Trow

Trow Consulting Engineers Ltd.
Thunder Bay Branch

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INTERNAL
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DIAND CC 26/11/99
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NIRB

October 13, 1999

Reference F90132

RECEIVED
OCT 29 1999

Ms. Sharon Meyer
Homestake Canada Inc.
P.O. Box 11115
Suite 1100-1055 West Georgia St.
Vancouver, BC
V6E 3P3

Dear Ms. Meyer;

1999 Tailings Dam Examination
Cullaton Lake Gold Mine, Nunavut

Further to your authorization, we have carried out a visual examination of the tailings impoundment facility at the above noted site. For your convenience, copies of the reports covering the 1994 and 1996 inspections are appended. These reports contain the most recently available site mapping.

The field examination was carried out by Mr. Demetri Georgiou, P.Eng. on July 24, 1999. Photos 1 and 2, attached, show oblique views of the site taken from the air on the date of the site examination, July 24, 1999. The tailings area, marked 1. in the foreground of Photo 1, has been covered with local till as reported in Trow's previous inspection reports. Vegetation on the tailings is small and sparse.

Tailings Dam No. 1

Photos 3 and 4 show views of the dam and spillway, respectively. Typically, the embankment which is constructed principally with local cohesionless till, is irregular in section and surface grade. Average side slopes of the upstream and downstream sides were typically about 3H:1V and 6H:1V, respectively. Some small erosion scars were observed on both the upstream and downstream sides. This is likely due to adjustment of the fill that was placed several years ago during the flattening of the side slopes. The crest width varies but is in the order of 15 m. No seepages were observed on the day of inspection. Based on our 1999 examination and our previous involvement with the project, the dam is considered to be stable.

The pond level was estimated to be at an elevation of about 93.7 m, approximately 0.3 m below the spillway crest level and no spillway flow was occurring. This is slightly lower than that observed in the 1994 and 1996 examinations when the levels were at about 94.0 m. The slight drop in water level, compared to what was observed previously is likely due to natural seasonal hydrologic variations, including precipitation, infiltration, runoff and evaporation. Within the tailings pond itself, no unsubmerged tailings were observed.

Tailings Dam No. 2

Photos 5 and 6 show views of the dam and spillway, respectively. As with the No. 1 dam, the principal construction material is local cohesionless till. The dam section and surface grade is irregular, although less so than the No. 1 dam. The crest width varies but is in the order of 15 m. No seepages were observed on the day of examination. Based on our 1999 examination and our previous involvement with the project, the dam is considered to be stable.

We trust that this information meets your current requirements. Should you have any questions or require additional information, please contact me.

Yours truly,
Trow Consulting Engineers Ltd.

Prepared by,

Demetri N. Georgiou, MASc., P.Eng.
Branch Manager/Principal Engineer

Reviewed by,

Robert B. Dodds, Ph.D., P.Eng.

REGISTERED PROFESSIONAL ENGINEER
R. B. DODDS
LICENSEE
N.W.T.

attachments photos, 1994 and 1996 reports

THE ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLOGISTS and GEOPHYSICISTS OF THE NORTHWEST TERRITORIES
PERMIT NUMBER
P 184
TROW CONSULTING ENGINEERS

F-90132
Photos July 24, 1999

Photo 1. Oblique view of tailings impoundment looking east.
1. Covered Tailings, 2. Pond, 3. Quarry, 4. Dam 1 and Spillway 1, 5. Pond 2

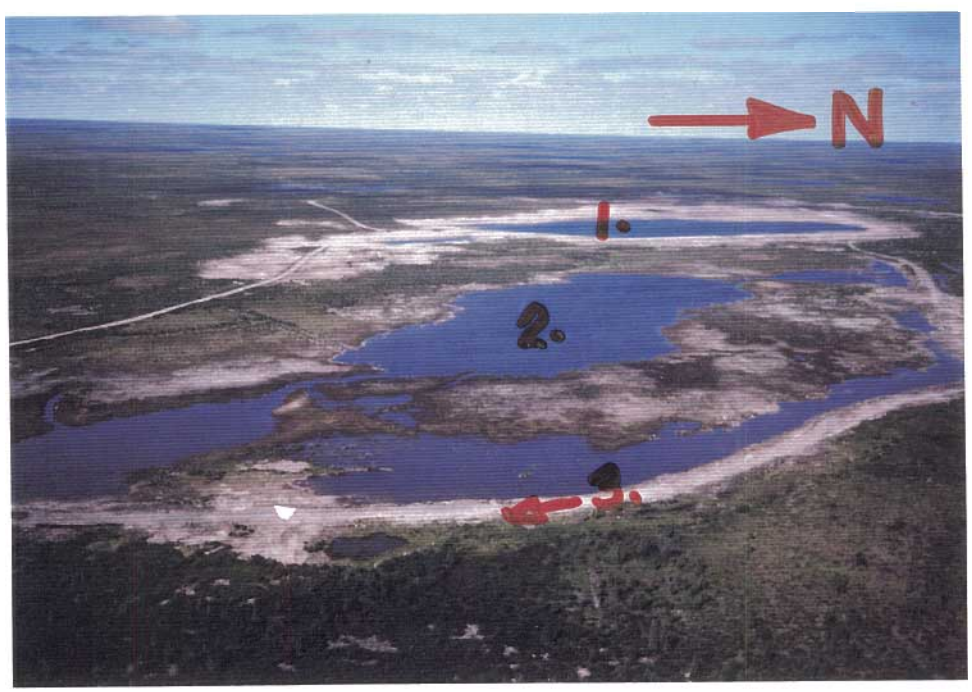

Photo 2. Oblique view of tailings impoundment looking west.
1. Pond 1, 2. Pond 2, 3. Dam 2 & Spillway 2

Photo 3. Tailings Dam No. 1 looking north.

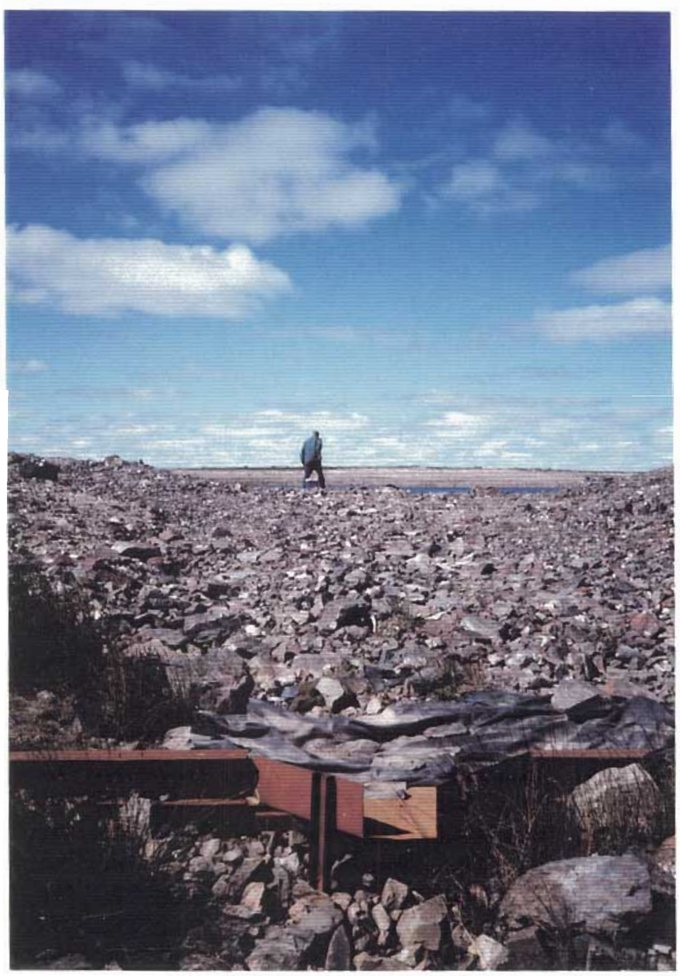

Photo 4. Spillway No. 1 looking upstream (west). Note flow measurement weir.

Photo 5. Tailings Dam No. 2 looking north, north of Spillway.

Photo 6. Spillway No. 2 looking upstream (west).

Trow Thunder Bay Branch

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February 1, 1995

Homestake Canada Ltd.
1000 – 700 West Pender Street
Vancouver, B.C.
V6C 1G8

Attention: Mr. Bill Napier, Manager Environmental Affairs

RE: Cullaton Lake Gold Mine
Our Reference No. F–90132–B/E

Dear Mr. Napier,

1.0 INTRODUCTION

The undersigned visited the Cullaton Lake Gold Mine during the period of June 25 to June 28, 1994 to examine the Tailings Containment Area and to conduct a topographic survey of this area.

2.0 SURVEY

A topographic survey was conducted to accurately establish the water elevations in the Tailings Pond and Polishing Pond, the size of the tailings pond, the depth of cover material, typical cross sections of the dams, locations of the thermistors and monitoring wells and locations of the mill buildings and shops. The elevations of these features are referenced to a temporary bench mark established on a concrete slab at the northeast corner of the mill building and given an assumed elevation of 100.00 m. Details are shown on Drawing No. 1. Typical sections of the tailings dams are shown on Drawing No.s 2 and 3.

3.0 THERMISTORS

Readings of the previously installed thermistors were recorded by Mr. Rodney McKay of McKay Environmental Industries Ltd. The results are given in the following table and are shown graphically on Drawings, No.s 4 through 7 along with readings from previous years.

Thermistor	Readings (June 27, 1994)					
No.	0	1	2	3	4	5
1	7.67 15.51	9.37 11.26	12.68 5.03	16.51 -0.21	18.17 -2.07	19.40 (kilohms) -3.33 (°C)
2	7.71 15.40	7.76 15.26	10.31 9.27	14.49 2.35	17.31 -1.13	19.04 (kilohms) -2.97 (°C)
3	7.71 15.40	8.52 13.27	11.67 6.72	16.47 -0.16	18.05 -1.94	19.20 (kilohms) -3.13 (°C)
4	7.74 15.32	8.37 13.65	11.53 6.97	16.24 0.10	17.87 -1.74	19.40 (kilohms) -3.33 (°C)

The comparative results from the four thermistor installations indicate that there is an upward trend in the level of permafrost. The average depth of frost was approximately 400 mm below the tailings ground surface during the time of this study. This compares to a frost level of a 800 mm below the ground surface during a similar time period in 1992 (July 6, 1992). It should be noted, however, that the greatest depth of thaw occurs at the end of the summer season which will lower the level of frost to the greatest seasonal depth. To obtain the level of maximum thaw, thermistor readings should be taken sometime in the month of September. A more accurate level of permafrost can then be recorded. At the current rate of rise in frost levels, it is expected that the covered tailings area will be in a permanently frozen state (permafrost) in 2 to 3 more years.

4.0 TAILINGS AREAS

A visual examination was conducted on the dams for Tailing Area No.s 1 and 2. The average water elevations measured on Dam No.s 1 and 2 are approximately 94.0 m and 89.4 m, respectively. There was no evidence of any seepage on the downstream side of each of the dams.

A visual examination of Tailings Dam No. 1 indicates that the dam is stable under current conditions. A stability analysis was carried out on this dam in Trow's, "Abandonment and Restoration Plan", dated May 7, 1991 prior to closure. The dams have since been lowered and the face flattened which increases the stability (see Trow report of July 19, 1993). The current water elevation of 94.0 m is controlled by the spillway constructed on the east side of the dam.

The spillways at each of the two dams appear to be in good condition. However, some levelling of some small rock piles immediately adjacent to the spillway in Dam No. 2 would provide a better appearance and provide better control of surface runoff. A slight trickle of water was noted through the rock fill in the spillway on Dam No. 1. Photographs, No.s 1 and 2 show the conditions of the two spillways.

Attempts were made to determine the profile of the bottom of Tailings Pond No. 1 by depth soundings using a canoe. Unfortunately, strong wind conditions during this field study proved to be too dangerous to take soundings with a canoe. Topographic information from a 1990 survey by H I W Surveys Ltd. was used in combination with our survey to provide a profile of Tailings Pond No. 1. Based on this combined survey information, there is a maximum water depth of approximately 3.0 m (10 ft.) in Tailings Pond No. 1.

There was no evidence of any exposed tailings in Tailings Area No. 1. Field measurements from a September 1990 site visit indicate that the maximum depth of seasonal thawing (active zone) is estimated to be 1.4 m. Measurements from a subsequent field visit of August 11, 1992 show that the cover material over the tailings is approximately 1.2 m thick. Photographs, No.s 3 and 4 show the covered tailings area.

A small section of the dam in the northwest corner of Tailings Dam No. 2 is not well defined. It is assumed that this section was disturbed when material was being used to cover the exposed tailings in Tailings Area No. 1. A stockpile of waste rock immediately adjacent to this area could be used to shape the dam to the conditions similar to the rest of the dam. Mr. Rodney McKay stated that this would be done during this site visit.

Based on our examination, the structures associated with the former tailings disposal system are stable. A visual inspection of Tailings Dam No. 1 shows that the dam is stable under current conditions. There is no evidence of seepage from the dams in Tailings Pond No. 1. The water level in Tailings Pond No. 1 is remaining stable at the level of the invert of the spillway (El 94.1 m). The permafrost level is rising in the covered tailings as predicated.

If there are any questions or comments regarding this information, please contact us at your convenience.

Yours truly,
TROW CONSULTING ENGINEERS LTD.

