2606 -

APPENDIX II

RECLAMATION SECURITY DOCUMENTATION

Table of Contents

II - 1 Letter from DIAND to BYG dated December 20, 1995

II - 2 Accrued Reclamation Liability and Proposed Bonding,

II - 3 Graph of Liability Versus Bonding

II - 4 Letter dated December 19, 1995 from J. Brodie, P.Eng regarding Mine Abandonment Costing

II - 5 Letter report dated November, 8, 1995 entitled "Reclamation Unit Cost Review, BYG Natural Resources Inc., Mount Nansen Mine, prepared by John Brodie, P. Eng.

II - 6 Schedules of Existing Mining Impacts and New Impacts, and

II - 7 Letter report dated November 9, 1995 from S.J. Day, NDM to J. Brodie regarding BYG Natural Resources, Mount Nansen Project, Geochemical Review.

Exhibit Ve)

APPENDIX II - 1

Indian and Northern Affairs Canada / Affaires indiennes et du Nord Canada

Northern Affairs Program
310 - 300 Main Street
Whitehorse, Yukon
Y1A 2B5

Your file / Votre référence

Our file / Notre référence

Jim Smith
BYG Resources
Suite 208
3190 St John Street
Port Moody B.C.
V3H 2C7

December 20, 1995

Dear Jim Smith

Reclamation Security for the Mount Nansen Mine

This will confirm our understanding regarding our discussions on reclamation security of last Friday and this week.

Issues:

ARD Potential for the Tailings pond

DIAND agreed to partially defer the proposed bonding and to treat bonding separately from other security (Part B Water Licence Security). Bonding for Tailings ARD would be dropped from or modified in the licence if the Tailings ARD Mitigation Plan program and Tailings Arsenic referred to in Supporting Document Volume II of I I Section IX, Application QZ94-004 resulted in the conclusion that there would be no ARD problem from the tailings and if the study programs referred to as the Tailings Dam Seepage Monitoring (Section IX) Program and the Liquefaction Monitoring Program (Section X) demonstrated that as water cover could be maintained over the tailings and thus preventing an ARD problem.

Water Treatment for potential Arsenic Leaching from Tailings

As for the ARD potential from the Tailings discussed above, DIAND proposed that security for Arsenic Treatment would be treated separately from the other security (Part B Water Licence Security), Bonding for the potential to require treatment would be dropped or modified from the licence if the company would carry out studies as proposed in their Water licence Supporting Document, Section XII, Tailings Arsenic Mitigation Plan and if it could be demonstrated to the Water Board and to Gov't of Canada that their would not be an arsenic generation problem.

ARD from Adit beneath the Brown McDade Pit

Exhibit V e)

Canada

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As for the potential problems for ARD and Arsenic seepage in the tailings, discussed above, DIAND proposed that security for mitigation would be separated out and dropped or modified should BYG be able to demonstrate that the adit could be plugged prior to final abandonment in such a manner as to allow the pit to be maintained in a flooded state to prevent ARD seeping from the adit below the pit.

Existing Environmental Impacts from Previous Mining Operations

DIAND agreed to the proposed reclamation schedule BYG included in their Water Licence Application, Appendix b - Table B -2.

Schedule of Reclamation Bonding

DIAND proposed to modify the reclamation bonding security schedule to be more reflective of the accrual of liability on the property over the mining life and in a manner that the company could live with.

As A result of this understanding I have modified the attached Reclamation Accrued Liability and Bonding Schedule and provide you with a copy of the proposed wording on Reclamation Security which we propose to include in our statement of intervention to the Water Board.

Please call me at PH. 403-667-3177 to discuss this.

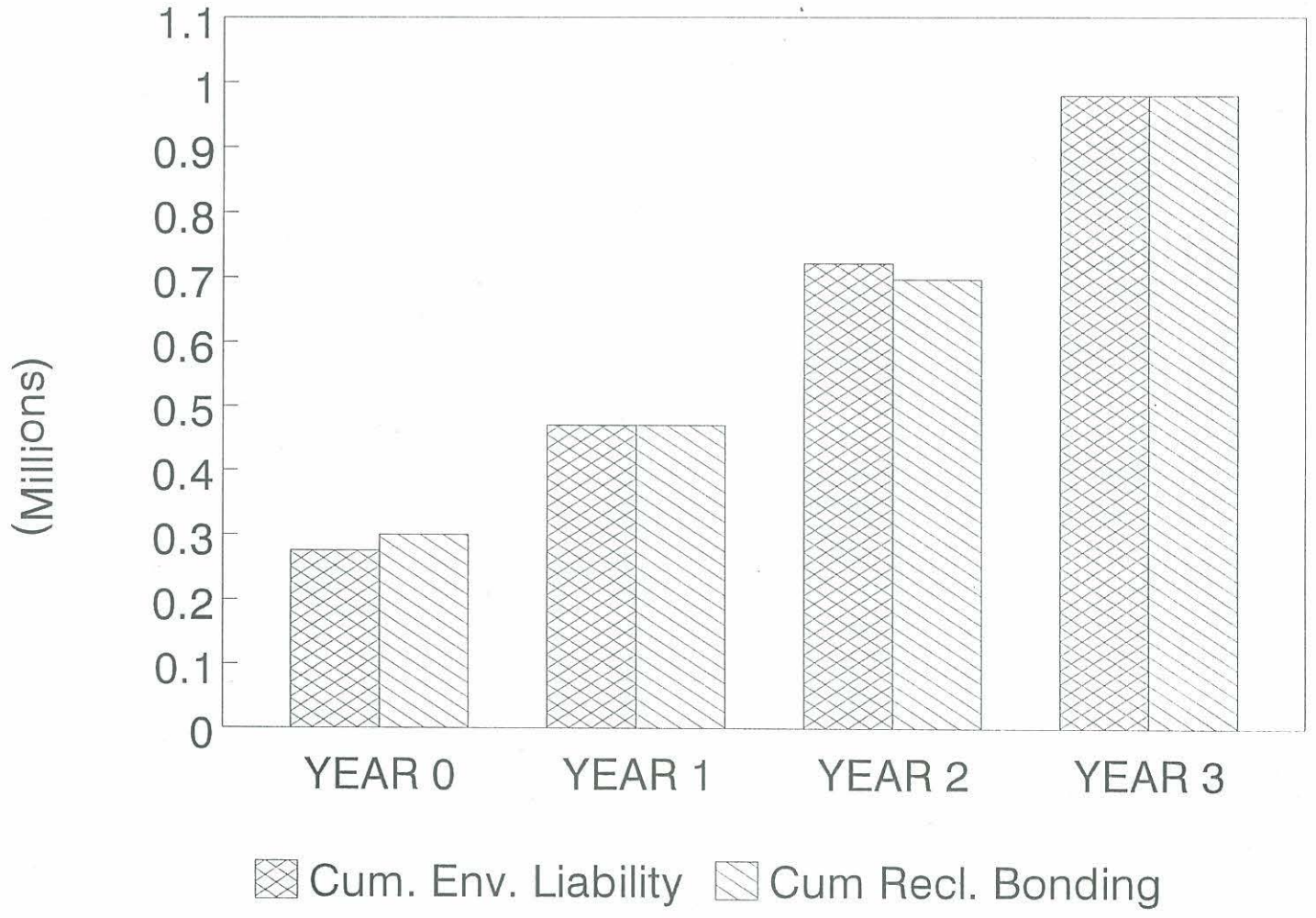
Yours truly

Fred Privett

Fred Privett
Manager of Socio-Economic Benefits

Exhibit Ve)

MOUNT NANSEN MINE LIABILITY VERSUS BONDING



APPENDIX II-4

December 19, 1995

Indian and Northern Affairs Canada
Water Resources Division
Northern Affairs Program
Yukon Region
345 - 300 Main Street
Whitehorse, Yukon, Y1A 2B5

Attention Mr. Fred Privett

RE: WATER LICENSE APPLICATION REVIEW
B.Y.G. NATURAL RESOURCES, MOUNT NANSEN PROJECT

Dear Mr. Privett,

The letter of November 28, 1995 from T. Higgs Associates Ltd. to B.Y.G. Natural Resources, points out that the reviews of the closure plan and chemical stability of the tailings (conducted by myself and Norecol, Dames and Moore) did not consider the information presented in the Water License Application. I have since reviewed this document and present the following comments.

1. The Water License Application does not present any new site specific data or other results of tests or analyses.

2. The Water License Application does present specific plans to conduct tests to determine the most appropriate mine closure condition.

3. The uncertainty of the mine closure condition, which is implicit in the fact that testing must be conducted, is the same as that assessed in my review of November 8, 1995.

4. Additionally, there is concern with respect to the ability to implement acceptable measures in order to achieve an mine closure scenario should the test results prove unfavorable. The key issue in this regard is the chemical stability of the tailings. ARD and arsenic leaching from the tailings is a concern for long term environmental protection. B.Y.G. proposes "to ensure that the tailings are flooded at closure." (Water License Application, Effluent Treatment Program, Section 5.5.1.4). Although this would be beneficial and satisfactory, the seepage analyses presented by B.Y.G. (Klohn-Crippen, August 1995, Appendix V) indicate that a significant portion of the tailings are not expected to be saturated at closure. Modification of the proposed

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Exhibit V e)

structure at mine closure to achieve a flooded condition would likely be impractical. No method for achieving the flooded condition is proposed.

Based on my review of the Water License Application, I find no basis for revising the conclusions of the review presented in my November 8, 1995 letter. That review presents an estimate of the costs to complete mine closure work to yield an acceptable mine closure scenario should adverse conditions be encountered during mining. To date, the proponent has not presented test results which demonstrate that such adverse conditions will not be encountered. Nor have they proposed a mine development and mitigation strategy which can be expected to control the potential range of conditions which could reasonably be encountered during the mine operations.

Should new information become available I would be pleased to reassess the cost of mine closure. At this time the cost estimate presented in my November 8, 1995 letter still appears necessary in order to ensure that there are adequate funds to decommission the mine.

Please call if you have any questions.

Yours truly,

M.J. Brodie

M.J. Brodie, P.Eng.

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APPENDIX II-5

November 8, 1995

Indian and Northern Affairs Canada
Water Resources Division
Northern Affairs Program
Yukon Region
345 - 300 Main Street
Whitehorse, Yukon, Y1A 2B5

Attention Mr. Fred Privett

RE: CONTRACT 94-0094 ADDENDUM
REVISED RECLAMATION UNIT COST REVIEW
B.Y.G. NATURAL RESOURCES, MOUNT NANSEN PROJECT

Dear Mr. Privett,

1.0 INTRODUCTION

I am pleased to present this letter report, REVISED RECLAMATION UNIT COST REVIEW, B.Y.G. NATURAL RESOURCES, MOUNT NANSEN PROJECT. The scope of work for this project is to provide DIAND with:

- updated unit cost figures for use in the reclamation cost estimating model,
- a review of the reclamation costs proposed for the Mount Nansen project,
- a review of the reclamation plan proposed for the Mount Nansen project, and,
- technical support regarding reclamation activities at Water Board hearings.

This review is an update of the July 18, 1995 review. The update is to reflect: i) additional information and analyses presented by the proponent, ii) the observations made during a site inspection conducted on October 26, 1995, iii) DIAND's request that the assessment of level of reclamation and closure effort be based on measures expected to achieve long term chemical and physical stability of the mine components and not on "minimal efforts" as was assumed in the July review, and iv) DIAND's request to include costs of post-closure monitoring and maintenance for the tailings dam.

This report is presented in 8 sections as follows;

1 introduction,
2 a list of the documents reviewed,
3 a summary of the principal mine components,
4 a review of the proposed reclamation plan,

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5 recommended additional reclamation measures,
6 unit cost review of the proposed reclamation activities,
7 a summary table presenting the estimated cost to reclaim the site, and,
8 conclusions.

2.0 DOCUMENTS REVIEWED

The following documents were reviewed in the initial phase of this work:

- Mount Nansen Initial Environmental Evaluation, Volumes 1 and 2, dated November 1994, as submitted by B.Y.G. Natural Resources Inc.,
- Mount Nansen Initial Environmental Evaluation - Addendum, dated April 6, 1995, as submitted by B.Y.G. Natural Resources Inc.,
- a set of 27 unlabeled photographs taken by Water Resources staff, and,
- a 20 minute video of the site taken by Water Resources staff.

The following additional documents were reviewed in preparing this update:

- Tailings Impoundment Final Design Report, B.Y.G. Natural Resources Inc., Mt. Nansen Gold Project, by Klohn-Crippen Consultants Ltd. August 1995,
- Letter from Klohn-Crippen Consultants Ltd. to B.Y.G. Natural Resources Inc., Response To RERC Enquiries, September 15, 1995,
- Letter from B.Y.G. Natural Resources Inc., to DIAND - Kevin McDonell, RE: Comments on Site Visit ....., September 12, 1995
- Letter from B.Y.G. Natural Resources Inc., to DIAND -Fred Privett, RE: Mt. Nansen Project Reclamation Report by M.J. Brodie, Comments, August 9, 1995
- Letter from T.W. Higgs Associates Ltd. to DIAND, Mt. Nansen Project - Response to Reclamation Cost Estimate Review, Comments, August 9, 1995
- Letter from Geo-Engineering (M.S.T.) Ltd. to DIAND, RE: Mt. Nansen Gold Project - Review of Tailings Impoundment Report, September 12, 1995.

3.0 PRINCIPAL MINE COMPONENTS

The principle features of the mine plan include the following:

- an existing camp,
- an existing mill,
- 5 existing adits, with associated ore and waste piles at the portals,
- two existing tailings ponds,

- two open pits to be excavated during operations to produce about 300,000 tonnes of ore,
- a potential underground operation to commence after about year 3 of operations,
- a total mine life of about 5 years, if there is underground mining,
- a waste stockpile to be constructed during operations,
- a cross-valley tailings dam for the containment of new and old tailings; the dam is to be located about 1.5 km east of the mill in Dome Creek, and,
- associated roads, water and power lines.

4.0 REVIEW OF RECLAMATION PLAN

In my review of July 18, 1995 I stated that "the mine plan presents a high risk and high maintenance mine closure scenario." Many of the concerns which were the basis for that opinion have been addressed, at least in part. However, there are still many aspects of uncertainty with the proposed mine plan which the proponent plans to address by building and operating the mine with the observational approach. In this context, the observational approach implies the identification of reclamation measures during operations rather than prior to the start of mining.

From the perspective of determining the level of reclamation security, the observational approach is less than ideal for two reasons. First, there is uncertainty as to the expected conditions at the end of mining. Secondly, as unacceptable conditions are encountered it may not be possible to correct them immediately due to practical or economic constraints. The objective of reclamation security is to ensure that the mine site will be left in an acceptable condition after mining has ceased. In order to meet this objective a conservative assessment of reclamation security should be based on adverse conditions being encountered during mining. This is not a worst case assessment such as would occur if instability were to occur in the tailings dam.

The proponent may successfully identify and mitigate all of the adverse conditions during the course of mining, in which case the reclamation security will be greater than is required. If the proponent is not successful then the reclamation security will be just adequate. The assessment presented herein is intended to ensure that the reclamation security is adequate.

The observational approach to mine development is not consistent with the recommended approach to mine development and reclamation as described in the Water Resources publication; Mine Reclamation In Northwest Territories and Yukon. The proponent should recognize that the saving in detailed site analysis and design is in part off-set by the increased cost of the reclamation security.

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Exhibit V(e)

In regard to the Mt. Nansen project specifically, there is still concern for the long-term physical stability of the tailings embankment and chemical stability of the tailings and mine workings. These and other concerns are elaborated below.

- A detailed geotechnical review of the tailings embankment has been made by Geo-Engineering. In their Sept. 12, 1995 letter they recommend the following with respect to mine closure:
  i) contingency measures such as a toe berm and raising of the dam crest,
  ii) closure spillway design assuming probable most adverse ground conditions,

- The tailings have a net acid generation potential of -5.6 kg/tonne $CaCO_3$. In the November 1994 I.E.E. Volume 2 Appendices: Tailings Treatment Test Report the acid base accounting test on the treated tailing sample is presented. The reported net neutralization potential is based on sulphide sulfur (i.e.: the potentially oxidizable component) and incorporates the neutralization provided by lime addition in the metallurgical process.

  This material will eventually become acid generating unless oxidation of the sulphide minerals is prevented. There is industry consensus that tailings samples with a negative acid generation potential are expected to generate acid (Ferguson, K. & Morin, K., 1991, The Prediction Of Acid Rock Drainage - Lessons From The Database. Proceedings 2nd Intl. Conference On The Abatement Of Acidic Drainage). The fine grain size of the tailings and re-vegetation of the beaches will not prevent the on-set of acid generation.

  I agree with the proponent that this material is unlikely to be a strong acid producer. However, depression of pH below 5 and leaching of metals may occur. The depression of pH is likely to exacerbate the leaching of arsenic from the tailings. The proponent has stated that they do not believe that these are serious concerns for the project, but they have not demonstrated that this is the case. In the absence of any test results it is conservative to assume that there will be pH depression in the tailings and increased leaching of asenic.

  T.W. Higgs letter of August 17, 1995 states, with respect to the tailings testing that "The sample set contained a high percentage of samples from the lower portion of the pit and also included drill intervals that extended below the pit. These intervals would have contained higher sulphide level than the more oxide ore from near surface." This implies that the tailings are likely to change in character over the mine life as the deeper ore is mined. The first tailings may have a lower acid potential than the composite sample which was tested and the last tailings to be produced may have a higher acid potential than the sample which was tested. It is this later material which

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Exhibit Ve)

will be the upper-most material in the tailings impoundment and the least likely to be submerged for control of ARD.

If it becomes necessary to further review the ARD potential of the tailings it is suggested that an expert geo-chemist be retained to examine the data and comment on my opinion.

- Leaching of arsenic from tailings is expected to occur from the tailings. The proponents are planning to conduct test work during operations to determine the most effective method of controlling this leaching. If these measures are successful then an arsenic rich sludge will be formed and disposed of in the tailings impoundment. The proponents have not demonstrated that this sludge will be stable under the range of geo-chemical conditions as may occur in the tailings pond. If these measures are not successful then it is proposed that leaching of arsenic from the tailings impoundment will be achieved by flooding all of the tailings at closure or covering exposed tailings beaches with overburden.

  At closure it will be difficult to modify the tailings impoundment system to achieve a permanent water cover if the as-built condition does not result in this condition. The seepage analysis presented in the August 1995 Klohn-Crippen report indicates that the tailings are expected to remain unsaturated for a distance of 50 m back form the crest of the dam. The proposed design is not expected to allow flooding of the tailings at closure. The effectiveness of an overburden cover on the tailings beaches as an alternative means of controlling leaching of arsenic is questionable. Such a cover will be difficult to construct because of the soft nature of the tailings.

  Following on the above discussion on the potential for pH depression in the tailings and the seepage analyses which indicate that not all of the tailings will be saturated at closure it is expected that leaching of arsenic after closure is likely to occur. I do not agree with the closure leaching assessment presented in T.W. Higgs letter of August 17, 1995. It does not present a worst case assessment because it does not reflect the potential for pH depression due to oxidation of sulphide minerals and the resulting dissolution of arsenic precipitates.

  Even if the proposed measures for stabilization of arsenic in the tailings are successful, it may still be necessary to provide for post-closure water treatment of the seepage or overflow from the impoundment.

- It is proposed to construct a spillway capable of passing the flow of the probable maximum flood (PMF). The calculation of PMF should recognize the potential for an unusually high run-off coefficient due to the effect of local permafrost. The proposed

Exhibit V(e)

location of the spillway is underlain by up to 20 m of sand and silty sand. This material will require a carefully constructed armor of gravel and rip rap to prevent erosion and winnowing of the sand. The spillway will be located on the right abutment of the dam. The soils on this slope are moving down-slope due to solifluction processes. Even if the spillway is excavated to bedrock this process will tend to cause infilling of the inlet of the spillway. Lower on the slope it is unlikely that the spillway will be in bedrock and the entire lower section of the spillway channel will be subject to soil movement. Provision for long-term maintenance of the spillway will be required.

The diversion channel will have a much lower gradient and follows a natural topographic depression which drains into Dome Creek. The proponent should consider constructing the permanent spillway along the alignment of the diversion channel.

- Many open pits leave ore type material in the pit walls and bottom as the economics of waste rock stripping do not allow these materials to be mined. It appears as if this will be the case at the Mount Nansen site (B.Y.G. Nov. 1994 Vol. 1 p 12). If it is, then acid generation should be expected to occur in the pit. Figure 1.7 of the report (B.Y.G. Nov. 1994 Vol. 1 p 12) shows an adit passing about 2 m below the bottom of the pit. Natural and blast induced fractures in the rock will permit drainage of the pit via the adit. Acid generation is likely to occur in the pit and drain to the environment via the adit unless other remedial measures are taken. B.Y.G. proposed to control ARD by sealing the adit to cause the pit to flood.

  An inspection of the adit during the site visit was conducted. The rock is not massive and competent granodiorite. The adit passes through frozen fracture granodiorite for about 150 m and about 40 m of unfrozen fractured granodiorite up to the drift. Rock mass quality was visually assessed by estimating the Rock Quality Designation (RQD) of drill intersection through the rock. RQD is estimated to range from 25% to a maximum of 75%, with most of the rock having an RQD of 50% or less. This is considered to be moderately fractured rock. In the unfrozen rock near the ore zone the RQD was between 25% and 50%. Klohn-Crippen report that they have not inspected the adit and that their Sept. 15, 1995 assessment of sealing the adit is based on information provided by B.Y.G.

  Relatively warm water from the pit will thaw any ice in the fractures in the rock. Consequently, grouting will be required, which generally cannot be conducted in frozen material. Therefore, the bulkhead should be located in the unfrozen material near the ore zone. As this material is highly fractured, grouting will definitely be required.

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- The proposed waste dump design appears reasonable. Confirmatory testing of the foundation conditions should be made during stripping and the design revised, if necessary. The cost of reclaiming the waste dump to the proposed slope will increase if the dump is not constructed in off-set lifts as proposed. This aspect of operation should be monitored during operation and the reclamation plan and security revised if the method of construction is changed.

5.0 ADDITIONAL RECLAMATION MEASURES

Many concerns are presented above regarding physical stability of the tailings dam and chemical stability of the tailings and residual ore material in the pit. Consequently, it is believed that a conservative approach should be taken in estimating the reclamation security. There are also several omissions in the reclamation cost estimate. These are described in this section along with the cost implication of these additional measures.

The proponent should not consider these additional reclamation measures as recommendations to improve the mine plan. These are provided only as a basis for estimating the cost of a mine closure plan which could meet long term mine abandonment objectives.

All total costs are rounded to the nearest $500.

A) Stabilizing the Tailings Embankment

Measures to improve the stability of the embankment, as proposed by B.Y.G. include berms and material on the crest to compensate for settlement. No estimate of the volume of material is provided. For the purpose of this estimate it is assumed that 3850 m^3 would be placed on the crest (240 m x 8 m x 2 m high) and about 12,000 m^3 in a toe berm. The cost of constructing these will involve excavation from source, hauling to the impoundment and then spreading. These are examined as three steps, below.

i) Loading

Excavation of frozen material will require a powerful excavator such as 245 excavator, with a large bucket such as 2.7 m^3. Assume medium digging due to ice. Based on 50 minute working hour productivity is 270 m^3/hr. At a cost of $230/hr, the unit cost for loading this material is $0.85/$m^3$.

ii) Hauling

Exhibit Ve)

Assume that the work is carried out with a 44 tonne truck with a capacity of 24 m^3. The borrow source could be within 250 m of the impoundment, such that a return trip could be completed in 2 minutes. Loading time is about 11 minutes for a total cycle time of 13 minutes per 24 m^3. At a cost of $165/hr, the unit cost for hauling this material is $1.49/$m^3$.

iii) Spreading

Assume that the work is carried out with a D-8 dozer. This work will be at a high efficiency due to the nature of the fill and working on a level surfaces. Productivity is estimated to be 375 m^3/hr. It is assumed that some of the fill could be dumped before the dozer is ready to work in order to minimize idle time. At a cost of $150/hr, the unit cost for spreading is $0.40/$m^3$.

Adding the unit costs of the three tasks yields $2.74/$m^3$. The total cost of placing the 15,850 m^3 of fill is $43,400.

Embankment Stabilization Cost $43,500
Unit cost $2.74/$m^3$

B) Control of ARD & Leaching of Arsenic,

It is my opinion that control of ARD and leaching of arsenic will be best achieved through provision of a permanent water cover. Based on the seepage analysis presented by B.Y.G. it is expected that a 50 m wide zone of tailings placed against the dam will not be under a permanent water cover. Consequently it is necessary to consider other methods of control. Covers for the control of migration of water into the material is the most common approach for such a situation. A simple cover consisting of overburden is likely to crack from thermal stress and settlement of the tailings. A multi-layer composite material cover will be prohibitively costly.

A simple cover consisting of a geomembrane such as high-density polyethylene (HDPE) with a protective cover of overburden may be effective. Depending on the slope of the tailings beach and the level of the pond surface after allowance for seepage under the embankment, up to 50 % of the impoundment may have to be covered. As noted above, it is not clear as to what volume of material is to be contained within the impoundment or what the impoundment geometry is (due to limited topographic data), however, for the purpose of this estimate is it assumed that the area to be covered is 18,700 m^2. A 60 mil HDPE may be sufficiently strong to allow placement of the protective overburden without a geotextile. Purchase, delivery and installation of 18,700 m^2 of HDPE will cost $10/$m^2$ for a cost of $187,000. It is possible that a higher cost could be incurred due to the difficulty of placing and welding the HDPE while working on the soft tailings. Working

Exhibit Ve)

on the frozen tailings in the winter would alleviate this problem but the low temperature may not permit welding.

In order to place a protective cover on the HDPE it will be necessary to place a layer at least 0.5 m thick using a small dozer so that the HDPE is not damaged. Constructing this layer will involve excavation from source, hauling to the impoundment and then spreading. These are examined as three steps, below.

i) Loading

Excavation of frozen soil will require a powerful excavator such as 245 excavator with a 2.7 m^3 bucket. Assume medium digging due to ice. Based on 50 minute working hour productivity is 270 m^3/hr. At a cost of $230/hr, the unit cost for loading this material is $0.85/$m^3$.

ii) Hauling

Assume that the work is carried out with a 44 tonne truck with a capacity of 24 m^3. The borrow source could be within 250 m of the impoundment, such that a return trip could be completed in 2 minutes. Loading time is about 11 minutes for a total cycle time of 13 minutes per 24 m^3. At a cost of $165/hr, the unit cost for hauling this material is $1.49/$m^3$.

iii) Spreading

Assume that the work is carried out with a D-6 dozer. This work will be at a low efficiency due to the need to prevent damage to the liner. Assuming a moving speed of 3 km/hr and an average blade capacity of 3.5 m^3 and pushing over 200 m (average round trip distance), productivity is estimated to be 52 m^3/hr. Moving 9,400 m^3 will require 180 hours. At a cost of $95/hr, the unit cost for spreading is $1.82/$m^3$.

Adding the unit costs of the three tasks yields $3.47/$m^3$. The cost of placing the 9400 m^3 will be $32,600. The total cost of covering one half of the tailings impoundment will be $219,600.

Note that this work yields a unit cost of $11.74/$m^2$. This is much lower than the generally accepted range of $20 - 35/$m^2$ for a composite or multi-layer cover and should be viewed as a "minimal efforts" case.

Tailings Cover for ARD Control $219,500
Unit Cost $11.74/$m^2$

C) Control of ARD from Pits and Adits

ARD is expected to occur in the pits and drain from the adit. It is proposed that a bulkhead will be constructed in the adit to raise the flood elevation in the mine workings to a level sufficient to prevent ARD. Based on the writer's experience with similar bulkheads (size of adit and generally low head conditions), the bulkhead with grouting will cost in the order of $200,000.

Control Of ARD From Adit $200,000
Lump Sum Cost

D) Treatment of Tailings Pond Water

Developing an estimate of the cost of water treatment for control of arsenic is very difficult, given the data presented by the proponent. The proponent acknowledges that there is a potential for post-closure water treatment (B.Y.G., Sept. 12, 1995). Both the quantity and water quality of any seepage are largely unknown. It is not known if treatment will be required year round or perhaps only during spring run-off. There is potential for increasing levels of arsenic over time as pH depression due to acid generation in the unsaturated tailings results in increased solubility of the calcium arsenates. For the purpose of this evaluation it is assumed that the cover over the tailings described above is sufficiently effective to reduce water treatment requirements to batch treatment during spring run-off. Addition of lime, including materials and site personnel, may cost $20,000. If this is required for 5 years then the total cost of providing water treatment is $100,000.

Control Of Arsenic from tailings $100,000
Lump Sum Cost

E) Removal of Chemicals and Contaminated Soil

Experience with other sites indicates that $15,000 to $20,000 is reasonable lump sum estimate for removal of general chemicals and reagents. As this is a relatively small mine, the low end of the range should be used. It is understood that PCB's on the site were removed during September 1995 to the satisfaction of Environment Canada.

Considering that the Mount Nansen site has been operated by two different operators in past, both of whom experienced economic difficulties, it should be anticipated that there are contaminated soils on site. Provision should be made for removal or treatment of this soil. A minimum allowance of $5000 should be made. Combining the costs of $15,000 for chemicals and $5000 for contaminated soil give a total of $20,000.

Removal Of Chemicals and Contaminated Soil $20,000
Lump Sum Cost

Ve)

F) Contractor Mobilization and Demobilization

In order to develop a cost estimate assuming that the work is to be carried out using a third party contractor, it is necessary to provide for the mobilization and demobilization costs of the contractor. For the purpose of this evaluation it is assumed that the contractor will mobilize from Whitehorse. He will provide an excavator, dump truck, D-6 or equivalent dozer, D-8 or equivalent dozer, one scoop tram, three operators, one foreman, one mechanic and 2 laborers. Based on one day to mobilize and one day to demobilize, average personnel rate of $30.00/hr, and $1.50/km per piece of equipment for 480 km return trip, the cost of mobilization and demobilization is $6,250.

Mob/Demob $6,000
Lump Sum Cost

G) Accommodation

Assume that all of the work can be completed in 30 days and that the workers can use the existing accommodation. The cost of housing and feeding a worker is $100/day. Seven men for 30 days will cost $21,000.

Accommodation $21,000
Lump Sum Cost

6.0 UNIT COST REVIEW

Following are comments on the proposed reclamation activities and costs as presented in Appendix A from the IEE Addendum of April 1995. All total costs are rounded to the nearest $500.

Item 1 Existing Construction Areas (11.3 ha)

This task is to include leveling and scarifying, stabilizing waste slopes, re-establishment of drainage, and re-vegetation as necessary. Areas to be reclaimed under this task include the mill site, portal areas, waste and ore dumps, existing tailings ponds, old camp and other buildings, and power and water lines. Quantities of work for the various sub-

Exhibit Ve)

activities are not presented. It is difficult to comment on the unit cost for this work without further information, however, the unit cost of $5,250/ha seems low.

Scarifying compact surfaces on other sites has been estimated at about $450/ha, re-contouring and sloping may cost in the order of $0.16/m^2 or $1,600/ha, re-establishment of drainage including placement of rip rap should not be part of the average reclamation cost for the general area, re-vegetation at other sites is estimated to be $3,000/ha. The equipment costs presented by the proponent for dozer and excavator appear to be 20 to 40% low. At this time an overall unit rate for the described tasks may be in the order of $6,050/ha. The proponent should provide more detail as to the nature of work to be conducted. A unit cost of $6,050/ha gives a total cost of $68,500.

Item 1, Surface restoration $68,500
Unit Cost $6,050/ha

Item 2 Roads (5.7 ha)

For estimation purposes assume that there are 2 culverts per kilometer and that the roads are on average 10 m wide. Removal of each culvert and re-establishing the drainage will require 4 hours work with a 245 excavator. At a cost of $230/hr the unit cost will be $920. Allow $200 for removing the culvert to the site landfill. The total cost is $1120 per culvert or $2240/km.

Assume that some re-contouring of fill sections of the roads will be required. This may take 4 hours work per kilometer with a D-8 dozer. At a cost of $150/hr the unit cost will be $600. The total cost is $600 per kilometer.

Scarifying the road surface can be conducted with a large dozer such as a D-8. Moderate ripping will give a travel rate of about 1.3 km/hr over a 3 m width, which gives 0.4 ha/hr. At a cost of $150/hr the cost will be $375 per hectare or $375/km of road.

The total cost for road reclamation is $3,215/km or $3,215/ha, for a total cost on 5.7 hectares of $18,300.

Item 2 Road restoration, $18,500
Unit Cost $3,215/ha

Item 3 Trenches (11.4 ha)

It may be reasonable to leave some of the older trenches where natural reclamation has occurred as they are. There is insufficient information regarding the size and nature of materials at the trenches to develop a reasonable reclamation cost estimate. If it is assumed that all trenches can be reclaimed by dozing the trenched material back into the

Exhibit (Ve)

excavation then an allowance of 20 hours work per ha. appears reasonable. The unit rate for the dozer appears low; $150/hr should be used. A revised unit cost for this work is $4,100/ha for a total cost of $46,700.

Item 3 Trench Restoration $46,500
Unit Cost $4,100/ha

Item 4 Portals

Sealing of portals for control of ARD and arsenic leaching will require measures to raise the water level in the adits as described above. Portals which do not require concrete can be closed off by pushing waste rock from the portal area into the portal. This could be completed in about 2 hours per portal with a dozer at $150/hr for a cost of $300/portal. One portal has already been sealed. The total cost of sealing the remaining 3 portals would be $900.

Item 4, Sealing Portals $1200
Unit cost, $300/portal

Item 5 Buildings

i) Frame Buildings

There is no information provided on the size or contents of the frame buildings. B.Y.G. has stated in their August 9, 1995 letter that some of the frame buildings have been removed but provide no indication of the remaining work. There are still frame buildings in the camp area. An allowance of $2,500/building for dozing, burning and clean up seems reasonable.

Item 5 Frame Buildings $35,000
Unit Cost $2,500

ii) Steel Buildings

The total plan view area of the steel buildings is about 30 m x 60 m. Experience with demolition on other sites suggests that $10/m^2$ is a reasonable cost, for a total cost of $180,000.

Exhibit Ve)

(Note that the IEE Volume I, p 76 implies that removal of buildings and re-vegetation will commence only after all opportunities for future development have been dismissed. DIAND should be cautious that this does not become a reason to post-pone all reclamation indefinitely.)

Item 5	**Steel Buildings**	**$180,000**
	Unit Cost	**$10/m^2**

Item 6 Existing Dams

This task will include removal of tailings from two ponds and dozing and flattening three dams. Elsewhere in the IEE it is estimated that there are 25,000 tonnes of tailings in these ponds. This task will require excavation and hauling of the tailings plus dozing of the dams. These are examined as three steps, below.

i) Excavation of tailings

Excavation of tailings can be carried out with the 245 excavator, described above. At a cost of $230/hr, the unit cost for loading this material is $0.85/m^3.

ii) Hauling

Assume that the work is carried out with a 44 tonne truck with a capacity of 24 m^3. The haul distance to the new impoundment may be 3500 m, such that a return trip could be completed in about 22 minutes, including one minute to dump. Loading time is about 11 minutes for a total cycle time of 33 minutes per 24 m^3. At a cost of $165/hr, the unit cost for hauling this material is $3.76/m^3.

iii) Spreading

Assume that the work is carried out with a D-8 dozer. Productivity is estimated to be 375 m^3/hr. It is assumed that some of the fill could be dumped before the dozer is ready to the work in order to minimize idle time. At a cost of $150/hr, the unit cost for spreading is $0.40/m^3.

The unit cost for removing the tailings to the new impoundment is $5.01/m^3 for a total cost of $125,300.

Item 6	**Removing tailings**	**$125,500**

Unit cost $5.01/m^3

iii) removing dams

Once the materials have been removed the dams can be contoured to avoid ponding by pushing the crest off the dam into the impoundment area. This will require moving about half the dam volume. This may be about 2500 m^3. The productivity of a dozer for this type of work may be about 300 m^3/hr. Allowing 8 hours at $150/hr for a cost of $1,200 appears reasonable.

Item 6 Removing dams $1,200
Lump sum

Item 7 Ore Zone Material

On page 13 of the IEE, it is estimated that there are 66,000 tonnes of ore material in dumps and includes the 25,000 tonnes addressed above. The remainder is 41,000 tonnes or 23,700 m^3. If this material is not processed in the mill it will be necessary to re-locate it to the tailings pond for disposal. This is examined as three steps, below.

i) Excavation of rock

Excavation of rock can be carried out with the 245 excavator, described above. At a cost of $230/hr and a productivity of 200 m^3/hr for digging in shot rock, the unit cost for loading this material is $1.15/m^3.

ii) Hauling

Assume that the work is carried out with a 44 tonne truck with a capacity of 24 m^3. The distance to the new impoundment may be 3500 m, such that a return trip could be completed in about 22 minutes. Loading time is about 11 minutes for a total cycle time of 33 minutes per 24 m^3. At a cost of $165/hr, the unit cost for hauling this material is $3.76/m^3.

iii) Spreading

Assume that the work is carried out with a D-8 dozer. Productivity is estimated to be 375 m^3/hr. It is assumed that some of the fill could be dumped before the dozer is ready to the work in order to minimize idle time. At a cost of $150/hr, the unit cost for spreading is $0.40/m^3.

