

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

006321

DATE: December 30, 1987

TO: Kim Barrowman
Jack Bowers
Robert McLenehan
Debbie Runesson

FROM: Joan Eamer

SUBJECT: Zone 2 Information Meeting

Attached are notes from the meeting held December 17, 1987 in Whitehorse to discuss plans for development of the Zone 2 waste dump.

cc: Gregg Jilson
Andy Robertson, SRK

Joan Eamer: Summary of environmental impact

- Review of seep survey data, zinc problems.
- Objective - Long term reduction of zinc load in overflow from Zone 2 pit.
- Reduction of zinc load by diversion of flow: lining and diverting.
- Further study to evaluate effectiveness and develop abandonment plan: seep surveys, other sampling, piezometers.

Robert McLenehan: Relation of Zone 2 plan to Faro Pit abandonment plan

- Faro Pit abandonment plan - no choice but to flood the Faro pit - economically and technically the only alternative.
- Outflow from pit - ditch to go along haulroad and intersect North or South of North Fork causeway.
- Major potential problem - backflow seepage from head (to Zone 2).
- Because there is a major seep at toe of dump (in old Faro Valley, at sampling site X23), we assume there is groundwater flow to the SW. Next steps - original contour and bedrock maps; by March should have good idea of groundwater flow.

Bud McAlpine: Discussion about elevations of potential outflow from Faro Pit, Faro Valley, North Fork, adit. Rob stated that adit elevation is above invert of Faro Creek channel. Government agencies were not aware that outflow of Faro Pit will likely be to the North Fork.

Jack Nickel:

Pleased to see data and interpretations done.

Three broad approaches to solving problem of Zone 2:

1. Take out mineralized material - but Curragh has indicated this is not a viable option - proof of economics could come up with abandonment proposal at hearings.
2. Maintenance - feasible while Curragh is on site but in the long term? This will also be brought up at discussions on abandonment.
3. Divert flows away from entering surface waters. A start has been made by reducing seepage, but will that result in no surface seepage entering North Fork? Curragh will be

reducing flow by 1/5th from load estimations.

Joan: Hoping to divert entire surface and shallow subsurface flow from North of pit. This should be more than 1/5 of what is flowing in (the 1/5th estimate is of load, not flow--we hope that the seepage collection system will intercept pit wall seepage also).

Jack N: There will be a continued groundwater flow.

Joan: We recognize that this component is poorly understood and we are taking steps to define it, but will not have all data by March.

Jack N: Inflow from groundwater will have high zinc levels. Is there an option for diverting flows in the opposite direction?

Robert: Elevation problems.

Joan: We suspect water will always have high zinc levels (following abandonment), but zinc loading should be low (small flow). Quality of receiving waters is stipulated in the licence, not effluent quality.

Jack Nickel: During Cyprus Anvil - zinc concentration, not zinc loading, was the parameter controlled.

Gerry Whitley: Will need base flow data on North Fork to argue this point. During low flow, zinc loading may be a problem. There are monthly X2 (North Fork at road) data for about 20 yrs (water quality) but no equivalent flow data. For abandonment, will need to know flows on the North Fork.

Jack N: Loading control vs concentration control - there will be additional loading from the Faro pit flooding.

Joan: Must look at cumulative effects of loading from all sources: Faro Creek diversion, Zone 2, Faro pit drainage, tailings area. Anticipate that in the long term zinc will be the problem.

Gerry Whitley: Are pH changes expected in zone 2 pit water?

Joan: Well buffered system.

Gerry Whitley: Will surface water diversion change pH due to reduced buffering? Will zinc levels remain the same with surface diversion?

Joan: Some reduction in Zn expected as pit fills and material below water becomes inert. Do not know if pH will change - all

pit waters and Grum adit are neutral. Alkalinity will be added to water quality surveys.

Ken Wile: Concerned re groundwater flow and water quality measurement.

Joan and Robert discussed proposed piezometer sites: one at low point of pit, one at toe of dumps by North Fork. Gerry W. wanted to see groundwater sites with permanent samplers established for reliable readings.

Ken Wile: Has Curragh considered recovery of water from hidden stream and lake under dump? ie. Recovery well to pump water out.

Joan: Pumping would only help during operations and not abandonment. It would be very expensive and we'd have no certainty of hitting the main flow.

Bud McAlpine: What will be the reduction in the estimated 190 mg/s zinc load?

Joan: We cannot predict how much of that will be picked up; depends on how much of seepage through pit wall is intercepted.

Jack Nickel: Key statement in plan is that increasing material in Zone 2 does not foreclose options.

-This is true with maintenance option.

-Not true if option is removing source material - economic or not?

-Redirect flows - will dumping in pit limit this option? (referring to seepage from Zone 2 pit toward North Fork.) ie. in future might Curragh want to plug rock drain and redirect flow toward Faro pit.

Robert: Not a viable option due to water head and structural geology. Channel outflow from Faro pit will have to be impermeable. Indian Fault may be an impermeable barrier to groundwater flow. Some outflow from Zone 2 pit will be tributary to tailings pond through groundwater.

Gerry Whitley: Any indications of water quality in pit (flooded Faro pit)?

Joan: We are mapping pit, looking at wall rock above flooded level.

Ken Wile: Concerns re horizontal drain vs. vertical collection wells. Sealing of plug and installation of pipe is critical.

Joan: Consultant felt horizontal drain was preferable, less subject to damage.

Bud McAlpine: Concerned about movement of pipe in drain.

Kim: Should be no problem - built on hard rock.

Jack Bowers (response to further questions about removal of sulphide rock): Seam of sulphide stringers, geologists feel it may be difficult to trace these.

Kim: Fair amount of ore left in both Faro and Zone 2 by Cyprus Anvil.

Jack N: Question re urgency to use this area, the abandonment plan due in 2 months. Is the site needed before the abandonment plan is presented and resolved?

Kim: Yes - estimate dump 2 million tonnes by March, still leave a sump of reduced size. Need to use for construction of Vangorda Rd. (already 5-6 months behind).

Jack N: How much material in first 6 months?

Jack B: 2.6 million tonnes. Need short haul to maintain production schedule.

Jack N: Availability of other short haul locations?

Kim: Small sites only (2-3 weeks to fill).

Jack N: Underground mining?

Kim: Depends on market conditions and costs.

Ken Wile: Vancouver office (Environmental Protection) concerned re long term management. No reference to collection and treatment. Three major B.C. mines treating acid mine drainage.

Joan: Their water chemistry is different, and their goals are to raise the pH to the level our water is already at. We are investigating this for treatment of Vangorda water. Collecting and treating is an option for Zone 2.

Bud McAlpine: Other mines are spending over \$1 million a year for acid-drainage treatment.

Robert: How would you fund this in the long term?

Jack Nickel: Would like to see cost estimates for various alternatives. Modification of waste rock deposition requires Water Board approval.

Larry Carlyle: Board won't make a decision before receiving written comments from members here today. Next meeting is Jan 19/88 which may lead to a letter of approval. The Board has not decided whether Curragh needs approval.

Jack Nickel: If the Board decides approval is not required, Water Resources will follow their direction.

Larry Carlyle: Other alternative: possible phone poll of the Board. How do the agencies feel if a phone poll let to the decision to allow Curragh to start dumping in the interim period (until the next Board meeting)?

Kim: Less than 1 million tonnes would be dumped in that time.

Jack Nickel: Expressed concern about this approach, Board should make a decision one way or the other.

Larry Carlyle: Decision Board could make is whether or not Curragh should be allowed to continue dumping before abandonment submission in March. Will consult with Diane Granger (Chairperson of Water Board) about conducting a phone poll.

Ken Wile: Doesn't feel plan as is will affect longterm abandonment. The final plan needs more work and study.

Larry Carlyle: Requests written comments from agencies well before the next Water Board meeting.

Joan: Requests copies to Curragh. Agencies agreed.

Larry Carlyle: Remind Curragh of the following:

1. Six month update on tailings abandonment project due. Robert is finishing this.
2. Details of the Truisted Environmental Fund required in March. Joan indicated that Curragh is aware of this.

Consensus that the meeting had been useful to all parties and that a meeting will be organized in late Jan/early Feb to discuss Faro Pit abandonment plan development.

Following the meeting, Larry Carlyle called to inform me that Diane Granger would like to receive the written comments from the agencies before deciding whether to conduct a telephone poll of Board members. He will contact the agencies and get comments as soon as possible.

VANGUARD RIR AND HUMPSR E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: December 22, 1987

TO: Gregg Jilson

FROM: Joan Eamer

SUBJECT: Cyanide meeting with Water Resources and Environmental Protection

I met with Gerry Whitley and Dan Cornett from Water Resources (WR) and Ken Wile from Environmental Protection (EPS) this morning. The following points were discussed:

13. CN levels at the tailings outfall (X9), Intermediate decant (X4) and final decant (X5). There appears to be a longterm upward trend in levels at the former two, but levels at the final decant have no statistically valid trend. This is likely due to analytical problems at these low levels.

14. Analytical problems. The results of split sampling with the government lab indicate that our lab (Ecotech) is not reliable for cyanide analysis. WR have been suggesting since spring that we change labs and/or techniques. Both agencies would like us to take some steps to resolve this. They are willing to split samples to the government lab for quality control. The EPS would like us to follow their method, which is not currently used by commercial labs, but should not be difficult for a lab to adopt. I will look into this.

15. CN effluent standard. I indicated that we would be applying for a change in the standard, as Curragh's standard is currently more stringent than most and below both the reliable detection limit and the treatment level. Both agencies indicated that they would support such a move. I will write a letter to them outlining the reasons for the suggested change in order to get a letter approving this, which then can be included in our application for amendments in the spring. Gerry Whitley said that he would support a standard of 0.1 mg/L weak acid dissociable and 1.0 mg/L total (current standard is .05 mg/L total; WAD levels seem to be about half of total levels). WAD

would be the best one to use for monitoring purposes, as it reflects toxicity better.

16. We went over Bill Scheduling's "Measures to Minimize..." (attached). They were pleased with this and agreed that the best solution is better control of CN addition. They were very pleased to see us working at developing a contingency plan for spills and had several suggestions.

Memo to File.

CN EFFLUENT STANDARDS (mg/L)

December 22, 1987

Joan Eamer

United Keno Hill	tot	.5
	free	.05
Mt Skukum	tot	1.0
	free	.05
Canamax	tot	1.0
	free	.4

North West Territories: levels all much higher, range of 1 to 3

Standards from other mines we have checked with are, for total CN, in the range of 1.0 to 2.0 mg/L (Sask, Man, Ont, Quebec, N.B., Nfld and California).

Curragh Resources standard tot .05

We would like to recommend WAD .05
with no tot conc standard, or tot .1 to .2

This is still as stringent an effluent standard as any we have found.

However,

Canadian Water Quality Guidelines (1987)
free .005

BC recommended standards (Singleton 1986) for aquatic life:

30 day average	WAD	.005
max. grab	WAD	.01

Meeting with Manfred Hoefs re SHEEP

December 18, 1987

- Radio collaring should be in winter.
- He recommends using a trap, constructed of trailer, both doors open, put hay in every second day, get them used to it, then trap and collar.
- Check out road access to base of Sheep Mt., access to winter range.

- Re control of illegal hunting and harrassment:
 - Public meeting, including Ros River Band, to get people involved
 - Possible to restrict use of ATV's on Mt Mye and Sheep Mountain. He will recommend this in his briefing notes to the deputy minister. We should write a letter in support of this.
 - He will see about posting signs in the area to mark it as a protected zone. They want to establish it as an area for non-consumptive use because it is the only place with access to dark sheep for viewing.

- Grad student: He will contact Val Geist and get him to call me. suggests PHD student.

- Monitoring: fixed wing could be used. CO could do some. He agrees that much could be done from the road.

- He requires from me asap definite ideas about YTG involvement in collaring and monitoring.

- He will send a briefing note to the deputy minister re this meeting and stressing importance of involvement of YTG.

- He is of the opinion that diverting the sheep, using salt and hay as bait on a prepared trail should be tried simultaneously with other options. He agrees that it will be difficult to keep corridor within minesite.

October 27, 1987

Mr. Ken Wile
Environmental Protection, Yukon Branch
Environment Canada
Room 225 - 308 Main Street
Whitehorse, Yukon Y1A 2B5

Dear Ken:

In response to your inquiry regarding waste handling procedures, I obtained the following information from Jack Bowers, the Pit Production Engineer.

13. Drilling in the pit is inspected by the geologists. Assays are taken of sulphide-bearing rock, which is then classified as ore, low grade ore or sulphide waste.

14. Low grade ore is stockpiled in two piles according to graphite content. It is blended with high grade ore during milling.

15. Sulphide waste is flagged in the pit from hole assays. A digging map is issued each shift, showing the types of material and where each type will go. As the shovel digs, the operator assigns material to its appropriate area.

If you require more information on these points, please contact me.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Supervisor of Environmental Relations

cc: Jim Moore
Mine Manager, Faro

October 27, 1987

Mr. Jack Nickel
Acting Regional Manager
Water Resources, Northern Affairs Program
200 Range Road
Whitehorse, Yukon
Y1A 3V1

Dear Jack:

During the course of a seep survey of the Faro pit and waste dumps, conducted September 24 to Sept 30, 1987, I sampled water in Faro Creek, the diversion ditch and water from the swamp in the Faro Valley that is being pumped into the diversion ditch. The results indicate that this pumped water exceeds the effluent standards set by Curragh Resources Inc.'s water licence. The relevant data are presented below:

<u>Site</u>	<u>Total Zinc</u> mg/L	<u>FLOW</u> L/s (method)
Faro Creek u/s diversion	<0.002	-
Inflow to swamp pump pond	4.85	22.1 (meter)
Outflow from pond to Faro diversion	4.40	9.1 (45 gallon drum)
Faro diversion 1.3 km d/s pumped water	0.285	81.4 (weir and meter)

Other parameters measured were: total copper, total sulphate, pH, temperature and conductivity. There were no levels of these parameters outside of our licence standards.

We stopped pumping water from this pond into the Faro diversion on October 19, shortly after we received these results. I took further samples on October 21 to see if I could trace the source of the contamination, as this pumping forms an important part of our pit dewatering.

Zinc concentrations in samples taken from the small creek through the swamp and in Faro Creek are marked on the enclosed map. All samples were analyzed by Bondar-Clegg Laboratories in Whitehorse. Duplicate samples were taken at three locations; the variation between duplicates ranged from 1% to 11%, with the higher rate of variation being near the lower limit of detection. The means of duplicate samples are presented on the map.

The results indicate that the source of the zinc is groundwater or diffuse surface seeps entering the swamp about 200 m to 300 m downstream of the point of diversion of Faro Creek. The only disturbance in this part of the Faro Valley is the diversion itself, and there has been no recent activity in this area.

Does your agency have any data which relates to this discharge? Water has been pumped from this swamp area to the Faro Diversion for many years and we cannot see any reason for its recent contamination.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Supervisor of Environmental Relations

cc: Jim Moore
General Manager, Faro

October 23, 1987

Dr. Andrew M. Robertson
Steffen Robertson and Kirsten
Suite 801, The Burrard Building
1030 West Georgia Street
Vancouver, B.C., V6E 2Y3

Dear Andy:

I have enclosed the following plans and information related to the use of Zone 2 as a waste dump:

1. Engineering plans from Jack Bowers.
2. Relevant seep survey data. I haven't had a chance to write up all the data properly--please regard this as preliminary.
3. Results from zinc survey done in June by Robert.

Please review this material and comment on the environmental implications of this plan, specifically:

1. What are the options for abandonment of the Zone 2 area? Please include for each option:
 - how it would be affected by filling Zone 2 with waste rock.
 - probable effectiveness (in terms of longterm water quality).
 - cost estimate.
2. Assess the short term effects (ie up to abandonment).
3. Recommend what to do with the overflow water (ie can it be treated in a small pond at the outflow or should it be pumped to tailings?) Will the proposed drain be effective in collecting water, or will leakage to Rose Creek still occur?
4. Comment on the effectiveness of a phyllite seal on the bottom of the exposed part of the pit, as this has been considered.
5. Recommend a type and installation procedure for a

piezometer.

6. Recommend any monitoring that should be done (eg frequency of piezometer readings) and any further work (such as the additional seep surveys we discussed) that will be needed in order to complete the abandonment plan for this area.

I would like to include your assessment with the engineering plans in a submission to the Water Board. If you have any suggestions for modifications to the plans, perhaps you could call Jack Bowers and discuss them.

As I indicated on the phone, I would appreciate it if you could obtain an opinion from Keith Ferguson on this matter. Please make any of this information available to him.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Supervisor of Environmental Relations

cc Jack Bowers

October 15, 1987

Ms. Marg Crombie
Regional Environmental Review Committee
Northern Affairs Program
200 Range Road
Whitehorse, Yukon Y1A 3V1

Dear Marg:

We are making the following change to our monitoring schedule until further notice:

Site V7 will not be sampled. Instead, a new site, V10, located on Vangorda Creek downstream of Shrimp Creek, will be sampled on a monthly basis.

This change is being made because access is difficult and dangerous in winter to V7 and because the substrate allows better flow measurements to be taken at V10. There are no major tributaries between the sites and no anticipated impact in this region.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Supervisor of Environmental Relations

cc: Yukon Territorial Water Board

MEMORANDUM

October 26, 1987

TO: Kim Barrowman

FROM: Joan Eamer

RE: Sampling results, Faro Valley water

On Oct 21 I sampled several sites in the swamp area in the Faro Valley, the Faro Diversion Ditch and the North Fork of Rose Creek.

Zinc levels (total), expressed in mg/L, for this survey are shown on the enclosed map. Additional data from this and the previous sampling trip are shown on the enclosed table. The effluent standard in our water licence is 0.50 mg/L.

Notes on these data:

1. The main source of zinc enters the "swamp creek" somewhere between sites 12 and 11. There was no obvious surface inflow along this section.

I didn't mark these sites--to help you locate them: site 14 is by the big tree beside the road. Sites 12 and 13 are two branches of the creek about 200 m downstream of the point of diversion. Site 11 is by a pile of rock along the road side--the "creek" is near the road at this point.

2. Note that the zinc level in the cribbed sump increased greatly when pumping was stopped, so switching the pump to that location would not solve the problem.

3. The zinc level in the North Fork remained just as high when we stopped pumping, although the level in the Faro Diversion dropped.

4. A small amount of zinc is picked up in the diversion ditch itself.

Enclosed is a copy of the letter to Water Resources.

ZINC CONCENTRATIONS (MG/L)

SITE	SEPT 26 (pumping)	OCT 21 (not pumping)
Faro Creek u/s diversion	<0.002	
Ditch joining Faro Creek from west at the point of diversion	0.024	
Small seep from Faro Diversion through road about halfway along "swamp creek"	0.048	
Inflow to pump pond (duplicate samples in Oct)	4.85	3.23 3.28
Outflow from pump pond	4.40.	
Cribbed sump	1.91	3.42
Faro Diversion at pumping point (duplicate samples)		0.035 0.031
Faro Diversion at lower weir	0.285	0.047
North Fork of Rose Creek (d/s rock drain in Sept, at road in Oct.)	0.042	0.042

MEMORANDUM

October 19, 1987

to: Gregg Jilson

from: Joan Eamer

Results from the seep survey conducted in late September, 1987 indicate that the water being pumped from the swamp in the Faro Valley to the Faro Creek diversion contains zinc levels in excess of the effluent standards set by Curragh's water licence. The pumped water contained 4.4 mg/L zinc; the limit allowed by our licence for any discharge is 0.5 mg/L.

These effluent standards are to be met by all "waste discharges", which "includes ... contaminated surface drainage prior to entering the receiving waters, and including the Faro Creek diversion waters." (Water Licence, Part B, Section 2 A).

I recommend that we stop pumping this water and inform the Water Resources Division of Northern Affairs of this matter. We are under clear obligation to do so under our licence:

"The Licensee shall immediately contact the Water Resources Division ... should a spill or an unauthorized discharge occur or seem likely to occur."

(Water Licence, Part A Section 9)

I will be sampling this discharge again this week and will try to track down the source of contamination.

Joan

I agree you should recommend immediate halt to pumping - please send similar memo to John Anthony of Ken Beamsonner/ Jim Nasore. Discuss with Jim before notifying Water authorities but write up notification ASAP

MEMO

to: Kurt Forgaard
from: Joan Eamer
date: August 18, 1987
re: Vangorda Plateau development

Our planning is so far behind on the Vangorda Plateau project that we are in danger of running into a great deal of opposition (in the form of protests from government agencies, legal charges and bad publicity) very soon. Lower Vangorda Creek and the Pelly River are Chinook salmon habitat, which means that we are liable to serious charges if we do not operate in an environmentally sound manner. Water Resources (Northern Affairs), who enforce the Northern Inland Waters Act, are seeking legal counsel regarding whether or not this season's drainage project can proceed without a water licence.

We can reduce the conflict if we are very open and willing to provide information and consider alternatives and measures for reducing the impact of the project at this stage. If we just roll along with the project, not responding to the government agencies' concerns, we will find these matters will instead be addressed in public--at a water board hearing, through the press and possibly in court.

The drainage that is scheduled to go ahead this month has not been approved by any agency. We have not presented any plans to the Regional Environmental Review Committee (RERC), which consists of representatives from Fisheries, Water Resources, Environmental Protection, Renewable Resources, and YTG Economic Development. The stand taken by the RERC is that the entire Vangorda development should be evaluated by them before any work impacting the environment is started. I recommend:

1. I put together a sort of mini-Environmental Evaluation covering this year's work, along with plans for studies and conceptual plans for the project as a whole.
2. We present this as quickly as possible to the RERC and request a meeting with them to discuss their concerns. At the meeting we should have one or two of the people who have developed the plans and someone who can argue forcefully for the importance of initiating drainage this year, both from a technical and an economic point of view (I would suggest you).
3. I then put together the Initial Environmental Evaluation for the entire project. This must include plans for water collection and treatment and conceptual plans for abandonment. Plans for pits, waste rock management, haul road and overburden dumps must be evaluated for short and long term impacts. This will be much more successful if those developing the project take environmental matters into consideration at the planning stage.

August 6 /87

Notes on Water Quality Lab for Faro

-Robert McLenehan spoke with Herb Lanz from BC Research regarding our concerns with locating the lab at the minesite. He feels that if procedures are kept tight we should be able to maintain high standards of water quality analysis.

