

019581

LETTER OF TRANSMITTAL

**Golder Associates**

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

TO Milos Stepanek
Geo-Engineering Ltd
10, 1915 - 32nd Avenue N.E.
Calgary, Alberta

DATE	10 Jan '90	JOB NO.	802-2410
ATTENTION	Milos Stepanek		
RE	Diversion Canal Stability at 2+100, Faro, Yukon.		

GENTLEMEN:

WE ARE SENDING YOU Attached Under separate cover via _____ the following items:

THESE ARE TRANSMITTED as checked: For approval For your use For review and comment As requested

Milos,
 Sorry for the delay in sending you information. Please find enclosed

- Plan showing borehole locations at stations 2+115 and 2+160 and sketched on horizontal movements up to 28 June '89
- plot of horizontal movement versus time
- table of total horizontal movements to 28 June '89
- Reduction data for the 4 slope indicators for 28 June '89 reading
- 2 Figures showing the toe berm stabilisation carried out.

We are waiting on a second set of readings to be taken after the toe berm installation and will then send a complete package.

COPY TO Greg Tilson, Curragh

SIGNED: D. Kettle

If enclosures are not so noted, kindly notify us at once.

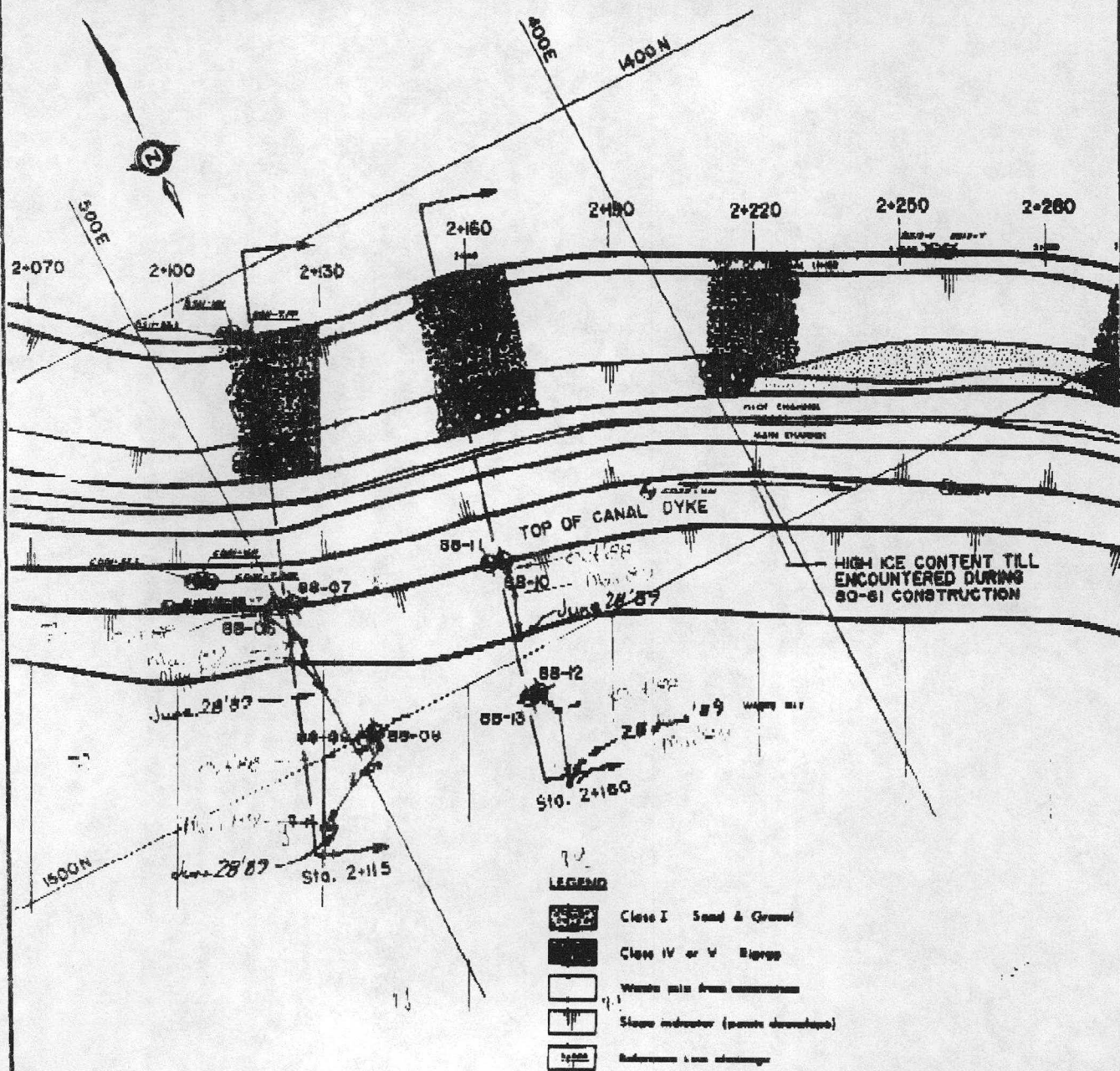
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DIVERSION CANAL DYKE 1988 BOREHOLE LOCATION PLAN STATIONS 2+115 TO 2+160m