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Ve)

The unit cost for removing the rock to the new impoundment is $\$5.31/m^3$ for a total cost of $126,000.

Item 7	**Removing rock**	**$126,000**
	Unit cost	**$\$5.31/m^3$**

Item 8 Waste Material At Portals

It is not clear what this task entails. It appears as if this involves re-sloping of rock piles to stabilize slopes and allow re-vegetation. There are 23,000 tonnes or about 12,100 m3 of material to be moved. Assume work is carried out using a D-8 dozer and the average push distance 45 m. The uncorrected production rate is 535 m^3/hr. Corrections for working efficiency (50 min./hr), material density (1700 kg/m^3), material type (rock - 0.80), coefficient of traction (0.3), and average operator (0.75) give estimated production of 128 m^3/hr.

At a cost of $150/hr the unit cost for dozing these rock piles is $\$1.17/m^3$ for a cost of $14,200.

Item 8, Re-slope Portal Rock Piles $14,000
Unit cost is $\$1.17/m^3$.

Item 9 Open Pit

Considering the remote location of the mine and the expected stable pit slopes, further reclamation should not be required. Fencing is not warranted at a remote site. Stabilization and revegetation is covered in Item 1. The only additional cost here should be restricting access to the pit via the haul road by constructing a berm. It is assumed that rock is dozed from road bed into a berm 3 m high. On a 25 m wide road the berm will involve 150 m^3 of material. Considering D-8 productivity of 168 m^3/hr and allowing 1 hour travel time to each berm location, each berm would take about 1.5 hours to complete.

At a cost of $150/hr the unit cost for dozing two berms is $225/each for a total cost of $450.

Item 9, Construct Pit Access Berms, $500
Unit cost is $225/each.

Item 10 Waste Dump

Ve)

Recognizing that the waste dump will be constructed to minimize re-sloping, there should be only a small volume of material to be moved. This may be in the order of 3.1 m^3 per m of crest length per lift of the dump for a total volume of 5,000 m^3. A rough estimate of the dump geometry results in an average push distance of 20 m or less. The uncorrected production rate is 1070 m^3/hr. Corrections for working efficiency (50 min./hr), material density (1700 kg/m^3), material type (rock - 0.80), coefficient of traction (0.3), and average operator (0.75) give estimated production of 255 m^3/hr.

At a cost of $150/hr the unit cost for dozing these rock piles is $0.67/$m^3$ for a total cost of $3350.

Item 10, Re-slope Rock Piles, $3,500
Unit Cost $0.67/$m^3$

Item 11 Tailings Impoundment

Measures for the reclamation of the tailings impoundment are partially addressed in Additional Reclamation Measures, above. Not covered there are re-vegetation and construction of the spillway. Allowance of $3,000/ha for re-vegetation is typical on other sites. On the covered area of the tailings of 1.9 ha this will cost $5,700.

Item 11 Re-vegetation of Tailings Cover $5,500
Unit Cost $3,000/ha

i) Excavation of spillway

Up-grading of the spillway is estimated to cost $91,000 by Klohn-Crippen Consultants. Over a spillway length of 380 m, this represents a unit cost of $240/m. Construction of the spillway will involve excavating about 15m^3/m of soil per meter of length and then placing 10m^3/m of length of rip rap. (Total excavation of 5700 m^3 and total rip rap of 3400 m^3)

Excavation of the spillway can be carried out with the 245 excavator, described above. At a cost of $230/hr, the unit cost for excavating this material is $0.85/$m^3$ for a total cost of $5,000.

ii) Placement of rip rap

An excavator can manufacture about 50 m3/hr of rip rap from mine rock. At a cost of $230/hr, the unit cost for producing rip rap is $4.60/$m^3$. This must then be loaded and hauled to the spillway and placed. From Item 6, above, the cost for loading and hauling are $1.15/$m^3$ and $3.76/$m^3$, respectively. An excavator can place this material at about 100 m^3/hr for a unit cost of $2.30/$m^3$. The total unit cost for the rip rap is $11.81/$m^3$. The cost of rip rap in the 380 m long spillway is $44,900.

The total cost of up-grading the spillway is $49,900 for a net unit cost of $131/m.

Item 11 Permanent Spillway $50,000
Unit Cost $131/m

Item 12 Seepage Pond

Reclamation of the settling pond will involve breaching the structure and re-contouring the area. The embankment is only 2 m high. An allowance of 8 hours work with a dozer should be sufficient for this task. The liner will be buried. The cost will be $1200. Revegetation at $3000/ha for the dam and pond area of 0.1 ha will cost $300. The total cost for removal of the settling pond is $1500.

Item 12, Removal of Settling Pond
Lump sum cost is $1500

Item 13 Dome Creek Diversion (0.3 ha)

Reclamation of the Dome Creek diversion will involve breaching the structure and re-contouring the area. An allowance of 8 hours work with a dozer should be sufficient for this task. The cost will be $1200. Revegetation at $3000/ha for the dam and pond area of 0.3 ha will cost $900. The total cost for removal of the diversion is $2100.

Item 13, Removal of Dome Creek Diversion
Lump sum cost is $2100

Item 14 Pit Access Road (1.1 ha)

From item 2, above, the total cost for road reclamation is $3,215/ha for a cost of $3500 for the pit access road.

Item 14 Pit Access Road, $3500
Unit Cost $3,215/ha

Item 15 Dam Access Road (0.7 ha)

From item 2, above, the total cost for road reclamation is $3,215/ha for a cost of $2,250 for the dam access road.

Item 15 Dam Access Road, $2500
Unit Cost $3,215/ha

Item 16 Water & Power Lines (1.2 ha)

Ve)

The provision of $36,500 for crew and equipment to remove up to 10 km of power and water lines appears reasonable and consistent with experience elsewhere. From item 2, above, the total cost for road reclamation is $3,215/ha for a cost of $3900 for the water and power line roads.

Item 16 Water & Power Lines $40,500
Lump Sum

Item 17 New Trailer Units

There is no information provided on the size or contents of the four new trailer units. However, an allowance of $2,500/building for dozing, burning and clean up is reasonable.

Item 17 New Trailer Units $10,000
Unit Cost $2,500

Some items normally included in the cost of carrying out and completing a reclamation plan in addition to those proposed by B.Y.G. are as follows.

Item 18 Annual Inspections

Provision of $10,000 per year for inspections allows for approximately 10 days of consulting effort. For a consultant based in Whitehorse, allowing for travel time and expenses, site time and reporting, the allowance of $10,000 per year is ample. Considering the high risk nature of parts of the mine design, allowance for monitoring for physical stability (tailings embankment and cover) and chemical stability (arsenic and ARD from tailings and mine workings) in years 1, 2, 4, 7 and 10 should be made. If this work is to be conducted on an annual basis in perpetuity and assuming a real rate of return on invested money of 3.5 % then the net present value of this cost is $285,000.

Item 18, Annual Inspections $50,000
or; cost in perpetuity $285,000
Unit cost is $10,000/yr.

Item 19 Water Quality Monitoring

i) Collection

Water quality sampling will require about two person-days to travel to the site and conduct a single sampling set. A third day of reporting would follow. Based on a junior consultant the unit cost per sampling set would be about $1500. Allowance for monitoring in years 1, 2, 4, 7 and 10, as described in Item 18, should be made.

Item 19, Collection of Water Quality Samples $7,500
Unit cost is $1,500/survey

ii) Analysis

Water quality sampling of 5 on-site locations and 3 receiving environment locations will yield 8 samples per survey. Analysis of 8 samples at $200 each plus shipping costs and QA/QC at a cost of $500, gives a total cost of $2,500.

Item 19, Analysis of Water Quality Samples $2,500
Unit cost is $500/survey.

Item 20 Reclamation Supervision

Provision for general reclamation supervision at about 1% of the overall cost appears reasonable. This amount is the contractor's supervision only, any supervision or monitoring conducted by Water Resources would not be covered in this cost allowance.

Item 20, Reclamation Supervision
Allow 1% of total cost $13,000

Item 21 Long-term Monitoring and Maintenance

Long-term monitoring and maintenance will be required to ensure that the tailings dam continues to provide containment of the tailings. Monitoring should include settlement, ground temperature, pore pressure and visual assessment of the erosion protection layer and spillway channel. Monitoring is addressed in Item 18. Maintenance could consist of periodic clearing of the spillway, repairing the erosion protection layer or raising the dam to accommodate additional settlement. There is no estimated rate of decay of the dam or associated quantities of earthworks for the repair work. If the closure work is properly conducted then long-term maintenance should be minimal, perhaps minor earthworks every 10 years over a 50 year period. If we assume that $10,000 is sufficient for each repair event then the net present value of the 5 repair events is about $20,000, based on a real rate of return of 3.5 %.

Item 21 Long-term Maintenance $20,000
Lump Sum

7.0 SUMMARY TABLE

The following table summarizes the estimated cost for the reclamation activities described above.

8.0 CONCLUSIONS

In general I find the mine and reclamation plan as proposed by B.Y.G. Natural Resources to be deficient in several areas, specifically stability of the tailings embankment and control of ARD and leaching of arsenic. The proposed reclamation costs for many of the reclamation activities were derived (or at least presented) in a somewhat ambiguous manner. Reviewing these costs was difficult and it was necessary to make many assumptions. For the reclamation activities proposed by B.Y.G., I estimate the cost to be $97,840 or 14% higher than B.Y.G.'s estimate. Additional reclamation measures which I believe are required to yield an acceptable mine abandonment scenario are estimated to cost $610,000. In total, I estimate the reclamation cost for the site is about double the B.Y.G. estimate, or about $1,438,800.

It is recommended that B.Y.G review the proposed mine plan and make revisions so as to reduce the reclamation cost and improve confidence in environmental protection. Please note that review has been made in view of the need for a conservative assessment of the potential reclamation costs for the mine as described in the beginning of Section 4.0 of this report.

Please call if you have any questions concerning this report.

Yours truly,

MJ Brodie

M. John Brodie, P.Eng.

M.J. Brodie, P.Eng.
572 St. Andrews Place, West Vancouver, B.C., V7S 1V8
604-922-2034 fax-922-9520

APPENDIX II - 7

NORECOL, DAMES & MOORE, INC.
13571 COMMERCE PARKWAY, SUITE 250, RICHMOND, BRITISH COLUMBIA V6V 2R2
(604) 273-7763 FAX: (604) 273-7791

November 9, 1995
File: 32091-001-310

M. J. Brodie P. Eng.
572 St. Andrews Place,
Vancouver, B.C.
V7S 1V8

Attention: **Mr. John Brodie, P.Eng.**

B.Y.G. NATURAL RESOURCES -
MT. NANSEN PROJECT
GEOCHEMICAL REVIEW

Dear John;

As requested in your letter dated November 8, 1995, I have reviewed the information to assess the oxidation potential of the tailings and the potential for significant leaching of arsenic from the tailings as a result of oxidation. The documents provided were:

- M.J. Brodie, P.Eng. report of November 8, 1995 - Revised Reclamation Unit Cost Review;
- Appendix IV, Tailings Treatment Test Report from Volume 2 Mount Nansen Initial Environmental Evaluation, dated November 1994, as submitted by B.Y.G. Natural Resources Inc;
- Mount Nansen Initial Environmental Evaluation - Addendum, dated April 6, 1995, as submitted by B.Y.G. Natural Resources Inc.;
- A seepage analysis for the tailings pond showing unsaturated tailings, taken from Tailings Impoundment Final Design Report, B.Y.G. Natural Resources Inc., Mt. Nansen Gold Project, by Klohn-Crippen Consultants Ltd. August 1995;
- Letter from B.Y.G. Natural Resources Inc., to DIAND - Kevin McDonell, RE: Comments on Site Visit ....., September 12, 1995;
- Letter from T.W. Higgs Associates Ltd. to DIAND, Mt. Nansen Project - Response to Reclamation Cost Estimate Review, Comments, August 9, 1995;

In addition to the printed documents, a section of the Appendix V of the IEE describing distilled water leach tests on tailings was subsequently provided by fax.

Exhibit (Ve)

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OXIDATION POTENTIAL OF THE TAILINGS

SUMMARY OF TESTWORK

One tailings sample was submitted for acid-base accounting (ABA). The sample was produced from metallurgical testwork on a composite of 178 diamond drill core samples of ore. The sample was apparently composed of both strongly oxidized material from near surface and deeper less oxidized rock. The test material had been subjected to CIP cyanide leach and subsequent INCO-SO_2 treatment to oxidize cyanide.

The ABA test indicated 1.7% total sulphur of which 0.59% sulphur was present in the form of sulphide, which was converted to an acid potential (AP) of 18 kg $CaCO_3$/t. The neutralization potential was 13 kg $CaCO_3$/t. It was concluded by the laboratory that the material had a very low potential for acid generation due to the low sulphide content, despite the negative net neutralizing potential of -5 kg $CaCO_3$/t.

Head analyses on the test material indicated arsenic, copper, lead and zinc concentrations of 0.6%, 496 ppm, 0.4% and 0.1%, respectively.

DISCUSSION

Since the tailings will contain elevated concentrations of metals and arsenic, the conclusion that the tailings will be non-acid generating needs to be evaluated. The NP of the tailings is low and appears likely due primarily to residual lime and alumino-silicates. No carbonate analysis was performed on the tailings to determine whether carbonate minerals are present. Although the lime will provide buffering during operation, it is generally accepted that it is rapidly leached by percolating water and does not provide long term buffering capacity. The NP can probably be discounted from the equation. In which case, the reactivity of the tailings should be considered with respect to the sulphide content.

There are no reliable criteria for determining at what level sulphide concentrations become insignificant in terms of acid generation potential. The British Columbia guideline is 0.3% sulphide; although others have proposed values as low as 0.1%. My opinion is that the value is site specific and should be referenced largely to the presence of buffering capacity from minerals other than carbonates, and the potential for liberation of metals and metalloids due to marginal pH depression. I have observed a humidity cell with 0.4% total sulphur and negligible neutralizing potential in any form oxidize sufficiently rapidly to liberate acidity (pH<5), zinc and arsenic. The arsenic concentration in the sample was 0.2%. A second cell in the same project with 0.6% total sulphur showed similar results.

1/2)

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It has been suggested for this project that the sulphide minerals present are residual products of weathering and are therefore not likely to oxidize rapidly. While this argument would be relevant to rock, the tailings have been ground and the residual sulphide minerals liberated from the silicate matrix and exposed to oxidation.

An additional concern for the Mt. Nansen project is that the sample tested represented a composite of the whole orebody, but the mining sequence will proceed from oxidized (low sulphide concentration) rock to less oxidized (higher sulphide concentration) rock. The tailings mass will therefore be segregated with the sulphide-rich material at the top of the deposit. The upper part of the deposit may therefore be more susceptible to oxidation than implied by the test result.

I would therefore conclude that the acid generation potential of the tailings is unknown though pH depression (probably to pH less than 5 but greater than 4) in exposed tailings after closure is likely rather than improbable as was concluded in the IEE.

POTENTIAL FOR ARSENIC LEACHING

SUMMARY OF TESTWORK

As noted above, the test material feed contained 0.6% arsenic. Deionized water leach tests on the tailings indicated a leachable arsenic component which remained steady at a relatively constant arsenic concentration, implying equilibration of the test solution with a weakly soluble arsenic containing substance. Addition of ferric sulphate to the test solution lowered arsenic concentrations, presumably due to precipitation of basic ferric arsenates with high Fe/As ratios.

DISCUSSION

The potential for arsenic leaching depends on the occurrence of arsenic in the tailings. Several major forms are likely:

- Arsenopyrite - residual primary mineralization. Since the ore feed contained 0.6% arsenic and 0.6% sulphide it is likely that a significant proportion, if not the majority of arsenic occurs in this form.

- Scorodite - a natural weathering product of arsenopyrite, increasing in concentration in the more oxidized zones of the deposit. The leachable arsenic component in the tailings is reported to be 2 ppm.

- Calcium Arsenate - resulting from lime addition during cyanidation.

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The arsenic in arsenopyrite could be liberated by oxidation, generally occurring as a long term process, accelerating as pH depression occurs.

The solubility of scorodite (iron arsenate) decreases as pH decreases. In comparison, calcium arsenate becomes more soluble as pH decreases.

As noted above, moderate pH depression in the long term seems likely due to the oxidation of sulphide minerals, including arsenopyrite. Under these conditions, arsenic release due to dissolution of calcium arsenates could be expected. Leaching of scorodite could also be expected. Much of the discussion in the IEE has focused on stabilizing this leachable arsenic component in the tailings. However, the potential for long term release of arsenic due to arsenopyrite oxidation is probably the more significant issue from a closure perspective.

CONCLUSIONS

Based on review of the materials provided and previous experience, the following is concluded:

- the potential for moderate pH depression in the tailings is significant, especially given the likelihood of increasing sulphide concentration in the upper portions of the final tailings deposit; and

- unquantified long term arsenic leaching due to oxidation of arsenopyrite under depressed pH conditions may occur in exposed tailings after milling operations cease.

Operational and closure measures such as long term flooding or placement of engineered low permeability covers of clearly demonstrated effectiveness should be considered.

The above conclusions are based on the existing testwork and information available. The need for engineering measures to address acid generation and arsenic leaching could be addressed through well-designed kinetic tests. Due to the low buffering capacity of the tailings, the tests would probably provide sufficient information for decision-making after a few months of leaching.

Exhibit 1(e)

NORECOL, DAMES & MOORE, INC.

Please call the undersigned if you have any questions.

Very truly yours,

NORECOL, DAMES & MOORE, INC.

per:

Stephen J. Day, P.Geo.
Senior Geochemist

SJD:ijk

Ver)

1. APPLICATION

1.1 Shedule IV and Letter, 03.02.98
1.2 Response to Board Questions,12.02.98

2. PUBLIC NOTICES

3. CORRESPONDENCE - BOARD TO APPLICANT

4. CORRESPONDENCE - APPLICANT TO BOARD

5. INTERVENTIONS

5.1 Yukon Conservation Society, 06.02.98
5.2 Yukon Conservation Society, 10.02.98
5.3 Indian and Northern Affairs Canada, 12.02.98
5.4 Yukon Conservation Society, 11.02.98
5.5 Environment Canada and Fisheries & Oceans Canada (joint), 12.02.98
5.6 Government of Yukon, 12.02.98
5.7 Little Salmon / Carmacks First Nation, 12.02.98

6. CORRESPONDENCE - BOARD TO INTERVENORS - BOARD TO ALL PARTIES

7. CURRENT/PREVIOUS WATER USE LICENCE(S)

7.1 Office Compilation of Water Use Licence QZ94-004, as amended by Amendments one & two.

8. EXHIBITS ENTERED AT PUBLIC HEARING

9. ENVIRONMENTAL ASSESSMENT (CEAA)

9.1 Letter, DIAND, 04.02.98

10. DECISION

Amend #3, Feb 1998 + Reasons For Decision

11. TRANSCRIPT OF PUBLIC HEARING

12. OTHER

B.Y.G.
NATURAL RESOURCES INC.

YUKON TERRITORY
WATER BOARD

1998 FEB -3 P 4:33

fax

~~QZ94-004~~
QZ97-028

February 3, 1998

Mr. Ron Johnson
Chairperson, Yukon Territory Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A 3V1

RE: APPLICATION FOR AN EMERGENCY AMENDMENT TO LICENSE QZ94-004

Dear Sir:

The following summarizes the circumstances comprising this emergency

.

- We are expecting a spring run off of approximately 50,000 m^3 of water to enter the tailings impoundment
- There is only approximately 10,000 m3 of space left in the tailings pond.
- There is a possibility of an early spring due to El Nino.
- We have spent August to December 1996 and January 1997 in an attempt to find a method of being able to pass a fish bio-assay at the "end of pipe" of our water treatment plant.
- We have installed and are using ($700,000) the best available technology (BAT) the Inco-SO_2 process.
- We have been unsuccessful except with a dilution factor, and only a rate of 500 m^3 per day and there is some doubt as to our ability even at this dilution of 2:1.(see letter from Inco.).
- We need to discharge at a rate of 1,200 m^3 per day for the next 60 days, in order to avoid an uncontrolled discharge in spring. We will need to discharge at a lesser rate for the life of the mine.
- The existing LC_{50} test is not serving any environmental objective but has stopped us from discharging and is increasing the chances of an uncontrolled discharge in the spring.

The following summarizes the reasons why our application for an emergency amendment should be treated favorably.

- Presumably the fish bio-assay test is meant to protect the fish in the environment. If the effluent passes the LC_{50} prior to mixing with the creek water it is safe for fish.
- The first fish that will see our effluent are in Victoria Creek, which is 2.5 kilometers from our present point of discharge. Therefore protection of the fish would be achieved by passing the LC_{50} test at a point just prior to Dome Creek meeting Victoria Creek.
- Long before the short life species (cyanate) which has caused the fish bio-assay problem reaches Victoria Creek it is no longer a problem.

General Delivery, Carmacks, Yukon Territory Y0B 1C0 tel: 867 863 59136 fax: 867 863 6028 e-mail byg@unix.infoserve.net

QZ97-028
EXHIBIT 1.1

- We meet all other effluent guidelines as per section 22 concerning effluent quality standards.
- If we do not discharge at a higher rate continuously we will be in imminent danger of having an uncontrolled discharge at the spring run off.

AMENDMENT REQUESTED
We would like the following part of the License changed as follows:

PART E – EFFLUENT QUALITY STANDARDS

22. The Licensee shall ensure that all effluent which is discharged from the project, both during operation and at final decommissioning, shall meet the following effluent quality standards:

Parameter	Concentration
pH	6.0 to 8.5 pH units
Suspended Solids	50 mg/l
Toxicity	*100%
Weak Acid Dissociable Cyanide	0.1 mg/l
Total Cyanide	0.3 mg/l
Antimony (total)	0.15 mg/l
Arsenic (dissolved)	0.15 mg/l
Barium (total)	1.0 mg/l
Cadmium (total)	0.02 mg/l
Chromium (total)	0.04 mg/l
Copper (total)	0.2 mg/l
Iron (total)	1.0 mg/l
Lead	0.1 mg/l
Manganese	0.5 mg/l
Mercury	5.0 µg/l
Nickel (total)	0.3 mg/l
Silver	0.1 mg/l
Zinc (total)	0.3 mg/l

* Any effluent that is discharged must meet the non-toxicity requirement defined by the 96 hour LC_{50} bio-assay, using rainbow trout (pH non-adjusted).

The annotated * to be changed to:

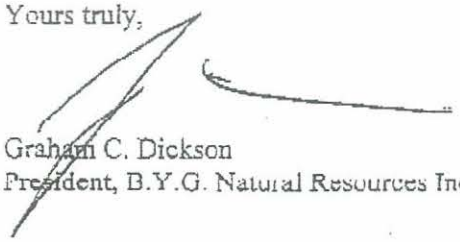
"*Any effluent that is discharged must, after entering Dome Creek, meet the non-toxicity requirement, defined by the 96 hour LC_{50} bio-assay, using rainbow trout (pH non-adjusted), at a point at least 0.5 kilometers upstream of the confluence of Victoria Creek and Dome Creek; and that any such LC_{50} bio-assay test be waived for the period of January 26th 1998 to May 26th 1998."

General Delivery, Carmacks, Yukon Territory Y0B 1C0 tel: 867 863 59136 fax: 867 863 6028 e-mail byg@unix.infoserve.net

QZ97-028
EXHIBIT 11

I believe that the above changes would allow the environment around the creeks to remain unharmed whilst allowing us to meet the objective of ensuring a safe spring run off.

Yours truly,



Graham C. Dickson
President, B.Y.G. Natural Resources Inc.

General Delivery, Carmacks, Yukon Territory Y0B 1C0 tel: 867 863 59136 fax: 867 863 6028 e-mail byg@unix.infoserve.net

QZ97-028
EXHIBIT 11

B.Y.G.
NATURAL RESOURCES INC.

12th February 1998

Mr. Ron W. Johnson, Chair
Yukon Territory Water Boeard
Suite 106, 419 Range Road
Whitehorse
YT Y1A 3V1

By Facsimile: 867 668 3628

YUKON TERRITORY
WATER BOARD
FAX
1998 FEB 13 A 7:54
867 668 3628

Dear Mr. Johnson:

I am writing to respond to your request for further comments on four particular topics of interest to the Water Board.

Rationale for the selection of May 26th as the date when the LC50 test should be reinstated.

Attached you will find Figures 1 and 2 which describe the freshet for the spring of 1997. The graphs indicate the rate, expressed in cubic meters per day, at which water entered the tailings facility. Figure 1 is derived from Figure 2 by removing from Figure 2 the amount of tailings and water from Victoria Creek that was sent to the facility by BYG.

The rate peaks towards the end of April and the freshet is over towards the end of May. This then is the rationale for picking a date towards the end of May. The exact date the 26th was chosen as it was four months to the day after we started discharging.

Volumetric Calculations in Tailings Impoundment

The 10,000m^3 mentioned is the safety level that we chose at BYG not to intrude upon for the safety of the environment in the Mt. Nansen area. In fact it cost BYG 25,000 tonnes of production (8 weeks) not to intrude on this volume. We certainly would not like to see this volume included in any calculations concerning the operation of the tailings facility. In fact we would like to see and are working towards providing for a much greater degree of safety.

If BYG can discharge at a rate of **1200m^3** per day then it is clear that the only time that we have a problem is when the rate of freshet entering the tailings facility is greater than **1200m^3** per day. From Figure 3 which indicates the calculated run off based on last years experience, it is clear that this situation would have occurred around April 5th. This is only 51 days away and this is the time that we need to have capacity in the pond to deal with the excess. Figure 3 assumes that nothing has changed much from last year. However this is not the case and we have carried out actions last year and will do further work this year to alleviate the situation.

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QZ97-028
EXHIBIT /.2

The weather may help with a smaller amount of precipitation in the Dome Creek valley but may also effect us adversely with an earlier freshet under the influence of El Nino.

Validity 50,000 m^3 estimate

The **50,000m3** estimate is calculated using last year's data to produce a simple model and to calibrate it to fit last year's data. The numbers and assumptions are shown below:

The accompanying drawing shows the Dome Creek drainage basin and outlines the area that drains into the creek above the tailings and seepage dams and also into the dams themselves. This area totals: **3,655,913m^2**

The drawing also indicates an area within this that drains directly into the tailings or seepage dams and this area totals: **637,290m^2**

The freshet that entered the tailings pond in 1997 came from this direct drainage of 630,290m2 and as well there was a contribution from the rest of the drainage basin (**3,018,623m^2**) due to the porous nature of the bottom of the diversion ditch. The porosity has been measured as 40% in the summer. As the bottom is still partially frozen and flow rates higher during freshet we have used the lower number of **25.2%** to satisfy our model.

With the measured snowpack being a **7.2cm** water equivalent last year the above data gives a calculated freshet in the tailings impoundment of **100,655m^3** for 1997. The actual measured freshet of **101,302m^2** suggests the model has some validity.

Using the above model, recognizing the effect of ditching to lower the direct catchment to **120,793m^2** and that the measured snowpack water equivalent this year is **5.2cm** the calculations produce a freshet value of **53,600m^3**.

Capacity of Tailings Impoundment

The volumetric capacity of the tailings impoundment is approximately 300,000m^3. Durin ghe last year the company has milled and sent to tailings 102,000 tonnes of ore. This ore at a specific grvity of 2.5 will occupy 40,800m^3 of the facility but in actual fact as it is there as a fine material it will occupy 72,000m^3 with the interstitial spaces occupied by water. The tailings facility was designed to hold 300,000 tonnes of tailings and to have a one meter cover of water (70,000m^3 of water).

I hope I have addressed these points of information in a satisfactory manner but if you still have questions I would be only too pleased to be available to answer them.

I would now like to address a point that has been brought to my attention and that is the question of BYG operating during the next period of time.

I would like to point out at this point that BYG stopped operating of its own accord in early November. The decision to stop operating was made to protect the environment and has been at a substantial cost to BYG. The cost of operating the site has been $280,000 per week for the last 13 weeks.

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QZ97-028
EXHIBIT 1.2

I would hope it could be left to BYG to make the decision when we feel it is safe to operate again without an increase of risk to the environment.

However I do want everyone to understand that our inability to meet the fish bioassay does not mean that we have not taken this issue seriously and I do not believe it reflects on the technical ability of BYG or on any of our consultants that we have used. It is clear from Inco's letter, provided to you previously, that we set ourselves an impossible task.

The operation of the milling facility will improve the situation at the tailings impoundment for four reasons.

- We will be recycling water from the tailings impoundment to the mill and destroying the cyanide in the water before it is sent back to the tailings impoundment. This will effectively bring the cyanide level into compliance in July even without direct treatment of the tailings facility which is now planned for June.

- The small amount of volume that will be taken up by any ore milled will be more than offset by the increased availability of the water treatment plant and equipment (i.e. a decrease in downtime) due to the presence on site of many more skilled operators and millwrights.

- There will be an increase inventory of necessary chemicals on site if we are operating.

- At the present time there is seepage from the tailings dam into the seepage pond. While this is obviously what the seepage dam is designed for it is preferable to reduce this seepage to a minimum. The seepage is occurring because there is still not enough volume of tailings in the impoundment to have been distributed over all of the areas that the tailings were meant to seal.

BYG will not operate the milling facility unless we have the capacity to provide water to the mill in excess of that required for the water treatment plant

I would now like to address Figures 3, 4, 5 and 6 These figures are there to show how the operation of the water treatment plant a t a continuous rate of 1200m3 per day while freshet is occurring has a significant impact on the situation.

Figure 3 shows that even if the snowpack increases to last years value between now and freshet and even if we do no more ditching and last years ditches fail we still only need room for 50,000m3 because we will operate throughout freshet. This gives some comfort that the Board is asking for.

Fugures 4 and 5 show the effects of a reduced snowpack and better ditching. These figures show that based on our model, if we can operate throughout freshet at 1200m^3 per day we need only produce room for 8,000m^3 at the time of peak freshet.

Figure 6 shows that with the mill operating at 500 MTPD we would only need to provide for 12,000m^3 at the time of peak freshet.

General Delivery, Carmacks, Yukon Territory Y0B 1C0 tel: 867 863 59136 fax: 867 863 6028 e-mail bygt@unix.infoserve.net

QZ97-028
EXHIBIT 12

I think that it is clear that a financially strong BYG that will come about from having a producing. profitable mill, will have a much stronger presence and the financial ability to carry out many on site actions that will ensure that the environment in the Mt. Nansen surround remains pristine

Certainly the placer Dome Creek will suffer no harm.

Finally, I would like to comment on the paper from DIAND only as far as to correct their calculations on the last two pages. The flow chart in each case shows that the tailings are returning to the tailings pond at a specific gravity of 1.25 tonnes/m^3. While this is true, the majority of those tailings consist of water that has just been pumped up from the dam and is being recycled to the pond.

At 300 tonnes per day the actual volume being added to the tailings impoundment is not 240m^3 but 120m^3 and therefor the time required is not 41.7 days but 37 days.

At 700 tonnes per day the actual volume being added to the tailings impoundment is not 560m^3 but 280m^3 and therefore the time required is not 62.5 days but 43.5 days.

Yours truly,

Graham C. Dickson,
President, B.Y.G. Natural Resources Inc.

General Delivery, Carmacks, Yukon Territory Y0B 1C0 tel: 867 863 5913 6 fax: 867 863 6028 e-mail byg@unlc.infoserve.net

QZ97-028
EXHIBIT 12

Yukon Territory Water Board
Office des eaux du Territoire du Yukon

February 10, 1998

TO: Distribution List

RE: Application QZ97-028 Emergency Amendment, B.Y.G. Natural Resources Inc

The Yukon Territory Water Board has determined that this application, as it pertains to the issue of temporary removal of the LC_{50} standard, will be dealt with as an emergency. The issue of relocation of the compliance point is not an emergency and will not be addressed at this time.

With regard to process:

The Board has directed that known interested parties should be invited to provide submissions to the Board, and has requested that these be received no later than 9am on Friday February 13, 1998. You may, if you choose, send your submission by Fax to (867) 668-3628.

It is very important that all submissions clearly indicate that a copy has been sent to the Licensee.

There are some specific topics that are of particular interest to the Board and a list of those topics will be sent out by tomorrow morning.

Judi Doering
Manager, YTWB

QZ97-028
EXHIBIT

Suite 106, 419 Range Road, Whitehorse, Yukon Y1A 3V1 Ph: 867-667-3980 Fax: 867-668-3628
419 Chemin Range, bureau 106, Whitehorse (Yukon) Y1A 3V1 Tél: 867-667-3980 Fax: 867-668-3628

Yukon Territory Water Board
Office des eaux du Territoire du Yukon

February 10, 1998

TO: Distribution List, **QZ97-028 Emergency Amendment, B.Y.G. Natural Resources Inc**

RE: Specific Topics

The Board has invited known interested parties to comment on the application. Comments are due by 9 am Friday Feb 13, 1998 and copies should immediately be provided to the licensee. Our fax number is (403) 668 3628. Your comments can be delivered to our office between 8 am and 4.30 pm, they can be faxed, or they can be sent by email to johnsonc@inac.gc.ca. Since we have encountered several problems with our network, I strongly suggest that, if you send your comments by email, then you telephone our office at 667 3980 to confirm that it has been received.

Although parties are invited to comment on any aspect of the application, there are four topics where the Board has expressed a particular interest:

1. A rationale for the selection of May 26 as the date when the LC_{50} would again be included in the licence.

2. The Licensee has indicated that they would discharge at of rate of 1200 m^3 per day for a period of 60 days. This would equate to 72,000 m^3 of discharge. However, the application indicates that there is an expectation that 50,000 m^3 of water will enter the tailings impoundment during spring run off, and there is approximately 10,000 m^3 of space left in the tailings pond at this time. There appears to be a discrepancy of approximately 30,000 m^3.

3. How was the estimate of 50,000 m^3 during spring run off calculated? Is there some comfort that this is an accurate prediction?

4. What is the total capacity of the tailings impoundment?. What is the volume of tailings within the pond?

These questions are being addressed to the licensee, and the Board would also like to hear from other parties.

Judi Doering
Manager, YTWB

QZ97-028
EXHIBIT

Suite 106, 419 Range Road, Whitehorse, Yukon Y1A 3V1 Ph: 867-667-3980 Fax: 867-668-3628
419 Chemin Range, bureau 106, Whitehorse (Yukon) Y1A 3V1 Tél: 867-667-3980 Fax: 867-668-3628

Distribution List, QZ97-028
B.Y.G. Natural Resources
as of Feb 5/98
10

Graham Dixon B.Y.G. Natural Resources 110 Industrial Road Whitehorse, Yukon Y1A 2T9 Business (867)668 8076 Fax (604) 929 1929 (867) 863 6028 gdickson@scitex.ca	Counsel for Licensee: Rod Snow Davis & Company Suite 200, 304 Jarvis St. Whitehorse, Yukon Y1A 2H2 Office (867)668 6444 Fax (867)667 2669 rod_snow@davis.ca
David Sherstone Regional Manager, Water Resources Indian and Northern Affairs Canada 345 - 300 Main Street Whitehorse, Yukon Y1A 2B5 Office (403)667 3145 Fax (403)667 3195 sherstoned@inac.gc.ca	Vic Enns Environment Canada Mile 917.6B Alaska Highway Whitehorse, Yukon Y1A 5V1 Office (867)667 3403 Fax (867)667 7962 vicenns@ec.gc.ca
Bob Van Dijken, Director Yukon Conservation Society Box 4163 Whitehorse, Yukon Y1A 3T3 Office (867)668 5678 Fax (867)668 6637	Chris Noble Director, Lands Resources & Infrastructure Little Salmon Carmacks First Nation Box 135 Carmacks, Yukon Y0B 1G0 Fax (867)863 5710
Mayor D.L. Lacasse Village of Carmacks PO Box 113 Carmacks, Yukon Y0B 1C0 Office (867)863 6271 Fax (867)863 6606	Gail Faulkner Area Chief, Habitat & Enhancement Fisheries & Oceans Canada 419 Range Road Whitehorse, Yukon Y1A 3V1 Office (867)6730 Fax (867)393 6738 Internet: faulknerg@dfo-mpo-gc.ca

Jesse Duke Mining Facilitator Government of Yukon Economic Development Box 2703 Whitehorse, Yukon Y1A 2C6 Office (867)667 3422 Fax (867)667 8601	

Yukon Conservation Society

INC. 1968

YUKON TERRITORY WATER BOARD
1998 FEB -9 P 2:01

fax
QZ97-028

Mr. Ron Johnson
Chairperson
Yukon Territory Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A 3V1

Sent by FAX: 668-3628

February 6, 1998

Dear Mr. Johnson;

Re: BYG Application for an emergency amendment to License QZ94-004

The Yukon Conservation Society strongly urges the Water Board to reject BYG's application for an emergency amendment to License QZ94-004. The terms and conditions outlined by BYG in their application are all unacceptable to YCS.

