≤1	All drill induced breaks, planar rough.
161	49.07	-	100%	93%	-	R3	BASALT, massive, as above			80° 70°	<1	Drill induced breaks - planar smooth-rough two joints at 38.9m planar rough with chloritized mudstone on joints, gap 5-10mm
166	50.6	-	100%	100%	-	R3	BASALT, as above			30-40°	1-2	Planar smooth-rough joints with trace chlorite, also drill induced perp. to core axis. Natural joint gap 3-4mm
171	52.12	-	100%	100%	-	R3	BASALT, weak-mod. ves., dark greenish grey, some chloritized mudstone infill to ves. + thru matrix. Matrix inundated in lower 20cm			45° 90°	1	Planar rough joints in less inundated sections, irreg. stepped fracture at 52m in chloritized mudstone (drill induced)
176	53.7	-	100%	100%	-	R3	BASALT, As above becoming less vesicular in lower 50 cm			70°	<1	Drill breaks, planar rough in mod. ves. to planar smooth-rough in massive, 70° Gap 2-3mm some mudstone on face
181	55.17	-	100%	100%	-	R3 -R4	BASALT, Massive, F-FS, becoming ves. in lower 20cm with talc and chloritized mudstone infill			30-60°	<1	Drill breaks, planar - irreg rough. Joints tight in upper 30cm, planar smooth.
186	56.7	-	100%	63%	-	R3	BASALT, As above top 30cm, then 11cm mudstone seam - weak-mod. ves. limonite stained, brownish grey, SW-MW, grey below, vugs to 2cm in lower 30cm			90° 10°	1-2	Rough irreg. fract. in vesic. sections perp. to core axis, Planar rough at 10°, limonite stained, irreg rough contact.
191	58.21	-	73%	33%	-	R3-R2	BASALT, As above to 57.35m, SILTSTONE-SANDSTONE greenish brown - brownish red silty sand, trace gravel, dense well indurated, breaks easily, fine			10-30° 90°	1-2	As Above in Basalt, Rough irreg fract. in sediments, possible drill induced at 10-30° to core axis.
196	59.74	-	0%	—	—	—	SAND/SILT, Zero recovery, most likely sequence washed away.		—	—	—	
206	62.78	-	0%	—	—	—	SAND/SILT, As Above		—	—	—	

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 5 OF 10

PROJECT FISH LAKE
DATE AUG 3/94
LOGGED BY DGSA
DRILL HOLE No. 94-144
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 140.51m
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
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	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY /ft	DEFECT DESCRIPTION Type, shape, roughness, infilling
210	64.0	–	Approx 100%	34%	90°	R1 – R2	SILTSTONE – SANDSTONE, Interbedded red, green, brown + brownish green silty fine sand, med. dense - dense, friable, some green fine + coarse gravel, loose at bottom CONGLOM.			90°	2-3	Drill induced breaks with occ. bedding joint.
216	65.84	–	Approx 100%	63%	–	R3	CONGLOMERATE, As Above to 64.9m, underlain by mod. vesic. + vuggy Basalt similar to 56.7-58.2m, inundated with chloritized mudstone at 65.6m + limonite stained			– 70-80°	>20	Rough irreg. joints in vuggy basalt with random fract. lower 7cm
221	67.63	–	100%	93%	–	R3	BASALT, Dark grey, mod - highly ves., fine grained, SW-F.S. becoming less vesic. with depth to greenish grey massive in lower 60cm. Occ. chlorite infilled ves.			50-80° 80°	1	V. rough irreg fract. in vuggy zone with planar smooth - rough in less ves. zone Chlorite vein 1cm x 7cm at 67.2m
226	68.88	–	100%	94%	–	R3 – R4	BASALT, Dark greenish grey, fine - med. grained extremely weak ves. - massive as above, F.S. - F, mod - strong			80-90° 50-70°	<1	Planar rough - curved irreg. joints, slight weathering + some chlorite on faces gap 1-2mm
231	70.41	–	100%	100%	–	R4	BASALT, As above			90° 30° 90°	<1	Drill breaks only - planar rough
236	71.93	–	100%	100%	–	R4	BASALT, As above to 71.7m becoming v. weakly ves. and darker with chloritized dark green clay/mudstone and white infill to ves. in places.			40°	<1	As Above
241	73.46	–	100%	100%	–	R4	BASALT, Dark grey - greenish grey, F., fine grained, strong mod - strongly vesic., talc infill to ves. with zones of dark green chloritized clay/mudstone. Becoming vuggy then massive			90°	<1	Rough irreg. joint at highly chloritic mudstone zone at 72.4m. Drill induced also perp. to core axis.
246	74.98	–	100%	100%	–	R4	BASALT, Massive, fine grained, dark greenish grey with occas. veside + chloritized ves., strong, fresh			70-90°	<1	Planar rough drill breaks perp. to core axis, joints intact with some vesicles, planar smooth and undulating.
251	76.5	–	100%	100%	–	R3	BASALT Massive as above then similar to top of 71.93-73.46m. Chloritized mudstone seam (20-30cm) at 76.5m (R2).			60-80°	<1	Rough irreg - curved joints. Fracture at chloritic mudstone seam rough + irreg. Planar rough drillbreaks
253	77.12	–	84%	56%	–	R3	BASALT, similar to 71.93-73.46m with frequent chlorite mudstone at bottom fractured in lower 10cm into 3-5cm fragments.			90° 0-90°	1 >1	Planar - irreg. smooth along chloritized joint, gap 1mm Random rough irreg. fractures

KNIGHT AND PIESOLD LTD.
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EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 6 OF 10

PROJECT FISH LAKE
DATE AUG 3/94
LOGGED BY DGSA

DRILL HOLE No. 94-144
CONTRACTOR QUEST
CORE SIZE HQ

REF. EL.
BEDROCK EL.
TOTAL LENGTH

ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
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	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm)	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY /ft	DEFECT DESCRIPTION Type, shape, roughness, infilling
256	78.23	—	87%	76%	—	R1 -R2 R3	BASALT, similar to 71.93-73.46m, subA-subR clasts of chloritized mudstone (R1-R2) at top, soapy, clasts 1-5cm Zones of chloritized mudstone throughout + on basalt			0-90° 70°	 1	Random clasts Drill breaks planar rough-smooth with dark green mudstone visable.
261	79.55	—	86%	20%	—	R3	BASALT, limonitic, HW top 5cm undertain by fract. loose turgouise mudstone as above to 78.48m. Weak-mod. vesic. below, mod strong SW + further soapy mudstone			0-90 40°	750 1-2	Random irreg. fract to clasts 1mm-5cm Rough irreg joint, soapy mudstone
266	81.07	—	100%	65%	—	R3 -R4	BASALT, Similar to 71.93-73.46m, S.W. Some vesic. filled with chloritized clay/mudstone with dark green vein at 80.11m			10-20° 90°	1-2	Planar rough-irreg rough joint with hard brown infill. Drill breaks 90°, planar rough joint at dark green seam.
271	82.6	—	100%	100%	—	R3 -R4	BASALT, As Above, SW-FS Dark green chloritized mudstone veins at 81.53m (3cm) and 81.73m (3-5cm), also in zones			80 -90°	1-2	Planar smooth joints at mudstone/basalt interface. Drill breaks show high content of dark green mudstone throughout.
276	84.12	—	100%	100%	—	R3 -R4	BASALT, As Above becoming fine-med. grained greenish grey massive in lower 30cm, mod.-strong, SW-FS			60° 30° 30-90°	1	Rough irreg. joint in vesic. zone, one rough irreg. open fract + one planar smooth intact joint in massive.
278	84.73	—	100%	70%	—	R4 + R1- R2	BASALT, As Above, F-FS. fractured and inundated in lower 20cm with chloritized mudstone. (R1-R2), S.W., Similar to 71.93-73.46m			40° 0-90°	1	Rough irreg fract at top of chloritized clay zone with random fractures below
83	86.26	—	100%	100%	—	R3	BASALT, As Above, inundated with dark green chloritic mudstone in upper 40cm also mudstone seams 6-7cm at 85.5m and 4-5cm at 85.68m (R2			80 -90°	1	Drill breaks approx. perp to core axis. Basalt/mudstone contact also 90°, rough irreg.
286	87.17	—	100%	100%	—	R3 -R4	BASALT, As Above, dark greenish grey, fine grained mod vesic., FS-F, strong, occ. talc filled ves. + hairline vein of chloritic mudstone			70°	1	Planar smooth joint at 86.9m with smooth 1-2mm mudstone. Hairline veins (30-90°) smooth irreg.
291	88.7	—	100%	100%	—	R3 -R4	BASALT, As Above, weak-mod. vesic			40° -60° 90°	1	Planar rough joints in weak vesic with planar smooth where chloritized mudstone present.
296	90.22	—	100%	90%	—	R2 R3	BASALT, As Above, interbedded with turgouise green-dark green mudstone/soapstone (R2) and within matrix (10-30cm) at 88.9m, (8cm) 89.7m (4cm) 90m			30 -90°	1-2	Drill induced breaks at basalt/mudstone interface. Smooth irreg. fract. and drill breaks in basalt, frequent mudstone.

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 7 OF 10

PROJECT FISH LAKE
DATE AUG 4/94
LOGGED BY DGSA
DRILL HOLE No. 94-144
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 140.51m
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
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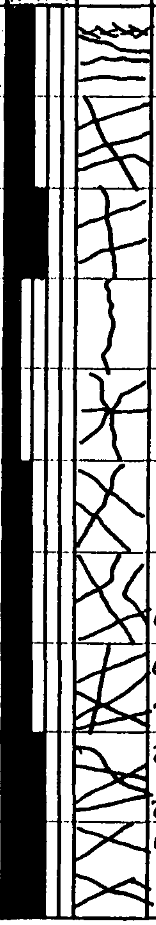
	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY /ft	DEFECT DESCRIPTION Type, shape, roughness, infilling
301	91.74	-	100%	74%	-	R2-R3	BASALT, As Above becoming vuggy towards bottom, vugs to 1cm, mod. vesic., frequent chloritized mudstone thru matrix with 6-8cm vein at 90.5m, broken, basalt, F.S.			80-90°	2-3	Random fractures in mudstone vein, rough irreg. joints in ves. + vuggy section with some smooth mudstone on surface
306	93.27	-	100%	86%	-	R2-R3	BASALT, As above but weakly vesic. towards bottom. Chloritized mudstone veins from hairline to 1cm throughout.			30-50°	1-2	Joints along seams and veins of dark green, mudstone planar rough but smooth areas of mudstone
313	95.4	-	100%	90%	-	R3	BASALT, As above, less mudstone veins, becoming vuggy at bottom infilled with quartz.			10-50°	1-2	Joints rough irreg. with veins also.
316	96.32	-	100%	Appox 20%	-	R2-R3	BASALT, As Above, fractured along core axis, mudstone on face + hairline veins, some quartz, talc infilled vesicles + vugs			0-10°	>10	Possible drillbreaks along veins and joints with mudstone (weak).
321	97.84	-	100%	53%	-	R3	BASALT, As Above, F.S.-S.W., fractured, fine-med. grained, dark greenish grey.			30-90°	5-10	As Above plus intact hairline joints, irreg rough-smooth 1mm fractures.
326	99.36	-	100%	78%	-	R3	BASALT, Dark grey, fine grained, extremely weakly ves.-massive, occ. chlorite/talc. infilled ves., F.S., mod. strong, more competent, v. little mudstone in matrix			30° 30-50°	2-3	Chlorite/talc infilled joint, rough irreg, 1mm gap others planar rough-smooth, chlorite staining on face (R2)
331	100.88	-	100%	55%	-	R4-R5	BASALT, As above, no vesicles, chloritized, Fresh			60° 0-60°	2-3	Soft chlorite/talc 5-6mm on joints planar rough-smooth + irreg. smooth with occ. undulating
336	102.41	-	100%	87%	-	R4-R5	BASALT, As above			60-70° 30-60°	2-3	As Above
341	103.94	-	100%	66%	-	R4-R5	BASALT, As above			20-30° 20-50°	1-2	As Above, undulating.
346	105.46	-	100%	100%	-	R4-R5	BASALT, As above			60-40° 50-60°	1-2	As Above



KNIGHT AND PIESOLD LTD. CONSULTING ENGINEERS	EXPLORATORY DRILLING - BEDROCK LOG	PROJECT No. 1738 SHEET 8 OF 10

PROJECT FISH LAKE
DATE AUG 5/94
LOGGED BY DGSA

DRILL HOLE No. 94-144
CONTRACTOR QUEST
CORE SIZE HQ

REF. EL.
BEDROCK EL.
TOTAL LENGTH 140·51m

ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
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DEPTH (ft)	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY /ft	DEFECT DESCRIPTION Type, shape, roughness, infilling
351	106.98	-	100%	80%	-	R4-R5	BASALT, As Above			30-50°	1-2	As above, some chlorite staining on joints with chlorite infilled vug at 106·7m, soft infill.
356	108.51	-	100%	84%	-	R4	BASALT, As Above			40° 20°	1-2	As Above
361	110·0	-	100%	72%	-	R2-R3	BASALT, As Above becoming mod. vesic + vuggy below with dark green chloritized mudstone zone 109-109·2m + talc infilled ves. Less vesicular in lower 30cm (R3)			70-90°	2-3	Rough and irreg. fractures in vesic. zone with irreg. smooth drill breaks at mudstone (R2) at 90° T.C.A. Rough irreg. contact.
366	111·56	-	100%	45%	-	R2-R3	BASALT, Dark greenish grey, fine-med. grained, mod. vesic. fract. + mudstone zones within matrix, S.W., some talc., closed weak joints in upper 40cm, mudstone (R2)			20-30° 0-90°	7-10 5-10	Curved and undulating smooth joints at top becoming rough - v. rough irreg. below Joints show signs of mudstone present.
371	113.09	-	100%	80%	-	R2-R3	BASALT, As above but less fractured and vesicular towards base, more competent.			70-90° 50°	2-3	Rough-v. rough in vesic. zone + contact of basalt/mudstone. Fractures generally at mudstone. Planar smooth-rough in less vesicular basalt
376	114·6	-	88%	57%		R2 -	BASALT, As above to 113·2m. GREYWACKE SANDSTONE greenish brown, S.W, weak, limonite staining to 113·9m CONGLOMERATE of loose subangular - well rounded			30-60° occ 90°	3-4	Planar rough contact between basalt and sandstone at 113·3m. Planar smooth joints in sandstone with limonite.
							and subrounded poorly graded gravel, cobbles some sand set in sandy matrix, clasts 1mm-5cm					
80	115·82	-	Approx 100%	25%		-	CONGLOMERATE, Loose cobbles and gravel with occ. boulder, sub R-Rounded, S.W., clasts 1-10cm no fines recovered		-	-	-	
86	117·65	-	Approx 80%	0%		-	CONGLOMERATE, As Above but fines recovered, greenish brown sand partly indurated with weak wackestone/conglomerate at 117·5m		-	-	-	
91	119·18	-	Approx 100%	8%		-	CONGLOMERATE, As above, weakly indurated green grey SubR-SubA gravel + cobbles in sand matrix fractured, some mudstone, poorly sorted		-	-	-	

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EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 9 OF 10

PROJECT FISH LAKE
DATE AUG 5/94
LOGGED BY DGSA
DRILL HOLE No. 94-144
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 140.51m
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
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DRILLING INFO.					LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY /ft	DEFECT DESCRIPTION Type, shape, roughness, infilling
396	1207	–	Approx 100%	0%	–	–	**CONGLOMERATE**, As above, slightly more cobbles		–	–	–	
401	122.22	–	Approx 100%	43%	–	–	**CONGLOMERATE**, As above with red and grey boulders		–	–	–	
406	123.75	–	Approx 72%	0%	–	–	**CONGLOMERATE**, As Above but excluding boulders.		–	–	–	
411	125.27	–	Approx 100%	0%	–	R2 -R3	**CONGLOMERATE**, As Above to 124m. **ARGILLITE** Dark greenish grey - black, very fine grained, SW-MW, weak-mod. strong, laminated, calcite, mod. fractured			50° 0-90° 0-20°	>10	All joints planar smooth-slick., shiny slate like appearance, white dusty substance on joints, calcite
415	126.49	–	100%	55%	10°	R2 -R3	**ARGILLITE**, As above, highly fractured into angular fragments 3mm to 3cm in upper 60cm becoming more competent below, SW.			0-90° 60° 30°	>50 5-10	Random fractures at top. Planar rough -smooth, slight slick joints, numerous white hairline calcite veins at joints
420	128.02	–	100%	63%	10°	R2 -R3	**ARGILLITE**, As above, more competent, high calcite content in frequent veins from hairline to 1cm wide. Highly fractured in lower 50cm, S.W.			50° 0-90°	2-3 >15	Fractures in upper 90cm are planar smooth-slick. along calcite veins and some slicks below. Weak along veins
425.5	129.69	–	100%	0%	12°	R2 -R3	**ARGILLITE**, As above, highly fractured, s.w.			0-90° 10-90°	>20 5-10	Random fractures in upper 80cm with planar to irreg. smooth/slicks below. Weak along calcite veins.
431	131.37	–	100%	0%	0-10°	R2 -R3	**ARGILLITE**, As above			0-90°	>20	Random fractures from planar smooth -irreg. rough with some slicks. Weak along calcite veins.
436	132.89	–	100%	26%	0°	R2 -R3	**ARGILLITE**, As above			0-90°	>20	As Above
441	134.42	–	100%	36%	20°	R2 -R3	**ARGILLITE**, As above but darker with slight reduction in calcite content			30-90°	4-5 7-8	As Above