Figure 11-4



PROJECT No. 882-2410 DRAWN BY RK REVIEWED BY DATE HCV 88

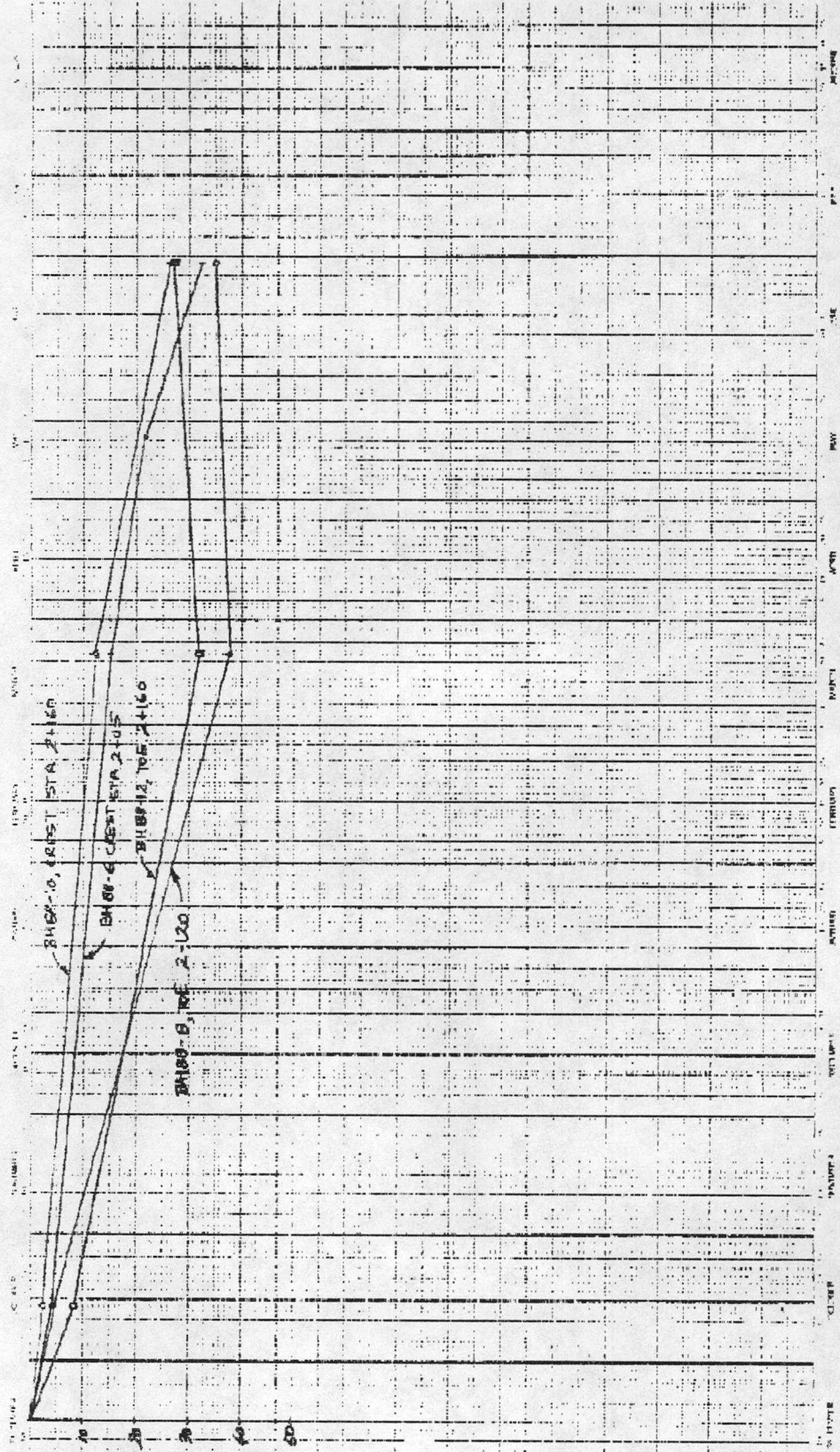
ES2 2410

SLOPE INDICATOR
TOTAL HORIZONTAL SURFACE DISPLACEMENT
VS TIME

1989

1988

TOTAL HORIZONTAL SURFACE DISPLACEMENT (mm)



Golder Associates

SUBJECT SI Tribal River Navigation Co	Job No.	Made by C	Date September 24 89
	Rev.		
Checked	Reviewed	Sheet	of

DATE	BU 88-6			$\Sigma = \sqrt{x^2 + y^2}$ BU 88-8			BU 88-10			BU 88-12		
	x	y	Σ	x	y	Σ	x	y	Σ	x	y	Σ
1988 Sept 15	initial houseline readings											
Oct 13	+3.8	+1.6	4.1	-0.4	+4	4.4	-1.4	+1.7	2.2	-5.2	+6.4	8.2
1989 Mar 22	-8.4	12.2	15.0	19.5	32.2	37.6	-1.6	+11.9	12.0	-3.4	31.7	31.9
May 16	-7.3	20.3	21.6									
June 28	-14.8	28.7	32.3	16.0	31.3	35.2	-0.1	26.2	26.2	-8.8	25.6	27.0