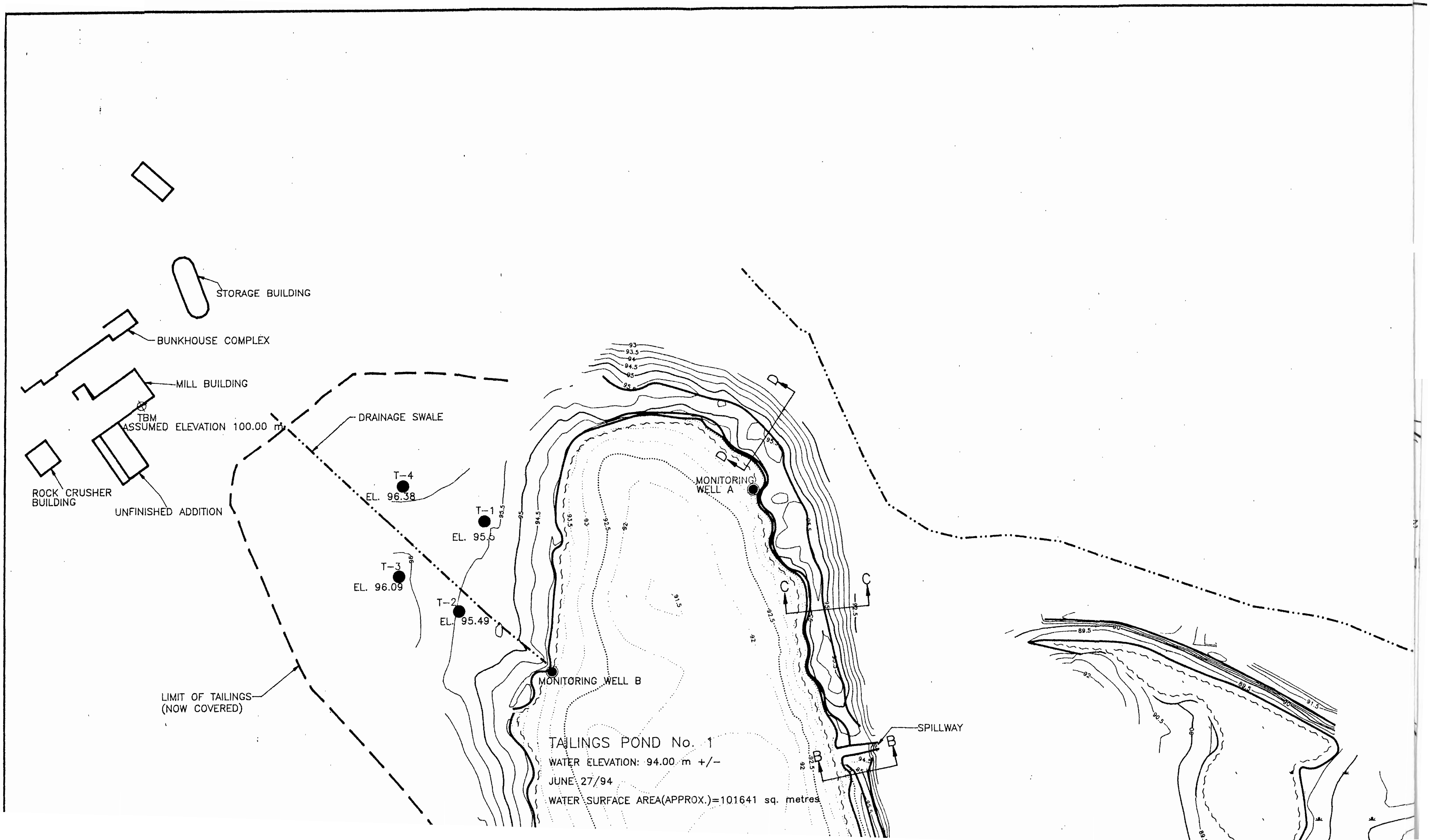
Feb. 2/95

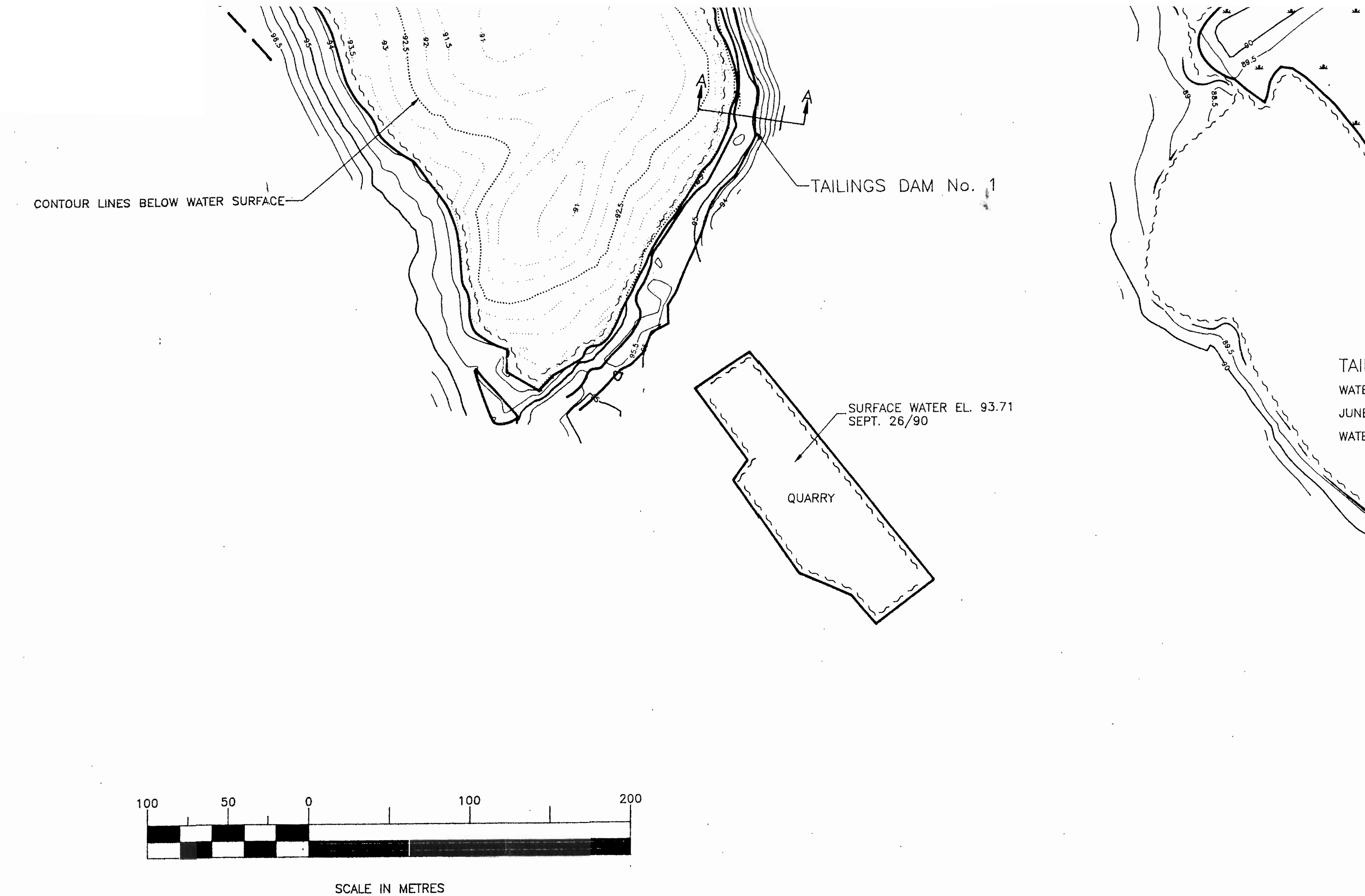
Donald E. Kaluza, P. Eng.

Robert B. Dodds, Ph.D., P.Eng.
Thunder Bay Branch Manager

b:\90132.rep

Part 1

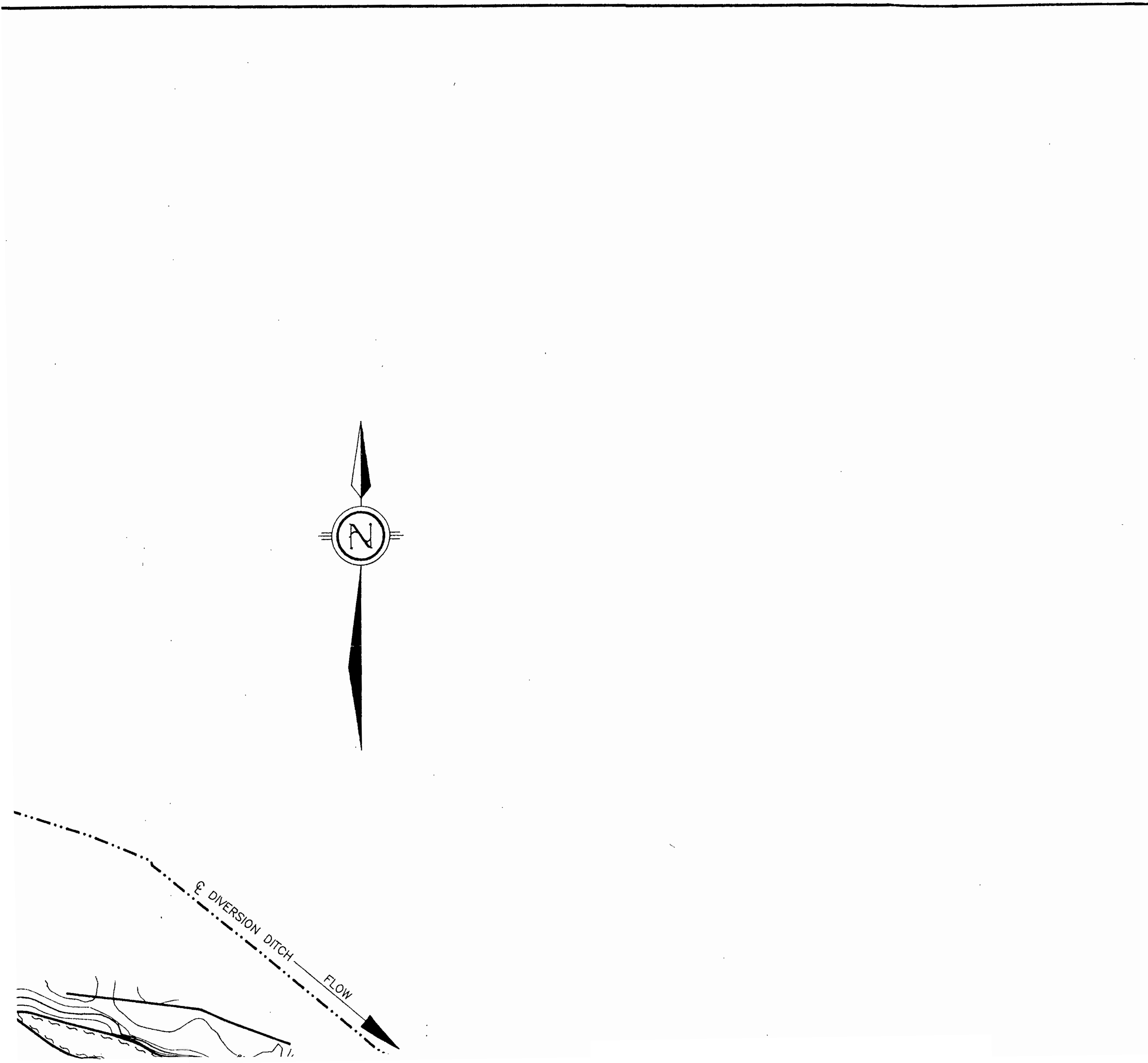

STORAGE BUILDING
BUNKHOUSE COMPLEX
MILL BUILDING
TBM
ASSUMED ELEVATION 100.00 m
DRAINAGE SWALE
ROCK CRUSHER
BUILDING
UNFINISHED ADDITION
T-4
EL. 96.38
T-1
EL. 95.6
T-3
EL. 96.09
T-2
EL. 95.49
MONITORING
WELL A
MONITORING WELL B
LIMIT OF TAILINGS
(NOW COVERED)
TAILINGS POND No. 1
WATER ELEVATION: 94.00 m +/-
JUNE 27/94
WATER SURFACE AREA(APPROX.)=101641 sq. metres
SPILLWAY
B
B
C
C
D
D



CONTOUR LINES BELOW WATER SURFACE
TAILINGS DAM No. 1
A
A
SURFACE WATER EL. 93.71
SEPT. 26/90
QUARRY
TAIL
WATER
JUNE
WATER
100
50
0
100
200
SCALE IN METRES

Part 2

Part 3



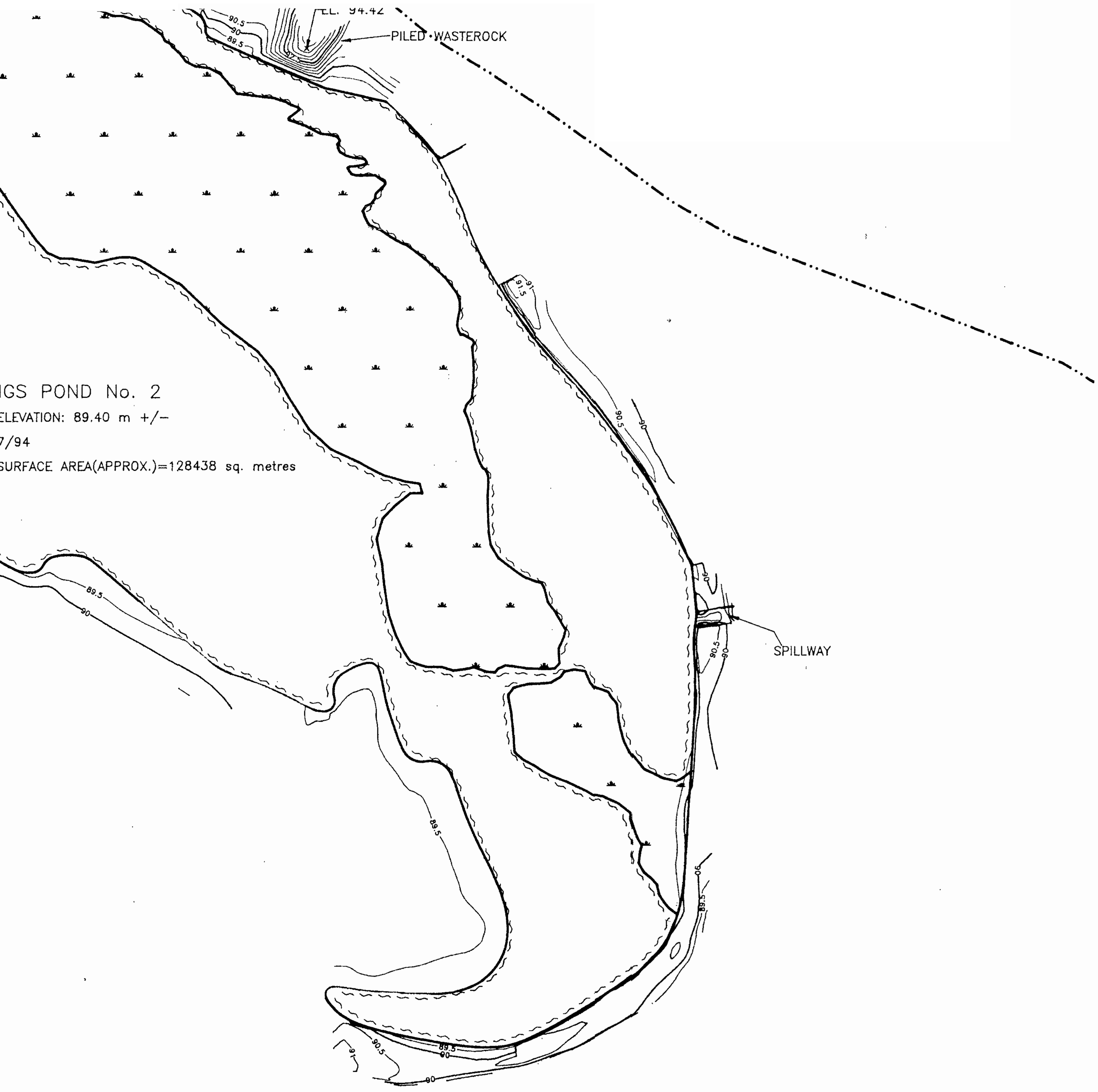
TROW CONSULTING ENGINEERS LTD.
Thunder Bay, Ontario, Canada

LEGEND

- MONITORING WELL
- BENCHMARK
- THERMOSTERS

NOTES:

1. DATA INTERPRETED FROM TROW ENGINEERING SURVEY(JUNE 27/94) AND SURVEY BY H.I.W. SURVEYS LTD.(NOV. 10/90)
2. BENCH MARK IS LOCATED ON CONCRETE SLAB AT NORTH EAST CORNER OF MILL BUILDING. ASSUMED ELEVATION: 100.00m
3. ALL ELEVATIONS ARE SHOWN IN METRES.