KNIGHT AND PIESOLD LTD. CONSULTING ENGINEERS	EXPLORATORY DRILLING - BEDROCK LOG	PROJECT No. 1738 SHEET 10 OF 10

PROJECT FISH LAKE
DATE AUG 6/94
LOGGED BY DGSA
DRILL HOLE No. 94-144
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 140·51 m
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
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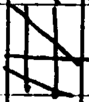
	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (M)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT /ft FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
150·5	137·31	–	100%	67%	15-20°	R3 R2-R3	**ARGILLITE**, As above but more competent with a reduction in calcite veins, dark grey/black to 136·24m contact, becoming light grey, fine, weak-mod. Strong.			20-50° 60-70°	1-2 3-4	Joints in darker material planar smooth-slick with calcite on faces, frequent planar rough in lighter zone
156	138·99	–	100%	32%	12-25°	R2-R3	**ARGILLITE**, Dark grey/black as above with high calcite content but more competent, calcite veins 1-3cm wide			50-60° 10-60°	5-10	Planar smooth-slick. joints with some rough, irreg. showing partly slicks. calcite on faces.
161	140·51	–	100%	0%	12-25°	R2-R3	**ARGILLITE**, As Above			0-90°	>10	As Above
							End of Hole 140·51 m (461ft)					

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 1 OF 7

PROJECT Fish Lake
DATE Aug 8/94
LOGGED BY DGSA

DRILL HOLE No. 94-147
CONTRACTOR Quest
CORE SIZE HQ

REF. EL.
BEDROCK EL.
TOTAL LENGTH 94.79m

ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
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	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
Depth (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
11	3.35	–	23%	0%	–	–	GLACIAL TILL, Loose gravel, fine + coarse, sub-angular and subrounded clasts with occ. cobble, brown sandy clay, cobbles in lower 20cm		–	–	–	
16	4.88	–	100%	39%	–	–	GLACIAL TILL, brown sandy clay, some ang.-sub-ang. gravel, trace cobble, dense, with dark brown basalt fragments with clay infill. mudstone lower 45					Matrix Supported
21	6.4	–	100%	0%	–	R3	BASALT, Grey-reddish grey, fractured, fine grained massive, med. strong, SW-MW with grey-greenish brown sandy clay infill to fractures			60-90° 20-90°	6-7	Rough irreg. fractures, random in top, clay infill, gap 3-5mm
26	7.92	–	84%	34%	–	R3 S3-S4	BASALT, Fine-med. grained, dark grey, v. weakly ves, mod. strong, SW-MW, interbedded with 15cm zone of green stiff clay, trace sand at 7.5m.			0-90° 60-80°	4-5	Rough irreg. in top 24cm, planar rough below. Clay/basalt contact rough-planar to irreg. Some brown clay infill to joints
31	9.45	–	100%	64%	–	R3	BASALT, As Above, more competent, with some infilled ves, SW, some calcite in rock, not interbedded			70-90° 0° 90°	3-4	Planar rough fractures with some brown clay infill to fractures and on faces, gap 1-3mm.
36	10.97	–	100%	80%	–	R3	BASALT, As Above, dark grey, competent massive, calcite phenos, SW-FS			60-80° 5° 70-90°	1-2	Planar rough joints 1-2mm gap with slight limonite. Occ. hairline vein of calcite. Calcite on oblique joint.
41	12.5	–	100%	98%	–	R3	BASALT, As Above but fine grained, F.S., jointed			40° 50-70°	3-4	As Above with occ. planar smooth with tight jointing (1mm or less).
46	14.02	–	100%	96%	–	R3	BASALT, As Above, F.S.-SW			50° 40-60°	4-5	Planar rough-smooth, trace chlorite on joints, occ. hairline veins. Oblique closed vein (20°), 1mm gap in tight joints.
51	15.54	–	100%	80%	–	R3	BASALT, As Above			80° 0-80°	4-5	As Above, calcite veins to 1mm in lower section occas., tight joints <1mm
56	17.07	–	100%	70%	–	R3	BASALT, As Above			20-30° 10-40°	2-3	Planar smooth joints, occ. planar rough some intact, with chlorite/calcite infill gap 1-2mm

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 2 OF 7

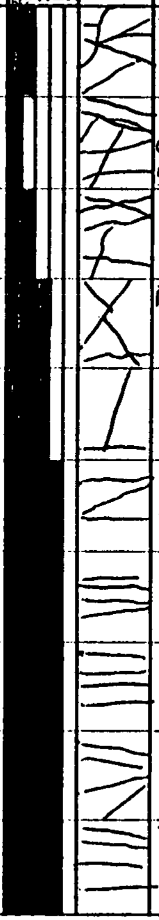
PROJECT FISH LAKE
DATE AUG 8/94
LOGGED BY DGSA

DRILL HOLE No. 94-147
CONTRACTOR QUEST
CORE SIZE HQ

REF. EL.
BEDROCK EL.
TOTAL LENGTH 94.79 m

ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
E

	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	/ft DEFECT FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
61	18.59	–	100%	74%	–	R3	BASALT, As Above, occ. soft infilled vesicles, white, some green talc.			20-40° 30-40°	2-3	Planar smooth and undulating smooth -rough joints; some intact, less jointed than above, gap 1-2mm.
66	20.11	–	100%	48%	–	R3	BASALT, As Above			50° 0-60° 5c 60°	3-5	As Above
71	21.64	–	100%	73%	–	R3	BASALT, As Above			30° 20° 90°	1-2	Planar smooth-rough with talc on joints and trace chlorite, gap 1-2mm
76	23.16	–	100%	100%	–	R3 -R4	BASALT, As Above, fine grained, dark grey, F.S. mod. strong-strong, F.S., massive, more competent			10-20° 90°	≤1	Planar rough joints 2-3mm wide infilled with greenish white soft talc.
81	24.69	–	100%	88%	–	R3 -R4	BASALT, As Above, SW.-FS.			0-15° 80°	<1	Planar smooth longitudinal joint 1mm wide infilled with white hard infill, crystalline, planar smooth at bottom.
86	26.21	–	100%	100%	–	R4	BASALT, As Above, F.S.-Fresh			70-90°	0	Drill induced breaks only approx. perp to core axis + one at 70°
91	27.74	–	100%	90%	–	R4	BASALT, As Above			70-90°	0	Drill induced breaks only Planar smooth-rough
96	29.26	–	100%	60%	–	R4	BASALT, As Above			90°	0	As Above
101	30.78	–	100%	100%	–	R4	BASALT, As Above			80° -40°	0	As Above
106	32.31	–	100%	100%	–	R4	BASALT, As Above			70° 90°	0-1	Single planar-smooth joint, all others drill induced.



KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 3 OF 7

PROJECT FISH LAKE
DATE AUG 8 & 9/94
LOGGED BY DGSA
DRILL HOLE No. 94-147
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 94-79m
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
E

	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT ~~/ft~~ FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
111	33.83	-	100%	100%	--	R4	BASALT, As Above, infilled vug 3mm x 6cm at 33m quartz, occ. 1mm vesicles in lower 80cm.			90°	0- 1	Drill induced breaks, planar rough-smooth approx perp to core axis.
116	35.32	-	100%	100%	--	R4 -R3	BASALT, As Above to 35m, becoming mod-strongly ves. & vuggy, vugs to 1cm x 1.5cm, inundated with green chloritized clay/mudstone in lower 15cm			90° 50-90°	1	As Above in massive, rough irreg in vesicular zone
121	36.88	-	100%	92%	-	R3	BASALT, Dark grey, mod. - strongly ves. + vuggy SW, fine, mod. strong, zones of dark green chloritized clay/mudstone thru matrix and 60cm zones top + bottom			80 -90°	1-2	Rough irreg. fractures at mudstone/basalt interfaces, drill breaks in less inundated sections, mudstone slick - irreg. fract.
126	38.4	-	86%	78%	-	R2 -R3	BASALT, As above with green mudstone seam 4-9cm at 37M also inundating matrix in lower 50cm, mudstone (R2)			80-90° 40-90°	1-2	Stepped irreg. smooth-slick fract. at mudstone and interface top + bottom Rough irreg. drill breaks and in vesicular
131	39.93	-	100%	95%	-	R3	BASALT, As above, inundated with green waxy clay mudstone thru matrix in upper 70cm reducing to zero. Vugs 3cm x 1cm, quartz infill			80° 90°	1-2	Planar rough-smooth fract in inundated basalt, rough irreg contact. Drill breaks only in less inundated zone.
136	41.45	-	100%	100%	-	R3	BASALT, Dark grey, fine grained weakly ves. in top 1m becoming less/massive, SW, some quartz infill to ves. and occ. waxy mudstone, seam at 40.8m (1-3cm)			70-90° 50-60°	1	Drill breaks only in weak ves. with planar-irreg smooth in massive @41.1m mudstone/basalt contact rough irreg.
141	42.98	-	100%	97%	-	R3	BASALT, Dark grey, fine, As Above			70° 20°	1	Planar rough joints, 1mm, some chlorite, occ. hairline vein of green waxy mudstone and on joints.
146	44.5	-	100%	90%	-	R3	BASALT, As Above becoming more vesicular in lower 10cm and inundated with dark green chloritized clay/waxy mudstone.			10° 0-40°	2-3	Planar rough to irreg. rough intact hairline joints, mudstone infilled to 1mm, 2 open joints 1mm, rough irreg inundated
151	46.02	-	100%	80%	-	R3	BASALT, Dark grey, mod. ves. fine, SW. inundated with mudstone top 50cm. Below occ. vein to 1cm with hairline veins along joints. Occ. mudstone below 45m			80-90° 45° 70°	2-3	Rough irreg. smooth mudstone fract in top 50cm, Planar rough less inundated zone, jointed 2-3m 45.1-45.4cm
156	47.55	-	100%	56%	-	R3	BASALT, As Above, SW-MW, brownish green mudstone infilling vuggs (1-3cm), weakly ves. in lower 40cm.			40-50° 0-90°	3-4	Rough irreg., slight limonite - mod. fract. - planar smooth - rough in weak ves. Random joints intact + broken 46.1-47.1m

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EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 4 OF 7

PROJECT FISH LAKE
DATE AUG 9/94
LOGGED BY DGSA
DRILL HOLE No. 94-147
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 94.79m
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
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	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	/ft DEFECT FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
161	49.07	–	100%	24%	–	R3	BASALT, Dark grey, fine, MW-SW, fractured, weak vesicular, weathered calcite on joints, trace limonite staining			0-10° 90 10-20°	2-3	Undulating rough, limonite stained, weathered calcite 0-10° with planar rough ± 90°
166	50.6	–	59%	20%	– 90°	R3 R2	BASALT As above to 49.4m - grey to brown med. to strongly ves. to 49.6m. Below greenish brown SILT/SANDSTONE, dense, friable, not fully recovered, weak			0-20° 20-50° 90°	2-3	As Above in Basalt. Drill breaks in sandstone perp. to core axis along bedding.
171	52.12	–	Approx 50%	–	–	–	GRAVEL, loose coarse + fine, some cobbles, trace sandstone clasts, all clasts round - subround, trace coarse sand, no fines recovered.		–	–	–	
177	53.65	–	Approx 72%	–	–	–	GRAVEL, As above, heterolithic, no fines or sandstone clasts.		–	–	–	
181	55.17	–	Approx 65%	–	–	–	GRAVEL, As above		–	–	–	
186	56.69	–	Approx 65%	–	–	–	GRAVEL, As above		–	–	–	
191	58.22	–	Approx 83%	61%	86°	R2	GRAVEL, As above to 57.26m. GLACIOLACUSTRINE SILTSTONE-CLAYSTONE, soft, well indurated, varved, light grey - beige - greenish grey - greenish brown			40° 90°	2	Drill induced breaks only in claystone along bedding. No natural defects oblique fracture 40°.
196	59.74	–	82%	82%	90°	R2	GLACIOLACUSTRINE SILTSTONE-CLAYSTONE, As above, varved silty claystone, soft clay in bottom 4-5cm		–	–	–	Drill induced breaks only along bedding planes, planar slicks
201	61.26	–	100%	100%	90°	R2	As Above, more clayey, very fine, weak		–	–	–	As Above
206	62.79	–	100%	100%	90°	R2	As Above, becoming denser with depth		–	–	–	As Above

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 5 OF 7

PROJECT FISH LAKE
DATE AUG 9/94
LOGGED BY DGSA
DRILL HOLE No. 94-147
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 94.79m
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
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	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (M)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
211	64.31	–	100%	100%	84°	R2	As Above		–	–	–	As Above
216	65.84	–	100%	100%	90°	R2	As Above		–	–	–	As Above
221	67.36	–	60%	60%	90°	R2	As Above		–	–	–	As Above
226	68.88	–	58%	58%	80°	R2	As Above		–	–	–	As Above
236	71.93	–	0%	–	–	–	SEDIMENTS. Zero recovery, most likely sand as below wash away from sequence		–	–	–	No Recovery
241	73.4	–	30%	0%	–	–	SANDSTONE, trace greenish brown fine sand-weak sandstone to 72.7m. Mod. indurated but weak loose gravel with some sand CONGLOMERATE		–	–	–	Drill induced breaks in Sandstone at 90° to core axis, possible bedding but not evident.
248	75.59	–	Approx 42%	–	–	–	CONGLOMERATE, loose gravel, coarse + fine, trace cobble, subround - round, heterolithic - No fines recovered.		–	–	–	
253	77.11	–	Approx 100%	30%	–	– R3	CONGLOMERATE, loose gravel as above, trace green silty sand to sandy clay, to 76.6m. Below BASALT, dark grey fine massive mod. strong, S.W. occ. ves. 2mm-1cm	■	═	90°	1-2	Planar rough drill breaks in basalt.
256	78.02	–	66%	47%	–	R3 R2	BASALT, Dark grey, med. grained, massive - v. weak ves., S.W, mod. strong + dark green waxy mudstone in lower 10cm, weak. Trace CONGLOMERATE 77.6-77.9m	■	~	20° 90°	1-2	Planar rough drill breaks at top with 20° limonite stained joint. Planar-irreg smooth contact (90°)
257½	78.5	–	Approx 100%	0%	–	–	CONGLOMERATE, Loose gravel to 78.1m underlain by cobble-boulder size. Basalt to 78.5m		–	–	–	

KNIGHT AND PIESOLD LTD. CONSULTING ENGINEERS	EXPLORATORY DRILLING - BEDROCK LOG	PROJECT No. 1738 SHEET 6 OF 7

PROJECT FISH LAKE
DATE AUG 9 & 10/94
LOGGED BY DGSA
DRILL HOLE No. 94-147
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 94.79m
ANGLE FROM HORIZ. -90°
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DEPTH (ft)	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY /ft	DEFECT DESCRIPTION Type, shape, roughness, infilling
261	79.5	-	Approx 100%	62%	--	R3	BASALT, Dark grey, fractured, med. grained, weakly ves., SW, massive with green waxy mudstone in lower 30cm. Random ves between			30-40° 0-90°	6-8 >20	Planar rough joint with others intact, rough irreg. fracture in random zone, fractured in lower 30cm.
266	81.08	-	88%	55%	--	R3 R2	BASALT, As Above in top 30cm. CONGLOMERATE, 20cm fract. core, round basalt clasts + irreg clasts to 25mm with dark green chloritized clay + green sand			80-90° 40-70°	1 >20 1-2	Planar rough drill breaks in massive + vesicular, Random fractures and planar rough mudstone/basalt contact.
							Below BASALT, dark grey-greenish grey, weak ves. - massive with 20-30cm of green clay/mudstone weak.					
272	82.9	-	100%	21%	--	R4	CONGLOMERATE Interbedded zones of massive, weak ves., highly fract. + heterolithic loose gravel + cobbles Fractured zones HW, clasts set in mudstone, Massive Strong			0-90°	>10 >20	Random rough irreg. fractures with occ. planar smooth intact joint, stained, greenish grey.
276	84.12	-	100%	22%	-	— R4	CONGLOMERATE, As above, highly fractured + weathered, broken dark green mudstone. Massive zones strong.			0 -90°	>10	As Above with occ. layer of dark green mudstone on face. All stained greenish grey (Top flow zone?)
281	85.65	-	100%	54%	-	— R3	CONGLOMERATE, As Above to 84.7m with some green highly chloritized basalt, fine to med. grained + rounded cobbles set in weak green mudstone (R2) Below greenish			0-90° 80-90° 0-90°	>10 1 >10	As Above, occ. joint 1-2mm, Drill breaks in massive zone. Mudstone/basalt contact rough-irreg. -planar smooth. Mudstone slick
							grey massive BASALT, fine-med. grained, S.W., med. strong.					
86	87.17	-	100%	100%	-	R3 -R4	CONGLOMERATE 85.9-86.5m, BASALT, massive as above interbedded with greenish grey sandy CONGLOMERATE with gravel + cobbles well indurated			30-60° 70-90°	1-2	Rough irreg fract. at contact of coarser clasts and sandstone matrix, planar rough-smooth, mudstone planar smooth-slick.
291	88.7	-	100%	90%	-	R3 -R4	CONGLOMERATE dark greenish grey well indurated, R, SbR, angular heterolithic gravel + cobbles in mud/sandstone matrix, poorly sorted, R3, basalt, jointed in lower 20cm			0-90°	2-3	As above with curved planar smooth. Joints at base in basalt 2-3mm gap.
96	90.22	-	Approx 100%	20%	-	R3	CONGLOMERATE, As above, weakly indurated + fract. Clasts heterolithic, trace green sand and mudstone some loss of fines			0-90°	>20	As Above with random fractures throughout.

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EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 7 OF 7

PROJECT FISH LAKE
DATE AUG 10/94
LOGGED BY DGSA
DRILL HOLE No. 94-147
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 94.79m
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
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	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
301	91.74	—	Approx 100%	0%	—	—	CONGLOMERATE As Above			0-90°	>20	As Above
306	93.27	—	Approx 100%	18%	—	—	CONGLOMERATE As Above			0-90°	>20	As Above
311	94.79	—	Approx 100%	7%	—	—	CONGLOMERATE As Above, some mod. ves. basalt, weathered			0-90°	>20	As Above
							End of Hole at 94.79 m (311 ft).					