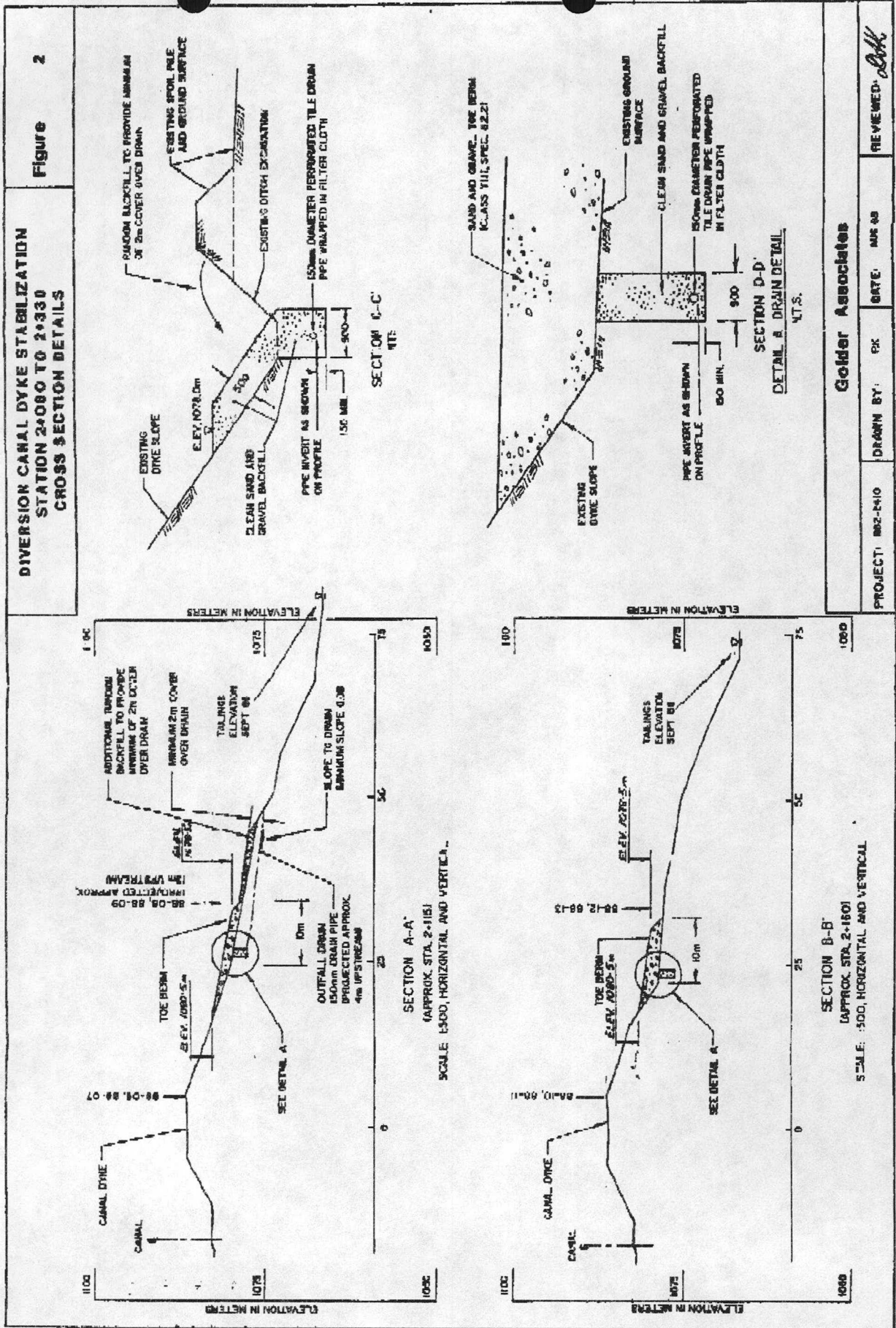
06-Jul-89

Carragh Resources Inc. - Slope Indicator Reduction BH88-B

882-2410

Date of reading : 28 June 1989

Depth	: Ini. reading : A+, B+ rdgs with upper wheel to black mark/downslope				: CHANGE				: SUM OF CHANGES				: DEFLECTION					
	: below 15 Sept 88 : A-, B- rdgs with lower wheel to black mark/downslope				: FROM BOTTOM OF				: HOLE				: Y, +ve : Y, +ve					
Top of casing	A	B	DIFF	DIFF	A	A	DIFF	DIFF	B	B	DIFF	DIFF	A	B	A	B	d/slope	u/stream
0.0																	31.3	16.0
0.5	8	-30	29	-18	11	47	-17	13	-4	-30	39	20	319	160	27.4	14.0		
1.0	6	-70	27	-17	10	44	-11	5	-6	-16	38	54	274	140	23.6	8.6		
1.5	37	-96	44	-34	10	78	-29	27	-2	-56	41	40	236	86	19.5	4.6		
2.0	215	-108	134	-124	10	238	-62	58	-4	-120	42	-12	195	46	15.3	5.8		
2.5	232	-127	152	-143	9	295	-68	63	-5	-131	43	-4	153	58	11.0	6.2		
3.0	277	-178	128	-118	10	246	-80	76	-4	-156	-31	22	110	62	14.1	4.0		
3.5	328	-226	197	-189	8	386	-113	104	-9	-217	58	5	141	40	8.3	3.1		