REVISIONS

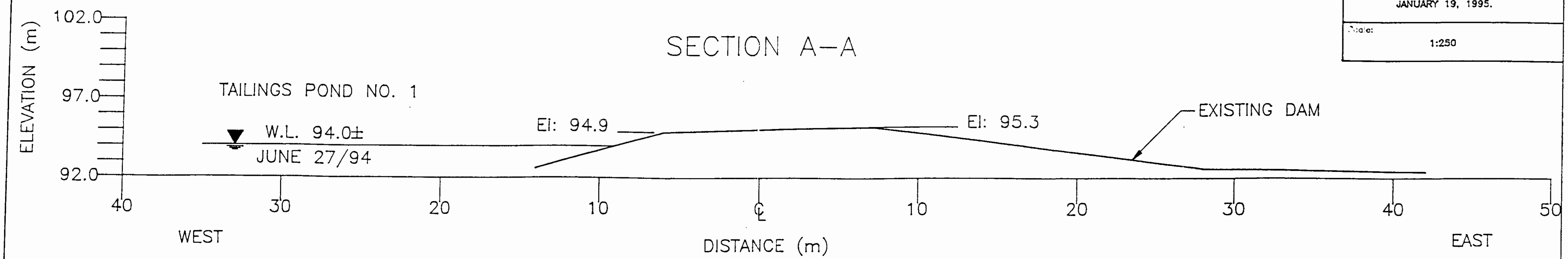
No:	Date:	Revision

Client: HOMESTAKE CANADA	
Project: CULLATON LAKE MINE CLOSURE	
Title: TAILINGS POND SURVEY CULLATON LAKE, N.W.T.	
Project No. F-90132-A/G	Dwg. No.: 1
Drawn By: PW/DT	Reviewed By: DK
Date: JANUARY 30, 1995	
Scale: 1 : 2500	

Part II

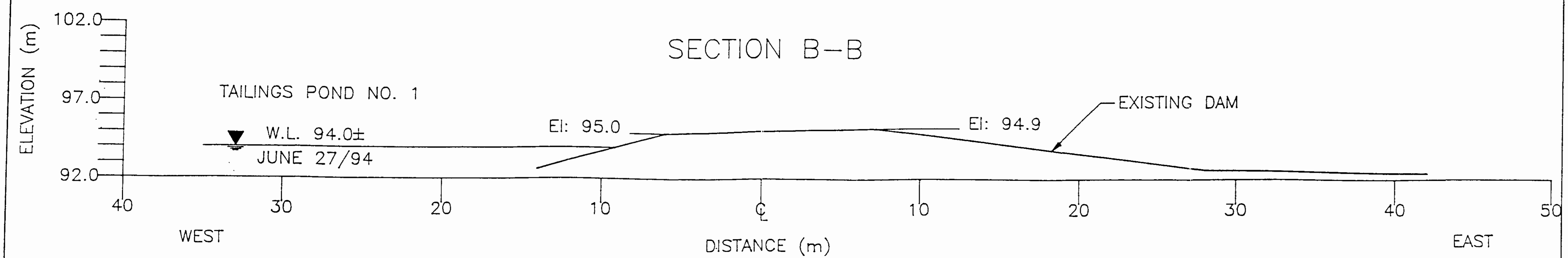
TROW CONSULTING ENGINEERS LTD. Thunder Bay, Ontario, Canada	
Client: HOMESTAKE CANADA	
Project: CULLATON LAKE MINE CLOSURE	
Title: CROSS SECTIONS TAILINGS DAM NO. 1	
Project No. F-90132-A/E	Dwg. No.: 2
Drawn By: D.T.	Reviewed By: D.K.
Date: JANUARY 19, 1995.	
Scale: 1:250	

SECTION A-A



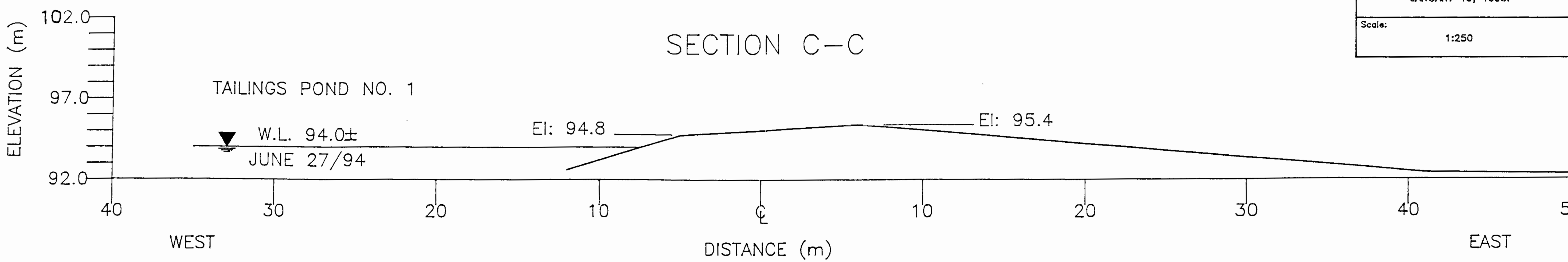
HORIZONTAL SCALE: 1:250
VERTICAL SCALE: 1:250

SECTION B-B



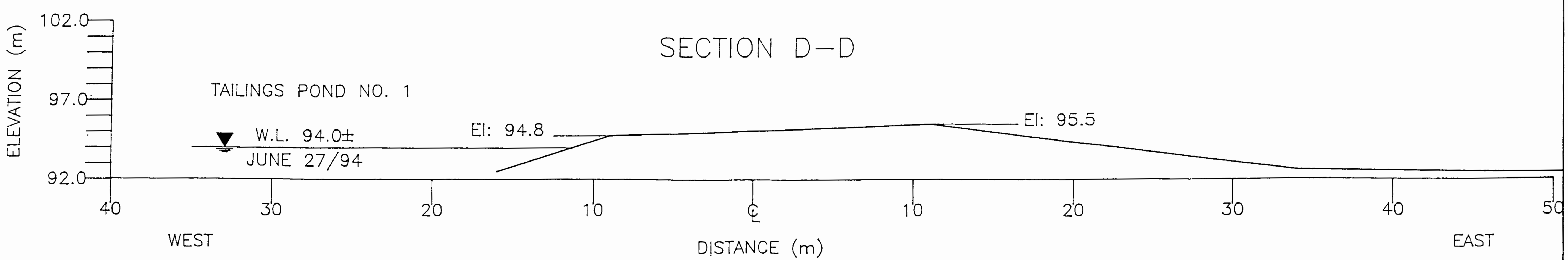
TROW CONSULTING ENGINEERS LTD. Thunder Bay, Ontario, Canada	
Client: HOMESTAKE CANADA	
Project: CULLATON LA'E MINE CLOSURE	
Title: CROSS SECTIONS TAILINGS DAM NO. 1	
Project No. F-90132-A/E	Dwg. No.: 3
Drawn By: D.T.	Reviewed By: D.K.
Date: JANUARY 19, 1995.	
Scale: 1:250	