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 1 OF 3

PROJECT FISH LAKE
DATE AUG. 12/94
LOGGED BY DGSA
DRILL HOLE No. 94-148
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 96ft
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
E

	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
3·7	1·14	-	0%	-	-	-	OVERBURDEN No Core Recovered					
8	2·44	-	Appro 100%	-	-	-	OVERBURDEN, Brown silty clay, trace sand, and gravel and cobbles, subangular - subrounded stiff GLACIAL TILL		-	-	-	
12	3·66	-	Approx. 47%	-	-	-	OVERBURDEN, GLACIAL TILL, As Above with soft silty clay, trace sand matrix, partially intact.		-	-	-	
15·5	4·72	-	Approx. 75%	-	-	-	GLACIAL TILL, As Above, more competent, stiff - v. stiff, well indurated		-	-	-	Drill induced breaks in stiff - v. stiff till, approx. perp to core axis, otherwise intact
21	6·40	-	100%	-	-	-	GLACIAL TILL, As Above, competent, stiff - v. stiff, well indurated		-	-	-	Drill induced breaks approx. perp. to core axis, otherwise intact.
26	7·92	-	100%	-	-	-	GLACIAL TILL, Brown clayey sand, trace silt, and gravel and cobbles, subangular - subrounded v. stiff - hard, competent, well indurated.		-	-	-	Drill induced breaks approx. perp. to core axis, otherwise intact.
31	9·45	-	100%	-	-	-	GLACIAL TILL, As Above becoming more sandy in matrix with depth.		-	-	-	Drill induced breaks approx. perp. to core axis otherwise intact.
36	10·97	-	100%	-	-	-	GLACIAL TILL, Brown silty sand - sandy silt, trace clay with some gravel and cobbles to 9·8m. Below SILTSTONE, Brownish grey silt - fine sand, med. dense		-	-	-	Drill induced breaks as above in Glacial Till.
41	12·5	-	100%	-	-	-	SILTSTONE, Brownish grey silt - fine sand, soft - v. soft becoming coarser to sandy siltstone, weakly indurated from 12 - 12·5m. No bedding evident		-	-	-	Drill induced breaks approx. perp. to core axis
46	14·02	-	Approx. 13%	0%	-	-	CONGLOMERATE, Brown silty, sandy clay, trace gravel and cobbles, weakly indurated with little recovery		-	-	-	

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 2 OF 3

PROJECT FISH LAKE
DATE AUG. 12/94
LOGGED BY DGSA
DRILL HOLE No. 94-148
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 96ft.
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
E

	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
49	14.94	–	Approx. 87%	54%	–	–	CONGLOMERATE, Loose grey gravel and cobbles recovered, trace brown, sandy clay with fines washed out, clasts heterolithic, one massive basalt boulder 50cm long.			80-90°	–	Random Clasts Irreg. smooth contact at boulder.
53	16.15	–	Approx 62%	0%	–	–	CONGLOMERATE, Loose round-sub round heterolithic grey gravel and cobbles as above with trace brown sandy clay – no fines, trace waxy clay/mudstone					loose conglomerate
56	17.07	–	Approx 100%	11%	–	R3	CONGLOMERATE, Dark grey fine grained, MW, fractured weak-massive basalt cobbles with heterolithic gravel and cobbles in a brown clayey sand matrix, indurated.			0-90°	–	Random fractures with occ. planar rough fractured cobble, trace sand on face.
59	17.98	–	Approx. 100%	26%	–	R3	CONGLOMERATE, MW-HW gravel and cobbles well indurated but fractured set in a hard sandy brown-green matrix. Clasts round-subround, Well indurated.			45-90° 90°	4-5	Random irreg. fractures, heavily weathered and stained, broken, some planar rough contact between cobbles and matrix
62	18.9	–	Approx 100%	0%	–	–	CONGLOMERATE, Dark brownish green clayey sand, trace silt, heterolithic round-subround loose-med. dense gravel and cobbles.		–	–	–	loose conglomerate.
66	20.12	–	Approx 100%	0%	–	–	CONGLOMERATE, As Above.		–	–	–	loose conglomerate.
71	21.64	–	Approx. 100%	0%	–	–	CONGLOMERATE, Greyish brown sandy clay matrix with loose rounded-subrounded gravel and cobbles and weathered ves. basalt layers to 10cm. loss of fines		–	–	–	loose conglomerate.
76	23.16	–	Approx 100%	7%	–	–	CONGLOMERATE, As above with increase in number cobbles towards base, loss of fines.		–	–	–	loose conglomerate
80	24.38		Approx ~ 100%	22%	–	–	CONGLOMERATE, Greenish brown, clayey sand, loose gravel and cobbles, occ. massive basalt boulder, MW-HW dark stained in places, cobbles/boulders fractured, loose		–	–	–	loose conglomerate
85	25.9		100%	74%	–	R3	BASALT, Dark grey, fine grained, weakly-v. weakly vesic. occ. ves. infilled with talc. SW-MW. Green waxy clay/mudstone vein 40-70mm at 25.3m Conglomerate zone at 24.8			70° 60-90°	2-3	Joint at 24.8m with 3cm of well indurated green sand and gravel, brown clay infill 12mm. Rough irreg contact with mudstone at 25.3 and 25.7m, Basalt fractured, weathered and

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 3 OF 3

PROJECT FISH LAKE
DATE AUG. 12/94
LOGGED BY DGSA
DRILL HOLE No. 94-148
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 96ft
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
E

DEPTH (ft)	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
90-5	27.58	-	100%	86%	-	R3 R3	<u>BASALT</u>, Dark grey, massive, fine grained, MW to 26.7m <u>CONGLOMERATE</u>, below contact, poorly-well sorted, well indurated with light greenish brown sandy matrix with heterolithic grey gravel, some ves. basalt and loose gravel in lower 10cm			40-50° 90°	1-2	Planar rough-smooth joints in massive basalt with mod-high limonite staining Fract. in Conglomerate are rough irreg. through matrix, gap 2-3mm.
96	29.26	-	100%	21%	-	R3	<u>CONGLOMERATE</u>, Broken and weathered, weakly indurated sand, gravel and cobbles, dark brown stained in upper 40cm. Broken and fractured below with loose rounded -subrounded-subangular heterolithic grey gravel and cobbles with trace of greenish brown waxy mudstone. Intact conglomerate between 28 and 28.3m, poorly sorted with sandy limonite stained matrix, well indurated S.W. and mod. strong.			0-90° 90° 0-90°	>10 1-2 >10	Random irreg. rough fractures in weakly indurated zones with rough irreg through matrix in well indurated, drill breaks.

End of Hole 96ft (29.26m)

KNIGHT AND PIESOLD LTD. CONSULTING ENGINEERS	EXPLORATORY DRILLING - BEDROCK LOG	PROJECT No. 1738 SHEET 1 OF 3

PROJECT FISH LAKE

DATE AUG 13/94

LOGGED BY DGSA

DRILL HOLE No. 94-150

CONTRACTOR QUEST

CORE SIZE HQ

REF. EL.

BEDROCK EL.

TOTAL LENGTH 38-4m

ANGLE FROM HORIZ. -90°

BEARING

COORDINATES N

E

DEPTH (ft)	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
6	1.83	–	0%	–	–	–	OVERBURDEN No Core Recovered					
9	2.74	–	Approx 100%	–	–	–	OVERBURDEN, Loose gravel and cobbles in upper 20cm underlain by 45cm of reddish brown sandy clay and gravel, stiff, poorly graded GLACIAL TILL becoming brownish grey below in 30cm zone, grey sandy clay trace silt with some sand and gravel, stiff-v stiff in this zone, poorly graded, competent below.					
16	4.88	–	Approx 100%	0%	–	R2 -R3	BASALT, Dark grey, fine grained, MW-HW, fractured + weathered into grey sand at top, some heavily jointed section with some greenish black mudstone inundated and weathered zones. Mostly massive with greenish grey vesicular zones HW + broken with limonite stained green waxy mudstone in matrix. Soft turquoise green infill to occ. ves. 3.35-4.88m			0 -90°	>20	Random rough irreg. joints mostly intact 1-2mm occ 4mm wide infilled with grey mudstone. HW zones v. fract. Near horiz. contacts between jointed massive basalt and green weathered zone.
21	6.4	–	Approx 100%	0%	–	R3	BASALT, Dark grey, fine grained massive with occ. vesicle, SW, jointed + fract., less jointed than above, med. strong. Some green mudstone on fractures, less fract. in upper 85cm			0 -90°	>10	Random planar + irreg rough joints and fractures, slight brown staining on joints, some intact, hairline with mudstone.
26	7.92	–	100%	0%	–	R3	BASALT, As above to 6.8m becoming reddish grey-dark grey weak-med. ves. S.W. fine grained trace dark green mudstone. Fractured below 6.8m			0-90° 90° 0-90°	5-6 7-9 >10	Rough planar + irreg rough fractures perp to core axis, possible drill breaks(?) spacing 3cm approx, more fractured in lower 60cm.
31	9.45	–	100%	10%	–	R3	BASALT, Dark grey, fine grained, SW, fractured, med. strong; med.-strongly vesicular, trace dark green mudstone on fractures and occ. in matrix			90° 0-90°	8-10	As Above
36	10.97	–	100%	55%	–	R3	BASALT, Dark greenish grey, fine grained, SW, massive, competent, med. strong, occ. vug with some chlorite infill + slight vesicles to 1mm at 9.65 and 10m.			20-30° 40-70°	2-3	Planar rough undulating rough and irreg rough joints with some chlorite on faces. Gap 1-2mm
41	12.5	–	100%	40%	–	R3 -R4	BASALT, Dark greenish grey, fine grained, massive, SW competent, med. strong, jointed. Slight green phenos in matrix			40-50° 0-10°	2-3	Planar rough joints with some chlorite on surface and slight dark green/black mudstone on long. joint in lower 5cm, 2mm thk

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 2 OF 3

PROJECT FISH LAKE
DATE AUG 13/94
LOGGED BY DGSA
DRILL HOLE No. 94-150
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 38.4m
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
E

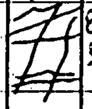
	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	DEFECT FREQUENCY /ft	DEFECT DESCRIPTION Type, shape, roughness, infilling
46	14.02	–	70%	47%	–	R3	BASALT, As above to 13.3m with some ves. + vugs infilled with soft talc, vugs to 1mm, becoming weak-med. ves. below			0-10° 80-90°	2-3	Planar rough-smooth contin. of long. joint 0-10° intact, 1-2mm gap infilled with chloritic mudstone. Rough planar, rough irreg. in ves.
51	15.59	–	100%	7%	–	R3	BASALT, Dark grey-greenish grey, fine-med. grained, S.W. med. ves. + vuggy, highly fract., vugs to 10mm some infilled with green waxy mudstone			0-90°	7-10	Rough irreg. fractures in med. ves., generally perp to core axis + parallel, zones of highly fract., some mudstone on joints + hairline veins
56	17.07	–	100%	73%	–	R3 R4	BASALT, As Above to 15.8m becoming less vesicular to massive, fine grained, S.W. competent, dark grey occ. ves. to 3mm in massive. Some green mudstone in ves. + mtrx			90° 80° 20°	1-2	Rough irreg. fract. in med. ves. Planar rough joint 20°, stained green at 16.5m. Occ hairline joint in med. ves.
59.7ft	18.22	–	100%	78%	–	R4 -R3	BASALT, As Above, massive with vugs 6x1x1cm part. infilled with talc. Becoming mod. ves. + fract. at 17.9m and reddish grey, weathered			80-90° 0-90°	1 5-7	Planar rough joint in massive 1-2mm gap drill induced breaks perp. to core axis. Random irreg. fractures in med. ves. + mudstone on joints
66	20.11	–	Approx 50%	0%	–	–	CONGLOMERATE, Indurated green sand + gravel, occ boulder weak, weathered to 61ft underlain by loose grey gravel trace coarse sand, limonite, subA-subR, no fines recovd.					
71	21.64	–	Approx 72%	13%	–	–	CONGLOMERATE, Loose gravel, coarse sand occ cobble + ves. basalt clast to 21m underlain by weak-mod green sand + gravel, HW. limonite stained, fract, sand matrix					No trace of fines in return water or recovered.
76	23.16	–	Approx 13%	0%	–	R3	CONGLOMERATE, Loose gravel, trace cobble, ang. to sub A, Round-subR, heavily limonite strained, no fines recovered.					Random rough irreg thru matrix
31	24.69	–	Approx 100%	26%	–	R3	CONGLOMERATE As above to 23.7m then weak-mod. indurated heterolithic sand and gravel, trace cobbles, H.W. + limonite stained broken sand matrix.					As Above
36	26.21	–	Approx 86%	0%	–	R3	CONGLOMERATE, weak-mod. indurated red-brown sand + gravel, poorly sorted, trace cobbles, H.W. + limonite stained; broken, sub A-subR + loose gravel					As Above
91	27.74	–	Approx 53%	0%	–	–	CONGLOMERATE As Above but weakly indurated with higher quantity of fine gravel, more stained + fract. with some loose gravel.					As Above

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

EXPLORATORY DRILLING - BEDROCK LOG

PROJECT No. 1738
SHEET 3 OF 3

PROJECT FISH LAKE
DATE AUG 14/94
LOGGED BY DGSA
DRILL HOLE No. 94-150
CONTRACTOR QUEST
CORE SIZE HQ
REF. EL.
BEDROCK EL.
TOTAL LENGTH 38-4m
ANGLE FROM HORIZ. -90°
BEARING
COORDINATES N
E

	DRILLING INFO.				LITHOLOGY			ROCK MASS DEFECTS				
DEPTH (ft)	DEPTH (m)	SAMPLES	CORE RECOVERY	R.Q.D.	FOLIATION/ BEDDING	HARDNESS	ROCK DESCRIPTION Weathering, structure, color, grain size, strength, rocktype. Other comments.	DEFECT SPACING (cm) 3 10 30 100 300	GRAPHIC LOG OF DEFECTS	DEFECT ORIENTATION	/ft DEFECT FREQUENCY	DEFECT DESCRIPTION Type, shape, roughness, infilling
96	29 26	–	Approx 100%	15%	–	R3	CONGLOMERATE, As Above with loose poorly sorted gravel and stained deeper orange red. Intact med. ind. sand + gravel, med. strong at 29·4–28·8m, heavily stained					Random fractures rough irreg thro. mtr
101	30·78	–	100%	41%	–	R3	CONGLOMERATE, well indurated, sands and gravels, dark reddish brown + grey, poorly sorted, heavily stained, some intact sections remainder broken and less competent					Random rough irreg. fract. thru matrix
103·8	31·64	–	100%	0%	–	–	CONGLOMERATE, As Above but highly fractured.					As Above
106	32·3	–	100%	53%	–	R2 -R3	ARGILLITE, Dark grey, waxy mudstone, S.W. fract zone 18cm at 31·7m, weak – med. strong.			0-90° 50-90°	>30	Rough irreg contact, weathered green brown Random irreg. fract at 31·7m zone + limonite staining. Drill breaks (slicks) below.
111	33·8	–	89%	34%	10°	R2 -R3	ARGILLITE, Dark grey-black, S.W., highly fract top 50cm. some areas crumbly. Zone of light grey middle 30cm. weak-med. strong. Bedding 10° with shearing parallel			0-90° 70° 10-30°	>20 5-10	Random fract, rough irreg with some vertical joints, talc infilled in upper 50cm. Hairline joints throughout < 1mm wide, planar smooth + slicks.
116	35·36	–	100%	46%	–	R2 -R3	ARGILLITE, As Above to 34·0m. Below CONGLOMERATE poorly sorted, rounded – well rounded greenish grey – green black argillitic and dark light grey clasts to 4cm			30-70° 90° 0-90°	3-4 >15	Curved contact at 34·27m below drill induced breaks, approx. perp to core axis with random fractures in lower 40cm
							in a greenish grey, med grained sandy matrix, Trace of fine grained sandstone at 34 – 34·27m. Locally crumbly and sheared.					
121	36·88	–	100%	43%	–	R2	CONGLOMERATE, As Above Trace sandstone, med. grained and calcite veins to 15.mm and trace quartz in thin strings			0-90° 70°	5-7	Drill breaks and rough irreg, perp to core axis + 0° and 70° - Some fract. at clast faces and quartz veins.
126	38·4	–	72%	30%	–	R2 -R3	CONGLOMERATE, Light grey as above with less calcite veins in lower 40cm becoming more competent with depth.			80-90° 30-40° 90°	4-5	Drill breaks, rough irreg perp to core axis becoming natural rough irreg - planar rough joints, numerous calcite veins to 2cm.
							End of Hole 38·4m (126 feet)					

APPENDIX C

POINT LOAD TEST RESULTS

Knight Piésold Ltd.
CONSULTING ENGINEERS

POINT LOAD TEST CALCULATION SHEET
DRILLHOLE 94-141

Core Type: HQ
Core Diameter, D: 63.5 mm
Piston Area, A: 5 sq. in.
Core Diameter Correction, K= 25

No.	Sample Depth		Gauge Reading, G	Applied Load, P=G*A	Point Load Strength Index, Is=P/D2	Uniaxial Compressive Strength σc=K*Is	Strength Designation	Rock Type
	(ft)	(m)	(kPa)	(kN)	(MPa)	(MPa)		
1	33.5	10.2	2,250	7.3	1.8	45	Moderate	Basalt
2	44.6	13.6	250	0.8	0.2	5	Very Weak	Basalt
3	45.9	14.0	1,000	3.2	0.8	20	Weak	Basalt
4	48.6	14.8	1,500	4.8	1.2	30	Moderate	Basalt
5	63.0	19.2	2,750	8.9	2.2	55	Strong	Basalt
6	81.7	24.9	650	2.1	0.5	13	Weak	Basalt
7	100.7	30.7	2,050	6.6	1.6	41	Moderate	Basalt
8	109.3	33.3	300	1.0	0.2	6	Weak	Sandstone
9	140.7	42.9	8,750	28.2	7.0	175	Very Strong	Basalt
10	144.7	44.1	6,800	21.9	5.4	136	Very Strong	Basalt
11	153.9	46.9	7,550	24.4	6.0	151	Very Strong	Basalt
12	164.4	50.1	850	2.7	0.7	17	Weak	Basalt

Knight Piésold Ltd.