4.0	289	-237	181	-170	11	351	-112	110	-2	-222	71	15	83	31	1.2	1.6		
4.5	296	-222	137	-147	10	304	-103	103	-2	-208	8	14	12	16	0.4	0.2		
5.0	392	-171	202	-192	10	394	-86	83	-3	-169	2	2	4	2	0.2	0.0		
5.5	400	-208	206	-196	10	402	-105	102	-3	-207	2	1	2	0	0.0	0.1		
6.0	411	-246	210	-201	9	411	-126	122	-4	-248	0	-2	0	-1	0.0	0.1		
6.5	414	-251	212	-203	9	415	-128	123	-5	-251	1	0	0	1	-0.1	0.1		
7.0	418	-274	213	-204	9	417	-139	134	-5	-273	-1	1	-1	1	0.0	0.0		



**DIVERSION CANAL DYKE STABILIZATION
STATION 2+080 TO 2+330
CROSS SECTION DETAILS**

Figure 2

Golden Associates

PROJECT: 882-1410	DRAWN BY: PK	DATE: MAR 88	REVIEWED: <i>AKH</i>
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DIAND INTERVENTION

Tailings physical stabilization
60602 mainly chemical

Stepanik :

Quotes from Robertson paper on (86) surface
mine stability

sees possibility of irreversible steps being
taken in tailings pond - wants the
Board to insist on

Problems in current opn.