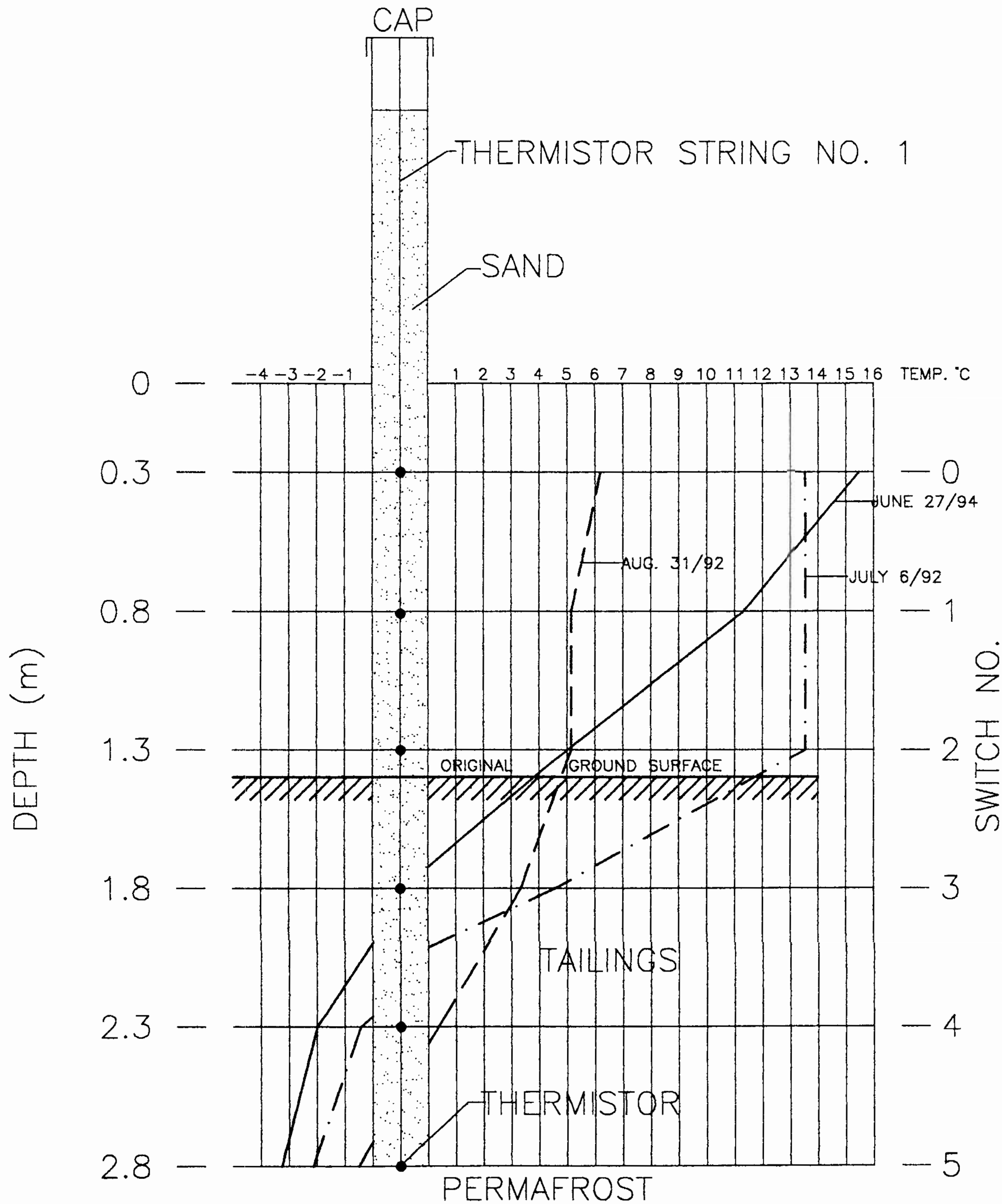
SECTION C–C



HORIZONTAL SCALE: 1:250
VERTICAL SCALE: 1:250

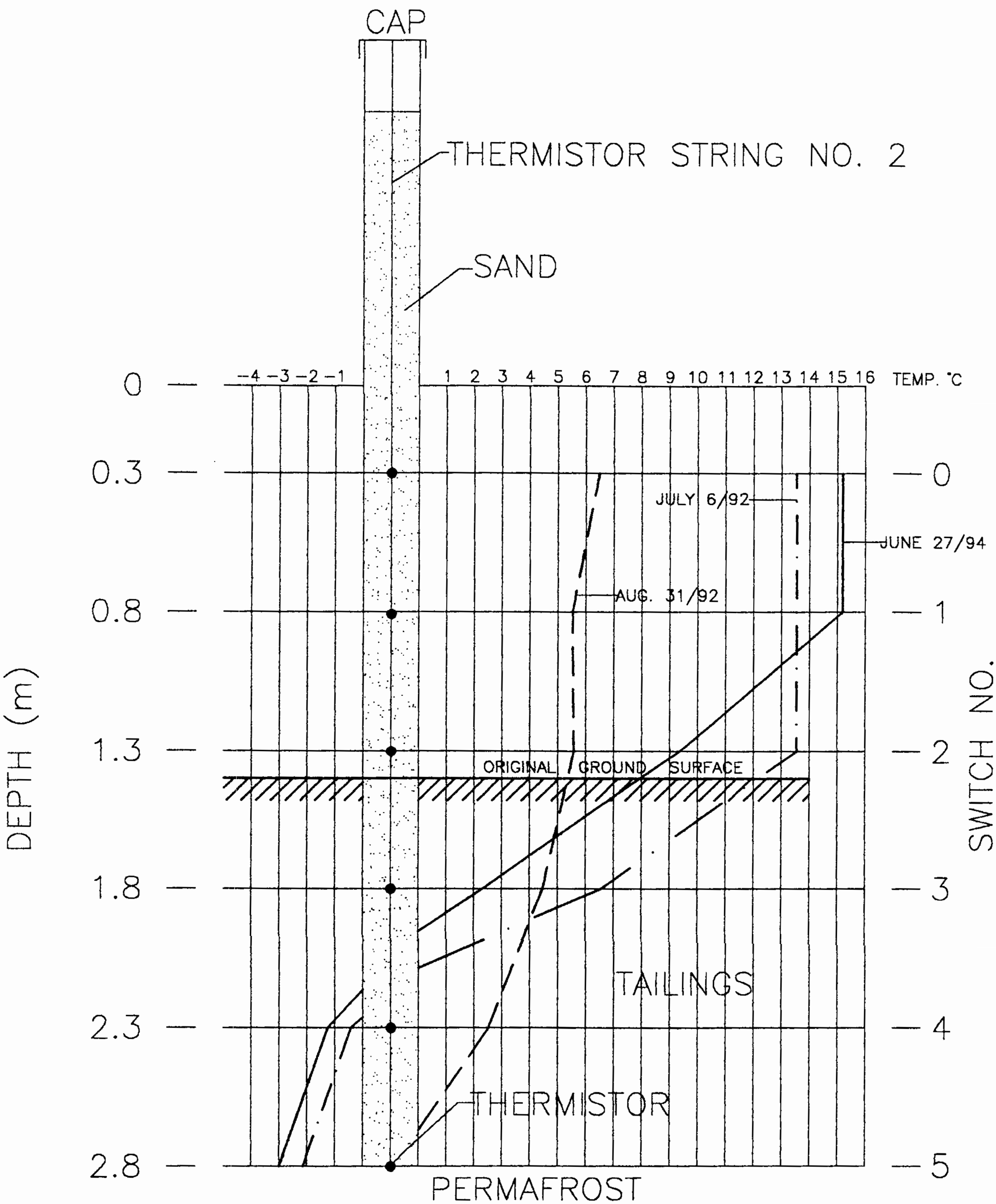
SECTION D–D





THERMISTOR STRING CONFIGURATION

INSTALLED AUGUST 23, 1991

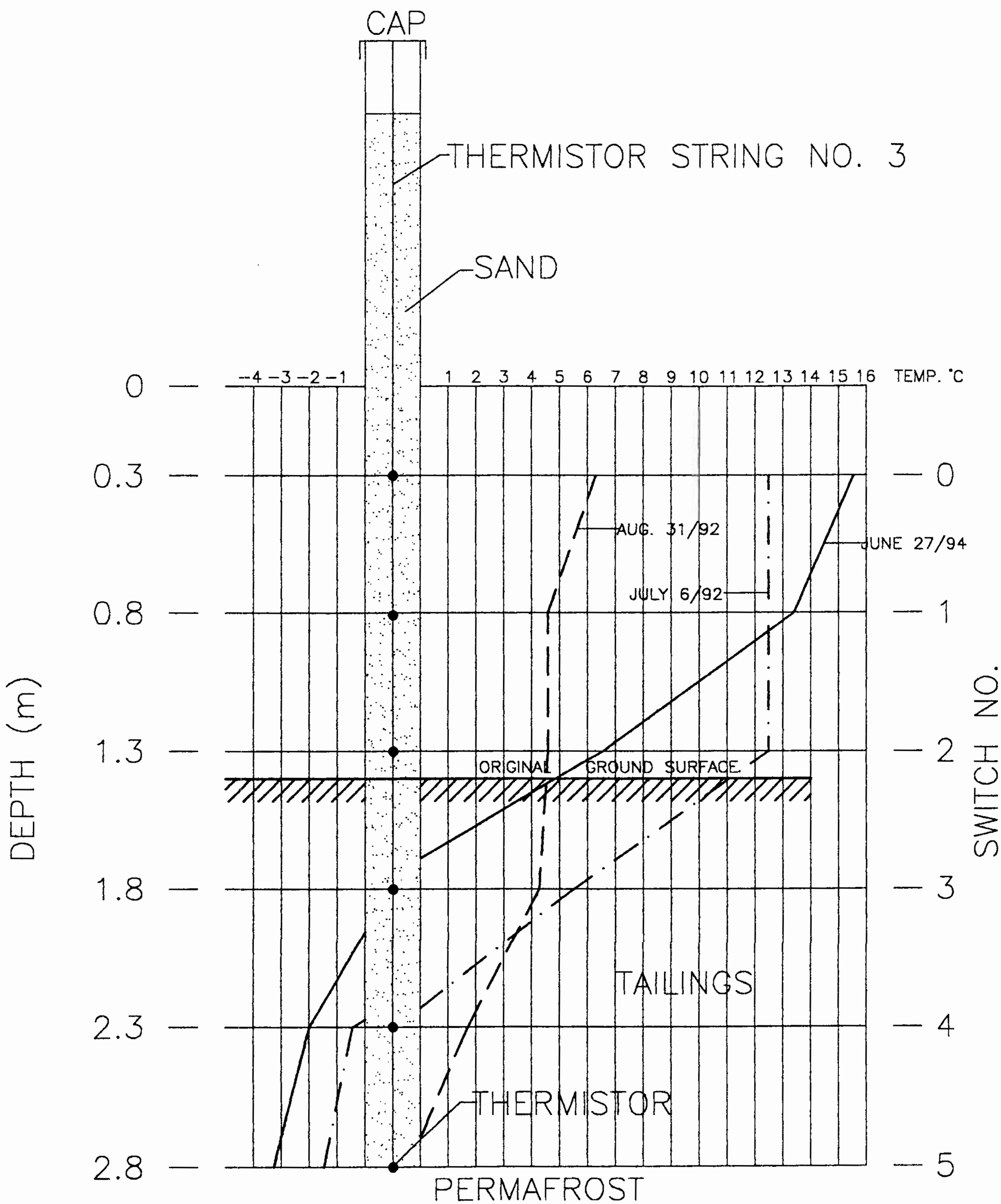


THERMISTOR STRING CONFIGURATION

INSTALLED AUGUST 23, 1991

REF. NO. F-90132-A/E

DRAWING NO. 6

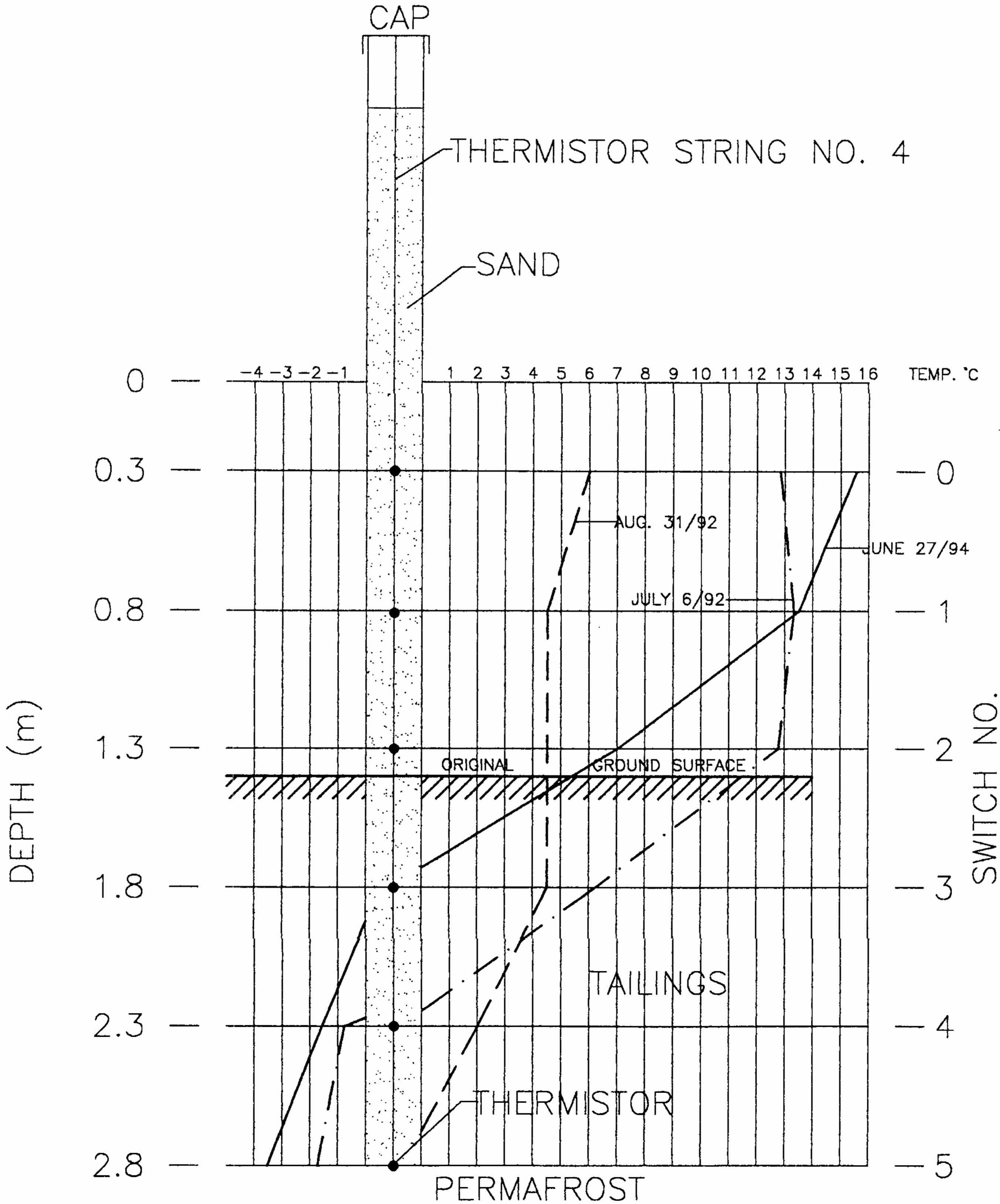


THERMISTOR STRING CONFIGURATION

INSTALLED AUGUST 23, 1991

REF. NO. F-90132-A/E

DRAWING NO. 7



THERMISTOR STRING CONFIGURATION

INSTALLED AUGUST 23, 1991

Photograph No. 1
Spillway at Tailings Dam No. 1

Photograph No. 2
Spillway at Tailings Dam No. 2

Photograph No. 3
Covered Tailings at Tailings Pond No. 1
View Looking South

Photograph No. 4
Covered Tailings at Tailings Pond No. 1
View Looking North

Trow Thunder Bay Branch

Trow Consulting Engineers Ltd.
807 Harold Crescent, Thunder Bay
Ontario, Canada. P7C 5H8
Telephone: (807) 623-9495
Facsimile: (807) 623-8070

November 27, 1996

Reference No. F-90132-B/E

Homestake Canada Ltd.
1000-700 West Pender Street
Vancouver, B.C.
V6C 1G8

Attention: Sharon Meyer

RE: Cullaton Lake Gold Mine

Dear Ms. Meyer:

At your request, Trow Consulting Engineers Ltd. visited the Cullaton Lake Gold Mine property during the period of September 15 - 18, 1996 to examine the tailings containment area and to measure the depth of permafrost in the covered tailings area.

TAILINGS AREAS

Tailings Pond Area No. 1

A visual examination around Tailings Area No. 1 was carried out. The containment dam appears to be in good condition with no signs of distress or erosion. Some small wet areas were present on the downstream toe at the south end of the tailings area. However, it is unclear if the wet areas are due to seepage or the large amount of rainfall which had fallen prior to this site visit. There is no evidence of soil loss in these wet areas and they do not present any instability to the dam. The approximate location of these wet areas are shown on Drawing No. 1.

The spillway appears to be in good condition with the exception of a small area on the south upstream side where the liner is exposed. A trickle of water was flowing over the spillway during this time. The water elevation was approximately 94.0 m[1], which is at the same level it was during our site visit in June of 1994. Although this only compares two time periods, it is an indicator that the drainage area has a positive water balance.

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[1] Elevations are referenced to a temporary benchmark located on a concrete slab at the east corner of the mill building with a local elevation of 100.00 m, previously established by HIW Surveys Ltd. in 1990.

There were no exposed tailings in the pond, shoreline, or covered areas. However, the tailings were within approximately 150 mm of the water surface on the western shoreline, adjacent to the covered tailings area near the interface between the B-zone and Shear zone tailings. There appear to be some pockets of tailings which may be near the surface of the water in centre of the pond. Unfortunately, a boat was not available to measure the water depth. It is understood that an attempt will be made to measure the water depth when the pond is ice covered. Photographs 1 and 2 show evidence of the tailings being close to the surface of the water.

It appears that some thaw settlement may have occurred in the B-zone covered tailings area. The area was ponded with water and stained reddish brown during this site visit. The settled area is shown on Photographs 3 and 4.

Tailings Area 2

Since the dams in Tailings Area 2 are not required, much of the material which was used for the dams has been removed and was used for cover over the former tailings beach near the mill building in Tailings Area 1. There was some material still available which could be used for additional cover material, if needed.

The water level in Tailings Pond No. 2 was low during this site visit and appeared to be at a similar elevation to what was measured in 1994 (elev: 89.4 m). It is expected that the water level will remain low under the present conditions.

A long stretch of liner (approx. 75 m) in the dam has been exposed and damaged at the northwest end of Tailings Area 2. Since the amount of material in the dam has been reduced, it is expected that more of this liner could be exposed as a result of erosion. Consideration could be given to removing some of the exposed liner and filter cloth and burying it in the quarry to ensure it does not become air- borne and present a hazard to wildlife, for instance.

PERMAFROST

Thermistors

Thermistor readings were recorded by Don Kaluza, P. Eng. of Trow on September 19, 1996. The results are given in the following table.

