REPORT ON:

MT. NANSEN MINE
CLOSURE COST ASSESSMENT

Prepared for:
Water Resources Division
Indian Affairs and Northern Development Canada
Whitehorse, Yukon

Prepared by:

Brodie Consulting Ltd.
West Vancouver, B.C.

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MT. NANSEN MINE
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1.0 Introduction

As per the instructions from Water Resources, the objectives of the work described in this report are to: estimate and/or update previous estimates of mine abandonment costs and accumulated site liability of the Mt. Nansen gold mine.

Fulfilling the project objectives has included the following steps:

- conduct a site inspection,
- review available information,
- characterize the existing mine condition and expected reclamation measures,
- compile a reclamation cost estimate using the RECLAIM cost estimating model, and,
- prepare this report describing the above steps.

2.0 Site Inspection

A site inspection was conducted on October 29, 1998, with Mr. Bud McAlpine of the Water Resources Division. The site inspection consisted of a brief meeting with Mr. Pascal Renardet, Mine Manager, a self-directed inspection of the pit, waste dump and tailings area. Additional information regarding the operation of the tailings impoundment was provided by Mr. S. Hureau, Environmental Coordinator. An inspection of the mill area was not conducted. However, the layout and condition of the mill area appeared to be substantially as it was during the previous inspection in 1995.

3.0 Information Sources

The following information was reviewed for this project:

- Initial Environmental Evaluation, Mt. Nansen Development, Vol. 1 and 2, Nov. 1994,
- Tailings Impoundment - Final Design Report, Klohn-Crippen, Aug. 1995,
- B.Y.G. Natural Resources, Water Licence Application, Mar. 1995,
- EARP Screening Report, Environmental Directorate, DIAND, Nov. 1995,
- Water Use Licence QZ94-004, and amendments 1, 2, and 3

- Waste Rock & Pit Wall Acid Rock Drainage Study, B.Y.G., July 1997,
- plots of ground temperature and piezometric levels in the tailings dam for the period April to Oct. 1998,
- letter to Water Resources from Geo-Engineering (M.S.T.) Ltd. - Mt. Nansen Mine Tailings Pond Dam Monitoring, Nov. 12, 1998,
- Mt. Nansen Conceptual Decommissioning and Reclamation Plan, January 1998, DRAFT
- Water Quality Reports for June, July and August, 1998,
- Water Resources memorandums on water quality inspections conducted on dates Aug. 19 and Sept. 15, 1998,
- analytical results for acid generation potential on two samples of tailings material collected on Nov. 2, 1998.
- letter to Water Resources Division, comments on arsenic stability test work by S. Hureau, B.Y.G. Environmental Coordinator, Nov. 11, 1998

4.0 Mine Life

This report is based on the assumption that the mine operations will cease within the next few months. At this time the storage capacity of the tailings impoundment has been reached or possibly already exceeded. Furthermore, the reserves of oxide ore (material which is not potentially acid generating) appears to have been exhausted as potentially acid generating tailings are now being deposited in the tailings impoundment. Processing of sulphide ore (interpreted here to mean material which is potentially acid generating) is prohibited under the conditions of the Water Licence.

No plans have been submitted for development of a new tailings impoundment area, and no plans exist for future ore recovery, waste management or water management.

Strict compliance with the terms of the Water Licence would result in immediate termination of mining and milling because of the acid generating ore and the discharge of tailings beyond the capacity of the impoundment.

5.0 Existing Mine Condition

Open Pit

The open pit has been mined down to about the 1230 m elevation, which is about 10 m deeper than proposed in the Nov. 1994, I.E.E. Mining has passed below the exploration adit. Frozen water in the pit bottom indicates that there had not been any ore recovery for possibly several weeks prior to the site inspection. Groundwater was entering the north end of the pit. The water level in the pit had not risen high enough to drain out the adit. A 2 m high berm on the north end of the pit restricts access from the Mt. Nansen access road.

Based on analysis of current tailings discharge, potentially acid generating ore has been recovered from the pit. Consequently, the lower pit walls and floor are also expected to be acid generating.

A study of the waste rock and pit wall rocks was prepared and submitted by B.Y.G. in 1997. This study only examined rocks at elevation 1255 m and above. The transition from oxide to sulphide ore, and thus towards increasing potential for acid generation, was believed to occur towards the bottom of the original pit at about 1240 m elevation (and is confirmed by the analysis of current tailings). Therefore, the waste rock and pit wall study report provides information only on upper pit. Because the more critical material is located at the bottom of the pit, the report is of limited value in addressing concerns relating to the mine condition at the end of operations.

Brown-McDade Adit

This adit is sealed with a temporary closure. It is understood that a portion of the waste rock in the portal dump adjacent to Pony Creek has been removed and processed in the mill.

Waste Dump

A waste dump is located on the south side of the pit. A stockpile of 15,000 to 20,000 tonnes of low grade ore is located on top of the dump. It is understood that the dump is stable. Stripping of organic soil for revegetation was not conducted as proposed (I.E.E. Fig. 1.12).

Based on the ARD issues for the pit, as described above, it is expected that there may be potentially acid generating rock in the dump and the ore stockpile.

Sampling of the waste dump runoff at Station E4 has not been conducted because no flow has been observed.

Mill & Camp Area

The mill and camp areas were generally clean. Additional structures constructed since 1995 include a tailings thickener, water treatment plant, second crusher, and personnel accommodation.

Tailings Impoundment

Tailings discharge has not been conducted according to the conditions of the Water License or good engineering practice. Concerns regarding the stability of the dam have not been satisfactorily addressed. These and other issues are addressed as follow;

- Potentially acid generating tailings are currently being placed in the impoundment. Two samples of tailings were collected by Water Resources Staff from the tailings disposal area at Mt. Nansen Mine on Nov. 2, 1998. Both samples are potentially acid generating, (N.N.P. values were -72 and -186) although the paste pH indicates that acid generation is currently being buffered by the neutralization potential of the material. These samples are considered to be moderate to strong potential acid generators.
- The above samples were taken from the current discharge and the beach area located at the north end of the tailings impoundment. Deposition of these materials is occurring at or possibly above the maximum permitted elevation in the pond (not higher than 1 m below the spillway invert) and appears to be above the crest of the dam in some areas. During the visual inspection on Oct. 29, 1998, it appeared that the upper-most tailings

may be up to 2 m above the spillway invert. It is not known how much potentially acid generating material is now in the impoundment area.