CONSULTING ENGINEERS

POINT LOAD TEST CALCULATION SHEET
DRILLHOLE 94-143

Core Type:	HQ	Piston Area, A:	5 sq. in.
Core Diameter, D:	63.5 mm	Core Diameter Correction, K=	25

No.	Sample Depth		Gauge Reading, G	Applied Load, P=G*A	Point Load Strength Index, Is=P/D2	Uniaxial Compressive Strength σc=K*Is	Strength Designation	Rock Type
	(ft)	(m)	(kPa)	(kN)	(MPa)	(MPa)		
1	13.6	4.2	1,375	4.4	1.1	27	Moderate	Basalt
2	23.6	7.2	800	2.6	0.6	16	Weak	Basalt
3	29.9	9.1	5,800	18.7	4.6	116	Very Strong	Basalt
4	52.2	15.9	1,500	4.8	1.2	30	Moderate	Basalt
5	70.8	21.6	1,250	4.0	1.0	25	Weak	Basalt
6	81.9	25.0	7,000	22.6	5.6	140	Very Strong	Basalt
7	118.3	36.1	1,450	4.7	1.2	29	Moderate	Basalt
8	144.7	44.1	800	2.6	0.6	16	Weak	Basalt
9	157.9	48.1	650	2.1	0.5	13	Weak	Basalt
10	170.7	52.0	3,700	11.9	3.0	74	Strong	Basalt

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Knight Piésold Ltd.

CONSULTING ENGINEERS

POINT LOAD TEST CALCULATION SHEET
DRILLHOLE 94-147

Core Type:	HQ	Piston Area, A:	5 sq. in.
Core Diameter, D:	63.5 mm	Core Diameter Correction, K=	25

No.	Sample Depth		Gauge Reading, G	Applied Load, P=G*A	Point Load Strength Index, Is=P/D2	Uniaxial Compressive Strength σc=K*Is	Strength Designation	Rock Type
	(ft)	(m)	(kPa)	(kN)	(MPa)	(MPa)		
1	32.7	10.0	875	2.8	0.7	17	Weak	Basalt
2	45.9	14.0	800	2.6	0.6	16	Weak	Basalt
3	66.4	20.3	3,875	12.5	3.1	77	Strong	Basalt
4	70.5	21.5	8,500	27.4	6.8	170	Very Strong	Basalt
5	85.8	26.2	7,300	23.5	5.8	146	Very Strong	Basalt
6	105.1	32.0	5,625	18.1	4.5	112	Very Strong	Basalt
7	126.1	38.5	0	0.0	0.0	0	Extremely Weak	Basalt
8	146.7	44.7	0	0.0	0.0	0	Extremely Weak	Basalt
9	151.1	46.1	1,550	5.0	1.2	31	Moderate	Basalt

Knight Piésold Ltd.

CONSULTING ENGINEERS

POINT LOAD TEST CALCULATION SHEET
DRILLHOLE 94-148

Core Type:	HQ	Piston Area, A:	5 sq. in.
Core Diameter, D:	63.5 mm	Core Diameter Correction, K=	25

No.	Sample Depth		Gauge Reading, G	Applied Load, $P=G*A$	Point Load Strength Index, $I_S=P/D2$	Uniaxial Compressive Strength $\sigma_C=K*I_S$	Strength Designation	Rock Type
	(ft)	(m)	(kPa)	(kN)	(MPa)	(MPa)		
1	47.9	14.6	3,800	12.3	3.0	76	Strong	Conglomerate
2	75.5	23.0	8,050	26.0	6.4	161	Very Strong	Conglomerate
3	82.4	25.1	250	0.8	0.2	5	Very Weak	Basalt
4	82.7	25.2	1,250	4.0	1.0	25	Weak	Basalt

Knight Piésold Ltd.
CONSULTING ENGINEERS

POINT LOAD TEST CALCULATION SHEET
DRILLHOLE 94-150

Core Type: HQ
Core Diameter, D: 63.5 mm
Piston Area, A: 5 sq. in.
Core Diameter Correction, K= 25

No.	Sample Depth		Gauge Reading, G	Applied Load, P=G*A	Point Load Strength Index, Is=P/D2	Uniaxial Compressive Strength σC=K*IS	Strength Designation	Rock Type
	(ft)	(m)	(kPa)	(kN)	(MPa)	(MPa)		
1	32.6	9.9	2,450	7.9	2.0	49	Moderate	Basalt
2	43.8	13.4	4,750	15.3	3.8	95	Strong	Basalt
3	51.3	15.7	500	1.6	0.4	10	Weak	Basalt
4	80.4	24.5	100	0.3	0.1	2	Very Weak	Conglomerate
5	96.8	29.5	650	2.1	0.5	13	Weak	Conglomerate
6	111.9	34.1	0	0.0	0.0	0	Extremely Weak	Argillite
7	115.8	35.3	0	0.0	0.0	0	Extremely Weak	Conglomerate
8	124.0	37.8	0	0.0	0.0	0	Extremely Weak	Conglomerate

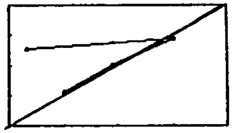
APPENDIX D

RESULTS OF IN-SITU PERMEABILITY TESTING

TASEKO MINES LIMITED
FISH LAKE PROJECT

PACKER TEST PERMEABILITY CALCULATIONS
DRILLHOLE 94 – 141

Drillhole Diameter =	HQ =	3.782 inches
Height of Pressure Gauge Above Ground =		2.0 ft
Depth to Water Table Below Pressure Gauge =		2.5 ft
Depth to Bedrock =		19 ft
Drillhole Angle (from Vertical) =		0 degrees
Tests Performed by:		DGSA
Test Date:		July 27, 1994

TEST No.	INTERVAL (ft)		FLOW METER (litres)		TIME (min)	FLOW RATE (l/min)	PACKER PRESS. (psi)	GAUGE PRESS. (psi)	HEAD CORR. (ft)	TEST HEAD (ft)	k AVERAGE PERMEABILITY (cm/sec)	COMMENTS	PACKER TEST RESULTS (Flow vs. Head)
	from	to	initial	final									
1	26.0	56.0	14.75	17.26	5	0.502	225	4.0	0.5	11.2	k = 2.4E−05	**Basalt** alternating low to high RQD	
	26.0	56.0	18.11	22.84	5	0.946	225	8.0	0.9	20.1			
	26.0	56.0	24.20	31.73	5	1.506	225	12.0	1.5	28.7			
	26.0	56.0	32.82	33.67	5	0.170	225	10.0	0.2	25.4			

Knight Piésold Ltd.
CONSULTING ENGINEERS

Project: FISH LAKE PROJECT
Project No.: 1738
Calculations for: Water Testing Hole 94-101
Date: JULY 28/94
Calculations by: DGEA
Sheet 1 of 1
Checked by:
Date:

Test 1 From 26.0 – 56.0 ft.

Packer Test. Result $\boxed{k = 1.7 \times 10^{-5} \text{ cm/sec.}}$ o.k. ✓

Test 2

Rising Head Test. from 56.0 – 86.0 ft $\boxed{k = +2.9 \times 10^{-5} \text{ cm/sec (artesian).}}$

(1) Avg. flow 1.4m above G.L. = $19\text{cm} \times 47.53\text{cm}^2 / 226$ = $3.996 \text{ cm}^3/\text{sec.}$

by constant head

$$k = \frac{Q}{F H_c} = \frac{-3.996}{1052.3 \times 250} = -1.52 \times 10^{-5} \text{ cm/sec.}$$

Static head above at rest water table ≈ 2.5m (8ft).

Fairly slow rate of rise 19cm in 226 sec.

Test 3

Rising Head Test from 86.0 – 116.0 ft. $\boxed{k = +2.28 \times 10^{-4} \text{ cm/sec (artesian)}}$

Avg. flow 1.34m above G.L. = $11\text{cm} \times 47.53\text{cm}^2 / 17$ = $30.75 \text{ cm}^3/\text{sec}$

Test 4

Rising Head Test from 116.0m – 146.0 ft. $\boxed{k = +7.0 \times 10^{-5} \text{ cm/sec (artesian)}}$

Avg. flow 1.52m above G.L. = $9.39 \text{ cm}^3/\text{sec.}$

Test 5

Rising Head Test from 146.0 – 176.0 ft. $\boxed{k = +2.4 \times 10^{-5} \text{ cm/sec (artesian)}}$

Avg. flow 1.52m above G.L. = $3.63 \text{ cm}^3/\text{sec.}$

Test 6

Rising Head Test from 176.0 – 206.0 ft $\boxed{k = +1.28 \times 10^{-4} \text{ cm/sec (artesian)}}$

Avg. flow 1.44m above G.L. = $19.01 \text{ cm}^3/\text{sec.}$

TASEKO MINES LIMITED
FISH LAKE PROJECT
PACKER TEST PERMEABILITY CALCULATIONS
DRILLHOLE 94 – 143

Drillhole Diameter = HQ = 3.782 inches
Height of Pressure Gauge Above Ground = 2.0 ft
Depth to Water Table Below Pressure Gauge = 3.0 ft
Depth to Bedrock = 10 ft
Drillhole Angle (from Vertical) = 0 degrees

Tested by: DGSA
Test Date: July 30, 1994
July 31, 1994

23-Sep-94
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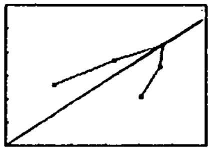
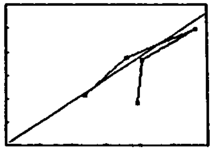
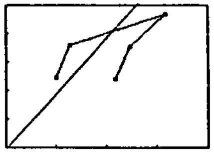
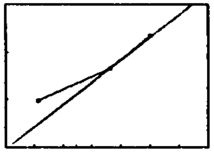
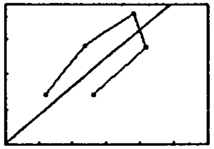
TEST No.	INTERVAL (ft)		FLOW METER (litres)		TIME (min)	FLOW RATE (l/min)	PACKER PRESS. (psi)	GAUGE PRESS. (psi)	HEAD CORR. (ft)	TEST HEAD (ft)	AVERAGE PERMEABILITY (cm/sec)	COMMENTS	PACKER TEST RESULTS (Flow vs. Head)
	from	to	initial	final									
1	18.5	46.0	230.94	251.39	5	4.091	225	5.0	4.0	10.5	k= 1.2E−04	**Basalt** very poor to fair RQD	
	18.5	46.0	255.94	279.12	5	4.637	225	8.0	4.5	16.9			
	18.5	46.0	313.22	336.86	5	4.728	225	10.0	4.6	21.5			
	18.5	46.0	340.95	357.32	5	3.273	225	8.0	3.2	18.3			
	18.5	46.0	378.23	385.50	5	1.455	225	5.0	1.4	13.1			
2	48.5	76.0	410.05	449.14	5	7.819	245	10.0	7.6	18.5	k= 1.1E−04	**Basalt** poor to good RQD	
	48.5	76.0	456.87	497.79	5	8.183	245	18.0	8.0	36.6			
	48.5	76.0	503.70	560.52	5	11.365	245	25.0	11.1	49.6			
	48.5	76.0	565.07	601.44	5	7.274	245	18.0	7.1	37.5			
	48.5	76.0	604.16	627.80	5	4.728	245	10.0	4.6	21.5			
3	78.5	106.0	640.53	645.99	5	1.091	275	20.0	1.1	48.1	k= 7.1E−06	**Basalt** fair to good RQD	
	78.5	106.0	647.81	653.94	5	1.227	275	30.0	1.2	71.1			
	78.5	106.0	656.44	664.40	5	1.591	275	40.0	1.6	93.8			
	78.5	106.0	664.63	667.81	5	0.636	275	30.0	0.6	71.7			
	78.5	106.0	668.26	670.76	5	0.500	275	20.0	0.5	48.7			
4	108.5	136.0	672.13	672.81	6	0.114	300	20.0	0.1	49.1	k= 2.3E−06	**Basalt** fair to good RQD	
	108.5	136.0	673.26	675.08	5	0.364	300	35.0	0.4	83.5			
	108.5	136.0	675.54	678.04	5	0.500	300	50.0	0.5	118.0			
	108.5	136.0	677.81	679.63	5	0.364	300	35.0	0.4	83.5			
									0.0				
5	138.5	166.0	685.31	694.40	5	1.818	350	30.0	1.8	70.5	k= 9.9E−06	**Basalt** poor to good RQD	
	138.5	166.0	695.99	708.72	5	2.546	350	50.0	2.5	116.0			
	138.5	166.0	711.68	726.68	5	3.000	350	70.0	2.9	161.7			
	138.5	166.0	727.59	736.91	5	1.864	350	50.0	1.8	116.7			
	138.5	166.0	737.36	742.36	5	1.000	350	30.0	1.0	71.3			
6	168.5	201.0	746.23	752.82	5	1.318	375	30.0	1.3	71.0	k= 5.7E−06	**Basalt** fair to good RQD	
	168.5	201.0	753.95	764.41	5	2.091	375	60.0	2.0	139.5			
	168.5	201.0	766.00	775.55	5	1.909	375	80.0	1.9	185.9			
	168.5	201.0	776.46	782.37	5	1.182	375	60.0	1.2	140.4			
	168.5	201.0	782.59	785.55	5	0.591	375	30.0	0.6 0.0	71.7			

TASEKO MINES LIMITED
FISH LAKE PROJECT
PACKER TEST PERMEABILITY CALCULATIONS
DRILLHOLE 94 - 144

Drillhole Diameter = HQ = 3.782 inches
Height of Pressure Gauge Above Ground = 3.0 ft
Depth to Water Table Below Pressure Gauge = 54.0 ft
Depth to Bedrock = 6 ft
Drillhole Angle (from Vertical) = 0 degrees

Tests Performed by: DGSA
Test Date : Tests 1-3 Aug. 2, 1994
Tests 4 & 5 Aug. 3, 1994
Test 6 Aug. 4, 1994

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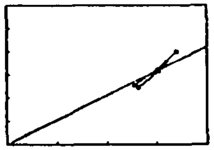
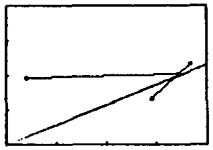
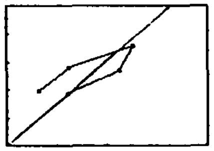
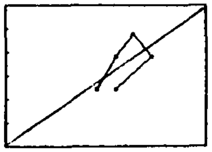
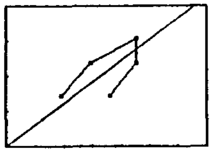
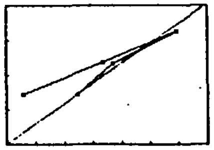
TEST No.	INTERVAL (ft)		FLOW METER (litres)		TIME (min)	FLOW RATE (l/min)	PACKER PRESS. (psi)	GAUGE PRESS. (psi)	HEAD CORR. (ft)	TEST HEAD (ft)	AVERAGE PERMEABILITY (cm/sec)	COMMENTS	PACKER TEST RESULTS (Flow vs. Head)
	from	to	initial	final									
1	68.5	96.0	1704.75	1832.04	5	25.458	275	10.0	26.8	50.3	k = 2.5E-04	Basalt Poor to Fair RQD	
	68.5	96.0	1852.50	2002.97	5	30.095	275	20.0	36.2	64.0			
	68.5	96.0	2027.29	2196.63	5	33.868	275	30.0	43.9	79.4			
	68.5	96.0	2227.99	2380.29	5	30.458	275	20.0	37.0	63.2			
	68.5	96.0	2394.38	2526.21	5	26.367	275	10.0	28.7	48.4			
2	98.5	126.0	2579.40	2599.86	5	4.091	300	20.0	4.0	96.2	k = 1.9E-04	Basalt Poor to Good RQD	
	98.5	126.0	2698.96	2871.25	5	34.459	300	40.0	45.1	101.3			
	98.5	126.0	2924.67	3109.01	5	36.868	300	50.0	54.0	115.5			
	98.5	126.0	3144.47	3316.76	5	34.459	300	40.0	45.1	101.3			
	98.5	126.0	3347.22	3492.69	5	29.094	300	20.0	34.2	66.0			
3	128.5	156.0	3538.83	3554.74	5	3.182	315	20.0	3.1	97.1	k = 3.4E-05	Basalt Fair to Excellent RQD	
	128.5	156.0	3559.29	3589.75	5	6.092	315	40.0	6.0	140.4			
	128.5	156.0	3597.93	3661.35	5	12.683	315	60.0	12.4	180.2			
	128.5	156.0	3674.99	3730.90	5	11.183	315	40.0	10.9	135.4			
	128.5	156.0	3738.40	3768.18	5	5.955	315	20.0	5.8	94.4			
4	158.5	186.0	3772.73	3774.09	5	0.273	350	30.0	0.3	123.0	k = 8.8E-07	Basalt Excellent RQD	
	158.5	186.0	3774.54	3776.36	5	0.364	350	60.0	0.4	192.2			
	158.5	186.0	3776.82	3778.41	5	0.318	350	80.0	0.3	238.4			
	158.5	186.0	3778.64	3780.00	5	0.273	350	60.0	0.3	192.3			
	158.5	186.0	3780.23	3781.36	5	0.227	350	30.0	0.2	123.1			
5	218.5	246.0	3782.27	3783.18	5	0.182	400	40.0	0.2	146.2	k = 4.5E-07	Basalt Excellent RQD	
	218.5	246.0	3783.52	3784.66	5	0.227	400	80.0	0.2	238.5			
	218.5	246.0	3785.11	3786.25	5	0.227	400	110.0	0.2	307.8			
	218.5	246.0	3786.25	3787.73	10	0.148	400	80.0	0.1	238.6			
	218.5	246.0	3787.73	3788.86	12	0.095	400	40.0	0.1	146.3			
6	248.5	276.0	3797.05	3809.32	5	2.455	425	40.0	2.4	144.0	k = 9.2E-06	Basalt Poor to Excellent RQD	
	248.5	276.0	3815.46	3834.10	5	3.728	425	80.0	3.6	235.1			
	248.5	276.0	3850.01	3879.78	5	5.955	425	120.0	5.8	325.3			
	248.5	276.0	3880.24	3897.06	5	3.364	425	80.0	3.3	235.5			
	248.5	276.0	3897.06	3900.01	5	0.591	425	40.0	0.6	145.8			