Therm. No.		THERMISTOR READINGS (SEPT. 19, 1996)					
		Setting 0	Setting 1	Setting 2	Setting 3	Setting 4	Setting 5
1	(kΩ)	11.02	11.76	11.14	12.85	14.92	16.48
	(°C)	8.0	6.5	7.7	4.7	1.7	-0.2
2	(kΩ)	10.90	11.57	12.13	13.85	15.75	16.88
	(°C)	8.0	6.8	6.0	3.2	0.7	-0.7
3	(kΩ)	10.70	11.23	11.80	13.80	15.76	16.74
	(°C)	8.5	7.6	6.5	3.2	0.7	-0.4
4	(kΩ)	10.22	11.15	11.48	13.23	15.30	16.70
	(°C)	9.5	7.6	7.0	4.2	1.3	-0.4

The results of the thermistor readings indicate that the active zone (greatest seasonal thaw) is at or very near the lowest nested thermistor (at Setting 5).

A test pit was excavated within 3 m of each thermistor installation to measure the permafrost level and compare it with the thermistor readings. The cover material was first removed using a CAT 950 loader. The permafrost levels were then estimated by driving a section of drill steel through the exposed tailings to refusal. At least two areas within each test pit were probed with the drill steel to ensure that the refusal was due to permafrost and not due to cobbles or boulders.

One additional test pit was excavated using a CAT D8 in the native undisturbed soil adjacent to the tailings area. The subsurface conditions in this test pit generally consisted of approximately 0.1 m of organic soil at the surface which was underlain by wet silty sand till. The till contained several cobbles and boulders throughout.

Generally, permafrost depths ranged between 1.75 m and 1.90 m in the covered tailings area and 2.0 m in the undisturbed native soil.

Assuming that each of the thermistor installations were installed to a depth of 1.4 m below the tailings surface, the thermistor readings show the permafrost level to be about 0.3 m lower than actual site conditions. This difference may be the result of heat being conducted down the PVC protective casing. Cover thicknesses ranged from 0.6 m near Thermistor No. 1 to 1.1 m near Thermistor No. 2. It should be noted, however, that approximately 0.45 m of cover material was mounded locally around Thermistor No. 2. Additional estimates of the cover material thickness were provided by Mr.

Ronald V. Nicholson of BEAK Consultants Limited. The BEAK field study conducted in 1996 indicates that the cover material is approximately 0.67 m thick over the Shear zone tailings and approximately 0.89 m thick over the B-zone tailings. The locations of the BEAK test hole locations are shown on Drawing 2. A comparison of the permafrost depth measurements are shown on Drawings 3 through 6 and in the following table.

PERMAFROST DEPTH MEASUREMENTS (SEPTEMBER 16, 1996)			
Thermistor No.	Estimated Permafrost Depth (m)	Thermistor Reading Permafrost Depth (m)	Cover Material Thickness (m)
1	1.90	1.95	0.6
2	1.85	2.25	1.1
3	1.85	2.10	0.9
4	1.75	2.10	0.8

notes:

1) estimated permafrost depths are based on probe refusal and are measured from the existing ground surface as of Sept. 16, 1996;
2) thermistor reading permafrost depths assume each of the thermistors were originally installed with the bottom at 1.4 m below the surface of the tailings.

Thermal Analysis

Although the thermistor readings have shown there has been some increase in the permafrost level, based on previous work and Trow reports there has been no significant increase in the level of permafrost over the past few seasons. A thermal analysis was used to model the conditions in the tailings area to help explain the thermistor results and make recommendations for the future.

Prior to covering the exposed tailings, an estimate of the active layer was obtained on September 20, 1990 by probing through the tailings and measuring the refusal depth. During this time, a maximum refusal depth of 1.4 m was recorded. Based on this measure of the active layer thickness, covering the exposed tailings with 1.4 m of on site material should have resulted in a 1.4 m rise in the permafrost level. Based upon the thermistor readings and the test pits of September 19, 1996, this has not been the case.

Assuming a linear temperature distribution in the thawed zone, a prediction of the original thaw depth in the tailings may be obtained by the following equation[2].

$$X = \sqrt{\frac{2k_u T_s}{L}\sqrt{t}} \quad (1)$$

where: X = the depth of thaw (m)
k_u = average thermal conductivity (W/m °C)
T_s = average surface temperature (°C)
L = soil volumetric latent heat (kJ/m^3)
t = time (in days)

Air temperature values from Cullaton Lake and Ennadai Lake were provided by Indian and Northern Affairs Canada and Environment Canada. The thermal conductivities were estimated from Fig. 318 and Fig. 319 in the Appendix of this report. The following assumptions were also made:

1. Air temperatures recorded at Ennadai Lake are similar to what is at Cullaton Lake;
2. The dry density and moisture content for the tailings is 1400 kg/m^3 and 32% respectively;
3. The dry density and moisture content for the cover material is 2100 kg/m^3 and 10% respectively;
4. The latent heat for water at 0°C is 333.7 kJ/kg;
5. The unfrozen water content, at and below the frozen zone, is very small.

A graph comparing air temperature data from Cullaton Lake and Ennadai Lake in May and June of 1995 is shown on Drawing No. 7. The comparison indicates that there are definite trends in the temperature but the temperatures at Cullaton Lake are on average, about 1.5°C lower. The graph also indicates that thawing begins towards the end of May and the beginning of June when average daily temperatures are greater than 0°C. On the basis of this comparison, it is considered appropriate to use air temperature data recorded at Ennadai Lake for this model with reasonable confidence. However, a small downward adjustment in the average air temperature should be made to approximate Cullaton Lake air temperatures.

Since air temperatures were not recorded at Cullaton Lake until 1994, the thaw depth was estimated from air temperatures recorded at Ennadai Lake in 1991. From this data, and the assumptions established for the on-site conditions at Cullaton Lake, the following information was obtained.

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2 Studies by Nixon and McRoberts (1973), Geotechnical Engineering for Cold Regions, Andersland. Anderson, 1978

k_u = 1.8 W/m °C (for the tailings)
T_s = 8.5°C (average annual air temperature)
L = 163500 kJ/m^3
t = 123 days (number of degree days above zero, supplied by Environment Canada)

Based on these data, the maximum depth of thaw, X in Equation 1, in the tailings in 1991 was 1.41 m. This compares favourably to the maximum depth of thaw estimated at 1.4 m on September 20, 1990.

Since the cover material has different thermal properties than the tailings, a two-layer problem must be considered. The time required to thaw the cover material can be solved by the following equation:

$$t_0 = \frac{H^2 L_1}{2 k_1 T_s} \qquad \textbf{(2)}$$

where: t_0 = time (in seconds)
H = layer thickness (m)
L_1 = soil volumetric latent heat (kJ/m^3)
k_1 = average thermal conductivity (W/m °C)
T_s = average surface temperature (°C)

Based on the air temperatures from Cullaton Lake in 1995, shown on Drawing 6, thawing at the ground surface began around June 1. The average air temperature above 0 °C recorded at Cullaton Lake over the first three weeks of June was 7.9°C. Based on the above equation, the time required to thaw the existing 0.9 m cover material is approximately 13 days.

A comparative summary of the frost levels using the readings in Thermistor #3 and the model from the two equations is presented in the following table.

ESTIMATES OF PERMAFROST DEPTHS (m)			
Date	Thermistor Value	Model	Probe Estimate
Sept 91	N.A.	1.4	1.4
Sept 4/94	2.2	2.5	N.A.
July 17/95	1.5	1.4	N.A.
June 21/96	1.1	1.2	N.A.
Sept 16/96	2.1	2.3	1.85

The model and thermistor readings give permafrost depths which are greater than field estimates would indicate. To obtain more accurate data for the model, additional field information would be required throughout the season. However, if the assumptions in this model are correct, it is clear that permafrost levels would not rise to the level of the tailings surface with the added 1.4 m of cover unless the cover material had the same properties as the tailings. The natural moisture content of the material, the existing on-site moisture conditions, and the density of the material affect the depth of thaw considerably.

Using the information presented in this analysis, it is estimated that up to 2.0 m of additional cover material would be required to raise the permafrost level to the surface of the underlying tailings.

Cover Material and Vegetation

Based on our field measurements and topographic survey, combined with information provided by Mr. Ron Nicholson from BEAK Consultants Ltd., an average of 0.67 m of cover exists over the Shear Zone tailings and 0.88 m over the B-Zone tailings. This is approximately 0.5 m less cover material than we recommended for cover over the B-Zone tailings[3]. A revised topographic survey plan which combines the HIW survey information and the former tailings beach area and our recent survey is shown on Drawing No. 6.

Due to the limited amount of available material, placing an additional 2.0 m of cover material may not be achievable. However, placing an additional 0.6 m of cover material and 0.1 m of natural surface material with existing vegetative matter will reduce the duration of the thaw in the underlying tailings considerably. Promotion of vegetation on the surface will help shield the permafrost from

[3] Abandonment and Restoration Plan, Cullaton Lake Gold Mines Ltd., Reference No. F-90132-A/E, May 7, 1991.

solar heat during the summer period thereby reducing thermal degradation of the frozen ground and raise the permafrost level[4].

Placing the additional cover material should prevent the underlying tailings from thaw until towards the end of July, or later. Using the model equations and average seasonal conditions, the tailings will thaw to a depth of about 1.0 m. However, with vegetation on the surface, the tailings may not be exposed to thaw until the end of August and may then only thaw to a depth of about 0.4 m. The type and coverage of vegetation will influence the effect it has on the permafrost level. From a field study conducted by Trow in June of 1990[5], the following plant species were known to grow at Cullaton Lake.

PLANT SPECIES, CULLATON LAKE	
Identification	Common Name
Rhododendron lapponicum (L.) Wahlenb.	Arctic Rosebay
Betula glandulosa Michx.	Dwarf or Ground Birch
Empetrum nigrum L. ssp. hermaphroditum (Lge.) Bocher	Crawberry
Vaccimium uliginosum L. s. lat.	Bilberry
Saliz sp	Willow Special
Picea mariana (Mill) B.S.P.	Black Spruce

To allow a quicker rise in the permafrost level, the additional cover material should be placed when the underlying soil is still frozen at the end of May or beginning of June.

SUMMARY

The tailings dams are presently stable under the current site conditions. Some minor repair work around the main spillway should be addressed to cover the exposed liner. Consideration should be given to removing the exposed and damaged sections of liner in Tailings Area 2.

The water level in Tailings Pond No. 1 was the same this year as it was in June, 1992 and there were no exposed tailings in the area.

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4 U.S. Army Corps of Engineers, 1966; Linell 1973.

5 Letter to Mr. Bill Napier, Corona Corporation, September 21, 1990.

The permafrost was estimated at an average depth of 1.85 m by probing in the test pits in the covered tailings area. Based on the thermal analysis model and the less than expected amount of cover material, the permafrost will not rise to the expected level. To reduce the exposure time the tailings will be in a thawed state, combining additional cover and vegetation on the surface is recommended in the B-Zone tailings area.

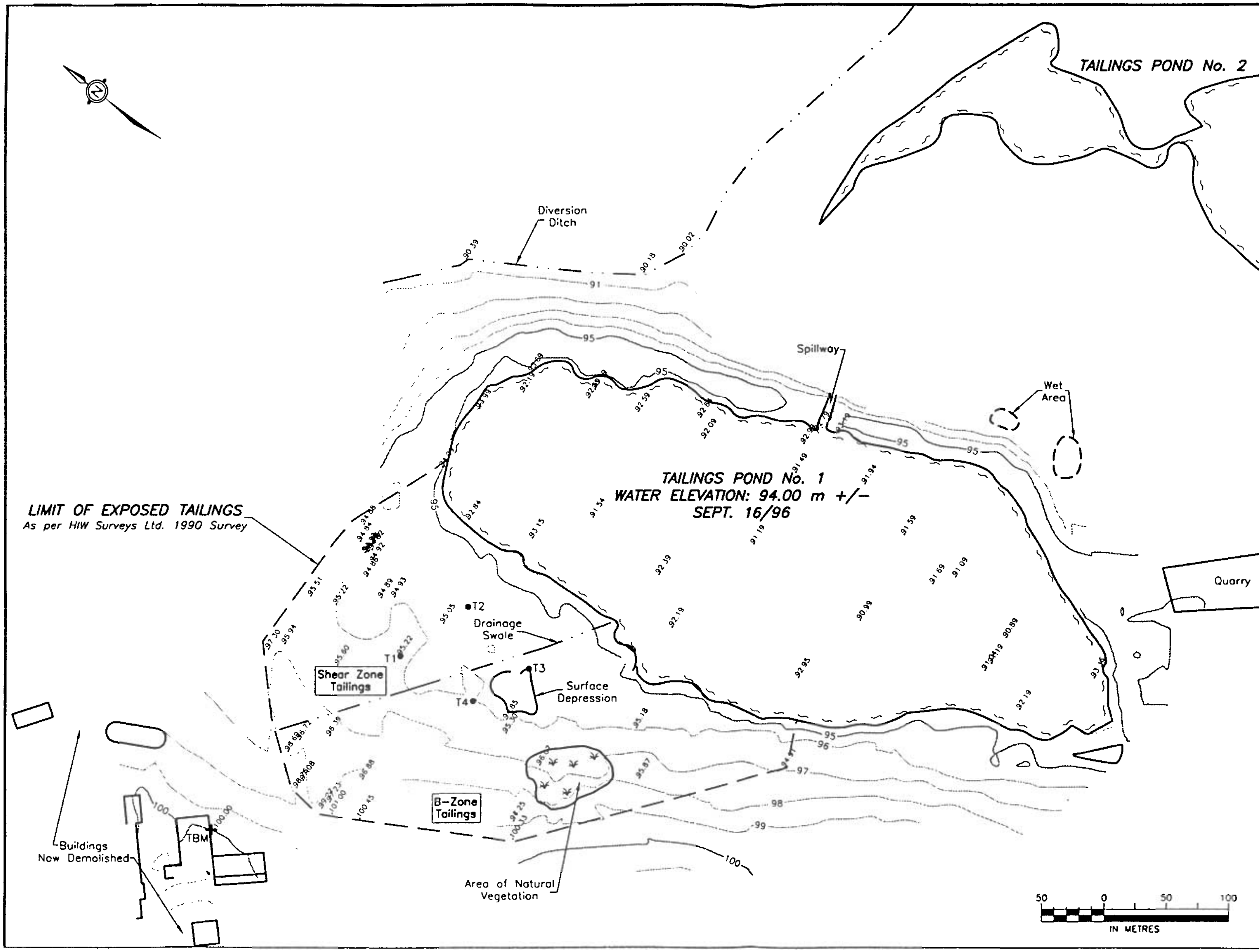
If you have any comments or questions regarding this letter, please contact us at your convenience.