BYG has consistently proven itself unable to fulfil the requirements of Mt. Nansen's water license. The requested dilution approach to reduce the impact to Dome Creek water quality does not address water quality impacts of the mineslte on the whole watershed or operational problems on site. It also indicates that BYG has no intention or ability to meet the water license requirements. Approval of this amendment request would appear to reward BYG's inability to comply and adequately manage water impacts. Continuation of their rights to water use under these conditions is inappropriate.

YCS requests that the Yukon Territory Water Board consider exercising its ability under section 18(1)(c)(iii) of the Yukon Waters Act to cancel BYG's A License in recognition of the risk to public interest.

Sincerely,

for Bob Van Dijken, Director

Sue Moodie, Mining Committee

QZ97-028
EXHIBIT 5.1

Printed on

Yukon Conservation Society

INC. 1968

1998 FEB 10 P 4:27

fax

QZ97028.

Mr. Ron Johnson
Chairperson
Yukon Territory Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A 3V1

February 10, 1998

Dear Mr. Johnson;

Re: BYG Application for an emergency amendment to License QZ94-004

The Yukon Conservation Society strongly urges the Water Board to reject BYG's application for an emergency amendment to License QZ94-004.

BYG has consistently proven itself unable to fulfill the requirements of Mt. Nansen's water license. The requested removal of the LC50 requirement does not address water quality impacts to the watershed from the minesite or operational problems on site. The LC50 has been part of the water license since it was originally issued and is a standard clause in all hard rock mining licenses. The company has provided no scientific rationale for its removal. The only reason for the "emergency" has been BYG's actions and inaction over the course of the license. BYG identified in its annual report, compiled in February 1997, that the tailings pond would be full be mid summer 1997. This long standing awareness and subsequent negligence in dealing with the issue should not be rewarded with an emergency amendment.

It is unclear to YCS why the Board has requested our comments on issues it seems that only the Licensee can answer. Does the Board intend to provide YCS and other interveners with additional information and rationales from BYG?

YCS believes it is critical that the YTWB have access to stream flow data from Dome Creek at the discharge point when making its decision. This information will help the YTWB to better understand the potential impacts to Dome Creek based on inferred mixing, dilution capacity of Dome Creek, and other issues such as glaciation.

QZ97-028
EXHIBIT 5.2

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If the Water Board feels it necessary to condone this amendment, YCS has additional concerns:
1. Milling must not be allowed to take place during the period of emergency discharge.
2. Only the amount of draw down necessary to prevent over-topping of the tailings impoundment be allowed.
3. A detailed water balance be submitted and updated weekly.
4. Sampling and monitoring of water quality be increased and trigger reporting and shut down of the facility if effluent standards are exceeded.
5. Follow up stream studies should be conducted to document aquatic impacts (benthic invertebrates etc.).
6. Securities as they stand are clearly inadequate to respond to the financial requirements of closure and mitigation of effects from this discharge.

YCS believes that none the above listed points will address the on going issue of inadequate water quality treatment. BYG has proven itself incapable of effectively managing the water quality treatment facilities at Mount Nansen. An independent third party should examine and monitor the water quality plant and treatment processes.

In summary, YCS feels that approval of this amendment would appear to reward BYG's inability to comply and adequately manage water impacts. Continuation of their rights to water use under these conditions is inappropriate.

YCS requests that the Yukon Territory Water Board consider exercising its ability under section 18(1)(c)(iii) of the Yukon Waters Act to cancel BYG's A Lincense in recognition of the risk to public interest.

Sincerely,

Bob Van Dijken, Director

Sue Moodie, Mining Committee

c.c. BYG, Little Salmon Carmacks First Nation, Village of Carmacks, EPS, DIAND, DFO

QZ97-028
EXHIBIT 5.2

Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

Water Resources Division
#310 - 300 Main Street
Whitehorse, Yukon
Y1A 2B5

Your file Votre référence

Our file Notre référence
Mt. Nansen - BYG

February 12, 1998

Mr. Ron W. Johnson, Chair
Yukon Territory Water Board
Suite 106, 419 Range Road
WHITEHORSE YT Y1A 3V1

Dear Mr. Johnson:

RE: EMERGENCY AMENDMENT APPLICATION QZ97-028 - BYG NATURAL RESOURCES MT. NANSEN MINE

Attached is the DIAND Submission to the Yukon Territory Water Board on the above emergency amendment application. DIAND wishes to thank the Board for the opportunity to make a submission.

In preparing the Submission DIAND recognized that this emergency has, essentially, been brought on by BYG's earlier operational and technical errors and omissions. However, in acceding to BYG's request for an exemption from the fish toxicity standard for effluent discharge, DIAND weighted most heavily the environmental impacts of discharging effluent which may fail the fish toxicity standard against the uncontrolled discharge of tailings pond water which will fail the fish toxicity test and also contains high concentrations of cyanide, arsenic and other heavy metals.

Given the critical timing, volume and concentration issues, we believe the most effective method available for dealing with the emergency is to draw down the tailings pond sufficiently to allow

QZ97-028
EXHIBIT 5.3

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storage of the spring freshet while, at the same time, reducing the cyanide concentrations in the tailings pond below those specified in existing water licence QZ94-004.

The details of our assessment and conclusions are contained in the attached Submission. Water Resources is prepared to expand upon these, either in writing or before the Water Board. Should you wish additional clarification or information, please contact me at your earliest convenience.

Yours sincerely,

David A. Sherstone

David A. Sherstone
Regional Manager, Water Resources

cc: Mr. Graham Dickson, President, BYG Natural Resources
Mr. Vic Enns, Head, Pollution Control, Environment Canada
Ms. Gail Faulkner, Chief, Habitat Protection, Fisheries & Oceans Canada

QZ97-028
EXHIBIT S.3

SUBMISSION TO THE YUKON TERRITORY WATER BOARD

ON THE MATTER OF THE REQUEST FOR AN EMERGENCY AMENDMENT TO WATER LICENCE QZ94-004

BYG NATURAL RESOURCES LTD'S MT. NANSEN GOLD MINE

EMERGENCY AMENDMENT APPLICATION QZ97-028

Submitted By:

INDIAN AND NORTHERN AFFAIRS CANADA
WATER RESOURCES DIVISION
NORTHERN AFFAIRS PROGRAM
#310 - 300 MAIN STREET
WHITEHORSE, YUKON, Y1A 2B5

Prepared February 11, 1998

QZ97-028
EXHIBIT 5.3

DIAND SUBMISSION ON EMERGENCY AMENDMENT APPLICATION QZ97-028

The DIAND Position:

DIAND will accede to BYG's request for an emergency amendment to Water Licence QZ94-004, in order to permit the discharge of treated effluent from the tailings pond at the Mt. Nansen mine, provided that the following conditions are imposed:

1. That BYG treat the effluent and ensure that all effluent standards set out in PART E - EFFLUENT QUALITY STANDARDS are met, except the effluent fish toxicity standard (the LC_{50} test) be waived.

2. The requirement to meet the LC_{50} fish toxicity standard be waived only for the period January 26, 1998 to May 26, 1998; or until there is no longer an emergency, whichever period is shorter.

3. That the emergency amendment expire sooner than May 26, 1998 when; a) BYG achieves a 50,000 cubic metre 'available storage capacity' in tailings pond, or, b) BYG reduces the cyanide concentrations within the tailings pond below the 25 milligram per litre (25 mg/l) limit set in Water Licence QZ94-004.

4. That BYG cease diluting the effluent discharge with fresh water.

5. That the location for obtaining LC_{50} samples not be altered from that presently set out in Water Licence QZ94-004.

QZ97-028
EXHIBIT 5.3

The Emergency:

The present emergency arises from two conditions, 1) the tailings pond is too full and must be drawn down to a level sufficient to prevent overtopping by spring inflows, and, 2) the cyanide concentration in the tailings pond exceeds the licence standards. An additional problem is that the cyanide concentration in the tailings pond water is too high for the treatment plant to deal with and not release an effluent which is toxic to fish at the point of discharge.

Because of BYG's delays in initiating effluent treatment and the failure of its treatment plant to deal with high cyanide concentrations, there is no longer sufficient time to further modify, test and treat tailings pond effluent before the onset of the spring freshet. Unless BYG begins immediate discharge of treated effluent (which may fail the fish toxicity standard), the tailings pond will overflow untreated cyanide and heavy metal contaminated effluent with the onset of the spring freshet.

The Rationale for the DIAND Position:

At the present time BYG finds itself in the position of having a full tailings pond, the water of which contains arsenic, cyanide and other heavy metals, at concentrations in excess of water licence limits and likely toxic to fish. The level of the water impounded behind the tailings dam is almost at the emergency spillway invert.

Because of groundwater conditions in the area of the basin upstream of the tailings pond and the leakage of water from the diversion channel, the water level in the tailings pond continues to rise at a slow rate. BYG was able to prevent a significant, uncontrolled spillage of tailings effluent only through stopping its milling operations and the cessation of tailings deposition in the tailings pond.

In an effort to treat the effluent in the pond BYG has installed, and subsequently substantially altered, an INCO SO_2 cyanide reduction circuit in the mill. The Company has also constructed a polishing pond adjacent to the mill complex.

Despite these efforts, BYG has consistently failed to produce an effluent which meets the fish toxicity standards set out in its licence. BYG has stated that the present system can meet all the parameters set out in PART E - EFFLUENT QUALITY STANDARDS, except the LC_{50}.

BYG has also set, and then missed, a number of target dates by which it intended to discharge adequately treated effluent. As a result, insufficient time remains before the expected start of the spring freshet to allow BYG to further study, modify and test its water treatment plant. In order to ensure sufficient storage volume in the tailings pond to contain the spring inflows BYG wants to immediately begin discharging effluent to the environment. It argues that failure to do so will

QZ97-028
EXHIBIT 5.3

result in the uncontrolled spillage of untreated effluent. By BYG's estimates this could amount to as much as 40,000 cubic metres (the estimated 50,000 cubic metre spring run-off volume minus the estimated 10,000 cubic metre storage remaining in the pond).

As of January 27, 1998, Water Resources sampling results show the concentrations of metals and/or chemicals of concern in the tailings pond are:

WAD Cyanide	=	78.0 milligrams per litre (mg/l)
Total Cyanide	=	80.0 mg/l
Arsenic (dissolved)	=	0.6 mg/l
Copper	=	17.4 mg/l
Zinc	=	28.0 mg/l

These concentrations are far in excess of those limits permitted for effluent discharge. As Figure 1 illustrates, the cyanide problem in the tailings pond is not transient, it is persistent. The discharge of substantial volumes of this effluent would have a significant downstream impact.

BYG has stated that its treatment plant can reduce the concentrations for all metals and other parameters to levels equal to, or lower than, those set out in its licence, with the exception of the LC_{50} fish toxicity standard. It is unlikely, given the high initial concentrations, that the present treatment system will ensure the fish toxicity standard is met for any length of time, if at all.

Nevertheless, despite BYG being responsible for the present tailing pond water volume and cyanide concentration problems, the discharge of effluent which meets all PART E standards except the LC_{50} test, is much preferable to the uncontrolled discharge of completely untreated effluent.

The Matter of Urgency (i.e. the "Emergency"):

Using the information provided by BYG in the first set of text 'bullets' in Application QZ97-028, DIAND Water Resources accepts that only the immediate initiation of effluent discharge will permit the storage of the spring freshet. Using BYG's data, the "best case scenario" will require a minimum of 33 days of continuous pumping to reduce the volume in the tailings pond by the necessary 40,000 cubic metres.

Further, DIAND believes BYG's estimates to be optimistic. BYG can only achieve the desired volume reduction if:

- the pumps can continuously discharge at a rate of 50 cubic metres per hour,
- there exists sufficient capacity in the pipelines to handle this pumping volume,
- the pumping continues 24 hours per day, seven days per week until complete,
- there are no line breakages, pump failures or other break-downs,
- the treatment plant operates continuously at optimum design efficiencies,
- there are no problems with chemical control and stocks of chemicals are always on hand.

QZ97-028
EXHIBIT S.3

DIAND believes these criteria cannot realistically be met. Conservative performance expectations and the likelihood of some down-time during treatment and discharge of effluent support the argument for immediate commencement of effluent discharge.

BYG's Proposal to Start Up Milling Prior to Completing the Emergency Effluent Discharge:

BYG has indicated to Water Resources that it believes once the discharge of effluent has progressed sufficiently milling of ore, at reduced volumes, could be initiated. BYG suggests that a milling rate of approximately 300 tonnes per day, while effluent treatment continued at a rate of 1,200 cubic metes per day, would be possible.

Water Resources Division has examined a number of scenarios for the emergency period. Assuming that BYG could meet the optimum operating conditions during the emergency period a minimum of 33 days would be required to accomplish the necessary reduction in pond levels and the lowering of cyanide levels to the concentrations set out in the water licence. This is shown schematically in Figure 2. However, should BYG decide to mill at a rate of 300 tonnes per day, the time required to achieve the same goals becomes 42 days (Figure 3). Should BYG attempt to maximize mill production, at approximately 700 tonnes per day, the time needed becomes 63 days (Figure 4). Assuming BYG begins discharge on January 26th, the corresponding dates for meeting the water level and cyanide targets are, March 02, March 11, and March 31, respectively. Any break-downs, interruptions or less than optimum treatment plant efficiencies would extend the time required to complete the emergency draw down of the reservoir. A delay in achieving target water volume and cyanide concentrations beyond mid-March could result in BYG not being able to store the spring freshet and consequently spilling untreated water.

While there are no snow courses in the immediate Mt. Nansen area, a review of preliminary data from the Williams Creek (Freegold Road) area suggests that the snow pack in the Carmacks region may be as high as 120 to 135 percent of normal. The amount of run-off which must be stored in the tailings pond may therefore be greater than average in 1998. The estimate of 50,000 cubic metres of run-off may, in fact, underestimate 1998 run-off.

While DIAND is not asking the Water Board to include a prohibition against milling during the term of an emergency amendment, no milling should be permitted until the cyanide levels in the tailings pond are within licence limits.

This Department further asserts that BYG should not recommence milling until it is certain that adding additional tailings to the tailings pond will not result in the uncontrolled release of non-compliant effluent. Further addition of cyanide compounds to the tailings pond (in the tailings slurry) would prolong the period during which the treatment plant would fail the bioassay (LC_{50}) test.

QZ97-028
EXHIBIT 5.3

Should BYG resume milling, with the result that uncontrolled or untreated effluent spillage occurs during, or immediately after, the period of an emergency amendment, DIAND would conclude that BYG had failed to exercise the due diligence necessary in a true emergency response. DIAND would therefore be obligated to take strong enforcement measures in such a situation, up to the maximum extent permitted under the *Yukon Waters Act*.

Summary and Conclusion:

DIAND is prepared to accede to BYG's request for emergency discharge of treated effluent under the conditions and with the provisos described above. BYG must be made to understand the true emergency nature of this amendment. Dealing with both the water levels and the cyanide concentrations in the tailings pond are critical. However, any emergency amendment should not permit BYG to escape the requirement to develop and maintain an effective effluent treatment system which can consistently meet all the standards now set out in PART E of Water Licence QZ94-004.

At the expiry of an emergency amendment, BYG must be in a position to consistently meet licence effluent standards without using the downstream, natural environment as a supplementary treatment facility. BYG must also ensure that it maintains adequate storage volume for the spring freshet and that any recommencement of milling does not compromise this storage capacity or result in ongoing discharge of non-compliant effluent. BYG must also reduce and maintain cyanide concentrations in the tailings pond to levels below those set out in its licence.

At the expiry of the emergency amendment BYG must also achieve PART E effluent standards without the need for dilution of the effluent with fresh water from the Victoria Creek wells or other fresh water sources, as per the Water Board's interpretation in its January 30, 1998 "Reasons for Decision" rejection of Application QZ97-027 by Environment Canada, Environmental Protection Service's "Petition For An Emergency Amendment To Licence QZ94-004".

Water Resources Division
Northern Affairs Program

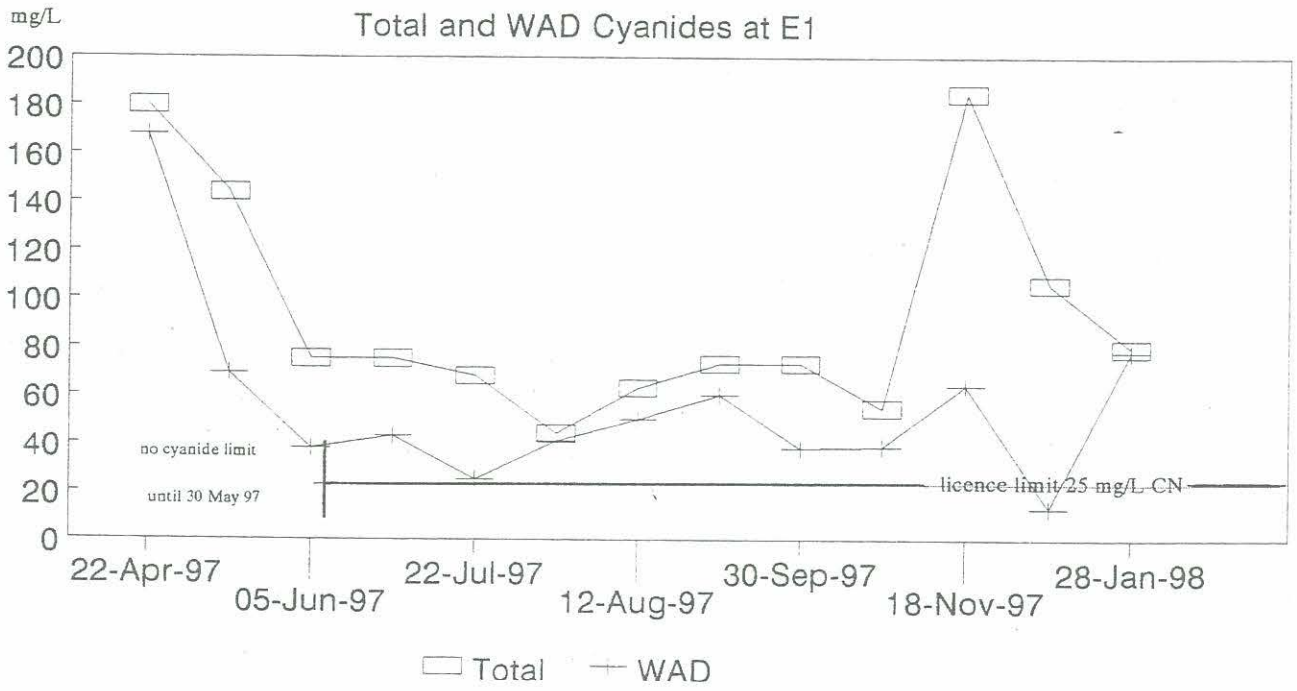
February 11, 1998

QZ97-028
EXHIBIT 5.3

Figure 1

TOTAL AND 'WAD' CYANIDE CONCENTRATIONS IN THE TAILINGS POND

BYG's Mt. Nansen Gold Mine - April 1997 to January 1998



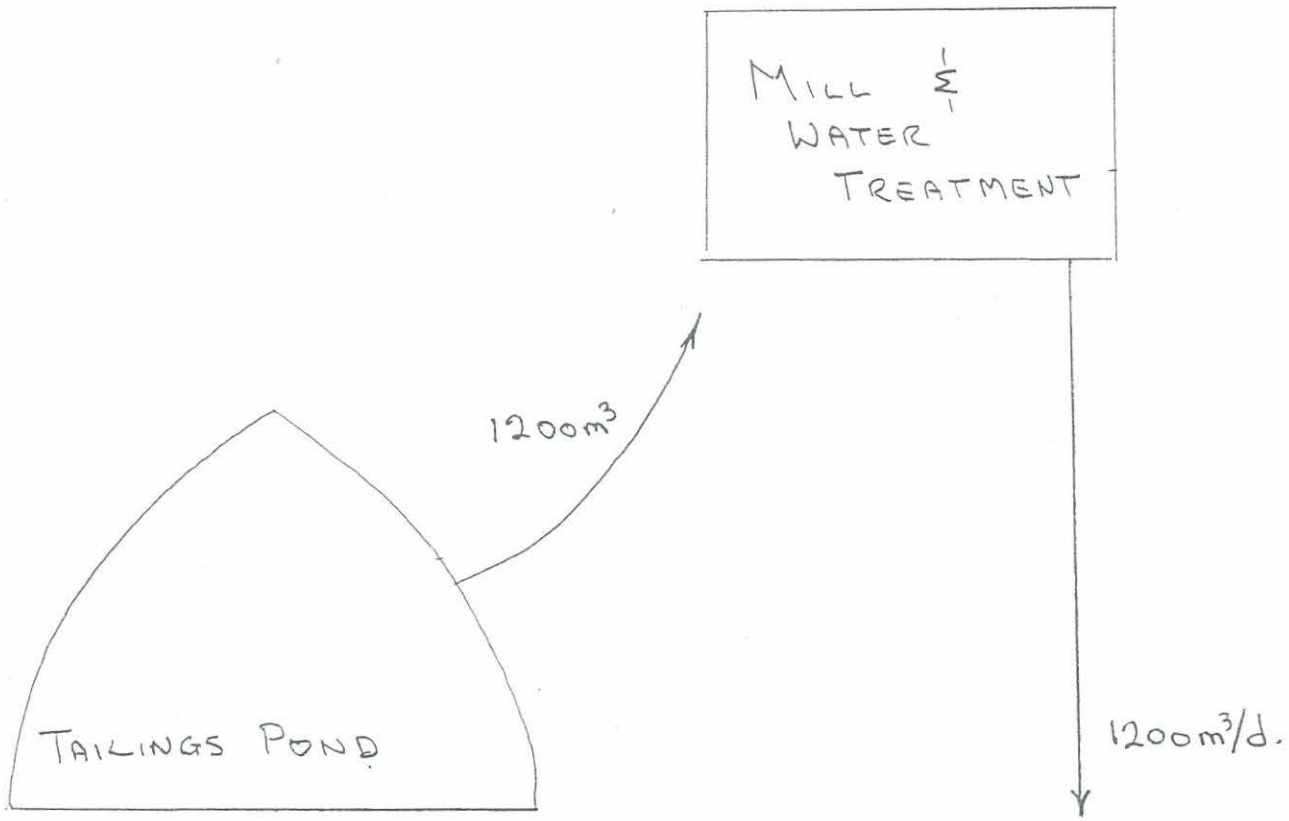
05 Feb 1998 WG Whitley

QZ97-028
EXHIBIT 5.3

Figure 2

SCHEMATIC OF WATER TREATMENT VOLUMES WITH NO MILLING

Treatment at a Rate of 50 Cubic Metres per Hour (1200 m^3/day)



Assumptions -no seepage losses or inflows
-there is 10,000m3 of storage currently available
-spring freshet requires storage of 50,000m3

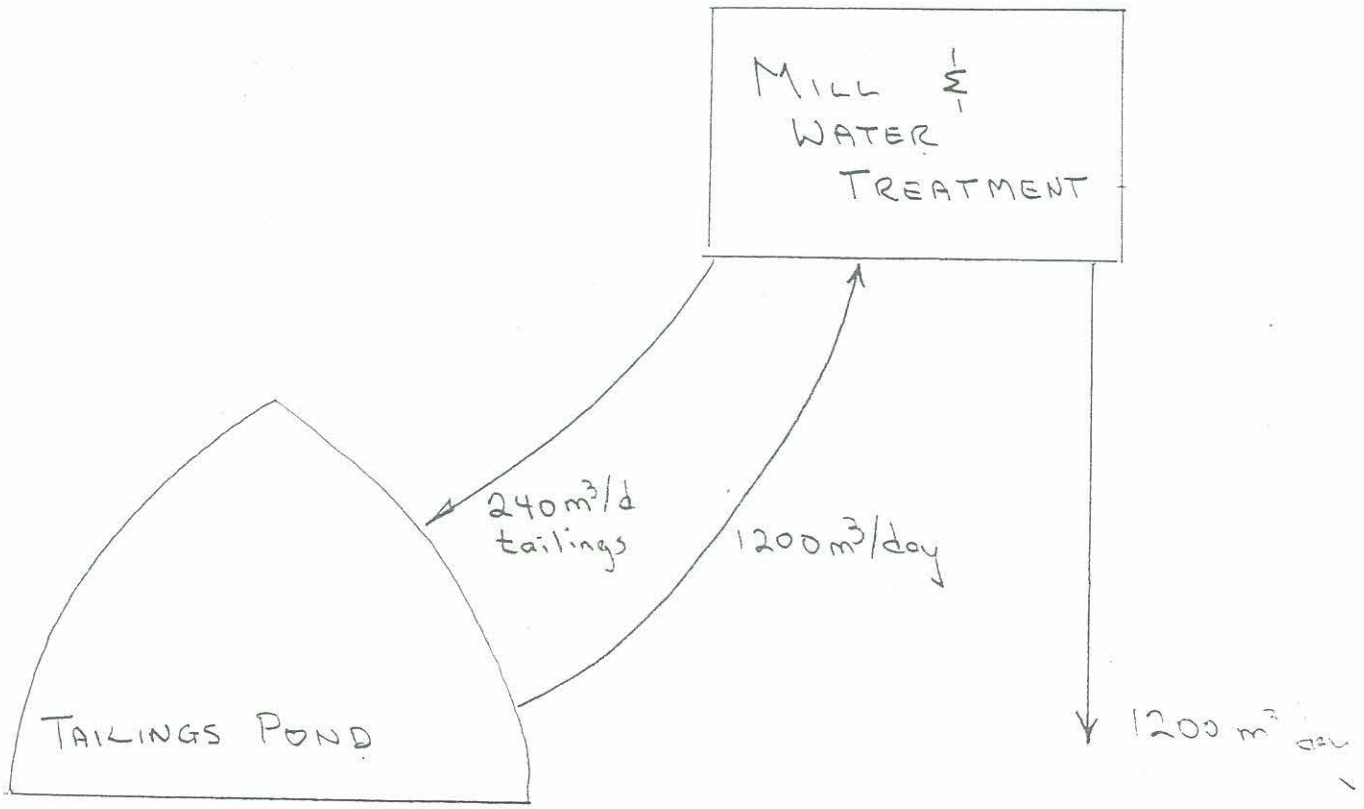
Result -pond drops by 1200m3/day. Time required to reduce pond volume by 40,000m3 is 33.3 days.

0297-028
EXHIBIT 5.3

Figure 3

SCHEMATIC OF WATER TREATMENT VOLUMES WITH MILLING AT 300 TONNES PER DAY

Treatment at a Rate of 50 Cubic Metres per Hour (1200 m^3/day)



Treatment of water at 50m3/hr (1200 m3/day) and milling at 300t/d (240m3/day @ 1.25 t/m3)

Assumptions -no seepage losses or inflows
-there is 10,000m3 of storage currently available
-spring freshet requires storage of 50,000m3

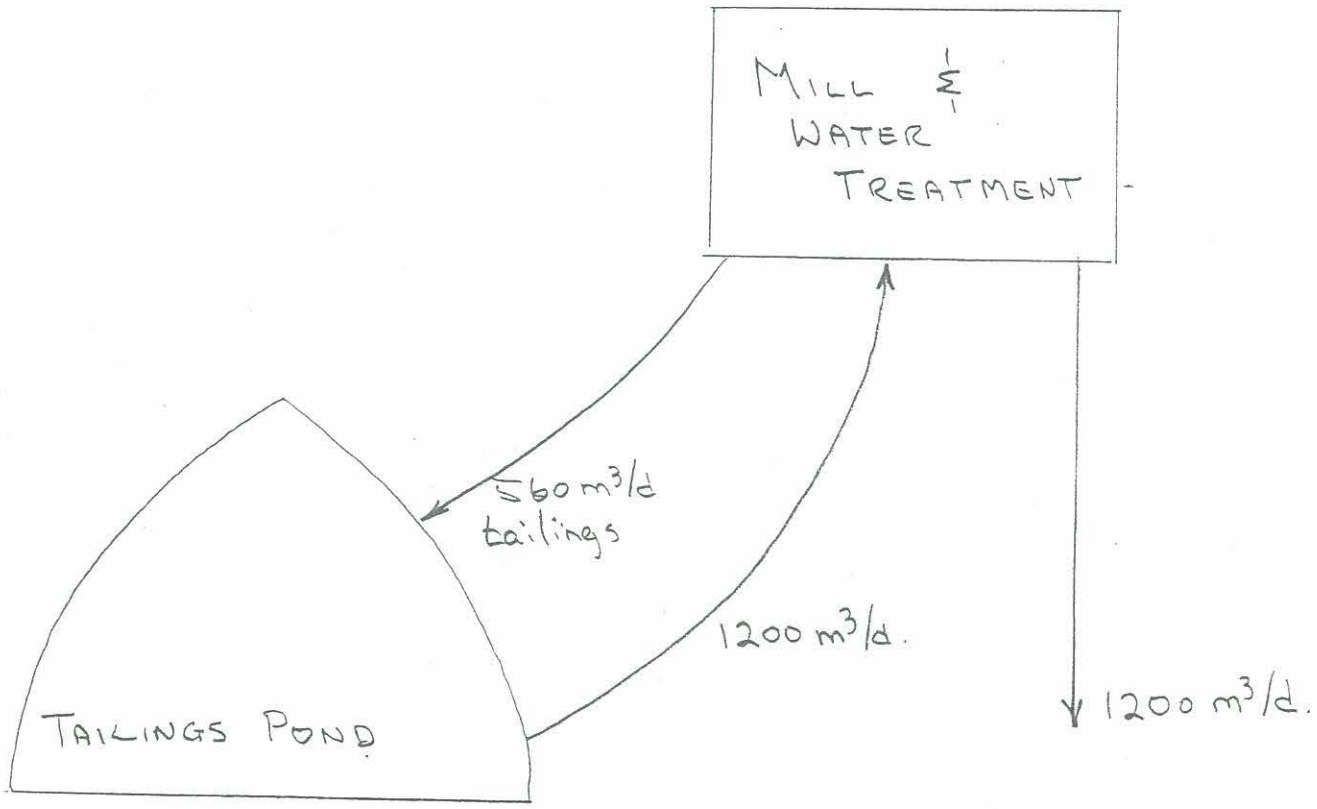
Result -pond drops by 960m3/day. Time required to reduce pond volume by 40,000m3 is 41.7 days.

QZ97-028
EXHIBIT 5.3

Figure 4

SCHEMATIC OF WATER TREATMENT VOLUMES WITH MILLING AT 700 TONNES PER DAY

Treatment at a Rate of 50 Cubic Metres per Hour (1200 m^3/day)



Treatment of water at 50m3/hr (1200 m3/day) and milling at 700t/d (560m3/day @ 1.25 t/m3)

Assumptions -no seepage losses or inflows
-there is 10,000m3 of storage currently available
-spring freshet requires storage of 50,000m3

Result -pond drops by 640m3/day. Time required to reduce pond volume by 40,000m3 is 62.5 days.

0297-028
EXHIBIT 5.3

Yukon Conservation Society

INC. 1968

Mr. Ron Johnson
Chairperson
Yukon Territory Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A 3V1

YUKON TERRITORY WATER BOARD
IRD FEB 12 P 3:11
Fax
Q29798

February 11, 1998

Dear Mr. Johnson;

Re: BYG Application for an emergency amendment to License QZ94-004

The Yukon Conservation Society would like to add two concerns that were not clearly defined in our letter dated February 10, 1998, regarding BYG's application for an emergency amendment to License QZ94-004.

On January 22, 1998, Vista Engineering submitted a report indicating that they had been able to treat the tailings water sufficiently to meet effluent standards but were not able to pass the LC50 96 hour acute toxicity test without dilution. The data charted in this report indicates that even with a 1:1 dilution of the effluent, 90% of the fish had died by the completion of the allotted test time 96 hours. This indicates that the **effluent is extremely acutely toxic**! YCS would like clarification on what component of the effluent is killing the fish. It would seem the licence requirements are inadequate because either:

1. one or more of the parameters in the license have not been defined low enough to mitigate impact to aquatic health;
2. the interaction of toxicity's of parameters in the effluent has not been adequately anticipated by the license requirements sufficiently to mitigate impact to aquatic health; or
3. a component of the effluent is toxic to fish but has not been defined in the license.

This suggests to YCS that the effluent requirements defined in BYG's Mount Nansen water license do not protect the health of aquatic life and should be reviewed and revised accordingly.

YCS has also noticed that there is no licence requirement for ammonia or total nitrogen. What is the rationale for this?

There is also no indication in this report of the volumes treated during the test or the length of the test. Can the treatment efficiency indicated by the report be maintained on a long term basis? Can the treatment efficiency indicated be maintained with the discharge volumes contemplated in this amendment request? What sampling protocol is necessary to ensure that the treatment plant is operating to maintain these results? Figures 5.6 and 5.7 of the report indicate how critical it is

Exhibit 5.4

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that the plant be operated correctly. A reduction of SO_2 input from 0.2 litres per minute to 0.1 liters per minute causes the discharge to fail the bioassay test even at a 1:5 dilution ration. This indicates how sensitive the treatment process is and the need for constant monitoring and automated, redundant systems.

The second concern deals with the "emergency" nature of the spring inflow to the tailings pond. BYG appears to be taking a passive approach to spring freshet. YCS believes that active approaches to reducing inflow should be investigated. A limited program of snow removal from previously disturbed areas of the tailings pond catchment could help reduce the total inflow. A program similar to that used by YTG highways to reduce glaciation on roads may also help. This program consists of a system of canvas barriers supported by stakes to divert runoff.

An investigation should also be undertaken into the mixing of runoff with pond water. Ice on the pond as well as temperature, density and chemical differences may prevent the mixing of freshet inflow with tailings water.

Sincerely,

Bob Van Dijken, Director

Sue Moodie, Mining Committee

c.c. BYG, Little Salmon Carmacks First Nation, Village of Carmacks, EPS, DIAND, DFO

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Conservation and Protection | Conservation et Protection
Pacific & Yukon Region
91782 Alaska Hwy.
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QZ97-028.

Your file Votre reference

Our file Notre reference

4484-37/M100

12 February, 1998

Mr. Ron Johnson
Chairperson, Yukon Territory Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A 3V1

RE: QZ97-028 BYG Mt. Nansen Emergency Amendment

Dear Mr. Johnson :

Environment Canada and Fisheries and Oceans Canada have reviewed the emergency amendment request submitted to the Yukon Territory Water Board on 3 February 1998. The tailings pond is currently full and the water quality in the pond is roughly 80 ppm CN_{WAD} and there are also toxic levels of other contaminants including zinc and copper. This water must be prevented from spilling into Dome Creek without being treated.

BYG is asking the Board to accept that they have done everything they can reasonably be expected to do to meet the effluent requirements and, in spite of this, they are unable to achieve compliance. In our view the evidence BYG has put before the Board and ourselves is not adequate to make this determination. At a meeting between officials from BYG, DIAND and ourselves on 28 November 1997, BYG stated that they had achieved results which indicated they would solve their treatment problems by using a combination of peroxide and activated carbon following the INCO SO2 treatment.

The pond level needs to be drawn down prior to freshet. The emergency amendment request is designed to ensure that a poorer quality effluent can be discharged without fear of prosecution. Within the context of the Water Licence and its enforcement the question is - Is this the only way to be assured that the pond level will be drawn down in a timely fashion?

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Z97-028
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DIAND Water Resources is responsible for water licence enforcement. In this case, they are the appropriate party to judge what can be done from a water licence enforcement point of view to minimize the environmental impacts from this minesite. If DIAND's recommendation is that the Water Board grant temporary relief from the bioassay requirement, then there are some specific licence conditions which we would recommend be attached to this licence for the duration of the Emergency Amendment.

Our recommendations and the supporting rationale are attached for the Board's consideration.

Respectfully,

Vic Enns P. Eng.
Head, Pollution Abatement
EP - Yukon

Gail Faulkner
Chief, Habitat and Enhancement Branch
Yukon and Northwest BC
DFO

cc. G. Dickson - BYG Natural Resources
D. Sherstone - DIAND, Water Resources
C. Noble - Little Salmon/Carmacks First Nation

QZ97-028
EXHIBIT 5.5

February 13, 1998

COMMENTS ON PROPOSED EMERGENCY AMENDMENT QZ97-028

SUBMITTED BY: EP/DFO

These recommendations are made in the context of the understanding that the Board is only considering a Temporary removal of the bioassay requirement in the discharge standards and no other relaxation of other effluent parameters.

The following conditions are recommended:

RECOMMENDATION 1: **WATER QUALITY MONITORING**

That BYG increase the water quality monitoring frequency at V4 (Victoria Ck below Dome Ck) to weekly for the duration of the emergency discharge and add WAD cyanide, cyanate and thiocyanate to the list of parameters normally included. LC_{50} bioassays should be carried out on Station E7 samples once every two weeks.