- It is estimated that approximately 10,000 m^3 of tailings has been deposited in the north-west end of the impoundment above the maximum level and a similar amount on the upstream face of the dam.
- Tailings are being discharged such that the pond is being moved against the dam and reducing the width of the current tailings beach unless water is treated and released at rate equal to the volume of tailings being added to the pond. The design for seepage and stability considerations was based on a 50 m beach on the upstream side of the dam. During the inspection it was on average about 25 m wide and in one place as little as 10 m.
- The seepage return line is discharging onto the upstream face of the dam and eroding the tailings beach at this location.
- It is estimated that the remaining capacity of the impoundment below 1149.7 m elevation could be as little as 28,000 m^3, (assuming 2% aerial beach slopes, 5% submerged beach slopes and a width of 190 m at the point where the pond is deepest).
- Excavation of a ditch on the south abutment downstream of the crest of the dam has resulted in thawing of permafrost and an unstable ditch which is eroding.
- Despite marginal stability of the dam, which required emergency stabilization in 1997, additional material has been placed on the crest of the dam, up to 1 m thick in some locations. The placement of any additional material on the crest of the dam reduces it's stability and should not be conducted. Reviews of the stability of the dam be Geo-Engineering have indicated that the stability of the dam does not meet minimum standards. The stability of the dam could further deteriorate as foundation thawing increases the potential for failure by piping or liquefaction.
- The emergency repairs to the dam were intended to improve stability until analysis of the thermal and seepage monitoring data could permit a final design for improved long-term stability. Currently, the foundation is still thawing and the phreatic surface in the dam is just below the original downstream face of the dam, as described below. The seepage rate is currently at the upper limit of the range predicted by the designers (0.2 to 2 lps) which assumed that the foundation had thawed down to 16 m below original

ground surface for the higher seepage rate. The current extent of thawing is variable, but appears to be in the range of 3 to 5 m. Further thawing towards the 16 m considered by the designers could result in a significant increase in seepage.

- The required analysis of stability and design of stabilization measures has not been conducted. It is believed that additional stabilization measures will be required.
- The seepage return pond has submerged the toe of the dam and is probably contributing to elevated pore pressure in the downstream section of the dam.
- During most of 1998, the WAD cyanide concentration in the tailings pond had an average value of 52 mg/l (Apr. 22 to Sept. 15), which is slightly over twice the 25 mg/l permit level. Only three of the 22 samples were at or below the permit level. Copper, zinc and arsenic are also elevated in the pond water. It is understood that levels were elevated in previous years.
- The WAD cyanide concentration in the seepage water at Station E2 (seepage collection pond) fluctuates in the range of 10 to 20 mg/l.
- Treatment of tailings water has been found to be most effective by raising the water temperature to 25 to 30 degrees Celsius, and then processing in several stages for removal of cyanide, stabilization of arsenic, copper and zinc, and ammonia removal.
- At the monitoring station, D2, in Dome Creek the arsenic concentration has ranged between 0.14 and 0.23 mg/l and the copper concentration is similarly elevated (June 18 to Sept. 15, 1998). This indicates that a there is a significant quantity of seepage water which is passing the seepage return dam.
- Preliminary results from the arsenic stabilization test work have been submitted to Water Resources (B.Y.G., Nov. 11, 1998). The test results should be corrected to reflect water to solid ratios as may occur in the field. For many of the metals, a trend of decreasing concentration followed by a gradual increase was reported. Metals levels could be elevated if the tests had been conducted under mildly acidic conditions. (The majority of the tailings have a marginal potential for acid generation (N.N.P. = -5.6) and the upper most tailings now being discharged have a much higher potential for acid generation {N.N.P. = -129, average of two samples}). Cyanide was not reported in the test results. After five weeks the concentration of antimony, arsenic, and copper was above the Effluent Quality Standards specified in the Water Licence. Other metals are

likely to have exceeded the standards if the tests were conducted under more aggressive (acidic) leaching conditions.

- Seepage out of the tailings impoundment is likely to exceed inflows to the impoundment in dry years when precipitation is low and evaporation is high, and during winter months when there is negligible surface runoff. Consequently, desaturation of the upper layers of tailings is likely to occur. As these materials are potentially acid generating there will be downstream impacts unless the reclamation plan is modified.

Instrumentation has been installed in the dam to monitor pore pressure and thermal conditions. To date, the thermal data indicate little change in the ground temperature in most locations and thawing of 2 to 4 m of soil in three locations. The seepage water temperature is in the range of 2 to 7 degrees Celsius. Further thawing of the foundation is expected due to the migration of this warm water through and under the dam.

Diversion Channel & Spillway

A diversion channel and emergency spillway is located on the north side of the impoundment. At the time of the inspection, erosion of the north side of the diversion channel had partially blocked the channel. Further reduction of the channel cross-section consisted of tailings and return water lines, and the use of culverts to construct a road across the channel. One of these culverts had glaciated. This channel would not likely pass the design flow in its current condition.

The Conceptual Reclamation plan proposes a closure spillway for the tailings impoundment which would be capable of passing the probable maximum flood (PMF). Construction of the closure spillway on the right abutment, as indicated in the decommissioning plan is not recommended as the slope contains frozen soils which are highly erodable once they thaw or are disturbed. Up-grading the existing spillway is preferred.

A previous runoff event resulted in failure of the emergency spillway downstream of the crest of the dam. In this area the channel consists of a geotextile over the native silty sand with an overlying layer of erosion-resistant mine rock. Failure occurred by piping of the silty sand when the water flowed under the geotextile. Replacement of the failed section was conducted using the same design as that which failed.

Roads & Borrow Areas

No revegetation of the borrow areas has been conducted.

Old Mine Wastes

There were about 41,000 tonnes of sulphide ore from previous operations in the stockpile located south-west of the office. This material was to be processed in the mill. This waste was to be incorporated in the lower portion of the tailings impoundment where saturated conditions would inhibit future acid generation. This work has not been done.

There were about 25,000 tonnes of sulphide tailings from previous operations which were to be processed in the mill or simply relocated to the tailings impoundment. It is understood that this work has been done.

It appears that there is not sufficient capacity remaining in the tailings impoundment for the stockpiled sulphide ore and it would not be kept in a saturated state even if it were relocated to the tailings impoundment.