TASEKO MINES LIMITED
FISH LAKE PROJECT
PACKER TEST PERMEABILITY CALCULATIONS
DRILLHOLE 94 – 144

Drillhole Diameter =	HQ =	3.782 inches	Tests Performed by:	DGSA	
Height of Pressure Gauge Above Ground =		3.0 ft	Test Date :	Tests 7 & 8	Aug. 4, 1994
Depth to Water Table Below Pressure Gauge =		54.0 ft		Tests 9,10 & 11	Aug. 5, 1994
Depth to Bedrock =		6 ft			
Drillhole Angle (from Vertical) =		0 degrees			

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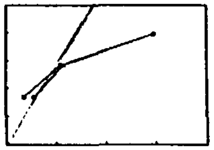
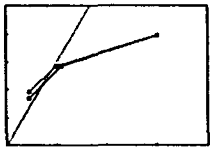
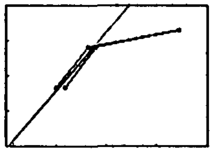
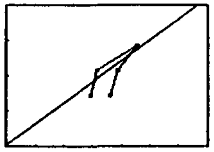
23-Sep-94

TEST No.	INTERVAL (ft)		FLOW METER (litres)		TIME (min)	FLOW RATE (l/min)	PACKER PRESS. (psi)	GAUGE PRESS. (psi)	HEAD CORR. (ft)	TEST HEAD (ft)	AVERAGE PERMEABILITY (cm/sec)	COMMENTS	PACKER TEST RESULTS (Flow vs. Head)
	from	to	initial	final									
7	278.5	306.0	3910.13	3911.72	10	0.159	460	50.0	0.2	169.3	k = 7.7E–07	**Basalt** Good to Excellent RQD	
	278.5	306.0	3912.06	3913.88	5	0.364	460	100.0	0.4	284.6			
	278.5	306.0	3914.56	3923.20	5	1.727	460	140.0	1.7	375.6			
	278.5	306.0	3923.65	3928.20	10	0.455	460	100.0	0.4	284.5			
	278.5	306.0	3928.54	3930.13	10	0.159	460	80.0	0.2	238.6			
8	308.5	336.0	3930.59	3933.43	5	0.568	485	50.0	0.6	168.9	k = 1.8E–06	**Basalt** Poor to Good RQD	
	308.5	336.0	3934.79	3940.47	5	1.137	485	100.0	1.1	283.8			
	308.5	336.0	3942.29	3957.07	5	2.955	485	150.0	2.9	397.5			
	308.5	336.0	3957.97	3963.43	5	1.091	485	100.0	1.1	283.9			
	308.5	336.0	3963.66	3965.36	5	0.341	485	50.0	0.3	169.1			
9	338.5	366.0	4220.28	4222.55	5	0.455	515	50.0	0.4	169.0	k = 1.7E–06	**Basalt** Poor to Good RQD	
	338.5	366.0	4223.46	4228.92	5	1.091	515	100.0	1.1	283.9			
	338.5	366.0	4231.64	4246.65	5	3.000	515	150.0	2.9	397.5			
	338.5	366.0	4248.24	4253.24	5	1.000	515	100.0	1.0	284.0			
	338.5	366.0	4254.37	4256.65	5	0.455	515	60.0	0.4	192.1			
10	368.5	411.0	4257.78	4260.28	5	0.500	510	50.0	0.5	169.0	k = 1.2E–06	**Basalt,Sandstone** **Conglomerate** Very Poor RQD	
	368.5	411.0	4261.42	4265.51	5	0.818	510	100.0	0.8	284.1			
	368.5	411.0	4268.69	4277.33	5	1.727	510	120.0	1.7	329.4			
	368.5	411.0	4278.70	4283.13	5	0.886	510	100.0	0.9	284.1			
	368.5	411.0	4283.70	4286.65	5	0.591	510	50.0	0.6	168.9			
11	413.5	436.0	4287.79	4289.61	5	0.364	530	40.0	0.4	146.0	k = 1.0E–06	**Argillite** Very Poor to Fair RQD	
	413.5	436.0	4290.06	4291.99	5	0.386	530	70.0	0.4	215.3			
	413.5	436.0	4292.22	4294.49	5	0.455	530	100.0	0.4	284.5			
	413.5	436.0	4294.61	4296.20	5	0.318	530	70.0	0.3	215.4			
	413.5	436.0	4296.31	4297.79	5	0.295	530	40.0	0.3	146.1			

TASEKO MINES LIMITED
FISH LAKE PROJECT
TAILINGS STORAGE FACILITY

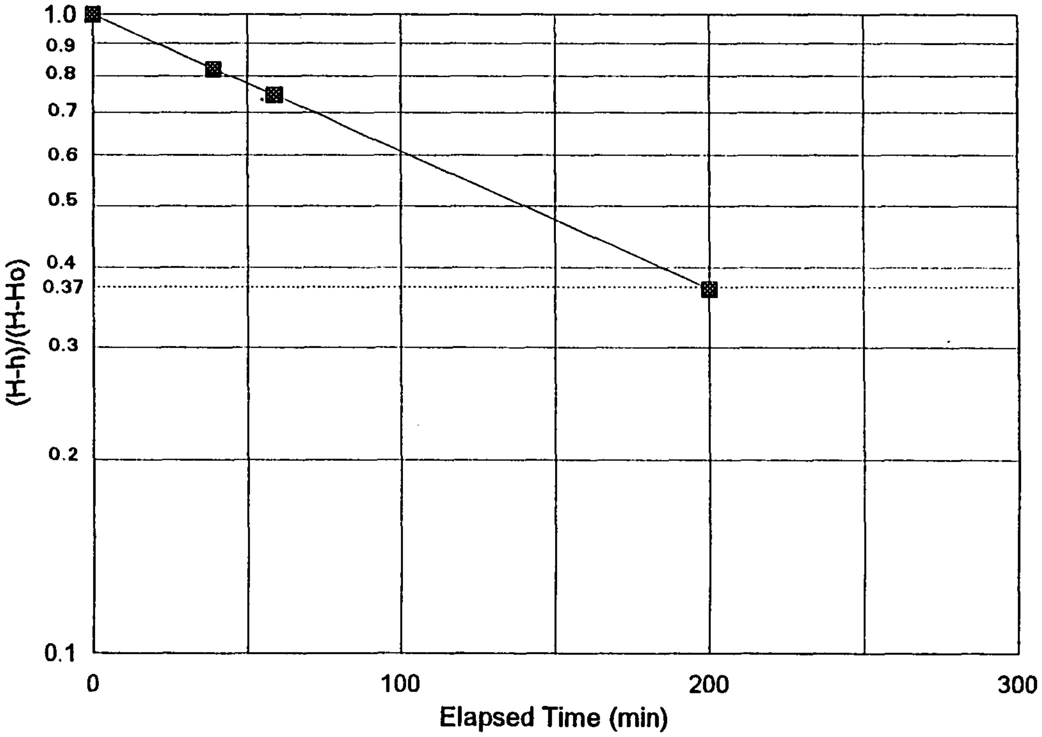
FALLING HEAD PERMEABILITY TEST USING HVORSLEV METHOD
DRILLHOLE 94-144

Input Parameters

Hole Diameter, D =	3.782 inches,	9.61 cm	Static Water Level, from ground, H =	93.7 ft,	28.56 m
Piezometer Diameter, d =	2.0 inches,	5.08 cm	Piezometer Stick-up =	0.3 ft,	0.10 m
Top of Test Interval =	160.0 ft,	48.8 m	Water Level at Start of Test, Ho =	66.6 ft,	20.30 m
Bottom of Test Interval =	231.0 ft,	70.4 m			
Length of Test Interval, L =	71.0 ft,	21.6 m	Test Performed By:	DGSA	

TEST DATA

Elapsed Time (min)	Water Depth, h (metres)	(H-h)/(H-Ho)
0	20.3	1.00
39	21.80	0.82
59	22.41	0.75
200	25.57	0.37



Notes:
Falling Head Test carried out in monitoring well completion zone.

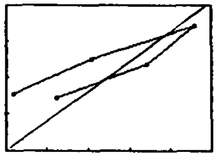
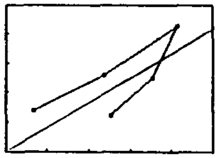
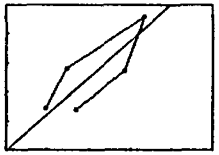
Time T, when (H-h)/(H-Ho) = 200 min

Permeability, k = 7.6E-07 cm/sec

TASEKO MINES LIMITED
FISH LAKE PROJECT
PACKER TEST PERMEABILITY CALCULATIONS
DRILLHOLE 94 – 147

Drillhole Diameter = HQ =	3.782 inches	Tests Performed by:	DGSA
Height of Pressure Gauge Above Ground =	2.0 ft	Test Date : Tests 1,2 & 3	Aug. 8, 1994
Depth to Water Table Below Pressure Gauge =	4.0 ft	Tests 8,9 & 10	Aug. 10, 1994
Depth to Bedrock =	16 ft		
Drillhole Angle (from Vertical) =	0 degrees		

J:\JOB\DATA\1738\94_147.WK3 23-Sep-94

TEST No.	INTERVAL (ft)		FLOW (litres)		TIME	FLOW RATE	PACKER PRESS.	GAUGE PRESS.	HEAD CORR.	TEST HEAD	AVERAGE PERMEABILITY	COMMENTS	PACKER TEST RESULTS
	from	to	initial	final	(min)	(l/min)	(psi)	(psi)	(ft)	(ft)	(cm/sec)		(Flow vs. Head)
1	28.5	56.0	4305.97	4312.11	5	1.227	230	5.0	1.2	14.3	k = 6.3E–05	**Basalt** Fair to Good RQD	
	28.5	56.0	4313.47	4330.52	5	3.409	230	10.0	3.3	23.8			
	28.5	56.0	4332.57	4355.52	5	4.591	230	15.0	4.5	34.2			
	28.5	56.0	4356.89	4367.23	5	2.068	230	10.0	2.0	25.1			
	28.5	56.0	4367.75	4369.62	10	0.186	230	5.0	0.2	15.4			
8	218.5	256.0	62.11	78.91	5	3.360	400	30.0	3.3	70.0	k = 4.8E–05	**Glaciolacustrine Sediments,Sand, Conglomerate**	
	218.5	256.0	92.81	152.27	5	11.891	400	60.0	11.6	130.9			
	218.5	256.0	189.22	293.04	5	20.762	400	100.0	20.3	214.6			
	218.5	256.0	321.04	409.35	5	17.662	400	60.0	17.3	125.3			
	218.5	256.0	424.35	487.06	5	12.542	400	30.0	12.3	61.0			
9	258.5	286.0	520.86	559.07	5	7.641	450	30.0	7.5	65.8	k = 6.2E–05	Anomalous Result	
	258.5	286.0	672.08	903.11	5	46.206	450	60.0			N/A		
	258.5	286.0	954.11	1235.15	5	56.207	450	100.0			N/A		
	258.5	286.0	1285.15	1380.17	2	47.506	450	60.0			N/A		
	258.5	286.0	1444.67	1553.19	5	21.703	450	12.0	21.2	10.5	k = 1.1E–03		
10	278.5	311.0	1575.09	1591.94	5	3.370	475	30.0	3.3	70.0	k = 1.5E–05	**Basalt and Conglomerate** Poor to Good RQD	
	278.5	311.0	1596.99	1625.60	5	5.721	475	60.0	5.6	137.0			
	278.5	311.0	1653.20	1686.70	5	6.701	475	100.0	6.6	228.4			
	278.5	311.0	1690.80	1705.60	5	2.960	475	60.0	2.9	139.7			
	278.5	311.0	1714.26	1723.96	5	1.940	475	30.0	1.9	71.4			

Note : Different Flow Meter Used for Tests 8 to 10.

TASEKO MINES LIMITED
FISH LAKE PROJECT
TAILINGS STORAGE FACILITY

FALLING HEAD PERMEABILITY TEST USING HVORSLEV METHOD
DRILLHOLE 94-147

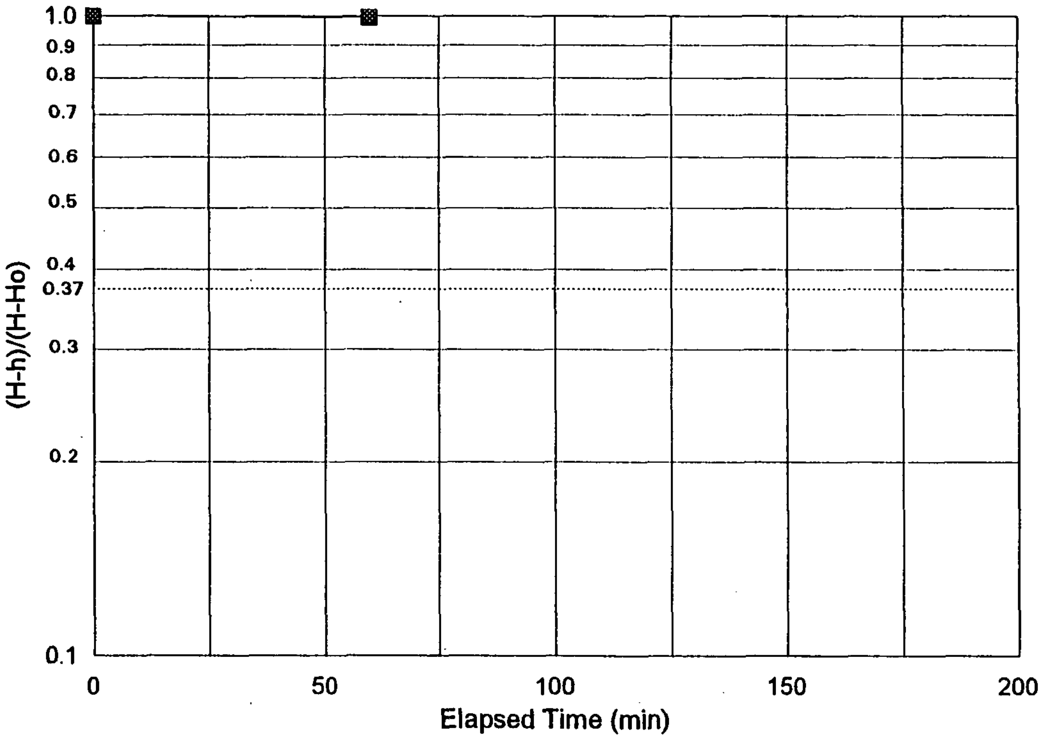
Input Parameters

Hole Diameter, D =	3.782 inches,	9.61 cm	Static Water Level, below ground, H	2.0 ft,	0.61 m
Drill Rod Diameter, d =	3.782 inches,	9.61 cm	Drill Rod Stick-up =	0.0 ft,	0.00 m
Top of Test Interval =	51.5 ft,	15.7 m	Water Level at Start of Test, Ho =	12.8 ft,	3.90 m
Bottom of Test Interval =	76.0 ft,	23.2 m			
Length of Test Interval, L =	24.5 ft,	7.5 m	Test Performed By:	DGSA	

TEST DATA

Elapsed Time (min)	Water Depth, h (metres)	(H-h)/(H-Ho)
0	3.90	1.00
60	3.88	0.99

Notes:



Time T, when (H-h)/(H-Ho) = 11,000 min

Permeability, k = 1.2E-07 cm/sec

TASEKO MINES LIMITED
FISH LAKE PROJECT
TAILINGS STORAGE FACILITY

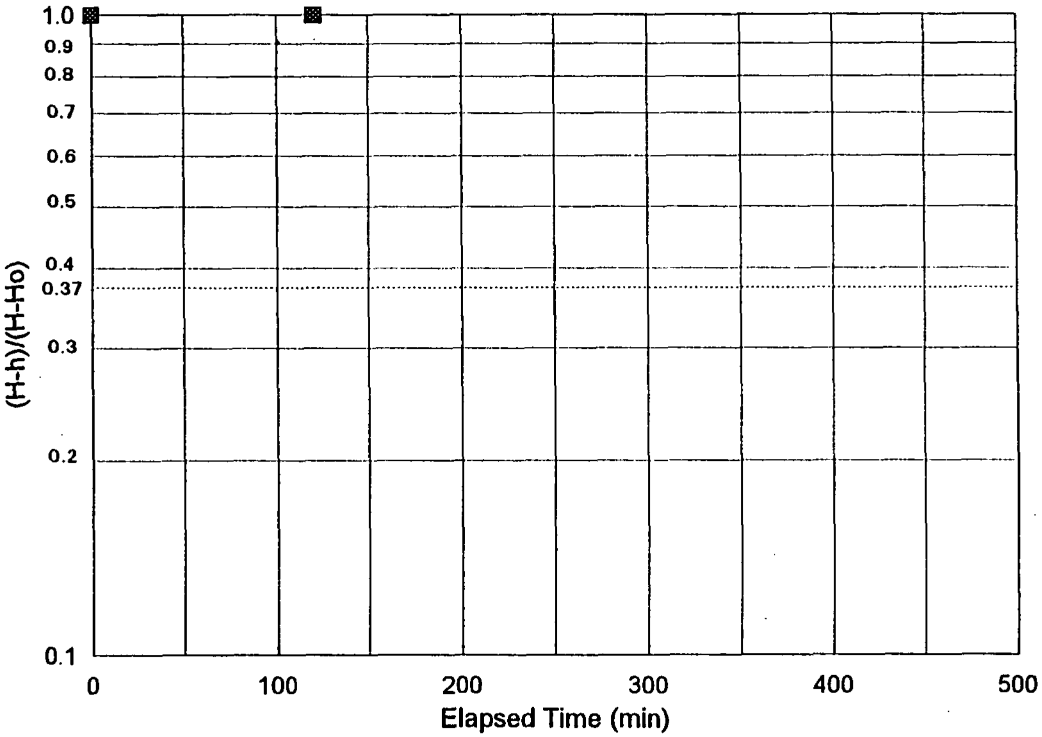
FALLING HEAD PERMEABILITY TEST USING HVORSLEV METHOD
DRILLHOLE 94-147

Input Parameters

Hole Diameter, D =	3.782 inches,	9.61 cm	Static Water Level, below ground, H	2.0 ft,	0.61 m
Drill Rod Diameter, d =	3.782 inches,	9.61 cm	Drill Rod Stick-up =	0.0 ft,	0.00 m
Top of Test Interval =	81.5 ft,	24.8 m	Water Level at Start of Test, Ho =	12.8 ft,	3.90 m
Bottom of Test Interval =	106.0 ft,	32.3 m			
Length of Test Interval, L =	24.5 ft,	7.5 m	Test Performed By:	DGSA	

TEST DATA

Elapsed Time (min)	Water Depth, h (metres)	(H-h)/(H-Ho)
0	3.90	1.00
120	3.90	1.00



Notes:

Time T, when (H-h)/(H-Ho) = 11,000 min

Permeability, k = 1.2E-07 cm/sec

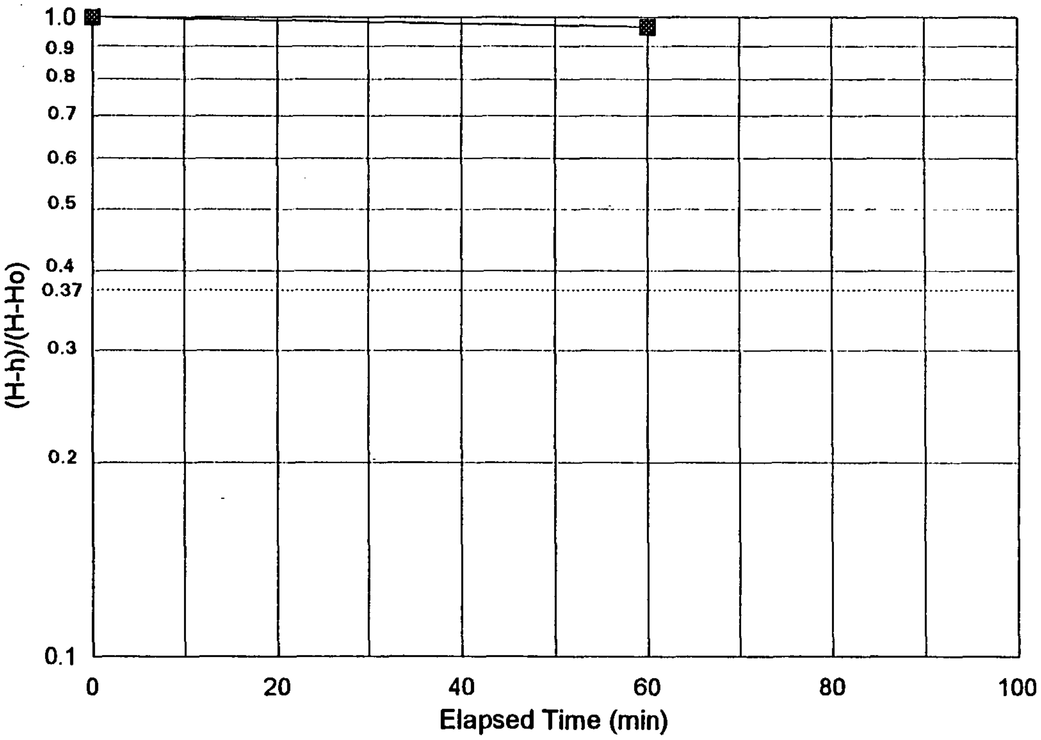
TASEKO MINES LIMITED
FISH LAKE PROJECT
TAILINGS STORAGE FACILITY

FALLING HEAD PERMEABILITY TEST USING HVORSLEV METHOD
DRILLHOLE 94-147

Input Parameters					
Hole Diameter, D =	3.782 inches,	9.61 cm	Static Water Level, below ground, H	2.0 ft,	0.61 m
Drill Rod Diameter, d =	3.782 inches,	9.61 cm	Drill Rod Stick-up =	0.0 ft,	0.00 m
Top of Test Interval =	108.5 ft,	33.1 m	Water Level at Start of Test, Ho =	5.8 ft,	1.77 m
Bottom of Test Interval =	136.0 ft,	41.5 m			
Length of Test Interval, L =	27.5 ft,	8.4 m	Test Performed By:	DGSA	

TEST DATA		
Elapsed Time (min)	Water Depth, h (metres)	(H-h)/(H-Ho)
0	1.77	1.00
60	1.73	0.97

Notes:



Time T, when (H-h)/(H-Ho) = 11000 min

Permeability, k = 1.1E-07 cm/sec

TASEKO MINES LIMITED
FISH LAKE PROJECT
TAILINGS STORAGE FACILITY

FALLING HEAD PERMEABILITY TEST USING HVORSLEV METHOD
DRILLHOLE 94-147

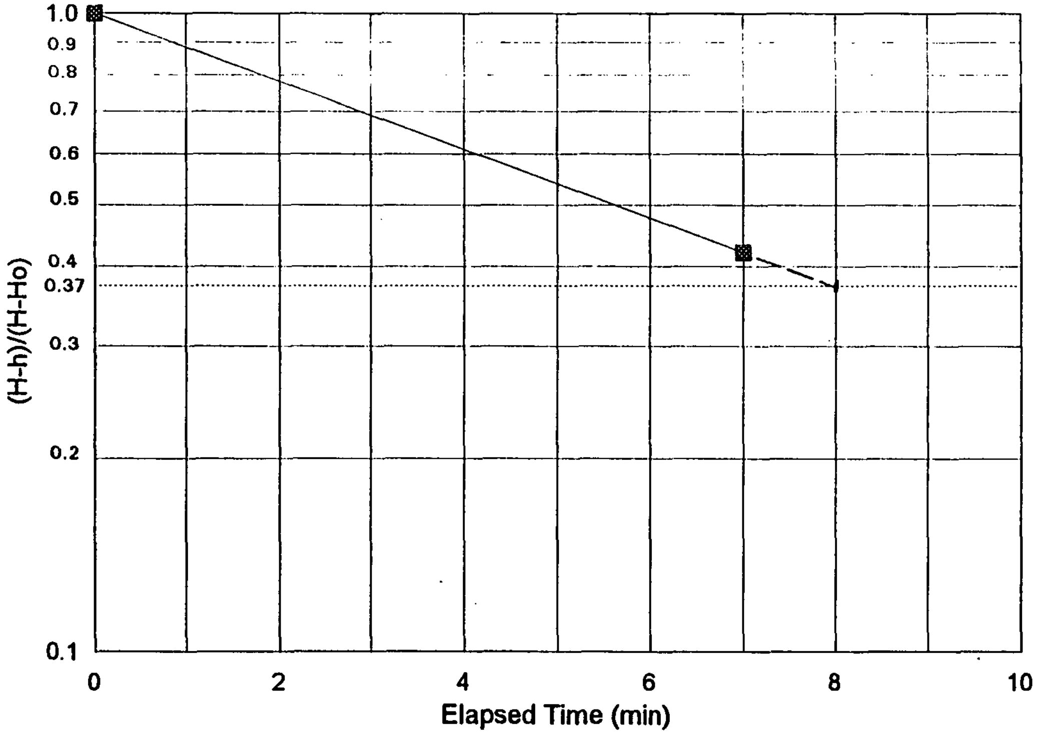
Input Parameters

Hole Diameter, D =	3.782 inches,	9.61 cm	Static Water Level, below ground, H	2.0 ft,	0.61 m
Drill Rod Diameter, d =	3.782 inches,	9.61 cm	Drill Rod Stick-up =	0.0 ft,	0.00 m
Top of Test Interval =	138.5 ft,	42.2 m	Water Level at Start of Test, Ho =	5.8 ft,	1.77 m
Bottom of Test Interval =	166.0 ft,	50.6 m			
Length of Test Interval, L =	27.5 ft,	8.4 m	Test Performed By:	DGSA	

TEST DATA

Elapsed Time (min)	Water Depth, h (metres)	(H-h)/(H-Ho)
0	1.77	1.00
7	1.10	0.42

Notes:



Time T, when (H-h)/(H-Ho) = 8 min

Permeability, k = 1.5E-04 cm/sec

TASEKO MINES LIMITED
FISH LAKE PROJECT
TAILINGS STORAGE FACILITY

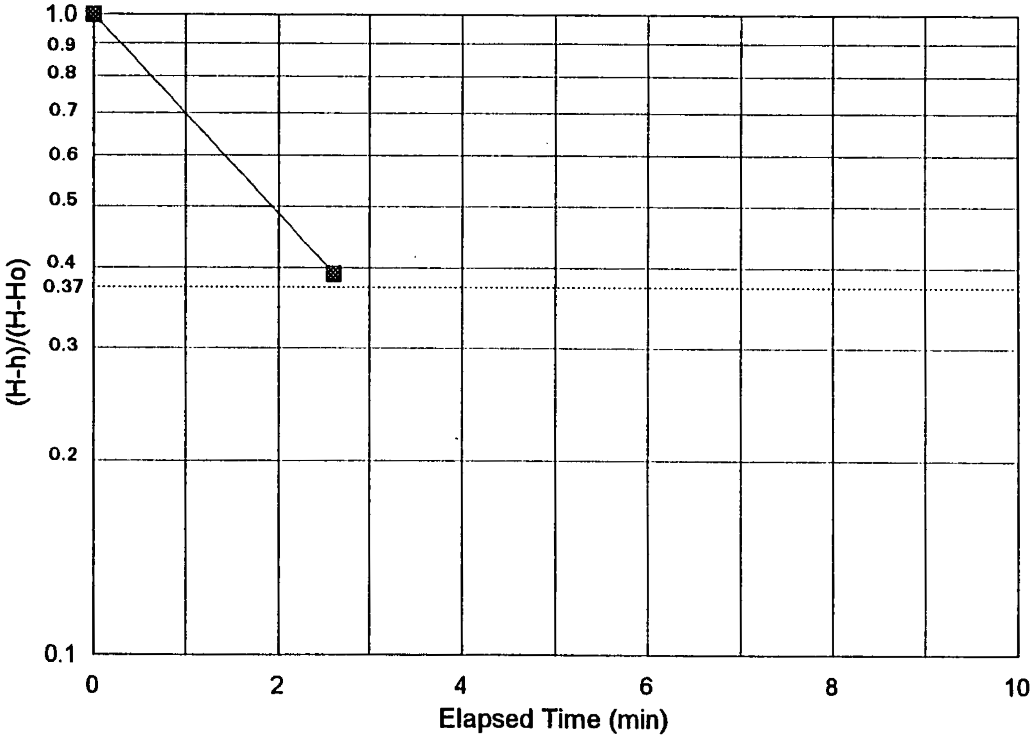
FALLING HEAD PERMEABILITY TEST USING HVORSLEV METHOD
DRILLHOLE 94-147

Input Parameters					
Hole Diameter, D =	3.782 inches,	9.61 cm	Static Water Level, below ground, H	2.0 ft,	0.61 m
Drill Rod Diameter, d =	3.782 inches,	9.61 cm	Drill Rod Stick-up =	0.0 ft,	0.00 m
Top of Test Interval =	161.0 ft,	49.1 m	Water Level at Start of Test, Ho =	12.8 ft,	3.90 m
Bottom of Test Interval =	191.0 ft,	58.2 m			
Length of Test Interval, L =	30.0 ft,	9.1 m	Test Performed By:	DGSA	

TEST DATA

Elapsed Time (min)	Water Depth, h (metres)	(H-h)/(H-Ho)
0	3.90	1.00
3	1.90	0.39

Notes:



Time T, when (H-h)/(H-Ho) = 3 min

Permeability, k = 3.7E-04 cm/sec

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TASEKO MINES LIMITED
FISH LAKE PROJECT
TAILINGS STORAGE FACILITY

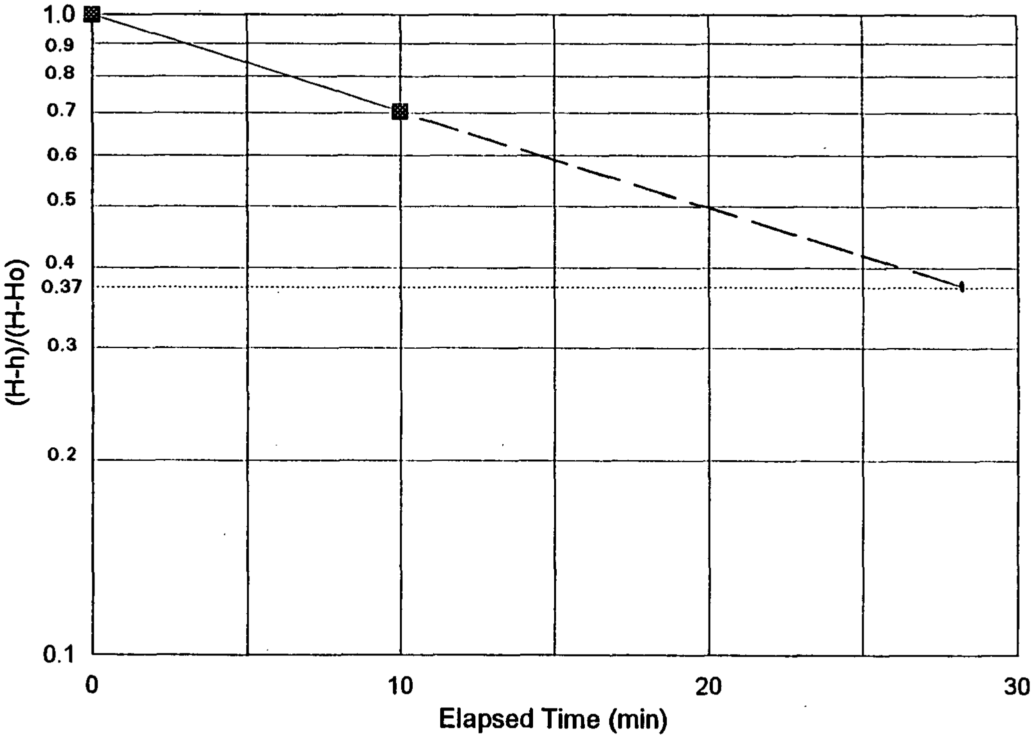
FALLING HEAD PERMEABILITY TEST USING HVORSLEV METHOD
DRILLHOLE 94-147

Input Parameters					
Hole Diameter, D =	3.782 inches,	9.61 cm	Static Water Level, below ground, H	2.0 ft,	0.61 m
Drill Rod Diameter, d =	3.782 inches,	9.61 cm	Drill Rod Stick-up =	0.0 ft,	0.00 m
Top of Test Interval =	198.5 ft,	60.5 m	Water Level at Start of Test, Ho =	5.9 ft,	1.80 m
Bottom of Test Interval =	226.0 ft,	68.9 m			
Length of Test Interval, L =	27.5 ft,	8.4 m	Test Performed By:	DGSA	

TEST DATA

Elapsed Time (min)	Water Depth, h (metres)	(H-h)/(H-Ho)
0	1.80	1.00
10	1.45	0.71

Notes:



Time T, when (H-h)/(H-Ho) = 28 min

Permeability, k = 4.2E-05 cm/sec

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TASEKO MINES LIMITED
FISH LAKE PROJECT
TAILINGS STORAGE FACILITY

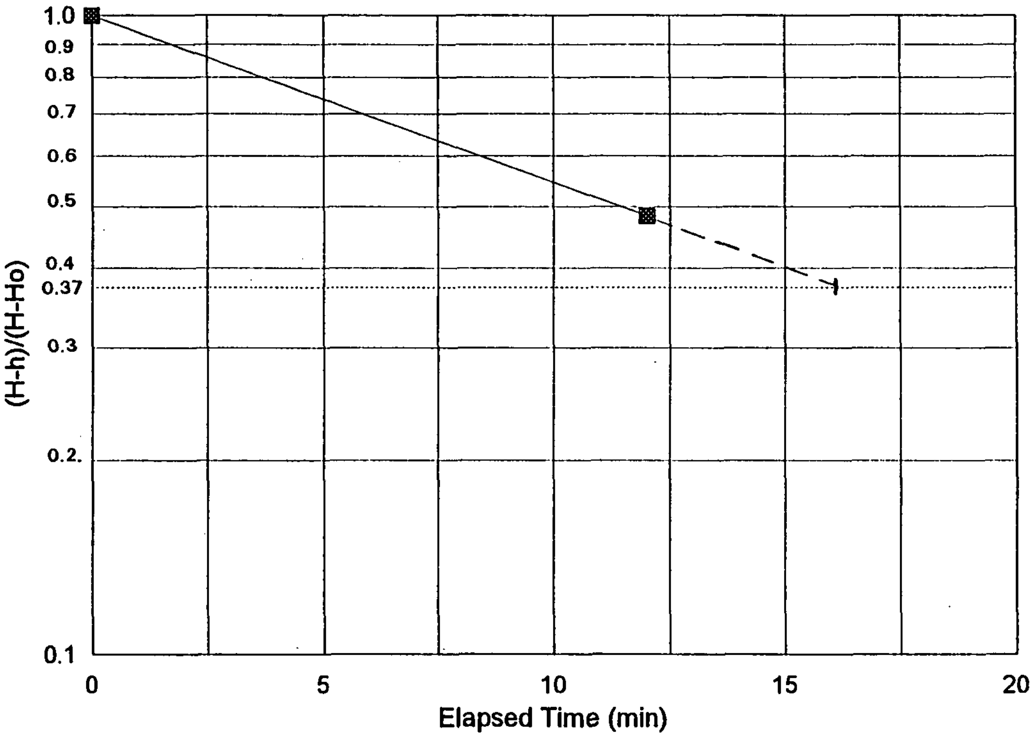
FALLING HEAD PERMEABILITY TEST USING HVORSLEV METHOD
DRILLHOLE 94-148

Input Parameters					
Hole Diameter, D =	3.782 inches,	9.61 cm	Static Water Level, below ground, H	16.5 ft,	5.03 m
Drill Rod Diameter, d =	3.782 inches,	9.61 cm	Drill Rod Stick-up =	0.0 ft,	0.00 m
Top of Test Interval =	8.0 ft,	2.4 m	Water Level at Start of Test, Ho =	20.5 ft,	6.25 m
Bottom of Test Interval =	46.0 ft,	14.0 m			
Length of Test Interval, L =	38.0 ft,	11.6 m	Test Performed By:	DGSA	

TEST DATA

Elapsed Time (min)	Water Depth, h (metres)	(H-h)/(H-Ho)
0	6.25	1.00
12	5.62	0.48

Notes:



Time T, when (H-h)/(H-Ho) = 16 min

Permeability, k = 5.7E-05 cm/sec

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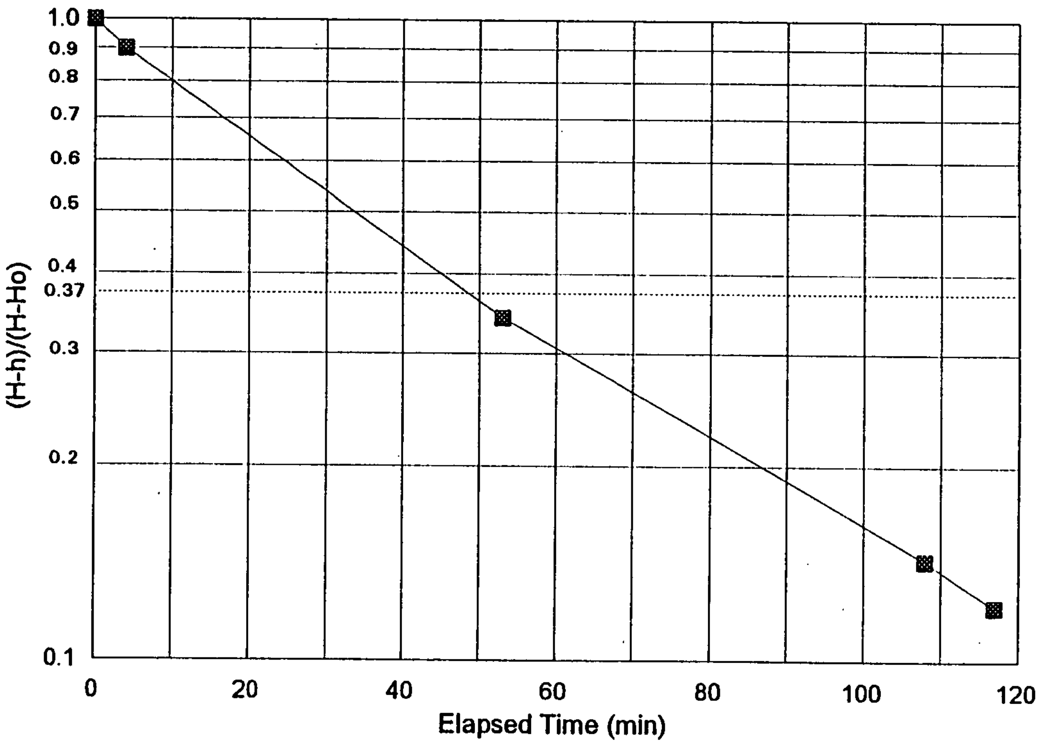
TASEKO MINES LIMITED
FISH LAKE PROJECT
TAILINGS STORAGE FACILITY

FALLING HEAD PERMEABILITY TEST USING HVORSLEV METHOD
DRILLHOLE 94-148

Input Parameters					
Hole Diameter, D =	3.782 inches,	9.61 cm	Static Water Level, below ground, H	16.5 ft,	5.03 m
Drill Rod Diameter, d =	3.782 inches,	9.61 cm	Drill Rod Stick-up =	0.0 ft,	0.00 m
Top of Test Interval =	10.0 ft,	3.0 m	Water Level at Start of Test, Ho =	0.0 ft,	0.00 m
Bottom of Test Interval =	76.0 ft,	23.2 m			
Length of Test Interval, L =	66.0 ft,	20.1 m	Test Performed By:	DGSA	

TEST DATA

Elapsed Time (min)	Water Depth, h (metres)	(H-h)/(H-Ho)
0	0.00	1.00
4	0.50	0.90
53	3.31	0.34
108	4.31	0.14
117	4.42	0.12



Notes:

Time T, when (H-h)/(H-Ho) = 50 min

Permeability, k = 1.2E-05 cm/sec

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05:10 PM 10-Nov-94

TASEKO MINES LIMITED
FISH LAKE PROJECT
PACKER TEST PERMEABILITY CALCULATIONS
BOREHOLE 94 – 150

Borehole Diameter = HQ = 3.78 inches
Height of Pressure Gauge Above Ground = 2.0 ft
Depth to Water Table Below Pressure Gauge = 5.5 ft
Depth to Bedrock = 9 ft
Borehole Angle (from Vertical) = 0 degrees
Tests Performed by: DGSA
Test Date : Tests 1 – 5 Aug. 14, 1994

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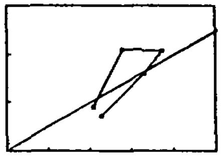
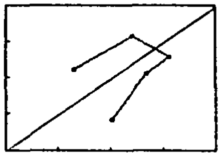
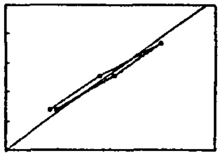
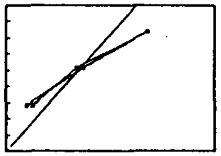
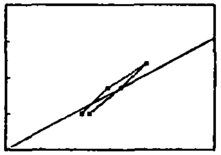
23-Sep-94

TEST No.	INTERVAL (ft)		FLOW METER (litres)		TIME (min)	FLOW RATE (l/min)	PACKER PRESS. (psi)	GAUGE PRESS. (psi)	HEAD CORR. (ft)	TEST HEAD (ft)	AVERAGE PERMEABILITY (cm/sec)	COMMENTS	PACKER TEST RESULTS (Flow vs. Head)
	from	to	initial	final									
1	18.5	46.0	1796.62	1853.67	5	11.411	215	4.0	11.2	3.6	k = 1.1E–03	**Basalt** Very Poor to Poor RQD	
	18.5	46.0	1868.22	1950.53	5	16.462	215	8.0	16.1	7.9			
	18.5	46.0	1963.69	2057.05	5	18.672	215	10.0	18.3	10.3			
	18.5	46.0	2068.85	2138.26	5	13.882	215	8.0	13.6	10.4			
	18.5	46.0	2149.56	2201.91	5	10.471	215	4.0	10.2	4.5			
2	38.5	66.0	2261.97	2363.08	5	20.222	235	8.0	19.8	4.2	k = 1.1E–03	**Basalt/Conglom.** Very Poor to fair RQD	
	38.5	66.0	2385.29	2519.30	5	26.803	235	15.0	29.5	10.6			
	38.5	66.0	2540.30	2697.32	5	31.404	235	20.0	38.9	12.8			
	38.5	66.0	2718.33	2839.84	5	24.303	235	15.0	24.5	15.7			
	38.5	66.0	2852.34	2918.35	5	13.202	235	8.0	12.9	11.1			
3	58.5	86.0	2915.95	2918.40	5	0.490	255	10.0	0.5	28.1	k = 1.0E–05	**Conglomerate** Very Poor RQD	
	58.5	86.0	2919.10	2923.25	4	1.038	255	20.0	1.0	50.7			
	58.5	86.0	2923.95	2929.85	4	1.475	255	30.0	1.4	73.3			
	58.5	86.0	2931.65	2936.15	5	0.900	255	20.0	0.9	50.8			
	58.5	86.0	2936.60	2938.75	5	0.430	255	10.0	0.4	28.2			
4	58.5	106.0	2939.68	2940.15	5	0.095	255	10.0	0.1	28.5	k = 2.3E–06	**Conglomerate** Very Poor RQD	
	58.5	106.0	2940.35	2942.20	5	0.370	255	20.0	0.4	51.3			
	58.5	106.0	2942.60	2946.00	5	0.680	255	30.0	0.7	74.1			
	58.5	106.0	2946.15	2947.85	5	0.340	255	20.0	0.3	51.4			
	58.5	106.0	2948.05	2948.68	5	0.125	255	10.0	0.1	28.5			
5	108.5	126.0	2950.40	2956.45	5	1.210	300	20.0	1.2	50.5	k = 1.5E–05	**Argillite,** **Conglomerate** Poor RQD	
	108.5	126.0	2957.70	2965.96	5	1.650	300	35.0	1.6	84.7			
	108.5	126.0	2968.06	2978.11	5	2.010	300	50.0	2.0	119.0			
	108.5	126.0	2979.51	2986.86	5	1.470	300	35.0	1.4	84.9			
	108.5	126.0	2987.46	2992.91	5	1.090	300	20.0	1.1	50.6			

APPENDIX E

GROUNDWATER MONITORING WELL COMPLETION DETAILS

1738.A6

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

GROUNDWATER MONITORING WELL COMPLETION DETAILS

PROJECT *FISH LAKE*

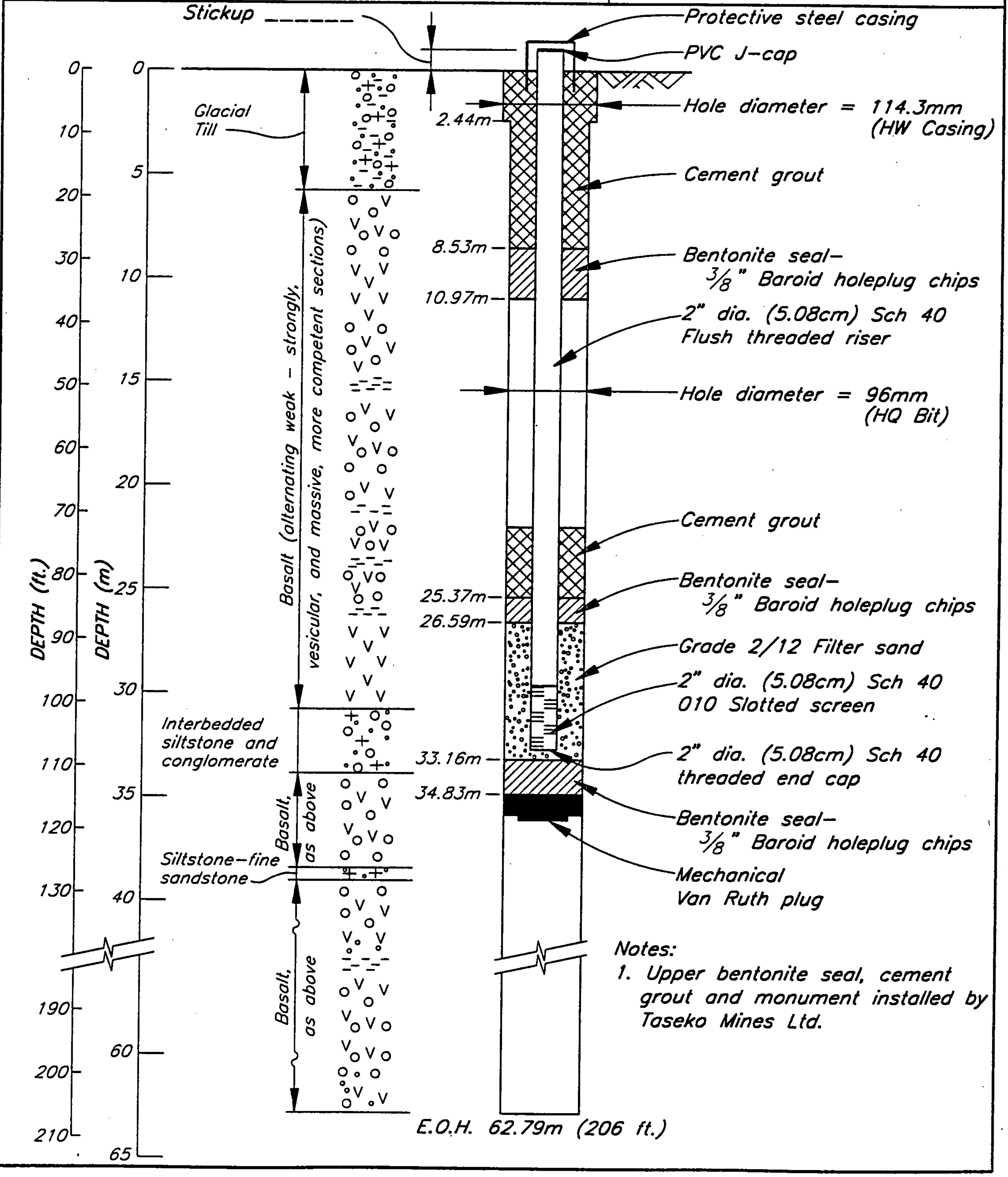
LOCATION N: ____ E: ____

COMPLETION DATE *July 29, 1994*

PROJECT No. *1738*

HOLE No. *94-141*

GROUND ELEVATION ____



Notes:
1. Upper bentonite seal, cement grout and monument installed by Taseko Mines Ltd.