Rose Ck diversion - if failure and
discharge - may be serious
problem in safe conveyance
of water

X valley dam

high volume of seepage and
lack of proper collection
and safe conveyance
esp in winter when
discharge freezes and
water not carried away

Cracking is significant and
has to be established why occurring
and means taken

Fresh works worse than X valley

1.2 Factor -

locally 1.1

badly cracked at crest
cracks opened since last year
they are more and
bigger

other out of 14 checks on workdumps
4 exp failure because of
foundation problems - near
creeks

Cause way - not contr.
according to specs - no
discharge apron.

Number of issues that can be
resolved at operational stage
rather than allowing to
slip in to Ab. stage when
problem worse.

Notes

Cunvaugh should provide conceptual plan
for physical stabilize along with proposed
program of study for physical stabilize
so that in 1991 both chem and phys.
stabil will be on table.

Don't see physical stabiliz. to be sequential
to chemical.

See physical stab of failings to be major
issue

Maintenance

mechanism not spelled out
nor are costs other than Rescan

Water Quality

He was
confused in
what we want.
thought we favored
a discharge std.

should be specified for Abandonment
So can be used as a performance
evaluation tool.

Develop model to predict water
quality - pleased to hear our
intentions -

Warway (Minkes Div.)

Design constr safety stds
Design Flood
Seismic

old lic: possible max Flood
max credible earthquake.

Browner & Curvagh agree stds needed.

DIAND will participate in a process
the WB may setup ackn. our willingness
to participate.

Privett

Econ Dev Branch
(on Financial Issues)

Review of Trust Fund Growth w/ their
costs of abandonment.

want overall review of TEF at lic.
renewal.

Should be sufficient funds for stand of
mine

TEF should not be used prior to
Final abandonment

Curvagh has agreed the funds will
not be withdrawn except for items in an approved
plan. ~~oo~~ should not draw funds until 1991

Min. of Diand should have draw if WB
draws length of Trustees

Sept 85 letter of Curran → CANAC provides guidance

Nikel

agreed to 4 of 5 proposed amendments
but want commitment to carry out submission of tailings abandonment plan.

Fresh water reservoir - not opposed to fish habitat.
~~not~~ feel that biggest threat is loss of tailings

Requirement should be left in license
want the office const. → obtain license

1:500 spillway is not a typo - Board put it in because of concern over dyke failure - Apparently discussed in a post Down Valley hearing - prior to use of DV. - 1781??

They actually said something good about this.

DIAND not committed to provide funding for Research but will ~~not~~ consider funding requests and see what can be done.

Browner to Nikel 3

— what flood return period do you see?

Nikel is a chemist pass to Stepanik

from a

if structure is 40' high - $\frac{1}{2}$ of pass max flood

" low - 200 yr \pm

if impact is low for structure \pm 50 yr

— Seismic risk?

ans

max probable seismic risk for this site

— What Safety factor for X-valley in light of seismic risk.

1.5 for both overall and local

Nikel wishes a process to determine these parameters

Browner to Nikel

P 13 Item F

do you mean Maximum Probable Flood &
Max Seismic event?

answer No -

WB legal Counsel to Privett re TEF

The 8.5M min aband. cost is in 1988 dollars?

were there any deductions from the TEF in your analysis no.

Granger to Stepanik

what do you think of plan for ^{FW} Reservoir dam.

Prudent considering history of structure, design, & performance
to maintain would call for major up grading

Rock Conveyer

what is discharge apron?

Normal practice to place additional material so water can discharge without erosion

was this recommended by Curvagh Consultants?

Yes.

Granger to Nikel

6 yrs 5 year question, what do you think of 3 yrs?

Nikel wants 5 yrs because there are 5 year notices elsewhere in license regarding onset of abandonment.

Granger to Privett

are you satisfied with T&F agreement, the indenture?

No, notes written can be improved to reflect spirit of '85 Sultan letter in evidence.