RATIONALE

The bioassay is a measure of the toxic constituents in the discharge. Some of these are also individually listed as regulated effluent parameters, others are not. The available data on the performance of the effluent treatment plant indicates that the likely cause of the toxicity has been variable. In some cases one or more of the following compounds could have caused the toxicity - copper, zinc, ammonia or cyanate. BYG now maintains that the treatment plant can consistently meet effluent standards for all the regulated compounds. This leaves ammonia and cyanate as known contributors to the toxicity. Cyanate is the direct product of the oxidation of cyanide in the Inco-SO2 process.

In this case BYG has maintained that most of the toxicity has been due to cyanate and ammonia. Most of the cyanate is expected to hydrolyze to ammonia in the creeks. Both ammonia and cyanate can be expected to persist in the creeks to a significant extent, particularly when the streams are ice covered. Recent observations indicate that there could be less than 1:1 dilution available in Victoria Creek below Dome Creek until the onset of freshet. In order to assess the extent of any potential impact on water quality in Victoria Creek more frequent monitoring is required, especially since the concentrations of these parameters in the treatment plant discharge could be quite variable. Thiocyanate is added since it can also be oxidized to cyanate. In the existing licence these parameters are monitored in Dome Creek but not Victoria Creek.

The bioassay monitoring frequency is increased at Station E7 so we can gauge how good a job the licensee is doing to try and minimize the toxicity during the Emergency period.

Z97-028
EXHIBIT 5.5

RECOMMENDATION 2: **REPORTING**

Weekly monitoring reports should be submitted to the Board by the licensee. The weekly report should include the monitoring program results for surveillance undertaken that week. The report should also include the current tailings pond water level and the total volume of pond water treated that week.

RATIONALE

It is important for the licensee and the agencies to get timely information to gauge the progress of the emergency measures.

RECOMMENDATION 3: **MILL OPERATION**

The licensee should be prohibited from milling ore until: a) there is a minimum of 75,000 cubic metres of unused water storage capacity in the pond **and** the pond total cyanide level is below 25 mg/l, **or**; b) until 26 May 1998, **whichever comes first**.

RATIONALE

a) 75,000 cubic metres of storage
On January 9, 1998 the licensee submitted a draft Decommissioning and Reclamation Plan to the YTWB. Appendix E of this report is an updated water balance model. This model attempts to correct some of the errors which led to the original gross underestimation of uncontrolled water inflow to the tailings pond. The model specifically addresses the licensee's best estimates for pond levels during 1998. There are several very significant assumptions made in this model which the Board should take into account. The model is based largely on the experience of one year and on one set of measurements of diversion leakage. Therefore there is still a fair amount of uncertainty in the model.

The model assumes that there will not be significant snow melt until May 1998. In that month the model predicts an inflow to the pond from run-off of 45,000 m^3. The report also documents that 48% of the water flowing into the top of the Dome Creek diversion (diverts Dome Ck around the tailings pond) leaks into the tailings pond. The model assumes that there will be zero leakage into the pond from the diversion until July 1998 due to frozen soils. The consultant acknowledges that this assumption has not been verified. It is quite possible that most of the leakage is taking place in the shallow soils. The shallow soils will not remain frozen until July. Substantial melting could take place as early as April and the meltwaters themselves will contribute to the thawing of the soils. If the model was adjusted to allow for Diversion leakage as early as May, the pond inflow that month would be 65,000 m^3. The model also considers what would happen if 1998 was a 200 yr. wet year. In that case, and assuming the diversion leaks in May, the inflows would be 85,000 m^3. In view of this, it is our recommendation that the licensee seek a buffer of 72,000 m^3 of storage capacity rather than 50,000 m^3. The licensee reports that it can treat at a rate of 36,000 m^3 per month. The licensee has already been discharging since at least 27 January 1998.

Z97-028
EXHIBIT 5.5

b) Pond cyanide below 25 mg/l.

This is an existing licence obligation. The monthly water quality reports indicate that very little progress has been made in reducing the pond cyanide levels. They are still being reported in the 80 to 90 mg/l cyanide range. These levels are of concern for two reasons. First, the instrumentation required to evaluate whether last summer's dam stabilization measures were effective has not been installed. If the dam failed, obviously 25 mg/l is better then 90 mg/l. cyanide. Secondly, the higher the pond cyanide level, the heavier the contaminant loading to the effluent treatment plant. A better quality pond would help ensure a better quality effluent.

c) Prohibition on Milling

This recommendation is not made lightly or with disregard to the potential financial peril of the mine operation. According to the licensee's own water balance, operating the mill at the 700 TPD design capacity almost doubles the length of time required to draw down the pond level. The model states that 16,800 m^3 of available water storage volume will be displaced by tailings each month. When the mill is operating, this much water must be treated and disposed of just to keep the pond level unchanged. At the proposed treatment rate of 36,000 m^3 per month only 19,000 m^3 would actually contribute to a reduction in tailings pond water levels. Operating the mill is inconsistent with the objective of creating sufficient storage capacity in the pond as quickly as possible in order to prevent a spill of untreated tailings water. As well, while the mill is not operating, the licensee could be re-circulating tailings pond water through the tailings cyanide destruction circuit to bring the pond cyanide levels down as quickly as possible. The monthly water quality reports do not demonstrate any effectiveness in lowering pond cyanide levels while the mill is operating.

If milling is allowed, there could be a significant financial advantage to the licensee for the emergency period to last as long as possible - particularly if the licensee is not extremely confident they will be able to meet the original discharge criteria when the emergency period ends. There could be a significant financial incentive to make sure the targets are not quite met so the 'emergency' lasts as long as possible. Also, if milling is allowed, there is no evidence to suggest that the pond cyanide levels will be able to be reduced. If a non-milling period is used as an opportunity to bring those levels down then the licensee will be better able to keep them down when the mill does re-start. There is no practical technical barrier to using the idle cyanide destruction circuit to treat pond water other than the licensee's willingness to make the necessary changes to the piping.

RECOMMENDATION 4: **WATER TREATMENT PLANT OPERATION**

The licensee must operate the INCO-SO2 system, the cyanate reactor and the carbon columns (as described in the Water Treatment Plant Interim Report dated 22 January 1998 and submitted to the YTWB) to the best of their ability to achieve the least toxic effluent reasonably attainable.

QZ97-028
EXHIBIT 5.5

RATIONALE:

There is a concern that once the bioassay requirement is suspended, there will be little incentive for the licensee to continue to utilize the additional water treatment equipment which was added to the INCO-SO2 system as part of their attempt to achieve a non-toxic discharge. The intent of this clause is to try and ensure that the licensee continues to make best efforts to reduce the toxicity of the effluent. This clause is not ideal but it is better than nothing.

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91782 Alaska Hwy.
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Your file / Votre reference

Our file / Notre reference

4484-37/M100

12 February, 1998

Mr. Ron Johnson
Chairperson, Yukon Territory Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A 3V1

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Dear Mr. Johnson :

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EP - Yukon

Gail Faulkner
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DFO

cc. G. Dickson - BYG Natural Resources
D. Sherstone - DIAND, Water Resources
C. Noble - Little Salmon/Carmacks First Nation

QZ97-028
EXHIBIT 5.5

February 13, 1998

COMMENTS ON PROPOSED EMERGENCY AMENDMENT QZ97-028

SUBMITTED BY: EP/DFO

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Z97-028
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If milling is allowed, there could be a significant financial advantage to the licensee for the emergency period to last as long as possible - particularly if the licensee is not extremely confident they will be able to meet the original discharge criteria when the emergency period ends. There could be a significant financial incentive to make sure the targets are not quite met so the 'emergency' lasts as long as possible. Also, if milling is allowed, there is no evidence to suggest that the pond cyanide levels will be able to be reduced. If a non-milling period is used as an opportunity to bring those levels down then the licensee will be better able to keep them down when the mill does re-start. There is no practical technical barrier to using the idle cyanide destruction circuit to treat pond water other than the licensee's willingness to make the necessary changes to the piping.

RECOMMENDATION 4: **WATER TREATMENT PLANT OPERATION**

The licensee must operate the INCO-SO2 system, the cyanate reactor and the carbon columns (as described in the Water Treatment Plant Interim Report dated 22 January 1998 and submitted to the YTWB) to the best of their ability to achieve the least toxic effluent reasonably attainable.

QZ97-028
EXHIBIT 5.5

RATIONALE:

There is a concern that once the bioassay requirement is suspended, there will be little incentive for the licensee to continue to utilize the additional water treatment equipment which was added to the INCO-SO2 system as part of their attempt to achieve a non-toxic discharge. The intent of this clause is to try and ensure that the licensee continues to make best efforts to reduce the toxicity of the effluent. This clause is not ideal but it is better than nothing.

QZ97-028
EXHIBIT 5.5.

Yukon
Renewable Resources
Box 2703, Whitehorse, Yukon Y1A 2C6

Yukon
Economic Development
Box 2703, Whitehorse, Yukon Y1A 2C6

1998 FEB 13 A 9:24

fax

QZ97-028

February 12, 1998

Ron Johnson, Chair
Yukon Territory Water Board
Suite 106, 416 Range Road
Whitehorse, Yukon Y1A 3V1

Re: Application QZ97-028 Emergency Amendment, B.Y.G. Natural Resources Inc.

Dear Mr. Johnson,

As you have requested, we have reviewed the emergency amendment received from B.Y.G Natural Resources Inc. for its water license. We recognize there is a public interest in ensuring that water quality objectives are achieved and that the Yukon Government does not have the responsibility for water use.

Consideration of a decision to bypass the LC50 bioassay and allow a controlled, time-limited discharge within the confines of the water license to ensure that an uncontrolled discharge of effluent does not occur during spring run-off is difficult. It is a choice between two uncomfortable options.

Within this context, our preferred option is to support an action by the Yukon Water Board to prevent an uncontrolled discharge of effluent during spring run-off if the Board is satisfied that the balance of scientific evidence that suggests the protection of fish in Victoria Creek can be assured and water resource officials at the Department of Indian Affairs and Northern Development (DIAND) are in agreement.

However, we strongly recommend that DIAND and the company work closely together on a plan that would ensure the company can be in full compliance of all term and conditions of the water license and that DIAND will enforce those terms and conditions.

Yours sincerely,

Jesse Duke
Mining Facilitator
Department of Economic Development

Joe Ballantyne
Director, Environmental
Protection and Assessment
Department of Renewable Resources

cc Ron Johnson, Chair, Yukon Territorial Water Board
Graham Dickson, B.Y.G Natural Resources

QZ97-028
EXHIBIT 5-6.

LITTLE SALMON / CARMACKS FIRST NATION

Box 135, Carmacks, Yukon
Y0B-1C0
Ph: (867) 863-5576 Fax: (867) 863-5710

YUKON TERRITORY
WATER BOARD
1998 FEB 13 P 1:45
fax
QZ97-028

February 12, 1998

Mr. Ron Johnson
Chair
Yukon Territorial Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A-3V1

Dear Mr. Johnson:

Re: BYG Natural Resources Emergency Amendment to Water License QZ94-004

The Little Salmon / Carmacks First Nation once again we find ourselves placed in the position to choose between two evils. It has been, and remains our position that BYG Natural Resources must meet all the conditions outlined within their original license. However, given poor planning and equally poor engineering advise this position maybe to difficult to achieve at present. It is our understanding that BYG is requesting the following:

1). The ability to use additional water from Victoria Creek for the purpose of diluting treated effluent from tailing's, and;
2). to forego the LC50 bioassay test until May 26 1998, and;
3). to move the LC50 test further down stream from the current testing site.

The proponents of the mine site have stated that if they are not allowed to make these changes they will continue to fail the LC50 tests, and therefore, be unable to discharge effluent from the tailing's pond, which is currently rising and may over flow in the near future.

If in deed this is the case, we have no other choice but to conditionally support the request of BYG. Those conditions are as follows:

1). BYG must be forced to commit its resources to bringing the water treatment facility up to a standard that will meet all the original license requirements no later than March 31, 1998, and;
2). the LC50 testing, or equivalent testing must be continued to monitor the levels of dilution being achieved, furthermore, should the levels reach critical risk for aquatic organisms the discharge of diluted effluent shall be stopped, and;
3). immediate remedial action should be undertaken by BYG to reduce the amount of spring run off into the tailing's pond, and;
4). a full reporting of ongoing efforts to reduce the occurrence of a overflow at the site should be provided to Governments and the Water Board on a daily basis, and;
5). that this amendment only be granted until March 31, 1998, after which the terms and conditions of the original licenses should be applied.

We further request that if BYG is not prepared, or is unwilling to agree to theses conditions, that they should have their water license revoked. We have been waiting for nearly 6 months for the treatment facility to be put in place and working to the standards outlined within the license. Surely, BYG must be made aware that this will not be tolerated any longer.

Sincerely

ORIGINAL SIGNED BY:

Ed Schultz
Executive Director

cc. Chief & Council LSCFN
BYG Natural Resources

QZ97-028
EXHIBIT 5-7

Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

Replaces faxed copy
Sent Feb 4/98 3:26pm.

Water Resources Division
#310 - 300 Main Street
Whitehorse, Yukon
Y1A 2B5

1998 FEB -6 P 12:48

Internal

QZ97-028

Your file Votre référence

Our file Notre référence
Mt. Nansen - BYG

February 04, 1998

FAXED 98/02/04 @ 1527 h

Mr. Ron W. Johnson, Chair
Yukon Territory Water Board
Suite 106, 419 Range Road
WHITEHORSE YT Y1A 3V1

Dear Mr. Johnson:

RE: EMERGENCY AMENDMENT APPLICATION QZ97-028: BYG NATURAL RESOURCES MT. NANSEN MINE

DIAND Water Resources Division has reviewed BYG's emergency amendment application QZ97-028. This application seeks to modify existing water licence QZ96-004 to permit discharge of effluent which does not meet limits set out in the existing water licence. BYG is requesting an emergency amendment because the tailings pond is at, or over, the maximum storage level and cannot provide storage for the spring snow melt run-off.

DIAND Water Resources has concluded that this emergency application does not require screening under the *Canadian Environmental Assessment Act (CEAA)*.

Section 7(1)(c) of the *CEAA* states:

> "..... an environmental assessment of a project is not required where the project is to be carried out in response to an emergency and carrying out the project forthwith is in the interest of preventing damage to property or the environment ....."

The request for exemption from the fish toxicity portion of Application QZ97-028 and the need to immediately reduce pond levels does, in Water Resources view, constitute an emergency. Without allowing the discharge of effluent which meets all licence standards except that for fish

QZ97-028
EXHIBIT 9.1

Canada

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toxicity (the LC_{50}), there will be uncontrolled spillage of untreated effluent from the tailings pond over the next few months. Such untreated overflow may continue for several months and cause significant environmental damage. The discharge of treated effluent, which may fail to meet the fish toxicity standards, is likely to cause much less significant environmental damage.

The additional BYG request to move the sampling point for the LC_{50} to a point immediately upstream of the point at which Dome Creek enters Victoria Creek does not, in Water Resources view constitute an emergency, nor is it a necessary corollary to the emergency discharge of tailings pond effluent. The exemption from a *CEAA* screening therefore applies only to the request for emergency discharge of tailings pond effluent. Water Resources strongly urges the Water Board to deal with the request for relocated LC_{50} sampling location through normal *Yukon Waters Act* application and *CEAA* screening processes.

If wish to discuss the matter further, or require additional clarification, please contact me at your convenience.

Yours sincerely,

David A. Sherstone

David A. Sherstone
Regional Manager, Water Resources

cc: Graham Dickson, BYG Natural Resources, Carmacks
Vic Enns, DOE, Environmental Protection, Whitehorse
Gail Faulkner, DFO, Habitat Protection, Whitehorse

QZ97-028
EXHIBIT 9.1

YUKON TERRITORY WATER BOARD
AMENDMENT OF LICENCE

LICENSEE: B.Y.G. Natural Resources Inc. LICENCE NUMBER: QZ94-004

AMENDMENT NUMBER: Three Application Number: QZ97-028

Pursuant to the Yukon Waters Act, Water Use Licence QZ94-004, as amended by amendments number one and number two, is hereby further amended as follows:

Part J is hereby appended, as follows:

PART J - TEMPORARY RELIEF FROM FISH TOXICITY STANDARD

49. Notwithstanding the requirements of Part E of this licence, and subject to the terms and conditions of this part of this licence, the Licensee is hereby granted a temporary exemption from the requirement to ensure that any effluent that is discharged must meet the non-toxicity requirements defined by the 96 hour LC_{50} bioassay, using rainbow trout (pH non-adjusted).

50. The temporary exemption from the requirement to meet the non-toxicity requirements of the 96 hour LC_{50} bioassay shall be for a continuous period of no more than sixty (60) days, commencing on a date in 1998 that shall be determined by the Licensee. For purposes of this section of this licence, this shall be referred to as the "exemption period".

51. The Licensee shall notify the board, in writing, of the first and last day of the exemption period and this notice ("the original notice") shall be provided within ten days of the commencement of the exemption period. The Licensee shall notify the board immediately if the last day of the exemption period occurs sooner than originally anticipated. In no case shall the last day of the exemption period be later than the date that is indicated in the original notice.

52. The Licensee shall make every reasonable effort to limit the exemption period to a period of less than sixty (60) days.

1998 Effluent Quality Analysis Report

53. No later than June 30, 1998, the Licensee shall submit a "1998 Effluent Quality Analysis" Report to the Board. The report shall be prepared by an independent qualified party and shall be certified by an engineer who is certified to practice in the Yukon.

54. The report shall be sufficiently detailed so as to provide assurance of compliance with all of the effluent quality standards enumerated in Part E of this licence, for the duration of this licence and shall include, at a minimum:

i) A detailed analysis of the conditions, actions, factors and circumstances that culminated in the emergency application for relief from the LC_{50} fish toxicity standard: and

ii) Details of actions that have been be taken and recommendations for actions that can be taken, to ensure that all effluent standards in the licence will be met for the duration of the licence and to minimize inflows to the tailings pond, and

iii) Clear statements of the actions that will be taken, including schedules for completion, and detailed explanations for any actions that are recommended but will not be implemented.

Monitoring and Analyses During Exemption Period

55. For the duration of the exemption period, and in addition to any other requirements of this licence, the Licensee shall comply with the following requirements for monitoring, analysis and reporting:

i) Site V4 (Victoria Creek downstream of Dome Creek) shall be monitored weekly for all parameters identified in Appendix 1 of the licence and also for WAD cyanide, cyanate and thiocyanate, as well as for all other parameters that are required by this licence.

ii) LC_{50} bioassays shall be conducted on samples from Station E7 (Polishing Pond discharge to Dome Creek) every second week

iii) The results of all monitoring and analysis required by the licence shall be submitted to the Board no later than seven days after the analyses is completed. Reports shall be submitted in printed form, accompanied by five paper copies and two computer diskette copies.

56. For the duration of the exemption period, the Licensee shall provide weekly reports of the volume of pond water that has been treated and the tailings pond water level.

Dated this 16 day

of February, 1998

D. Mueller
Witness

YUKON TERRITORY WATER BOARD

Ron W. Johnsen
Chairperson

Dated this 20th day of

February, 1998

Lauretta Francoeur
Witness

Jane Stewart
Minister of Indian and Northern
Affairs Canada

COPY

REASONS FOR DECISION - APPLICATION QZ97-028
AMENDMENT #3 TO WATER USE LICENCE QZ94-004
EMERGENCY AMENDMENT, B.Y.G NATURAL RESOURCES INC.

The Yukon Territory Water Board ("the Board") has concluded deliberations pertaining to application QZ97-028, an application to amend water use licence QZ94-004. Water use licence QZ94-004 is a type A licence for quartz mining undertaking that was issued to B.Y.G. Natural Resources Inc. ("the Licensee") in 1996.

On February 3, 1998, the Licensee made application for:

- Temporary relief from the requirement that all effluent had to pass an LC_{50} test.
- Relocation of the compliance point for the LC_{50} test from the point where the tailings impoundment discharges to Dome Creek to a point that would be approximately two kilometers downstream.
- Disposition of the application as an emergency.

The Licensee argued that:

- The tailings impoundment has approximately 10,000 m^3 of available space.
- Spring runoff is expected to result in an input of approximately 50,000 m^3 of water into the tailings pond, and the tailings pond cannot accommodate that quantity of water.
- Effluent from the tailings impoundment can likely pass an LC_{50} test only if the rate of discharge is kept at or below 500 m^3 per day.
- A discharge rate of 1,200 m^3 per day will be necessary to dispose of the water in the tailings pond so as to avoid an uncontrolled discharge of inadequately treated effluent.
- If effluent is discharged at a rate of at a rate of 1,200 m^3 per day, then effluent from the tailings impoundment cannot pass the LC_{50} test, but would meet all of the other effluent quality standards.

Emergency

The Yukon Waters Act ("the Act") provides that the Board may dispense with the public notice provisions when there is an emergency. Although 'emergency' is not defined in the Act, the Board has adopted a position that public participation is an important component of it's decision process and that dispensation for emergency purposes should be invoked only where there is some sudden condition calling for immediate action.

It could be argued that, in this case, the Licensee was aware of problems with the treatment system and should have been aware of the likely additional loadings during spring runoff, and therefore there is no "sudden act". However, the facts are that spring runoff will likely occur on or before the beginning of April, that there will be additional loadings in the tailings pond because of spring runoff, and there is not sufficient time between now and then to convene a public hearing, reach decisions, and forward those decisions to the Minister for approval.

The Board agreed that the application must be dealt with expeditiously because there is an imminent and legitimate potential for environmental damage due to the current level within the tailings impoundment and the expected additional loadings at spring runoff and because spring runoff is likely to occur within the next two months.

In this situation, the requirements for public notice and public hearing in the Act would have meant that a decision could not likely be reached in time to avoid potential environmental damage. Therefore, the application, insofar as it relates only to the request to temporarily remove the LC_{50} requirement, has been considered as an emergency.

The application to relocate the point of compliance for the LC_{50} test is not an emergency and has not been addressed. If the Licensee chooses to pursue this amendment, then a new application for amendment should be submitted and it will be disposed of in the normal procedure for amendments.

Canadian Environmental Assessment Act ("CEAA")

The Board agrees with the position put forward by Indian and Northern Affairs Canada ("DIAND") that this amendment, as it pertains to the request to temporarily remove the requirement to pass an LC_{50} test, is an emergency and an environmental assessment is not required.

Consultation

Although the emergency nature of this application prevented the usual process for public review, the Board did solicit input from Government and from known interested parties.

The following parties were invited to submit written recommendations:

Little Salmon Carmacks First Nation
Indian and Northern Affairs Canada
Environment Canada
Fisheries and Oceans
Government of Yukon
Village of Carmacks
Yukon Conservation Society

Except for the Village of Carmacks, all of the parties sent written submissions. The Board appreciates the timely responses that were received and careful consideration was given to each of the recommendations.

Consideration

In reaching decisions pertaining to this application, the Board considered the requirements of the Act and CEAA, the application itself, the written submissions of interested parties, water use licence QZ94-004 as amended by amendments one and two, and certain information from water use register QZ94-004 (proposed effluent standards from exhibit I, recommendations for effluent standards in exhibit Vd, and information regarding the location of the project in relation to Dome Creek, Victoria Creek and the Nisling River).

The Board considered the Yukon Placer Authorization ("YPA") stream classifications of Dome Creek and Victoria Creek as Type IV streams which are defined, in the YPA, as "streams and/or stream reaches considered to be inaccessible to fish because of physical barriers, velocity barriers, or unsuitable channel morphology, or which have unproductive habitats."

This was an emergency application. Parties did not have an opportunity to ask questions, clarify issues or offer responses. Therefore, the Board did not consider issues or recommendations that were not directly related to the application at hand. In March, the Board will be holding a public hearing to examine the current and potential effectiveness of environmental protection measures at this mine site and parties may choose to raise these other issues and recommendations at that time.

Decision

After giving thorough consideration to all of the information, it is the decision of the Board to approve the emergency amendment, as detailed in amendment number three to licence QZ94-004. The amendment permits a sixty day exemption from compliance with the LC_{50} requirement. The Licensee may choose the start date of the exemption period and the sixty days must be consecutive.

The amendment includes several conditions for monitoring and reporting that were recommended by Environment Canada and Fisheries and Oceans Canada ("EP/DFO"), as well as a requirement to submit a comprehensive report that must include sufficient detail and commitments to provide assurance of future compliance with all of the effluent quality standards of the licence.

The amendment does not include a restriction against milling. However, in making any decision regarding operation of the mill, the Licensee must give priority to ensuring compliance with licence conditions, particularly since the sixty day window for reducing the pond level does not provide for any real period of grace. In addition, the Licensee has made the following commitment to the Board:

> "BYG will not operate the milling facility unless we have the capacity to provide water to the mill in excess of that required for the water treatment plant".

The Board expects that this commitment will be met.

The amendment does not include any relief from the requirement to meet a cyanide standard in the pond, and it does not include any relief from any effluent quality standards other than the LC_{50}.

Conclusion

Information provided in the interventions suggests that this emergency application could have been avoided. There are several indications that this Licensee has not managed the site in an environmentally responsible manner.

However, the Board's role, in this circumstance, is not to determine fault. The Board's priority must be protection of the environment.

In the end, the environmental impacts of discharging effluent that may fail an LC_{50} test had to be compared to the environmental impacts of an uncontrolled discharge of tailings water that would not only fail the LC_{50} test, but would also contain high concentrations of cyanide, arsenic and other heavy metals.

Therefore, to avoid a situation that would likely have a severe environmental impact, the Board has approved amendment number three to water use licence QZ94-004 and has asked the Minister of Indian and Northern Affairs to expeditiously approve this amendment.

Ron W. Johnson

Ron Johnson, Chairperson
YUKON TERRITORY WATER BOARD

February 17, 1998

QZ97-024, B.Y.G. NATURAL RESOURCES INC.
EXHIBIT LIST - AS OF AUGUST 15, 1997

1. **APPLICATION**

   1.1 Schedule IV & Cover Letter
   1.2 Letter, EBA Engineering Consultants to BYG, 18.07.97,
   Re: Geotechnical Review of Existing Tailings Disposal Facilities
   1.3 Concept Sketch - Tailings Facility seepage control toe berm, EBA, 30.07.97
   1.4 Diagram of Polishing Pond, Yukon Engineering Services, 03.07.97

2. **PUBLIC NOTICES**

3. **CORRESPONDENCE - BOARD TO APPLICANT**

   3.1 Letter to Little Salmon Carmacks First Nation, August 6, 1997

4. **CORRESPONDENCE - APPLICANT TO BOARD**

5. **INTERVENTIONS**

   5.1 Indian & Northern Affairs Canada, 07.08.97
   5.2 Little Salmon/Carmacks First Nation, 08.08.97

6. **CORRESPONDENCE - BOARD TO INTERVENORS**
   - BOARD TO ALL PARTIES

7. **CURRENT/PREVIOUS WATER USE LICENCE(S)**

   7.1 Licence QZ94-004
   7.2 Amendment #1 to Licence QZ94-004

8. **EXHIBITS ENTERED AT PUBLIC HEARING**

9. **ENVIRONMENTAL ASSESSMENT (CEAA)**

9.1 Letter from Indian & Northern Affairs Canada, 7/8/97

10. **DECISION**

    Amendment # 2 & Reasons for Decision

11. **TRANSCRIPT OF PUBLIC HEARING**
12. **OTHER**

B.Y.G.
NATURAL RESOURCES INC.

YUKON TERRITORY
WATER BOARD
1997 JUL 31 A 10:38
hand
QZ97-024.

July 30, 1997

Yukon Territory Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A 3V1

Re: Request for Emergency Amendment – Water Licence QZ94-004

B.Y.G. Natural Resources Inc. hereby requests an emergency amendment to water licence QZ94-004 for the Mount Nansen mine to cover the following items:

1) Implementation of seepage control measures for the tailings facility dam and
2) Start up of water treatment plant to reduce water levels in impoundment facility.

Our engineering consultants have advised us that these measures should be implemented immediately in order to maintain the structural integrity of the tailings impoundment facility.

In support of the above request, please find enclosed ten copies of engineering drawings and design brief for the construction of a toe berm at the base of Dam No. 1. Engineering drawings and design data for the water treatment plant and associated storage pond have been submitted previously under separate cover.

The following provides a brief chronology of events leading up to this request for a licence amendment.

Summer – fall 1996	Construction of tailings impoundment facility
October 1996	Commissioning of tailings facility
Spring 1997	B.Y.G. staff and Water Resources Division inspectors note problems with tailings facility including seepage from dam and erosion and thaw degradation of ditches and spillway. Water testing indicates both dam no.1 and dam no. 2 leaking. Measures implemented to pump seepage water back into tailings pond.
May 1997	Klohn-Crippen, the original designers of the facility undertake an inspection of tailings facility. June 7, 1997 report does not address problems noted above. In particular, report does not indicate that seepage from dam is a concern and that the source is most likely other sources than impounded water.

110 Industrial Road, Whitehorse, Yukon Y1A 2T9 tel: (403) 668 8060 fax: (403) 668 2300

1.2

B.Y.G.
NATURAL RESOURCES INC.

June 1997	B.Y.G. Natural Resources retains Vista Engineering and E.B.A Engineering to review situation and provide second opinion on performance of tailings facility.
June 14, 1997	Vista Engineering report outlines a number of deficiencies with facility linked with original design and construction of facility. In particular, report identifies that seepage at dams could be significant and recommends immediate geotechnical evaluation of dam structures.
June 25, 1997	Meeting held with DIAND Water Resources Senior staff to review situation and determine if engineering consultants other than Klohn-Crippen could be used under terms of existing water licence. Water Resources confirmed that qualified northern firms could be used to provide additional engineering support to B.Y.G.
June 29, 1997	Letter sent to Klohn-Crippen consultants summarizing potential deficiencies in tailings structure and requesting immediate plan of action for dealing with same. Due to urgency of situation, E.B.A. Engineering Consultants retained to undertake geotechnical evaluation of dam structure.
July 4, 1997	Letter received from Klohn-Crippen which does not address the concerns noted by Water Resources inspectors, engineering consultants or B.Y.G. techncial staff.
July 18, 1997	Draft geotechnical evaluation of tailings facility submitted by E.B.A. (copy enclosed) identifies that there is sufficent evidence of structural instability at Dam No. 1 to undertake immediate remedial works to stabilize toe of dam against potential piping failure. Report recommends immediate design and construction of toe berm for Dam 1.
July 21, 1997	Routine site visit by EBA for other work. Engineer also inspects dam 1 and finds evidence of sand boils and liquefaction at downstream toe of structure. Recommends emergency repairs be undertaken immediately and temporary toe berm be placed. Water Resources Division notified of same.
July 22, 1997	EBA Engineering, Vista Engineering and Water Resources on site. Details of emergency toe berm developed and manpower and equipment mobilized to implement same.

Q297-024

B.Y.G.
NATURAL RESOURCES INC.

July 25, 1997	Draft engineering drawings of proposed toe berm submitted to Water Resources Division for review.
July 28, 1997	Comments received from Water Resources Division.
July 30, 1997	Final engineering drawings of improvements completed and emergency amendment submitted to Yukon Territory Water Board.

Work completed to date on the toe berm has included base preparation, placement of geotextile and placement of Johnsons placer gravel as a drainage layer. If the request for emergency amendment is approved, placement of rock fill can commence as early as August 1. It must be noted that our engineering consultants have advised us that placement of the rock fill cannot be delayed or serious structural degradation of the dam may occur.

Other measures, which have been implemented, are continual beaching of tailings on the upstream face of the dam to reduce the rate of seepage and continual monitoring of the structure.

In addition to the placement of the toe berm, our engineering consultants have recommended that all reasonable measures be implemented to begin to draw down the water level in the tailings pond. Decreasing the hydrostatic pressure on the dam is considered an essential measure in stabilization of the structure. For this reason, we are also including a request to be able to operate our water treatment plant as part of the emergency amendment.

Once the emergency works have been completed, it is intended that an in-depth evaluation of tailings handling be completed for the Mount Nansen site. The purpose of this evaluation will be to develop a long-term plan for the environmentally sound storage of tailings. It is expected that part of the evaluation will be a review of the existing facility to determine the cause of the current problems. A copy of the terms of reference will be submitted to the Board for review and comment as soon as it is available.

If you should have any questions or require additional information on the above, please contact the undersigned directly at 863-5913 (mine site) or 667-4758 (Whitehorse).

Yours truly,

B.Y.G. Natural Resources Inc.

Logan Hind
Mine Superintendent

Logan Hind

Q297-024

1.1

Yukon Territory Water Board
Office des eaux du Territoire du Yukon

FAXED Aug 6/97 2:40pm.

August 6, 1997

Eddie Skookum, Chief
Little Salmon/Carmacks First Nation
P.O. Box 135
Carmacks, YT YOB 1CO
fax: 863-5710

RE: APPLICATION FOR EMERGENCY AMENDMENT WATER USE LICENCE QZ94-004, BYG NATURAL RESOURCE CORPORATION

The Yukon Territory Water Board has received an application for an emergency amendment from BYG Natural Resource Corporation. The application number is QZ97-024.

The Purpose of the application is to notify the board that a toe berm is being constructed and to begin operating a water treatment system. This water treatment system, originally planned for later in mine life, will allow immediate release of excess waste water, within the effluent limits already specified in the licence.

The Board has agreed that this is an emergency and that the requirement for a public hearing should be waived. In addition, Indian and Northern Affairs Canada have confirmed that a CEAA screening is not required.

Before making a decision on the application, the Board has determined that DIAND, DFO/EP and Little Salmon/Carmacks First Nation should be given an opportunity to make recommendations.

Unfortunately, there is only a very short window available. Please submit your recommendations to the Yukon Territory Water Board by noon on Thursday, August 7, 1997 (fax number 403-668-3628), or contact me at 667-3984

I have attached a copy of the application.

C L Johnson

for Judi Doering, Manager
Water Board Secretariat

cc register qz97-024, section 2

3.1

Suite 106, 200 Range Road, Whitehorse, Yukon Y1A 3V1 Ph: 403-667-3980 Fax: 403-668-3628
200 Chemin Range, bureau 106, Whitehorse (Yukon) Y1A 3V1 Tél: 403-667-3980 Fax: 403-668-3628

Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

Water Resources Division
Northern Affairs Program
345-300 Main St,
Whitehorse, Yukon
Y1A 2B5

Replaces faxed copy sent Aug 7/97

Your file Votre référence

Our file Notre référence

August 7, 1997

BYG, Mt. Nansen

Mr. Ron Johnson
Chairperson, Yukon Territory Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A 3V1

Dear Mr. Johnson:

Re: Application QZ97-024, BYG Natural Resources, Emergency Amendment

Water Resources has reviewed BYG's emergency amendment application. The cover letter, dated July 30, accompanying the application requests authorization to:

1) implement seepage control measures for the tailings impoundment dam, and,
2) start up a water treatment system and discharge treated water from the tailings impoundment.

It is our understanding that BYG subsequently clarified its emergency amendment request by specifically asking for amendment of Clause 27 of its licence (QZ94-004).

Water Resources agrees that the current situation at the Mt. Nansen Mine constitutes an emergency as provided for in Section 21(3)(c) of the *Yukon Waters Act*. The dam requires immediate remediation to diminish the potential for failure by piping. In addition, the tailings water level in the tailings impoundment is approaching the spillway invert and release of tailings supernatant is imminent.

Seepage Control Measures - Toe Berm

BYG has complied with the advice of its consulting engineers and has begun construction of a toe berm on the tailings storage dam. Water Resources and our geotechnical consultant (Geo-engineering) have reviewed the designs provided by BYG and have discussed concerns with both EBA Engineering and BYG. In response, BYG has revised the design to include extension of the "non-woven geotextile" an additional 8 - 10 metres from the "anchor trench" to the furthest extent of the rock fill.

In addition to the specific amendment requested by BYG, Water Resources believes that Clause 17 of licence QZ94-004 must be revised to authorize construction of the toe berm. The design

report referenced in Clause 17 specifically precludes construction of a toe berm, although a berm had been proposed in earlier versions of the design.

The design engineers contended that, with a three year mine life, a toe berm would not be required. The engineers did, however, acknowledge the potential need for a toe berm if mine life were extended. No detailed designs were provided. The engineers proposed that the need for the berm could be evaluated on the basis of a performance monitoring program. Although the foundation monitoring program has not yet provided adequate data to confidently evaluate performance, the dam is not performing as planned and clearly requires immediate remediation.

In authorizing construction of the toe berm proposed by BYG, Water Resources recommends that the Board consider requirements for an overall evaluation of the tailings impoundment facility. Within the first season of operation, the dam has required remediation, the diversion ditch has failed, the emergency spillway has failed and the water balance has proven to be very inaccurate. Water Resources recommends that BYG be required to carry out a complete re-evaluation of the tailings facility and submit a revised tailings/water management plan, including detailed designs for any new or upgraded facilities. This evaluation must consider the long-term physical and chemical stability of the facilities. The revised plan submitted by BYG should receive detailed review followed by approval under the *Yukon Waters Act.* In a memo to Water Resources, dated August 1, 1997 (attached), BYG has proposed to carry out a similar program.