-He stressed that it will be critical to have a well-trained person in charge who will keep strict control of environmental conditions, instrument calibration, etc. He felt that having the same person do the sampling was a good idea, as the same concerns apply to sampling procedures.

-Note that, with increased field measurement of parameters such as pH and flow and with a move to field preparation (filtering and preservation), more time will be required for sampling.

-BC Research will send someone up (for expenses only) to train and advise in field and lab procedures.

-The mine at Port Hardy apparently successfully runs a lab under similar circumstances.

-For quality control he recommends duplicates of all samples sent to the outside lab for the first month, then a random duplication program.

-If the lab were to be set up in town, additional costs would be:

- use of a truck full time (only needed half time for sampling).

- building.

- atomic absorption spectroscope. Cost new is about \$75,000. Cost second hand is about \$45,000. Herb Lanz advised that it might be possible to take metals samples in batches in to the assay lab, as they are sealed. Possibly in the evening. This does not sound very practicable, but would possibly do as a temporary measure.

-I would strongly recommend hiring (or assigning an employee as) an environmental lab technician, responsible for sampling and analysis. This person would be responsible to Robert McLenehan and myself. Doing this would give both Curragh and the government agencies more confidence in the data generated and would minimize the risk of our quality control being so bad that we have to return to outside sampling.

Joan Eamer

November 26, 1987

Ms. Diane Granger
Chairperson
Yukon Territory Water Board
302-4114 Fourth Avenue
Whitehorse, Yukon Y1A 4N7

Dear Ms. Granger:

Curragh Resources Inc. is currently preparing abandonment plans to fulfil requirements in Part D of our Water Licence.

I would like to take this opportunity to outline to the Board the scope of the various plans and their expected dates of submission.

1. Section 4 (a) i), Faro pit and area:
This plan will deal with abandonment of the Faro pit, including the backfilled Zone 2 pit, and the Faro waste dumps, including the dump which forms the North Fork Causeway. This report is due by March 31, 1988.
2. Section 4 (a) ii), physical stabilization of the Rose Creek diversion ditch and the tailings in the event of a temporary closure. This report, which is well-defined in the Licence, is due by March 31, 1988.
3. Section 4 (a) iii), stabilization of the North Valley Wall interceptor ditch in the event of a temporary closure. This will form part of the report described in Point 2 above.
4. Section 4 (b): Vangorda and Grum Pits. The Vangorda pit abandonment plan will be included in the application for a water licence for this development, which we hope to submit in early 1988. We anticipate that we will apply for an amendment to this licence to include the Grum development later that year. The application for this amendment would include an abandonment plan.
5. Section 4 (b): Faro mine facilities. This plan will cover abandonment of buildings, roads and

other related facilities at the Faro minesite. It is due as part of the licence renewal application.

6. Section 6 (a): Tailings facilities abandonment plan: This plan will include the chemical and physical stabilization of the tailings facilities, the Rose Creek diversion channel and the freshwater reservoir, pumphouse reservoir and related structures. Our consultants have advised us that, because these issues are interrelated, the abandonment plan for the entire Rose Creek Valley should be researched and developed as a whole. This plan is due on completion of the program of investigations referred to in this section.

As I have encountered some uncertainty as to the scope of these various abandonment plans, I would appreciate it if the Board could indicate whether or not this timeframe is acceptable.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Supervisor of Environmental Relations

cc: Jim Moore
General Manager, Faro

November 13, 1987

Mr. Brian Campion
Anton and Campion
Ste 200-204 Lambert
Whitehorse, Yukon

Dear Mr. Campion:

We are planning on using an area of the Faro Pit (Zone 2) for a waste dump and would like a legal opinion on whether or not we require approval from the Yukon Territory Water Board to do so.

I direct your attention to Part B, Section 5 (a) and Section 7 of our Water Licence. With regard to Section 7, The plan required in (a) was submitted by Cypress Anvil, but waste deposition under Curragh has deviated from the plan considerably. Environment Canada has requested a Waste Management Plan from us on several occasions and we have prepared a new plan which will be ready for submission in a few weeks. This plan includes the plans for the use of Zone 2.

My question is, which, if either, of these sections apply to this matter? Also, if, in your opinion, we do require written approval from the Board, what will be the consequences of our informing the Board of our intent (in the form of a submission containing engineering plans, an assessment by a consultant and relevant water quality and flow data) and then proceeding with no approval?

To help you answer these questions, I enclose the following material:

1. Background information related to the use of Zone 2 as a waste dump.
2. The assessment from the consultant (Dr. Andy Robertson of SRK Consultants)
3. A draft copy of the engineering plans for the area.
4. A copy of the latest "office compilation" of our Water Licence from the Water Board.

Thanks.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Supervisor of Environmental Relations

Background Information on the Use of Zone 2 as a Waste Dump

The Zone 2 pit is an old pit which has been abandoned for several years. There are patches of ore left in the pit, but the extent and exact location of these patches is not well-known. It would not be economically feasible to mine these, as the ore is oxidized and as much of the pit is covered in waste rock (removal of this material has been suggested by government agencies as an abandonment measure).

In the past, water has on occasion filled the pit and overflowed into the North Fork of Rose Creek. Pit water contains unacceptably high levels of zinc.

Currently, water which accumulates in the pit is pumped out to the tailings system. The sources of the water are:

1. Surface flow (lined ditch) which is directed into the pit. This water drains waste dumps and upper benches of the main pit and is high in zinc.
2. Visible seeps to the pit.
3. An unknown flow resulting from seeps hidden by the waste rock, under water and groundwater flow.

We plan on using this area as a waste rock dump. This means that we can no longer pump from the pit. We are installing a rock and pipe drain to collect water. Water will accumulate in a sump and be pumped back to tailings. Thus there will be no short-term effect on water quality as there will continue to be no effluent from Zone 2.

We are taking the following steps to minimize inflow to the Zone 2 pit:

1. Line part of the Faro Creek diversion. A known amount of water leaks from this diversion and, from the contours of the land, it can be assumed that much of this flow ends up in Zone 2 either through surface flow or groundwater.
2. Divert as much as possible of the flow from the lined ditch into the main pit. Some of the seeps to this ditch that are close to Zone 2 may not be able to be diverted, due to the topography.

I anticipate that we will run into objections from the government agencies because of the long-term implications. We have not presented a plan for abandonment of this pit, or any indication of what will happen to pit water at abandonment. This will form part of the abandonment plan referred to in the Water Licence in Part D, Section 4. (a) i), due March 31, 1988.

November 16, 1987

Mr. Larry Carlyle
Technical Advisor
Yukon Territory Water Board
302-4114 Fourth Avenue
Whitehorse, Yukon Y1A 4N7

Dear Larry:

During our telephone conversation of November 4, 1987, you informed me that your records show that Curragh Resources Inc. is currently in non-compliance with regard to five sections of its Water Licence. I have checked our files and can provide you with the following information on these sections.

5. Part B, Section 3 (e)
"Prior to March 24, 1983, the Licensee shall, on the basis of data collected under Schedule C of this licence, construct a flood contingency overflow structure to channel flows in excess of 1:500 year return flood out of the diversion."

Plans for the construction of this structure were filed with the Water Board on August 25, 1982 and approval was given by the Board on August 30, 1982 in a letter from Mr. E. Stehelin. Construction was completed in the summer of 1983, as reported in Golder Associates' report No.822-2021, "1983 Performance Monitoring of the Down Valley Tailings Project".

6. Part B, Section 3 (f)
"The Licensee shall ensure that the spillways on the Intermediate dam and the Cross Valley dam have the hydraulic capacity to carry 1:500 year flood flow of Rose Creek."

I have consulted with Mr. Glenn Gilchrist of Golder Associates regarding this matter. The spillways were designed to the 1:50 year flood capacity and have not been altered. We will review this matter and either take steps to ensure that we are in compliance or apply for an ammendment to the licence with regard to this section.

7. Part B, Section 3 (h)
"Flow weirs shall be constructed at the decant structures on the Intermediate and Cross Valley dams."

A work order has been issued to construct a weir at X5 and this weir will be operational in the spring of 1988. There are no immediate plans for construction of a weir at X4, but this matter will be investigated. In the meantime, flows at both sites will be estimated using a stream velocity meter whenever possible.

8. Part B, Section 4
"North Fork of Rose Creek"
(a) The Licensee shall, as part of the annual report provide an impact assessment addressing the effects on water quality and fish habitat, of the elimination of the overflow of one thousand (1,000) IGPM over the pumping reservoir spillway. The Licensee shall also provide a long range plan for the conservation of water, and carry out a detailed study of the options for recycling mine process water."

You indicated that the two matters referred to above should have been addressed in our 1986 Annual Report. I would like to point out that the ammendment which inserted this section into Curragh's licence is dated January 9, 1987 (Ammendment Number Y-IN86-03A).

With regard to this section, I would also like to point out that there is an error in the office compilation of the licence. This section is entitled "North Fork of Rose Creek". As the North Fork is upstream of the reservoir, I believe that the title should read "Rose Creek".

9. Part B, Section 8 (a)
"Prior to March 24, 1987, the Licensee shall submit to the Board a contingency plan or plans for handling any groundwater downstream of the Cross Valley dam which contains concentrations of substances in excess of licence limits as set forth in Part B, Section 2(f) of this licence. The objective of such a plan shall be to ensure that licence standards are maintained in groundwater."

Our records show that two copies of this plan (Report 60603) were submitted to the Water Board with a covering letter addressed to Mr. R. A. Steers on March 23, 1987. We received a letter from you, dated March

31, 1987, acknowledging receipt of the report. An additional copy of the plan is enclosed for your records.

Thank you for bringing these matters to our attention. If you require further verification or information on any of these items, please contact me.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Supervisor of Environmental Relations

cc: Jim Moore
General Manager, Faro

Jack Nickel
Water Resources, Whitehorse

November 12, 1987

Ms. Diane Granger
Chairperson
Yukon Territory Water Board
302-4114 Fourth Avenue
Whitehorse, Yukon Y1A 4N7

Dear Ms. Granger:

Recent results of cyanide analyses from site X5, the Cross Valley Dam decant, indicate that our effluent is approaching and sometimes exceeding Curragh's Water Licence standard of 0.05 mg/L total cyanide. Bio-assay results from this same site, however, showed 100 % survival of fish in effluent.

We discussed this matter with Gerry Whitley of Water Resources and he made arrangements for his department to obtain samples, as cyanide analytical results tend to be unreliable. Water Resources and Curragh technicians sampled at several points concurrently and the samples have been submitted to three different laboratories for analysis.

We are taking the following additional steps to determine the extent of the problem and to rectify it:

10. Do monthly bio-assay tests (through B.C. Research) at X5 while analyses show that we are exceeding our standard for cyanide, or while we suspect that we may be exceeding the standard (because there is a time lag of several weeks between sampling and receipt of the results). We feel that this is a more reliable measure of concentration of cyanide in toxic forms than total cyanide analyses.
11. Cut back on cyanide use in the milling process as much as possible.
12. Conduct tests in the mill to assess different methods of treatment for cyanide destruction. We are consulting with Environment Canada and with

Water Resources on this matter. We are considering treatment on a contingency basis only, as natural destruction in the tailings ponds is the best treatment and increased residence time in the ponds will increase their effectiveness.

For your reference, I have enclosed a listing of cyanide analytical results at three sites (X9: Tailings Line, X4: Decant from the Intermediate Dam and X5: Decant from the Cross Valley Dam) from November, 1986 to October, 1987, along with graphs of these values against time.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Supervisor of Environmental Relations

cc: Jim Moore
General Manager, Faro

Gerry Whitley
Water Resources, Whitehorse

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: November 24, 1987

TO: Those Listed, J. Moore, K. Barrowman

FROM: Joan Eamer

SUBJECT: SUMMARY OF ENVIRONMENT GROUP MEETING, NOV 19, 1987

Meeting of Curragh Environment Group, 11:00 am, Faro Conference Room.

PRESENT J. Eamer, G. Jilson, T. Scoular, D. Wright, J. Bowers,
B. Scheduling, R. McLenehan

ABSENT J. Huntley

ITEMS DISCUSSED:

1. Environmental Library

Lists of reports related to environmental matters prepared by Joan, Dave and Robert. They will be put on a data base by Joan's temporary assistant. Other lists should be submitted as soon as possible.

2. Waste Dumps and Zone 2 Plans

-Plans for use of Zone 2 as a waste dump should be submitted next week.

-Discussion about whether or not we should wait for approval before dumping. A legal opinion has not yet been received. Possibilities: submit report, hold information meeting, then either wait for approval or begin dumping. Dumping could begin and we could leave part of the pit uncovered for pumping. The government agencies are primarily interested in the issue as it relates to abandonment.

-The SRK review of the plans was discussed. The plans for the rock/pipe collector drain have not been followed exactly; Jack has drawn up as-built plans.

-Discussed how to ensure that we have storage capacity when the pit is full. It was decided to put a valve on the pipe so that the area above the collector drain and below the natural overflow could serve as an emergency storage reservoir. A horizontal pipe will be installed at the top of this storage reservoir to warn of overflow.

-Joan and Jack will revise and complete submission. Jack:

ready to dump in Zone 2 in two weeks.

-Waste dumps. Re oxide fines: This is our most acid-generating material, how will we dispose of it? Bill: it would be cheaper to mill than to bulk treat and dump back in pit. Re low-grade stockpiles: 9.5 million tonnes of low/med grade stockpile at Faro will be generated from the Vangorda/Grum pits.

3. Water Use

-Wells. Joan: We have not submitted the "as-built" plans for the wells and the ponds in the North Fork (constructed in April). Bill will get these together. Joan: if we plan on using the wells, we need to apply for authority to use groundwater--as it stands, we are only authorized to use Rose Creek water. Bill: we need the capability of using the wells. Wells were started up last week, froze and shut down. We are diverting (part of) the North Fork to the pump house pond.

-Elimination of the 1000 IGPM overflow to Rose. Joan: we are required to assess effects on fish and water quality for our next annual report. Should have flow measurements at X3 (pond overflow) for this winter. Dave: this has been considered. Concrete weir with log stoppers would be ideal. Bill and Dave will look into this.

-Water conservation/recycling plan: Joan: this is required for the annual report (due March 1, but prefer earlier). Bill is looking after this. Completion date depends on technician time available to do study. Joan will send any old data on this from Whitehorse office.

4. Tailings

-Robert gave an update on the tailings project.

-Dam monitoring and maintenance: John Huntley organizing monitoring, following Glen Gilchrist's recommendations. His report will be available soon. Joan: when do we plan on raising the Intermediate dam? Bill: next year some time. Joan: Plans will have to be filed for approval. There may be some advantage in filing plans before the hearing if this matter will require a public hearing. Dave: The small dam we are currently building has no approval, but Water Resources people have seen it.

5. Abandonment

-Joan: list of scope of the various abandonment plans due is prepared and will be submitted to the Water Board--request for input. Robert: need to find out from SRK what the Interim Abandonment Plan will cover. Does it address physical stability or only maintenance/monitoring? Joan will clarify this. This issue (longterm physical stabilization of the various dams and the diversion canal)

is the potentially contentious one because we are not addressing it.

6. Pit Dewatering and hydrology

-Information required on Faro pit area groundwater quantity and movement for pit dewatering and for abandonment. Robert will assess available data, arrange reading of piezometers and evaluate whether more information is required.

-Discussion about Zone 2 piezometer, whether or not we should install one. It would provide us with data up until the pit is full of water. Cost is about \$4000. Jack, Joan and Robert will discuss further.

-Faro Swamp high zinc water. Pumping has stopped, no further action has been taken. As the source appears to be in one small area, we may be able to remove it. Gregg: probably load of sulphide waste used to patch dike. Joan: can further define this by more water sampling and analysing for Zn in assay lab.

7. Monitoring Review

-Changes can be made to the monitoring schedules without an amendment to the licence. Joan: would like to review all monitoring schedules for the annual report. Joan and Dave will review surface water, Joan will review benthic invertebrate monitoring, Robert will review groundwater. We will await Gilchrist's report for the physical monitoring schedule review. (There is an out-of-date schedule in the Licence because the Water Board has not responded to suggested changes from the 1986 annual report.)

8. Cyanide levels

-Testing underway in the metallurgy lab. Levels have gone down in the last few samples. Split sampling carried out with Water Resources indicate that water analyses for CN are very unreliable.

Joan will circulate a memo regarding a time for the next meeting.

Review of Detailed Waste Rock Management Plan

for Jack Bowers

from Joan Eamer

November 18, 1987

[I am trying to ask the questions that I think this plan would generate from the government agencies]

The section on Design Parameters should be expanded:

-Slope

What are the slopes of the old dumps? Are these dumps stable? What evidence have you to support this?

If the "overall slope" of the new dumps is 2:1, but the actual slope of the rock is steeper, is the waste rock in benches? How wide and high are the benches? Figure 2 would indicate that there are no benches, just the road width to achieve the 2:1 slope. What about dumps that the road does not intersect? Have the dump profiles shown in Figure 1 of the old plan been followed? What will the slope be on the Vangorda Access Road, particularly in the North Fork valley?

In the Water Licence, it states that weak or friable rock and overburden should have slopes of 3:1. What is the slope of old dumps containing such material? Are they stable? Will any of the new dumps be composed of this material? If so, what will the slope be?

-Limits

What is the separation between dump toes and power lines? It is 200 feet in the old plan.

-Volume

A swell factor of 35% was used in calculating dump capacity in the old report. Why has this been changed to 25%?

-Are the dumps to be covered in any material, compacted or the tops sloped for drainage control?

-Separation of waste rock types

Is calc-silicate being stockpiled (as it was according to the old plan) or is it all being used in the haul road?

What are the procedures for separating rock types--the plan should include a detailed description of how the waste rock deposition occurs, including the methods used in identifying the type of rock, directing it to a specific dump and method of dumping.

What types of waste rock will be in each dump? There should be a map or chart to show this.

Suggested format:

Phase/bench/ date mined/ waste rock types/ dumps/ acid-generation potential

[If you can tell me when each bench in each phase will be mined and which dump the rock is to go to, Gregg and I can complete this.]

Table 2

From this table it appears that sulphide waste goes to the Northwest dump, the Ramp Zone dump, the Zone II dump, the

Intermediate dump and is dumped back in the pit. Is this true?

There is no dump listed for two rows.

In Table 2, the Ramp zone dump receives 1380 Tonnes X 1000 of each of sulphide and non-sulphide waste, yet according to Table 1, the total volume is 1380 to this dump. There are other inconsistencies, unless I am misunderstanding the tables.

-Stockpiles and oxide fines.

What will happen to these? If this plan is supposed to address the "physical and chemical stabilization" of the waste rock dumps (as stated in our Water Licence), these are the most important, as they are the most acid-generating by far. The oxide fines are not on the map.

Section 4

-Why make the distinction that the Vangorda Road is not to be considered as a dump face?

-Sulphide waste dump--These procedures should be repeated here, because Gordon Grams' report was not released to the Board. What is the depth of the phyllite cover? Will it be sloped? How will it be compacted? Will drainage be collected from the dump? If not, where will the water run (there will undoubtedly be some contaminated water seeping from the downslope toe of the dump).

-Vangorda Road

Reference could be made to Golders' report on the haul road, as this was submitted to the Board.

Figure 3 is not labelled as such.

Corrections required to the roads.

The power line should be marked.

Roads referred to in the report should be labelled on the map.

This map shows Faro Creek in its diversion ditch, and no mention is made of this. We should probably indicate somewhere that alterations will have to be made to the final contours to accommodate the rerouting of the creek through its natural channel to the pit, but that this matter will be addressed in the Faro Pit abandonment plan.

Will all the sulphide wastes that are dumped back in the pit be well below water level when the pit is flooded?

Perhaps mention should be made that the Faro Pit abandonment plan will address the matter of potential contamination of water from

the dumps.

Editorial Notes

Table 1 should come before Table 2--they are listed that way in the List of Tables.

The sideways pages should all be read with the binding at the top.

The dump name abbreviations in Table 2 should be defined and "FT" should be typed in.

Is Figure 1 necessary? If it is used, the scale should be corrected (I wish Faro were that close to Whitehorse!) As someone unfamiliar with the mine, I would rather see a small site plan, indicating the general location of the dumps, pits, mill and creeks. Perhaps the power line could be located on such a map.

Table 1--EUs/DAY define.

The dates of both reports should be altered to the submission date (November or December)

Water License Review

Memo to file

Based partly on discussion with Jack Nickel, Nov 3/87

Part A

3. Security. Check that this was done.

8. Annual Report.

Need data on water quantities used, including a water balance for the tailings facility and the diversion canal.

Need record of any maintenance work on tailings, diversion, fw reservoir, anything else which has an impact on water.

Part B

1. Water Supply.

Are there plans to use the wells?

What are the plans for use of water--do we plan on diverting the North Fork into the reservoir this winter?

We have not sent the "as built" plans for the construction of the wells and series of ponds on the North Fork.

We are not authorized to use groundwater. We should seek the right to use groundwater at the hearing if we plan to continue to use the wells, or if we wish to have the capability to do so.

2. Waste Discharge

May apply to change total to free CN

(g) points of entry to receiving waters. X5, X11, X12, X13

Are these true "points of entry"? Any advantage to having this changed?

3. Tailings

(a) Sealing Intermediate Dam. What is the status of this?

What are the plans for tailings deposition?

(f) Spillways on the Intermediate and Cross Valley dams should be designed to 1:500 year flood. This has not been done. Golder recommends considering amending this. Higher floods would result in erosion of crest, but no structural failure. Now designed to 1:50 year flood.

(h) Weirs at X5 and X4. Will have to amend if we are not going to do this.

4. Elimination of 1000 IGMP spill. Fish study required.

Longrange plan for water conservation and options for recycling mine process water--needed for Annual Report.

5. We should file plans for the raising of the Intermediate Dam. Water Resources considers this a matter that will have to go to a public hearing, so best to file plans this winter.

Maybe we should consolidate this into a long-range water supply and tailings disposal plan, including plans for use of wells and/or diversion of North Fork to reservoir, plans for raising Intermediate Dam, siphon/decant structures, placement of tailings, and monitoring of flows and structural stability.

6. Need a copy of Golder's report when it comes.

7. (a) Waste Rock plan under preparation. If we are not constructing dumps with slope 2:1, will have to apply for an ammendment to Part D 3 (vi), which states that at abandonment dumps have "slope crests with a set back distance" of 2:1.

(c) Are we prepared to cap the sulphide wastes if necessary? Oxide fines must be leaching--what are we going to do with these?