Yours truly,
TROW CONSULTING ENGINEERS LTD.

Don Kaluza, P. Eng.

R.B. Dodds, PhD., P. Eng.

Demetri Georgiou, MASc., P. Eng.
Branch Manager



TROW CONSULTING ENGINEERS LTD.
Thunder Bay, Ontario, Canada

LEGEND

+TBM	Temporary Benchmark
•T2	Thermistors
95.05	Elevation from HIW Survey (1990)

NOTES:

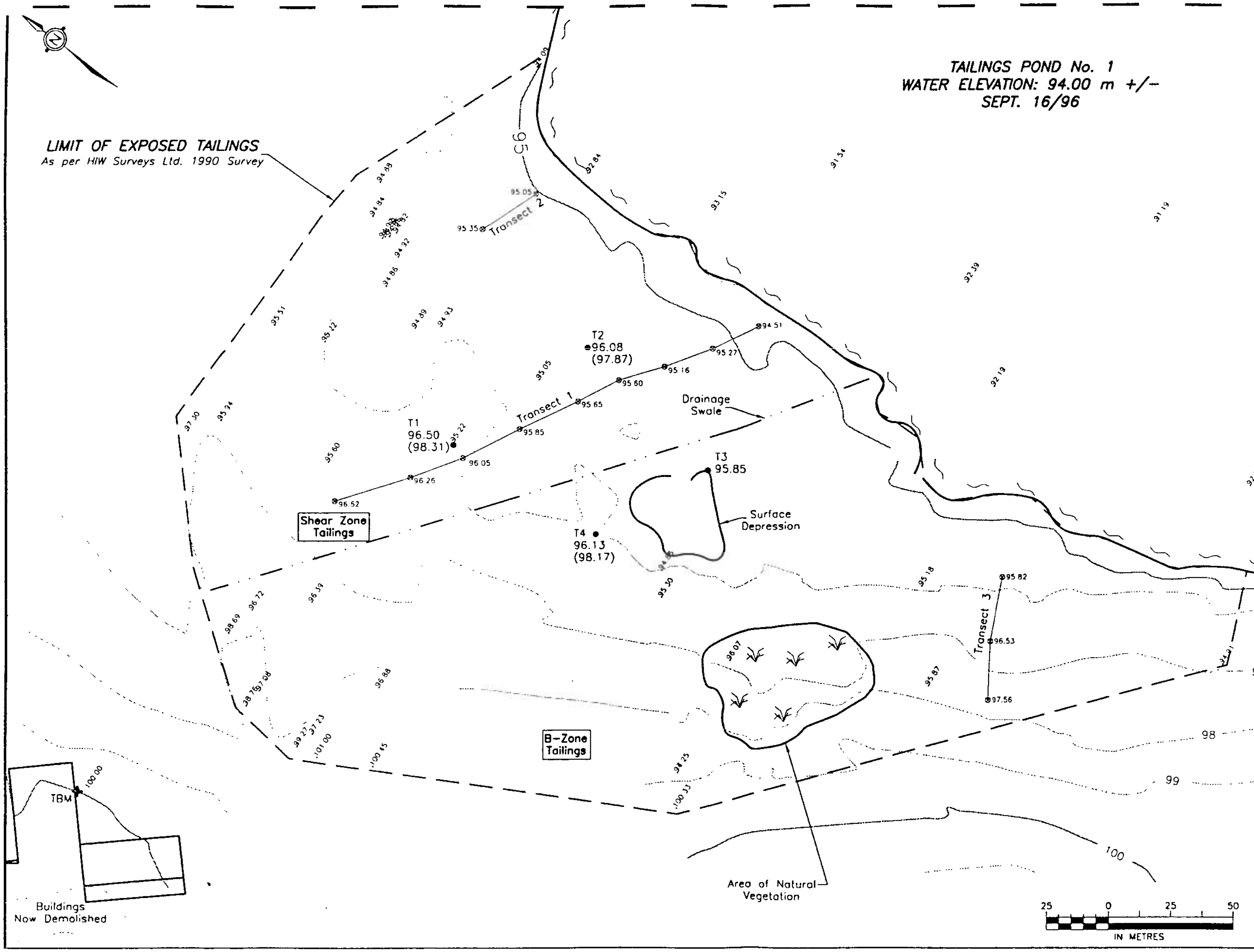
1) Elevations are in metres and referenced to a TBM located on concrete slab at North East corner of mill. Assumed Elevation 100.00m

2) Limit of Covered Tailings from HIW Surveys Ltd., Sketch Plan Showing Tailings Pond Survey, Drawing No. 5, dated 11/10/90.

3) Contours are shown in 1m intervals and represent 1996 conditions. Spot elevations represent conditions in 1990.

Client: Homestake Canada	
Project: Cullaton Lake Gold Mine	
Title: Tailings Pond Area No. 1	
Project No. F-90132-B/E	Dwg. No.: 1
Drawn By: DT	Reviewed By:
Date: Nov. 27/96	
Scale: 1:3000	

* - Scaled down from 11" x 17" to 8½" x 11" for fax only



TROW CONSULTING ENGINEERS LTD.
Thunder Bay, Ontario, Canada

LEGEND

TBM	Temporary Benchmark
T1 • 96.50 (98.31)	Thermistors Ground Elevation (1996) Top of PVC Casing Elevation (1996)
95.05	Elevation from HIW Survey (1990)
95.82	BEAK Observation Well with Elevation (1996)

NOTES:

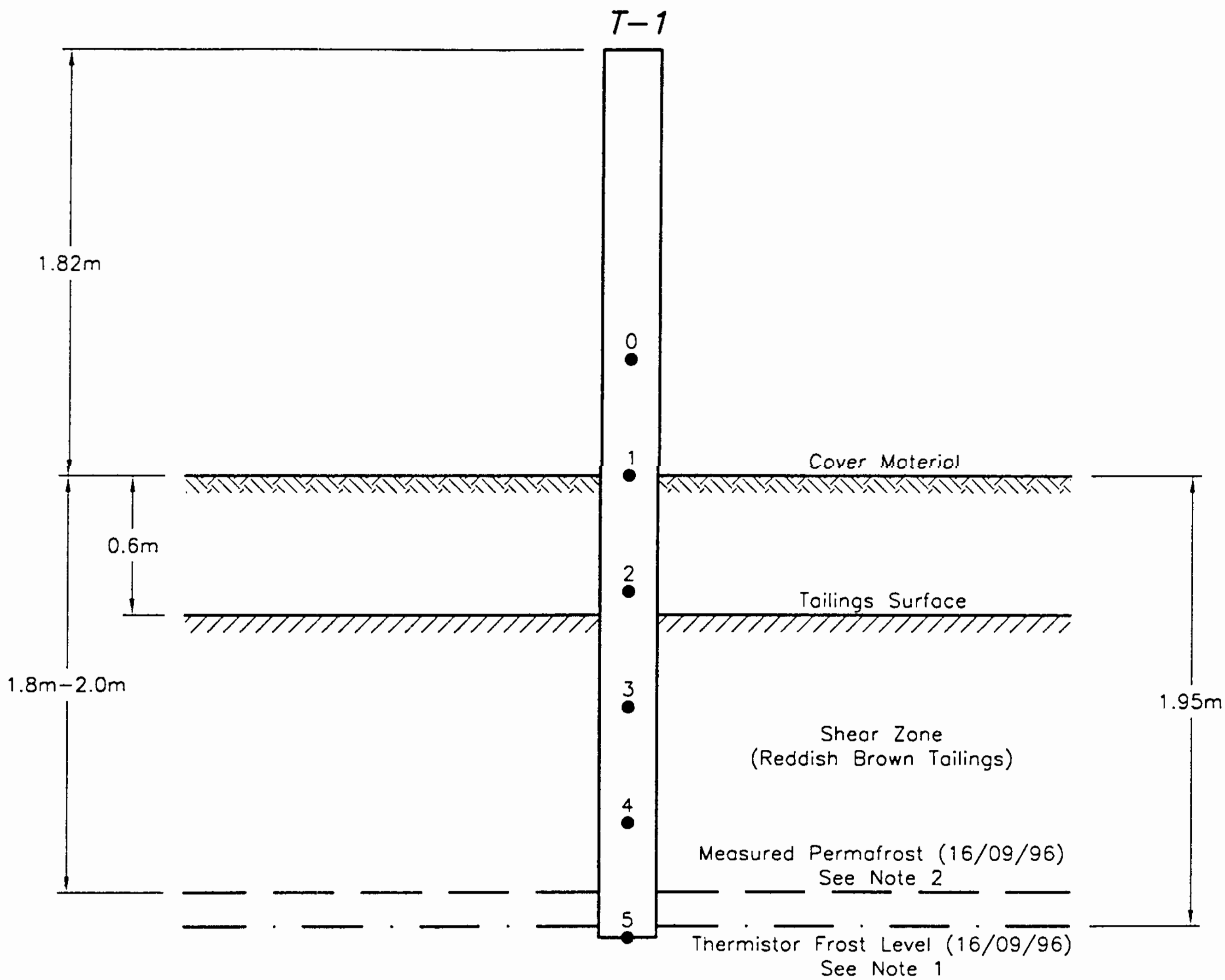
1) Elevations are in metres and referenced to a TBM located on concrete slab at North East corner of mill. Assumed Elevation 100.00m

2) Limit of Covered Tailings from HIW Surveys Ltd., Sketch Plan Showing Tailings Pond Survey, Drawing No. 5, dated 11/10/90.

3) Contours are shown in 1m intervals and represent 1996 conditions. Spot elevations represent conditions in 1990.

Client: Homestake Canada
Project: Cullaton Lake Gold Mine
Title: Covered Tailings Area
Project No.: F-90132-B/E
Dwg. No.: 2
Drawn By: DT
Reviewed By:
Date: Nov. 27/96
Scale: 1:1500

* Sharon - This drawing was scaled down from 11" x 17" to 8½" x 11" for fax only

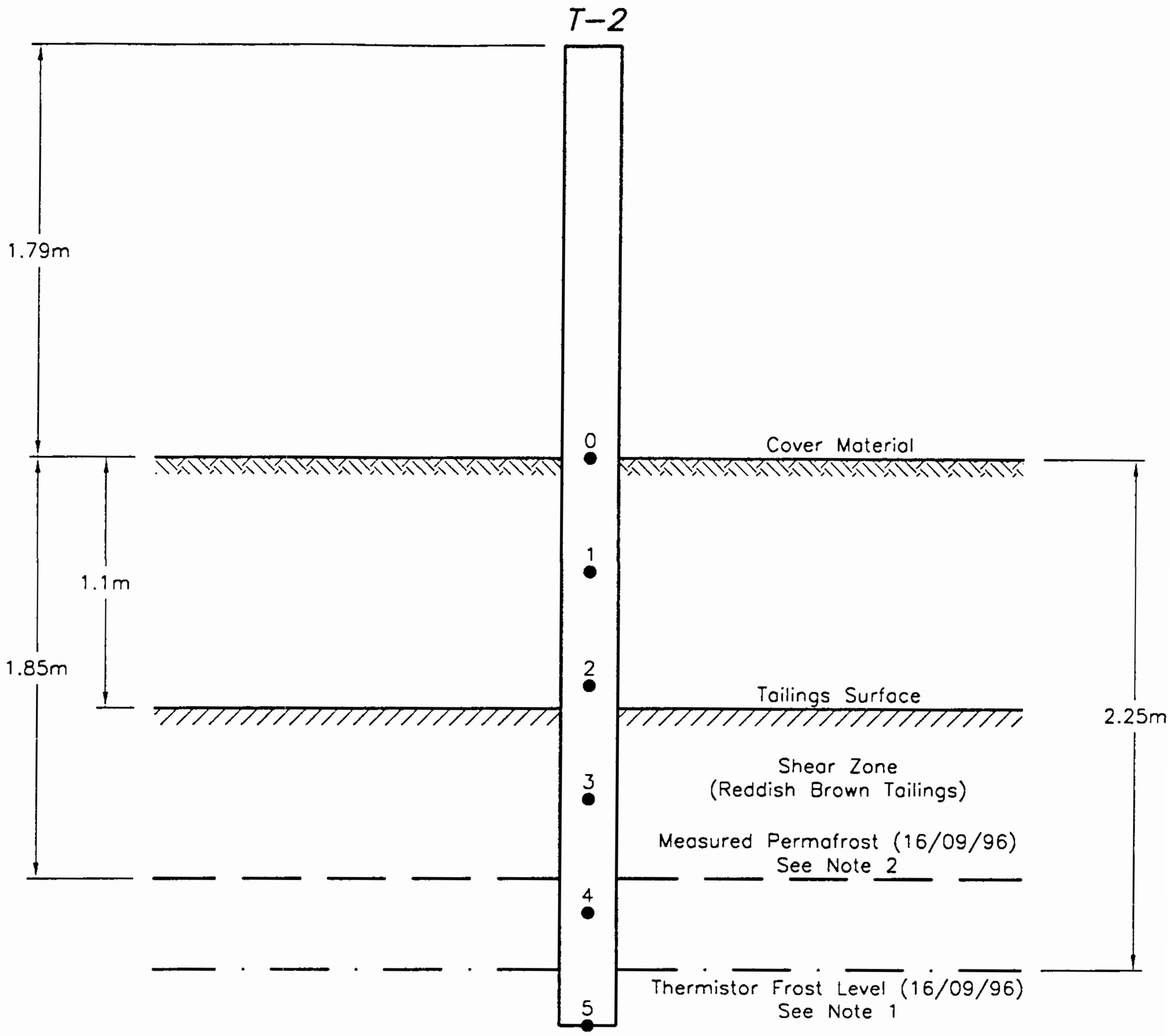


Note:

1) The thermistor frost level assumes that the lowest Thermistor #5 was installed at a depth of 1.4m below the tailings surface.

2) Measured permafrost levels were obtained by hand digging and probing with a steel bar.