Any further evaluation must also consider the results of the Tailings Arsenic Stability Program required in Licence QZ94-003 and clarified in Amendment One (QZ96-004). This evaluation program was to be completed no later than July 25, 1997. No results have been submitted to date.

Water Resources recommends that the Board incorporate the following condition into BYG's amended licence:

- The licensee shall construct, forthwith, a toe berm on the tailings impoundment dam to minimize the potential for piping of dam materials. The toe berm shall be constructed in accordance with the "Tailings Facility Seepage Control Toe Berm" drawing submitted as part of Application QZ97-024, except that the non-woven geotextile shall be extended from the anchor trench to the furthest extent of the rock fill.

- The licensee shall, by October 30, 1997 submit a "Revised Tailings/Water Management Plan" incorporating the results of a detailed evaluation of long-term and short-term physical and chemical stability of the tailings impoundment facility. The licensee may only carry out the recommendations of the above report based upon approval by the Yukon Territory Water Board.

Water Treatment

Water Resources acknowledges that BYG must immediately begin treating mine water for discharge. The current licence requires submission of designs for review at least six months in

advance of any discharge. Almost since operations began, BYG has been aware of the inaccuracy of its water balance and has been predicting early discharge. Despite repeated inquiries by Water Resources, BYG failed to submit a water treatment system design to the Board until July 18, 1997.

Water Resources recommends that the Board amend the licence to incorporate BYG's request to initiate release of treated water. The treatment system design, including polishing ponds may require additional review although some concerns about the polishing pond have already been discussed with BYG. These concerns relate to the foundation conditions under the north berm. This berm will require additional support in the form of a flatter rock berm.

The new water treatment system has not yet been tested and its likely performance is unknown. The discharge of treated solution should not be authorized until BYG has proven, during a testing program, that the system will work. This testing program would also serve to lower the pond cyanide levels which have remained above those required by Amendment One of BYG's licence. The testing program should include evaluation of bioassay results.

During initial discharge from the treatment system, Water Resources recommends frequent testing to evaluate the system performance. Once discharge to the environment begins, daily monitoring should be required at the "Polishing Pond Discharge to Dome Creek" for all parameters except the Bioassay. The Bioassay should be required twice weekly. These increased frequencies should be continued for one month following initial discharge.

Water Resources recommends that, in addition to the specific amendment request provided by BYG, the Board incorporate the following licence conditions pertaining to construction/testing/operation of the water treatment system:

- Before initiating discharge of treated solution to Dome Creek, the Licensee shall, through a testing program, confirm the effectiveness of the water treatment system in meeting all effluent discharge requirements, including the 96-hour LC50 test. The licensee shall verify the effectiveness of the system in a detailed testing report submitted to the Yukon Territory Water Board.

- Upon initiating discharge from the polishing pond to Dome Creek, the Licensee shall immediately implement daily monitoring at the Polishing Pond Discharge to Dome Creek, for all parameters outlined in the monitoring schedule, except the 96-hour LC50. The 96-hour LC50 shall be carried out twice weekly. The licensee shall continue the above monitoring frequencies for a period not less than one month.

Thank you for the opportunity to review this emergency application and thank you for considering our recommendations. If you have any questions, please call Bill Slater at 667-3147.

Sincerely,

for David A. Sherstone
Regional Manager, Water Resources

att.

c. BYG Natural Resources
V. Enns, Environment Canada
G. Faulkner, DFO

BYG - Mt Nansen

B.Y.G.
NATURAL RESOURCES INC.

YUKON TERRITORY
WATER BOARD
1997 AUG -7 P 1:13
fax
APPL. NO. Q297-024

August 1, 1997

Indian and Northern Affairs
Water Resources Division
345 – 300 Main Street
Whitehorse, YT
Y1A 2B5

Attention: *Please distribute to Inspectors and engineering staff involved with Mt. Nansen mine tailings facility*

Re: Update

The following provides an update on the progress of work on the tailings impoundment facility.

- EBA's geotechnical engineer on site supervising final stages of toe berm construction. Advises that situation is relatively stable and no further signs of degradation of structure.
- Holding pond for water treatment plant completed and currently being tested by filling with potable water – good performance thus far
- Drawings for proposed toe berm revised to incorporate comments received by Water Resources Division
- Drawings and engineering brief submitted to YT Water Board in support of request for emergency amendment to undertake work on Thursday July 31, 1997. Authorization to begin operating water treatment plant included in request in order to draw down water level in tailings pond to help with stabilization measures
- Toe of dam prepped, geotextile placed and Johnson's Placer drainage layer placed
- Construction of toe drain and north embankment buttress continuing today under EBA's supervision
- Placement of tailings beach completed in area of north abutment. After beach extended for approx. 20 more meters, discharge will be moved to south abutment next week
- Haul road to move heavy riprap armour for toe berm constructed from Brown McDade pit to dam site
- Drilling proceeding today in BM pit in granular diorite formation. This rock is expected to produce hard, well draining riprap for use for construction of the toe berm and other work such as spillway remediation. The drill and blast program

use of Anfo may result in blasted riprap armour

110 Industrial Road, Whitehorse, Yukon Y1A 2T9 tel: (403) 668 3060 fax: (403) 668 2300

5.1

B.Y.G.
NATURAL RESOURCES INC.

is being completed under the supervision of our senior geologist in order to ensure that hard, non-friable riprap is produced and to ensure that the rock is stable and non-acid producing (please note that the ARD study for the BM pit has been completed and will be submitted under separate cover)

- Expect to be placing final riprap layer by Sunday, completion of toe berm by Tuesday
- Last sections of supply line for water treatment plant being completed today
- Water treatment plant will be operational within two to three days if Water Board approval received
- Diversion ditch cleared of sand buildup and two additional culverts installed at crossing in anti-icing configuration
- Survey of spillway complete, remediation drawings expected to be completed next week.
- Have started overall technical review of tailings facility in order to develop short and long term plans for facility. Plan to be submitted for review to Water Resources when completed by engineering consultants

Please be advised that Fred Green, our environmental coordinator has resigned his position. As well Mr. Tony Lipiac, P.Eng. has been hired as part of the senior management team. His duties will include the oversight of all environmental work at our properties as well as the operations at all milling facilities. He will be assisted in completing environmental work as required by our staff. As well, Vista Engineering will be retained as required to assist with environmental engineering and reporting tasks.

We have begun the process of recruiting and hope to have the environmental coordinators position filled in the near future.

If you should have any questions or require additional information on the above, please contact the undersigned directly at 863-5913 (mine site) or 667-4758 (Whitehorse).

Yours truly,

B.Y.G. Natural Resources Inc.

Logan Hind
Mine Superintendent

LITTLE SALMON/CARMACKS FIRST NATION
BOX 135
CARMACKS, YUKON
Y0B 1C0

TEL: 403 - 863-5576
FAX: 403 - 863 - 5710

YUKON TERRITORY
WATER BOARD
1997 AUG -8 A 11: 10
FILE NO.

August 7,1997.

Yukon Territory Water Board,
Suite 106, 200 Range Road,
Whitehorse, Yukon
Y1A 3V1

Attention: Judi Doering, Manager

Dear Ms. Doering,

RE; APPLICATION FOR EMERGENCY AMENDMENT WATER USE LICENSE QZ94-004, BYG NATURAL RESOURCES CORPORATION

We do not support application for License Amendment.

We require full disclosure of information on the nature of the environmental problems being encountered at the site.

BYG Natural Resources Inc., has neglected to communicate environmental issues and/or have ignored environmental problems. Some of the problems we are aware of are: Fuel Spill on site due to vandalism.....hoses on fuel storage tanks cut and a large amount of fuel spilled...our members who work at the site state that no remediation occurred. Fuel spill on Mount Nansen Road at 25.9KM from Carmacks..area covers an area of approx. 100 feet by 250-300 feet -- fuel has migrated under the muskeg, plants and trees in area are dying...hydrocarbon vapour fumes extremely high (this area is within moose travel area). Two members of LSCFN were exposed to cyanide gas - one required use of oxygen.

Our shareholders and beneficiaries are becoming alarmed at the activities of these mining companies. We require monitoring and more strict enforcement of these activities. We need to ensure that our Traditional Territory does not become polluted.

Sincerely

Eddie Skookum

Chief Eddie Skookum.

cc: Russell Blackjack, E.D.O.

5.2

Little Salmon Carmacks First Nation
Box 135
Carmacks , Yukon
Y0B-1C0

YUKON TERRITORY
WATER BOARD
1997 AUG 26 A 9:21
Mail
Q297-024

August 15, 1997

Yukon Territorial Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A-3V1
Ph: (403)667-3980 / Fax 668- 3628

Attn: Judi Doering
Manager

RE: BYG Natural Resources Water Licence # QZ94-004

The Little Salmon/Carmacks First Nation Council is not in agreement with the treatment system outlined within amendment #2 to the BYG Natural Resources Water Licence. Our opposition is based on concerns over the discharge of high concentrations of cyanide in a water way which supports critical fisheries, moose and waterfowl habitat. Council feels that neither BYG or the responsible Government agencies have demonstrated that no adverse effects will result from this proposed discharge. Therefore, we would like to see a interim restraining order of the Boards decision as allowed for under **Chapter 14, Section 14.11.1** and **14.11.3** of the "Umbrella Final Agreement". We are furthermore requesting an immediate review through a public hearing to be held here in Carmacks.

We recognize and understand that time is of the essence and look forward from hearing from the Board as soon as possible. The Board should forward all response on this matter to me or Ed Schultz our Executive Director of Implementation at 1-(403)-863-5576.

Sincerely

Eddie Skookum

Eddie Skookum
Chief

cc/ Jane Steward, Minister DIAND
Lois Graig, Acting Regional Director DIAND
Eric Fairclough, YTG Minister Renewable Resources
Shirley Adamson, Grand Chief CYI
Regional Environmental Review Committee
Dept. Fisheries & Oceans

The Village of Carmacks

P.O. Box 113
Carmacks, Yukon Territory
Y0B 1C0
Telephone: (403) 863-6271
Fax: (403) 863-6606

19 August, 1997

Yukon Territorial Water Board
Suite 106, 200 Range Road
Whitehorse YT
Y1A 3V1

YUKON TERRITORY
WATER BOARD
1997 AUG 26 A 9:24
mail
FILE NO. Q24-004

Attention: Judi Doering

Re: **BYG Water License #0Z94-004**

Dear Ms. Doering

I am requesting, on behalf of the Village of Carmacks, that an intervention hearing be held concerning the noncompliance with the second amendment to the Water License issued to BYG Resources. Our request supports the concerns expressed by the Little Salmon Carmacks First Nation on this issue.

The Village further requests that DIAND support staff attend any public hearing to provide technical reports on the level of compliance of any discharges. We submit that a STOP WORK order be issued at your very earliest convenience, on production and the discharge of effluent into the tailings pond. We appeal to the Board that better effluent treatment alternatives be imposed on BYG.

Sincerely

D. L. (Luke) Lacasse
Mayor

p/c AYC, LSCFN

Indian and Northern Affairs Canada | Affaires indiennes et du Nord Canada

Water Resources Division
Northern Affairs Program
345-300 Main St,
Whitehorse, Yukon
Y1A 2B5

YUKON TERRITORY
WATER BOARD
1997 AUG 11 P 12: 35

Your file / Votre référence

Our file / Notre référence

FILE NO: Q297-024

BYG Mt. Nansen

Replaces Fax
Received Aug 7

August 7, 1997

Mr. Ron Johnson
Chairperson, Yukon Territory Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A 3V1

Dear Mr. Johnson:

Re: **Application QZ97-024, BYG Natural Resources, Emergency Amendment**

DIAND has reviewed BYG's emergency amendment application submitted to the Board on July 31, 1997. We have concluded that the application does not require screening under the *Canadian Environmental Assessment Act* (CEAA).

Section 7(1)(c) of the CEAA states:

> ". . . an environmental assessment of a project is not required where the project is to be carried out in response to an emergency and carrying out of the project forthwith is in the interest of preventing damage to property or the environment . . .."

The amendments requested in application QZ97-024 constitute and emergency that requires immediate attention. The toe berm must be constructed forthwith to minimize the potential for dam failure by piping. The water treatment system will be required in the very near future to allow BYG to discharge treated water. Failure to carry out these activities forthwith may result in significant environmental damage.

If you have any questions on the above determination, please call Bill Slater at 667-3147.

Sincerely,

for David A. Sherstone
Regional Manager, Water Resources

c. BYG Natural Resources
V. Enns, Environment Canada
G. Faulkner, DFO

Canada

Printed on recycled paper – Imprimé sur papier recyclé

9.1

YUKON TERRITORY WATER BOARD
AMENDMENT OF LICENCE

LICENSEE: B.Y.G. NATURAL RESOURCES INC. LICENCE NUMBER: QZ94-004

AMENDMENT NUMBER: TWO (2) Application Number: QZ97-024

Pursuant to the Yukon Waters Act, Water Use Licence QZ94-004, as amended by amendment one, is hereby further amended as follows:

1. Part I is hereby appended as follows:

PART I - IMMEDIATE TREATMENT AND DISCHARGE

43. Notwithstanding the requirements of Part F, Section 27, subsections d) and e), the Licensee may discharge effluent from the tailings facility , providing that such effluent meets the effluent quality standards that are required by licence QZ94-004, as amended by amendment one.

44. Before initiating discharge of treated solution to Dome Creek, the Licensee shall, through a testing program, confirm the effectiveness of the water treatment system in meeting all effluent discharge requirements, including the 96-hour LC_{50} test. The Licensee shall verify the effectiveness of the system in a detailed testing report submitted to the Board.

45. Upon initiating discharge from the polishing pond to Dome Creek, the Licensee shall immediately implement daily monitoring at the Polishing Pond Discharge to Dome Creek, for all parameters outlined in the monitoring schedule, except the 96-hour LC_{50}. The 96-hour LC_{50} shall be carried out twice weekly. The Licensee shall continue this monitoring frequency for a period not less than one month. Results of all analyses shall be submitted to the Board weekly.

46. If the Board notifies the Licensee that a public hearing will be held to examine the design of the water treatment system, then the Licensee shall cease any discharge from the impoundment either immediately, or on such date as the Board may identify in the notification, and the Licensee shall not resume discharge until the public hearing has been convened and the Board has concluded it's deliberations,

2. Part C, Section 17 d) is hereby appended as follows:

17. d) i) The Licensee shall immeldiately construct a toe berm on the tailings impoundment dam to minimize the potential for piping of dam materials. The toe berm shall be constructed in accordance with the "Tailings Facility Seepage Control Toe Berm" drawing submitted as exhibit 1.3 of Application QZ97-024, except that the non-woven geotextile shall be extended from the anchor trench to the furthest extent of the rock fill

ii) The Licensee shall, by October 30, 1997 submit a "Revised Tailings/Water Management Plan" incorporating the results of a detailed evaluation of long-term and short-term physical and chemical stability of the tailings impoundment facility.

Dated this 7 day
August, 1997

YUKON TERRITORY WATER BOARD

Witness

Ron W. Johnson
Chairperson

Dated this 20 day of

August, 1997

Witness

Jane Stewart
Minister of Indian and Northern
Affairs Canada

REASONS FOR DECISION
AMENDMENT #2 TO WATER USE LICENCE QZ94-004
B.Y.G. NATURAL RESOURCES INC. APPLICATION QZ97-024

The Yukon Territory Water Board has concluded deliberations pertaining to an application for an emergency amendment to water use licence QZ94-004, which is water use licence for quartz undertaking, issued to B.Y.G. Natural Resources Inc.

Water Use Licence QZ94-004 requires that the Licensee may not discharge any effluent from the tailings facility until at least six months after a design for the reclaim water treatment system has been submitted to the Board. This requirement was included in the original licence, at the recommendation of Indian and Northern Affairs Canada, so that there would be a reasonable opportunity for review of the proposed design before any effluent was actually discharged. The design was received July 18, 1997.

The Licensee has advised the Board that the tailings level within the impoundment is approaching the spillway invert and an uncontrolled spill is imminent. The Licensee has requested that the six month waiting period be waived, so that they can discharge now.

The Licensee has also requested approval to construct a toe berm on the tailings storage dam, as a spill control measure.

The Licensee has not requested any variation to the effluent quality standards.

With regard to the determination of "emergency":

The Yukon Waters Act ("the Act") requires the Board to provide an opportunity for public review of all applications and, in some cases, to provide an opportunity for a public hearing. The Board may dispense with this requirement where the amendment is required on an emergency basis.

Since the Act does not set out any criteria for the determination of an emergency, the Board has, by practice, accepted the principle that an emergency is a sudden or unforeseen condition calling for immediate action.

In this instance, the Board is satisfied that an emergency situation does exist. The tailings impoundment requires immediate attention and there is a significant potential for an uncontrolled spill.

With regard to CEAA

The Board accepts the determination of Indian and Northern Affairs Canada that, because of the emergency nature of this application, a screening is not required.

With regard to the proposed amendments:

The Board agrees that the requirement for a six month waiting period prior to discharge must be waived. However, the Board is also concerned that the original intent of that provision was to ensure that the reclaim water treatment system is designed and constructed to an acceptable standard. The design has been received, but there has been insufficient time for a thorough review.

Therefore, if any party is concerned about the design of the tailings facility, then they can notify the Board of that concern and the Board may decide that it would be in the public interest to hold a hearing to examine the design. In that case, the Board will notify the Licensee of the hearing and, until the matter is concluded, the Licensee will be required to stop discharging.

With regard to consultation:

The Yukon Waters Act provides that, in the case of an emergency amendment, the requirements for public notice and/or public hearing do not apply. However, before making decisions, the Board notified enforcement agencies and Little Salmon/Carmacks First Nation and requested their input.

Recommendations were received from Indian and Northern Affairs Canada. The Board concurs with the rationale for those recommendations and has amended the licence accordingly.

Little Salmon/Carmacks First Nation opposed the application. The First Nation noted that there are environmental problems at the site, including fuel spills, and have asked for full disclosure of information on the nature of the environmental problems and more strict enforcement.

The First Nation raised serious concerns about environmental issues and there are avenues available to address those concerns, including, as a last resort, the ability of the Board to cancel a water use licence.

However, in this instance, there is a significant potential for environmental damage if this emergency amendment does not proceed. The tailings dam must be repaired immediately, and it is imperative that any release of water from the facility must be accomplished in a controlled fashion to comply with effluent standards. The Board is concerned that, even if the mine were to immediately cease operations, the water level within the impoundment is such that significant precipitation could raise the water level to the spillway invert, resulting in an uncontrolled spill. Therefore, the Board is satisfied that the emergency amendment should be approved.

The effluent standards of Licence QZ94-004, as amended by amendment one, remain unchanged.

original signed by

August 8, 1997

Ron Johnson, Chairperson
Yukon Territory Water Board

REASONS FOR DECISION
AMENDMENT #2 TO WATER USE LICENCE QZ94-004
B.Y.G. NATURAL RESOURCES INC. APPLICATION QZ94-027

The Yukon Territory Water Board has concluded deliberations pertaining to an application for an emergency amendment to water use licence QZ94-004, which is water use licence for quartz undertaking, issued to B.Y.G. Natural Resources Inc.

Water Use Licence QZ94-004 requires that the Licensee may not discharge any effluent from the tailings facility until at least six months after a design for the reclaim water treatment system has been submitted to the Board. This requirement was included in the original licence, at the recommendation of Indian and Northern Affairs Canada, so that there would be a reasonable opportunity for review of the proposed design before any effluent was actually discharged. The design was received July 18, 1997.

The Licensee has advised the Board that the tailings level within the impoundment is approaching the spillway invert and an uncontrolled spill is imminent. The Licensee has requested that the six month waiting period be waived, so that they can discharge now.

The Licensee has also requested approval to construct a toe berm on the tailings storage dam, as a spill control measure.

The Licensee has not requested any variation to the effluent quality standards.

With regard to the determination of "emergency":

The Yukon Waters Act ("the Act") requires the Board to provide an opportunity for public review of all applications and, in some cases, to provide an opportunity for a public hearing. The Board may dispense with this requirement where the amendment is required on an emergency basis.

Since the Act does not set out any criteria for the determination of an emergency, the Board has, by practice, accepted the principle that an emergency is a sudden or unforeseen condition calling for immediate action.

In this instance, the Board is satisfied that an emergency situation does exist. The tailings impoundment requires immediate attention and there is a significant potential for an uncontrolled spill.

With regard to CEAA

The Board accepts the determination of Indian and Northern Affairs Canada that, because of the emergency nature of this application, a screening is not required.

With regard to the proposed amendments:

The Board agrees that the requirement for a six month waiting period prior to discharge must be waived. However, the Board is also concerned that the original intent of that provision was to ensure that the reclaim water treatment system is designed and constructed to an acceptable standard. The design has been received, but there has been insufficient time for a thorough review.

Therefore, if any party is concerned about the design of the tailings facility, then they can notify the Board of that concern and the Board may decide that it would be in the public interest to hold a hearing to examine the design. In that case, the Board will notify the Licensee of the hearing and, until the matter is concluded, the Licensee will be required to stop discharging.

With regard to consultation:

The Yukon Waters Act provides that, in the case of an emergency amendment, the requirements for public notice and/or public hearing do not apply. However, before making decisions, the Board notified enforcement agencies and Little Salmon/Carmacks First Nation and requested their input.

Recommendations were received from Indian and Northern Affairs Canada. The Board concurs with the rationale for those recommendations and has amended the licence accordingly.

Little Salmon/Carmacks First Nation opposed the application. The First Nation noted that there are environmental problems at the site, including fuel spills, and have asked for full disclosure of information on the nature of the environmental problems and more strict enforcement.

The First Nation raised serious concerns about environmental issues and there are avenues available to address those concerns, including, as a last resort, the ability of the Board to cancel a water use licence.

However, in this instance, there is a significant potential for environmental damage if this emergency amendment does not proceed. The tailings dam must be repaired immediately, and it is imperative that any release of water from the facility must be accomplished in a controlled fashion to comply with effluent standards. The Board is concerned that, even if the mine were to immediately cease operations, the water level within the impoundment is such that significant precipitation could raise the water level to the spillway invert, resulting in an uncontrolled spill. Therefore, the Board is satisfied that the emergency amendment should be approved.

The effluent standards of Licence QZ94-004, as amended by amendment one, remain unchanged.

Ron W. Johnson

August 8, 1997

Ron Johnson, Chairperson
Yukon Territory Water Board

QZ96-004 BYG Natural Resources Inc. Amendment to QZ94-004)
Wells in the vicinity of Victoria & Dome Creeks
Exhibit List As of April 15, 1997

1. **APPLICATION**
   1.1 Schedule IV & Letter

2. **PUBLIC NOTICES**
   2.1 Canada Gazette Notice

3. **CORRESPONDENCE - BOARD TO APPLICANT**

4. **CORRESPONDENCE - APPLICANT TO BOARD**
   4.1 Response to ceaa screening, 17.03.97

5. **INTERVENTIONS**
   5.1 Environment Canada, 27.03.97
   5.2 DIAND, 25.03.97

6. **CORRESPONDENCE - BOARD TO INTERVENORS**
   - BOARD TO ALL PARTIES

7. **CURRENT/PREVIOUS WATER USE LICENCE(S)**
   7.1 Water Use Licence QZ94-004

8. **EXHIBITS ENTERED AT PUBLIC HEARING**

9. **ENVIRONMENTAL ASSESSMENT (CEAA)**
   9.1 CEAA Screening, 13.02.97

10. **DECISION**
    AMENDMENT #1 & REASONS FOR DECISION

11. **TRANSCRIPT OF PUBLIC HEARING**

12. **OTHER**

B.Y.G.
NATURAL RESOURCES INC.

QZ96-004

Yukon Territory Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A 3V1

January 15, 1997

RE: Application to amend license # QZ94-004

To the water board:

The accompanying report details a water well drilled by BYG Natural Resources Inc. at our Mount Nansen site. It outlines the reasons the well was drilled and the use to which we intend to put the water. This report accompanies a schedule IV application for an amendment to the above license.

John Eggert P.Eng.
Supervisor of Special Projects

cc: Graham Dickson
Jim Pirie
Kevin Rumsey (5 copies)

110 Industrial Road, Whitehorse, Yukon Y1A 2T9 tel: (403) 668 8060 fax: (403) 668 2300

Exhibit 1-1

January 15, 1997

QZ96-004

NEW WELL AT MOUNT NANSEN

On November 17, 1996, drilling began on a water well at BYG Natural Resources Inc. Mount Nansen mine. The well was drilled to reduce the amount of seepage water moving through and around the milling facilities. This seepage water was moving through various buildings, including the power house. Once the water exited the buildings, it would freeze. This action resulted in the build up of ice sheets, commonly referred to as "glaciers". These ice sheets were presenting a potential safety hazard.

The flow of water through and around the mill buildings also presents a potential hazard to the structural integrity of the mill concrete foundations. The flow of water into cracks and subsequent freezing could lead to a deterioration of the concrete and an attendant loss of strength.

APPLICATION

BYG Natural Resources Inc. seeks an amendment to water license QZ94-004 to be permitted to take water from this well. In addition, BYG Natural Resources Inc. seeks to license two further wells, not yet drilled. It is not known whether the current well has successfully addressed the seepage difficulties. As such, further monitoring of the area may indicate that the current well is not sufficient to divert the water. If this is the case, we would propose drilling two further wells to divert seepage water sufficient to eliminate the problems outlined above. The location of the current well and proposed location for the other wells are detailed on figure 1, Mount Nansen area site plan and figure 2, mill plan. Water usage from this well is intermittent to approximately 100 m^3 per day. Total utilization from the three wells is expected to be 150 m^3 per day on average.

The water recovered from the current well is redirected from:
Natural drainage into Dome Creek to:
Controlled flow through the mill facilities to Dome Creek.

BYG feels that by using this water in lieu of water from the currently licensed well at Victoria creek, there will be no impact on the current water balance, other than reducing the water taken from the well at Victoria creek.

IMPACTS ON WATER QUALITY

A sample of the water from this site was taken and analyzed for the species required under the above water license. The following are the values for species which had detectable levels of concentration:

Sulphate:	538	ppm			
Nitrogen as ammonia:	0.035	ppm			
Nitrogen as Nitrite:	0.001	ppm			
Total Antimony:	0.0088	ppm	Dissolved Antimony:	0.0088	ppm
Total Arsenic:	0.457	ppm	Dissolved Arsenic:	0.304	ppm
Total Barium:	0.01	ppm	Dissolved Barium:	0.01	ppm
Total Iron:	1.01	ppm	Dissolved Iron:	No Detection	
Total Manganese:	0.366	ppm	Dissolved Manganese:	0.338	ppm

These values confirm that the source of this seepage is a mineralized shear zone referred to in some of the literature as the "Mill Zone". The current treatment facilities and those proposed for the mill will greatly reduce the level of arsenic in this ground water. Hence overall, redirecting and or using this water will reduce the net loading of arsenic available to Victoria creek. This

Exhibit 11

benefit will only last as long as the mill is operating or the zone is mined. Mining of the zone is the only means available to permanently eliminate the arsenic.

John Eggert P.Eng.

Q296-004

Exhibit 11

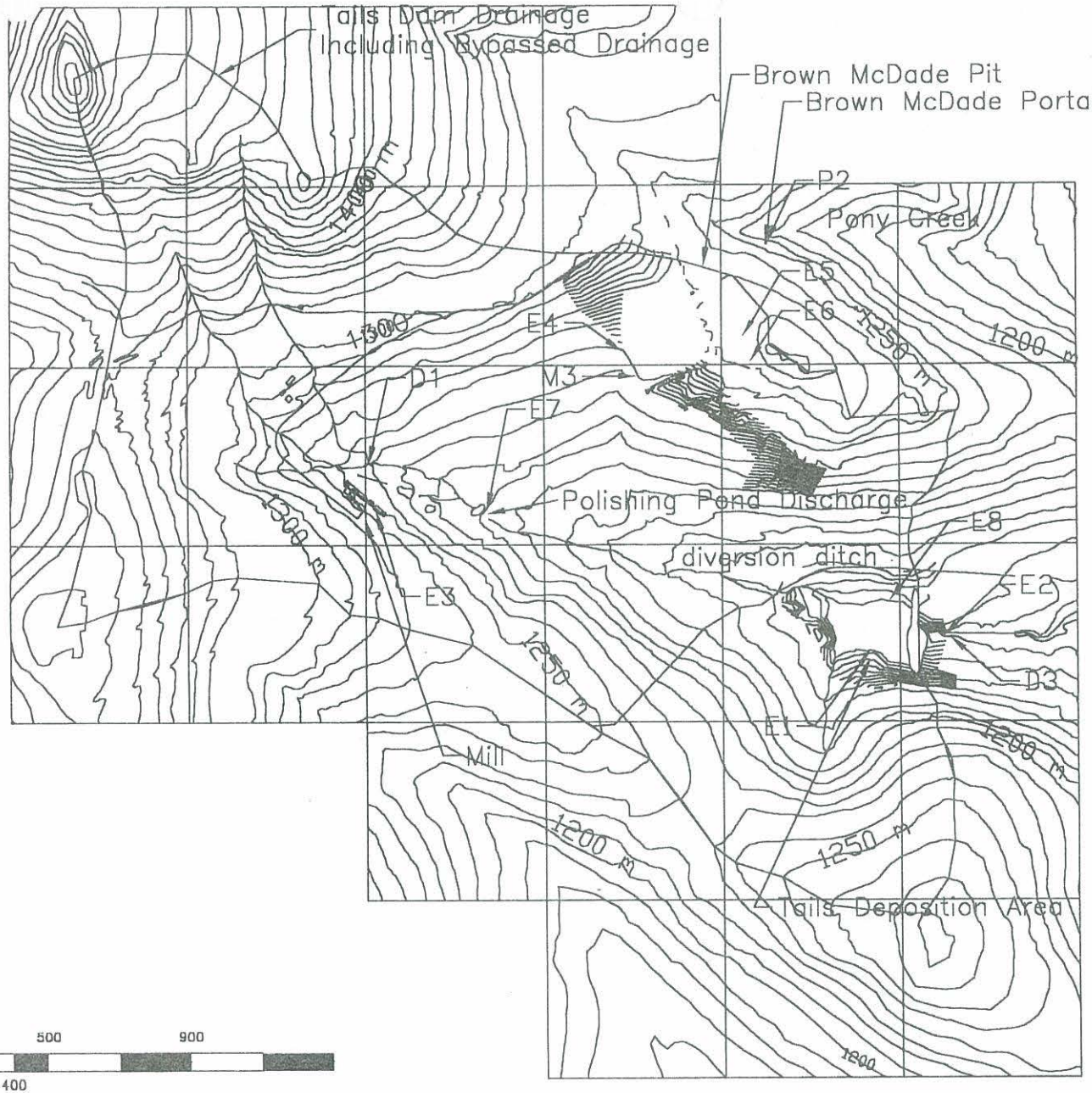


Exhibit 1

Q296-004

BYG Natural Resources Inc.

Mount Nansen Site Plan
Not To Scale

Seepage Water Diversion Well #1, Approximate Location, within 5 feet

Q2916-004

Proposed Site of
New Wells

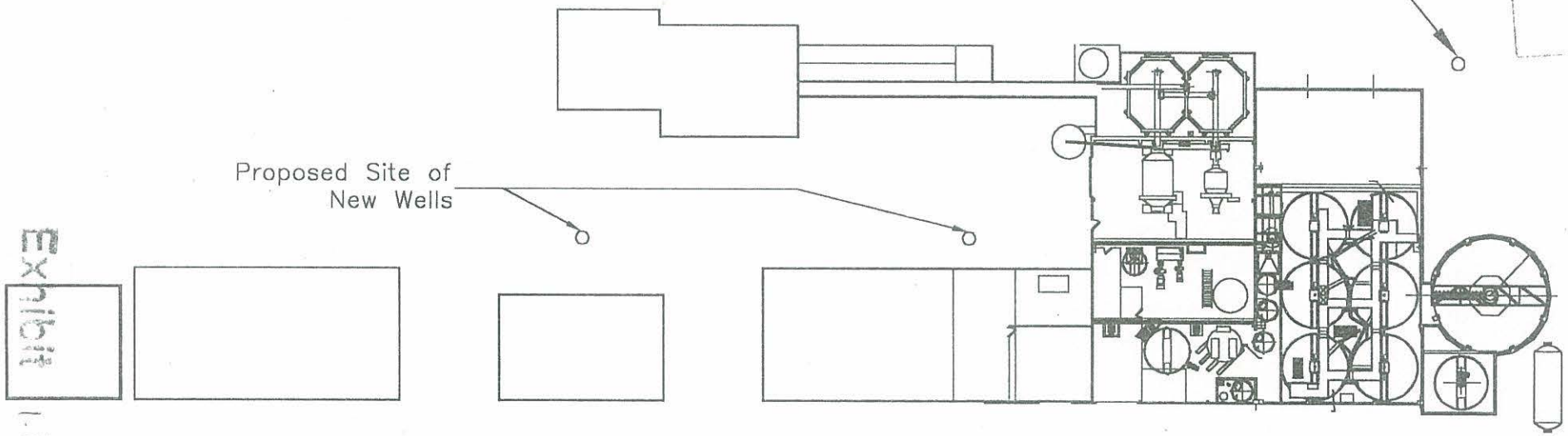


Exhibit 1-1

BYG Natural Resources Inc.

Mount Nansen Mill Plan
Not To Scale

WATER RESOURCES
NORTHERN AFFAIRS PROGRAM
WHITEHORSE, YUKON
Mailing Address: # 345 - 300 Main Street
Whitehorse, Yukon Territory
Y1A 2B5

FAX: (403) 667-3195

YUKON TERRITORY
WATER BOARD
1997 MAR 17 A 11:51

VIA: fax.
APPL. NO. Q296-004

DATE: 17/03/97
FROM: MARTY STRACHAN

TO: B. GODIN E.P.
J. DORLING YTWB.
TEL. #: 667-3234

# of PAGES: 5
(INCLUDING COVER SHEET)

FAX #:

TEL. #

MESSAGE: ATTACHED IS A HAND DELIVERED RESPONCE, FROM JOHN EGGERT (BYG), ADDRESSING ONE OF THE ENVIRONMENTAL EFFECTS LISTED IN OUR SCREENING REPORT FOR W.L. APPLICATION Q296-004. THE CONCERN WAS RAISED BY E.P. SO I HAVE FORWARDED THE RESPONCE TO THAT OFFICE. Marty

Exhibit 1.2

110 Industrial Road
Whitehorse, Yukon
Y1A 2T9

March 3, 1997

YUKON TERRITORY
WATER BOARD
1997 MAR 17 A 11:51
RECEIVED fax
APPL. NO

Department of Indian and Northern Affairs Canada
Water Resources Division
Northern Affairs Program
345-300 Main Street
Whitehorse, Yukon
Y1A 2B5

Attn: David A. Sherstone
Regional Manager, Water Resources

Re: WATER LICENCE: QZ94-004, MT. NANSEN MINE, DOME CREEK, APPLICATION FOR AMMENDMENT TO COVER NEW WELL AT MILL SITE

Mr. Sherstone:

In your screening report for the well as described in our application for ammendment, you state in paragraph 4 of section 7. Description of Environmental Effects and Mitigaiton, that the data from site D1 do not reflect the elevated levels of arsenic reported in the mill vicinity well water. The confluence of the drainage of the runoff from the water which would have seeped from the well and dome creek is below site D1 and hence site D2 should be used for determination of the historical impact on Dome Creek. Site D2 was sampled by BYG on October 16, 1997, prior to the discharge of any mill material. It had a level of arsenic of 0.0065 ppm. The attached table outlines the predicted loadings immediately after the flow from the seepage (prior to well drilling) and the predicted loading at site D2. The loading at site D2 shows that the arsenic rich ground water was seeping prior to operations. It strongly indicates that this arsenic flow probably originated from the water source tapped by the well. As such, the well has not changed the situation which existed prior to operation of the mill.