8. (a) Done. Remove from licence.

9. Seepage Control

Should this be changed to reflect the design of the dams--maybe that sealing should be done if the seepage exceeds effluent standards or is destabilizing the dam.

Part C

- 1 (a) Do we need to submit the date and time the sample was analyzed? Unnecessary work.

(c) Bioassays--EPS say that BC Research does poor bioassays--they did a check on them this year. We should check, as they (EPS) have to approve our procedures.

2. (c) We should inform the Board which labs we are using.

Part D

Abandonment Objectives.

2. These are generally good--the objective is to maintain water quality in Rose Creek downstream of the tailings at a level equal to or better than during operations. Thus we are not required to

maintain all discharges at effluent standards.

3. (vi) and (vii), waste rock slopes.

4. Abandonment plans

The scope of these should be outlined in a letter to the Board.

(b) Reference to Vangorda Grum should be deleted. This will be a separate licence.

8. Trusteed Environmental Fund. Details required by March 31.

Schedules

Proposal for revisions to all schedules should be included as part of the Annual Report. This way we may avoid this being part of the public hearing.

Memo. to File

[1988 budget items, submitted in November, 1987]

VANGORDA PLATEAU DEVELOPMENT PROJECTS

1. Study of acid generation potential of Grum and Vangorda waste. Samples of waste rock types from both pits will be submitted to Chemex Labs in Vancouver for analysis for potential to generate acid. The data will be compiled and assessed in-house.
2. Sheep monitoring. Plans will be finalized after the consultant (Dr. Horesji) has submitted a report. Preliminary plans are to: (1) Radio-collar ten ewes in early spring (2) Hire Dr. Horesji to conduct a survey of sheep movements and trail use in the spring and to advise on the program (3) Monitor movements of radio-collared animals in the minesite area for two months in the spring and two months in the fall. This would require four months half-time work for an environmental technician.
3. Pit drainage water flow model for RERC/IEE. Analysis of surface and groundwater movement in the mine areas in order to predict short and longterm impacts of the Vangorda Plateau development. This will be done in-house.
4. Benthic invertebrate study--Vangorda Creek. One site will be established in the section of the creek that is good salmon habitat. Samples will be collected by an employee and the data will be assessed in-house, but a consultant is required for sample sorting and identification. This will probably be part of the Water Licence requirement.
5. Vangorda Creek water license application. Legal fees and funds for bringing experts to appear at the hearing will be required.
6. Preliminary abandonment study for Vangorda Plateau. The abandonment plan must be presented as part of the Initial Environmental Evaluation and as part of the Water Licence application. Preparation of the plan will be done in-house but a consultant should be retained to assess it.
7. Update hydrology baseline data for RERC/IEE. It would be advisable to install a stream discharge station in the creek if a permanent diversion of Vangorda Creek is being considered.
8. Background water sampling--Vangorda. Pre-impact water chemistry data on Vangorda Creek and its tributaries will be collected, along with monitoring of impact as the

development proceeds. Sample collection, some analyses and data assessment will be done in-house, but many of the analyses will be done by a commercial laboratory. When Curragh's water quality lab is complete, these costs will be reduced. Some testing will continue to be done by a commercial lab for quality control purposes.

9. Haul road stream crossing design for RERC/IEE. Detailed plans are required for all stream crossings. This will be done in-house.
10. Update recreational, hunting etc. resource use for RERC/IEE. A section on present and historic use of the area is required as part of the Initial Environmental Evaluation. This will be done in-house.
11. Test for possible contamination of Faro townsite water supply. The townsite wells are close to Vangorda Creek and, as part of the Initial Environmental Evaluation and the Water Licence Application, an assessment of the potential for contamination will be required. Information will be collected in-house and a groundwater consultant will be retained to look at this.
12. Provision of haul road data to RERC/IEE. This forms part of the Initial Environmental Evaluation and will be done in-house.

FARO MINESITE PROJECTS

1. Faro interim tailings abandonment study. Steffen, Robertson and Kirsten Consultants have been retained to do this study. It must form part of the Water Licence Ammendment application due March 31, 1988.
2. Minesite and pit abandonment study, also due March 31, 1988. Advice and assistance from SRK Consultants is required to collect and assess data needed to prepare this plan. Laboratory fees for water analyses and funds for installation of groundwater monitoring instruments are included. Data collection and compilation, planning and report preparation will be done in-house. The consultant will be retained to evaluate the final plan.
3. Fisheries resource study of Rose Creek. Completion of the study on the North Fork of Rose Creek is slated for 1988. This study is part of the Vangorda Haul Road development. Assessment of downstream Rose/Anvil fisheries will also be done in 1988. It is anticipated that no further studies

will be required on Vangorda Creek. Some of the field work will be done in-house, under the direction of the consultant (P.A. Harder), as was done for the Vangorda Study; the reports will be prepared by the consultant.

September 12, 1988

Ms. Marg Crombie
Regional Environmental Review Committee
Northern Affairs Program
200 Range Road
Whitehorse, Yukon Y1A 3V1

Dear Marg:

Re: Vangorda Haulroad Construction

As I indicated to you last week, material required for the haulroad construction will be removed from the areas of the Grum and Vangorda Pits, starting within a few days and continuing for approximately 60 days. This material will be till only and mineralized rock will not be uncovered.

Attached are two maps showing the location of this work. The total amounts of till to be removed are 600,000 tonnes from Grum and 120,000 tonnes from Vangorda.

I have informed the following RERC members (or observers) of this: Al von Finster, George Mackenzie-Grieve, Jack Nickel, Len Mychasiw.

We will be sampling weekly at VB (lower Vangorda Creek) for suspended solids during this period. Results will be available from our Whitehorse office.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Jim Moore, General Manager, Curragh, Faro
Ken Nordin, YTWB

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: September 29, 1988

TO: Gregg Jilson
FROM: Joan Eamer
SUBJECT: Anvil Weather Station

Jim Steele of the Weather Office in Whitehorse contacted me regarding the results from this station. Readings were missing during June and for much of July. Temperature readings are often missing and precipitation readings often "do not make sense".

The data from this station are very valuable to us in planning for abandonment. This station is also important to the Atmospheric Environment Service, as it is the only high elevation station in the Yukon with longterm records.

The station is operated by the security guards.

Suggestions:

- We have Paul Silverman train the guards in the operation of the station (he apparently does an excellent job with the Grum station).
- We request Doug Grey, who is a maintenance inspector/trainer with AES, to go to Faro to train the guards.

August 10, 1988

Mr. Ken Nordin
Technical Advisor
Yukon Territory Water Board
302-4114 Fourth Avenue
Whitehorse, Yukon Y1A 4N7

Dear Ken:

RE: Intermediate dam raising: comments from agencies

We have received verbal comments from Environmental Protection and a copy of the comments sent to you by the Department of Indian and Northern Development (August 10, 1988). As we realize that you will be reviewing these comments at your meeting tomorrow, we would like to clarify a few points arising from these. We would appreciate it if you would bring these matters to the attention of the Board during this review.

1. Regarding the letter from Geo-Engineering to Jack Nickel, appended to the memo from Gerry Whitley to yourself: Please note that the spillway design discussed on p. 2 was a previous design--since that time, and in response to comments from DIAND, we have increased the design capacity to accommodate the same flow as the existing Cross Valley Dam spillway (which is the same as the existing Intermediate dam spillway).
2. EPS has expressed concern over the use of old tailings sands on the upstream face of the dam. We would like to point out that this material will be submerged as the dam fills with water. We estimate that this will take from 6 to 8 months--during much of this time, the material will be frozen. As the water is slightly alkaline at this point in the system, little leaching should occur. In this buffered system, any copper leached by acid produced in the tailings should be rapidly precipitated. Zinc in the effluent may be slightly elevated from this source, but, as zinc levels have in general been well below the .5 mg/L limit, we do not anticipate that this will become a problem. However, should our weekly monitoring at X4 indicate that zinc levels will exceed the limit at X5, lime will be added at the Intermediate decant.
3. EPS inquired what the impact would be from pumping water from behind the Intermediate Dam to lower the water level during construction of the dam. There are two sides to this question:

- a) Concentration: effluent water quality we can predict to be somewhere between X4 and X5. The annual averages (1987) of parameters of concern are presented below:

	ammonia (mg/L)	cyanide (mg/L)	lead (mg/L)	zinc (mg/L)	copper (mg/L)	pH
X4	.99	.08	.17	.20	.07	8.1
X5	.94	.05	.11	.16	.05	7.9

Also note that August is a period during which cyanide is rapidly removed from the system and we can expect the concentrations to be low. Dilution during the period of pumping will be good as the flow in Rose Creek is abnormally high for August.

- b) Flow: The pumping rate is now anticipated to be 13,500 USGPM (850 L/s) over a period of 5 days. There is some capacity behind the Cross Valley Dam to store water. The increase in effluent flow will thus be less than this, over a longer period. This will approximately double the effluent flow for a period of about a week.

Once again, thanks for your prompt attention to this matter.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Jim Moore, General Manager, Curragh, Faro
Gerry Whitley, DIAND
George Mackenzie-Grieve, EPS

August 9, 1988

Ms. Diane Granger
Chairperson
Yukon Territory Water Board
302-4114 Fourth Avenue
Whitehorse, Yukon Y1A 4N7

Dear Ms. Granger:

Enclosed please find the report "Intermediate Dam Raising Plans", Curragh Resources Inc., August 8, 1988.

These plans are filed in accordance with Part B, Section 5 (a) and (b) of Water Licence Y-IN85-05AL. We request a letter of approval for this project so that construction may begin on schedule.

Figure 4 was unavailable at the time these plans were compiled. It will be submitted to the Board tomorrow (August 10).

Details of the final specifications depend upon the results of a drilling program which is being carried out this week. As soon as these specifications have been submitted to us by Golder Associates, we will make them available to the Water Board.

Thank you very much for your prompt attention to this matter.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Jim Moore, General Manager, Curragh, Faro
Jack Nickel, DIAND
Ken Wile, EPS

enclosure

August 8, 1988

Ms. Diane Granger
Chairperson
Yukon Territory Water Board
302-4114 Fourth Avenue
Whitehorse, Yukon Y1A 4N7

Dear Ms. Granger:

RE: Raising of Intermediate Dam

Enclosed please find preliminary plans, designed by Golder Associates, to raise the Intermediate Dam by 6 meters. This is part of a five year plan to raise the dam to its design height, as shown in Golder Associates' original plans for the dam, submitted to the Water Board in 1981. The lift is required immediately in order to expand the tailings pond capacity.

Final plans depend in part on results of a drilling program being conducted by Golder from August 8 to 12. During the following week, August 15 to 19, plans will be finalized and submitted to the Board. It is necessary to begin site preparation as soon as possible in order to complete construction before freeze-up. We therefore request the Board to consider the preliminary plans and grant permission to begin construction.

The design for the dam raising is at variance with current licence requirements as the emergency spillway capacity is the 1:50 year flood, the same as it has been for the last seven years, since implementation of the down valley scheme. There are valid technical reasons for this difference and we request the Board to consider these in arriving at a decision.

As you are aware, the current spillways of the Intermediate and Cross Valley dams are designed to pass the 1:50 year flood of all of Rose Creek, while Curragh's water licence calls for design to the 1:500 year flood event. This requirement was written into the 1982 water licence, after the spillways had been constructed and the as-constructed plans had been submitted to the Water Board. There was no discussion of the design of the spillways at the hearing preceding the drafting of that licence. We would like the Board to consider altering this flood protection requirement to the 1:50 year flood event for the proposed raising of the Intermediate Dam.

The Intermediate Dam will be raised in stages over the next five years and the spillway will be reconstructed each time the dam is raised. The spillway to be constructed in 1988 thus has a lifespan of one year.

The tailings/diversion system is currently designed to accommodate a flood in excess of the 1:500 year event. The diversion ditch is designed to hold the 1:500 year flood of Rose Creek and an overflow structure was built in 1983 to spill flows in excess of the 1:500 year event to the tailings pond without threatening the integrity of the diversion canal. The down valley dam spillways are currently designed to accommodate the overflow from a much greater than 1:500 year flood with the diversion canal intact. In addition to this, the flood predictions used in the design of the down valley project were extremely conservative, much more so than the flood predictions used by the Northern Affairs Program and by the Yukon Territorial Government in dam and culvert design throughout the Yukon.

Constructing the Intermediate spillway to the 1:500 year flood level would be inconsistent with the design of the Cross Valley spillway. Reconstructing the Cross Valley dam spillway to the 1:500 year flood level would require lowering the water level in the pond behind the dam and thus shortening the retention time. This would result in a deterioration of effluent quality. As cyanide levels, in particular, are directly related to the retention time of water in the system, we do not feel that this is a step that we can take at this time.

As the spillway will be built at the end of the construction period (September), we do not have to commit ourselves to a specific design at this time. Attached is a letter from Glen Gilchrist, senior engineer with Golder Associates, presenting his

recommendation to Curragh Resources for the Intermediate dam spillway capacity.

Thankyou for considering this matter so promptly. We would be pleased to answer any questions you or your consultants might have regarding the design.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Jim Moore, General Manager, Curragh, Faro
Jack Nickel, DIAND
Ken Wile, EPS

CURRAGH RESOURCES INC.

INTERMEDIATE DAM RAISING PLANS

August 8, 1988

Contractor: Pelly Construction

Surveyors: Yukon Engineering Services

Consultant Engineers: Golder Associates

Process of Construction

The dam will be constructed by the downstream method of dam building. The core will be exposed and the upward continuation will be doubled in thickness from 4 m to 8 m. The core will be extended upward for 6 m. The upstream face of the core will be blanketed by 2 m of old tailings sand placed by scraper. The water contact will reside against the tailings sand. A clean sand and gravel filter will be placed next to the core section. This will provide connection with a drainage layer at the toe of the downstream section of the dam. The rest of the dam above the toe filter will be built of coarse sand and gravel. The core and the dam will be 100% compacted. The spillway and decant will be constructed as integral parts of the dam structure.

Prior to and during the construction period, the tailings will be discharged in the old pond area above the present pond. The water level in the pond upstream of the dam will be lowered by pumping in order to enhance the construction. Effluent will be closely monitored and treated if necessary.

Timing of Construction

Construction is scheduled to proceed from mid-August to the end of September, 1988, as per Table 1.

TABLE 1: CONSTRUCTION SCHEDULE

Event	Timing
Contractor mobilization	Aug 13 - Aug 15
Diverting tails discharge to old tails pond	Aug 15 - Sept 30
Clearing of pits	Aug 15 - Aug 20
Lowering water level upstream of dam	Aug 16 - Aug 19
Exposing the core	Aug 20 - Aug 25
Excavation pits preparation	Aug 25 - Sept 30
Placement and compaction, spillway and decant construction	Aug 25 - Sept 30
Completion	Sept 30

Plans

The following figures are provided:

- Figure 1: Intermediate Dam Raising, 1988, Plan View
- Figure 2a: Cross-section of Northern Section of Intermediate Dam, as Exists
- Figure 2b: Cross-section of Northern Section of Intermediate Dam, 1988 Construction
- Figure 3a: Cross-section of Southern Section of Intermediate Dam, as Exists
- Figure 3b: Cross-section of Southern Section of Intermediate Dam, 1988 Construction
- Figure 4: Spillway design

The southern third of the dam is different from the northern two-thirds because the old Rose Creek channel was cut into the valley bottom terrace materials in that section. Therefore the dam has a constructed height similar to the Cross Valley Dam over the southern section. The northern section of the dam has a

constructed height that is minor by comparison. Dam raising details are therefore different for the two parts of the dam.

Details for the northern part of the dam (see Figures 2a and 2b):

1. Remove the top of the dam to expose the top of the core;
2. Remove the material from in front of the core to expose the "shelf" of the core;
3. Raise the core at a width of 10 m, facing it with a scraper width of mechanically placed tailings sand;
4. Install a filter zone behind the core and construct a drainage layer sandwich that extends from the toe of the existing backslope of the narrow section to the outside edge of the new backslope;
5. Construct a shallow ditch along the toe to pick up seepage.

Details for the southern part of the dam (see Figures 3a and 3b):

1. Remove the top of the dam to expose the top of the core;
2. Raise the core at a width of 10 m, facing it with a scraper width of mechanically placed tailings sand;
3. Install a filter zone behind the core and construct a drainage layer that extends from the toe of the existing backslope to the outside edge of the new backslope;
4. Construct a shallow ditch along the toe to pick up seepage.

Abandonment Considerations

Abandonment has been considered in the development of this plan. The dam raising as planned does not limit the abandonment options since the raising is by the downstream method, the most stable method, and the core thickness has been increased beyond the original design allowance.

August 29, 1988

Mr. Ken Nordin
Technical Advisor
Yukon Territory Water Board
302-4114 Fourth Avenue
Whitehorse, Yukon Y1A 4N7

Dear Ken:

Attached are the final construction plans for the Intermediate Dam raising, prepared by Golder Associates. There are four construction drawings and a data package to accompany these drawings. The fifth drawing, the final spillway design, will be forwarded to you as soon as it is completed.

Please contact me if you have any questions regarding these plans.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Jim Moore, General Manager, Curragh, Faro

August 16, 1988

Mr. Ken Nordin
Technical Advisor
Yukon Territory Water Board
302-4114 Fourth Avenue
Whitehorse, Yukon Y1A 4N7

Dear Ken:

RE: Scheduling of Fisheries Studies in Rose Creek

I would like to inform the Board that the second part of the Rose Creek fisheries study has been postponed until the summer of 1989.

This study was originally planned for early August, 1988. We were forced to postpone the field work due to abnormally high water levels--water was too high during this period to sample and assess habitat adequately in the lower parts of Rose and Anvil Creeks. We considered rescheduling the study in September, but our consultants (P.A. Harder and Associates Ltd.) have advised us that we would be better to postpone the study until 1989. Mr. Harder expressed concern that normal fish distributions may have been severely impacted by the summer floods. This would be particularly true for recently emerged grayling fry which would likely have been prone to high mortality and downstream displacement. Thus the fish distribution data acquired during a September, 1988 field study would be difficult to interpret.

We would point out that the portion of the study concerned with evaluating the impact of the North Fork Rock Drain was substantially completed in June, 1988. An interim report will be prepared based on these data.

We trust that the Board will support us in this decision and will realize that scheduling of field studies such as this must be flexible if we are to collect the data required to assess the resources of Rose and Anvil Creeks.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Jim Moore, General Manager, Curragh, Faro
Al von Finster, DFO
Ken Wile, EPS
Jack Nickel, DIAND
Hammond Dick, Ross River Dena Council
Skeeter Verlaine-Wright, YCS
Paul Harder, P.A. Harder and Associates, Victoria

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: August 11, 1988

TO: Kresho Galovich

FROM: Joan Eamer

SUBJECT: Sheep trail and sheep trap

Could you please arrange for Northlands to move the sheep trap to a more level place and rebuild it and reinforce it so it will stay up for at least 2 winters? Have them give me a call when they know when they will be doing it. Remember, they promised to charge us no more for this.

Attached are the plans for the sheep trail as drawn up by our consultant. I have \$4000 budgetted for this. If at all possible, I would like this to go out to contract to the Ross River Band. Can you advise me on this? The trail should be built this month.

Thanks

CURRAGH RESOURCES INC.

INTER-OFFICE MEMORANDUMDATE: August 11, 1988

TO: Rob McLenehan cc: Andy Robertson, Gregg Jilson
FROM: Joan Eamer
SUBJECT: Surface Water Quality Program in relation to TAPDP

Andy Robertson asked me if the current water sampling program covered the requirements in 60602 (attached). I realize that you are working on this, but as I have done some additional sampling related to other programs, I thought I should outline my thoughts on background surface water studies.

1. Upstream sites:

(X2 and X3 continue to be done for licence requirements)

- A site (V14) has been added on Rose Creek (south fork), upstream of the mine road (upstream of the reservoir). This site is sampled monthly with the Vangorda sites. We have 4 samples from 1987 and will have at least 5 from 1988.

- On the North Fork, we have added sites upstream and downstream of the rock drain in conjunction with the seep surveys. A site will be added upstream of Faro Creek when an access road has been built for access to the hydrometric station.

- Faro Creek: upstream samples are being taken with the seep surveys.

2. Receiving water sites:

In terms of the environmental assessment, I think it essential to also characterize water quality at several points downstream of the mine. Eventually we will want to assess impact not only directly below the mine but also at points downstream. We will want to know dilution, buffering and parameters related to metals toxicity (metals, hardness, temp). Data exist for the following sites (benthic invertebrate sites), both from the company and from EPS.

-R3: about half-way from the mine to the confluence with Anvil Cr.

-R4: Rose u/s Anvil
 -R5: Anvil d/s Rose
 -EPS site R7: Anvil u/s Rose. I think we should be adding this to the list of our sites for benthic studies and for water quality - this is unaffected downstream water. For benthics, it provides a control for changes related to natural variation.

I have collected these data (in relation to the benthic invertebrate program) and will put into a logical form and send to you.

Possibly some sampling should be done on lower Anvil also.

This year, we sampled R3, R4, R5 and R7 in early August and will sample them again in September. I suggest that at this time we also collect a sample in lower Anvil. Next year the fisheries study will be in August--we could also collect water samples at these sites at that time.

X14, as the regular downstream site, should be viewed with these and sampled for the same parameters and at the same time.

3. Parameters

CN, Na and NH_3

These parameters are related to operational concerns, not to abandonment and I see no need to sample them for the abandonment plan purposes. For operational purposes, however, we do need data on natural levels and variation in ammonia as well as in its attenuation downstream, so I think it should be tested for.

Flow

We have done few metered flows on these. We have the staff gauge on the North Fork and the two hydrometric stations (in place and coming soon!). Also metered flows on Faro Creek. Some metered flows have been done at the downstream sites. I would think that flows, both for modelling and impact assessment purposes, would be estimated as monthly averages, adjusted by watershed area from the gauge data. More metered readings would likely be helpful as data points to check these estimates. They are difficult and unreliable at many sites, due to high flows and large substrate.

Metals

We have added iron to the suite of metals for most of these sites (in 1988). We routinely measure totals. Dissolved metals should be done when there is any turbidity in the water in order to get some data on the form the metals are in. Possibly for the upstream sites, dissolved should always be done, as that would go into the model (wouldn't it?). However, we definitely should not do dissolved metals if the filtering procedures are contaminating the samples, because we certainly do not want data that falsely indicate high background dissolved metals.