Programs and Studies

The Water Licence required B.Y.G. to conduct a number of studies to aid in development and decommissioning of the mine.

The initial results of the arsenic stabilization study were to be submitted in a report within 60 days of mill start-up, and the balance within seven months. Two years later the initial phase of this work has been started. It is not certain that the test work which is being conducted is representative of conditions which will exist in the pond at closure (saturated versus unsaturated, pH of rinse water and potential for development of ARD).

An acid rock drainage study was to be conducted to examine the pit walls and floor and the tailings. A pit wall study was conducted in 1997 failed to address the most critical rocks in the floor and wall of the bottom of the pit. No work has been done on the tailings ARD study.

A thaw settlement study was to be conducted to determine the performance of the dam and underlying foundations. The instrumentation was not installed until 1998, two years after construction of the dam, and only then under duress as the stability of the dam was highly questionable. The information obtained to date is not sufficient to definitively characterize thermal trends in the dam. Additional data are needed to complete the design of remedial measures for the dam. However, because of the current state of the mine it is now necessary to consider reclamation measures to deal with conditions which are worse than originally envisioned.

Elements of the Tailings Impoundment Seepage Monitoring and Liquefaction Monitoring programs have not been conducted. SPT date to characterize the dam foundation was not obtained. This data is still necessary.

A detailed decommissioning and reclamation plan was to be submitted by Dec. 31, 1997. A conceptual plan was submitted in Jan. 1998. However, without the complete results from the other studies, this plan is of little value.

Clearly, the management of the Mt. Nansen Mine have not fulfilled their obligations for developing and operating the mine in accordance with their original proposal. Their original proposal for operation using the "observational approach" has proven to be unsatisfactory.

6.0 Reclamation Measures

Open Pit

- Drainage of pit water via the adit is likely to occur in the spring of 1999 unless the water is pumped out. If necessary, the water should be treated and then pumped to the tailings impoundment.
- Construction of a bulkhead in the adit will be required to control drainage and flood the pit bottom to prevent acidic drainage. Construction of a bulkhead for low head conditions at a remote road-access mine in northern B.C. cost approximately $85,000. This work did not include grouting or measures to deal with permafrost. Therefore, the 1995 allowance of $200,000 for a bulkhead appears reasonable.
- The ARD study indicated that the rocks exposed at the 1255 m elevation and above are not potentially acid generating. It is assumed that flooding the bottom 10 m of the pit, up to elevation 1240 m, will submerge most or all of the potentially acid generating rock.

Pit capacity (for waste rock and old ore stockpiles) below the south rim is estimated to be 40,000 m^3 (10 m by 20 m wide by 200 m long).

Brown-McDade Adit

- A permanent closure should be constructed in the adit. The remaining waste rock at the portal should be relocated to the pit.

Waste Dump

- Relocation of some potentially acid generating waste into the pit may be required to prevent ARD. An investigation, consisting of sampling and analysis, should be conducted. At this time allowance for moving low grade ore which cannot be processed due to lack of tailings storage capacity and some waste rock is recommended. In order to compile this estimate, 15,000 m^3 of rock is allowed for.
- The surface of the waste dump should be scarified and revegetated.

Mill & Camp Area

- Hazardous materials and chemical should be shipped off-site for disposal.
- All buildings should be removed. Demolition waste can be disposed of in the open pit after backfilling with potentially acid generating wastes. A cover of waste rock should be placed over the waste.
- Concrete foundations should be cracked and buried in place.
- The camp and offices should be demolished.

Tailings Impoundment

- Construction and operation of the tailings impoundment has been very poorly managed. At closure, measures will be necessary to improve the stability of the dam with respect to slope stability, foundation degradation and potential liquefaction, and piping due to high seepage. In addition, measures will be necessary to prevent potential environmental impact associated with elevated cyanide, arsenic and copper in the pore water, and metal release associated with acid generation from the upper-most tailings.
- Placement of any additional tailings in the impoundment will make some of the following measures very difficult to implement. In addition, because the most recent tailings are potentially acid generating and cannot be flooded at closure in the existing impoundment, it is assumed that the it will be necessary to relocate some tailings to the open pit. This will require construction of a dam in the south end of the pit to contain the material. A provisional volume of tailings to be relocated is 25,000 m^3. This work could be conducted by hydraulic mining of the tailings and pumping the material to the pit. a study of the distribution of potentially acid generating tailings within the impoundment should be conducted.
- After removal of potentially acid generating material, any tailings which have been disposed above the maximum permitted level should be moved into the central pond area. Tailings which are currently located against the upstream face of the dam should remain in place to maintain the pond away from the dam, assuming that these tailings have a low potential for acid generation (N.N.P. = -5.6). Water in the pond must be removed and treated for discharge before this work can commence. The volume of water to be treated is estimated to be 60,000 m^3. After removal of the 25,000 m^3 to the

pit, the remaining tailings should be contoured to increase the width of the beach on the upstream side of the dam. The volume of tailings to be relocated to the middle of the pond is estimated to be 25,000 m^3. This work can also be conducted using hydraulic methods.

- There will be exposed tailings on the beach upstream of the crest of the dam. Measures to prevent wind erosion will be required. Placement of 30 cm of local sand and gravel over the beach will address this problem.
- Water treatment costs during decommissioning will be similar to current costs, which are estimated to be $1.20/$m^3$. Post-closure water treatment costs will be higher and are discussed below.
- Additional work will be required for embankment stabilization. This must be preceded by an review of data and design of stabilization measures. Increasing the toe buttress will increase resistance to liquefaction and slope failure. A buttress of 5 m thickness over the existing buttress and 5 m further up the face of the dam may be sufficient. It is estimated that 15,000 m^3 of rockfill could be required. This rock could be taken from the waste rock dump.

Post-closure Water Treatment

- Covering the entire impoundment with an impervious layer appears to be impractical and costly. There is no local source of till or other low permeability material. The area to be covered is in the order of 50,000 m^2. A geosynthetic cover installed with protection for to least in the range of 50 years is likely to cost more than $25/$m^2$. Water treatment would still be required because seepage containing cyanide and metals would continue to be released from the pond. The arsenic stabilization work indicates that long-term release of arsenic is likely to occur.
- Post-closure water treatment costs will be higher than during operation due to the higher labour cost per cubic meter processed and the fuel required to heat the water after heat from power generation is reduced. There will be additional costs for maintaining the access road to the site and ongoing water quality monitoring. Perpetual water treatment will justify relocation of the water treatment plant to a location just downstream of the tailings impoundment so that pumping costs are

eliminated. A provisional amount of $250,000 is recommended for construction of a new building. A provisional amount of $50,000 is recommended for design of the treatment process for reduced flows and gradually changing water quality. A provisional amount of $150,000 is recommended for procurement of the plant equipment, installation and commissioning.