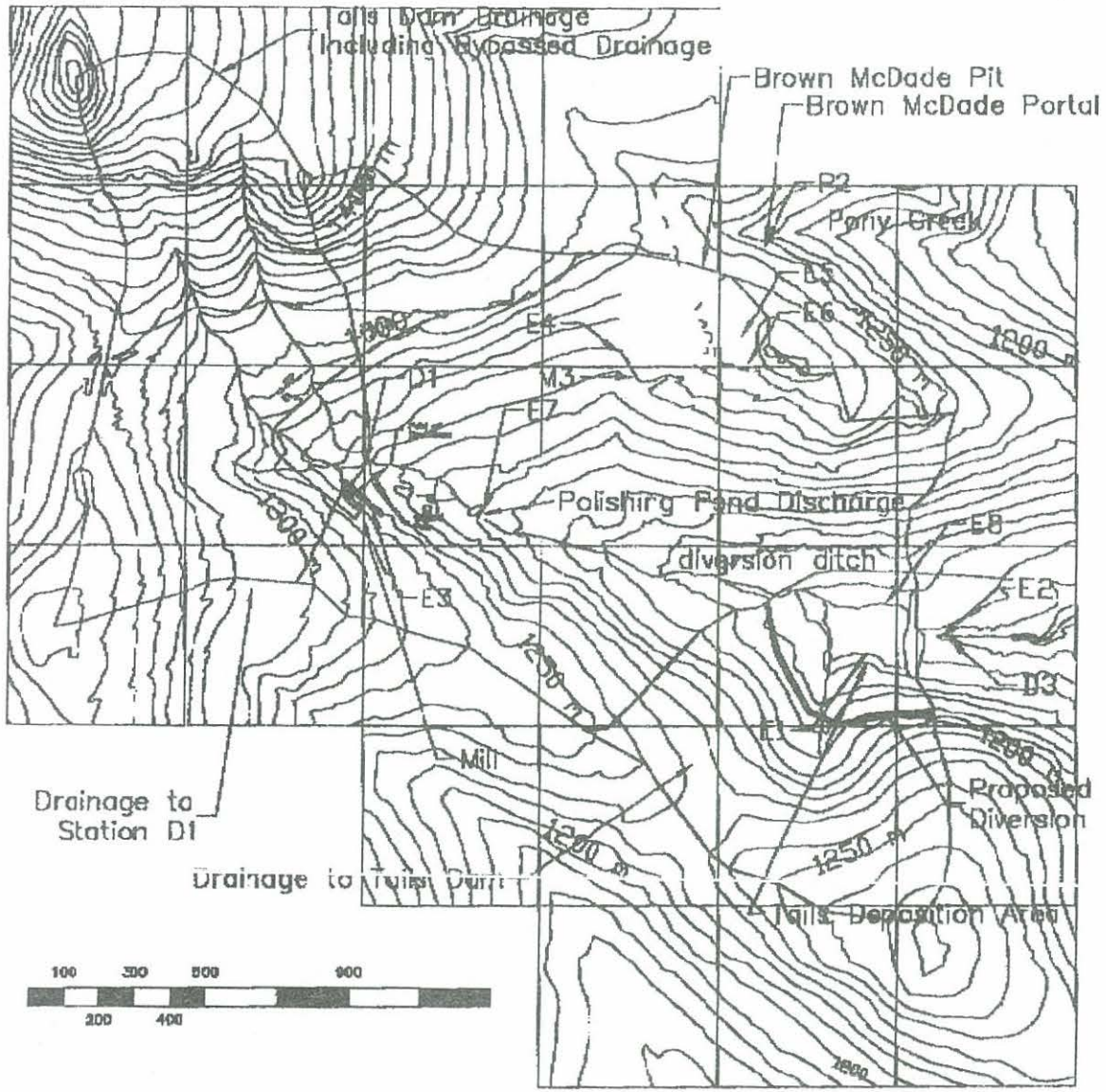
The above indicates that the operation at BYG, particularly the water well for which amendment is sought, does not change the nature of the hydrology relative to that which existed prior to man made disturbances. As such, the requirement to provide for treatment of this flow is unprecedented in that it requires that the company provide treatment which "improves" on the natural quality of the environment prior to operations. As such, this requirement mandates that BYG intentionally and permanently alter the balance, which is in opposition to the principles of sustainable development which require that as much as possible, sites be returned to the state they were originally found in.

Sincerely

John Eggert, P.Eng., Supervisor of Special Projects

cc: Graham Dickson
Chris Caron
John Slack

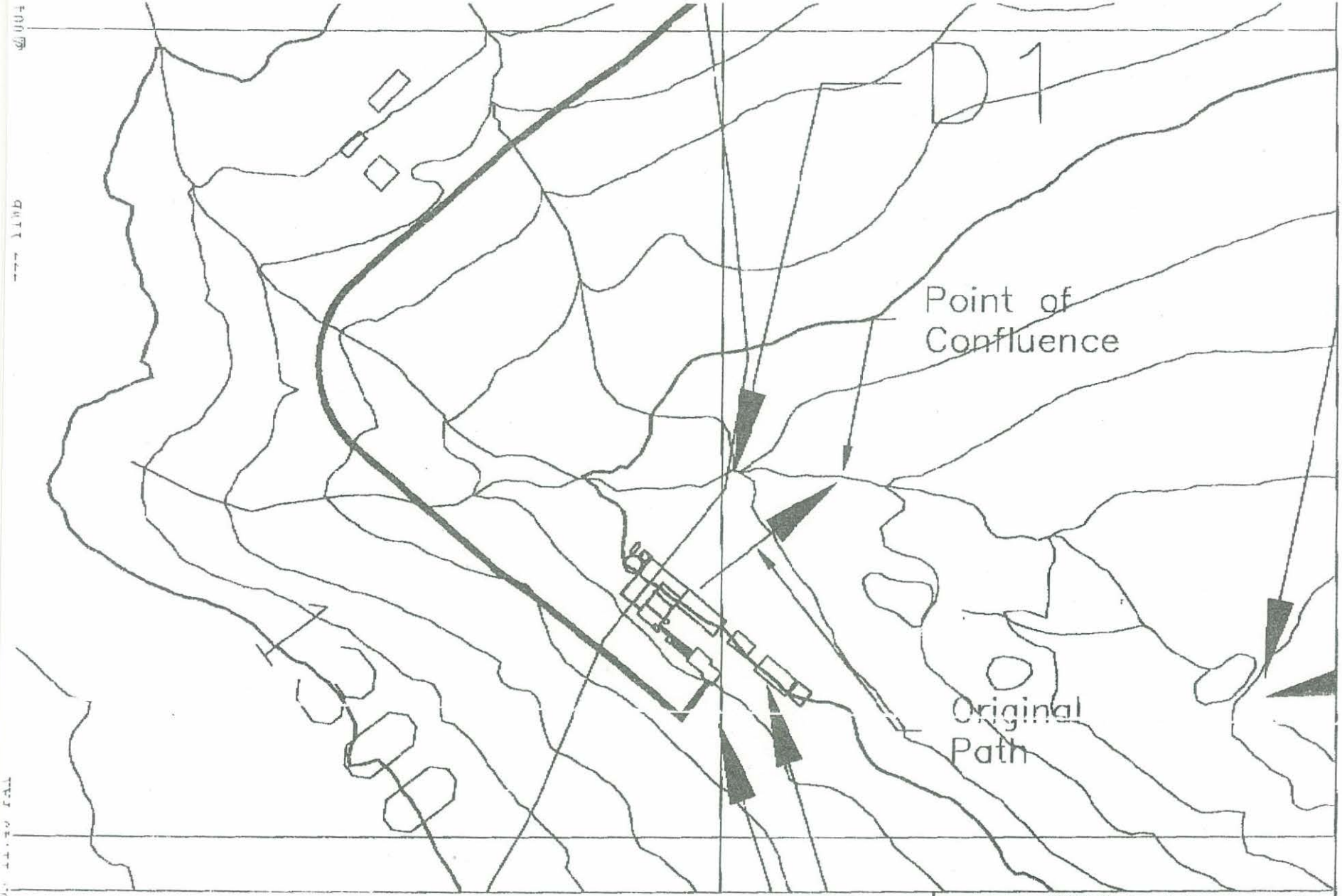
Exhibit 1.2



YYG Natural Resources Inc.

Figure 1:Mount Nansen Site Plan
Scale: 1:20,000

Exhibit 4 1.2



BYG Natural Resources Inc.

Figure 2:Detail of Flow Path

Exhibit 4 / 2

005
→→ YTWB

Estimated Loading of Arsenic at D1, assuming all arsenic comes from well and all water comes from well and drainage.

Month		Precipitation Average (m/month)	10 year (m/month)	200 year (m/month)	Evaporatio Average (m/month)	Run Off Factor	Volume to D1 (m³/month)	Daily Vol to D1 (m³/day)	Well Volume (m³/day)	Arsenic Assay (ppm)	Well As Load grams	Predicted As at D1 ppm
January	31	0.0175	0.0130	0.0265	0.0000	1.0	16,576	535	50	0.304	15.2	0.0260
February	28	0.0120	0.0089	0.0182	0.0000	1.0	11,367	406	50	0.304	15.2	0.0333
March	31	0.0068	0.0050	0.0103	0.0000	1.0	6,441	208	50	0.304	15.2	0.0590
April	30	0.0066	0.0049	0.0100	0.0000	1.0	6,252	208	50	0.304	15.2	0.0588
May	3'	0.0196	0.0145	0.0298	0.1050	0.9	16,709	539	50	0.304	15.2	0.0258
June	30	0.0337	0.0250	0.0512	0.1213	0.9	28,729	958	50	0.304	15.2	0.0151
July	31	0.0538	0.0399	0.0817	0.1112	0.9	45,864	1,479	50	0.304	15.2	0.0099
August	31	0.0385	0.0285	0.0585	0.0800	0.9	32,821	1,059	50	0.304	15.2	0.0137
September	30	0.0300	0.0222	0.0456	0.0366	1.0	28,417	947	50	0.304	15.2	**0.0152**
October	31	0.0187	0.0139	0.0284	0.0000	1.0	17,713	571	50	0.304	15.2	**0.0245**
November	30	0.0179	0.0132	0.0272	0.0000	1.0	16,955	565	50	0.304	15.2	0.0247
December	31	0.0149	0.0110	0.0226	0.0000	1.0	14,114	455	50	0.304	15.2	0.0301
Total		0.2700	0.2000	0.4100	0.4541	1.0						

Drainage prior to D1 947,221 m³

Estimated Loading of Arsenic at D2, assuming all arsenic comes from well and all water comes from well and drainage.

Month		Precipitation Average (m/month)	10 year (m/month)	200 year (m/month)	Evaporatio Average (m/month)	Run Off Factor	Volume to D1 (m³/month)	Daily Vol to D1 (m³/day)	Well Volume (m³/day)	Arsenic Assay (ppm)	Well As Load grams	Predicted As at D2 ppm
January	31	0.0175	0.0130	0.0265	0.0000	1.0	45,272	1,460	50	0.304	15.2	0.0101
February	28	0.0120	0.0089	0.0182	0.0000	1.0	31,044	1,109	50	0.304	15.2	0.0131
March	31	0.0068	0.0050	0.0103	0.0000	1.0	17,591	567	50	0.304	15.2	0.0246
April	30	0.0066	0.0049	0.0100	0.0000	1.0	17,074	569	50	0.304	15.2	0.0246
May	31	0.0196	0.0145	0.0298	0.1050	0.9	45,624	1,472	50	0.304	15.2	0.0100
June	30	0.0337	0.0250	0.0512	0.1213	0.9	78,463	2,615	50	0.304	15.2	0.0057
July	31	0.0538	0.0399	0.0817	0.1112	0.9	125,262	4,041	50	0.304	15.2	0.0037
August	31	0.0385	0.0285	0.0585	0.0800	0.9	89,639	2,892	50	0.304	15.2	0.0052
September	30	0.0300	0.0222	0.0456	0.0366	1.0	77,609	2,587	50	0.304	15.2	**0.0058**
October	31	0.0187	0.0139	0.0284	0.0000	1.0	48,377	1,561	50	0.304	15.2	**0.0094**
November	30	0.0179	0.0132	0.0272	0.0000	1.0	46,307	1,544	50	0.304	15.2	0.0095
December	31	0.0149	0.0110	0.0226	0.0000	1.0	38,546	1,243	50	0.304	15.2	0.0118
Total		0.2700	0.2000	0.4100	0.4541	1.0						

Drainage prior to D2 2,586,980 m³

STORAGE DAM

'03/17/97 MON 11:44 FAX

Environment Canada | Environnement Canada

Pacific & Yukon Region
Mile 917.6B Alaska Hwy.
Whitehorse, Yukon
Y1A 5X7

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TO: A: Y.T. WATER BOARD
CO.:
CIE.:
DEPT.:
SERVICE:
FAX #: (403) 668-3628

FROM: DOE - EPB
CO.:
CIE.:
PHONE #: (403) 667-3400
FAX #: (403) 667-7962

APPL. # QZ96-004.

March 27, 1997

4484-37/M100

Mr. Ron Johnson
Chair, Yukon Territory Water Board
Suite 106 - 200 Range Rd..
Whitehorse, Yukon
Y1A 3V1

RE: BYG Water Licence Application - QZ96-004

Dear Mr. Johnson:

EP has completed a review of the above referenced licence amendments. EP is very concerned about BYG's failure to carry out the arsenic stability tailings test program in accordance with the timeframe specified in their existing licence. The test work we have carried out on the Ketza tailings clearly demonstrates the potential for tailings of this type to release significant quantities of dissolved arsenic. The levels of dissolved arsenic recently reported in the tailings pond reinforce this concern.

The cyanide levels in the pond are much higher than anticipated. The seepage of pond water through the dam also appears to be higher than anticipated.

We have provided recommendations to DIAND through the CEA screening of this application and these are reflected within the DIAND intervention statement for this application. We support the recommendations as detailed in the DIAND intervention.

We are not requesting that a public hearing be called to consider this application, but will participate if one is held.

Respectfully,

Vic Enns P. Eng.
Head, Pollution Abatement
EP - Yukon

667-3403 (o) 667-7962 (Fax)

cc. BYG

Canada

Exhibit 5.1

Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

Water Resources Division
Northern affairs Program
345-300 Main St.
Whitehorse, YT
Y1A 2B5

YUKON TERRITORY
WATER BOARD
1997 MAR 27 P 3:13
RECEIVED intenail mail
APPL. NO Q296-004
Replaces original

Your file Votre référence

Our file Notre référence
11:35 Am 03/27/97.
Mount Nansen Mine
QZ96-004

March 25 1997.

Mr. Ron Johnson
Chairperson, Yukon Territory Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A 3V1

Re: Water Licence Amendment Application QZ96-004, BYG Natural Resources Inc., Mount Nansen Operations

Dear Mr. Johnson:

Water Resources has completed its review of BYG's licence amendment application QZ96-004. Water Resources is not requesting a hearing for this application although we will attend should the Board convene a hearing. This letter contains several recommendations for the Board's consideration.

Recommendations for Issues Raised in Environmental Assessment

As discussed in the Canadian Environmental Assessment Act (CEAA) Screening Report dated March 5, 1997, the proposed additional water sources may contribute to the arsenic loading in mine effluent both during operations and at closure. The screening report recommended that, for operations, the Tailings Arsenic Stability and Groundwater Arsenic Attenuation Programs required under the existing licence (QZ94-004) consider the implications of any additional arsenic loading. The Screening Report further recommended that the wells be addressed in the closure plan submitted as a condition of licence. In the following sections, Water Resources has proposed licence mechanisms for addressing these environmental assessment issues.

1. Tailings Arsenic Stability and Groundwater Arsenic Attenuation Program

The Tailings Arsenic Stability and Groundwater Arsenic Attenuation Program was proposed by BYG in an effort to address concerns regarding the elevated levels of arsenic in the tailings at the Mount Nansen operation. The implementation of this program is required as a condition of Water Use Licence QZ94-004. The intention of the "Tailings Arsenic Stability Program" is to determine the effectiveness of ferric sulphate in stabilizing arsenic within the tailings impoundment. The bench sample test component of this program was required, by licence, to be

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Exhibit No 5.2

completed and a report submitted to the YTWB by February 8, 1996. This work has not been started. Recent water quality samples from tailings pond water revealed arsenic concentrations as high as 14.8 mg/L total arsenic and 3.44 mg/L dissolved arsenic. The discharge licence limit for the Mount Nansen Operation is 0.15 mg/L dissolved arsenic. The arsenic concentration in the tailings is not known as the Tailings Acid Rock Drainage Program monthly reports, also required by Water Use Licence QZ94-004, have not been submitted to the YTWB.

These arsenic concentrations raise additional concern because the tailings impoundment is filling at a rate faster than predicted and no facility is in place to treat tailings impoundment water before it is discharged to Dome Creek. BYG proposed to complete a Reclaim Water Treatment Facility by the end of the first quarter of 1997. The designs for this facility, required by licence six months prior to the discharge of any effluent from the tailings pond, have not been submitted to the YTWB.

If the "Tailings Arsenic Stability Program" determined that ferric sulphate treatment at the mill could be successful in stabilizing arsenic in place, then BYG believes that ferric sulphate treatment in the mill could eliminate or reduce the need to treat arsenic at the Reclaim Water Treatment Facility. Ferric sulphate treatment at the mill may reduce the risks associated with elevated concentrations of arsenic in the tailings impoundment. As such it would be in the best interest of the company to complete the "Tailings Arsenic Stability Program". To this effect Water Resources has recommended time lines, for work items and reports, that were not included in Water Use Licence QZ94-004.

Water quality testing of the mill site well already drilled has revealed arsenic concentrations of 0.304 mg/L. The well water is being utilized in the mill and discharged as a component of the tailings effluent. This arsenic rich well water may represent a significant loading to the mill tailings effluent. Water Resources recommends the Board address the additional arsenic loading to the tailings, and the stability of arsenic in the tailings through the following conditions of licence.

i) The licensee will address the additional arsenic loading in the mill effluent from the mill vicinity wells in the "Tailings Arsenic Stability And Groundwater Arsenic Attenuation Program", Appendix 4, Water Use Licence QZ94-004.

ii) Upon receipt of Water Use Licence Amendment QZ96-004, the licensee will initiate the actions described in Part 4) of subsection 4.1.2, Appendix 4, Water Use Licence QZ94-004.

iii) The licensee will submit to the YTWB a report on the outcome of work items listed in Part 4) of Subsection 4.1.2, Appendix 4, Water Use Licence QZ94-004 within 35 days of receipt of Water Use Licence Amendment QZ96-004.

iv) Should the testing detailed in Part 4) of Subsection 4.1.2, Appendix 4, Water Use Licence QZ94-004, determine ferric sulphate treatment to be effective in stabilizing arsenic in place, the licensee will initiate the work outlined in part 5) of subsection 4.1.2 of Appendix 4, Water Use Licence QZ94-004, within 40 days of receipt of Water Use Licence Amendment QZ96-004.

2. Arsenic Loading From Mill Vicinity Wells to Dome Creek at Closure

BYG has determined that, at closure, the seepage from the mill well at closure will be approximately 50 m^3/ day, with an arsenic concentration of 0.304 mg/L. Evidence indicates that this arsenic loading to Dome Creek may not be represented by historical water quality testing. Upon closure, this arsenic rich seepage may travel directly to Dome Creek without benefitting from natural attenuation mechanisms presently effective. Water Resources recommends the Board consider the following licence condition to address this concern.

v) Upon permanent closure the licensee will complete mitigative measures to ensure no additional negative impact to Dome Creek occurs from mill well seepage. These mitigative measures must be detailed in the "Decommissioning and Reclamation Plan" required under "Part G, Decommissioning and Reclamation" of Water Use Licence QZ94-004.

General Licence Recommendations

Water Resources also raises the following additional concerns with the Mount Nansen Operation that falls outside the scope of the CEAA Screening for Water Use Licence Amendment Application QZ96-004.

3. Cyanide Concentration in the Tailings Pond

Cyanide concentrations in the tailings pond are an increasing concern. The potential for environmental degradation from uncontrolled release increases with the concentration of cyanide and other effluent parameters within the tailings pond. In section 3.2.1.1 of Water Licence Application QZ94-004, dated March 21, 1995, BY Natural Resources proposed that:

> "Tailings will be treated for cyanide using the Inco SO_2-Air process prior to discharge to the tailings pond in order to maintain a maximum pond cyanide concentration of 25 mg/L."

During the initial environmental assessment review for the Mt. Nansen project, the above proposal addressed concerns about cyanide levels in the tailings pond. The proposed levels are consistent with the requirements of the Ketza River Mine licence and are significantly less restrictive than the concentrations required at the Mt. Skookum Mine. Recent water quality testing of the Mount Nansen tailings pond water reveal weak acid dissociable cyanide

Exhibit 5.2

concentrations of approximately 200 mg/L. For example, tailings pond water cyanide concentrations on January 23, 1997 of 208 mg/L would require a dilution factor of 2080:1 to meet compliance for discharge. Water Resources recommends that BY be required to fulfil it's earlier commitment to operate the cyanide destruction circuit in the mill whenever the mill is operating and to maintain the cyanide concentration in the pond below 25 mg/L. Water Resources recommends that the Board consider the following conditions of licence.

vi) The licensee shall ensure that, before being discharged to the tailings pond, all effluent from the milling operation is treated for cyanide using a cyanide destruction system.

vii) If the concentration of total cyanide in the tailings pond water exceeds 25 mg/L the licensee will commence additional treatment of the tailings pond water until the tailings pond water meets the above cyanide concentration limit. The tailings pond water total cyanide concentration limit of 25 mg/L does not supersede Water Use Licence QZ94-004 Effluent Discharge Water Quality Standards.

Thank you for the opportunity to review this application and for your consideration of our recommendations. If you have any questions, please contact our office at 667-3147.

Yours sincerely,

David A. Sherstone

David A. Sherstone
Regional Manager, Water Resources

c. BYG Natural Resources
V. Enns, Environmental Protection
K. McDonnell, Environment Directorate

Exhibit 5.2

1. APPLICATION

1.1 Schedule IV and letter, 25.3.99
1.2 Report "Tailings impoundment Drainage Control Evaluation", Vista Engineering, February 24, 1998

2. PUBLIC NOTICES

3. CORRESPONDENCE - BOARD TO APPLICANT

4. CORRESPONDENCE - APPLICANT TO BOARD

5. INTERVENTIONS

5.1

6. CORRESPONDENCE - BOARD TO INTERVENORS & TO ALL PARTIES

7. CURRENT/PREVIOUS WATER USE LICENCE(S)

7.1 Office Compilation of Water Use Licence QZ94-004, as of Feb/98

8. EXHIBITS ENTERED AT PUBLIC HEARING

9. ENVIRONMENTAL ASSESSMENT (CEAA)

9.1 CEAA Screening Report, 4.12.98

10. DECISION

11. TRANSCRIPT OF PUBLIC HEARING

12. OTHER

B.Y.G.
NATURAL RESOURCES INC.

YUKON TERRITORY
RECEIVED
1998 MAR 25 P 3:39

March 25, 1998

land
QZ97-029

Mr. Ron Johnson
Chairperson, Yukon Territory Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A 3V1

RE: APPLICATION FOR AN AMENDMENT TO LICENSE QZ94-004

Dear Sir:

I am requesting an amendment to our water license to reflect our ability to deal with the greater than expected run off that occurs on a yearly basis.

Our 1996 annual report to the Water Board correctly identified a deficiency in the calculations for the amount of run off that will arrive at our tailings impoundment. This deficiency has led to most if not all of the problems that are presently plaguing our operation. Since that time and in light of last years data we believe we have much more reliable information.

In the light of this more reliable information we would like to utilize intercept ditches to intercept run off prior to its arrival in our tailings impoundment and ensure that it flows into the Dome Creek diversion and subsequently down the valley.

The water that we wish to intercept is water that would have taken this same course down the valley previous to the construction of the tailings impoundment.

The amendment I am requesting to the license refers to Section 20

"

(f) to divert water via a diversion of Dome Creek around a tailings impoundment, to construct and operate a system of intercept ditches for the collection of run-off water and.....

as proposed in water use application QZ94-004 and subject to this License....."

I would like to request a change to specifically allow the construction and operation of intercept ditches as proposed in the documentation appended to this application.

"as proposed in water use application QZ94-004 ***and as further proposed in this amendment*** application and subject to this license."

General Delivery, Carmacks, Yukon Territory Y0B 1C0 tel: 867 863 5916 fax: 867 863 6028 e-mail byg@unx.inforserve.net

The intercept ditches are described in the accompanying materials.

I thank you in advance for your attention to this matter and hope that I can receive an early answer to this request.

Yours truly,

Graham C. Dickson
President, B.Y.G. Natural Resources Inc.

General Delivery, Carmacks, Yukon Territory Y0B 1C0 tel: 867 863 39136 fax: 867 863 6028 e-mail byg@unix.infoserve.net

Q297-029

YUKON TERRITORY
WATER BOARD
1999 JUN -8 A 10: 39
Can Post
Q297-089

April 26, 1999

Yodit Johnson
A/Head, Environment Assessment &Planning
Water Resources
Northern Affairs Program
310-300 Main St.
Whitehorse Yukon
Y1A 2B5

Dear Ms. Johnson:

Re: Canadian Environmental Assessment Act screening
Amendment Application QZ98-029 to Water Licence QZ94-004
BYG Natural Resources Inc. Mt. Nansen Gold Mine

The Yukon Salmon Committee (YSC) fully supports the need to make amendments to licence QZ94-004. The Committee feels that there is no potential for the proposed amendments to cause a negative environmental impact.

We will offer detailed comments on each of the Water Board proposals:

- Prohibition of water use for millings purposes if total cyanide levels in the tailings pond rise above the limit of 25 mg/l currently set in the licence.

This provision will have a positive environmental impact. Water treatment for discharge will be easier and seepage from the tailings pond will have less impact. However the YSC believes that the limit should be 10 mg/l. Initial documentation submitted during the environmental assessment (and to the Water Board) indicated that the discharge to the tailings pond would contain < 10 mg/l of cyanide. There must be a requirement for daily sampling of the tailings discharge for cyanide levels. There should also be a licence provisions added to the water licence similar to section 3 of licence Y-IN85-08AL (amendment 1), Mt Skukum Gold Mining Corporation.
Part B
3. Operation
(a) The Licensee shall insure that all wastewater from the milling operation is directed:
i) through a cyanide destruction system of appropriate capacity to insure that waste

Yukon Salmon Committee, 100 - 419 Range Road, Whitehorse, YT Y1A 3V1
867- 393-6725 Fax: 867-393-6738
Email: Salmon@yknet.yk.ca
Web page: http://www.yukonweb.com/government/salmon/

discharge standards prescribed in this license are met;
ii) through a primary tailings pond and a secondary tailings pond located downstream of the primary tailings pond before entering Butte Creek.
iii) the objective of the cyanide destruction system referred to in Part B. Section 3(a)(i) of this license shall be a cyanide level in the mill effluent of less than 1.0 milligrams per litre.

(c) The licensee shall, within six months of the effective date of this Amendment, provide the Board with an acceptable plan for the monitoring of groundwater and shall implement said plan in the event that cyanide concentrations in the tailings pond exceed 1.0 mg/litre.

- Relocation and/or addition of effluent compliance point(s)

There should be an effluent compliance point added for tailings discharge. Notwithstanding the presence of permafrost and its controls on groundwater, given the effluent quality in the tailings pond as well as the increasing effluent concentrations in the seepage pond effluent, there is a need to set up a groundwater-monitoring network.

- Additional monitoring parameters for effluent quality standards

There is the need to add parameters including Ammonia Nitrogen, Nitrate Nitrogen, Nitrite Nitrogen, Cyanite and Thiocyanate. There should be standard licence limits developed for these parameters.

- Tailings dam stability

There must be an independent review of stability concerns based on current conditions and water licence requirements.

Additional items: There should be a specified discharge period developed for this water licence. It should specify a time window as well as dilution criterion. Further recommendation will be submitted as part of the water licence amendment process.

Sincerely yours,

Carl Sidney

Carl Sidney
Chair, Yukon Salmon Committee

cc: BYG Natural Resources, CYFN, Little Salmon Carmacks, Water Board

YUKON TERRITORY WATER BOARD
1998 DEC -7 A 8:38
RECD BY fax
APPL. NO. QZ94-004

CANADIAN ENVIRONMENTAL ASSESSMENT ACT SCREENING REPORT (LEVEL 1)

PREPARED BY:
WATER RESOURCES, NORTHERN AFFAIRS PROGRAM
YUKON REGION

DECEMBER 04 1998

Water Licence Application QZ97-029
BYG NATURAL RESOURCES INC. Amendment to Water Licence QZ94-004

Table of Contents

1. GENERAL ENVIRONMENTAL ASSESSMENT FILE INFORMATION 2

2. RESPONSIBLE AUTHORITY IDENTIFICATION 2

3. PROJECT LOCATION 3

4. SCREENING PROCEDURES 4
4.1 Scope of Screening 4
4.2 Sources of Information 5

5. PROJECT DESCRIPTION 6
5.1 Background 6
5.1.1 Mount Nansen Gold Mine 6
5.1.2 North and West Diversion Ditches 7
5.2 Description of Proposed Amendments 8

6. DESCRIPTION OF ENVIRONMENT 9

7. CONSULTATION/REFERRAL OF APPLICATION 10

8. ENVIRONMENTAL ISSUES AND MITIGATION 11
8.1 Effective Functioning of Ditches 11
8.2 Acid Rock Drainage Potential of Rip Rap 12
8.3 Revision of Water Balance 12

9. CUMULATIVE ENVIRONMENTAL EFFECTS 13

10. SUMMARY OF MITIGATION MEASURES 13

11. SIGNIFICANCE 14

12. LIKELIHOOD OF OCCURRENCE 14

13. CEAA DETERMINATION RECOMMENDATION 14

14. SCREENING REPORT AND/OR DECISION REPORT 14

15. AUTHORISATION 14

1. GENERAL ENVIRONMENTAL ASSESSMENT FILE INFORMATION

Application Number:	QZ97-029
Project Title:	BYG Natural Resources Inc. Amendment to Water Licence QZ94-004
Alias Project Title:	Diversion Ditch Water Licence Amendment
Proponent:	BYG Natural Resources Inc., General Delivery, Carmacks, Yukon Territory, Y0B 1C0, Telephone 867.863.5913, Fax 867.863.6028, E-Mail byg@unix.infoserve.met
Subject Descriptors:	Mining
EA Type:	Screening
EA Start Date:	March 26 1998
EA Determination:	20(1)(a) ...taking into account the implementation of any mitigation measures that the responsible authority considers appropriate, the project is not likely to cause significant adverse environmental effects, the responsible authority may exercise any power or perform any duty or function that would permit the project to be carried out and shall ensure that any mitigation measures that the responsible authority considers appropriate are implemented; ....
EA Determination Date:	December 04 1998
Follow-up Program Required:	No

2. RESPONSIBLE AUTHORITY IDENTIFICATION

Lead Responsible Authority:	DIAND
Screening Division:	Water Resources
Lead Responsible Authority Contact:	David Sherstone, Regional Manager, DIAND, Water Resources, 345-300 Main St., Whitehorse, Yukon,

	Y1A 2B5, Telephone 867.667.3145, Fax 867.667.3195, E-Mail sherstoned@inac.gc.ca
Lead Responsible Authority Trigger:	Law List Approval
Type of Approval:	Water Licence
Status of Approval:	Amendment
Other Responsible Authorities:	None
Integrated Screening?	N/A
Other RA Trigger Types:	N/A
Other RA Types of Approval:	N/A
Project File Location:	Water Resources Division, Renewable Resources Directorate

3. PROJECT LOCATION

Region:	Yukon
Topographic Map Sheet:	NTS 115/I/3
Geographic Location Name Code:	Mount Nansen
Latitude:	62° 05' N
Longitude:	137° 08' W
Drainage Region:	Yukon River
Watershed:	Dome Creek, Victoria Creek, Nisling River, Donjek River, White River, Yukon River, Bering Sea
Street Name:	N/A
Nearest Community:	Carmacks, Yukon
Traditional Territory:	Little Salmon Carmacks First Nation
Surrounding Land Status:	Federal Crown Land
Special Designations:	None

The Mount Nansen project is located 60 kilometres west of Carmacks in central Yukon Territory. The site lies within the traditional territory of the Little Salmon Carmacks First Nation. The property is situated at an elevation of about 1200 metres in the Dawson Range. A public, gravel road from Carmacks to the Mt. Nansen property is maintained year round by the Yukon Territorial Government.

The tailings pond and the mill site are in the Dome Creek drainage. Treated mine water and uncollected seepage report to Dome Creek. The Brown-McDade open pit is on the divide between Dome Creek and Pony Creek, and the pit bottom intercepts an adit which daylights above Pony Creek. Pony Creek flows into Victoria Creek above Dome Creek. Dome Creek flows into Victoria Creek, which flows into the Nisling River, then the Donjek River, then the White River, then the Yukon River and finally the Bering Sea.

4. SCREENING PROCEDURES

4.1 Scope of Screening

Section 15 (1) of the *Canadian Environmental Assessment Act* (CEAA) states that where the environmental assessment of a project entails a screening, the scope of the project in relation to which an environmental assessment is to be conducted shall be determined by the responsible authority.

Section 15 (3) of CEAA states that:

> *Where a project is in relation to a physical work, an environmental assessment shall be conducted in respect of every construction, operation, modification, decommissioning, abandonment or other undertaking in relation to that physical work that is proposed by the proponent or that is, in the opinion of... the responsible authority ... likely to be carried out in relation to that physical work.*

The project proposed by BYG is in relation to a physical work. The project consists of construction of a west tailings pond diversion ditch and modification of the north tailings pond diversion ditch. These ditches intercept surface water flowing towards the tailings pond. The west and north diversion ditches have both already been constructed. However, unlike the north ditch, the west diversion ditch was not part of the original mine proposal. The west ditch was constructed by the company in the spring of 1997, and was not authorised by the water licence. Because the company did not submit an application for a licence amendment to authorise the west diversion ditch, an environmental assessment of this ditch was not done prior to construction.

The scope of this screening includes only those undertakings proposed in application QZ97-029: that is the construction of the west diversion ditch and the modification of the existing north diversion ditch. The potential environmental impacts of other aspects of this project, such as construction and operation of the north diversion ditch and decommissioning and abandonment of the entire mine site in general, were assessed in the 1995 EARPGO environmental assessment, and as described in Section 74 (3) of CEAA, do not need to be reassessed as part of this screening.

Of critical importance is that only those aspects of the 1995 EARPGO environmental assessment which deal directly and specifically with diversion channels have been used for the purpose of conducting a screening of the west diversion ditch construction and the north diversion ditch modification. Other aspects of the Mount Nansen mine have performed in a substantially different way than initially planned, and important assumptions and predictions upon which the 1995 EARPGO environmental screening was based are no longer valid for this site. These aspects should be reassessed at another time.

The screening of the diversion ditch project considered the factors detailed in section 16 (1) of CEAA:

(a) the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
(b) the significance of the effects referred to in paragraph (a);
(c) comments from the public that are received in accordance with this Act and the regulations;
(d) measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project; and
(e) any other matter relevant to the screening ... such as the need for the project and alternatives to the project, that the ... Minister after consulting with the responsible authority, may require to be considered.

4.2 Sources of Information

The information used for assessing potential environmental impacts of this project was derived primarily from the original application package. This package consisted of:

- letter from Mr. Graham Dickson, President of BYG to Mr. Ron Johnson, Chair of the YTWB, dated March 25 1998;
- Yukon Waters Act Schedule IV Application;
- report entitled "Mt. Nansen Gold Mine, Tailings Impoundment Drainage Control Evaluation" prepared by Vista Engineering, numbered 290-09 and dated February 24 1998.

In addition, the following supplemental information was used in the screening:

- letter from Mr. Stephen Hureau, Environmental Coordinator at BYG to Mr. Bill Slater, Head, Environmental Assessment & Planning at DIAND Water Resources, undated and received in the Water Resources office on August 11 1998;
- letter from Mr. Stephen Hureau to Ms. Yodit Johnson, A/ Head, Environmental Assessment & Planning at DIAND Water Resources, dated November 11 1998;
- letter from Mr. Stephen Hureau to Ms. Yodit Johnson, dated November 18 1998;
- letter from Mr. Stephen Hureau to Ms. Yodit Johnson, dated November 19 1998;
- letter from Mr. Stephen Hureau to Ms. Yodit Johnson, dated December 02 1998 with attached letter from Mr. Victor Menkal to Mr. Stephen Hureau dated October 13 1998.

Some details in the application were clarified during telephone conversations with Mr. Stephen Hureau.

Input from government agencies and others who reviewed the application and supplementary information was also considered in the screening.

5. PROJECT DESCRIPTION

Physical Work:	Mining Infrastructure
Multiple Activities:	No
Primary Undertaking:	Modification
Physical Activity:	N/A
Project Category Code:	Point

5.1 Background

5.1.1 Mount Nansen Gold Mine

The BYG Mt. Nansen property consists of 257 mineral claims and 30 mineral leases covering an area of 53 square kilometres. There are another 122 mineral claims controlled by BYG immediately surrounding the main Mt. Nansen property.

BYG Natural Resources Inc. (BYG) approached DIAND with an Exploration and Development Overview for the Mt. Nansen gold property in 1988 and 1989. BYG then put the project on hold for the next few years, pending better metal prices and financing.

BYG submitted another Mt. Nansen Project Overview to DIAND on June 16 1994, and on November 22 1994, BYG submitted a two volume Initial Environmental Evaluation (IEE). The DIAND Regional Environmental Review Committee (RERC) initiated a Level II review of the proposed Mount Nansen project under the Environmental Assessment Review Process Guidelines Order (EARPGO). BYG submitted an application for a water licence to the YTWB on March 21 1995. A public hearing was held on June 06 1995. Because the EARPGO screening had not yet been completed at that time, DIAND, Environment Canada and DFO did not participate. DIAND, in conjunction with the RERC, released a screening report on the Mt. Nansen project on November 15 1995.

