

Faro Mine  
Env.  
Test Pits  
Planning



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December 22, 1989  
Project Number 60602

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

Attention: Gregg Jilson

Dear Gregg;

We have recently reviewed the Faro mine Tailings Abandonment Plan Development Program (APDP) as described in Steffen Robertson and Kirsten Report 60602 (January, 1987). A summary of the Phase I progress review is provided below. Further, work programs which are scheduled for completion during 1990 are identified and detailed. Cost summaries have been included.

The Faro mine Tailings APDP was designed in four phases of which Phase I is currently being implemented. The four APDP phases include:

- Phase I: Investigation and Basic design of Abandonment Plan.
- Phase II: Implementation of Pre-Close-Out Measures and Re-Evaluation of Abandonment Plan.
- Phase III: Implementation of Final Abandonment Plan
- Phase IV: Monitoring and Maintenance

Phase I was planned as a four year program and was initiated in 1987. Expenditures for each year of the program were estimated as follows:

Year 1	Apr/87 to Apr/88	\$ 425,000
Year 2	Apr/88 to Apr/89	\$ 164,000
Year 3	Apr/89 to Apr/90	\$ 164,000
Year 4	Apr/90 to Mar.91	\$ 319,000
<b>TOTAL</b>		<u>\$1,072,000</u>



The phase I program was further detailed for the four year period by task. The task outline together with estimated task costs are as follows:

A. Test Plot Program	\$ 725,000
B. Groundwater Baseline Program	\$ 68,000
C. Surface Water Baseline Program	\$ 42,000
D. Tailings and Subsite Soils Characterization	\$ 50,000
E. Modelling	\$ 80,000
F. Preparation of Abandonment Plan	\$ 75,000
Contingency	\$ 32,000
 TOTAL	 <u>\$1,072,000</u>

### PHASE I REVIEW

The purpose of the following review is to determine the extent to which Phase I tasks have been completed, delineate deficiencies in task completion, and detail work remaining to be completed. The last scheduled sampling of the test facility is the summer of 1990; thus, all data requirements for the APDP must be satisfied by the fall of 1990. The remainder of 1990 and the first few months of 1991 will be required to establish a data base, evaluate collected data, model the results, and prepare a detailed abandonment plan.

#### **TASK A: Test Plot Program**

The testing of five tailings covers was initiated in 1987. The primary objective of this program is to identify appropriate technology and stabilization measures which will ensure the long term protection of the water quality in Rose Creek. Of the five tailings covers being tested, four tests are still considered valid. The fifth tailings cover being tested was a shallow water cover. As the water cover was not continuously maintained, test results for the water cover must be treated with doubt. *Sp. t. leaked.*

In 1987, the tailings as placed into the test facility were chemically analyzed. Subsequent to cover placement, water quality analysis was conducted in the test facility in October, 1988, July, 1989, and October, 1989. Solids sampling and analysis was conducted in October, 1989. ~~Two~~ remaining water quality sampling and analysis events are scheduled: one in July, 1990, and one in October, 1990. ~~One~~ solids sampling and analysis event is scheduled for October, 1990.

Water quality sampling and analysis has been successfully undertaken to date. One type of sampler, the air/water sampler, has proven to be particularly successful and free from mal-function. The back-up lysimeters, which to date have not been required, have not functioned well. Sample extraction has proven to be difficult, and sample volumes have been small. Small volumes create difficulties in in-situ and laboratory analysis.

Solids sampling was not successful in 1988. The sampler unit had inherent design problems. In July, 1989, efforts were made to modify the sampler. The sampler was subsequently abandoned and a new sampling method introduced. To date, the success of this sampler is not known. Should this sampler also prove to be unsatisfactory, arrangements will have to be made to collect samples from surface using a small hand auger. Changes in solids chemistry is critical to analysis and samples must be collected in 1990.

Pore water pressure can be monitored by pneumatic piezometers installed at various depths throughout each test pit. Pore water pressures were determined in October, 1988; however, by July, 1989, most of the brass adapter fittings at the end of the instrument leads had cracked. These fittings must be replaced if further pore water pressure readings are to be obtained.

Temperature profiles can be determined in each test pit through access to thermistor strings. Temperatures were monitored in 1987, in 1988 and several times during 1989. These instruments continue to function well; however, in 1990, the frequency of readings must be increased to once every ~~two~~ two weeks throughout the year beginning.

★ Oxygen and carbon dioxide gas profiles have not been determined to date. These in-situ tests should be undertaken at monthly intervals through 1990.

With respect to outstanding tasks scheduled for 1990/ 91, these include up-dating and refinement of the data base, evaluating the data, and reporting on the final results of the tailings covers tests. (Item A.(v): estimated cost = \$ 60,000). ★

#### **TASK B: Groundwater Baseline Program**

The necessary installations to supplement existing instrumentation were completed in September, 1988. A complete sampling of all groundwater monitoring stations was scheduled for 1989. One more sampling event is scheduled for 1990.

not done →

The major tasks for 1990/ 91 include developing a data base, evaluating the data and preparing a report which summarizes the findings. (Item B.(iv): estimated cost = \$ 10,000).

### **TASK C: Surface Water Baseline Characterization**

The surface water within the immediate vicinity of the mine site has been monitored regularly since mining began in Faro in 1969. The major task involved with surface water baseline characterization is completing the data base. A data base was partly developed in 1987, and has since been updated on a regular basis. However, data prior to 1987 has not been entered into the computer data base. Results from 1982 to 1987 have been organized for easy access. Data prior to 1982 has not been reviewed in detail.