Camp: what about amendments

Don't know what's on table, will monies be spent before 1991

What do you see minister doing with the Funds you feel should have access to?
— carry out abandonment —

would min. be ~~an~~ responsible if dams failed after spending money.

Granger says they would be

Would Diand be the depositor in a manner
to the Min. of Finance in B.C. along the
lines of the BC system Brauner described.

So diand would hold the fund?

we hold similar security for other activities

YES wrap up.

want Mar 1989 schedule ?? - or Fall Plan??

Still want backup fund.

Removing much overhead should be prepared
to put something back.

EPS backup

morning schedule

DIAND

Board will ask for legal opinion
on the validity of the TEF

and contact us with their findings

then move with subv. and or hearing
on TEF.

Ehlers to DFO

Fisheries views on removal of created habitat - no real answer.

Sutter to DFO

is it likely that the N Fork population will survive. - maybe if left alone.

Granger to Wilz

How does BPS see the Gov spending the TEF for dam construction?

What is Tailings committee?

0.03 is an effluent level? - no a receiving water level.

Definitions are taken care of ~~to~~ for "Project"

Final abandonment not temporary or interim abandonment.

Mutual only trust co doing business in Yukon
we wanted a responsible reliable company

part of
Mutual Life of Canada, a highly regarded trust
company.

governed ~~by~~ by Canadian and British Ins Act with limits
on types of investments

Wet vs Dry tonnes. go Wet as in master agreement

Review of Fund in 1991 vs 7.5 cap.

will agree to redraft the fund but
wording will be difficult

"absent any changes by periodic review
the cap will be 7.5"

Mutual may add --- (come out of mutual)

- option for voluntary payment - not
public.

- can't be merged with any other Fund.

commingling of funds

Whitehouse Bank and Account

bank but not account #

Delegation to Carrrough employee

only delegation of administrative duties

Permitted investments

1) mutual funds - pooled funds of Mutual Trust
0 \rightarrow 5×10^6 is dealt with as segregated funds.

"new, rapidly growing funds" !! rather than small

2) won't do anything in contravention of the Act. - govt out says 35% is limit for "mutual funds" - but we will stick to

3) other investments - add such other high quality investments will work this out

Clause 10 b

Abandonment is a plan that we submit and
is approved by the water board.
we won't use fund for abandoned means
we don't agree with

unsecured loans

limit the amount - sometimes
may want to loan money to

Yearly Audit

will provide to WB

Remuneration

will be disclosed in Annual Report
Trustees are Voluntary
Mr Bell token remuneration + expenses
Mutual usual fee 5000 \$ >

Nordin

3810 elevation likely hood of overtopping
remove trees!

Brauner

Curragh's resp

- initiate responsible programs to minimize env impact

Curragh's expect

- license stipulations will be reasonable.

MAX POSS FLOOD - "unreasonable criteria" he said
~~seismic~~ Risk - should be investigated
potential for liquefaction

what Safety Factors for stability for
various components

x vally

Intermediate

Fresh Water

~~Risk~~ per Brauner

most critical - earthquake signifying
foundation under x vally dam

- how large earthquake / frog

- return period for floods

1:500 is too high because
of wholesale damage.

- dilation -

- concept is a valid design
criterion

- same for tailings cell dilation
for groundwater, eliminate
need for costly treatment
plant

Ovestrains

Stability Today

* we are working on this.

1) X creek ^(Valk?) potential for failure -
Stabilization - sand and gravel toe
(he also wants a perforated pipe)

2) ^{Rose?} X creek channel movement - what is
recommendation of Golder to Curragh,
Gleeson?

- have been watching cracks - this spring
cracks are wider than expected
though movement has slowed.

Thermistors
Slope monitoring tube) in a
drill hole to be
put in in
10 days
Same down slope in
another hole.

3) Freshwater Dam

Seepage and high water Pat toe of dam

What was earthquake criteria for
original design.

What for final abandon? - we will
include earthquake in more detailed
design

Gleeson
- advantage to getting and getting
better perspective clearer.

will recommend more work this
Fall.

* toe berm
going in?

will we do
this

Temporary Abandonment

- 1) Schedule of a typical week in the maintenance program - wants to see what areas what parameters will be monitored.
- 2) Water 12 req. for 1:500 requirement for spillways. - Brawner says not required

Emergency spillways - put in as a backup since no track record of diversion channel - was concern over back cuts in perimeter st. - a 1:50 yr return [88 cfs/ft] period was chosen ^{Spillway} - will pass this with no freeboard. - the decant provides extra capacity

He thinks it is a typographical ~~error~~ error.