On December 14 1998, the YTWB public hearing was scheduled to reconvene on January 08 1996, providing that by December 28 1998 at least one party had expressed interest in attending the hearing. On December 27 1995, DIAND issued an EARPGO decision report in which it was recommended that the BYG Mt. Nansen proposal met the requirements of EARPGO under Section 12(c) and that the proposal could proceed to the regulatory process with the mitigation measures recommended in the IEE and the recommendations set forth in the screening report. As of December 28 1998, there were no expressions of interest in attending the YTWB public hearing, and the reconvening of the public hearing was cancelled. The YTWB issued water licence QZ94-004 for the BYG Mt. Nansen mine under the Yukon Waters Act (YWA), effective March 14 1996. This licence authorises water use of up to 527 m^3/ day. The licence expiry date is December 31, 2001.

BYG has obtained three amendments to water licence QZ94-004. Amendment #1 was to include wells in the vicinity of Dome Creek as a water source. This amendment came into effect May 30 1997. Emergency amendment #2 came into effect August 08 1998 and authorised discharge from the tailings impoundment and construction of a toe berm on the tailings dam. Emergency amendment #3 authorised BYG to discharge effluent from the tailings impoundment although the fish toxicity standard would not be met. Amendment #3 came into effect February 20 1998.

The Mt. Nansen mill buildings and much of the equipment were remaining from previous production of the Heustis ore body and were therefore on site prior to BYG opening the mine. The mill began to run on October 26 1996. Commercial production of gold began on January 01 1997. There was a temporary cessation of production between November 06 1997 and February 26 1998 due to water management problems. As of November 25 1998, there have been 214,313 tonnes of ore milled and 34,671 ounces of gold produced since milling commenced in October 1996. The total mine production tonnage is similar to the total milling tonnage since very little ore is stockpiled. The mean mill processing rate since October 1996 has been 334 tonnes per day. The mill is designed to process 450 tonnes per day. The maximum mill throughput has been 750 tonnes per day.

On November 01 1996 - the month milling commenced - the price of gold was $378.00. The price of gold for the week ending November 27 1998 was $296.15.

5.1.2 North and West Diversion Ditches

The existing, unlined west and north diversion ditches extend along the entire lengths of the west and north sides of the tailings pond respectively. These ditches intercept surface water that would otherwise report to the tailings pond. The north diversion has an invert grade of 0.1%, a maximum invert width of 3 m, and maximum side slopes of 2:1. The bed and side slopes were originally lined with 75 mm minus screened Victoria Creek gravel to a vertical height of 1.4 m (letter from Hureau to Slater, August 11 1998). The slopes of both ditches are now armoured with rip rap. Both the north and west diversion ditches were sized to accommodate the 200 year flood.

Run-off in the west ditch flows into the north ditch, then into the emergency spillway channel and finally into the original Dome Creek course. The north ditch diverts Dome Creek and intercepts surface run off from the area directly north of the tailings impoundment (VISTA Evaluation, February 24 1998).

The north ditch receives run off from 281.1 hectares, which is approximately 85% of the drainage area upstream of the tailings impoundment (VISTA Evaluation, February 24 1998; letter from Hureau to Slater, August 11 1998). The west ditch intercepts run off from the valley and gully located to the south west of the impoundment. This ditch intercepts 42.2 ha or approximately 13% of the entire drainage basin (VISTA Evaluation, February 24 1998). Approximately 7.1 ha or 2% of the watershed located to the south of the tailings pond is not diverted and drains directly into the tailings pond

(VISTA Evaluation, February 24 1998). The total area which drains into the tailings basin is approximately 330.4 ha (VISTA Evaluation, February 24 1998).

Based on stream flow measurements collected in 1997, the applicant has estimated that approximately 50% of the water which enters the ditches seeps into the tailings pond in the latter portions of the open water season (VISTA Evaluation, February 24 1998). This seepage is due to the highly porous sandy and silty soils in which structures have been constructed. The original design for the tailings facility assumed that the soils underlying the diversion ditches would be frozen and completely impermeable during the spring freshet (VISTA Evaluation, February 24 1998). However field observations suggest that there may be some seepage even under fully frozen conditions (VISTA Evaluation, February 24 1998).

In March 1998, BYG estimated that in one season, 28,000 m^3 to 48,000 m^3 could enter the tailings pond as seepage from the west diversion ditch, and that 190,000 m^3 to 320,000 m^3 could enter the pond from the north diversion ditch. The actual volume of seepage that entered the pond is unknown. The application stated that "in-stream measurements would need to be collected during spring freshet and early summer to determine the actual amount of seepage from the structures" (VISTA Evaluation, February 24 1998, Page 4). The VISTA report recommended that the water balance model be updated to allow for seepage, taking into consideration any improvements to the diversion structures (VM to GD, February 24 1998).

5.2 Description of Proposed Amendments

BYG is requesting authorisation to construct the (existing) west tailings pond diversion ditch and authorisation to upgrade the existing north diversion ditch. The construction and upgrade would consist of lining the ditches with sand, an impermeable liner and rip rap. The purpose of the proposed undertaking is to increase the efficiency of the diversion ditches; that is to reduce the amount of seepage that occurs from the ditches into the tailings pond. The proponent has stated that there was "a deficiency in the calculations for the amount of run off that will arrive at our tailings impoundment" (Dickson to Johnson, March 25 1998) and that the amendment is required to "deal with greater than expected run off that occurs on a yearly basis" (Dickson to Johnson, March 25 1998).

The proponent has requested a change to Section 20 of the BYG Mount Nansen water licence to "specifically allow the construction and operation of intercept ditches as proposed ..." (Dickson to Johnson, March 25 1998). Section 20 of the BYG Mount Nansen water licence now reads:

20. <u>Water Use and Waste Deposit</u>
The licensee is hereby authorized

....

f) to divert water via a diversion of Dome Creek around a tailings impoundment, to construct and operate a system of intercept ditches for the collection of run-off water and to construct and operate

a seepage collection pond for the storage of seepage water that will be returned to the tailings pond impoundment;
as proposed in water use application QZ94-004 and subject to this Licence. ....

The design of the ditch upgrades is specified in the Vista Engineering report entitled "Mt. Nansen Gold Mine, Tailings Impoundment Drainage Control Evaluation", and in supplementary correspondence. The design, which was submitted in March 1998, includes the following components:

i. liners will be installed once soils have thawed to a depth of approximately one metre;
ii. there will be sand layers with a minimum thickness of 150 mm each above and below the liners to protect the liners from tears;
iii. the liner will be a polyolefin liner called Enviro Liner, installation will be done by on-site personnel using an installation kit provided by the liner company;
iv. welding of the liner seams will be inspected prior to covering;
v. the rip rap material to be used in this project will come from the Brown-McDade open pit, and will have tested negatively for acid rock drainage potential;
vi. the gradients within the diversions will be measured once the liner has been installed, and the appropriate sized rip rap will be installed according to Section 8.5.2 (Diversion Channel Design) and Section 9.4 (Erosion Protection) of the "BYG Natural Resources Inc., Mt. Nansen Gold Project, Tailings Impoundment Final Design Report, August 1995 (PM 5314.05.02)", prepared by Klohn-Crippen;
vii. all excavated material from this project will be removed and deposited toward the tailings pond.

6. DESCRIPTION OF ENVIRONMENT

Ecozone:	Boreal Cordillera
Ecoregion:	Yukon Plateau (Central)

The BYG Mount Nansen mine is located in the southern reach of the Dawson Range. The property is situated at an elevation of 1200 metres with rounded ridges and shallow valleys. The terrain has a light cover of vegetation and small trees. Permafrost is prevalent in this area and is classified as discontinuous.

Since the 1930's the immediate environment has been altered by extensive hard rock exploration and mining. Remnants of placer operations, some of which predate the hard rock activity, can be seen throughout the area. Hard rock exploration in the area is ongoing.

Between December 1997 and October 1998 temperatures at the Mt. Nansen site have varied from a low of -33.5 °C (January 1998) to a high of 23.2 °C (June 1998). Mt. Nansen precipitation data collected by BYG consists of rainfall measurements during six months of 1998: April 3.6 mm, May

65.0 mm, June 67.3 mm, July 25.0 mm, August 33.8 mm and September 37.1 mm. Details about the environment at the Mount Nansen mine site are provided in the IEE submitted by BYG in 1994.

7. CONSULTATION/REFERRAL OF APPLICATION

Public consultation? Yes

Original Application

Date referred to government departments: March 26 1998
Date referred to public: March 26 1998
Deadline for comments: April 20 1998

Additional Information

Date referred to government departments: August 25 1998
Date referred to public: August 25 1998
Deadline for comments: September 14 1998

Referral Sent To	Date Comments Received
DIAND ENVIRONMENT, Kirstie Simpson, Project Manager	No comments received.
DIAND LAND RESOURCES, Mark Zrum, Regional Manager	No comments received.
DIAND MINERAL RESOURCES, Hugh Copland, Engineer of Mines	April 07 1998 & August 27 1998
DIAND EXECUTIVE SERVICES Fred Privett, Manager Socio-Economic Benefits	No comments received.
DIAND CARMACKS DISTRICT OFFICE Kirby Meister, Regional Management Officer (RMO)	No comments received.
LITTLE SALMON CARMACKS FIRST NATION Joe Bellmore, First Nation Resource Officer/ Chris Noble, Director, Lands Resources & Infrastructure	No comments received.
DEPARTMENT OF ENVIRONMENT(DOE) Vic Enns, Head, Pollution Abatement	No comments received.
DEPARTMENT OF FISHERIES & OCEANS (DFO) Gail Faulkner, Chief, Habitat Protection	No comments received.
YTG RENEWABLE RESOURCES - ENVIRONMENTAL ASSESSMENT SECTION Kelvin Leary, Manager	March 30 1998 & April 09 1998

Referral Sent To	Date Comments Received
YTG ECONOMIC DEVELOPMENT - CANADA/ YUKON GEOSCIENCE OFFICE Diane Brent, Development Assessment Coordinator	No comments received.
YTG ECONOMIC DEVELOPMENT, Jessie Duke, Mining Facilitator	No comments received.
VILLAGE OF CARMACKS, D Luc Lacasse, Mayor	No comments received.
COUNCIL OF YUKON FIRST NATIONS	No comments received.
YUKON CONSERVATION SOCIETY (YCS) Jennifer Ellis, Executive Director/ Bob Van Dijken, Director	No comments received.
YUKON SALMON COMMITTEE, Carl Sidney	No comments received.
MIDNIGHT MINES LTD., Bill Harris, President	No comments received.

A site tour at the Mount Nansen mine was organised by DIAND Water Resources on September 17 1998. Ms. Sue Moodie and Mr. Bob van Dijken from the Yukon Conservation Society, Mr. Jon Bowen from YTG Renewable Resources, Ms. Allison Back from Environment Canada and Mr. Bill Slater from DIAND Water Resources participated in the site visit.

On November 19 1998 Water Resources circulated a draft screening report to all of the agencies on the original referral list. The deadline for comments on the draft screening report was December 02, 1998. Comments were received from Kevin McDonnell (Project Manager, DIAND, Environment Directorate), Stephen Hureau (Environmental Coordinator, BYG), Jon Bowen (Environmental Assessment Analyst, YTG Renewable Resources), and Hugh Copland (DIAND, Mineral Resources).

8. ENVIRONMENTAL ISSUES AND MITIGATION

8.1 Effective Functioning of Ditches

If the proposed work is not carried out according to specifications the structure could fail to operate effectively. Damage to the liner could result in seepage into the tailings pond. Erosion of ditch materials could occur. Unplanned seepage of ditch flows into the tailings pond could result in exceedance of the tailings pond capacity and discharge of contaminated pond water to the downstream environment. Erosion of ditch materials could cause sedimentation in Dome and Victoria Creek waters, negatively impacting aquatic life in these watercourses (fish fry have been observed in Victoria Creek) and compromising overall stream health.

Mitigation

1. The modifications proposed for the north and west diversion ditches must be undertaken in accordance with Section 8.5.2 (Diversion Channel Design) and Section 9.4 (Erosion Protection) of the "BYG Natural Resources Inc., Mt. Nansen Gold Project, Tailings Impoundment Final Design Report, August 1995 (PM 5314.05.02)", prepared by Klohn-Crippen.

2. The ditch modifications must be carried out in compliance with the Construction Quality Assurance Manual that is appended to water licence QZ94-004 (Appendix 3).

3. The west and north diversion ditches must be maintained in accordance with the ditch design.

8.2 Acid Rock Drainage Potential of Rip Rap

Rip rap material with the potential for acid rock drainage should not be used for ditch construction. Materials used in the construction of the ditches will be exposed to water and air. Construction rock with the potential for ARD could cause the release of acid and metals into ditch flows which report to Dome and Victoria Creeks. This could negatively impact aquatic life in these watercourses (fish fry have been observed in Victoria Creek), and compromise overall stream health.

Mitigation

4. Only material that does not have acid rock drainage potential may be used in the ditch construction.

8.3 Revision of Water Balance

The original water balance for the Mt. Nansen tailings management facility did not correctly estimate the volume of seepage that would report to the tailings pond from the north diversion ditch. The water balance should be updated to include realistic estimates of seepage from the diversion ditches, taking into consideration the effects of the proposed modifications. As has already occurred at the Mt. Nansen site, incorrect water management modelling can result in the inability of the tailings pond to accommodate all the water that reports to the pond. This could result in discharge of contaminated pond water to the downstream environment, with potentially negative impacts on aquatic life (fish fry have been observed in Victoria Creek).

In the diversion ditch water licence amendment application, BYG recommends that in-stream measurements be collected during spring freshet and early summer to determine the actual amount of seepage from the diversion ditches, and that the model be updated to allow for this seepage, as well as any improvements to the diversion structures (VISTA Evaluation, February 24 1998).

Mitigation

5. The water balance for the Mt. Nansen mine operation must be revised to incorporate site conditions.

8.4 Crossings of Diversion Ditches

Crossings of the diversion ditches should not encumber the hydraulic capacity of the ditches. Inadequately sized culvert installations could result in ditch flow spilling into the tailings pond and causing unplanned discharge of contaminated water from the pond to the environment. Inadequately sized culvert installations may also cause washouts, resulting in sedimentation of ditch flows causing negative impact to downstream aquatic life (fish fry have been observed in Victoria Creek), as well as degradation of overall stream health.

Mitigation

6. Any crossings of the west and north diversion ditches must not reduce the hydraulic capacity of the ditches.

9. CUMULATIVE ENVIRONMENTAL EFFECTS

With the implementation of the mitigation measures discussed above, cumulative effects are not likely to occur as a direct result of the proposed amendments.

10. SUMMARY OF MITIGATION MEASURES

1. The modifications proposed for the north and west diversion ditches must be undertaken in accordance with Section 8.5.2 (Diversion Channel Design) and Section 9.4 (Erosion Protection) of the "BYG Natural Resources Inc., Mt. Nansen Gold Project, Tailings Impoundment Final Design Report, August 1995 (PM 5314.05.02)", prepared by Klohn-Crippen.

2. The ditch modifications must be carried out in compliance with the Construction Quality Assurance Manual that is appended to water licence QZ94-004 (Appendix 3).

3. The west and north diversion ditches must be maintained in accordance with the ditch design.

4. Only material that does not have acid rock drainage potential may be used in the ditch construction.

5. The water balance for the Mt. Nansen mine operation must be revised to incorporate site conditions.

6. Any crossings of the west and north diversion ditches must not reduce the hydraulic capacity of the ditches.

11. SIGNIFICANCE

After taking into account the above mitigation measures, are any of the adverse environmental effects significant?	No
If yes, which ones?	N/A

12. LIKELIHOOD OF OCCURRENCE

Are any of the above adverse, significant, environmental effects likely to occur?	N/A
If yes, which ones?	N/A

13. CEAA DETERMINATION RECOMMENDATION

20(1)(a) ...taking into account the implementation of any mitigation measures that the responsible authority considers appropriate, the project is not likely to cause significant adverse environmental effects, the responsible authority may exercise any power or perform any duty or function that would permit the project to be carried out and shall ensure that any mitigation measures that the responsible authority considers appropriate are implemented; ....

14. SCREENING REPORT AND/OR DECISION REPORT

Public notified of screening:	No
Public comments on screening:	No
Record of comments attached to screening form?	No

15. AUTHORISATION

Prepared By: Yodit Johnson
A/ Head, Environmental Assessment and Planning
Water Resources Division

Signature: Yodit Johnson Date: DECEMBER 04 1998

Authorised By: David Sherstone
Regional Manager
Water Resources Division

Signature: David A. Sherstone Date: December 04, 1998

1. APPLICATION

1.1 Schedule IV and letter, 23.11.98
1.2 Drawing, General Arrangement FlotationCircuit, 20.7.98
1.3 Set of Three Drawings, "Process Flowsheet", May, 1995
1.4 Clarification of Application, 9.2.99

2. PUBLIC NOTICES

3. CORRESPONDENCE - BOARD TO APPLICANT

4. CORRESPONDENCE - APPLICANT TO BOARD

5. INTERVENTIONS

6. CORRESPONDENCE - BOARD TO INTERVENORS & TO ALL PARTIES

7. CURRENT/PREVIOUS WATER USE LICENCE(S)

7.1 Office Compilation of Water Use Licence QZ94-004, as of Feb/98

8. EXHIBITS ENTERED AT PUBLIC HEARING

9. ENVIRONMENTAL ASSESSMENT (CEAA)

10. DECISION

11. TRANSCRIPT OF PUBLIC HEARING

12. OTHER

B.Y.G.
NATURAL RESOURCES INC.

YUKON TERRITORY
WATER BOARD
1998 NOV 23 P 2:28
RECEIVED
APPL. NO. QZ98-033

November 23, 1998

Mr. Ron Johnson
Chairperson, Yukon Territory Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A 3V1

RE: APPLICATION FOR AN AMENDMENT TO LICENSE QZ94-004

Dear Sir:

I am requesting an amendment to our water license to reflect the following two items:

- The greater than expected specific gravity of the tailings in the tailings pond.
- Our ability to float sulfides from our tailings.

The greater than expected specific gravity of tailings in the tailings impoundment

Recent soundings and mapping of the tailings in place in the impoundment has shown that there are 77,000m^3 of unfilled volume in the impoundment up to a point one metre below the spillway.

If we filled this volume with tailings at a fill rate of 1.417 tonne/m^3 this would enable us to deposit a further 109,000 tonnes of tailings.

The present Brown M^{c}Dade pit and stockpiles contain approximately 60,000 tonnes of ore.

The processing of all further licensed materials would therefore leave an unfilled volume in the tailings pond capable of holding approximately 49,000 tonnes of ore.

Our ability to float sulfidic material from the tailings

The Flex zone contains ore material very similar to the material in the lower levels of the Brown McDade pit i.e. it is a mixture of oxidised and unoxidised ore giving lower recoveries of gold and silver.

We have designed a flotation plant and carried out the required test work to show that we can do a bulk flotation to remove sulfidic materials and produce a saleable concentrate.

General Delivery, Carmacks, Yukon Territory Y0B 1C0 tel: 867 863 59136 fax: 867 863 6028 e-mail byg@unix.infoserve.net

This plant is presently under construction. See accompanying General Arrangement and Flow Sheets 1 through 3.

The result of the flotation of the sulfidic material from the cyanidation tailings is a tailings product that has a lower sulfidic content than the majority of Brown McDade ore processed to date.

This lower sulfidic content means that the tailings from this process will be similar in all regards to the Brown McDade tailings except they will be acid consuming. (See attachment)

I am therefore requesting that ore from the Flex zone be included in the list of materials we are allowed to process and deposit in the tailings facility.

I thank you in advance for your attention to this matter and hope that I can receive an early answer to this amendment request.

Yours truly,

Graham C. Dickson
President, B.Y.G. Natural Resources Inc.

General Delivery, Carmacks, Yukon Territory Y0B 1C0 tel: 867 863 59136 fax: 867 863 6028 e-mail byg@unix.infoserve.net

ACID BASE ACCOUNTING TEST REPORT

Sobek Method

Client: **BYG Natural Resources Ltd**
110 Industrial Rd.
Whitehorse, Yukon
Y1A 2T9

Date: 16-Nov-98
Project: 98-034

Attention: **Ms. Gordana Vicentijevic**

Sample I.D.	% Total Sulfur	% Sulfate Sulfur	Paste pH	Acid Potential	Neutralization Potential (NP)		
					Actual	Ratio	Net
F4 Flotation tails	0.42	0.34	7.9	2.50	3.4	1.38	0.9
F4 Flot. tails (duplicate)					3.7		

Boja Grcic
Senior Chemist

Notes:
1. Analytical procedures from 'Field and Laboratory Methods Applicable to Overburden and Minesoils'. EPA 600/2-78-054, 1978. pp. 48-55.
2. Actual NP = Neutralization potential as determined by Sobek acid consumption test.
3. Acid potential = (% total sulfur - % sulfate sulfur) X 31.25
4. NP Ratio = Actual NP / Acid potential
5. Net NP = Actual NP - Acid potential
6. The acid potential and the neutralizing potentials are expressed in Kg $CaCO_3$ equivalent per tonne of sample.
7. Samples with negative Net NP are potential acid producers

1. **APPLICATION**

   1.1 Schedule IV and letter, 28.12.98
   1.2 Clarification of Application, 9.2.99

2. **PUBLIC NOTICES**

3. **CORRESPONDENCE - BOARD TO APPLICANT**

4. **CORRESPONDENCE - APPLICANT TO BOARD**

5. **INTERVENTIONS**

6. **CORRESPONDENCE - BOARD TO INTERVENORS & TO ALL PARTIES**

7. **CURRENT/PREVIOUS WATER USE LICENCE(S)**

   7.1 Office Compilation of Water Use Licence QZ94-004, as of Feb/98

8. **EXHIBITS ENTERED AT PUBLIC HEARING**

9. **ENVIRONMENTAL ASSESSMENT (CEAA)**

10. **DECISION**

11. **TRANSCRIPT OF PUBLIC HEARING**

12. **OTHER**

B.Y.G.
NATURAL RESOURCES INC.

YUKON TERRITORY
WATER BOARD
1998 DEC 29 A 9:35
RECEIVED
APPL. NO QZ98-035

December 28, 1998

Mr. Ron Johnson
Chairperson, Yukon Territory Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A 3V1

RE: APPLICATION FOR AN AMENDMENT TO LICENSE QZ94-004

Dear Sir:

I am requesting an amendment to our water license to reflect our ability to float sulfidic materials from our tailings.

The proposed installation of a flotation plant capable of floating the sulfidic materials from tailings containing up to 700 tonnes per day of solids will give BYG the ability to produce a tailings product lacking any ability to produce acid and which is in actual fact a consumer of acid. (see attached report appendix 1.)

The original constraint contained in the Water Licence, of placing all tailings materials at least one metre below the spillway invert, was put in place to deal with the expected sulfidic nature of the lower part of the Brown McDade pit. This sulfidic nature gives the tailings from this part of the pit an ability to generate acid upon the oxidation of the sulfide content.

The last one metre was to be filled with water, to reduce the access of oxygen to the sulfidic content of the tailings, the reduced access of oxygen would have slowed the rate of oxidation of the sulfides, which would therefore have lessened the rate of the formation of acids and consequently the rate of their discharge to the environment.

By utilising this volume for the placement of an acid consuming material the access of oxygen is further reduced (appendix 2) and any possibility of acid being discharged to the environment is reduced to zero.

The one metre at the top of the tailings impoundment to the bottom of the spillway invert, has a volume of approximately 80,000m^3.

At a specific gravity of 1.46 tonne per cubic metre this would enable us to deposit a further 116,800 tonnes of ore in the present tailings facility.

General Delivery, Carmacks, Yukon Territory Y0B 1C0 tel: 867 863 59136 fax: 867 863 6028 e-mail byg@unix.infoserve.net

For the December 28th application: "deposit tailings in the volume of the tailings facility up to the level of the bottom of the spillway invert".

Change Requested

PART C – DESIGN, CONSTRUCTION AND MODIFICATION

17.

c) The tailings impoundment shall be equipped with an emergency spillway. The volume of the impoundment from one meter below the spillway invert to the invert itself may be filled with tailings which have been shown to be neutral or acid consuming.

I hope this is what you required, if any further information is needed please do not hesitate to call me at 867 863 5913.

Yours truly,

Graham C. Dickson,
President, B.Y.G. Natural Resources Inc.

General Delivery, Carmacks, Yukon Territory Y0B 1C0 tel: 867 863 59136 fax: 867 863 6028 e-mail byg@unix.infoserve.net

B.Y.G.
NATURAL RESOURCES INC.

YUKON TERRITORY
WATER BOARD
1999 FEB -9 A 8:35
RECEIVED fax
APPL. NO QZ94-004
QZ98-033 &
QZ98-035

9th February 1999

Mr. Dale Eftoda, Chair
Yukon Territory Water Board
Suite 106, 419 Range Road
Whitehorse
YT Y1A 3V1

By Facsimile: 867 668 3628 & e-mail: doeringj@inac.gc.ca

Dear Mr. Eftoda:

I am writing in response to a request from Judy Doering to provide in greater and exact detail the changes we are requesting in the wording of the Water License QZ94-004.

For the November 23rd application: "ore from the Flex Zone be included in the list of materials we are allowed to process and deposit in the tailings facility".

Change Requested

Part D – OPERATING CONDITIONS

20. Water Use and Deposit

The Licensee is hereby authorized

c) To modify and existing mill facility, to operate that mill facility for the processing of oxide ores from a deposit known as the Brown McDade deposit and from such tailings and waste dumps that are in existence on the effective date of this License and which have been identified in application QZ94-004 and which are amenable to cyanide extraction and also for the processing of ore from other ore bodies on the property in such a manner as to produce tailings that are either neutral or acid consuming.

General Delivery, Carmacks, Yukon Territory Y0B 1C0 tel: 867 863 59136 fax: 867 863 6028 e-mail byg@umx.mfoserve.net

The amendment would not increase the hydrostatic pressure on the dam.

I am therefore requesting an amendment allowing us to deposit tailings in the volume of the tailings facility up to the level of the bottom of the spillway invert.

I thank you in advance for your attention to this matter and hope that I can receive an early answer to this request.

Yours truly,

Graham C. Dickson
President, B.Y.G. Natural Resources Inc.

Q298-035

General Delivery, Carmacks, Yukon Territory Y0B 1C0 tel: 867 863 59136 fax: 867 863 6028 e-mail byg@unix.infoserve.net

ACID BASE ACCOUNTING TEST REPORT

Sobek Method

Client: **BYG Natural Resources Ltd**
110 Industrial Rd.
Whitehorse, Yukon
Y1A 2T9

Date: 16-Nov-98
Project: 98-034

Attention: Ms. Gordana Vicentijevic

Sample I.D.	% Total Sulfur	% Sulfate Sulfur	Paste pH	Acid Potential	Neutralization Potential (NP)		
					Actual	Ratio	Net
F4 Flotation tails	0.42	0.34	7.9	2.50	3.4	1.38	0.9
F4 Flot. tails (duplicate)					3.7		

Boja Grcic
Senior Chemist

Notes:
1. Analytical procedures from "Field and Laboratory Methods Applicable to Overburden and Minesoils", EPA 600/2-78-054, 1978. pp. 48-55.
2. Actual NP = Neutralization potential as determined by Sobek acid consumption test.
3. Acid potential = (% total sulfur - % sulfate sulfur) X 31.25
4. NP Ratio = Actual NP / Acid potential
5. Net NP = Actual NP - Acid potential
6. The acid potential and the neutralizing potentials are expressed in Kg $CaCO_3$ equivalent per tonne of sample.
7. Samples with negative Net NP are potential acid producers

Q298-035

APPENDIX 2.

Diffusion of Oxygen to the Tailings Surface:

With one metre of water above the tailings the rate of diffusion to the surface of the tailings can be calculated from:

The concentration of oxygen at the surface of the pond C_p

The concentration of oxygen at the surface of the oxygen consuming /acid generating tailings C_t

The distance from the oxygen consuming /acid generating tailings surface to the pond surface δ

The surface area available for diffusion per unit surface area **A**

The diffusion coefficient of oxygen Δ_o

The rate of diffusion = $\Delta_o A (C_p - C_t) / \delta$

With δ equal to 100 cm, C_t at a value of zero and **A** equal to one this becomes:

The rate of diffusion = $\Delta_o C_p / 100$

With one metre of acid consuming tailings replacing the one metre of water diffusion to the acid generating tailings can be calculated from:

The rate of diffusion = $\Delta_o A (C_p - C_t) / \delta$

In this case A can be calculated from the volume of liquid contained in 1 m3 of tailings

SG of ore 3.0 tonnes per cubic metre. SG of tailings 1.46 tonnes per cubic metre.

Water in one cubic metre of tailings = 1 - 1.46/3 = 0.51

With δ equal to 100 cm, Ct at a value of zero and A equal to 0.51 this becomes:

The rate of diffusion = $\Delta_o C_p / 51$

Q298-035.

General Delivery, Carmacks, Yukon Territory Y0B 1C0 tel: 867 863 59136 fax: 867 863 6028 e-mail byg@unix.infoserve.net

Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

Environment Directorate
DIAND
345 - 300 Main Street
Whitehorse, Yukon
Y1A 2B5

YUKON TERRITORY
WATER BOARD
1995 JUN 28 P 1:28
REC'D
APPL. NO. 0297-004

CANADA REMEMBERS
LE CANADA SE SOUVIENT

Your file Votre référence

Our file Notre référence

June 28, 1995

Mr. Paul Hunter,
Chairman,
Yukon Territory Water Board
Suite 200, 4114 - 4th Ave.,
Whitehorse, Yukon, Y1A 4N7

Dear Mr. Hunter:

RE: STATUS OF EARP SCREENING CLASS B WATER LICENCE APPLICATION - VICTORIA CREEK CROSSING, B.Y.G. MT. NANSEN

This letter is to advise you as to the status of the environmental assessment of B.Y.G.'s Type B Water licence application for the Victoria Creek crossing. I am aware of a letter from Judi Doering to Cornett, Von Finster, and MacKenzie-Grieve dated April 12, 1995 that stated that the Board would be dealing with this application separately from the quartz mining application. I wanted to take this opportunity to ensure there is no misunderstanding regarding the environmental assessment of the Victoria Creek crossing water licence application.

I would draw your attention to a letter dated April 19, 1995 from Dan Cornett to RERC members, and copied to Judy Doering, which stated that the screening underway for the Mt. Nansen mining project would incorporate comments received for the Victoria Creek crossing as part of the overall project screening. This position was also stated in a letter dated May 25, 1995 from Dan Cornett to yourself.

The RERC review of the BYG mining project includes the various components that are directly linked to the mining and milling development. This includes the Victoria Creek crossing. As the creek crossing is an integral part of the overall mining project, we are unable to make a separate EARPGO screening decision for the creek crossing only. The decision on this aspect of the development will be incorporated into the overall project screening and decision report which we

Canada

Exhibit IX C)

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will provide to you as soon as they are completed. As you are aware, the completion of our screening report is pending submission of further information from B.Y.G. regarding their tailings dam. Thank you for your understanding in this matter and if you have any questions please call me at 667-3250, or Kevin McDonnell at 667-3864.

Marg Crombie

Marg Crombie,
Chair, Regional Environmental Review Committee

cc. Jim Smith,
Mike Ivanski,
Dan Cornett,
J. Hough,
G. Mackenzie-Grieve,
G. Faulkner,
C. Cuddy.

Exhibit 1(c)

Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

Environment Directorate,
Northern Affairs Program, DIAND
345-300 Main St.
Whitehorse, Yukon Territory
Y1A 2B5

YUKON TERRITORY
WATER BOARD
1995 NOV 17 A 10: 13
Ext. Mail
Q295-004

Your file / Votre reference

Our file / Notre reference
5510-4-8

November 16, 1995

To: Public Distribution List for BYG/Mt. Nansen Project

Re: EARP Screening Report - Mt. Nansen Resources Ltd. Gold Mine Project

Please find attached the Screening Report, dated November 15, 1995 resulting from the environmental assessment carried out under the federal Environmental Assessment and Review Process Guidelines Order (EARPGO) of BYG, Natural Resources Inc. Gold Mine Project. If you have any comments in relation to the Screening Report, I would ask that you submit them in writing to Director of Environment Directorate, Northern Affairs Program, DIAND, Room 330, 3rd floor Elijah Smith Building, 300 Main Street, Whitehorse, Yukon, Y1A 2B5. Comments should be submitted no later than December 15, 1995 and will be considered in development of DIAND's Decision Report on this project.

Copies of this Screening Report and further information regarding the environmental assessment process are available at:

- Communication Services, Northern Affairs Program, Room 410 Elijah Smith Building, 300 Main Street, Whitehorse; and
- the Carmacks District Field Operations Office, Northern Affairs Program

The Report is available for viewing at:

- DIAND Library, 3rd Floor, Elijah Smith Building, Whitehorse;
- Whitehorse Public Library, 2nd Avenue, Whitehorse;
- Carmacks Library, Carmacks Yukon
- The Council for Yukon First Nations, ll Nisutlin Drive, Whitehorse; and
- Little Salmon Carmacks First Nation, Carmacks
- Selkirk First Nation, Pelly Crossing
- Na-Cho Ny 'a'k Dun First Nation, Mayo

Exhibit IX b)

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Pursuant to Section 12(c) of EARPGO, the Regional Environmental Review Committee (RERC) has recommended that:

"the potentially adverse environmental effects that may be caused by the proposal are insignificant or mitigable with known technology, in which case the proposal may proceed or proceed with the mitigation as the case may be".

Thank you for your interest in this project. If you have any questions in relation to this screening, you may either contact myself at (667-3250) or Kevin McDonnell (Project Manager, Environment Directorate, NAP) at 667-3864.

Yours truly,

Marg Crombie

Marg Crombie
Chair, Regional Environmental Review Committee
Environment Directorate, Northern Affairs Program,
Department of Indian Affairs & Northern Development

Attachment: 1995 Screening Report

cc.
- J. Smith V-President Operations, BYG
- RERC Members - BYG Project
- M. Ivanski, Regional Director General, DIAND, Yukon Region
- L. Craig, Associate Regional Director General, DIAND Yukon Region
- K. McDonnell, Project Manager, Environment Directorate, NAP, DIAND
- J. Wolchuck, RMO, Carmacks
- M. Vance, Little Salmon/Carmacks First Nation
- D. Isaac, Selkirk First Nation
- B. Germaine, Na-Cho Ny'a'k Dun, Mayo
- Yukon Conservation Society
- Yukon Chamber of Mines
- Communication Services, Northern Affairs Program, DIAND
- DIAND Library, 3rd Floor, Elijah Smith Building
- Whitehorse Public Library,
- Carmacks Library
- The Council for Yukon First Nations, Whitehorse
- CBC Yukon, Whitehorse
- CHON-FM Radio, Whitehorse
- CKRW Radio, Whitehorse
- Whitehorse Star, Whitehorse
- Yukon News, Whitehorse
- Yukon Territory Water Board

Exhibit 1X b)

SCREENING REPORT:

B.Y.G. Natural Resources Inc.'s

Mount Nansen Gold Mine Project

Prepared Pursuant to the

Environmental Assessment and Review Process Guidelines Order, 1984

Prepared by

Regional Environmental Review Committee and

Department of Indian Affairs and Northern Development

Whitehorse, Yukon Territory

November 15,1995

Exhibit 1 b)

6.12.2 Baseline Climatic Data 23
6.13 Decommissioning Plan. 23
6.14 Control of Hunting in Project Area 25
6.15 Security Deposit. 25

7.0 CONCLUSION 26

8.0 RECOMMENDATION 26

LIST OF APPENDICES.

Appendix 1: RERC Membership 28
Appendix 2: Chronological Summary of Key Events Related to the Environmental Assessment of the Mount Nansen Project . . . 29
Appendix 3: References 34

LIST OF FIGURES

Figure 1: Project Location 36
Figure 2: Regional Location of Mount Nansen Project 37

b)

IX

as a Level II review.

DIAND carries out Level II screening with the assistance of the Regional Environmental Review Committee, or RERC. RERC is chaired by the DIAND Director of Environment and is comprised of representatives of federal and territorial government departments, the Council for Yukon First Nations and Yukon First Nations directly affected by project proposals (Appendix 1).

The assessment process is initiated by the submission of a Project Overview. RERC's evaluation of the Project Overview often results in a request for the preparation of more detailed information in the form of an Initial Environmental Evaluation (IEE). An IEE is a documented evaluation of the proposed Project, providing detailed information regarding the Project's potential environmental and related socio-economic impacts. RERC members will evaluate the adequacy of the information and the proposed mitigation measures. Based upon the information provided, RERC members will make recommendations to DIAND as to whether the Project may proceed or not. RERC may also make recommendations on mitigation.

A Screening Report based on the IEE is prepared by DIAND under the *EARPGO*, and contains recommendations for review by DIAND senior management. The Screening Report may recommend:

- the environmental and related socio-economic impacts of the proposal are insignificant or mitigable with known technology and the project may proceed to the regulatory level (and may include recommendations on mitigation measures);

- the impacts are unknown and call for the proposal to be reassessed and re-screened, or for the proposal to be referred to an EARP Panel;

- the proposal's impacts are significant and should be referred for review by a full EARP Panel; or

- the impacts of the proposal are unacceptable and the proposal should be rejected.