Hardness

As zinc toxicity is strongly related to hardness, I think this parameter (Ca and Mg) should be added to the downstream sites, including to the regular sampling of X14. We have some hardness data (EPS and possibly some DIAND sampling and the August 1988 sampling).

Alkalinity

This has been added to all sites in 1988 and should be continued.

4. QA/QC

We did duplicate sampling at 7 stream sites with EPS in August and will again in Sept. They use ICAP scans, so I don't know how comparable the data will be. Possibly we should do some samples in duplicate or triplicate to gauge how representative the grab samples are. Certainly we should send a lot of these samples out when we have our own lab, as the levels being measured are so low.

CONVERSATION WITH ANDY ROBERTSON
RE: TEST PITS AND INTERMEDIATE DAM
10 AUG 88

(Joan Eamer / Gregg Jilson)

What is needed for the non test pit part of the project is to define the scope of the remaining characterization program - not detailed in 60602.

- Previous RM and AR have decided locations of sample sites and tests to be done on samples as well as methods to be used for:
 - preservation of samples
 - extraction of pore water
- There is a potential here for getting data that we can't use for the purposes it was collected as with Klonn-Leonoff data that existed before the Test Pit Program.
- Drilling: - holes to go through tailings all way to bedrock

Typical rig would be a SME-55 - hydraulic feed
- can take shelby samples
and do SPT's

Area under X Valley and Down Valley is already done but need pore waters which we can get from pizsometers.

SURFACE WATER PROGRAM

Entirely by Robert over phone - need to ensure sampling and flow measurements are accurate and sufficient - need good background data - all previous sites are near mine and data are erratic.

Need seasonal variation in upstream surface water quality and quantity - need amount and alkalinity to assess nutralization capacity - monthly data needed - maybe a 4 week period of weekly measurements during runoff.

GROUNDWATER

- Will it be done correctly? - what is planned?
- Can we provide someone to sit with rig - 2 days - 3 days per hole, 3 holes on down stream side = 9, 10-11 hr days?

Typical person would be \$40-45/hr; \$450 per day depending on experience; 2-3 year practiced eng. would be okay.

Need to get:

Physical composition, grain size, etc

Clean comp pore water

Check comp soils

Check comp soils

Need good logging and good sample preparation. Seal in saran wrap with air excluded. Can't leave in Shebys, must be extracted soon after taking to avoid rust. (This is Roberts 1st geotech assignment - he has not done all of this before.)

BEST PROGRAM:

Simple mechanical testing

- Sieving
- Permeability tests

Chemical analysis on water to define current contaminant migration level and to allow us to define the parameters for mixing with AMD water to define constraints for equations for chemical change.

Attenuation tests for soils - ie. column tests on soils.

After sampling: organize testing. Want to see what detailed testing will be done, methods, procedures and parameters to be tested for.

Prepare a little report on the results of the program.

(Adrian Brown could review (from Denver) the project.)

FOUNDATION CHARACTERIZATION PROGRAM

Samples from above program - need tests laid out.

TAILINGS CHARACTERIZATION PROGRAM

This year be sure we get right samples and analyses.

Mainly in 1989 review placement, methods and sequence - "literature" review and records review - where are coarse tails versus the slimes.

3 holes in above program are through tailings

EPS has done 6 or 7 holes and carried out characterization.

Need to draw up models of tailings type distribution. Need location of coarse zones, soft zones, included ice zones for long term settling is affected by this - testing for settlement characteristics. Reason: Shallow paddy type water cover - large settlements in slimes area will require rebuilding of paddies, need to know amount required.

80% of physical stuff will get this year, may need to do another 20% next year.

MODELLING PROGRAM

All other programs aim to provide data for modelling and eventually design.

Physically (quantity) and kinematically how does water move through tailings impoundment and down into aquifer below.

Need to know how physically and chemically how the water moves through different zones - sand composition different and rates of movements higher than slimes, more oxygenated, higher reaction rates.

Pictorial model starting with elements at YTWB hearing - then breaks them down and adds modifier routine to look at chemical change. Leading to a linear model of water movement through the various elements.

For 1988:

Pictorial model - must get all the elements together and their inter relationships, basic structure of each of elements, inflows and outflows - but also need to look at what happens in each elements and at what rate.

Don't need any computer work this year only to get the framework sorted out.

Objective here is to have a tool that allows us to modify certain elements and evaluate effectiveness of each mitigative measures

Brenda mines models is similar, Lotus model on spreadsheet is done, SRK will show it to us.

TEST PLOT PROGRAM

- Lack of progress getting instruments working.
- 3-4 week exercise to recover instrumentation in drums - now we still don't know if the instruments are working.
For example do the thermistors work? Throw a voltmeter on to check.
- Cover placement progress is good but may be wasted if instrumentation doesn't work.
- Sample tubes are so bent and bowed that may not work.
Robert has modified certain tubes and these modifications may effect performance when bent - need to know this.
- We should now have a summers worth of results - should be getting data now.

- Robert does not appear to be planning ahead on how the program should proceed.
- AR concerned we will get into a situation where deficiencies are revealed too late to remedy by this winter when its too late to do anything about them.
- AR has gone over testing quantities and procedures for the tailings that went into the pits in the 6 weeks RM was at SRK - RM says its done but hasn't provided any results of physical and chemical analyses..

Equity has done some of this type of work. Sweedes have done hundreds (Boliden). Waterloo has done a lot - Dr. Bloes (?).

Jim Sharp can do this and we could employ him directly - ideal person is Robert - best assistant is someone with a strong instrumentation background like Jim Sharp.

- Jim Sharp would be \$35.00/hr
- Ordinary tech might be \$22-25

AR thinks the 4 year program will be judged to be too short to show that dry covers will work. (Show down 1/2 m per year acid front movement (neutralization front where water goes back to original tailing pH)). EPS will not really be able to say no it won't but they will want more testing if we insist the dry cover is working and the data are not convincing.

TAILINGS POND

1. Concern over the quantity of tailings that has gone in and the capacity of the impoundment.

What is the source of the design?

- Klom Lenoff?
- Golder?

What is the height volume relationship?

Why do the estimates seem so flawed?

- Is the bulk density wrong

Was volume calculated on the basis of a level fill to top of impoundment or a sloping surface from a beach at the upstream side?

- 1a. What was the original down valley concept?

- Centerline raising
- downstream raising
- Is CL raising feasible based on tailings nature, flow gradient from mill and timing wrt winter formation of ice lenses
- possible full size test embankment an Curragh beach area then get photographic evidence it

works.

2. Following the current plan will trigger a probable \$20M expenditure starting in 1992 related to abandon of down valley impoundment in addition to old CAMC tailings (the abandon of CAMC will probably triggered anyway)

- Further it may invalidate possible abandonments because of restrictions to the ultimate height of intermediate dam wrt slope on tailings behind the ID.
- May not be able to use what we regard as the full capacity of DV scheme if we want a wet abandonment.
- To use this full capacity and to have a wet abandon (if tailings test pits show dry won't work and forced to go wet) then may be forced to raise XV dam (or build new one) per KL (at \$10 M+) and dredge old tailings into Faro Pit or behind this huge dam.
- Sloping beaches and small dyke in current DV may be causing problems of elevation wrt to dam height and again limiting abandon options
- We need a good topo map of this area so can evaluate just what has been done here wrt abandon.

EPS is well aware that the contaminant front is moving down at 0.5 m per year in the old tailings and will be exerting great pressure to cap those tailings soon especially if the test pits don't show the dry covers working clearly enough.

- Possible alternative (assuming now committed to DS scheme) is to go CL on next raise if at all possible - to do this we need to spigget tails off the upstream side of the ID in the coming summer season (to limit ice lenses) in order to build stability.

CONCLUSION:

We have to get together: Jim Moore, Golders Gilchrist, Robertson Me (and Forgaard?) to look at the implications of different happenings in the tailings pond area with respect to the financial commitments that they may trigger and overall operational cost savings being achieved by comparison.

Some options are:

- 1) Continue as is
- 2) Go CL now
- 3) DS now then CL
- 4) go to pit ASAP
- 5) use XV impd. and - pump water to pit for treat or
 - treat plant for pit water
 - recycle

followed by:

1. wet aband, or
2. dry aband - layered: slimes, till, riprap
- simple till

Consider:

- 1) Structure design wrt certain height limitations in light of wet/dry choice.
- 2) when going to pit is possible
- 3) what costs of going to pit are
- 4) what costs triggered are by each choice

Need a meeting possibly in September to deal with these questions - most likely mtg and memo to KAF.

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: August 23, 1988

TO: Glen Gilchrist

FROM: Joan Eamer

SUBJECT: Down Valley Project Hydrology

Thanks for the memo from Greg Laird.

What we need now is a statement from you with your re-evaluation of the capacity of the diversion channel, overflow structure, spillways (and of the system as a whole) and of the north valley wall interceptor ditch in light of this. In this statement you could indicate that the hydrology review was done by Mr. Laird, what his conclusions were and that the flood design of the Down Valley Project has therefore been reviewed using these more realistic estimates of flood levels. I would then file this letter with the Water Board.

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: August 11, 1988

TO: Gregg
FROM: Joan
SUBJECT: Sheep Management Plan

This is draft 2 of the plan and it incorporates the sections I wrote plus changes I recommended, which were largely the toning down of predictions of disaster.

The plan is being reviewed by YTG - including by the director of Renewable Resources and the deputy minister. I have not promised that Curragh will co-author this plan or sign the agreement (last page).

Having said this, I would strongly recommend that we support this plan fully. I think it is a good plan (from the sheep's point of view and from Faro's point of view) and will receive wide public support. Some benefits to Curragh are:

- 1- The RERC will see this as satisfying concerns regarding sheep for the plateau development.
- 2- Curragh will receive good publicity over this which will help the company's credibility in other environmental matters. This will be promoted as a project to demonstrate government-industry cooperation in conservation.
- 3- The plan puts a limit to Curragh's responsibility in this matter--both by sharing costs and responsibilities throughout the program and by putting a time limit (page 32) to the company's responsibility. Curragh continues to have a strong role in directing the project.

I realize there may be some reluctance to endorse plans to restrict access, ATV use and hunting (all of which are quite minor restrictions). However, I am sure that the majority of mine workers will support this plan and will approve of Curragh's involvement. There was very strong feeling in the town against the people who were hunting sheep on Sheep Mountain last year.

Another point is that this plan definitely eliminates the possibility of hauling Dy ore around Sheep mountain.

Notes from Meeting August 4/88, Faro

Gregg Jilson, Rob McLenehan, Joan Eamer

REPORTS DUE TO WATER BOARD

"Due" dates are internal deadlines. Reports 2, 3, 4 and 6 form part of the Licence Renewal Application. The Licence expires March 24/89, so the renewal application should be in by late December to provide time for the hearing process. Reports 5, 7 and 8 are the Annual Report, due March 1, 1989.

Outlines of each report to be ready for review 2 weeks before reports are due.

1. Tailings progress reports
 - Robert
 - due every six months: end of October and March 1.
 - Joan will write letter to Board explaining this schedule in relation to the field season.
2. Faro Licence Renewal Application
 - Gregg, Joan
 - due Dec 1/88
3. Abandonment Plan for Other Mine Facilities
 - Rob, Jack
 - due Nov 15
 - Includes: buildings, roads, culverts/bridges, chemicals, stockpiles, boneyards.
 - Need to find out where responsibility for CIL site lies.
 - Requires site map, blueprints, chemical inventory
 - Estimated 2 weeks part-time research, 1-2 weeks writing.
4. Detailed report on tailings program
 - Rob
 - due Nov 30/88
 - 2 weeks research, 1 week report writing.
5. Annual Report
 - Rob write, Joan review
 - due Jan 31/89
 - Need Golders' report by Jan 1/89
6. Sampling schedule revision - groundwater and surface water
 - Rob
 - If possible - this is our initiative.
 - Outline by Oct 31.
7. Faro Pit research

-Rob
 -Dec 1 - 15, outline, report due Feb 15/89
 -1 month

8. Impact assessment (including model)

-Rob
 -Dec 1 - 15, outline, report due Feb 15/89
 -1 month

9. Cyanide control and contingency plan

-Rob
 -priority. due Sept 15/88.
 -Intermediate decant design should provide for control of level (for emergency storage) and mixing of treatment chemicals for emergency treatment.

10. Vangorda-Grum reports: Joan

Ongoing projects, duties:

- Tailings research - Rob
- TAC meetings - Rob
- Faro Pit Monitoring/research - Rob
- Faro licenc requirements -
 Surface water - Rob
 Groundwater - Rob
 Benthic Invertebrates - Joan
 Physical monitoring - Rob (Joan has letter to complete re this schedule)
- Monthly reports to Water Board - Rob, to Whitehorse
- Assessment of use of Faro pit for tailings - needs to be done soon.
- Faro Valley Zn
- Water lab
- RATS - Gregg
- Vangorda monitoring/research - Joan
- Blind Cr assessment - Joan
- Rose Cr fisheries - Joan
- Liason with government, review of reports and submissions-
 Joan

Budget items

CAPITAL - Faro

- Faro Pit and Area monitoring/research
- Tailings research

CAPITAL - Whitehorse

- Vangorda water licence
- Vangorda monitoring/research

- Dy IEE

OPERATING - Faro

- 2135 - licence monitoring, water lab, consultants, physical assessments, unscheduled costs (Separate into 1)water supply; 2)tailings impoundment and diversion, and; 3)water monitoring.)

Where are the following covered:

- Geotechnical and groundwater investigations at Vangorda
- Water treatment at Vangorda - design and implementation

OPERATING - Whitehorse

- Hearings related to Faro licence renewal
- Hearings related to abandonment

Discussed possibility of getting a technical contractor to cover routine water sampling at Faro and Vangorda/Grum/Blind.

July 11, 1988

Al von Finster
Habitat Technician
Department of Fisheries and Oceans
122 Industrial Road
Whitehorse, Yukon
Y1A 2T9

Dear Al:

We are considering undertaking a baseline study on Blind Creek in mid-August, 1988. The Dy and Swim developments will be in the Blind Creek drainage and we have initiated background water quality studies in this area.

I would like to apply for a permit for this study. As we will have Paul Harder and Dave Bustard (P.A. Harder and Associates Ltd.) here in August for the second part of the Rose Creek study, it would be cost-effective for us to combine the studies. However, we have not yet made the final decision as to whether or not the study will be done this year.

I have received a preliminary proposal from Paul Harder for the Blind Creek study; the relevant bits are excerpted below:

"The objectives of the program would be to assemble existing information, meet with DFO and undertake a biophysical assessment of Blind Creek and the Swim Lake tributary.

The proposed work would consist of fish sampling and detailed habitat descriptions throughout the system using ground and aerial surveys. It is proposed that ten sample sites be established from the Pelly River confluence throughout the mainstem creek and major tributaries to determine the distribution and abundance of fish in the system. Electrofishing and beach seining would be the main sample techniques used. Other techniques

including snorkeling, angling and minnow trapping may also be used depending upon the suitability of habitat and access. The extent and location of any chinook salmon spawning would also be investigated during this survey.

These data would provide a preliminary baseline of fisheries values in the Blind Creek system from which potential impact areas could be identified."

Once a decision has been made regarding this study, we will be in touch to discuss the details.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Gregg Jilson, Curragh, Whitehorse
Jim Moore, Curragh, Faro

July 5, 1988

Mr. Ken Nordin
Technical Advisor
Yukon Territory Water Board
302-4114 Fourth Avenue
Whitehorse, Yukon Y1A 4N7

Dear Ken:

Curragh Resources Inc is reviewing the peak flow estimates for subwatersheds of Rose Creek, as outlined in Sections 6.1 and 6.2 of the Faro Mine Abandonment Plan (April 1988). The attached report (Review of Peak Flow Estimates for Rose and Vangorda Creeks, June 1988) is the in-house portion of this review. It has been forwarded to a hydrology specialist consultant and to DIAND and EPS for comment.

Please regard this as working document, providing background information to supplement the sections on hydrology in the two abandonment plans submitted by Curragh in support of the application for amendment to Water Licence # Y-IN85-05AL.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Jim Moore, General Manager, Curragh, Faro

July 5, 1988

Mr. Ken Nordin
Technical Advisor
Yukon Territory Water Board
302-4114 Fourth Avenue
Whitehorse, Yukon Y1A 4N7

Dear Ken:

Enclosed are the following items of information relevant to Curragh's amendment application for Water Licence Y-IN85-05AL which we would like to be made available to Water Board members and intervenors preparing for the public hearing:

1. The Indenture of Trust for Curragh's Trusteed Environmental Fund.
2. Letter from Gregory Peebles of Cassels, Brock and Blackwell to Adrian White, Curragh Resources Inc., dated June 24, 1988:
RE: Master Agreement
3. Letter from Gregory Peebles of Cassels, Brock and Blackwell to Adrian White, Curragh Resources Inc., dated June 27, 1988:
RE: Curragh Resources Inc.
Trusteed Environmental Fund
4. List of trustees of Curragh's Trusteed Environmental Fund.
5. Report entitled "Vangorda Project, Preliminary Design: Effluent Treatment Plant", prepared for Curragh Resources Inc., by Rescan Environmental Services, Vancouver, April, 1988.
6. Paper entitled "Treatment of Acid Mine Water and the Disposal of Lime Neutralization Sludge" by Vachon et al. This paper is excerpted from the Proceedings of the Acid Mine Drainage Seminar/Workshop, Halifax, N.S., March, 1987, published by Supply and Services Canada.

Items 1, 2, 3 and 4 fulfil the requirements made by the Water Board in a letter to Curragh Resources Inc. from Diane Granger, dated June 15, 1988:

RE: Application to Amend Licence #Y-IN85-
OSAL to Incorporate Abandonment Plan

Items 5 and 6 are submitted in response to requests from DIAND and EPS for further information related to the design of a water treatment system. Please note that item 5 was not commissioned for this abandonment study, but contains information relevant to water treatment at Faro. We would like to stress that submission of an actual design would be premature, as water treatment will continue to occur in the tailings system for as long as the mill is in operation. Item 6 is a state-of-the-art review of treatment by lime of acid mine water in Canada. These items are intended to provide backup for our statement that preliminary indications are that lime treatment would be the most cost-effective method and to provide assurance that the technology does exist to remove metals and acidity from mine drainage. Both reports also contain cost estimates for lime treatment plants and discuss options for sludge disposal.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Jim Moore, General Manager, Curragh, Faro

July 5, 1988

Glenn Gilchrist
7017 Farrel Road SE
Calgary, Alberta
T2H 0T3

Dear Glenn:

Enclosed are the reports submitted to the Yukon Territory Water Board. Please review these in preparation for the hearing of July 20 and 21.

Those involved in the hearing are tentatively planning to meet in Faro on July 18 and July 19 (the Water Board's site tour is the 19th), returning to Whitehorse in the evening of July 19. I suggest that you plan to arrive in Whitehorse on Sunday, July 17 and leave the evening of July 21. You, Andy Robertson and myself can travel to Faro on Sunday evening. I'll book accommodation.

I have also enclosed a copy of the Review of Peak Flow Estimates for Rose and Vangorda Creeks. As we discussed, I would like you to have a specialist in hydrology look at this and provide the following recommendations:

1. What methodology is most appropriate to use in peak flood estimation for design of structures for these creeks?
2. What flood routing advantage could be predicted for the reservoir if this structure is left in place at abandonment? As the Acres report may be of use in this assessment, I have also enclosed a full copy of this report.

The objective of Point (1) is to come up with a set of flood estimates that you feel are realistic and then review the dam, rock drain and diversion specifications in light of these, so that we know to what flood recurrence interval they are currently designed to. We can then look at upgrading for temporary or permanent abandonment in terms of these flood estimates.

I recommend that you obtain this assessment from

someone who has not been connected with any of the previous studies reviewed.

Please call Rob or me if you have any questions. I look forward to meeting you in a couple of weeks.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Rob McLenehan
Gregg Jilson

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: July 28, 1988

TO: Glen Gilchrist cc: Rob McLenehan
FROM: Joan Eamer
SUBJECT: 1:500 year requirement for spillways

I have been through the transcripts and the "reasons for decisions" from the 1982 hearings. There was no discussion of the spillways at the hearing, only of the overflow channel for the diversion canal. I have attached the section from the "reasons for decision" dealing with this issue. It is clear to me from this that the Board did not understand the design of the down valley scheme when inserting this clause and that they did not intend the company to make changes to the spillways.

I would like to prepare a brief submission on this for the Board's consideration at their August 11 meeting, requesting them to change this spillway design standard to 1:50 on the grounds that it was set at 1:500 through a misunderstanding. It would be useful to append a letter from you covering the following:

1. Explain that the designs called for 1:50 year specifications for the spillways, that these designs were filed with the Water Board and were fully discussed at the 1982 hearing. Point out that you prepared the designs and were involved in all discussions with government agencies and with the Board and that the 1:50 design standard was never questioned.
2. Explain the current set up - i.e. that the channel is designed to carry the 1:500 flow, with flows in excess of that spilling into the ponds and that the spillways are designed to cope with the 1:50 year flow of the whole of Rose Creek. (What flood level could the system carry with the canal intact, and overflow spilling to the ponds? Isn't that the true flood level design of the system?)
3. Pointing out what is involved in rebuilding the spillways to the 1:500 flood level (estimated cost).

Please give me a call and let me know what you think about this.

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: July 27, 1988

TO: Rob McLenehan
 Kresho Galovich
 Gregg Jil son
 Jim Moore

FROM: Joan Eamer

SUBJECT: Raising of Intermediate Dam

We are required to submit to the Water Board construction plans and specifications for this project, along with a construction schedule. We must obtain approval from the Board before work begins. Any changes made to these plans must also receive approval from the Board, and as-constructed plans must be submitted within 60 days of completion of the project.

Due to the linkage with abandonment, I suggest that the plans clearly indicate how this modification relates to options for abandonment of the tailings dams. We should demonstrate that this project does not limit abandonment options or make upgrading of the Intermediate Dam to final abandonment configuration more expensive.

I recognize that approval must be obtained as soon as possible. If we do not address this from an abandonment point of view, the approval process will be very much slowed down. I suggest that we have Golders prepare the submission to the Board, consulting with Robert and with Andy Robertson on the abandonment aspects.

Below are quoted the relevant sections of the Water Licence:

Part B, Section 5

- (a) The Licensee shall file with the Board the final design and construction plans and specifications for any modifications to ... the tailings dykes and related structures ... prior to the proposed start of any construction or work and receive a letter of approval from the Board, prior to the start of any construction.
- (b) The Licensee shall file with the Board at least ten days prior to commencing any construction work..., a detailed construction schedule.
- (c) All design alterations from those approved by the Board

shall be submitted to the Board, and the Licensee shall receive approval from the Board prior to any alterations being made.