- Water treatment will be required for the seepage and incident precipitation. Treatment of 5 pore volumes may be needed to reduce the cyanide concentration to acceptable levels. The pond volume is 240,000 m^3. At a void ratio of 1.0, one half of the pond volume is pore space = 120,000 m^3. Treatment of 5 pore volumes will involve 600,000 m^3. If we assume that further thawing of the foundation results in a 25% increase in the seepage rate to 10 m^3/hr (87,600 m^3/year) then treatment for cyanide and ammonia may be required for 6.9 years. Ongoing treatment will be required after this time for removal of metals. However the treatment cost will decrease with time as reagent consumption decreases.
- Seepage water is by-passing the current collection pond. It is possible that the seepage is passing under the dam in the silty sands and/or the gravels at 9 m depth. It may be possible to collect the seepage in a trench downstream of the dam or by pumping from wells. Ongoing thawing of foundation of the dam may necessitate the use of wells, which has been assumed for this cost estimate.
- It is assumed that the diversion channel will be maintained and continue to route water around the impoundment such that there will be no surface water to treat and all water to be treated will report as seepage. Maintenance of the channel will be required for as long as water treatment is needed.

Diversion Channel & Spillway

- The current construction for the spillway is a rebuild of a design which failed. It is not acceptable for closure. Long-term reliance on a geotextile as the key in meeting performance objectives is not acceptable. The rip rap and geotextile should be removed and replaced. An acceptable design to provide long term resistance to erosion may require two filter layers between the silty sand native soil and the rip rap layer. The spillway length is 390 m and it is currently sized for the 200 year flow. Up-grading for the PMF event should be provided. A hydraulic analysis should be conducted to design the channel. For the purpose of providing a cost estimate it is assumed that the channel will have a base width of 10 m, each filter layer is 0.5 m thick and the rip rap layer is 0.75 m thick. The volume of material to be removed is 3220 m^3 (8.25 m^3/m x 390 m) of rip rap and the geotextile. The volume to be placed is 3120 m^3 fine filter, 3120 m^3 coarse filter and 4680 m^3 rip rap (8.0 m^3/m fine and coarse filter, 12.0 m^3/m rip rap). Screening of waste rock could be conducted to provide the fine and coarse filter material.

Roads & Borrow Areas

- Roads and borrow areas should be scarified and revegetated.

Old Mine Wastes

- Relocation of the 41,000 tonnes of sulphide ore from previous operations into the tailings impoundment does not appear to be possible. Placement of this material into the pit would mitigate future acid generation. Addition of lime will be necessary to mitigate impacts from oxidation products contained in the waste. Allow two tonnes of lime per 100 tonnes of rock.

6.0 Reclamation Cost Estimate

A cost estimate for reclamation of the Mt. Nansen Mine has been prepared using the RECLAIM model. A complete output from the model is attached as Appendix I. The capital costs at closure are estimated to be $2,160,230 and the cost for post-closure water treatment is estimated to be $5,912,203 (net present value of $170,000 to $190,000 for 100 years), for a total closure cost of $8,038,434.

A supplementary spreadsheet was developed to estimate the cost of post-closure water treatment, and is presented in Appendix II. The cost estimate for water treatment was broken into two parts; the first seven years after closure during which treatment for cyanide, ammonia and metals is required, and years 8 to 100 during which treatment for only metals is required. Estimation of the net present value of the post-closure costs is based on a discount rate (difference between investment returns and inflation) of 2.75 %.

This estimate is presented as "a conservative assessment which has a high degree of confidence of meeting all reclamation requirements". It may be possible to achieve a satisfactory reclamation condition which is less costly. However, at this time the data and analyses to demonstrate a less costly solution are not available. There may be variations to the reclamation solution presented here which are equally effective.

A possible variation which could reduce the reclamation cost may be to dispose of all of the tailings, waste rock and stockpiled ore in the pit with a larger dam. This option is not demonstrable at this time because the capacity of the pit and the hydrogeologic properties of the rock around the pit are not known. If studies can demonstrate that this option is viable then the high cost associated with long-term water treatment could be avoided.

This estimate is higher than the cost estimate of 1995 ($1,438,800). The differences are due to:

- failure of the company to conduct test work and analyses as proposed, resulting in the need for conservative assumptions in this estimate,
- failure of the company to operate the mine as proposed and in the interest of minimizing closure costs (excavation of acid generating materials, deposition of acid generating tailings above the saturation level in the impoundment, old ore stockpiles not processed, failure to stabilize arsenic in the tailings, failure to reduce cyanide levels before discharge of tailings, deposition of tailings such that "minimal efforts" for post-closure water management could be effective), and,
- a requirement for post-closure water treatment for at least 100 years.

I trust that this report addresses your current requirements. Please call if you have any questions.

Yours truly,
Brodie Consulting Ltd.

PROFESSIONAL ENGINEER M. J. BRODIE BRITISH COLUMBIA

M.J. Brodie, P.Eng.