*

armor'g this spillway needed has this been completed.

3) Extreme rainfall/flood can occur with little warning - Stockpiles needed of various materials so don't have to look for them ^{in emergency}.
Are they near the dam?

* make sure there is a map showing locations of these

- coarse rip rap stockpiles on diversion or dam

- gravel downstream from dam

- medium rip-rap

Abandonment Criteria

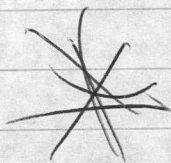
* Tailings acid test program complete than 4-6 months later Currough will supply Conceptual Plan.

- Will we include changes in abandonment strategy in Annual report - Agreed we would. as part of discussion of annual env. impact assessment and changes in knowledge base \rightarrow to future planning

- What is a ~~the~~ recommended flood return period for Abandonment

- Hydrology review underway

- Design conservatism - based
0.030 roughness (N) used actually seems to be at 0.025 for low Q (flow rate) - larger flows use lower N



implication is that design is conservative

Shaving Peaks is an advantage to be included

Should not Be PMF

Andy -

be realistic - include realistic
est. of probability of failure
- 200 years of history limits range
of reasonable insurance.

beyond 1000 years is purely speculative
but should have a reasonable expectation
of surviving this.

500 year event will cover the 200 year
expectations

500 yr is reasonable min but not max
2000 yr is a maximum for survival
but not satisfactory

Abandonment Fund

BC Practice

1969 - every mine required to provide some
fund for env reclamation

sect. 10 in Mines Act reg Ab. Act
a committee in MCM discusses
fund required to match M.C. plan

We have 1000 hectares
this would be
\$ 2.5 - 3.0 x 10⁶

→ payment up to \$2500/hectare for each
dist hectare Yrs. 2, 3 after that other formula

Answer to Browner.

1) 2 to 1 dump is operational now
only old dumps not our dumps

2) go through table 17 page 93

3) As part of an Abandonment plan we will list steps to be undertaken, present to Board for Approval and public discussion then only the items in the AP can be considered for ~~recovery~~ recovery election from TEF -

1 hectare = 10,000 m²

Stulter - questions re tailings elevation -
going to get into problems
here relative to raising
dam 11
60

d) water stds

e) argument fund to include unexpected change
and poor investments

f) trustees vanishing, circumvent cases

g) Trustees synonymous with lawsuit

- VCS wants Trustees to be at least
"seal of perceived" combat of
interest

Money	Parent Savings account
	Separate funds for Ab only
	Cumulative remains liable

h) Unwise investments

i) Disappearance of Curragh
want additional bond for use when
TEP is not sufficient for abandonment
backup procedure.

EPS, F&O

our
question

Do you agree that a Rec. water std is
appropriate for this basin at
abandonment

Concerns :

Objective of the plan - fish and water quality
want confirmation of this throughout
Anvil/Rose system

our
Corrections

of discharge not adequate & we didn't
use this - it will be part of
an operations licence for many
yrs & we live within it - do not
propose it has any relationship to
Site Abandonment.

their
recommendation

incorporate Treatment plan research
into Schedule 1

Notes on Milos Stepanik's presentation at the
Water Board hearings July 22 '88.

Rose Creek diversion

He didn't cover the specifics of this structure but other information indicates he feels there is a foundation failure beneath the diversion. Concern has been expressed over the cracks in the canal dyke.

Cross Valley dam.

He is concerned over the high volume of seepage and lack of proper collection and safe conveyance, especially in winter when discharge freezes and water is not carried away.

Cracking in the dam is considered to be significant and it must be established why this is occurring and corrective measures taken.

Freshwater Reservoir Dam

He considers this worse than the cross valley dam. He considers it to have a 1.2 Factor of Safety, locally down to 1.1. The dam was said to be badly cracked at the crest. He stated that the cracks have opened since last year and that there are more of them and that they

At the hearing he
are bigger. ~~He~~ did not repeat his statement
made in private at previous meetings that he
did not consider that the cracks indicated
imminent catastrophic failure