- (d) The Licensee shall provide as-constructed plans and drawings of the works referred to ... within sixty days after completion of construction.



Curragh
Resources
Inc.

117 Industrial Rd.
Whitehorse, Yukon Y1A 2T8
Tel: (403) 668-3578
Telex: 036 8359

FAX COVER SHEET

Fax Number: (403) 668-6518
Telex Number: 036-8359
Telephone: (403) 668-3578

DATE: July 27

TO: Kresho Galovich

FROM: Joan Eamer

Number of Pages 1 including Cover Page.

Circulation and/or Comments:

Re: underground mine at Faro.

I see no requirement for further approvals or changes to
the Water Licence, unless the mine affects our use
or disposal of water in any manner.

Joan.

If all pages were not received, please contact: _____

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: July 27, 1988

TO: Rob McLenehan
FROM: Joan Eamer
SUBJECT: Submissions to the Water Board

The Water Board's next meeting is August 10 and 11 (to deal with matters coming out of the hearing). In order to have anything considered at this meeting, it will have to be submitted to DIAND (and EPS and DFO must be contacted) in time for their comments to be available to the Board at the meeting.

This means that we must have the plans for the Intermediate Dam ready for submission by early next week if we are to have a hope of having them considered at this meeting. Although we could possibly submit preliminary plans, indicating the full plans are following, we should not submit anything on this without discussion of the implications for tailings abandonment.

I would also like to submit the schedule of monitoring and research for consideration at this meeting. Ken Nordin feels that if we don't, we will have such a schedule imposed on us by the Board. We should, therefore, have this in to the agencies within the next day or so. Could you please fax me changes and additions, ignoring the "resources" sections?

Joan.

C U R R A G H R E S O U R C E S I N C .

DATE: June 24, 1988

TO: Al von Finster, DFO

FROM: Joan Eamer

SUBJECT: Meeting June 10, 1988 with myself, yourself and Dave
 Bustard

Attached is the letter report on the haulroad crossing of the South Fork of Rose Creek from Dave Bustard, as promised at the meeting. This will confirm that Curragh will follow this advice and not incorporate fish passage requirements into the road crossing of this stream.

Also, as discussed, the haulroad crossing of the small tributary that flows into the reservoir will be crossed with a rock drain of calc-silicate rock. The crossing point is a narrow canyon and this creek is not fish habitat.

On another matter, this will also confirm that I will be setting minnow traps in lower Vangorda Creek periodically throughout the summer and fall in an attempt to define when Chinook move into the creek. I'll take temperature readings in the Pelly and in Vangorda for each set.

Thankyou for a productive meeting and for your draft report on lower Rose and Anvil.

cc: Jim Moore, Kim Barrowman

fax: (403) 668-6518

June 17, 1988

Rik Vos
Technical Officer
Waste Management Program
B.C. Research
3650 Wesbrook Mall
Vancouver, B.C. V6S 2L2

Dear Rik:

The following is an outline of the tests we would like to do for acid generation potential of the waste rock for the Vangorda and Grum developments near Faro, Yukon.

Please submit a bid on this work indicating:

- Experimental design, including method of sample preparation, column and humidity cell sizes used, method and rate of water feed to columns, recommended frequency of sampling leachate.

- Breakdown of costs by item.

This choice of columns and conditions is preliminary and will have to be approved by the government agencies involved before tests are set up.

As an alternative, would BC Research rent us the necessary equipment for the column leach tests and come to Whitehorse to set up the columns? If this is a possibility, please cost out this alternative.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

VANGORDA-GRUM ROCK TESTING PROGRAM

1. Slake tests

PURPOSE

To determine slaking characteristics of rock in waste dumps and in pit walls. This information will be used to assess 1) stability of the waste dumps, and 2) rate of acid generation in pit walls and waste dumps, as this rate is related to particle size.

METHODS

Two tests will be conducted. The "severe slaking" test identifies rock types that slake rapidly. The wet-dry cycles test identifies rocks that will slake in the longterm.

1.1. Severe slaking

Pieces of core about 15 cm long placed in water and left to soak for 48 hours. Observations, including estimated percent lost by volume, recorded at intervals:

1 min., 3 min., 10 min., 30 min., 1 hr., 3 hr.,
10 hr., 24 hr., 48 hr.

Preliminary results:

Seventeen samples of rock types typical for the waste dumps and pit walls were tested. Two samples of one rock type (5A, carbonaceous phyllite) showed signs of minor slaking, especially around cracks. Less than 1% was lost from each sample. Other rock types did not change.

1.2. Wet-dry cycles

Samples used in the severe slaking test will be used. Core broken into 100 g segments, each segment weighed. Rocks dipped in water for 1 minute, then allowed to air dry in the lab for 2 days. Continue for 50 cycles, recording observations at each cycle. At end, weigh unslaked portion of each segment and calculate percent loss for each sample.

2. Freeze-thaw tests

PURPOSE

To assess rock durability in waste dumps and pit walls. As for the slaking tests, this information will be useful in assessments of stability and rate of acid generation.

METHODS

Samples as those used in slaking tests. (Duplicate samples were taken from core for the slake tests and freeze-thaw tests.) Core broken into 100 g segments. Rocks immersed in water for 24 hours, placed in freezer overnight and thawed, while still immersed. Continue for 50 cycles, recording observations at each cycle. At end, weigh all segments which have not broken into three or more pieces. Subtract this from the original mass to determine the percent loss.

3. Extraction tests

PURPOSE

To find out what metals and acidity load can be anticipated from the oxidized material that will be uncovered during stripping. (The column leach test on this material will provide information on rate.)

METHODS

Adapted from EP (Extraction Procedure) Toxicity Test Procedure (Solid Waste Leaching Procedure Manual, U.S. Env. Prot. Agency, 1984).

- Minimum sample size 100 g (wet weight).
- Crushed to pass through 9.5 mm (.375 in) sieve.
- Placed in extraction vessel with 16 times its weight in deionized water. Vessel placed on bottle roller and agitated for 24 hours.
- pH measured at intervals of 15, 30 and 60 minutes, hourly for the first 6 hours and at 24 hours.
- Extraction fluid filtered through .45 micron filter and analysed for acidity, sulphate, iron, zinc, copper (some also for lead and manganese).
- This may be repeated with fresh water over sufficient cycles to extract the readily available load of metals and acidity. The total load could then be calculated.

4. Acid-Generation Potential.

4.1. Acid-base Accounting on Waste Rock Types

PURPOSE

To acquire information on the potential of the various Grum and Vangorda waste rock types to produce acid and to consume acid.

METHODS

Sixty-nine samples were taken from drill core. Intervals representative of the major waste rock types at Vangorda and Grum were chosen randomly. Samples within each selected interval were chosen to be representative of the rock type.

The samples were sent to Chemex Labs in North Vancouver, B.C., where they were crushed, subsampled and analysed for sulphur content, paste pH and neutralization potential. Maximum potential acidity was calculated from the percent sulphur and net neutralization was calculated as the difference between neutralization potential and maximum potential acidity.

4.2. Kinetic testing

PURPOSE

The acid-base accounting provides information on the maximum capacity of the rock for acid production and acid consumption. Kinetic testing models the field situation and provides information on reaction rates. The results of all of the tests will then be examined in order to predict the impact of the waste dumps and abandoned pits.

METHODS

On the basis of the acid-base accounting (4.1), waste rock was divided into 1) "sulphide waste" (clearly acid-generating), 2) rock with a potential to generate acid and 3) clearly acid-consuming rock. As a large proportion of the Vangorda rock is of the second type, kinetic tests will concentrate on these rock types.

Sample composition:

As the type 2 rocks are extremely variable in their acid-base accounting results and as it will not be possible to separate these types in the dumps, it was decided to prepare composite samples for kinetic testing. The samples were formed by physical averaging--the entire waste rock interval was taken from drill holes randomly selected from sections. Due to the high degree of variability within rock types and the fact that the rock types overlap, this is a more realistic composite than could be achieved by estimating proportions of different rock types and randomly choosing samples. Four composite samples have been collected and carefully logged; small representative samples of rock types were saved before compositing. One sample is composed of rock type 5A, carbonaceous phyllite, as

this type can be easily separated. The other three composites are mixtures of rock types that were sampled individually in the acid-base accounting tests (Part 4.1). Drill holes were selected from three areas of the pit to form these three samples.

4.2.1. Humidity cell tests

PURPOSE

The humidity cell test provides optimum oxidizing conditions to small particle size samples. It is a test of the chemical reactivity of the sulphides. Rock types with the potential to produce acid will do so under these conditions. It is thus a "worst case" test for acid generation.

METHODS

A humidity cell test will be performed for each composite sample and for a sample of sulphide waste (as a reference). Samples will be sent to a lab in Vancouver for analysis. Along with this test, samples will be analysed for static acid-base accounting and for the form the sulphur is in.

4.2.2. Column leach tests

PURPOSE

Column leach tests are models of field conditions, with oxidizing conditions provided to accelerate acid generation. These tests will be used to model 1) seepage water quality from the nonsulphide dump at Vangorda, 2) the effect of blending small quantities of acid-producing waste rock with acid-consuming rock in the Grum main dump, 3) seepage water quality from oxidized waste rock, 4) the degree of attenuation of acid mine water in the till foundation of the dumps, and 5) the degree to which till covers limit oxygen in the dump.

METHODS

Columns:

-sulphide waste rock (1), as a reference for tests 1 and 2 below.

i. Seepage water quality from Vangorda dump:

-each of the four composite samples (4)

ii. Effect of blending at Grum

-acid-consuming rock (1)

-column with acid-consuming and acid-producing rock blended intimately in proportions they will be in the dump (1)

-as above, but blended in layers (1)

iii. Seepage water quality from oxidized rock

-column with oxidized waste rock (1)

iv. Attenuation in till

-till column leached with simulated rain water (1)

-till column leached with acid, high metals water (1)

-till column leached with neutral, high zinc water (1)

Till in columns would be compacted to in situ density. This would simulate in situ permeability.

The simulated acid mine water would be Faro pit or seep water, with pH adjusted.

* The following test is being considered and will be discussed with Environment Canada. We question its usefulness as the results would be hard to interpret. The sides of the column are impermeable to oxygen; in the dump they will be till covered. In real life cracks would develop in the dump covers. There are also problems in simulating the permeability and in interpreting the results due to the vastly different scale.

v. Test of effectiveness of till cover in reducing oxygen levels in dumps.

-For one of the composite samples, set up column with till covers top and bottom and measure oxygen in column, as well as compare leachate with the uncovered column (1). Measure oxygen content in the uncovered column as well.

-Alternatively, two larger diameter columns (17") could be set up, one covered and one not covered.

-Till would have to be compacted to density that simulates cover density.

Column set-up:

Particle size: minus 1". A particle size analysis will be done to determine the distribution of sizes. In order to compare this with tests using smaller particle sizes and to gauge effect of particle size in tests, one column and one humidity cell test will be run in duplicate with minus 1/4 " particle size.

Columns about 6" diameter, 5 ft long.

For all columns, analyse leachate periodically for pH, acidity, sulphate, dissolved Zn, Cu, Fe. Occasional measurements of Pb and Mn.

Water used to leach columns: simulated rainwater--distilled water adjusted to pH 5.5 (average pH of rainwater in Whitehorse).

5. Attenuation Tests

5.1. Attenuation by groundwater

PURPOSE

To test the capacity of the groundwater to attenuate acid mine water

METHODS

Using groundwater samples from flowing drillholes and the two standardized acid mine water solutions used in the column attenuation tests. Measure initial pH, alkalinity and metals content of groundwater sample. Mix groundwater and acid mine water in varying proportions (simulating proportions in the field) in flasks. Mix and let sit 24 hours. Filter and analyse water for pH, alkalinity or acidity, sulphate and dissolved metals.

5.2. Attenuation by glacial till

PURPOSE

To test the capacity of the glacial till foundation of the dumps to attenuate acid mine water. Static and kinetic tests are performed to acquire information on total acid consuming capacity, reaction rate and attenuation of metals at neutral pH.

METHODS

- i. Acid-base accounting on sample of till.
- ii. Column leach test (Section 4.2, iv).

June 13, 1988

Mr. Ken Nordin
Technical Advisor
Yukon Territory Water Board
302-4114 Fourth Avenue
Whitehorse, Yukon Y1A 4N7

Dear Ken:

Enclosed please find the "as constructed" plans for the water wells designed and built by International Water Supply, Ltd. of Saskatoon. These plans are being submitted in accordance with Part 'B' Section 5. (e) of Water Licence Y-IN85-05AL.

The plans, supplied to us by International Water Supply, Ltd., contain the following information:

1. Drawing D86-823 records the location of the four water wells PW3, PW4, PW5 and PW6, as well as the nearby gauge holes used to record groundwater levels.
2. Drawing 86-822 records construction details of Wells 3, 4, 5 and 6, as well as associated works. Pleuger submersible pumps were installed in Wells #3 and #6.

International Water Supply, Ltd. also informed us that the above ground head of Well #3 piping was extended by one foot by their crew in March, 1987, prior to installation of the well pumps.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Bill Scheduling, Chief Metallurgist, Faro
Jim Moore, General Manager, Curragh, Faro

CURRAGH RESOURCES INC.

INTER-OFFICE MEMORANDUMDATE: June 23, 1988

TO: Those present (Curragh representatives)
Brian Campion
Glenn Gilchrist

FROM: Joan Eamer

SUBJECT: NOTES FROM MEETING ON FARD ABANDONMENT SUBMISSION,
APRIL 11, 1988

Place: Westmark Hotel, Whitehorse

Present:

Curragh: Jim Moore, Kresho Galovich, Jack Bowers, Rob McLenehan, Joan Eamer, Gregg Jilson, Andy Robertson

Government: Brian Lendrom (Water Board), Jack Nickel, Bud McAlpine, Al Waroway, Milos Stepanek, Gerry Whitley (DIAND), Ken Wile, Peri Mehling (EPS, Environment Canada), Al von Finster (Department of Fisheries and Oceans)

Yukon Conservation Society: Skeeter Verlaine-Wright

INTERIM ABANDONMENT REPORT

Andy: Summary of Interim Report

- Plan designed to cover abandonment of up to 6 years
- Expanded scope to cover concerns outlined by Brawner
- Philosophy: 1. Plan should not contribute to costs of reopening
- 2. Part of operations, not related to longterm abandonment
- 3. Maintenance required. Cannot be engineered out for stabilization for interim closure.

Peri: Sulphide waste dump - what will be the impact during temporary closure?

Andy: Does not form part of this report. Have to give this some thought. Collection and treatment possible--the potential is there for impact.

Bud and Milos: Freshwater reservoir - what provisions for this during temporary closure?

Andy: Not covered.

Milos: Reservoir is not stable. Serious consideration should be given to addressing this. Underseepage and cracks are serious. This should be covered with respect to temporary closure.

Jack: They are still waiting for an action plan to address the concerns in Milos's report (Aug/87).

Further discussion of reservoir dam:

Milos:

- significant chunk of crest affected. This must be addressed in interim closure plan - back up for emergency. Equipment is there.
- Curragh should review the stability of the dam. Factor of safety for segments of downstream slope, about 1.2. Customarily expected factor of safety is 1.5. Also cracks in top. Seepage documented by piezometers is above acceptable limits. Underseepage at toe, adverse conditions.
- Therefore, Curragh needs to ensure greater stability for high seepage conditions.
- An independent review should be done - the design is faulty. Historic data and current state should be reviewed.
- However, there is no indication of catastrophic failure.
- Thorough review especially necessary if the dam is to be left in place in the long term.
- ACRES review of 1984 recommended a toe berm. This was not installed.

Al von Finster:

- Report does not go far enough, does not cover all aspects.
- Favourable hydrologic regime downstream has been created by the operation (referring to the low gradient reach between the reservoir and the tailings). Overwintering habitat in that reach will be affected if the flow regime is not maintained. CAMC maintained this during the shutdown by drawing the reservoir low during the winter.

General agreement by Curragh that this could be done. (This has been added to the report).

Gerry:

- Clean up and contaminant control not addressed in report.
- Spills occur during shutdown and start up (CAMC had problems with this in the past).
- Re section 4.7.5., ensure tanks are empty, reagents tidied up before shut down. Compile a checklist of reagent tanks, things that require cleaning up.

(this has also been dealt with in additions to the report)

Jack:

- Trusteed Environmental Fund (TEF) - he assumes (correctly) that there will be no contributions during shutdown.

Milos:

- Problems at the site change. It should be recognized in the report that whatever maintenance is required would be accelerated to stabilize structures. (Dealt with in revised report).
- Rose Creek Diversion - mud slip area of instability. Not a catastrophic situation, but should be monitored and mitigation taken if required. This is not adequately covered in the report.
- Cross Valley Dam - cracks - monitored and checked. Need a check list for each structure. (This was under development at the mine - John Huntley with Gilchrist - status should be checked).

Jack:

Notes that interim monitoring schedule (Schedule A) is out of date (eg wrt Zone 2). (This should not be a problem, as the report commits to carrying out monitoring as per the schedule, which would be updated in the case of a closure).

Milos and Jack:

Generalize the report more to cover conditions that are prevalent at the time of shutdown, recognize changing conditions and requirements. (This has been incorporated into report)

FARO PLAN

Robert McLenehan presented a summary

Jack:

How would pit discharge be kept from Zone 2?

Skeeter:

Concern that there may be a period of nontreatment. He did not realize that treatment of pit water occurs in the tailings system.

Al von Finster:

- The plan is conceptual and contains no detailed drawings. The preface should state this.
- Concern about perched drainage (pit outflow channel). Will require maintenance. Need detailed design of discharge channels built to avoid erosion and instability due to frost action, settlement, etc. Need energy dissipator down to Rose Creek. The preliminary design should indicate that there

should be no mass movement of sediment in the outflow channel.
How will this be stabilized?

- Concerns re stability of dumps in this area.

Bud: What is the slope in the outflow channel?

Skeeter: Note that dump faces prior to Curragh's takeover not to be changed.

Jack Bowers:

- We will demonstrate stability at angle of repose
- Dumps being built now in lifts - decreasing the angle to 2:1 slope.

Andy:

- Demonstrate no loss of shear strength through slaking tests.
- Toe seepage is the other cause of loss of stability (from groundwater pooling leading to high pore pressures).
- Recognition that under seismic events, may be some creep, not massive failure.
- Slake tests should be added to monitoring and research program.

Milos:

- Freeze-thaw tests are more appropriate for these climatic conditions.

Jack:

- I understand you are seeking to change the design slope in waste dump plan after your assessment (correct)
- Waste dump stability question contains implications to North Fork causeway and outlet channel.

Milos:

- Assumptions of stability are unsupported.
- Just because it was dumped before Curragh, it is not necessarily stable (to quote).
- Factor of safety = 1 when dumped to angle of repose (determined by material friction). With weathering, the factor of safety is reduced to less than one.
- The analysis of safety factor is different for the causeway-pore pressures and slip zones.
- Now there are two slip zones on the east dumps.
- Important to review the stability of the dumps.
- Crucial thing is stability of the toe - toe berms would increase overall stability, dumping on top would decrease stability.

Ken:

- Groundwater. Concern about hydrogeology - how comprehensive is the program? Is it Curragh's intention to expand if necessary? We should expand the seep survey section in relation to contamination from groundwater to the North Fork.

Jack:

- Costs should be compared between south outlet and maintenance of the other (proposed) outlet.

Gerry:

- Concern about length of time sulphides are exposed in the pit. 4 - 8 years exposed.
- Tests required on this (extraction tests).

Jack:

- Not happy with filling the pit as an "experiment". Wants testing and prediction ahead.

Peri:

- Possibility of layers, compaction, blending in sulphides in pit. This has not been adequately addressed.

LUNCH BREAK

Jack:

- Deficiency in the plan - physical stability of tailings impoundment.
- recognizes that confusion existed on this.
- 60601 - favoured plan is to maintain Rose diversion as a perched drainage. Nothing is being done to assess this configuration.
- Concern that Curragh will start working on the physical aspects after 4 years.
- Desire to have total costs and identification of favoured alternative.
- Our program of work (monitoring and research) does not address physical stability.

Al von Finster:

- There is no commitment to monitor after abandonment.
- When planning timing of work, consideration should be given to fisheries.
- Fig. 18: prepared slope, sediment reduction - should be indicated.
- Sediment load in pumphouse pond - should look at extent of it and measures for protection against resuspending it. A possibility is a rock weir.
- Fish in reservoir - need to look at growth and age structure (we are).
- Concerns with lowering dam - how maintain good overwintering habitat, and timing the lowering to reduce fish mortality.

Peri:

- Need flow estimates for treatment.
- Information in treatment report - should be made available.

Gerry:

- Concern re water quality of Zone 2.

Jack:

- Points out that temporary approval only was given for dumping in Zone 2. Are we able to convince the Board that dumping in the pit will not reduce options? What new information or plans are we proposing? (Commitment to longterm treatment)

Milos:

- This plan is conceptual.
- Geotechnical aspects particularly sketchy.
- Acquisition of baseline data essential for waste dumps, reservoir and causeway
- Process of review required.

Peri:

- Acid-base accounting by weight - percentage in dumps - required (i.e. x % of waste in intermediate dumps is rock type y)
- Sulphide dump:
 - First time sulphide waste has been lumped in one location
 - Design based on water control (not control of acid generation)
 - Other aspects have not been examined:
 - minimize acid generation through blending
 - possibility of minimizing air flow, convection
 - possibility of a layer of alkaline rock - (discussion followed; Andy indicated that oxygen control or alkaline rock layer would probably not be effective)
 - possibility of till or synthetic cover
- Dump back in pit - concerns about accumulation of products of oxidation, high initial contaminant load.
- Equity - very contaminated small seeps - trying till covers (dumps). They can collect their seeps well - at Faro more appears to infiltrate, may be difficult to collect and treat if becomes badly contaminated.

Andy

Modelling on dump infiltration needed. Equity only 3/4 m cover. Peri felt that compaction would help (I think this was related to Vangorda)

Peri:

- Fuller static acid-base accounting of rocks needed.
- Need to know mean and variability of rock types, not just those in the haul road.
- Trenching good approach to characterizing old dumps.