TROW CONSULTING ENGINEERS LTD. Thunder Bay, Ontario, Canada		DRAWN BY: DT	DATE: Oct. 29/96	
		APR. BY:	REVISED:	
		SCALE: NTS		
CLIENT:	Homestake Canada	TROW FILE NO. F-90132-B/E	DWG. NO: 3	REV. △
PROJECT:	Cullaton Lake Gold Mine			
DWG TITLE:	Thermistor String Configuration (T-1)			

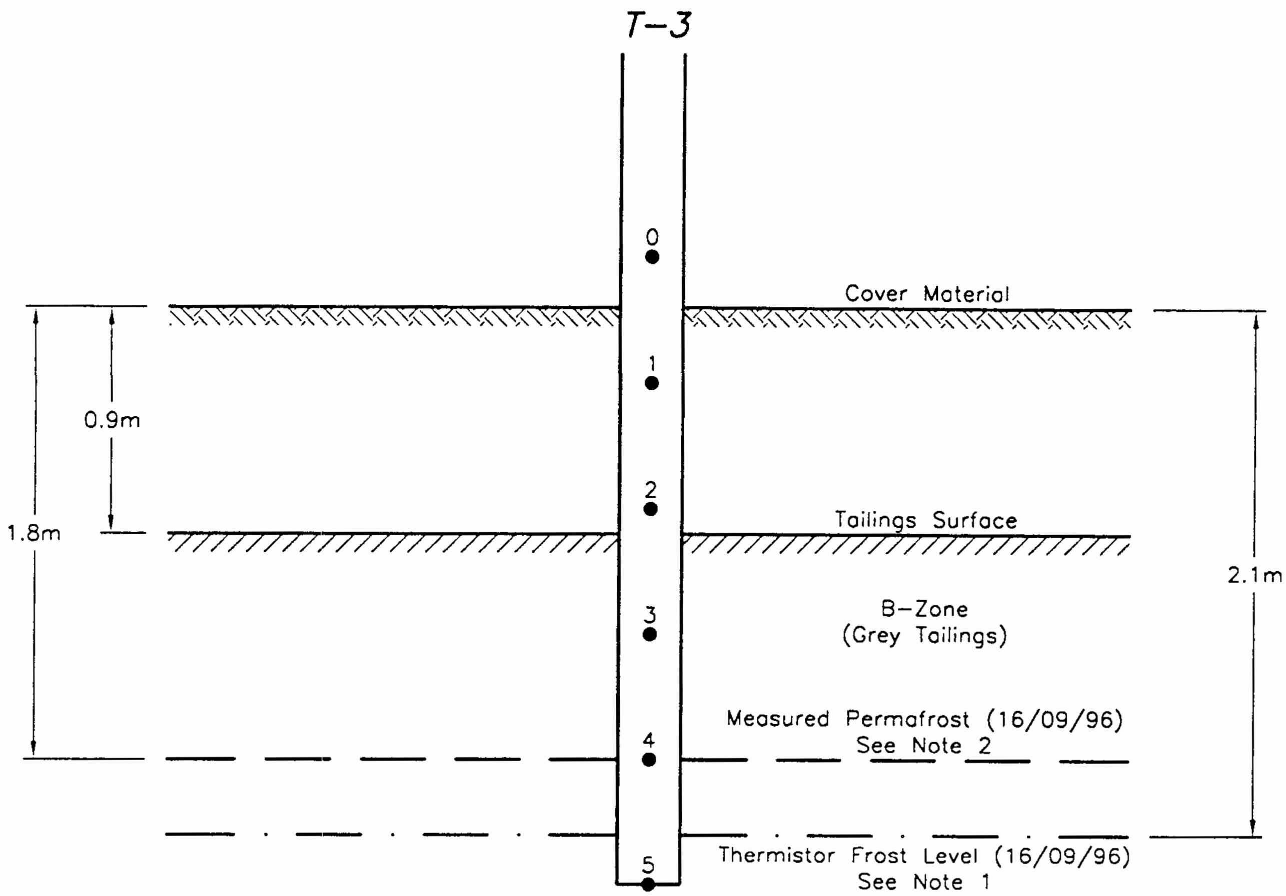


Note:

1) The thermistor frost level assumes that the lowest Thermistor #5 was installed at a depth of 1.4m below the tailings surface.

2) Measured permafrost levels were obtained by hand digging and probing with a steel bar.

TROW CONSULTING ENGINEERS LTD. *Thunder Bay, Ontario, Canada*		DRAWN BY: DT	DATE: Oct. 29/96
		APR. BY:	REVISED:
CLIENT:	Homestake Canada	SCALE: NTS	
PROJECT:	Culloton Lake Gold Mine	TROW FILE NO. F-90132-B/E	DWG. NO: 4 / REV.
DWG TITLE:	Thermistor String Configuration (T-2)		

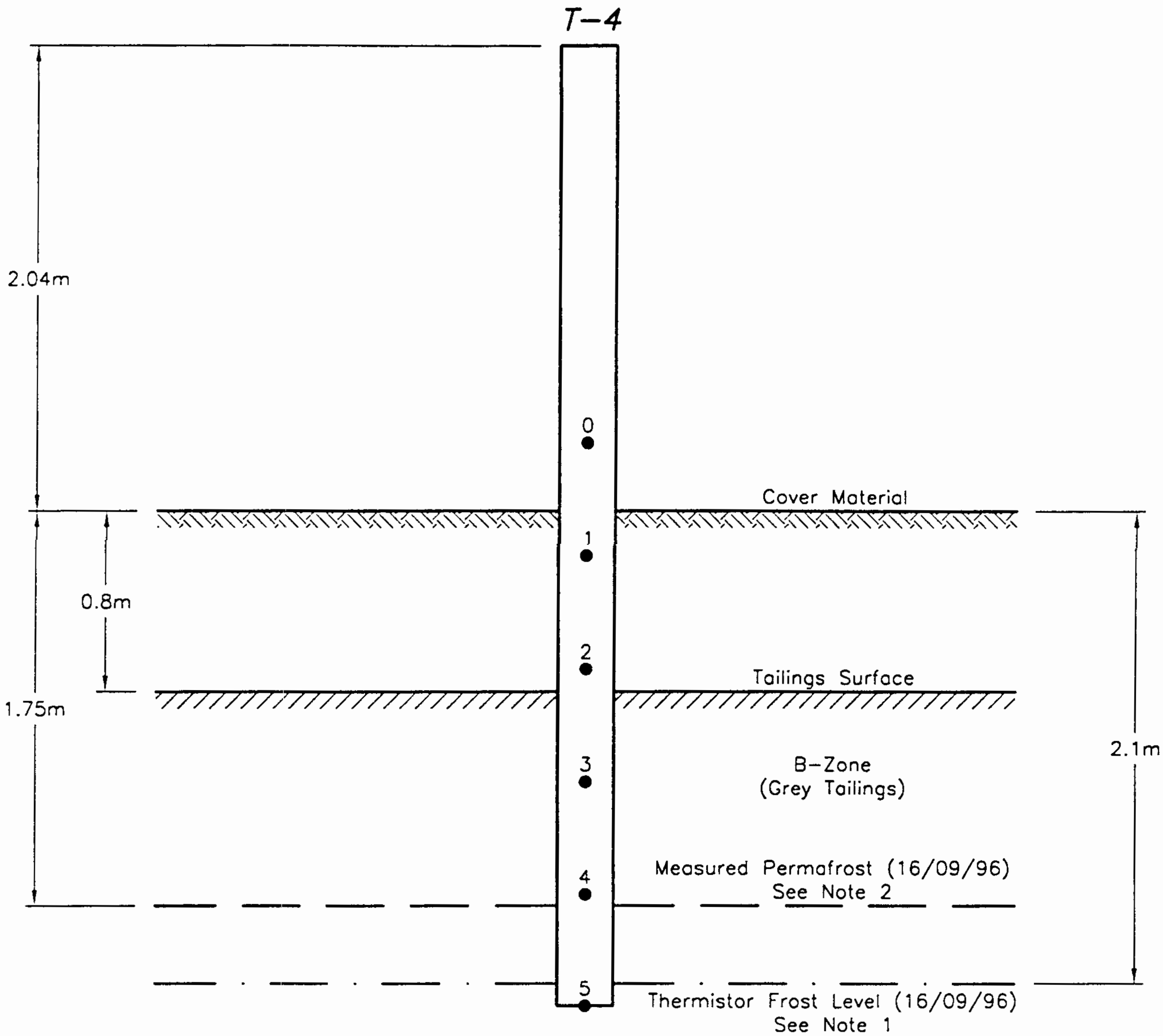


Note:

1) The thermistor frost level assumes that the lowest Thermistor #5 was installed at a depth of 1.4m below the tailings surface.

2) Measured permafrost levels were obtained by hand digging and probing with a steel bar.

TROW CONSULTING ENGINEERS LTD. Thunder Bay, Ontario, Canada	DRAWN BY: DT	DATE: Oct. 29/96	
	APR. BY:	REVISED:	
CLIENT: Homestake Canada	SCALE: NTS		
PROJECT: Culloton Lake Gold Mine	TROW FILE NO. F-90132-B/E	DWG. NO: 5	REV. △
DWG TITLE: Thermistor String Configuration (T-3)			

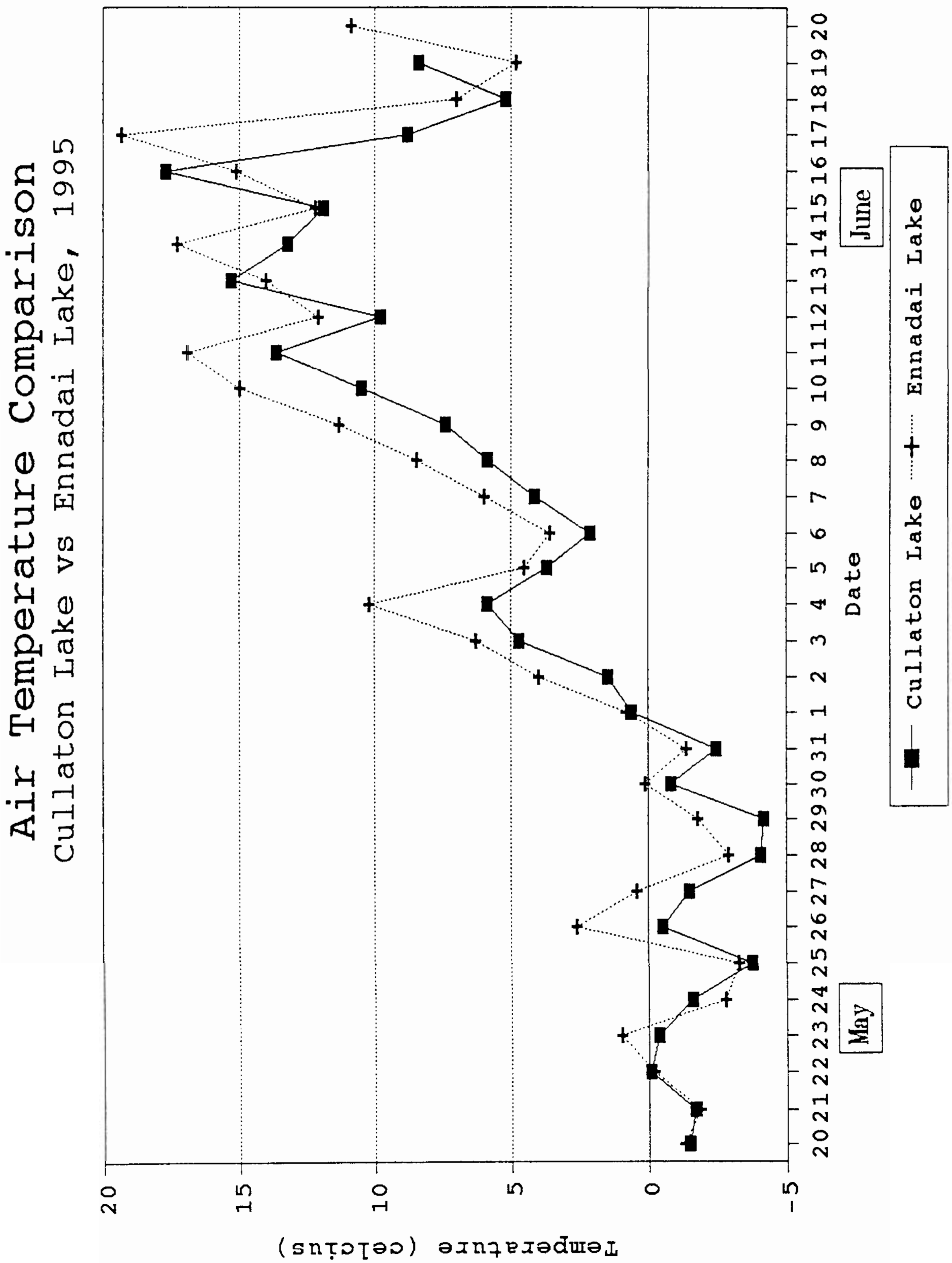


Note:

1) The thermistor frost level assumes that the lowest Thermistor #5 was installed at a depth of 1.4m below the tailings surface.

2) Measured permafrost levels were obtained by hand digging and probing with a steel bar.

TROW CONSULTING ENGINEERS LTD Thunder Bay, Ontario, Canada		DRAWN BY: DT	DATE: Oct. 29/96	
		APR. BY:	REVISED:	
		SCALE: NTS		
CLIENT:	Homestake Canada	TROW FILE NO.	DWG. NO:	REV.
PROJECT:	Culloton Lake Gold Mine	F-90132-B/E	6	
DWG TITLE:	Thermistor String Configuration (T-4)			


Air Temperature Comparison
Cullaton Lake vs Ennadai Lake, 1995
Temperature (celcius)
20
15
10
5
0
-5
Date
20 21 22 23 24 25 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
May
June
Cullaton Lake
Ennadai Lake

Trow

F-90132-A/G

Figure 1: Tailings near surface at west shoreline.