RECLAMATION COST SUMMARY

PROJECT NAME: **Mt. Nansen Mine**

BEST ESTIMATE FOR UNIT COSTS 05-Dec-98

CAPITAL COST COMPONENT NAME	COMPONENT TYPE	TOTAL COST
	OPEN PIT	$394,965
	UNDERGROUND MINE	$230
	TAILINGS IMPOUNDMENT	$397,772
	ROCK PILE	$351,671
	BUILDINGS AND EQUIPMENT	$121,130
	CHEMICALS & CONTAM. SOILS	$36,748
	WATER MANAGEMENT	$334,020
	MOBILIZATION/DEMOBILIZATION	$24,581
SUBTOTAL		**$1,661,118**
PROJECT MANAGEMENT	3 % of subtotal	$49,834
ENGINEERING	% of subtotal	$0
CONTINGENCY	25 % of subtotal	$415,279
GRAND TOTAL - CAPITAL COSTS		**$2,126,230**

MONITORING & MAINTENANCE, years 1 - 7	$190,716	
MONITORING & MAINTENANCE, years 8 -100	$170,370	
Discount rate	2.75	
Net present value of perpetual monitoring & Maintenance, for 100 years		**$5,912,203**

TOTAL - CAPITAL & ANNUAL ONGOING COSTS	$8,038,434

PROJECT NAME: **Mt. Nansen Mine** DATE: 05-Dec-98

COMPONENT TYPE: OPEN PIT

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

	ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST
A	OBJECTIVE: CONTROL ACCESS					
	Fence	m		NA	0	$0
	Signs	each		NA	0	$0
	Ditch, mat'l A	m3		NA	0	$0
	, mat'l B	m3		NA	0	$0
	Berm	m3		NA	0	$0
	Block roads	m3		NA	0	$0
	Other			NA	0	$0
				NA		
B	OBJECTIVE: STABILIZE SLOPES			NA		
	Off-load crest, mat'l A	m3		NA	0	$0
	, mat'l B	m3		NA	0	$0
	extend dam	m3		NA	0	$0
	, fill mat'l A	m3		NA	0	$0
	, fill mat'l B	m3		NA	0	$0
		m		NA	0	$0
	Pumping, pumps	each		NA	0	$0
	, pipes	m		NA	0	$0
	, power	kWh		NA	0	$0
	Other			NA	0	$0
				NA		
C	OBJECTIVE: COVER/CONTOUR SLOPES			NA		
	Fill over demolition waste in pit	m3	10000	SBSH	5.46	$54,600
	, mat'l B	m3		NA	0	$0
	Rip rap	m3		NA	0	$0
	Vegetate borrow areas	ha	0.59	VHFL	1100	$649
	Contour & vegetate expl'n trenches	ha	10.1	NA	4100	$41,410
D	OBJECTIVE: SPILLWAY			NA		
	Excavate channel, mat'l A	m3		NA	0	$0
	, mat'l B	m3		NA	0	$0
	Concrete	m3		NA	0	$0
	Rip rap	m3		NA	0	$0
	Other			NA	0	$0

PROJECT NAME: **Mt. Nansen Mine** DATE: 05-Dec-98

COMPONENT TYPE: OPEN PIT

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

	ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST
				NA		
E	OBJECTIVE: FLOOD PIT			NA		
	Ditch, mat'l A	m3		NA	0	$0
	Grout embankment foundation		1	NA	25000	$25,000
	Embankment, mat'l A, core	m3	1260	SB4H	7.67	$9,664
	, mat'l B, filter zone	m3	490	SB4H	7.67	$3,758
	, mat'l C, rock fill	m3	6160	SBSH	5.46	$33,634
	Pumping,	m3	5000	NA	0.25	$1,250
	, pipes	m		NA	0	$0
	, power	kWh		NA	0	$0
	Other (lime addition)	tonne		NA	0	$0
F	OBJECTIVE: BACKFILL PIT			NA		
	Fill, mat'l A	m3		NA	0	$0
	, mat'l B	m3		NA	0	$0
	Other			NA	0	$0
				NA		
G	OBJECTIVE: DEVELOP WETLAND			NA		
	Earthworks, mat'l A	m3		NA	0	$0
	, mat'l B	m3		NA	0	$0
	Vegetate	ha		NA	0	$0
	Other			NA	0	$0
				NA		
H	Adit Bulkhead	each	1	NA	200000	$200,000
	Engineering of pit embankment	each	1	NA	25000	$25,000
	Subtotal					$394,965

COMMENTS:

PROJECT NAME: **Mt. Nansen Mine** DATE: 05-Dec-98

COMPONENT TYPE: OPEN PIT

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: UNDERGROUND MINE

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

	ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST
A	OBJECTIVE: CONTROL ACCESS					
	Fence	m		NA	0	$0
	Signs	each		NA	0	$0
	Ditch, mat'l A	m3		NA	0	$0
	, mat'l B	m3		NA	0	$0
	Berm	m3		NA	0	$0
	Block adits	m3	30	SB4H	7.67	$230
	Cap shaft	m3		NA	0	$0
	Cap raise #1	m3		NA	0	$0
	Cap raise #2	m3		NA	0	$0
	Backfill adits	m3		NA	0	$0
	Backfill shaft	m3		NA	0	$0
	Backfill raise #1	m3		NA	0	$0
	Backfill raise #2	m3		NA	0	$0
	Backfill open stopes	m3		NA	0	$0
	Specified control			NA	0	$0
				NA		
B	OBJECTIVE: STABILIZE GROUND SURFACE			NA		
	Backfill mine	m3		NA	0	$0
	Collapse mine	m3		NA	0	$0
	Contour, mat'l A	m3		NA	0	$0
	, mat'l B	m3		NA	0	$0
	Maintain dewatering (see "MONITORING/MAINTENANCE			NA		
	Other			NA	0	$0
				NA		
C	OBJECTIVE: FLOOD MINE			NA		
	Plug adits	m3		NA	0	$0
	Plug drillholes to surface	each		NA	0	$0
	Grouting	m3		NA	0	$0
	Other			NA	0	$0
				NA		
D	OBJECTIVE: DEVELOP WETLAND			NA		
	Earthworks, mat'l A	m3		NA	0	$0

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: UNDERGROUND MINE

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

	ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST
	, mat'l B	m3		NA	0	$0
	Vegetate	ha		NA	0	$0
	Other			NA	0	$0
				NA		
E	SPECIALIZED ITEMS			NA	0	$0
	Subtotal					$230

COMMENTS:

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: TAILINGS IMPOUNDMENT

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

	ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST
A	OBJECTIVE: CONTROL ACCESS					
	Fence	m		NA	0	$0
	Signs	each		NA	0	$0
	Ditch, mat'l A	m3		NA	0	$0
	, mat'l B	m3		NA	0	$0
	Berm	m3		NA	0	$0
	Block roads	m3		NA	0	$0
	Other			NA	0	$0
				NA		
B	OBJECTIVE: STABILIZE EMBANKMENT			NA		
	Toe buttress, drain mat'l	m3		NA	0	$0
	, fill mat'l A	m3	15000	SBSH	5.46	$81,900
	, fill mat'l B	m3		NA	0	$0
	Rip rap	m3		NA	0	$0
	Vegetate	ha		NA	0	$0
	Raise crest	m3		NA	0	$0
	Flatten slopes	m3		NA	0	$0
	Other			NA	0	$0
				NA		
C	OBJECTIVE: TAILINGS			NA		
	Relocate against dam	m3	25000	NA	2.65	$66,250
	Rip rap	m3	7500	SB2H	5.12	$38,400
	Vegetate	ha		NA	0	$0
	Other			NA	0	$0
				NA		
D	OBJECTIVE: FLOOD TAILINGS			NA		
	Hydraulic mine & pump to pit	m3	25000	NA	3.65	$91,250
	, mat'l B	m3		NA	0	$0
	Raise crest	m3		NA	0	$0
	Other			NA	0	$0
				NA		
E	OBJECTIVE: DEVELOP WETLAND			NA		
	Earthworks, mat'l A	m3		NA	0	$0

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: TAILINGS IMPOUNDMENT

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

	ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST
	, mat'l B	m3		NA	0	$0
	Vegetate	ha		NA	0	$0
	Other			NA	0	$0
				NA		
F	OBJECTIVE: UPGRADE SPILLWAY			NA		
	Excavate channel, mat'l A	m3	3220	SC1H	6.54	$21,059
	Place fine filter	m3	3120	SB4H	7.67	$23,930
	Place coarse filter	m3	3120	SB4H	7.67	$23,930
	Rip rap	m3	4680	SBSH	5.46	$25,553
	Other			NA	0	$0
				NA		
G	OBJECTIVE: STABILIZE DECANT SYSTEM			NA		
	Remove	m3		NA	0	$0
	Plug/backfill	m3		NA	0	$0
	Other			NA	0	$0
				NA		
H	OBJECTIVE: REMOVE TAILINGS DISCHARGE			NA		
	Cyclones	m3		NA	0	$0
	Pipe	m	3500	PPLL	1	$3,500
	Other			NA	0	$0
	Design dam stabilization work		15	NA	800	$12,000
I	and spillway design					
	Drill invest. for dam foundation STP		1	NA	10000	$10,000
	Subtotal					$397,772

COMMENTS:

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: TAILINGS IMPOUNDMENT

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: ROCK PILE

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

	ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST
A	OBJECTIVE: STABILIZE SLOPES					
	Flatten slopes with dozer	m3		NA	0	$0
	Divert runon, ditch mat'l A	m3		NA	0	$0
	, ditch mat'l B	m3		NA	0	$0
	Toe buttress, drain mat'l	m3		NA	0	$0
	, fill mat'l A	m3		NA	0	$0
	, fill mat'l B	m3		NA	0	$0
	Other			NA	0	$0
B	OBJECTIVE: COVER DUMP			NA		
	Mat'l A	m3		NA	0	$0
	Mat'l B	m3		NA	0	$0
	Rip rap	m3		NA	0	$0
	Vegetate	ha	6.35	VHFL	1100	$6,985
	Other			NA	0	$0
				NA		
C	OBJECTIVE: UNDERWATER DISPOSAL			NA		
	Move material	m3	15000	SBSH	5.46	$81,900
	Remove rock at portal	m3	4000	SBSH	5.46	$21,840
	Add lime	tonne	361	ILML	136	$49,096
	Add crushed limestone	m3		NA	0	$0
	Other			NA	0	$0
	Move old mine waste to pit	m3	21,500	SBSH	5.46	$117,390
D	Add lime	tonne	410	ILML	136	$55,760
	OBJECTIVE: COLLECT AND TREAT			NA		
	See "ONGOING TREATMENT" costing component					
E	OBJECTIVE: DEVELOP WETLAND			NA		
	Earthworks, mat'l A	m3		NA	0	$0
	, mat'l B	m3		NA	0	$0
	Vegetate	ha		NA	0	$0
	Other			NA	0	$0
				NA		
F	Trenching, geochem. sampling & analysis includes sampling of tailings beach		1	NA	18700	$18,700

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: ROCK PILE

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST
Subtotal					$351,671

COMMENTS:
ARD sampling based on 6.5 days technician for travel, sampling & reporting @$800/day, 100 samples @ $108 each, $200 shipping, and $2500 travel and accom.

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: BUILDINGS AND EQUIPMENT

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

	ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST
A	OBJECTIVE: DISPOSE MOBILE EQUIPMENT					
	Sell equipment 1	each		NA	0	$0
	Sell equipment 2	each		NA	0	$0
	Sell equipment 3	each		NA	0	$0
	Decontaminate and dispose 1	each		NA	0	$0
	Decontaminate and dispose 2	each		NA	0	$0
	Decontaminate and dispose 3	each		NA	0	$0
	Other			NA	0	$0
				NA		
B	OBJECTIVE: DISPOSE STATIONARY EQUIPMENT			NA		
	Sell equipment 1	each		NA	0	$0
	Sell equipment 2	each		NA	0	$0
	Sell equipment 3	each		NA	0	$0
	Decontaminate and dispose 1	each		NA	0	$0
	Decontaminate and dispose 2	each		NA	0	$0
	Decontaminate and dispose 3	each		NA	0	$0
	Other			NA	0	$0
				NA		
C	OBJECTIVE: DISPOSE ORE CONCENTRATION EQUIP			NA		
	Autoclave - sell	each		NA	0	$0
	Decontaminate tanks & plumb.	each		NA	0	$0
	Remove tanks & plumbing	each		NA	0	$0
	Other			NA	0	$0
				NA		
D	OBJECTIVE: DISPOSE WATER TREATMENT EQUIPME			NA		
	Decontaminate tanks & plumb.	each		NA	0	$0
	Remove tanks & plumbing	each		NA	0	$0
	Other			NA	0	$0
				NA		
E	OBJECTIVE: DECONTAMINATE BUILDINGS & TANKS			NA		
	Buildings, all , chemicals	pallet	10	LCRL	1500	$15,000
				NA	0	$0
				NA	0	$0