General comments:

- Peri: geology unclear, incomplete wrt acid generation potential
- Ken: more attention to groundwater, nothing on treatment

- Jack: physical stability question. Unease with no final plan. Need for a time line - know when certain things will be done, certain information gained.
- Milos - insufficient attention to groundwater. No deadline to review information - need this.

ADDITIONAL POINTS FROM ANDY ROBERTSON'S NOTES

- Need to prepare a program for Faro waste dump characterization and testing (wrt acid generation potential).
- Andy prefers the south route - look at what excavation costs would be. Need to cost and eliminate if not used.
- Curragh treats causeway as a haul road, not as a dump-abandoned at angle of repose. Slumping and overtopping.
- Waste dumps - consider small toe berm. Need to look at foundation, potential for flooding of toe. Also program of study - slaking and freeze-thaw tests.
- Cost and maintenance of Faro Creek diversion and of east outlet vs south outlet (Jack Nickel)
- Discuss oxygen transport to acid generating rocks in an open pit where convective transport is not prevented. Not an automatic solution.
- Need for water quality model (Jack N and Peri). Need for determination of loads in oxidized rock waste in pit. Can wastes be mixed to reduce acid product generation?
- treatment - should also address sludge disposal. Need flow estimates.
- What can be done about getting an idea about what will happen in Zone II (must be multilevel to detect layering) (Gerry W)
- Need to cost out double handling of sulphide wastes back into the pit (to indicate it is not feasible)
- Also need to cost synthetic liner on sulphide dump.

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: June 15, 1988

TO: Jim Moore cc: Bill Scheduling
Rob McLenehan

FROM: Joan Eamer

SUBJECT: Protection against spills during the strike

Gerry Whitley from DIAND called me to express his concern that extra care be taken during temporary shutdown and during startup operations through the labour dispute. He pointed out that in the past Cypress Anvil experienced several minor and major spills during strikes and shutdowns. Most of these apparently were related to operators unfamiliar with the system adding reagents at inappropriate rates, reagent tanks being drained into tailings or pipes being rearranged.

He will be up within a week or two to take a few samples and look around.

If any spills or problems that could affect the tailings system do occur, please let me know.

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: June 6, 1988

TO: Marv Pelley

FROM: Joan Eamer

SUBJECT: RATS

Ed Joe, Senior Industrial Research Officer with Energy, Mines and Resources Canada, and the federal government's senior representative on RATS, was in Whitehorse last week to give a talk on mine abandonment at a CIM meeting. He contacted me after the meeting and invited Curragh to become a member of the Board of Directors of RATS. They want to have a representative of a smaller mining company on the Board.

This would raise the profile of Curragh within this program and assist us to get financial support for our tailings research project, as well as indicating our comittment to finding technically and economically feasible solutions to abandonment problems. The representative on the Board of Directors would have to be someone very senior. Mr. Joe asked me to approach you regarding this and to ask you to give him a call about it.

cc: Kurt Forgaard, Jim Moore, Gregg Jilson

Notes from Sheep meeting

Friday June 3, 1:00 PM, Faro

(Notes taken by Joan Eamer - these are probably not very complete--please let me know if you would like to correct or add anything major and I will redo them)

Present:

Dan Lindsey, Conservation Officer
Manfred Hoefs, Manager of Habitat and Research, Renewable Resources
Stephen Fuller, Policy and Planning, Renewable Resources
Joan Eamer, Curragh Resources
Grant Lortie, technician hired on contract for the project
Brian Horesji, consultant hired to advise on the project

1. Agenda and chairman

The agenda was approved and Joan Eamer was appointed chairman for the meeting.

2. Report on spring study status

- The objective of capturing and collaring 10 sheep was not met. Trapping was unsuccessful. Other methods tried were drugs and snares. However, due to changes in sheep movement patterns, these were unsuccessful.
- The only bait tried was hay. The sheep were not attracted to hay, but this may have been a problem with timing, as the hay was put out as new growth was starting to appear.
- Grant proposed net-gunning on Mt. Mye. Possible problems are: not finding the sheep and radio-collaring sheep that use a different winter range. Brian recommends not doing this or only collaring 2 or 3.
- The second objective of this spring's study was to monitor lambing and habitat use. In mid-May the sheep quit using the south aspect of the mountain and began to use the north side more. May 24th, first lambs. May 26th, 28 nursery sheep plus 3 small lambs seen by mine personnel on the Vangorda road (AEX road). June 3- 19 sheep on Sheep Mtn, 5 lambs. We have good classified counts. Total count about 70, 13 yearlings.
- Known mortalities in past year are 8 (estimate from Dan). Brian estimates carrying capacity higher than population.
- Population appears to be stable, with heavy mortality from hunting (illegal hunting and native hunting). Sheep appear to be in good condition.

- There is interchange between Rose Mtn and Sheep Mtn across the mine road. Rams are seen crossing road all winter.

3. Aspects of protection of the sheep population

3.1. Poaching and harrassment - enforcement, access, hunting regulations, education, cooperation with the Ross River Band

- Dan has an assistant until November to help with this aspect.
- Grant felt that a different approach was required. He proposed that special status be given to the area and noted that this would require high level input and support from both the company and the government.
- Possibility of rerouting the Blind Creek road was discussed. (The alternative is to limit the access, possibly seasonally.) Grant reported that use by trucks and by ATV's was intensive during spring. This is particularly critical as it is the time when the nursery sheep cross the road to go to the lick by Blind Creek. One Sunday Grant counted 26 trucks going out to the sheep area, then returning to town. The road could be rerouted over the stretch that approaches the mountain and around the mineral lick--a total distance of about 4 miles(?), most of it through the flat Pelly flood plain. This would entail building a new bridge over Blind Creek downstream of the current crossing. The road would then follow Blind Creek to join the old road.
- Discussion followed about developing the area as a viewing area in conjunction with a rerouting of the road.
- Manfred reported that changes in the hunting regulations were applied for, to close the area to hunting of all species, not just sheep. This has been recommended in Heather McLeod's and Brian Horesji's reports as a means of reducing harrassment and strengthening enforcement in the area. The change in regulations was not passed this year, but Manfred will pursue the matter further.
- An agreement was reached that a management plan is required. The plan should encompass all aspects of management of the population. Aspects discussed were:
 - Should all or parts be contracted out? Manfred and Joan will consider this.
 - The plan should be presented for review and endorsement to interested parties, and should be endorsed at a high level by the government and the company.
 - Ross River Band must be involved, as their cooperation is essential. Dan felt that a representative should have been at

this meeting. He will discuss this with Hammond Dick.

3.2. Habitat protection - mitigation measures

Brian is preparing a route from the point of departure from sheep mountain, around the plateau development, to Mt. Mye. He will flag and describe the route. The route will likely be constructed this summer by Curragh (probably contracted out).

Manfred suggested that habitat enhancement on the winter range also be considered--regrowth could be cleared to improve habitat.

4. Project management

4.1. Capture and monitoring

Grant's suggestion of capture during summer will be considered. The value of the added information gained by marking animals this summer as opposed to next winter will be weighed against the potentially high cost.

Joan reported that the trap will be relocated on a flat area and fixed this summer for use in the winter. Brian felt that trapping should be successful next winter.

4.2. Committee formation and community involvement

A joint committee will be set up and a meeting convened in late August or September. The funding bodies (the YTG and Curragh) will organize this--input must be sought from the Ross River Band and the Faro town people. Various ways of doing this were discussed. Dan will prepare an article for the Dotter (Curragh newsletter).

4.3. Place as demonstration project in Conservation Strategy

Stephen indicated that the project is considered as a demonstration project and he will consider ways in which it can be promoted as such. He will check into whether or not a slide show can be prepared under this program.

Manfred and Stephen will work together to secure support and funding of this project from Renewable Resources.

4.4. Documentation

Brian stressed that it is critical to maintain good records of all data and events, as this is a valuable research project.

ADDITIONAL NOTES:

Following the meeting, a trip was made to Sheep Mtn and the Plateau. The potential of the area for development for wildlife

viewing was striking--there are good vantage points for viewing the excellent winter habitat and the extensive mineral lick. The idea of rerouting the road was discussed further and all agreed that this is an essential part of the overall plan.

Next events

- Mitigation measures to be planned in detail and the migration route to be constructed - Brian, Joan and Manfred
- Details of capture program and winter program to be decided upon. A biologist will be hired for the project from fall to next spring to observe and protect the sheep and to radio-collar 10 ewes. - Manfred and Joan, with input from Grant and Brian
- Management plan to be developed - Manfred, Stephen and Joan
- Status of the project secured - commitment by YTG to longterm funding required and to the objective of management for nonconsumptive purposes. - Manfred and Stephen
- Broadening of base of support in community - Dan, Stephen, Manfred, Joan

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: June 2, 1988

TO: Kresho Galovich

FROM: Joan Eamer

SUBJECT: Water Treatment Facilities for Grum and Vangorda

Kurt asked me to find out what equipment was available from Whitehorse Copper (they are selling off all their on site equipment) that might be used for water treatment at Vangorda and Grum. The following items are for sale:

2 X Maxwell 750 cu ft flotation cells.....ea \$7500

18 X Denver Size 30 cells.....ea \$1500

8 X Denver Size 24 cells.....ea \$1000

14 X Galliger Size 24 cells.....ea \$ 500

6 X Galliger Size 36 cells.....ea \$ 500

plus spare parts for above

4 X 24" cyclones.....ea \$1500

Ken Johnson has a complete list of equipment available--there may be tanks as well.

Call Whitehorse Copper for any particulars. All the items are in place.

Kurt feels that we should be able to design treatment facilities inhouse using flotation cells and then settling ponds.

Could you let me know where you think we should take this from here? Bill Scheduling can likely help you to assess what is the best route to take.

I'll be in Faro next Tuesday and Wednesday.

May 18, 1988

Ms. Diane Granger
Chairperson
Yukon Territory Water Board
302-4114 Fourth Avenue
Whitehorse, Yukon Y1A 4N7

Dear Ms. Granger:

We would like to apply for a change to Schedule A of our Water Licence No. Y-IN-85-05AL.

By this schedule, Curragh is required to sample for extractable copper, lead, zinc and manganese at all stations (on both the program for normal operations and the program for temporary cessation of operations). We find, as we develop and adapt our monitoring system to provide us with the information that we need to refine the abandonment plans, that we require total, and in some cases, dissolved, metals concentrations. We are, therefore, at some sites, requesting all three metals analyses. As each analysis costs \$8.00, we are paying an extra \$32.00 per site per week in order to satisfy the requirements of Schedule A.

Total metals data enable one to calculate loadings. We have been sampling for total metals in seep surveys and related programs since last September. Dissolved metals data allow one to assess toxicity and provide information on the persistence of the substance in the water column. In order to understand the chemistry of the pit, dumps and tailings, we need to know what form the metals are in. We will not be analysing for dissolved metals on a regular basis--only when we require the extra information this analysis will give us. Extractable metals levels fall somewhere between total and dissolved, depending on the particulate levels. Exactly what extractable metals data mean also depends on the lab technique used and how long the samples have been stored before analysis.

We have discussed this matter with Water Resources and with Environmental Protection and are confident that

they will support this change to Schedule A.

We recognize that our effluent standards are expressed as extractable and we will consider applying to amend this when our Licence comes up for renewal. However, in the mean time we would appreciate it if you would amend Schedule A to replace "extractable" with "total" on both sampling programs.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Jim Moore, General Manager, Curragh, Faro
Gerry Whitley, Water Resources, Whitehorse
Ken Wile, Environmental Protection, Whitehorse

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: May 19, 1988

TO: Kresho, Ion and John

FROM: Joan

SUBJECT: Questions regarding the Grum plan

1. Ore stockpile

- We have previously made quite a point of impacting only one drainage basin with this development.
- Could this be relocated out of the West Fork drainage? We may require another water treatment facility if the runoff will flow to another watershed and not drain into the pit. How about the area south of this location (just off the southwest corner of the pit)--note that the elevation is about the same.
- Is this a stockpile during operations only? Could it be renamed something like a "millfeed holding area" or "transfer point", if that is what it is? What quantities will it hold?
- What will remain here after abandonment?
- Will there be any other stockpile, particularly a low-grade stockpile on site, or only at Faro? If it is at Faro, where would such a stockpile be located, what quantities of ore will it contain and what will be the timing of it?

2. Where will the water treatment facility be located? We need water quantity estimates to 1)design the facility, and 2)estimate the quantities of sludge. If we are going to store sludge in situ we will need a big pond.

3. Dumps

- The dumps cover Grum Creek--are we building a rock drain of coarse, durable acid-consuming rock? If so, where will you get it?
- Am I right in assuming there is no cover and no

segregation of waste rock types?

- The southwest corner of the southwest dump will drain to the West Fork of Vangorda Creek--can we put only acid-consuming waste rock there?
- Stability--based on spot checks, the rock dumps in their final configuration have 1.5:1 (34°) overall slopes. Is this right? I understand from Gregg that the waste rock at Grum is not expected to be as durable as at Faro. What is our assessment of stability for this design? The Grum geotechnical report (Montreal Engineering 1979) recommends rock waste dump slopes of not more than 28° and till not more than 23°. This report describes the phyllite at Grum as "extremely fissile and ready to break along foliation planes. It is expected to deteriorate rapidly upon exposure." Andy Holmes' report (Piteau Associates 1987) presents recommendations for the dump locations and design (attached page). How do the current designs relate to this and to the results from last year's geotechnical program?
- Will there be interceptor ditches to divert water around the dumps?
- Will there be a foundation study for the Grum dump sites including groundwater wells/piezometers?
- For Ion--what are the Stage I, II and III sulphide waste quantities from the PCMINE printouts? Can you estimate a proportion that could be dumped back to the pit?
- What are the design details of the southeast overburden dump. This is going to be a contentious issue, given the material, the size of the dumps, the slope of the foundation and the probability of high groundwater pressures. Are there examples of large clay/silt till dumps resting on comparable slopes in Western Canada we can use for comparison?
- Where did the Grum Lake sediments wind up? Do we know what the depth of these sediments are?
- Would an alternative overburden dump in the partly natural bowl of the southwest dump area be suitable for a till dump?

Review of Vangorda pit and waste dump plans, from an abandonment point of view

from conversation with Andy Robertson, SRK

Pit:

Till Cover:

- Will need slopes of 2:1 (27 degrees) to maintain a till cover on walls. Pit wall is 35 degrees on NE side.
- Recommends a thick till cover (2 m at top) over a clean slope - significant quantities of loose rock removed.
- Rip rap in region above till/water contact to stop wave erosion.
- This thick till cover should be effective in inhibiting oxygen transport. Oxygen transport through the till cover and the pit walls would be by diffusion only. Waste dumps act as a lung, with air moving in and out with changes in barometric pressure. This does not occur with intact rock. A till cover on pit walls has been proposed at Cinola, but there is no history of an abandoned pit treated in this manner.
- Will have to demonstrate that this till cover will stay - or commit to some degree of maintenance.

Dyke:

- Alternative is a dyke at 12E, raising water level at SE part of pit.

Dump:

- Till dump foundation - instability associated with tills with high moisture content - need data on moisture content, shear strength, plastic limits.
- Feels that 3 m cover not significant benefit - commit to 1 m, look at more.
- Recommends increasing slope on top of dump to improve drainage - to above 2 %. Best would be to raise it to 5 % using ridge lines.
- Dump design requires drainage. Recommends rock drains located at toe of dump to allow water to drain but inhibit oxygen entry.
- Need to determine how much acid will be generated during construction of dump, how much washed out and how much will be left (i.e. how long will it take to wash out the products of oxidation).
- Infiltration rate through covers - inputs to HELP model: permeability (permeability tests with permeameter and compaction tests - should be done with two samples, about 60 lb each), slope, monthly rainfall. Output: percent infiltration - and thus total yield.

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: May 18, 1988

TO: John Huntley

FROM: Joan Eamer

SUBJECT: Flood design for haul road

The hydrologist (Rick Janowicz) from DIAND supplies MAF and 50-year flood levels to highways. He wasn't sure what design criteria they use.

I spoke with the bridge engineer for Yukon Highways (Eric Gibson, tel: 667-3005). The flood design of Yukon road culverts depends on the permanency of the road and the consequences of a washout. He recommended, for our haulroad, a design of 1 in 10 year to 1 in 20 year if the consequences of a washout are not severe. Presumably, as we have equipment on site, a washout could be repaired quickly. Certainly the 1 in 100 year is overkill.

Joan

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: May 9, 1988

TO: John Huntley
Kresho Galovich

FROM: Joan Eamer

SUBJECT: Vangorda IEE and Water Licence application

The following information is required to complete the IEE:

1. Geotechnical program - results from last year, program for Vangorda.
2. Diversion design - inlet and outlet structures, route, specifications of channel and culvert design, flood protection measures and flood rating.
3. Groundwater program - including results to date.
4. Plans for water treatment and sludge disposal - we don't need detailed plans for the IEE, but we will for the Water Licence application. I could present a condensation of the Rescan report (as is in the Faro abandonment plan) for the IEE, and indicate that options are being examined.
5. Abandonment plan - we need to have decided on one plan for the pit and for the dump and to have drawings, cost estimates and design specifications.
6. Haul road design - changes in creek crossings from Stanley's report, map of alignment (also of power line alignment), design specifications. Schedule for work to completion.

CURRAGH RESOURCES INC.

INTER-OFFICE MEMORANDUM

DATE: May 9, 1988

TO: Rob McLenehan
Kresho Galovich
Gregg Jilson

FROM: Joan Eamer

SUBJECT: Planning of environmental projects

I feel we should come to some agreement about division of responsibilities for projects over the next year. The following are preliminary lists of projects and ongoing work.

I suggest we develop procedures for review of submissions at early stages and for keeping lines of communication open.

Reports due to the government

Tailings Progress Reports - July and December

CN 'Spill Report' - before hearing in mid-July

Faro Licence Renewal Application - due March 24, 1989

Abandonment plan for other mine facilities - due March 24, 1989

Detailed report on tailings program, with data - due March 24, 1989

Annual Report for Faro Licence - March 1, 1989

Sampling schedule revision - groundwater and surface water - summer/fall

Vangorda IEE - June 1

Vangorda Water Licence Application

Grum IEE

Water Licence Amendment Application to cover Grum

Annual Report for Vangorda Licence

Plus any plans for changes to structures (e.g. raising intermediate dam), dump plan changes, reports on emergencies or periods of non-compliance (such as high CN levels).

Projects and ongoing duties

Tailings research project

Technical Advisory Committee meetings

Monitoring/research related to Faro abandonment plan

Preparation for Faro hearing in mid to late July

Monitoring as required in Faro licence:

Surface water

Groundwater

Benthic invertebrates

Monthly reports to Water Board

Assessment of use of Faro pit as tailings disposal

Development of better controls and of emergency treatment for CN

Solving the high Zn problem in the Faro valley sump

Proposed Schedule C (physical monitoring)

Water lab

RATS research proposals and attempts to gain funding

Monitoring/research associated with Vangorda development

Rose Creek fisheries study

Hydrology review (Rose and Vangorda)

Liason with government, Water Board, etc.

Daily readings during spring - clarity wedge

- North Fork temperature/staff gauge

February 15, 1988

Mr. Larry Carlyle
Technical Advisor
Yukon Territory Water Board
302-4114 Fourth Avenue
Whitehorse, Yukon Y1A 4N7

Dear Larry:

As we discussed on the phone today, I will provide the Board with periodic updates of cyanide test results at X9, X4 and X5 for the duration of our program of extra sampling. The first update is enclosed.

Results are phoned in to Gerry Whitley at Water Resources as soon as they are received.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Jim Moore, General Manager, Curragh, Faro

February 10, 1988

Ms. Diane Granger
Chairperson
Yukon Territory Water Board
302-4114 Fourth Avenue
Whitehorse, Yukon Y1A 4N7

Dear Ms. Granger:

As requested by Mr. Carlyle, I am providing the Board with information related to our application to change the point of compliance (letter dated February 4, 1988).

First, I would like to clarify when treatment below our current points of compliance would be implemented. We plan on treating in the channel below the final decant if lab results indicate that our effluent contains sufficient cyanide to be acutely toxic or if bioassay results indicate that the effluent is toxic. We base this decision on the following points:

1. The residence time will be short in this treatment pond and there will be limited opportunity to adjust the effluent quality before it meets Rose Creek. There is thus a risk of causing toxicity by the treatment itself through excess addition of the treatment agent or through pH change. This risk is acceptable if the effluent itself is toxic, but does not seem to us to be acceptable if the effluent is nontoxic.

2. Experts with whom we have discussed this matter indicate that it will be very difficult to reduce total CN concentration to our effluent standard of .05 mg/L.

As our lab results have indicated that the effluent is nontoxic, we believe at this point that treating higher up in the system is a better option. However, should any of our or the government agencies' laboratory test results indicate that the final decant is toxic, we would like to have the capability to put into effect our plans to treat below X5 immediately.

To summarize our action plan, we will continue daily monitoring at X9, X4 and X5 until cyanide at X5 is low. We are performing bench scale treatability tests now, following methodology arrived at through consultation

with Northern Affairs and Environmental Protection. If we are still experiencing elevated cyanide levels at X4 when we are in a position to implement treatment, we will treat at X4. The most recent data we have received indicates to us that levels are stabilizing. and we do not anticipate having to treat below X5. However, should the effluent become toxic, we would like to have the capability of immediately treating at that point. If we institute such treatment, our point of compliance should be moved, as indicated in my previous letter. We are concerned that the Board cannot act quickly to allow such a change should the need arise. We therefore renew our request for a decision to be made to change the point of compliance now.

Attached to this letter please find information related to this problem that I hope will help you in making your decision. We are in the midst of trying to ensure that we establish better control from the process end and to develop an emergency treatment method. The conclusions we have drawn are thus preliminary. Our spill report will contain a full discussion of events surrounding this problem.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Jim Moore, General Manager, Curragh, Faro
Bill Scheduling, Chief Metallurgist, Faro
Jack Nickel, Northern Affairs, Whitehorse
Ken Wile, Environmental Protection, Whitehorse

Background Information

1. Curragh Resources recognized in November, 1987, that cyanide levels at X5 were approaching and sometimes exceeding the licence effluent standard (see letter, Eamer to Granger, November 12, 1987). At that time we increased our frequency of bioassays and instituted a program to control cyanide use in the mill and to assess methods of treatment for cyanide destruction on a contingency basis.