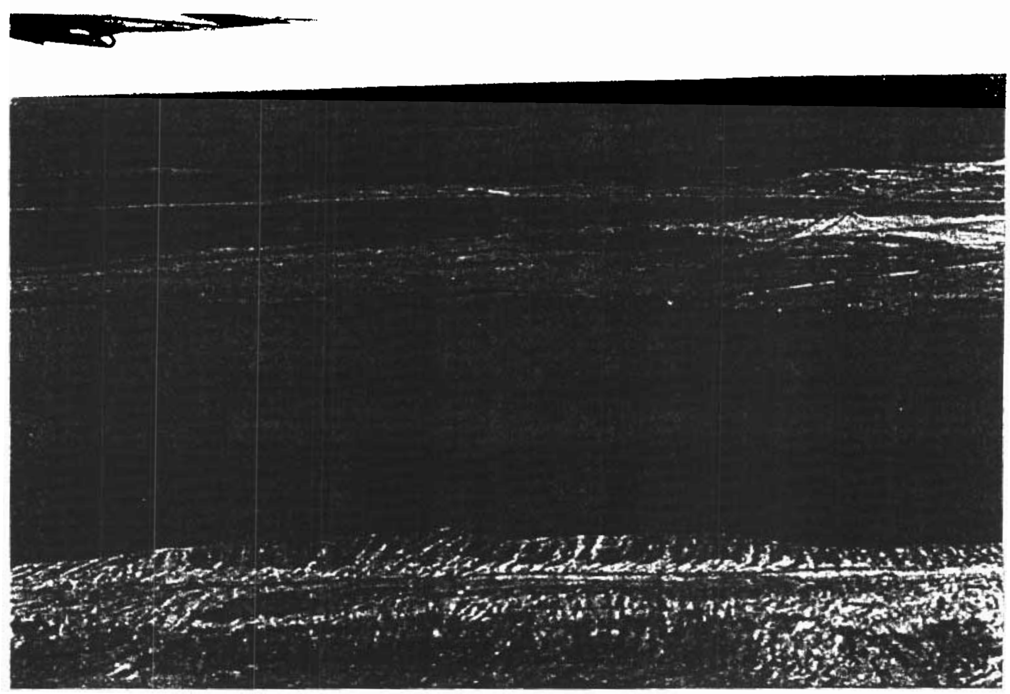


Figure 2: Tailings near surface of water; aerial view looking west.

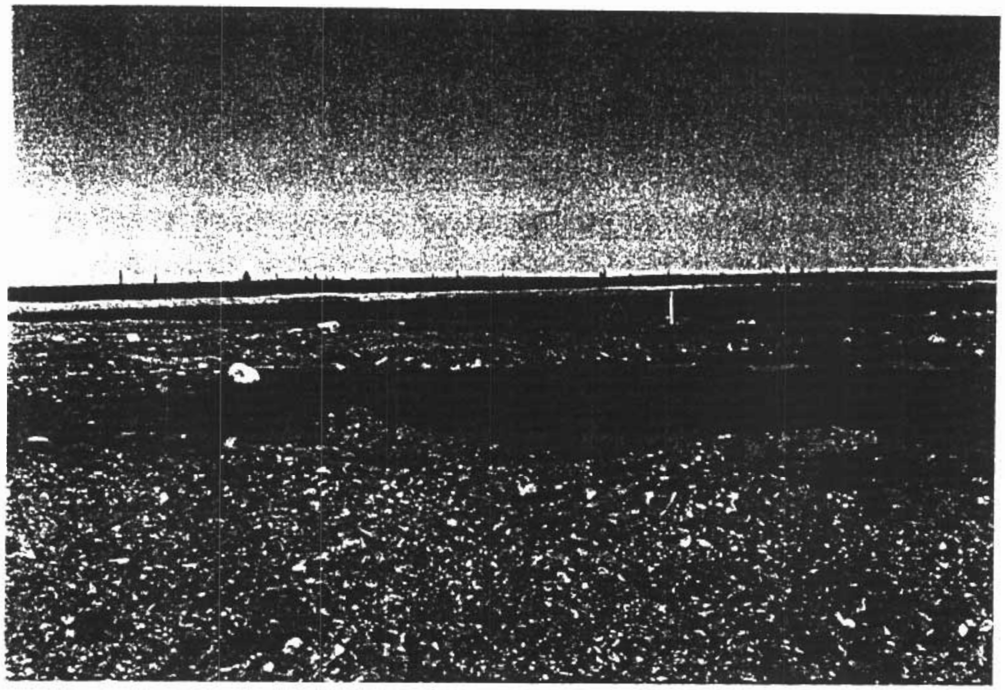


Figure 3: Surface depression in B-zone covered tailings area.

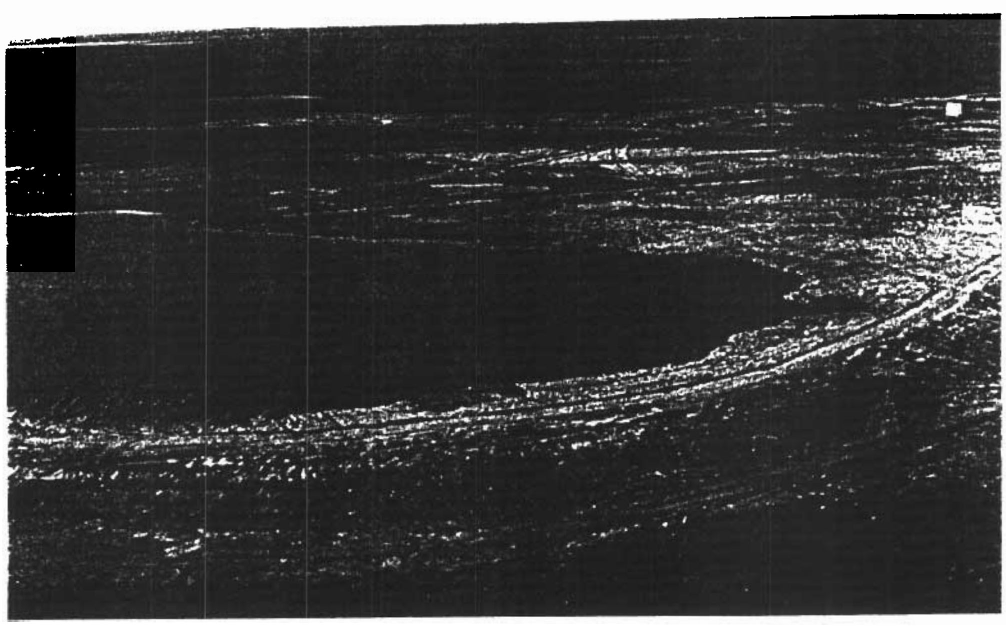


Figure 4: Aerial view of surface depression in B-zone covered tailings area.

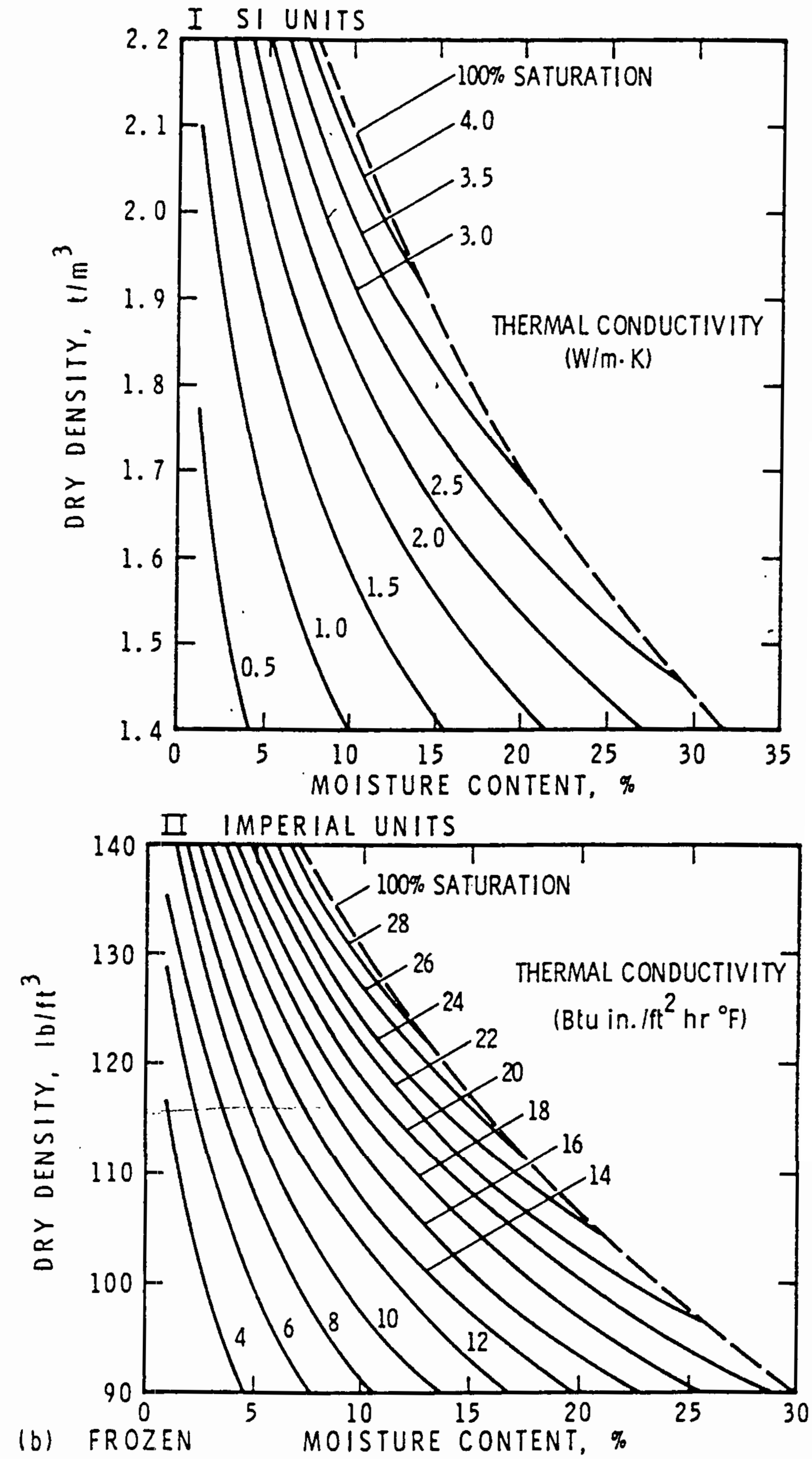


FIG. 3.19 (b) Thermal conductivities of frozen coarse-grained soils (After Kersten 1949).

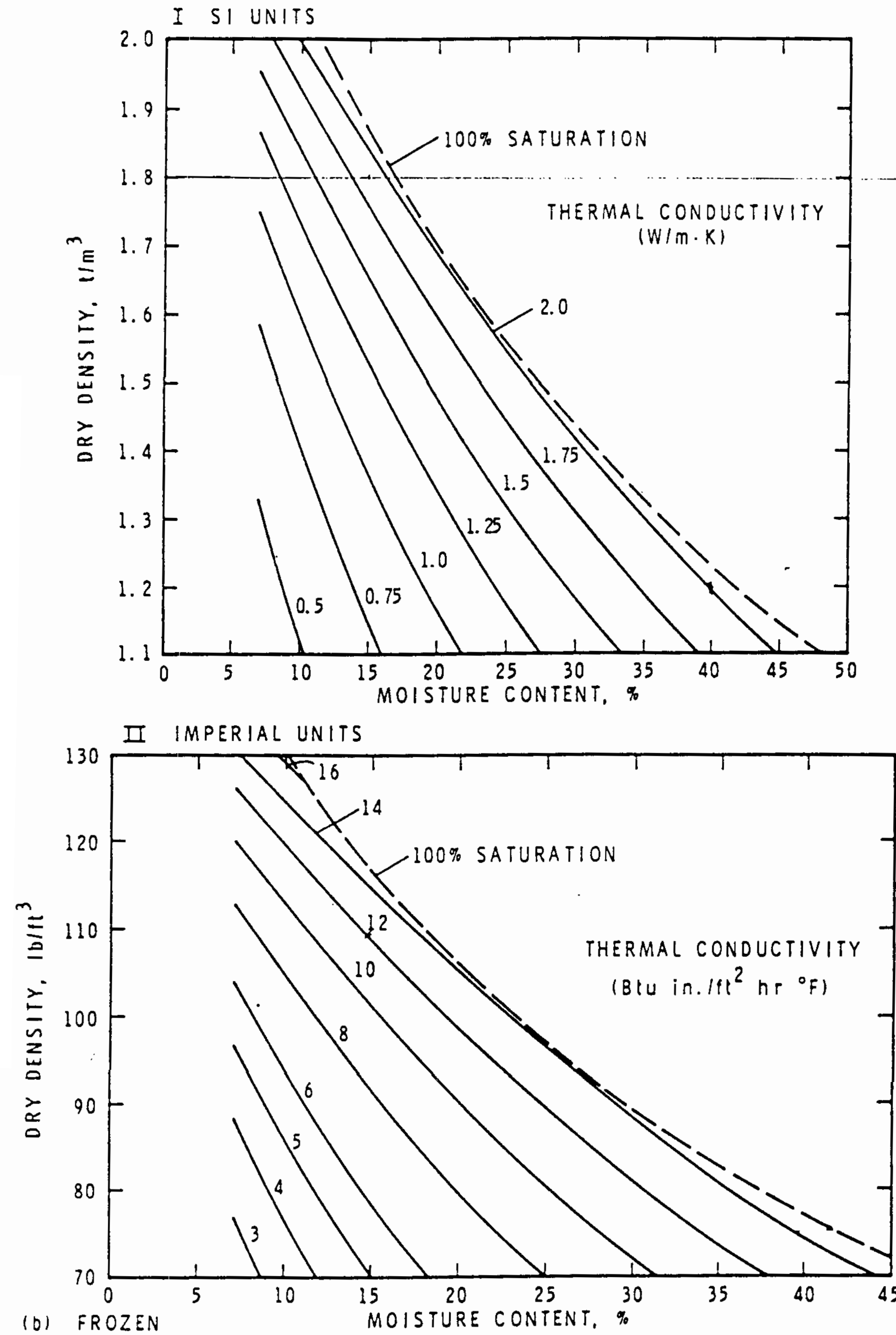


FIG. 3.18 (b) Thermal conductivities of frozen fine-grained soils (After Kersten 1949).