CAD FILE: \CAD\FIG\A6 scale 1=1

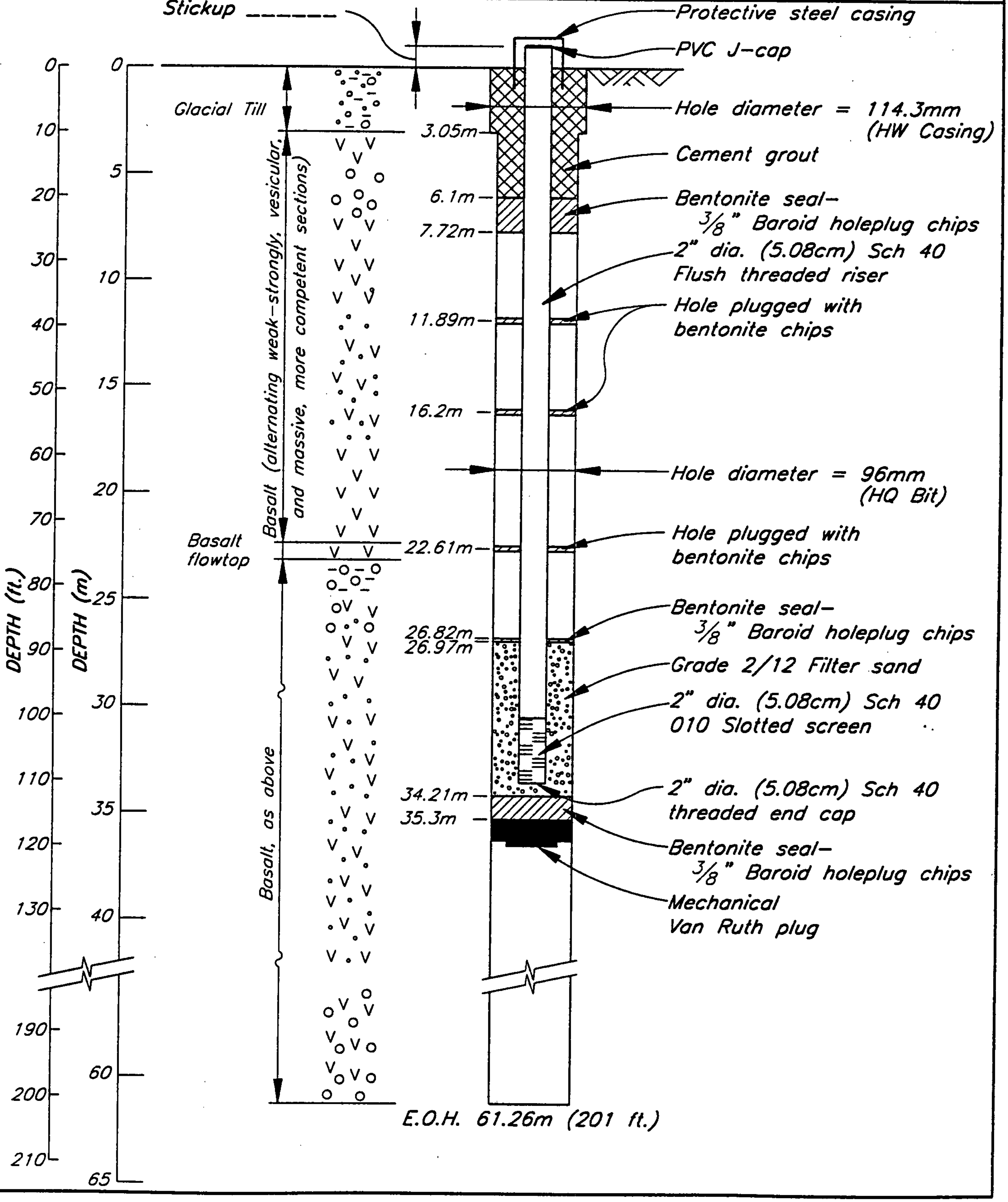
1738.A13

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

GROUNDWATER MONITORING WELL COMPLETION DETAILS

PROJECT *FISH LAKE*
LOCATION N: E:
COMPLETION DATE *August 1,1994*

PROJECT No. *1738*
HOLE No. *94-143*
GROUND ELEVATION



CAD FILE: \CAD\FIG\A13 . scale 1=1

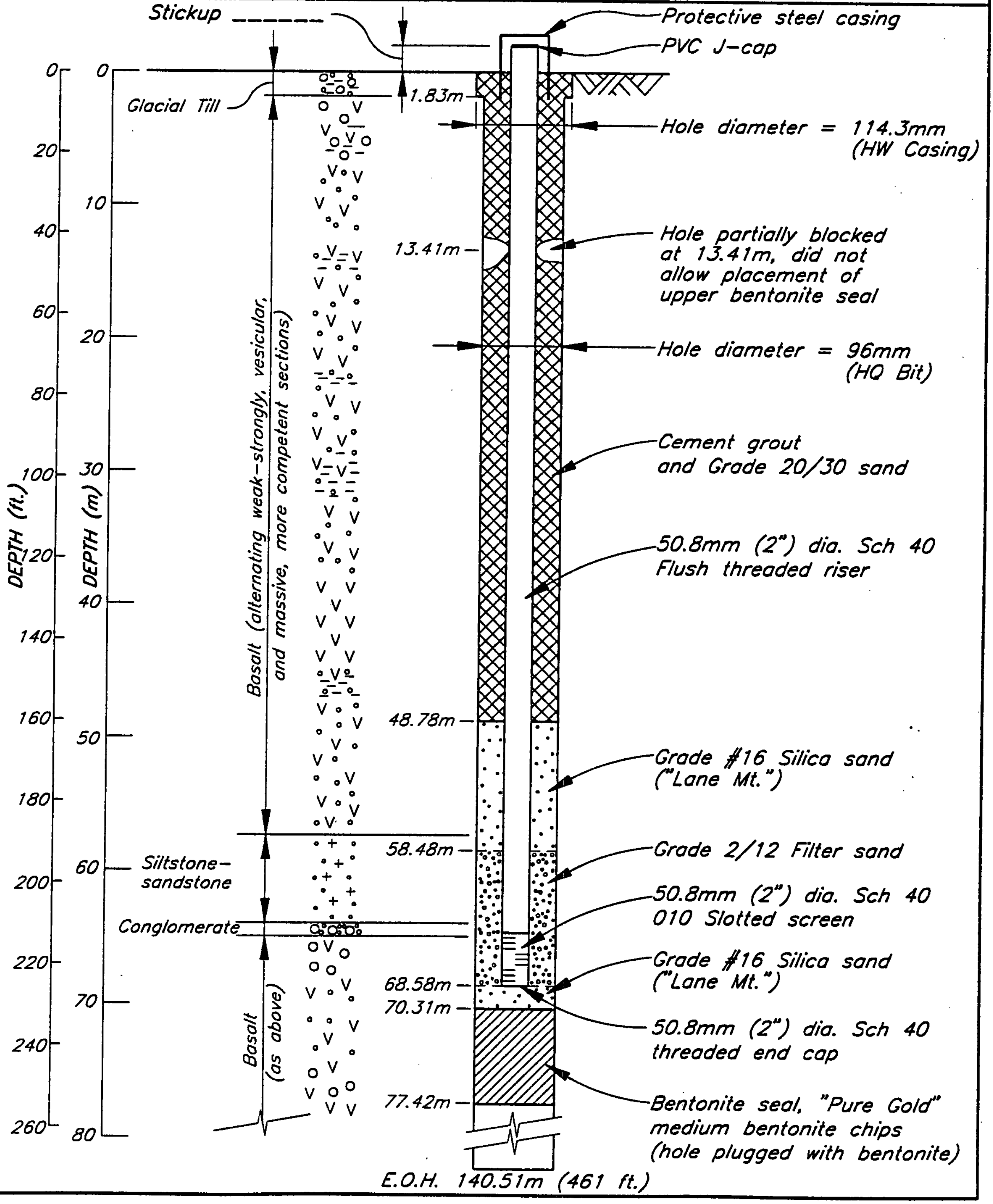
1738.A2

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

GROUNDWATER MONITORING WELL COMPLETION DETAILS

PROJECT *FISH LAKE*
LOCATION N: ______ E: ______
COMPLETION DATE *Aug. 7, 1994*

PROJECT No. *1738*
HOLE No. *94-144*
GROUND ELEVATION ______



CAD FILE: \1738\FIG\A. : scale 1=1 NOV 1994

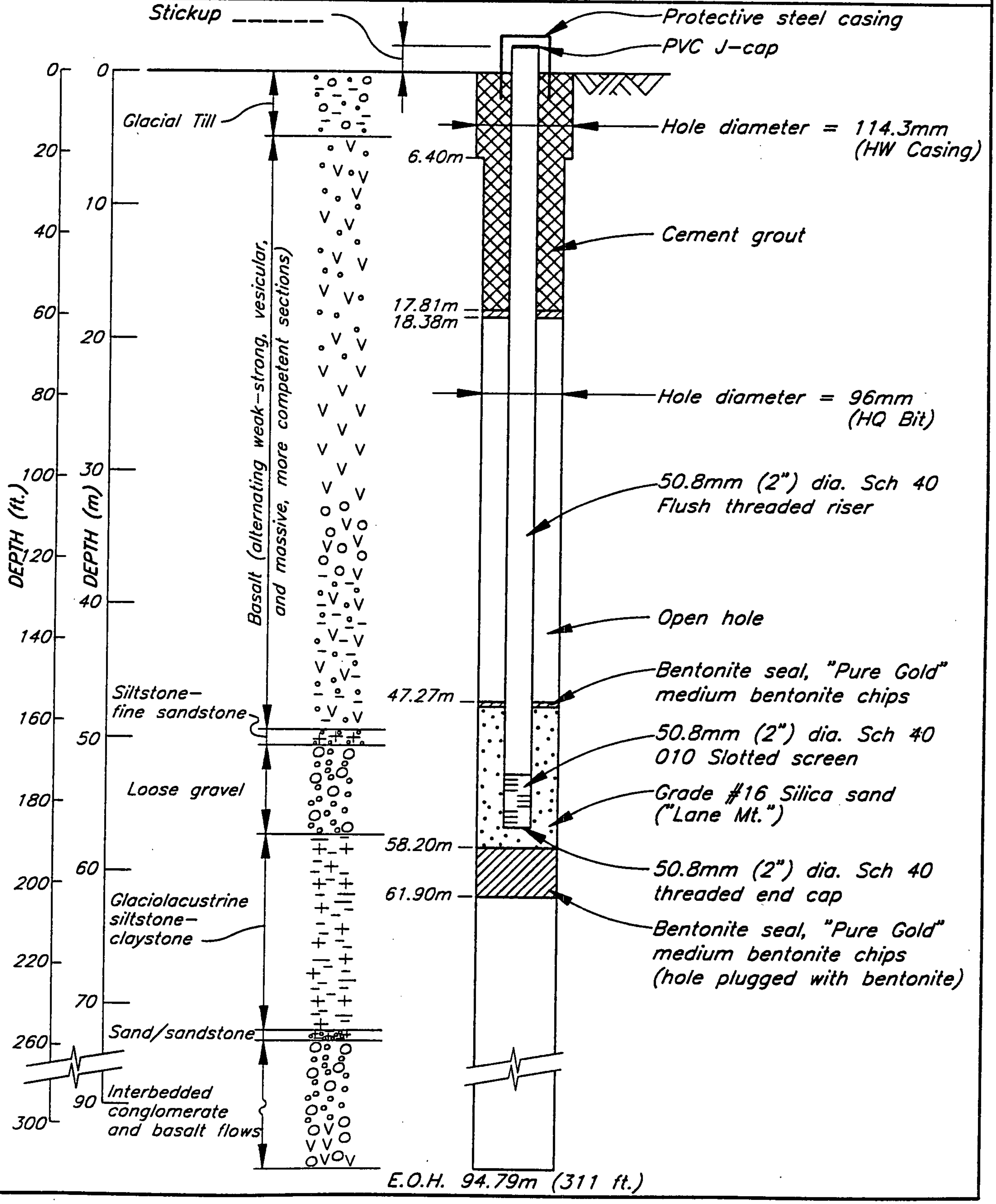
1738.A14

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

GROUNDWATER MONITORING WELL COMPLETION DETAILS

PROJECT *FISH LAKE*
LOCATION N:_____ E:_____
COMPLETION DATE *Aug. 11, 1994*

PROJECT No. *1738*
HOLE No. *94-147*
GROUND ELEVATION _____



CAD FILE: \1738\FIG\A at scale 1=1 NOV 1994

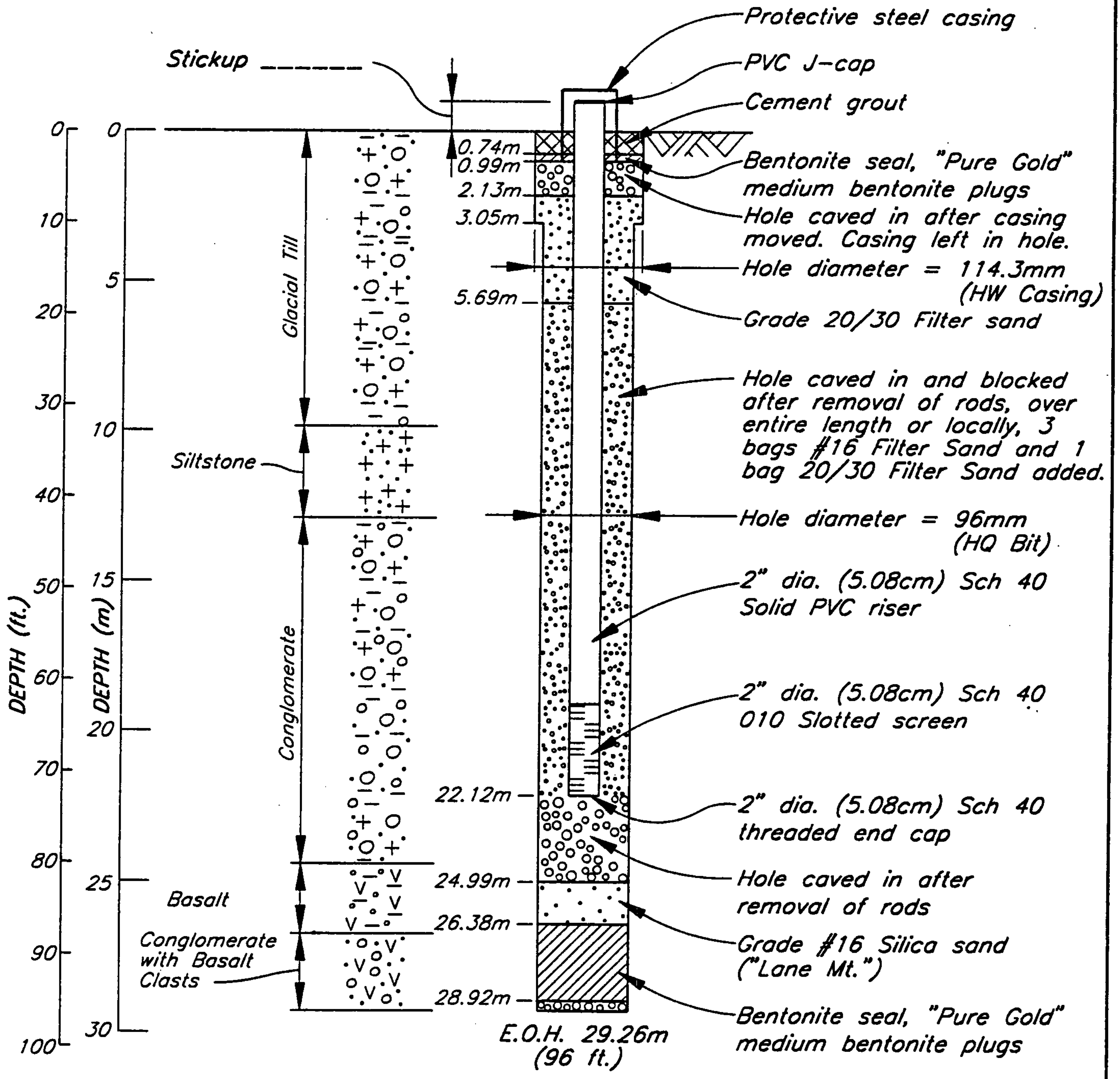
1738.A15

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

GROUNDWATER MONITORING WELL COMPLETION DETAILS

PROJECT *FISH LAKE*
LOCATION N: E:
COMPLETION DATE *Aug. 13, 1994*

PROJECT No. *1738*
HOLE No. *94-148*
GROUND ELEVATION



CAD FILE: \CAD\FIG\A1. scale 1=1

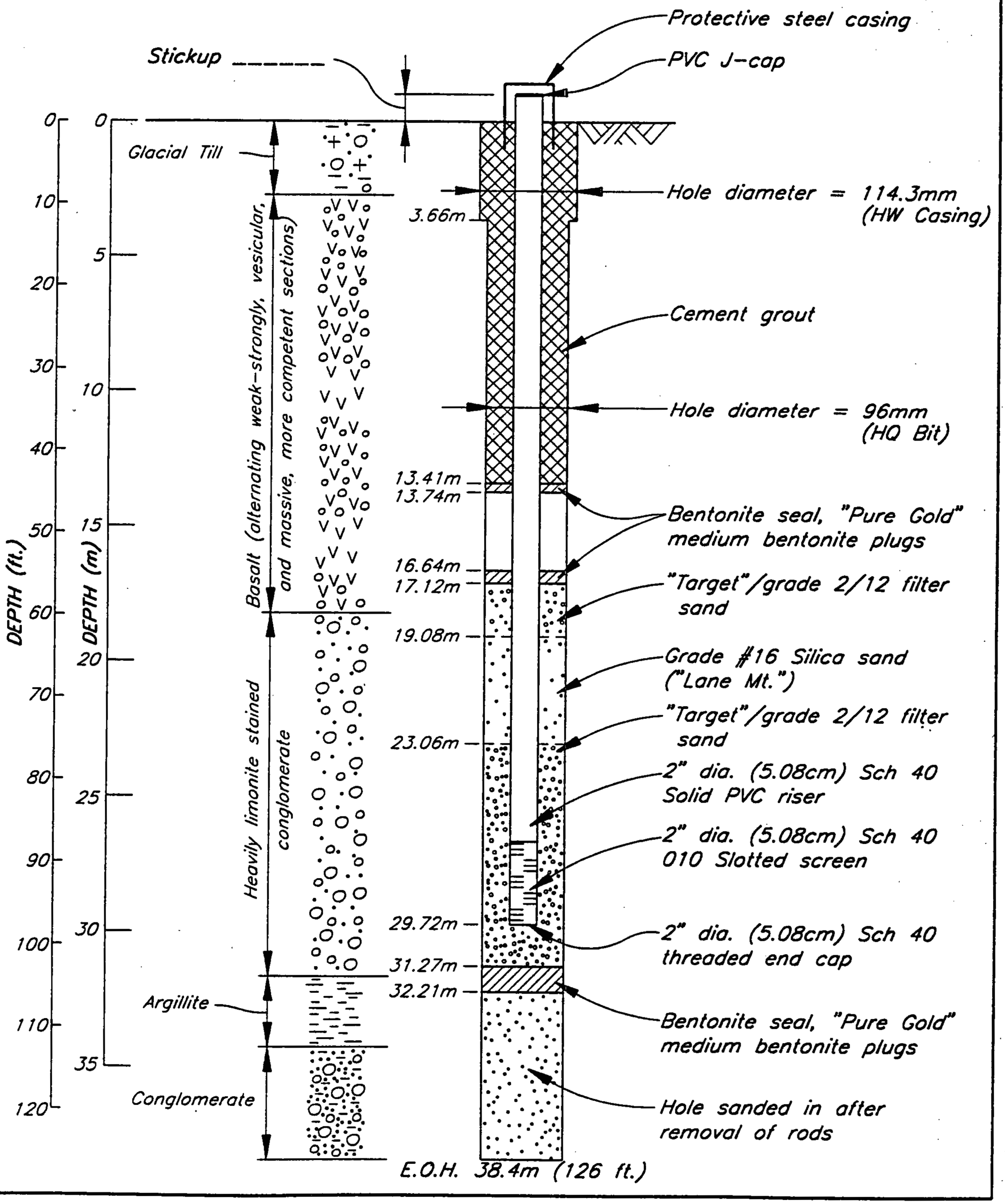
1738.A16

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

GROUNDWATER MONITORING WELL COMPLETION DETAILS

PROJECT *FISH LAKE*
LOCATION N: E:
COMPLETION DATE *Aug. 15, 1994*

PROJECT No. *1738*
HOLE No. *94-150*
GROUND ELEVATION



CAD FILE: \CAD\FIG\A. ol scale 1=1