2. Bench scale treatment tests were initiated on November 11 at the minesite, but the results were inconclusive and it was decided to research the topic and carry out further tests. The aim of these tests was to develop a plan for treatment for emergencies at the spillway of the Intermediate dam (X4).

3. Longterm results (Figures 1, 2 and 3) indicate that cyanide levels were sporadic and rising at X9 during the fall, but the lowering of cyanide addition rates in the mill was effective in reducing the input to the tailings system during December and early January. However, the effectiveness of the pond system in treating for CN has clearly deteriorated with winter conditions and possibly with reduced residence time. The data from which these figures were plotted are listed in Table 1.

Cause of the problem and cyanide addition rates

1. Our preliminary conclusion is that the high cyanide levels in the tailings line are a result of a mismatch of cyanide addition rates to ore types. This matter is under investigation and the process of determining rates of cyanide addition has been changed.

2. A summary of daily average cyanide addition rates is presented in Table 2. These data indicate that no unusually high amounts of cyanide were added during the period that the problem apparently occurred.

3. Processing ore with low iron content has allowed us to cut back severely on cyanide addition over the past few days (see Table 2). This cutback has affected production as it has resulted in a decrease in lead recovery and too high levels of lead in the zinc concentrate.

Current monitoring

1. Results of our extra monitoring for cyanide levels in the system and at the discharge are presented in

Table 3. These results are being phoned in to Northern Affairs as soon as they are received. The most recent results indicate to us that levels are stabilizing.

2. We will continue to monitor on a daily basis at X4, X5 and X9 until the levels at X5 are low.

Proposed treatment

1. We have started bench scale treatability tests using varying dosages of hydrogen peroxide for different reaction times and under different pH and catalyst conditions. The advantage of hydrogen peroxide is that there are no toxic by-products, as there may be if sodium hypochlorite is used. The experimental design for this testing was discussed and refined yesterday at a meeting with Northern Affairs and Environmental Protection representatives.

2. Our plan is to implement treatment at X4, should the latest monitoring results indicate that there is still a need for treatment, when the dosages and treatment conditions have been determined and when the treatment plan has been approved by the government agencies.

TABLE 3: JAN AND FEB, 1988 CYANIDE AND BIOASSAY TEST RESULTS

SAMPLE DATE	X9 TOT	X4 TOT	X5 TOT	X5 WAD	BIOASSAY 96 HRS
Jan 19	5.3	.15	.074	.035	
Jan 27	being analysed today (Feb 10)				(X5) LC50>100%
Jan 31	3.1	.41	.13		
Feb 1	1.7	.21	.096	.072	
Feb 2	.51	.35	.16	.064	
Feb 3	.71	.31	.13	.068	
Feb 4	.28	.28	.13	.080	

Curragh Resources Inc.
117 Industrial Road
Whitehorse, Yukon Y1A 2T8

February 4, 1988

Ms. Diane Granger
Chairperson
Yukon Territory Water Board
302-4114 Fourth Avenue
Whitehorse, Yukon Y1A 4N7

Dear Ms. Granger:

We have received high cyanide readings on two sample dates from the upper part of the tailings system. We are currently investigating the problem and preparing for emergency treatment should further testing indicate that this is required.

Should we discover that the lower part of the tailings pond is contaminated with cyanide, our only way of preventing a toxic discharge to Rose Creek is to treat below the final decant. Our current points of compliance with effluent standards include the final decant (2BC-X5) and seeps from the Cross Valley dam (2BC-X11, 2BC-X12 and 2BC-X13). As we would be treating below these points, but before our effluent meets receiving waters (Rose Creek), we hereby request that the Board designate the following new site as the point at which the effluent standards outlined in our water licence shall be met:

"Tailings effluent stream prior to its confluence with Rose Creek."

I discussed this matter with Jack Nickel yesterday and he recommended that Curragh apply for this change in the point of compliance. Part 'B', Section 2. (g) allows the Board the flexibility to do so.

Could you please contact me to let me know when the Board will be making a decision on this matter?

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Jim Moore, General Manager, Curragh, Faro
Jack Nickel, Northern Affairs Program, Whitehorse

February 10, 1988

Mr. Al von Finster
Habitat Technician
Department of Fisheries and Oceans
122 Industrial Road
Whitehorse, Yukon
Y1A 2T9

Dear Al:

Attached is the submission Study Recommendations and Estimated Costs for the 1988 Rose Creek Fisheries Program, from F.A. Harder and Associates. I would appreciate it if your department would review this submission and provide us with comments.

Specifically, I am concerned that we complete the major part of our fisheries work on the Rose Creek watershed in 1988. We require information which will assist us to:

- 1) assess the impact of the North Fork Causeway on grayling,
- 2) develop compensation measures, if necessary, and
- 3) formulate our Faro abandonment plans, including plans for the abandonment of the reservoir and pumphouse pond.

Do you see this proposed study as meeting these needs?

Thankyou for your assistance in this matter.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Jim Moore, General Manager, Curragh, Faro

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: February 23, 1988

TO: Glen Gilchrist

FROM: Joan Eamer

SUBJECT: 500 year flood capacity of diversion/dams

Could you please prepare a letter to me that assesses the current flood capacity of the Rose Creek Diversion and Intermediate and Cross Valley dams? Specifically, what would happen in a 500 year flood?

The relevant sections from the water licence are attached. Are we in compliance with these sections? If so, please indicate this. If not, just assess the capacity without referring to the licence.

This letter may be submitted to the Water Board.

Please call me in Whitehorse if you have any questions.

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: February 23, 1988

TO: John Huntley

FROM: Joan Eamer

SUBJECT: Information required for Vangorda report

Could you please send me the following information as soon as possible so that I may include it in the Initial Environmental Evaluation for Vangorda?

1. All geotechnical data from test pits and drill holes.
2. Piezometer locations, results, your flow net diagram.
3. Designs for the diversion, including flood control.
4. Plans for further geotechnical/groundwater test work (such as frequency of piezometer readings).
5. Any further data or observations re soils and water conditions from this year's work, such as a description of the sediments in Doal Lake.

All of this can be in rough, note form or sketch maps.

CURRAGH RESOURCES INC.

INTER-OFFICE MEMORANDUM

DATE: February 12, 1988

TO: Gregg Jilson

FROM: Joan Eamer

SUBJECT: Yukon Conservation Strategy Public Working Group

I attended a meeting of the above group on February 10. The organizers and participants expressed their delight that Curragh was participating in this process and I would recommend that we continue to be involved.

I brought up the concern that one document would result from this process with no room for dissenting opinion. This was discussed and put on the agenda for the next meeting. The group is made up of people with extremely varying interests and certainly everyone is not going to agree on every point. They do not as yet seem to have arrived at a way of dealing with this. As far as I can tell, there will be one final set of objectives, goals and guidelines to emerge from this. However, we are not obliged to put our seal of approval on anything at the end of the process and we can definitely affect the contents of the final document.

The Yukon Conservation Strategy is being developed by the Public Working Group and by the Department of Renewable Resources. It is part of the Yukon 2000 process and it is also part of a world-wide effort to develop conservation strategies, following the adoption of the World Conservation Strategy in 1985 by the United Nations. Renewable Resources has developed a "strategic plan" and policy analysis document which will be discussed through this process.

There are three stages in the process:

1. Objectives, goals, framework--to be done by early April for presentation to the Cabinet.
2. Details of the Conservation strategy, including developing policy for conflict resolution.
3. Demonstration projects--the working group will have input into the choice of these and money should be available in 1989. The Mt. Mye sheep has been suggested as one of these.

The Public Working Group has input into the formulation of:

- Objectives, goals and specific policy items guiding the YTG's management of renewable and non-renewable resources.
- Policy related to resolution of conflicts between the mining

industry and other interests.

- Policy related to the regulation of the mining industry, including effluent standards, approval processes, coordination among different governments. (Related to devolution.)

- The YTG's environmental assessment review process, which the department has a cabinet mandate to develop now.

CURRAGH RESOURCES INC.:

INTER-OFFICE MEMORANDUM

DATE: February 11, 1988

TO: Brian Campion/copies to Jim Moore, Rob McLenehan

FROM: Joan Eamer

SUBJECT: Scope of abandonment plans

The Water Board discussed the attached letter yesterday and have asked Chuck Brawner to review the transcripts and his notes for the hearings and come up with a list of things that have to be included. Items which the Board decided yesterday must be addressed include:

- physical stability of the tailings dams and diversions.
- abandonment plan for freshwater reservoir and pumphouse pond.
- chemical aspect of Faro Pit water.

The latter is clearly a part of the Faro Pit abandonment plan and we are making some attempt to address it. However, we will not be submitting plans covering the first and second points at the spring hearings. These are not specified in the Licence. Have we any kind of binding commitment to do so?

Please look into this and we can discuss it at the meeting next week.

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: February 10, 1988

TO: Joan Eamer
copies to Jack Nickel and Ken Wile

FROM: Bill Scheduling

SUBJECT: REVISED TEST DESIGN, CN TREATMENT TESTS

Purpose:

To assess the effect of peroxide addition on free, weak acid dissociable (WAD) and total (strong acid dissociable, or SAD) cyanide concentrations in a contaminated X4 sample over time.

Date:

Test to be conducted February 11.

Procedure:

- A. Collect 25 litres of X4 sample at 9:30 AM. Measure pH and temperature. Assume analysis of 0.25 ppm SAD cyanide.
- B. Subdivide sample as soon as possible into 8 X 3 litre subsamples in 4 litre beakers. Retain remainder of solution and measure pH, Cu^{++} and temperature. Fix 2 X 1 litre samples for future cyanide analysis.
- C. Set up the 8 beakers in the fridge to maintain water temperature in the 2-3 degree C range.
- D. Based on the assumed CN^- concentration, add 50, 100, 200, 500 and 1000 % of stoichiometric additions of 35% hydrogen peroxide to Beakers # 1-5. Add 1 ppm Cu^{++} as neutral $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ to Beaker #6 and apply 200% stoichiometric peroxide addition to it also. Add lime to Beaker #7 (gradually) to increase pH by 1.0 units before adding 200% stoichiometric addition of peroxide. Leave Beaker #8 as a control with no dosage. Mix all beaker contents by stirring. Leave beakers uncovered in fridge.
- E. Remix beaker samples hourly for first 5 hours and measure

pH's. Remove 500 mL from Beakers # 1-5 and 7, at 1, 5 and 24 hour intervals after start of test and fix immediately for future cyanide analysis. Also sample Beaker #6 for Cu^{++} after 5 hours. Beaker #8 should be sampled only after 24 hours during this period.

- F. Discontinue tests # 1-7, maintain daily pH checks on #8 and sample again for cyanide (and fix) after 48 hours and 120 hours.
- G. Air freight fixed samples down to Ecotech for immediate SAD cyanide analysis. After review of results, re-analyse for WAD or free cyanide where required.

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: February 9, 1988

TO: Jim Moore/Kevin Coombs/Bill Scheduling/Rob McLenehan

FROM: Joan Eamer

SUBJECT: Information requirements for DIAND and the Water Board

I need the following information immediately in order to prepare a report for the Water Board and for DIAND.

1. A record of daily CN consumption in the mill going back to December and up to date.
2. A plan for emergency treatment at X4 and at X5. This should include the following:
 - procedures and timing for benchscale treatment tests to arrive at a proper dosage and determine if pH needs to be adjusted and if a Cu catalyst is necessary. The effluent must be tested for CN, excess oxidant, pH and Cu if it is added.
 - plans for addition, mixing, aeration. Estimation of residence time following treatment at either place.
3. A brief report outlining our investigation into the causes of this problem and our preliminary conclusions.

I would also like to make the following recommendation:
Due to the slow turnaround for CN testing and our shortage of lab people, I think we should be sending out water to a consultant lab for bench scale testing to determine our treatment requirements.

CURRAGH RESOURCES INC.

INTER-OFFICE MEMORANDUM

DATE: February 3, 1988

TO: Rob McLenehan

FROM: Joan Eamer

SUBJECT: Phone call to Jack Nickel, Feb 2/88

Highlights of his comments:

•They are concerned about the long turn around time for CN sampling results and would like us to do something about it.

•He indicated that they are "almost at the point of shutting down the decant". I asked for clarification--DIAND does not have the power to order a shutdown. They will recommend a shutdown and extensive sampling if lab results are as indicated by the Hach kit, and collect evidence if they consider they may lay charges. The Department of Fisheries does have the power to order a shut down. They will inform Fisheries if the lab results indicate the problem is serious.

•Emergency treatment methods carried out by Cyprus Anvil:

1. Sodium hypochlorite. CAM used to keep a supply for emergencies. Treated in a small holding pond below the tailings. They rigged up a hopper on the channel to the holding pond. Perforated airlines were in the pond for aeration. Potential problem with free residual chlorine. They also monitored the effluent and if excess oxidant was added, they added a reducing agent.

2. Potassium permanganate. (1978). Mixed in vat in mill, discharged to tailings, recycled the tailings water. They air freighted the chemical in from all over North America. Very dangerous.

3. Emergency treatment for Zn, using lime, was done in a sort of reaction vessel created with plastic curtains hung in the tailings by the discharge. Batches of lime slurry were dumped by truck.

•Emergency treatments: Chlorine gas most effective (reactive)
Potassium permanganate, hydrogen peroxide
next most reactive. Both dangerous to
work with.
Sodium hypochlorite less reactive,
slower, less dangerous

•Jack asked us to check into emergency measures--no need to implement anything unless the lab results indicate the problem is serious. Specific requests:

-Find out what the freeboard is in the ponds--how long could we shut down the decant and continue the mill?

-Look at the feasibility of putting a lift on the outlet to the Intermediate Dam to temporarily increase retention time.

-Look into arrangements for emergency chemical treatment.

-Establish baseline for the Hach kit--suggested trying to get a sample from the old tailings pond above the discharge--there should be thiocyanate there, but low free cyanide--to test for interference.

-If samples do not arrive in lab tomorrow, trace them to find out when they will arrive (air and truck samples).

-Call BC Research and request that results of the last bioassay be phoned to us on a daily basis.

•He reminded us of the requirement for a spill report to the Water Board (not later than 15 days after occurrence of the spill).

I spoke with Jim Cronin, SRK, re emergency treatment. He recommends H_2O_2 with 10 ppm Cu as a catalyst. This should take free CN down to .5 ppm. Need to mix well.

To avoid misunderstandings and duplication of effort, I would like to clarify the division of responsibilities on this matter. My understanding is:

--Whitehorse: Handle communications with the government.

--Faro: Check into the cause of this problem, monitor, arrange emergency treatment if necessary and look into prevention of future problems. Write the spill report and submit it through Whitehorse.

For this to be effective, I must be kept informed about results and plans.

If this is not satisfactory, please let me know.

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

TO: File
FROM: Joan Eamer
SUBJECT: Record of events pertaining to high CN levels, Jan/Feb,
 1988

Jan 29/88 (Fri)

Results received: CN 5.3 mg/L at X9

Action taken:

1. Informed Dan Cornett, Northern Affairs.
2. Rob checked with Kevin Coombs. No. 4 Rod Mill was shut down during the time of sampling. It appears probable that the CN line was left on during the shutdown.
3. Had lab (Ecotech) redo sample; they informed us that the results were the same. Priority put on samples taken on Jan 27 and not yet received by lab.

Jan 31/88 (Sun)

Rob took samples at X4, X5, X9 and kept.

Feb 1/88 (Mon)

Dan Cornett requested we send out samples today by air. They would like to see some results by Wednesday.

Dan requested we collect daily samples at X4, X5, X9 and hold. Found out that last week's samples were sent by truck due to problems with the airline classifying samples as hazardous goods.

Dan brought DIAND's Hach kit--sent on truck to Faro.

Samples sent by Alkan Air at noon.

Feb 2/88 (Tues)

Rob checked on availability of chemicals--nothing appropriate available except a small quantity of H₂O₂.

Hach kit results (free CN): X9 .25 mg/L
X4 .23
X5 .28
X13 .26

Called Jim Cronin, SRK, re emergency treatment. He recommends H_2O_2 with 10 ppm Cu as a catalyst. This should take free CN down to .5 ppm. Need to mix well.

Called Jack Nickel

Highlights of his comments:

- They are concerned about the long turn around time for CN sampling results.

- He indicated that they "are almost at the point of shutting down the decant". I asked for clarification--DIAND does not have the power to order a shut down. They will recommend a shutdown and extensive sampling if lab results are as indicated by the Hach kit, and collect evidence if they consider they may lay charges. Fisheries does have the power to order a shut down. They will inform fisheries if the lab results indicate the problem is serious.

- Emergency treatment methods carried out by Cyprus Anvil:

1. Sodium hypochlorite. CAM used to keep a supply for emergencies. Treated in a small holding pond below the tailings. They rigged up a hopper on the channel to the holding pond. Perforated airlines were in the pond for aeration. Potential problem with free residual chlorine. They also monitored the effluent and if excess oxidant was added, they added a reducing agent.

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- Jack asked us to check into emergency measures--no need to implement anything unless the lab results indicate the problem is serious. Specific requests:

- Find out what the freeboard is in the ponds--how long could we shut down the decant and continue the mill?

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-If samples do not arrive in lab tomorrow, trace them to find out when they will arrive (air and truck samples).

-He reminded us of the requirement for a spill report to the Water Board (not later than 15 days after occurrence of the spill).

-Call BC Research and request that results of the last bioassay be phoned to us on a daily basis.

Feb 3 (Wed)

Feb 8 (Mon)

JAN AND FEB, 1988 CYANIDE AND BIOASSAY TEST RESULTS

Status on February 9, 1988

SAMPLED	SENT	RESULTS REC'D	X9	X4	X5	BIOASSAY
Jan 19		Jan 29	5.3	.15	.074	
Jan 27	Jan 28	Feb 8				(X5)LC50>100%
Jan 27	Jan 28	being traced	*	*	*	
Jan 31	Feb 2	Feb 3	3.1	.41	.13	
Feb 1	Feb 5	being analysed	*	*	*	
Feb 2	Feb 3	Feb 8	.51	.35	.16	
Feb 3	Feb 5	being analysed	*	*	*	
Feb 4	Feb 5	being analysed	*	*	*	
Feb 5	Feb 6	-should arrive at Ecotech Feb 10 -not yet arrived at BC Research	*	*	*	X4 * X5 * X13 * FINAL DISCHARGE *
Feb 6	Feb 6	-should arrive at Ecotech Feb 10	*	*	*	

CURRAGH RESOURCES INC.

INTER-OFFICE MEMORANDUM

DATE: February 3, 1988

TO: Jim Moore/Rob McLenehan/Bill Scheduling
FROM: Joan Eamer
SUBJECT: Conversation with Jack Nickel regarding CN levels,
comments and recommendations

I called in the Jan 31 data to Dan Cornett (technician for DIAND). He discussed it with Jack Nickel, who called me. Main points:

- The data suggest that there have been at least two weeks of high CN at X9.

- DIAND inspectors will be going to the minesite tomorrow. Jack Nickel will be informing the Department of Fisheries and the Environmental Protection Service tonight or tomorrow. They (EPS) will likely go to Faro also. They will probably all travel together late tomorrow and sample on Friday.

- Key issues--we need to reduce the CN inflow, further define the problem, set up treatment and monitor for toxicity.

- Information requested by Jack Nickel:

- Full CN results for December and early January.

- Report on status of the Jan 27 bioassay.

- Results of our investigation into the cause of these high values.

- Mill CN addition for Jan 31.

- Details of our proposed treatment, including timing.

- He recommends:

- Immediately reduce CN addition in the mill to as low a level as possible.

- Collect a bioassay sample.

- Sample daily, send by plane from Faro and get results as soon as possible.

- Attempt to define the problem in the pond so that we can assess whether or not to treat. If X4 is .41 mg/L and X5 is .13 mg/L, what is the rest of the pond? Could we get a sample part way down the pond (if the ice is safe)?

- These items he recommends for our own protection:

- Sample discharge as it hits Rose Creek as well as at X5 (there is some dilution before this point and this is the point our effluent enters fish habitat). We could apply to the Water Board for them to designate this as our point of compliance. There is

flexibility on this in the Licence. This would enable us to treat below X5 and discharge an acceptable effluent.

-Consider accompanying them on their inspection and duplicating their sample collection, in case we want to challenge their results.

•He suggested we contact United Keno Hill and Mt. Skukum to see if they have any chemicals available for emergency treatment (depending on how soon the peroxide will arrive).

•He commented that Cyprus Anvil brought in outside help when they encountered similar problems. I informed him that we had contacted a consultant in water treatment and were following his advice in ordering the hydrogen peroxide. (Jim Cronin of SRK). I also said that we would contact outside experts for anything we did not have the expertise to handle ourselves.

•We agreed that I would call him tomorrow morning to let him know our immediate plans.

Following this conversation, I contacted Bill Scheduling and asked if we could cut down on CN addition tonight. He phoned the mill to order a reduction in the CN addition rate immediately.

My comments and recommendations:

•DIAND employees are taking a cautious, reasonable approach, but are gearing up for the possibility of laying charges. We should also go into legal mode and formally investigate the cause of this (review mill records, procedures, precautions taken) and ensure we have written records of actions we are taking. This may fizzle out nicely when we get more lab results, but just in case...

•I don't see much value in duplicating their chemical sampling, though it is probably worthwhile accompanying them to see where they sample, observe their procedures and do Hach kit tests. We could probably better spend our time and money on sampling to define the problem within the system (so that we will know when and where to start treatment). However, I think we should duplicate at least one of their bioassays. Toxicity is the crucial issue and the EPS has had toxic bioassays in the past at times when our bioassays have been non toxic.

•For sampling, tomorrow (Thursday) we should do X4, X5, X9 and total effluent stream before it meets Rose Cr and collect a bioassay at the latter point.

•We should provide them with the information requested (I would also like a list of daily CN addition rates over the past several months to back up our claim that we have been controlling

addition).

•We should be ready to proceed immediately with treatment as soon as results indicate we should (and we have the chemicals.) If we are uncertain about any aspects of it, we should contact a consultant.

•I should apply for a change in our point of compliance.

C U R R A G H R E S O U R C E S I N C .

INTER-OFFICE MEMORANDUM

DATE: February 2, 1988

TO: FILE

FROM: Joan Eamer

SUBJECT: Meeting with Environmental Protection, Jan 21/88, in
Vancouver (offices of SRK) to discuss Faro Pit and
Vangorda abandonment

Present:

Curragh Resources: Gregg Jilson
Joan Eamer

SRK Consultants: Andy Robertson
Adrian Smith
Jim Cronin

Environmental Protection: Peri Mehling
Keith Ferguson

The objective of the meeting was to hold an open discussion on abandonment issues in order to determine what approach the EPS will be taking to these plans and to find out what our information requirements are.