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: BUILDINGS AND EQUIPMENT

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

	ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST
	, asbestos	m2		NA	0	$0
	Building 3 , chemicals	m3		NA	0	$0
	, asbestos	m2		NA	0	$0
	Building 4 , chemicals	m3		NA	0	$0
	, asbestos	m2		NA	0	$0
	Building 5 , chemicals	m3		NA	0	$0
	, asbestos	m2		NA	0	$0
	Other			NA	0	$0
				NA		
F	OBJECTIVE: REMOVE/MOTHBALL BUILDINGS			NA		
	Buildings, mill, power, warehouse, conveyors		2520	BRS1H	20	$50,400
	office, camp	m2	1639	BRW2	5	$8,195
	Building, pit shop	m2	225	BRS1H	20	$4,500
	Oil tanks	m2	21	BRS1H	20	$420
	Building 5			NA	0	$0
	Other			NA	0	$0
				NA		
G	OBJECTIVE: BREAK BASEMENT SLABS			NA		
	Buildings, all, break & bury	m2	4384		1	$4,384
	Building 2	m2		NA	0	$0
	Building 3	m2		NA	0	$0
	Building 4	m2		NA	0	$0
	Building 5	m2		NA	0	$0
	Other			NA	0	$0
				NA		
H	OBJECTIVE: REMOVE BURIED TANKS			NA		
	Tank 1, decontaminate	m3		NA	0	$0
	, excavate & dispose	m3		NA	0	$0
	Tank 2, decontaminate	m3		NA	0	$0
	, excavate & dispose	m3		NA	0	$0
	Tank 3, decontaminate	m3		NA	0	$0
	, excavate & dispose	m3		NA	0	$0
	Other			NA	0	$0

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: BUILDINGS AND EQUIPMENT

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

	ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST
				NA		
I	OBJECTIVE: GRADE AND CONTOUR			NA		
	Grade mill and camp area	m2	3.16	SCFYI	3215	$10,159
	Place soil cover	m3		NA	0	$0
	Rip rap on ditches	m3		NA	0	$0
	Vegetate	ha	3.16	VHFL	1100	$3,476
	Other			NA	0	$0
				NA		
J	OBJECTIVE: RECLAIM ROADS			NA		
	Scarify and install water breaks	ha	5.7	SCFYI	3215	$18,326
	Vegetate	ha	5.7	VHFL	1100	$6,270
				NA		
K	SPECIALIZED ITEMS			NA	200	$0
	Subtotal					$121,130

COMMENTS:

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: CHEMICALS & CONTAMINATED SOILS

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

Note: The procedures, equipment and packaging for clean up and removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be considered on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have been conducted.

	ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST
A	LABORATORY CHEMICALS	pallet	2	LCRL	1500	$3,000
				NA		
B	PCB	kg		NA	0	$0
				NA		
C	FUEL			NA		
	Type 1	kg		NA	0	$0
	Type 2	kg		NA	0	$0
				NA		
D	OIL			NA		
	Type 1, waste oil	litre	20000	ORL	0.12	$2,400
	Type 2, tank sludge	litre	2100	ORH	0.88	$1,848
				NA		
E	PROCESS OR TREATMENT CHEMICALS			NA		
	Type 1	pallet	8	LCRL	1500	$12,000
	Type 2	kg		NA	0	$0
	Type 3	kg		NA	0	$0
	Type 4	kg		NA	0	$0
				NA		
F	EXPLOSIVES	kg		NA	0	$0
				NA		
G	CONTAMINATED SOILS			NA		
	Type 1, petroleum	m3	500	NA	35	$17,500
	Type 2	m3		NA	0	$0
	Subtotal					$36,748

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: CHEMICALS & CONTAMINATED SOILS

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST

COMMENTS:

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: WATER MANAGEMENT

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

	ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST
A	OBJECTIVE: STABILIZE EMBANKMENT					
	Toe buttress, drain mat'l	m3		NA	1	$0
	, fill mat'l A	m3		NA	0	$0
	, fill mat'l B	m3		NA	0	$0
	Rip rap	m3		NA	0	$0
	Vegetate	ha		NA	0	$0
	Raise crest	m3		NA	0	$0
	Other			NA	0	$0
				NA		
B	OBJECTIVE: UPGRADE SPILLWAY			NA		
	Excavate channel, mat'l A	m3		NA	0	$0
	, mat'l B	m3		NA	0	$0
	Concrete	m3		NA	0	$0
	Rip rap	m3		NA	0	$0
	Other			NA	0	$0
				NA		
C	OBJECTIVE: STABILIZE DECANT SYSTEM			NA		
	Remove	m3		NA	0	$0
	Plug/backfill	m3		NA	0	$0
	Other			NA	0	$0
				NA		
D	OBJECTIVE: BREACH EMBANKMENT			NA		
	Remove Fill	m3		NA	0	$0
	Other			NA	0	$0
				NA		
E	OBJECTIVE: STABILIZE DITCHES			NA		
	Flatten side slopes	m3		NA	0	$0
	Rip rap	m3		NA	0	$0
	Vegetate	ha		NA	0	$0
	Other			NA	0	$0
				NA		
F	OBJECTIVE: BREACH DITCHES			NA		
	Excavate	m3		NA	0	$0

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: WATER MANAGEMENT

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

	ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST
	Backfill/recontour	m3		NA	0	$0
	Vegetate	ha		NA	0	$0
	Other			NA	0	$0
				NA		
G	OBJECTIVE: REMOVE PIPELINES			NA		
	Remove pipes	m		NA	0	$0
	Concrete plug deep pipes	m3		NA	0	$0
	Other			NA	0	$0
				NA		
H	OBJECTIVE: REMOVE STORAGE TANKS			NA		
	Knock down lump sum			NA	0	$0
	Excavate & backfill	m3		NA	0	$0
	Other			NA	0	$0
				NA		
I	OBJECTIVE: COLLECT DRAINAGE FOR TREATMENT			NA		
	Install groundwater wells	each	4	NA	8600	$34,400
		m3		NA	0	$0
	Pipes	m		NA	0	$0
	Pumps	each		NA	0	$0
	polishing pond, exc. mat'l A	m3	3000	SC1H	6.54	$19,620
	, exc. mat'l B	m3		NA	0	$0
	Collect'n pond, fill mat'l A	m3		NA	0	$0
	, fill mat'l B	m3		NA	0	$0
	polishing pond, liner	m2	2000	NA	15	$30,000
				NA		
J	OBJECTIVE: TREAT DRAINAGE (see "ONGOING TREA			NA		
	Treatment plant building, lump sum		1	NA	250000	$250,000
	Treatment plant , design, control, tanks, pumps		1		200000	
	Subtotal					$334,020

COMMENTS:

PROJECT NAME: Mt. Nansen Mine

DATE: 05-Dec-98

COMPONENT TYPE: WATER MANAGEMENT

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST

Groundwater wells, drilling: mob/demob $2500, 8 days drilling/installation $20,000 casing $2000, pumps $6000, instrumentation $2000, surface piping $2000, total $34, 500

Treatment plant , design, control, tanks, pumps; cost based on $50,000 engineering and $150,000 equipment, installation and commissioning.