In addition, sampling above the confluence of Faro and North Fork Creeks should be undertaken monthly. Water quality results from this sample location should help to determine background water quality for the Faro mine area. Sampling should begin as soon as possible, and continue through 1990.

Data entry is the major component of this program. Besides this, the major work remaining for 1990/ 91 are data evaluation and report compilation. (Item C.(iii): estimated cost = \$ 9,000).

### **TASK D. Tailings and Subsite Characterization**

The drilling and sampling was completed in September, 1988. The laboratory analysis was completed by spring, 1989.

In-situ monitoring of oxygen and carbon dioxide gases must be done in 1990. Equipment problems prevented this component of the program to be initialized in 1989. The in-situ investigation program should entail a transect from old to new tailings. Paste pH should also be determined during instrument installation.

In-situ permeability tests should be done in 1990 at locations in the proximity of the CO<sub>2</sub>/ O<sub>2</sub> monitoring installations.

Samples should be collected in 1990 along a transect from old to new tailings for analysis for the presence of the bacteria, Thiobacillus Ferroxidans. Samples should be taken approximately every 0.3 meters to a depth at which the paste pH is greater than 5.5. Samples taken during 1988 for this purpose were lost in transit.

*monthly  
maybe  
closer.  
in spring  
need  
alkalinity  
cycle*

Supplementary weather data was collected during 1989 at the tailings facility. Maximum and minimum temperatures, precipitation and evaporation rates were measured. This program should be continued throughout 1990.

This investigation has generated a lot of data, which must be entered into a data base, summarized and then evaluated. The data has been organized and presented in SRK Report 60613. This work is scheduled for 1990/ 91. (Item D.(iii): estimated cost = \$8,000 which does not include remaining test work which must be completed).

#### **TASK E. Modelling**

The approach to and the type of modelling to be undertaken must be determined in early 1990. Two modelling systems are required: acid-generation modelling and contaminant migration modelling. (Item E.(i & ii): estimated cost = \$ 80,000).

#### **TASK F: Preparation of Abandonment Plan**

This task entails evaluating acid abatement options, evaluating stabilization options, and preparing the abandonment plan. Preliminary organizational work should be started early in 1990. (Item F.(i,ii, & iii): estimated cost = \$ 75,000).

#### **SUMMARY OF 1990/ 91 PHASE I WORK**

Tasks and estimated costs of completion for 1990/ 91 program year are provided below.

A.	Test Plot Program	\$ 60,000
B.	Groundwater Baseline Program	\$ 10,000
C.	Surface Water Baseline Program	\$ 9,000
D.	Tailings & Subsite Soils Characterization	\$ 8,000
E.	Modelling	\$ 80,000
F.	Preparation of Abandonment Plan	\$ 75,000
	<b>TOTAL</b>	<b><u>\$ 242,000</u></b>

Curragh Resources Inc.  
December 22, 1989

Page 6

We would like to emphasize the importance of planning the 1990/ 91 programs, and the importance of an early start date for the remaining work in each of the phase I programs. Should you require any further information, please contact either A. Robertson, R. McLenehan or myself.

Yours very truly,

STEFFEN, ROBERTSON AND KIRSTEN (B.C.) INC.

A handwritten signature in cursive script, appearing to read "Andy MacG. Robertson".

Andy MacG. Robertson, P. Eng.  
Principal

AMR/cs

# Hydro geochemistry

- Sample all wells from PW4 → K4  
at same time - ASAP in the  
Springtime

~~- need  $\text{CO}_2/\text{O}_2$  monitors along with  
Thermistors need help to  
get this done~~

- 2 samplings one early on again  
later

- need But water report on  
Rose creek and any other  
drill hole data to  
construct cross sections

need - dimensions

- Kd's (may need lab tests)

- Use Golebs data from creek informed  
by valley dam

need to establish differences for  
modeling

- Radup model - need a run before summer to find out what data differences are - evaluate parameters and see sensitivity to them.

- then link to contaminant transport model - will use 1 or 2D model - maybe just several linear paths  
then  $K_D$  to migration

Needed for the overall plan to progress

1) Maps of tailings pond surface - 1 foot contours - essential to evaluate paddy concept.

2) Optionally a compaction test on tailings to test permeability

1a) maps of the entire down valley area up to date detailed contours

3)  $O_2/CO_2$  monitoring - paste pH in transect from old to new trails

4) Need "lithology" sections across Rose Ck valley - Golden dune and Int water Sew duct + our new holes.

## Test Pits

- Stand pipe on saturated composites - volume is the water in the till zone
- Western Ontario owes us \$12000 worth of test results on lab equivalents of the field tests - should follow up on this
- 2 samplings of water for 1990  
July and October
- monthly T and  $Q/CO_2$  content
- get all bottom samplings
- find out why pit dropping during transit  
one solids sampling in Oct 1990

# Abandonment

= water cons ok but cause stability problem and are expensive

= Composites may work but much needs to be demonstrated.

= Previous abandonment scenarios are for a

→ Modeling - won't have data to model but can say that low values are possible, - will have to recalibrate at later date - but now must implement in 92

→ This year Wake up Test Pit Program in good scientific fashion

- Test pit a little understudy will get 80% of what wanted

= Terry ok

monthly = Catchy on  $O_2$  &  $CO_2$  but will be ok next year very important

= Water Chemistry is ok provide 2 m<sup>3</sup>

- Presimeters lost but not critical

→ Air water samplers work ok but lysimeters don't work not input as same data

→ bottom sampling ok but missed some.

- Solids sampling generally ok but  
missed a few

MR proposes 6 mo rept that can  
update abandonment plan rept  
with new readings -

In next 6 months should get