The meeting lasted 7 hours--the following is a summary of important points, not necessarily in the order discussed.

FARO PIT ABANDONMENT

•Rock types and Faro seep survey data:

Keith: we need to present an hypothesis for the mechanism of acid generation. Alternative hypotheses:

1. Acid generation is occurring in the Faro dumps and the acid is being consumed by the carbonates. If this is so, one would expect the Faro dumps to become more acid generating as the carbonate is depleted. This has been observed at other sites, where dumps have taken 10 years to become net acid generators.

2. Acid generation is occurring in "pockets" in the dumps, with the bulk of the rock being non acid generating. The acid is buffered along its pathway through the rocks. This would result

in a more stable situation.

Keith indicated we have good evidence for hypothesizing that acid generation occurs in pockets:

- Dumps as old as 20 years that have not turned acid.

- Observations from the seep survey could be taken as a model of what is occurring in the dumps--uncontaminated water flowed through a pocket of acid-generating pit wall rock to become acid water with high Zn and Cu, then flowed into neutral water, was buffered and the Cu dropped out. The resulting neutral, high Zn water is typical of Faro pit and dump seeps. The Faro Valley high-Zn water, which evidently comes from a pocket of acid-generating waste rock, supports this.

- If the carbonate level in the phyllites in the dumps is low, it would be depleted quickly and the old dumps should have reached a stable condition.

Gregg suggested a comparison of the old (SW) dumps with current waste rock. Keith expressed concern about characterizing the old dumps.

-Pit walls

Keith: what is our plan for handling stringers of sulphide in the upper pit walls? We need to quantify the loading to pit water over the coming years.

-Sulphide waste dump (Faro)

Peri: Will the sulphide waste dumped back in the pit be under water? (current waste dump plan indicates some will be above water level). Expressed strong concern that it should all be under water.

Waste rock management: we discussed identifying high sulphide waste rock--we must indicate exactly what rock types are "sulphide waste" (ie massive sulphides only, or also other acid-generating types such as white mica envelope); how sulphide waste is distinguished in the pit.

Peri expressed grave concerns about the Faro sulphide waste dump. We are taking a "cell" approach to abandonment of this dump--creating a cell of high acid generation and covering it with low-permeability material. This approach has not been proven to be effective--sufficient water still may penetrate to create problems. Specifics of information required to justify this approach:

- Acid generation potential of waste rock

- Handling procedures

- Construction of dump--suggests internal divisions to further limit water flow

- Water budget for sulphide dump area

- Carbonate levels in waste rock

- What is there now--what it will be like at abandonment.

-Water chemistry at Faro pit

Adrian expressed the opinion that the Zn may be in fine particulate form rather than dissolved. He bases this on the high Fe levels in the Zone 2 pit water--too high to be dissolved.

We have a paucity of Fe data and no dissolved vs total metals.

We can resolve this with: 1) review of any government data on dissolved vs totals, 2) sequential filtering tests on neutral, high Zn water (pits, dumps, Grum adit), 3) add dissolved metals and Fe to regular samples.

•Loading approach to abandonment

Approach taken by Curragh in Zone 2 report: Minimize cumulative loading from the various sources with the objective of keeping loading such that downstream water is of acceptable quality, rather than minimize contaminant concentration in each source with the objective of maintaining effluent standards.

Keith and Peri recognized the logic behind this approach but stated that it does not fall within current abandonment guidelines. Peri stated that there is one (operating) mine in Ontario that is permitted to discharge effluent with non-compliant concentrations, and very low flows. If we continue to take this approach, they emphasized, we must well-define fluctuations in concentrations and flows.

•Abandonment plan requirements:

Peri reminded us to address--cost estimates, how abandonment will be funded, study plan for further work--lab work, seep studies, review of information.

•Bog treatment:

Jim Cronin (SRK, San Francisco): Bog treatment has been used in the San Francisco area to reduce Zn levels in municipal waste from 10-20 mg/L to about .5 mg/L. It appears to be an ion-exchange mechanism, not a biological process. As this is sewage, the organisms are presumably heterotroph bacteria. Peat is generally the active ingredient. We have to look at applicability to: 1) low temperature 2) low nutrient conditions (autotroph bacteria/algae) 3) pH differences. This was introduced to the meeting as a possible long-term passive treatment method that we are considering and proposing studying through RATS. Peri indicated that this is the way research is going. Little is known, but it looks promising.

•Regulatory agencies' approaches to abandonment

Distinguish between existing dumps (Faro) and new dumps, in new developments (Vangorda).

Keith and Peri: in BC they have not yet approved a new dump that they thought would be acid generating. If the Vangorda dump appears to be acid-generating and our approach is to limit water flow through the dump, we will have to overcome this "philosophical" hurdle. We must sell both our philosophical and technical approaches to abandonment in our plans.

Perpetual treatment is regarded as a contingency for operations such as Equity Silver, where there is as yet no alternative (but alternatives are under investigation). It is not a politically saleable abandonment alternative unless the treatment is passive--hence the appeal of wetlands treatment.

There is growing concern because there are 5 acid-generating

mines in BC requiring about \$1 million/year treatment and other abandoned mines with no money for treatment.

If perpetual treatment (or a plan involving a high degree of uncertainty) is proposed, the nature and extent of the financial commitment from the company becomes very important.

VANGORDA ABANDONMENT

•Vangorda pit walls

Discussed doing slaking tests (Andy outlined methodology). Acid generation rate is related to surface area, related to slaking. This will assist us to predict impact of upper pit walls.

Options for abandonment discussed. Peri and Keith suggest: 1) clean out loose material on pit walls above flooding level, 2) cover in carbonate material from Grum, 3) cover in till. This will stabilize the walls, provide some buffering and limit infiltration from direct precipitation to the pit wall area. Interceptor ditches would direct surface flow around pit.

As the worst rock will be along the east wall of the pit, the possibility of building a berm in the pit and flooding the east part of the pit to a higher level was discussed.

•Vangorda waste rock lab results

The four groups of waste rock analysed were discussed:

1. Pyritic and graphitic quartzites, massive sulphides: clearly strongly acid generating
2. Altered phyllite: two samples (rock type 4LO) were much worse than the others.
3. Carbonaceous phyllite: quite high % S and high neutralization potential (NP) indicates that this rock type might take a long time to generate acid.
4. Phyllite: % S and NP low, indicating that this rock type would likely go acid quickly.

Keith said that this data set indicates that all the Vangorda waste rock has the potential to generate acid. However, several variables such as the form the base is in influence the relative rates of acid production and consumption. He recommended further testing in order to better predict what will happen in the dumps.

Humidity cell tests and column leach tests discussed (sampling and test methods). These tests were strongly recommended by government and consultants present. The objective is to look more closely at types 2, 3 and 4 to see if all types will generate acid. These tests take up to six months. If we have low sulphates in the leachate from the humidity cell tests after 4 to 6 weeks, this is a good indication that the rock is not strongly acid-generating.

•Vangorda dump

Points discussed:

- Internal till layer. Recommended by Keith. Andy questioned this, pointing out that cracking and deformation would occur during dump construction, still allowing oxygen transmission. It is very difficult to make oxygen the limiting factor in dumps because the dumps "breathe" with barometric pressure changes. Keith felt that the added barrier to water penetration would make this worth trying.
- Oxygen trapped in dump during construction. This was raised by Adrian. Studies on another dump showed that oxygen trapped in the dump before a cover was put on resulted in acid mine drainage. Again, our approach is not to limit acid production but to limit its escape from the dump through reduction of water flow.
- Segregation of the worst rock. The low-grade and oxidized ore stockpile was discussed. This is currently planned as part of the dump, near the pit. Keith and Peri indicated that special treatment should be given to the strongly acid-generating rock. Possibilities discussed:
 1. Dump back in pit. By far the most acceptable solution as it is the only one with any certainty of success.
 2. Create a separate dump with additional measures such as complex covers--calcareous rock from Grum, till, synthetic liner. Contaminated runoff could be collected separately for treatment if necessary. Far less acceptable because of the uncertainty involved.
- Approach suggested by Adrian: Exclude worst rock from dump, preferably by dumping back in pit. Demonstrate minimal impact from the remaining dump. A possibility is to direct the flow from the dump as a diffuse flow to near-surface groundwater rather than as a point source to surface water. To demonstrate that this would work, we would need to examine buffering capacities of the till and develop a good model of the hydrology. Adrian suggested a layer (at least one meter) of calcareous rock from Grum over the acid-generating rock, then till. The rain water would pick up alkalinity from the calcareous material, inhibiting the formation of AMD.

Impact assessment

A rough estimate of impact was made based on 50% and 10% infiltration rates, the average annual rainfall on the dump area and dilution. A "worst case" was taken, looking at low flow, year-round average seep flow and seep quality of AMD from the Zone 2 seep. This indicates that, should the entire dump be acid-generating, Vangorda Creek Zn levels could exceed safe levels for aquatic life, especially since the dump is only one of several potential sources of Zn to the creek.

Peri: need to firm up estimates of Zn/Cu concentrations, not just extrapolate from Faro seeps. The humidity cell and column leach experiments could be used for this.

Jo Eamer. updated January 20, 1988

FARD

Monthly reports	...ONGOING...
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ANNUAL REPORT* ||||| LD REPORT COMPILED BY ROBERT, IMPACT AND SUMMARY WRITTEN BY JOA

Includes:

JOAN AND ROBERT WILL MAKE LIST OF REQUIREMENTS

- | | |
|-----------------------|---|
| Faro Pit abandonment* | BOLD THE PLAN WILL BE PRELIMINARY AND REQUIRE MORE WORK |
|-----------------------|---|

Robert, Engineering

Includes waste rock plan

Seep Surveys JOAN INVOLVED IN FIRST, TRANSFER TO FARO [REDACTED] [REDACTED] [REDACTED]

Interim Abandonment plan#

Part of Faro pit abandonmen

SRK with Robert, Bill, Kevin

Tailings Abandonment work |

Robert, SRK involvement

Tailings progress report						1111D
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Water Lab	BILL AND CHIEF ASSAYER, INPUT FROM ROBERT, TIMING UNCERTAIN
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FARD/WHITEHORSE

Cyanide	1	11111	1111	JUAN AND BILL
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Include plan for spill, app
for effluent level change
Robert-groundwater, Joan-
surface water

Water Monitoring Review#

APPLICATION FOR FARD
LICENCE AMENDMENTS*  LD JOAN WILL MAKE A LIST OF PROPOSED AMENDMENTS

Robert & Joan, need input
from Bill, engineers, SRK

Includes:

- Use of well water - Robert, Bill
- Mining Intern. Dam - Kevin, Golders
- Spillway flood level - Kevin, Golders

Golders?
Golders

Faro & Vangorda

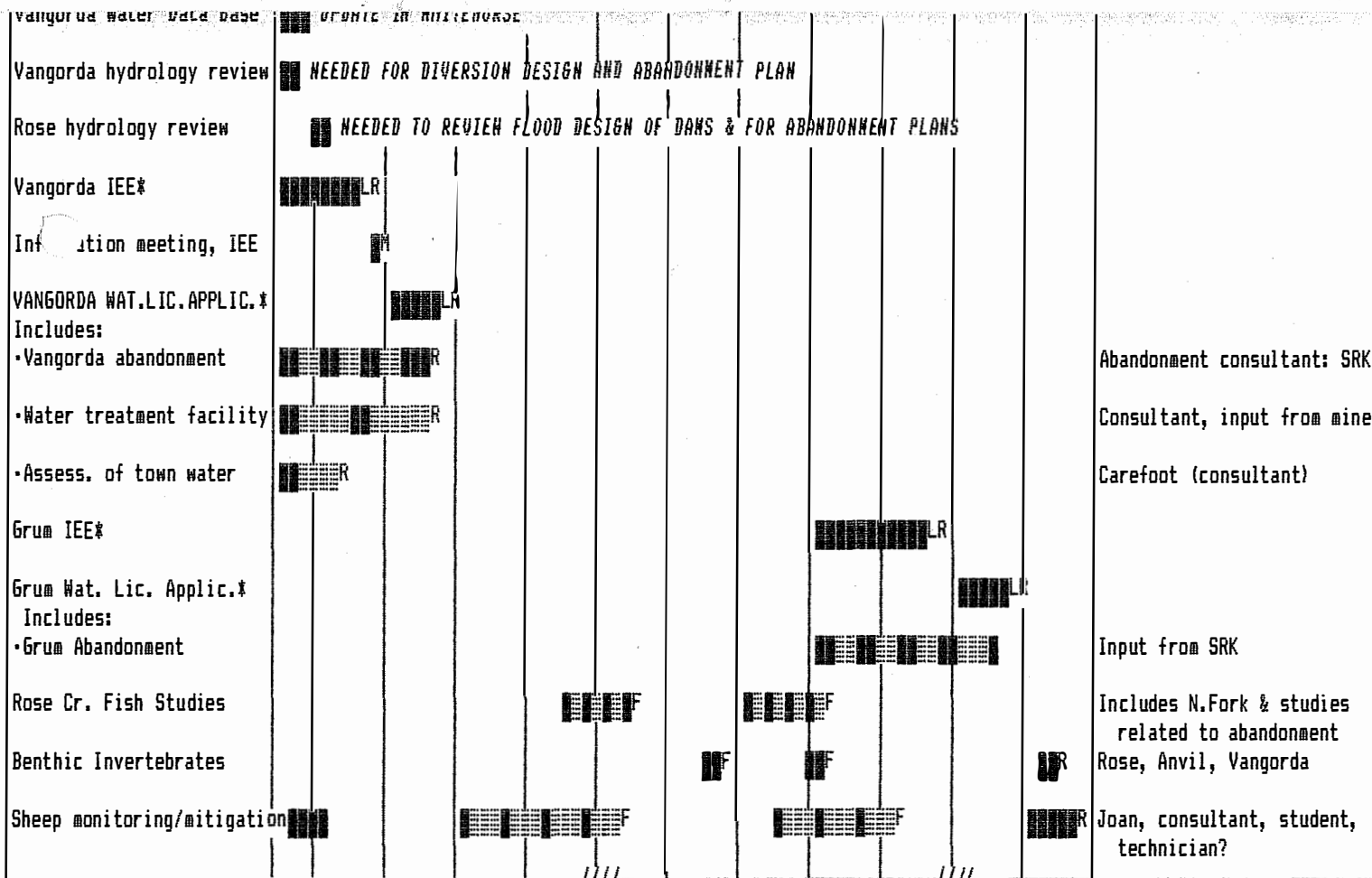
Бгцм

Water Board Hearings

M: Jim Moore, Joan, Robert,
SRK, Golders, Campion

WHITEHORSE

[illegible]



* MAJOR REPORT

M MEETING

F FIELD WORK

R REPORT

LD LEGAL DEADLINE

LR LEGAL REQUIREMENT

■■■ WHITEHORSE

■■■■ CONSULTANT

■■■ FARO

January 13, 1988

Larry Whelan
Boreal Consulting
302 Jarvis
Whitehorse, Yukon

Dear Sir:

The following outlines the terms of reference for the design of a water treatment system for Curragh Resources' Vangorda and Grum open pit developments.

Background

Curragh Resources is planning the development of two open pits (Vangorda and Grum) on the Vangorda Plateau, near Faro, Yukon. Stripping is scheduled to begin this spring for the Vangorda pit. We will require a facility to treat the water pumped from the pits, water pumped from an old adit at the Grum development and possibly runoff from the waste dumps. We anticipate that this water will be neutral and contain high levels of zinc, although there is the potential for the water to be acid and contain unacceptable levels of other metals (especially copper) in solution.

Timeframe

A design for the treatment system is required by March 25, 1987, for inclusion in the application for the water licence for the Vangorda pit development. A brief progress report outlining development of the treatment system and conceptual plans for alternative treatment methods is required in late February for inclusion in the Initial Environmental Evaluation.

Scope of the contract

The final report should include:

- Engineered plans for the construction and operation of a water treatment system to reduce potential contaminants in pit water, adit water and waste dump drainage to concentrations within limits set by Curragh's current water licence. Cost estimates should be included. Where possible, alternative solutions should be presented.
- A justification for the system, including a discussion of treatment systems in operation at other mines and results from any bench-scale tests or chemical modelling performed in the development of the system.

Information available

- Water quality data on background surface and groundwater, Grum adit water, and pit water from the nearby Faro pit will be provided. If further data are required on these waters, Curragh will undertake the sampling and analysis on request from the consultant.
- Any other existing information on geology, flows, topography, logistics, availability of materials, etc. will be provided by Curragh on request from the consultant.

We would be pleased to consider a proposal for this contract from your company. Due to the rapidly approaching deadlines, the cutoff for proposals is Friday, January 22, 1988.

If you have any questions, please call me in Whitehorse at (403) 668-3578. Thursday and Friday (Jan 14 and 15) I can be contacted in Faro at 994-2600 (days) or 994-2813 (evenings).

I am putting together an information package. If you wish to submit a bid, please let me know and I will get the package to you as quickly as possible.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

January 12, 1988

Mr. E.I. Carefoot
9323 - 74th Street
Edmonton, Alberta T6B 2B5

Dear Mr Carefoot:

The following outlines the terms of reference for a report to be entitled "Assessment of the potential for a hydraulic link between Vangorda Creek and the Faro town wells." We would be pleased to consider a proposal from you for the preparation of this report.

Background

Curragh Resources is developing two open pits on the Vangorda Plateau (see enclosed map), approximately 10 km upstream of the mouth of Vangorda Creek. As the wells for the Faro townsite water supply are located close to the mouth of the creek, we are required to assess the potential for contamination of this water supply. We are describing background surface water quality and assessing the potential for contamination of the creek. However, we do not know if creek water is a source of recharge for the town wells.

Requirement

Government regulatory agencies have requested that we assess the potential for such a connection as part of our Environmental Evaluation and our Water Licence application. This assessment will be attached to these submissions to the government and will be scrutinized at a public hearing.

Contents of the report

- Presentation of existing information on the wells.
- An assessment of the potential for a hydraulic link between Vangorda Creek and the wells.
- If such an assessment concludes that Vangorda Creek water may enter the wells, we would require an outline of possible testing that could be done to determine the existence and extent of a hydraulic connection (i.e. what would be the probable dilution factor for creek water in the water supply?).

Timeframe

The report is required by mid-February, 1988.

Information

Curragh would provide any information that the company has or can acquire locally. It would be the responsibility of the consultant to acquire information from the companies that designed and installed the wells.

I hope that you can undertake to prepare this report for us. If you have any questions, please call me.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

January 7, 1988

Ms. Diane Granger
Chairperson
Yukon Territory Water Board
302-4114 Fourth Avenue
Whitehorse, Yukon Y1A 4N7

Dear Ms. Granger:

Re: Letter to the Water Board from George Mackenzie-Grieve, Environment Canada, re Development of Zone 2 Dump, dated January 4, 1988.

The above letter consists of comments which the Environmental Protection Service's representative raised at the December 17 meeting with Curragh Resources in Whitehorse. These points were discussed at the meeting and we felt that most of the issues had been thoroughly explored and resolved through discussion. However, as Mr. Mackenzie-Grieve's letter does not reflect any of the content of that discussion, I would like to take this opportunity to present to the Board Curragh's comments on these points.

Mr. Mackenzie-Grieve expresses his concern that Curragh will be dumping in the area before the efficacy of the proposed measures can be evaluated and that the dumping of waste precludes the implementation of other measures if the rock drain is not effective. First, it should be clearly understood that the Zone 2 pit is already about 80 % full of waste rock. Options such as removal of the acid-generating rock, which is widely dispersed throughout the pit, have already been precluded.

Effectiveness of the seep collection and diversion system can be evaluated by measuring flows in the ditches and the rate at which water rises in the pit (using the pit piezometer). However, the rock drain cannot be tested until the pit overflows into it. As we anticipate that it will take a year or more for the pit water to reach the level of the drain following the final pit pumping and installation of the seep collection system in the spring of 1988, it will be at least that long before the drain can be evaluated. However, the Zone 2 dump is required now to balance the long hauls involved in the construction of the Vangorda haul road.

We do not know of any feasible options that will be precluded by dumping, nor were any such options presented at the December 17 meeting. If the rock drain is not successful, a vertical well can still be installed by drilling through waste, as will be done for the piezometer installation. Most of the waste rock that would be drilled through is already in place. We had initially considered installing a vertical well and dumping around it, but our consultant on this matter, Dr. A. Robertson, recommended a horizontal collection drain as being less subject to damage.

The drain itself cannot be damaged as it will be buried in waste rock by dumping directly on the drain, not from the top of the dump. The outlet will be maintained, as will the access road between the dump toe and the outlet. This road will act as a catch berm to stop any chunks of rock from reaching the drain outlet. We do not anticipate any problem in sealing the drain. The channel is cut through rock which has not been damaged in construction. We know from observation that the rock is not porous. A compacted till plug seals the outlet around the pipe.

Treatment of the water was not presented as an option in the report because we have not fully explored this possibility. However, we are certainly considering this--indeed it is our preferred option, as pumping is expensive and technically difficult from this location. We are researching treatment methods for the Vangorda development and bench scale tests are under consideration using water from the Faro pits to approximate Vangorda and Grum pit water; the results will therefore be applicable to Zone 2 water. With the rock drain, we will retain the capability of pumping back to tailings if treatment is ineffective. The current issue of dumping is, however, irrelevant to the treatment issue since a treatment pond can still be put in place after the dump is utilized.

The seep survey of the Faro pit and dumps will be re-done several times in 1988. We will be adding alkalinity to our suite of parameters, but do not see that the measurement of acidity in the neutral to alkaline waters will provide useful information. However, we would be glad to discuss this further and add acidity if the information will help us to develop treatment methods.

Curragh will be installing a piezometer at the low

point of the Zone 2 pit and we are evaluating the feasibility of installing another between the pit and the North Fork. We are also mapping groundwater movement from an analysis of bedrock structure. We would welcome any assistance from Environment Canada's groundwater specialist in this evaluation.

I would appreciate it if you would contact me if you have any questions related to these issues or to other aspects of our plans for development and impact assessment in Zone 2.

Yours truly,
CURRAGH RESOURCES INC.

Joan Eamer
Environmental Supervisor

cc: Jim Moore, General Manager, Curragh, Faro
Kim Barrowman, Manager of Mining, Curragh, Faro