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: MOBILIZATION/DEMOBILIZATION

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

	ACTIVITY/MATERIAL		UNITS	QUANTIT	COST CODE	UNIT COST	COST
A	MOBILIZE HEAVY EQUIPMENT						
	Machine 1		km	480	MHER	2.4	$1,152
	Machine 2		km	480	MHER	2.4	$1,152
	Machine 3		km	480	MHER	2.4	$1,152
UnderGnd					NA		
B	MOBILIZE CAMP				NA	0	$0
					NA		
C	MOBILIZE WORKERS			10	MM<L	175	$1,750
					NA		
D	MOBILIZE MISC. SUPPLIES				NA	0	$0
					NA		
E	HOUSE WORKERS	person days	days	45	MHWL	75	$3,375
					NA		
F	BONDING	lump sum		1	NA	16000	$16,000
					NA		
G	TAXES	lump sum			NA	0	$0
					NA		
H	INSURANCE	lump sum			NA	0	$0
	Subtotal						$24,581

COMMENTS:

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: MOBILIZATION/DEMOBILIZATION

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

ACTIVITY/MATERIAL	UNITS	QUANTIT	COST CODE	UNIT COST	COST

PROJECT NAME: Mt. Nansen Mine DATE: 05-Dec-98

COMPONENT TYPE: MONITORING AND MAINTENANCE

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

	ACTIVITY/MATERIAL	UNITS	QUANTIT PER YEA	COST CODE	UNIT COST	COST
A	OBJECTIVE: INSPECTIONS					
	Visual inspection	each		VIL	3000	$0
	Geotech inspection	each	1	VIL	3000	$3,000
	Water sampling	each	4	WSL	4500	$18,000
	Reporting	each		NA	0	$0
	Other			NA	0	$0
				NA		
B	OBJECTIVE: MAINTENANCE			NA		
	Security guard	month		NA	0	$0
	Accomodation	month		NA	0	$0
	Maintain pumping	month		NA	0	$0
	Clear spillway	each	1	NA	2500	$2,500
	Other			NA	0	$0
				NA		
C	OBJECTIVE: ONGOING WATER TREATMENT			NA		

Note: The cost of water treatment can vary widely depending on the nature of the influent and the effluent objectives. The size of a water treatment plant depends on the peak inflow rate which can be many times greater than the mean. Therefore, an estimate of water treatment costs made here should be considered very rough unless chemical testing and hydraulic modelling has been conducted.

Operate treatment plant, post-closure years 1-		1	NA	167216	$167,216
Operate treatment plant, post-closure years 1-		1	NA	146870	$146,870
see attached sheet for breakdown					
	Years 1 -7				$190,716
Subtotal	Years 8 - 100				$170,370

COMMENTS:

PROJECT NAME: Mt. Nansen Mine

DATE: 05-Dec-98

COMPONENT TYPE: MONITORING AND MAINTENANCE

COMPONENT NAME:

COMPONENT No.: 1

BEST ESTIMATE FOR UNIT COSTS

ACTIVITY/MATERIAL	UNITS	QUANTIT PER YEA	COST CODE	UNIT COST	COST

PROJECT MT. NANSEN MINE

WATER TREATMENT COSTS **Post-closure years 1 to 7**

ANNUAL VOLUME OF WATER, m3		90000
INFLOW CONCENTRATION		
	mg/l = g/m3	
CYANIDE	25	
AMMONIA	14	
ARSENIC	0.5	
COPPER	10	
ZINC	0.2	
pH	7	

Reagent addition rates

	mg reagent/mg contam.	cost, $/kg, FOB site
H2O2	1	1.98
lime	0.2 kg/m3	0.15
ferric sulphate	0.05 kg/m3	1.02
copper sulphate	2.5	1.87

Annual reagent cost	H2O2	$	4,455
	lime	$	2,700
	ferric sulp	$	4,590
	copper sulp.	$	5,891

power, fuel for heating and pumping	$	15,000			
misc. supplies, hoses, tools	$	2,000			
sampling equip.	$	1,000			
equip. maintenance and parts	$	3,000			
water analysis	$	3,000	samples weekly from pond, effluent & downstream		
reporting	$	7,500		samples per month	12
truck	$	5,000		analysis cost, incl shipping	50
road maintenace	$	5,000			

labor $ 35 hourly rate

attendance, men per day for water treatment work 2

on site, days per year 183

spring/fall maintenance, extra 1 week work, 2 men 160 hours

hours worked per year 3088

annual labor cost $ 108,080

Total Cost $ 167,216 per year

PROJECT	MT. NANSEN MINE

WATER TREATMENT COSTS **Post-closure years 8 to 100**

ANNUAL VOLUME OF WATER, m3		90000
INFLOW CONCENTRATION		
	mg/l = g/m3	
CYANIDE	0	
AMMONIA	0	
ARSENIC	0.5	
COPPER	10	
ZINC	0.2	
pH	7	

Reagent addition rates

	mg reagent/mg contam.	cost, $/kg, FOB site
H2O2	1	1.98
lime	0.2 kg/m3	0.15
ferric sulphate	0.05 kg/m3	1.02
copper sulphate	0	1.87

Annual reagent cost	H2O2	$	-		
	lime	$	2,700		
	ferric sulp	$	4,590		
	copper sulp.	$	-		
power, fuel for heating and pumping		$	5,000		
misc. supplies, hoses, tools		$	2,000		
sampling equip.		$	1,000		
equip. maintenance and parts		$	3,000		
water analysis		$	3,000	samples weekly from pond, effluent & downstream	
reporting		$	7,500	samples per month	12
truck		$	5,000	analysis cost, incl shipping	50
road maintenace		$	5,000		

labor $ 35 hourly rate

attendance, men per day for water treatment work 2

on site, days per year 183

spring/fall maintenance, extra 1 week work, 2 men 160 hours

hours worked per year	3088
annual labor cost	$ 108,080

Total Cost $ 146,870 per year