For more information on the Level I and II EARP processes please refer to the DIAND publications:

"The Environmental Assessment and Review Process (EARP) Yukon Region"

"The Environmental Assessment and Review Process Level I Screening: Yukon Region"; and

b)

had submitted their Initial Environmental Evaluation (IEE) and that it was available for public review. The letter also provided information regarding the environmental assessment process and invited members of the public to submit any comments or concerns about the project. The IEE was made available at the Whitehorse and Village of Carmacks Libraries, Selkirk and Little Salmon / Carmacks First Nation Offices, the DIAND office in Carmacks and DIAND library in Whitehorse.

DIAND encouraged B.Y.G. to carry out, and document, a public consultation program. B.Y.G. documented the consultation they carried out in Section 9 of their IEE. This included meetings with Little Salmon / Carmacks First Nation, and the local Village of Carmacks government. On February 21, 1995 B.Y.G. hosted a public meeting in Carmacks which DIAND attended.

DIAND may also hold a public meeting if interested members of the public so desire. At such a meeting, there would be an opportunity for members of the public to ask questions about the project and express any concerns in relation to the EARP review of the project and for DIAND to summarize its findings and recommendations. Public concerns are then considered prior to DIAND making it's final determination on the project. As no significant public concerns were raised at the public meeting held by B.Y.G., nor were any other public concerns identified to DIAND during the assessment, a DIAND sponsored public meeting was not held.

3.2 Consultation with First Nations

The B.Y.G. Project proposal falls within the traditional territory of the Little Salmon/Carmacks First Nation. The Little Salmon/Carmacks First Nation, Council for Yukon First Nations, Selkirk First Nation, and Northern Tutchone Council are represented on the RERC and were provided all RERC correspondence, invited to attend RERC meetings, and were given the opportunity to identify and submit their concerns. In addition, DIAND provided contribution funds to assist Selkirk First Nation in their review. DIAND staff had meetings and telephone conversations with First Nation representatives to solicit and clarify concerns. The concerns raised by the First Nations have been incorporated into this Screening Report.

4.0 CHRONOLOGY

In 1988 and 1989, B.Y.G. approached DIAND and RERC with a Exploration and Development Overview for the Mt. Nansen Property. However during the next few years, B.Y.G. put the project on hold pending better metal prices and financing.

In June 1994, B.Y.G. submitted their Mount Nansen Project Overview to DIAND.

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IX

was constructed and it was operated during the periods 1966-1967 and 1976-1977. The mill, much of the support plant, and two small tailings ponds containing waste from production activities remain on site.

B.Y.G. Natural Resources Inc. acquired the properties and combined them with additional claims to form the current property in 1984. In conjunction with Chevron Minerals, B.Y.G. carried out an exploration program between 1985 and 1989. B.Y.G. currently owns 100% of the Mount Nansen project, subject to royalties.

5.3 Mine Plan Summary and Scheduling

B.Y.G. plans to mine approximately 300 tonnes of gold-bearing oxide ore per day using open pit mining methods. Oxide ore will be excavated from the open pit, trucked and dumped in the run-of-mine ore stockpile. From here it will be reclaimed by front end loader, dumped through a grizzly to a dump hopper and fed by conveyor to the coarse ore bin. Coarse ore would discharge onto a conveyor belt feeding the primary crushing circuit and then transferred via conveyor to the fine ore bins. Fine ore would be transferred to secondary crushing and grinding, followed by thickening prior to cyanidation.

The existing on-site mill would be converted to a process involving cyanidation, carbon adsorption (using the carbon in pulp method), carbon elution and zinc preparation. This process is referred to for simplicity elsewhere in this report as the carbon-in-pulp or CIP process. The resulting sludge would then be fluxed and smelted to produce dore bullion. The CIP tailings would be treated to destroy cyanide prior to discharging to the tailings containment area.

Based on proven reserves, the project life is about four years, including one year of preproduction work. B.Y.G. considers extension of mine life likely through development of additional oxide ore deposits, or if viable metallurgical processes are developed to allow for development of sulphide ore on the property.

B.Y.G. estimates that infrastructure and construction activities necessary prior to start-up would take 4 - 6 months and would include:

- Construct a 50 person kitchen-bunkhouse complex (establish bunkhouse and cafeteria, renovate offices, provide water, power, sewage, telephone services);

- Retrofit the existing flotation mill to a cyanidation/carbon-in-pulp (CIP) gold recovery circuit capable of processing 300 tonnes/day of oxide ore from the Brown-McDade ore zone;

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IX

information should be submitted to the Water Board by B.Y.G. in support of it's water licence application. This information should be submitted for the following reasons:

1) It will identify how the proposed mitigative measures will be constructed and implemented;

2) The information submitted in support of the water licence application can be assessed and recommendations made to the Water Board for their consideration when preparing the water licence; and

3) The development of licence conditions based upon detailed information will enable effective enforcement of the water licence such that mitigative measures will be implemented.

B.Y.G.'s Proposed Mitigation:

B.Y.G. has provided the information as listed in Appendix 3: References, and has committed to providing additional information and plans as discussed in this report.

RERC Recommendation:

In the water licence application, B.Y.G: should provide:

- Detailed Design or Construction Drawings;
- Detailed Construction Quality Assurance (CQA) / Construction Quality Control (CQC) manual for the tailings system and diversions, waste dumps and treatment ponds;
- Design Criteria Report;
- Detailed Operations Plan;
- Solution Management Plan;
- Operational Monitoring Plan;
- Waste Rock Management Plan; and
- Emergency Response and Spill Contingency Plan.

The tailings dam and associated facilities should be constructed and operated according to approved CQA/CQC manual and operating plan.

residues, suspended solids, or dissolved metals. The passage of water through the adit is also of concern since there are some sulphidic materials in the adit and water flowing through the adit may result in ARD conditions and mobilize metal contaminants.

Furthermore, one of the methods proposed by B.Y.G. to prevent the generation of ARD at the pit floor and wall is to allow the pit to fill with water, which may not happen if sufficient amounts of pit water seep through the pit floor.

B.Y.G.'s Proposed Mitigation:

B.Y.G. stated that they will install a concrete bulkhead in the Brown-McDade adit if water seeps out of the adit. This bulkhead will be designed to prevent passage of any seepage through the adit which may contaminate surface and subsurface waters.

The backup of waters behind the bulkhead will also allow the pit to fill with water, preventing the development of ARD conditions in the pit.

RERC Recommendation:

In the Water Licence Application, B.Y.G. should submit a plan which includes

- program to monitor quantity and quality of seepage from the Brown McDade adit; and
- triggers and contingencies in the event that monitoring shows that seepage of unacceptable quality is being or will be discharged from the adit.

If the adit hasn't been plugged by the time the final decommissioning plan is due, B.Y.G. should identify in the plan long term monitoring for seepage of pit water to the adit, and triggers and contingencies including plugging the adit.

The cost of plugging the adit should be included in the security deposit until the adit is plugged or it can be clearly shown that there will be no need to plug the adit.

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6.5 Tailings Impoundment Facility

6.5.1 Thaw Settlement

Issue / Potential Impact:

The region in which the mine is located lies within the discontinuous permafrost zone and B.Y.G.'s studies indicate that the entire minesite, including the tailings impoundment facility, is underlain by discontinuous permafrost.

The presence of frozen soil under the dam may pose problems since the temperature of the permafrost is only slightly below zero, and slight changes to the thermal properties of the ground may result in thawing of the permafrost. Depending upon soil properties, moisture content and design factors, if thawing did occur it could result in unstable foundation conditions for the dam or lowering of the dam crest such that overtopping occurs. Unstable dam foundation conditions or overtopping could lead to failure of the dam and loss of tailings and pond water to the environment.

The key issue with respect to the stability, design, and expected performance of the tailings dam is whether it will remain stable if the foundation thaws.

B.Y.G.'s Proposed Mitigation:

B.Y.G. collected and submitted further information ("Tailings Impoundment Final Design Report", August, 1995) with respect to the dam and associated infrastructure which included information on:

- site selection;
- the geotechnical conditions at their proposed site;
- dam design details including thermal, thaw settlement, and seepage analyses;
- details regarding hydrology and water management (eg. water balance; design details for the diversion channel, emergency and closure spillways);
- Performance monitoring plan including a field monitoring program.

B.Y.G. estimates that the dam crest would settle by 0.6 m during the three years of operation as a result of thawing of foundation materials. Following construction, B.Y.G. proposed the dam crest elevation to be 1151.5 m. After three years, B.Y.G. anticipates the dam crest to be 1150.9 m (1151.5

6.5.2 Seepage

Issue / Potential Impact:

Seepage of water from the tailings impoundment facility is of concern for two reasons:

- High rates of seepage may be indicative of thawing of foundation soils, and may affect the stability of the dam foundation through development of thaw induced pore pressures, differential settlement, piping or loss of material at the toe; and

- There is a potential for seepage of water containing contaminants from the tailings impoundment facility to the downstream environment (i.e. Dome Creek) since all dams seep to some extent.

B.Y.G.'s Proposed Mitigation:

To address the concern with seepage and implications to dam stability, B.Y.G. has proposed in the performance monitoring plan to install and monitor piezometers in the embankment and foundation zones which are unfrozen. This will assist in determining seepage through the dam and will allow measurement of actual thaw-induced pore pressures for stability assessment.

To address the possibility of seepage through the tailings and dam, B.Y.G. submitted particle size analysis test results of the tailings in order to provide RERC with further information regarding potential seepage rates of pond water through the tailings and dam foundation.

To minimize seepage through the dam, B.Y.G. proposed to:

- construct a geosynthetic clay liner on the upstream face of the dam. This liner would be intended to minimize potential seepage during the pond construction, when water will be ponded against the upstream slope prior to tailings deposition;

- develop a tailings beach of fine materials on the upstream face of the dam. The thickness of the tailings will increase throughout the life of the mine; and

- construct a seepage recovery pond downstream of the tailings pond. Any seepage would be collected in this pond and be pumped back to

1x b)

RERC Recommendations:

The performance monitoring and field monitoring program should include monitoring for liquefaction potential and identify the trigger that will initiate contingencies. The contingencies, such as construction of a toe berm should be identified.

The final decommissioning plan should include the results of the review of the seismic stability including the design earthquake and SPT data from thawed zones (if any). Proposed actions and rationale based upon the results should also be included in the decommissioning plan.

6.6 Diversion Channel, Emergency Spillway, Temporary Diversion Ditch

6.6.1 Diversion Channel

Issue / Potential Impact:

The proposed tailings dam site is located in the Dome Creek valley. Uncontrolled water flow inputs into the tailings dam via Dome Creek would be unadvisable for reasons which include water management problems; increased head in dam which may increase seepage rates and stability concerns; outflow of pond water via the spillway, and a corresponding need to treat water.

B.Y.G.'s Proposed Mitigation:

In order to control the flow of water into the tailings dam, B.Y.G. has stated that a diversion channel will be constructed to divert the flow of Dome Creek around the tailings pond to the north and then rejoin Dome Creek downstream of the pond. B.Y.G. proposed to monitor the diversion channel, especially in the spring, to ensure that water is properly conveyed through the channel.

RERC Recommendation:

Detailed designs and CQA/CQC for the diversion channel should be provided in the water licence application.

1 x b)

levels in Dome Creek.

RERC Recommendation:

Construction, operation and abandonment of the temporary diversion ditch should be to appropriate engineering standards and the potential for erosion minimized.

6.7 Tailings Acid Rock Drainage (ARD)

Issue / Potential Impact:

B.Y.G. has stated that tailings from the Brown-McDade oxide ore have a slight negative net neutralizing potential which means that they have the potential to generate acid. There is a concern that ARD conditions in the tailings will release heavy metals to the pond water and the water will require treatment prior to discharge to the environment, possibly for long after the mine has closed.

B.Y.G.'s Proposed Mitigation:

B.Y.G. notes that because of the low sulphide content and fine particle size of the tailings, ARD conditions should not develop. B.Y.G. has proposed to conduct monthly Acid Base Accounting static tests on the tailings, and, if the tailings demonstrate ARD potential then kinetic tests will be conducted to verify the theoretical results. If the kinetic tests determine that acid generation is still a concern then the tailings will either be permanently flooded at abandonment, or covered with sufficient overburden to prevent ARD.

RERC Recommendation:

A detailed study plan which includes objectives, methodology, triggers and action plans, scheduling, and reporting should be included as part of the water licence application. The study plan should address the sampling and analysis of tailings samples for ARD potential by static and kinetic tests. Sampling and assessment of tailings should be ongoing during the life of the mine.

In their water licence application B.Y.G. should propose contingency measures such as special milling strategies and restoration options in the event that tailings with ARD potential are generated, as determined by the detailed study plan.

b)

submerge the tailings and to cover any exposed beaches with overburden. Due to the fine particle size of the tailings, B.Y.G. notes that the diffusion of arsenic from the tailings to the impounded water would be slow. B.Y.G. provided particle size analysis test results of the tailings to demonstrate that the tailings have a low permeability. Covering the exposed tailings will prevent runoff water from flushing the arsenic from the tailings.

RERC Recommendation:

The commitments made by B.Y.G. should be incorporated into the water licence. A detailed study plan on the treatment of arsenic in the tailings and pond water, which includes objectives, methodology, triggers and action plans, scheduling, and reporting should be submitted as part of the water licence application.

The final decommissioning plan should identify how the tailings will be abandoned, considering the potential for arsenic solubilization from the tailings.

The cost of decommissioning the tailings to prevent arsenic solubilization should be included as part of the security deposit until it can be shown that the tailings will not solubilize arsenic, or that the tailings have been adequately decommissioned.

6.9 Effluent quality

Issue / Potential Impact:

The tailings pond water will contain cyanide, ammonia and metals, and it will require treatment before discharge to the environment. There is a concern regarding the need for B.Y.G. to conduct additional studies before finalizing the effluent treatment process.

B.Y.G.'S Proposed Mitigation:

B.Y.G. has proposed to treat the tailings slurry using the SO_2 air process to reduce cyanide levels in the tailings slurry prior to discharge to the tailings impoundment facility. Excess reclaim water would be treated using sulphur dioxide and air, or possibly hydrogen peroxide, to destroy residual cyanide, and ferric sulphate and a clarifier to precipitate arsenic. Treated effluent will be discharged to a polishing pond prior to release to Dome Creek. B.Y.G. states that it will not have to discharge effluent for two years after mill start-up. During this time and once equilibrium conditions have been reached

IR b)

B.Y.G.'S Proposed Mitigation:

B.Y.G. has committed to implement a Water Balance Contingency Plan to ensure that adequate data is collected to update the water balance and make decisions regarding changes to operating plans. During the first year of operation, the water balance would be revised on a monthly basis and the Water Balance Contingency Plan will include potential measures for correcting the water balance through reductions in inputs to the system, increased recycle, or other measures. B.Y.G. proposed to submit the plan by December 31, 1995.

RERC Recommendation:

In the water licence application B.Y.G. should provide a monitoring plan for the collection of data to be used to update the water balance model. B.Y.G. should confirm when the Water Balance Contingency Plan will be submitted to the Board. The Water Balance Contingency Plan should be submitted to the Board for review and approval.

6.12 Victoria Creek Crossing

The gravel access road (Nansen Creek Road) to B.Y.G.'s minesite crosses Victoria Creek. The road is currently used by B.Y.G. employees and members of the public. Vehicles ford the Creek at a point where the Creek flows across a gravel flood plain and such usage is expected to increase. The road is B.Y.G.'s primary access and B.Y.G. wishes year-round, secure access, which causes minimal disruption to the environment.

B.Y.G. proposes to construct and install a culvert at Victoria Creek. Their proposed crossing was designed to allow passage of runoff from a two-year storm event; allow the passage of fish; and allow passage of a flood greater than the design by flow over a low section of the road.

6.12.1 Archaeological / Heritage Resources

One archaeological site has been identified in the Victoria Creek crossing area. There is a potential to impact the archaeological site as a result of the upgrading of the Victoria Creek Crossing through fill extraction or other activities.

B.Y.G.'s Proposed Mitigation:

None proposed.

18 b)

surrounding mine reclamation strategies. During the operating life of the mine, the company proposes to undertake a number of studies to resolve uncertainties and develop reclamation measures. These studies and monitoring plans should be considered when developing the final decommissioning plan.

There is a concern that due to the short mine life and need to complete detailed studies before finalizing reclamation plans, that a detailed final reclamation plan will not be ready by mine closure.

B.Y.G.'S Proposed Mitigation:

B.Y.G. has stated in their addendum that a revised reclamation plan will be assembled after one year of operation, and a final reclamation plan will be submitted to the Water Board by December 31, 1996.

RERC Recommendation:

B.Y.G. should submit to the Water Board for review and approval, a final site decommissioning plan.

The decommissioning plan should include but not be limited to the following items:

- the results of reclamation studies that B.Y.G. has done;
- the results of the tailings monitoring program, and any other monitoring which may have implications to decommissioning;
- final design and supporting information for the construction of a permanent spillway assuming probable most adverse ground conditions;
- Detailed engineered designs and quality control / assurance procedures for decommissioning and abandoning the project; and
- post-decommissioning monitoring requirements of the tailings and dam, and any other potential sources of contamination to the environment.

As part of the water licence application, B.Y.G. should provide a schedule that identifies what studies are being done, when they will be completed, and confirm when the final decommissioning plan will be submitted.

b)

Inc. to cover the environmental liability associated with the Mount Nansen Project. This should include, but not be limited to, the costs associated with plugging the adit and decommissioning the tailings facility to ensure physical and chemical stability.

DIAND and the Water Board should review the amount of financial security so that there is adequate financial security available to ensure that reclamation can be carried out.

The security should be in place within a reasonable, specified time after issuance of the Water Licence. Security should be included as a term and condition of the Water Licence.

The security should be accessible to the Government of Canada.

7.0 CONCLUSION

The Regional Environmental Review Committee has concluded its review of the information provided by B.Y.G. Natural Resources Inc. regarding the Mount Nansen mine project and recommends that the proposal, with mitigation measures identified in the documents submitted by B.Y.G. and the recommendations and mitigation measures set forth in this report, can proceed to the regulatory process for issuance of the necessary authorizations.

8.0 RECOMMENDATION

It is recommended that B.Y.G.'s proposal, as outlined in this Screening Report, and as presented in B.Y.G.'s IEE and IEE Addendum submissions in response to the RERC, meets the requirements of the Environmental Assessment and Review Process Guidelines Order under Section 12 © specifically:

Section 12 © "the potentially adverse environmental effects that may be caused by the proposal are insignificant or mitigable with known technology, in which case the proposal may proceed or proceed with the mitigation, as the case may be".

b)
IX

Appendix 1: RERC Membership

Federal Government:

- Northern Affairs Program, Department of Indian Affairs and Northern Development:
    - Environment Directorate
    - Land Resources
    - Economic Development
    - Water Resources
    - Exploration and Geological Services
    - Mineral Development
- Department of Fisheries and Oceans
- Environment Canada
- Health and Welfare Canada

Yukon Government:

- Yukon Worker's Compensation Health and Safety Board (Mine Safety)
- Transportation Planning and Programming, Community and Transportation Services
- Community Services Branch, Community and Transportation Services
- Economic Development, Economic Policy Planning and Research Branch
- Heritage Branch, Department of Tourism
- Environmental Assessment, Department of Renewable Resources

First Nations:

- Northern Tutchone Council
- Selkirk First Nation
- Little Salmon Carmacks First Nation
- CYFN

Other:

- Village of Carmacks

b)
IX

May 31, 1994	DIAND requested B.Y.G. to submit a Project Overview and sent B.Y.G. a copy of Generic Initial Environmental Evaluation (IEE) Guidelines; a chronology of the Mt. Nansen Project; and further information.
June 16, 1994	DIAND met with B.Y.G. to discuss RERC review, mining plans, IEE information requirements, Project Overview, public consultation. B.Y.G. submitted a Project Overview.
August 3, 1994	RERC meeting at which B.Y.G. representatives presented the project.
September 16, 1994	B.Y.G. submitted "Laboratory Evaluation of the Inco SO_2 ... Process ..." which summarized test results from the Inco SO_2 air process treatment of carbon-in-pulp tailings.
October 25, 1994	RERC sent draft Initial Environmental Evaluation (IEE) Guidelines for the Mount Nansen Project to B.Y.G.
November 10, 1994	DIAND sent final IEE Guidelines to B.Y.G.
November 22, 1994	B.Y.G. submitted their two-volume IEE.
November 23, 1994	RERC meeting with B.Y.G. representatives to discuss their IEE submission.
February 21, 1995	A public information session, hosted by B.Y.G., was held in Carmacks regarding the Mount Nansen Project.
February 22, 1995	A RERC meeting with B.Y.G. representatives occurred to discuss B.Y.G.'s IEE submission and RERC members' concerns with it.
March 1, 1995	DIAND and B.Y.G. met in Vancouver to discuss outstanding (i.e. geotechnical) issues.
March 21, 1995	RERC sent the IEE response letter to B.Y.G.
March 21, 1995	B.Y.G. submitted their Water Licence Application for the mine and mill development proposal

b)

June 5, 1995	Chair, RERC sent B.Y.G. a letter in response to B.Y.G.'s recent submissions (eg. Addendum Report; Tailings Impoundment -- Feasibility Design Update) which included DIAND's (June 2, 1995) geotechnical report in relation to B.Y.G.'s May 25 submission.
June 6, 1995	Yukon Territory Water Board hearing took place in Whitehorse. Because the EARP screening was not completed, DIAND, Environment Canada and Department of Fisheries and Oceans did not participate.
June 6, 1995	DIAND and B.Y.G. met to discuss status of EARP review.
July 10, 1995	B.Y.G. submitted their Final Draft Reclamation Review.
July 18, 1995	Chair, RERC and Project Officer had a meeting with Selkirk First Nation in Pelly and Little Salmon Carmacks First Nation in Carmacks to discuss the project.
July 26, 1995	A letter was received from B.Y.G. regarding the control of hunting in the project area.
July 27, 1995	A Preliminary Draft Screening Report excluding assessment of tailings dam and associated facilities was distributed to proponent and RERC for review and comment.
August 14, 1995	B.Y.G. submitted their Tailings Impoundment Final Design Report.
August 14, 1995	A letter was sent by the RERC Chair to B.Y.G. advising them not to proceed with the proposed construction at this time as it did not meet the terms of the Yukon Waters Act Regulations.
August 23, 1995	B.Y.G. submitted a copy of the response to the Reclamation Cost Estimate Review.
September 8, 1995	DIAND and B.Y.G. met to discuss tailings dam and financial security.
September 12, 1995	B.Y.G. submitted a letter with further information on outstanding environmental issues.

b)
IX

Appendix 3: REFERENCES

B.Y.G. Natural Resources Inc.'s Initial Environmental Evaluation for the Mt. Nansen Project consisted of the following two documents:

- Initial Environmental Evaluation -- Mount Nansen Development, Volume 1, November, 1994

- Initial Environmental Evaluation -- Mount Nansen Development, Volume 2 -- Appendices, November, 1994

Further documentation that B.Y.G. submitted in support of their project proposal which were reviewed when evaluating this project consisted of the following:

- "Report on preliminary investigation for tailings disposal and leach pad sites for the Mt. Nansen project", prepared by Klohn Leonoff Ltd., dated November 7, 1985.

- "Tailings Dam Preliminary Design Report, Mount Nansen Gold Project", prepared by Klohn Leonoff, dated December 7, 1988.

- "Victoria Creek Crossing" letter report, dated April 6, 1995

- "IEE Addendum Report", dated April 6, 1995

- "Acid Titration Tests on B.Y.G. Mount Nansen ABA Samples", dated April 10, 1995

- "Tailings Impoundment, Feasibility Design Update", prepared by Klohn-Crippen, dated April 4, 1995

- "Water Licence Application, Victoria Creek Culvert

- "Victoria Creek Crossing Updated Submission for Culvert Design", dated April 17, 1995 (which replaced April 6, 1995 letter report)

- "Mount Nansen Project Tailings Disposal -- Response to RERC Concerns", dated May 25, 1995

- B.Y.G. letter to Water Resources, DIAND concerning "Tailings Dam Construction Project" dated August 9, 1995.

b)

18

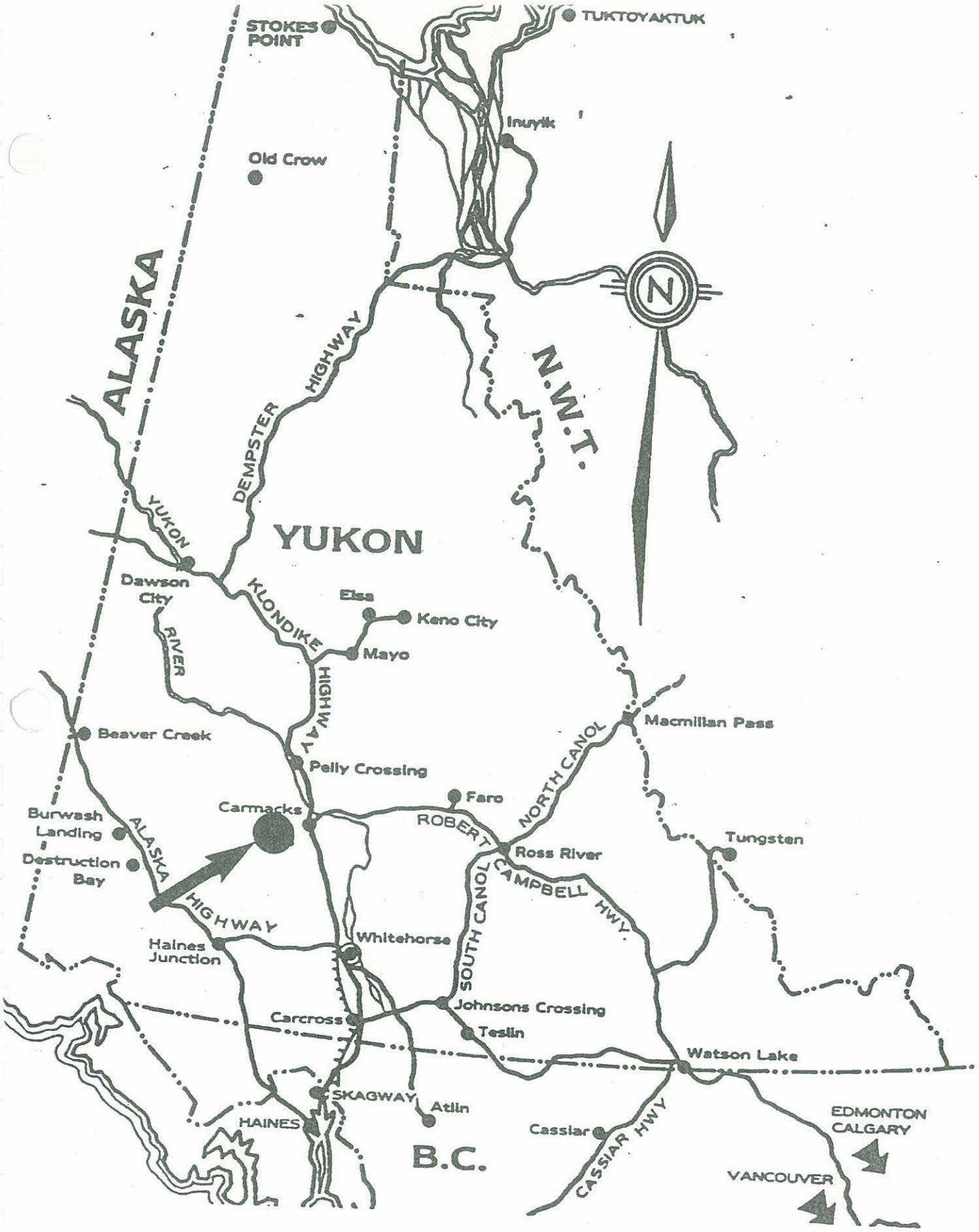

Figure 1: Location of Mount Nansen Project

Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

345-300 Main Street
Whitehorse, Yukon
Y1A 2B5

CANADA REMEMBERS
LE CANADA SE SOUVIENT

Your file Votre référence

Our file Notre référence

December 27, 1995

Paul Hunter
Yukon Territory Water Board
200 Range Road
Whitehorse, Yukon
Y1A 3V1

Dear Mr. Hunter;

RE: B.Y.G. Natural Resources Decision Report

Enclosed for your information are the Screening and Decision Reports prepared pursuant to EARPGO for the B.Y.G. Natural Resources, Mt. Nansen Gold Mine Project.

If you have any questions regarding the attached please call myself or Marg Crombie at (403) 667-3250.

Sincerely,

Mike Ivanski
Regional Director General
DIAND, Yukon Region

Exhibit IX c)

Canada

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Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

Department of Indian Affairs
and Northern Development
345-300 Main Street
Whitehorse, Yukon Territory
Y1A 2B5

CANADA REMEMBERS
LE CANADA SE SOUVIENT

Your file Votre référence

Our file Notre référence

5510-4-8

December 27, 1995

TO: Public Distribution List and RERC Members
BYG (Mt. Nansen) Project
(see distribution list attached)

RE: EARP Decision Report for BYG Natural Resources Inc.'s Mount Nansen Gold Mine Project

Please find attached the Decision Report resulting from the environmental assessment carried out under the federal *Environmental Assessment and Review Process Guidelines Order* (EARPGO) of BYG Natural Resources Inc. Mt. Nansen gold mine project. In releasing this Decision Report, DIAND considered the Regional Environmental Review Committees (RERC's) November 16, 1995 Screening Report and subsequent correspondence received from a member of the public resulting from his review of the Screening Report.

The Department of Indian Affairs and Northern Development (DIAND) has determined that the proposal, with commitments and mitigation as identified in BYG Natural Resources Inc's Initial Environmental Evaluation (IEE), IEE Addendum, other supporting information and the Screening Report meets the requirements of Section 12(c) of the *Environmental Assessment and Review Process Guidelines Order* (EARPGO):

Section 12(c)

> **" the potentially adverse environmental effects that may be caused by the proposal are insignificant or mitigable with known technology, in which case the proposal may proceed with the mitigation, as the case may be".**

Pursuant to Section 13 of the Guidelines Order, DIAND has determined that a public review by an EARP panel of the Mount Nansen Project is not necessary:

Section 13

> **" Notwithstanding the determination concerning a proposal made pursuant to Section 12, if public review is desirable, the initiating department shall refer the proposal to the Minister for public review by a panel".**

Canada

Exhibit IX C)

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With the completion of the EARP assessment, the proposed project can now proceed to the regulatory level for the issuance of necessary authorizations (i.e. permits and licences).

Copies of the Screening Report and Decision Report are available at:

- Communication Services, DIAND, Room 410 Elijah Smith Building, 300 Main Street, Whitehorse; and

- the Carmacks District Field Operations Office, Northern Affairs Program

The reports are available for viewing at:

- DIAND Library, 3rd Floor, Elijah Smith Building, Whitehorse
- Whitehorse Public Library, 2nd Avenue, Whitehorse
- Carmacks Library, Carmacks, Yukon
- The Council of Yukon First Nations, 11 Nisutlin Drive, Whitehorse, and
- Little Salmon Carmacks First Nation, Carmacks
- Selkirk First Nation, Pelly Crossing
- Nacho N'yak Dun First Nation, Mayo

I appreciate the interest that has been shown during the environmental assessment of this project and thank those who contributed to it.

Sincerely,

Mike Ivanski
Regional Director General
DIAND, Yukon Region

Exhibit IX c)

Distribution List:

J. Smith V-President Operations, BYG
RERC Members - BYG Project
M. Ivanski, Regional Director General, DIAND, Yukon Region
L. Craig, Associate Regional Director General, DIAND, Yukon Region
K. McDonnell, Project Manager, Environmental Directorate, NAP, DIAND
J. Wolchuck, RMO, Carmacks
M. Vance, Little Salmon/ Carmacks First Nation
D. Issac, Selkirk First Nation
B. Germaine, Nacho N'yak Dun, Mayo
Yukon Conservation Society
Yukon Chamber of Mines
Communication Services, Northern Affairs Program, DIAND
DIAND Library, 3rd Floor, Elijah Smith Building
Whitehorse Public Library
Carmacks Library
The Council for Yukon First Nations, Whitehorse
CBC Yukon, Whitehorse
CHON-FM Radio, Whitehorse
CKRW Radio, Whitehorse
Whitehorse Star, Whitehorse
Yukon News, Whitehorse
Yukon Territory Water Board
Bob Bonnefoy-Tate

Exhibit IX c)

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

ENVIRONMENTAL ASSESSMENT AND REVIEW PROCESS
DECISION REPORT

B.Y.G. NATURAL RESOURCES INC.'S
MOUNT NANSEN GOLD MINE PROJECT

December 1995

A. PROJECT IDENTIFICATION

Proponent: B.Y.G. Natural Resources Inc. (B.Y.G.)

Project: Mount Nansen, Open Pit Hard Rock Gold Mine Project (Mount Nansen Project)

File #: DIAND RERC file # 5510-4-8

Entry Point: March 20, 1988 -- Department of Indian Affairs and Northern Development, Yukon Region

B. PROJECT DESCRIPTION

The Mount Nansen Project is located approximately 60 kilometres west of the Village of Carmacks, Yukon. The location is on NTS map sheet 115 I/3 W at latitude 62 05' north, and longitude 137 08' west. The site lies within the traditional territory of the Little Salmon/Carmacks First Nation. The property claims occur at an elevation of about 1200 metres in the Dawson range. A gravel road from Carmacks to the Mount Nansen property is seasonally maintained by the Yukon Territorial Government.

B.Y.G. plans to mine approximately 300 tonnes of gold-bearing oxide ore per day using open pit mining methods. The existing on-site mill would be converted to a process involving cyanidation, carbon adsorption (using the carbon in pulp method), carbon elution and zinc preparation. The tailings would be treated to destroy cyanide prior to discharging to the tailings containment area.

Based on proven reserves, the project life is about four years, including one year of preproduction work. B.Y.G. considers extension of mine life likely through development of additional oxide ore deposits, or if viable metallurgical processes are developed to allow for development of sulphide ore on the property.

Exhibit IX c)

C. SUMMARY OF SCREENING PROCESS

- Project Overview
- IEE Guidelines
- IEE, Addendum and related submissions
- Public meeting
- Screening Report (Results of screening process and RERC recommendations)
- Public Review Period for Screening Report
- Decision Report Issued

D. RESPONSE TO SCREENING

The November 16, 1995 Screening Report was advertised to give the public an opportunity to provide written comments to DIAND prior to December 15, 1995. One response was received and the questions and concerns were addressed by DIAND staff (letter and response are on file).

For the key concerns raised during the screening process refer to the *Environmental Assessment and Review Process* (EARP) Screening Report, dated November 16, 1995, see Section 6.0 Environmental and Socioeconomic Issues and Mitigation and Recommendations.

The recommendations made by RERC to the Department were specific in order to ensure that potential significant environmental impacts were mitigated and the mitigation was addressed through the regulatory processes. DIAND accepts the recommendations made by the RERC in the Screening Report.

E. DECISION

The DIAND EARP review of BYG Natural Resources Inc. Mt. Nansen Gold Mine Project has been concluded.

DIAND has determined that BYG Natural Inc.'s proposal as assessed in the November 16, 1995 Screening Report, meets the requirements of the Environmental Assessment and Review Process Guidelines Order under Section 12(c) specifically:

Section 12(c) **" the potentially adverse environmental effects that may be caused by the proposal are insignificant or mitigable with known technology, in which case the proposal may proceed or proceed with mitigation, as the case may be".**

Pursuant to Section 13 of the Guidelines Order, DIAND has determined that a public review by an EARP panel of the Mount Nansen Project is not necessary:

Section 13 **" Notwithstanding the determination concerning a proposal made**

IX c)

pursuant to Section 12, if public review is desirable, the initiating department shall refer the proposal to the Minister for public review by a panel"

DIAND concurs that the proposal should now proceed to the regulatory phase for permitting and licencing and reaffirms the need for all mitigation to be included in permits and licences given the requirement in the EARP Guidelines Order for all required mitigation to be implemented.

H. ACKNOWLEDGEMENTS

The Department would like to acknowledge each of the following parties for their assistance and input in the screening of this proposal: BYG Natural Resources Inc., the Little Salmon Carmacks First Nation, Selkirk First Nation, Nacho N'yak Dun First Nation, the participating Federal and Territorial Government Departments, and residents of Carmacks, business interests of the Yukon and residents of the Yukon.

Mike Ivanski
Regional Director General
Department of Indian Affairs and Northern Development
Yukon Region

Dec. 27/95
Date

Exhibit IX c)

Note: "Screening Report, B.Y.G. Resources Inc.'s Mount Nansen Gold Mine Project" was attached. This report was previously submitted (ex. IX b)

2614

BYG NATURAL RESOURCES INC.

1998 JAN -6 P 2:51

HAND

Q294004

MOUNT NANSEN CONCEPTUAL DECOMMISSIONING AND RECLAMATION PLAN
DRAFT COPY FOR REVIEW

January 1998

Prepared By:

BYG Natural Resources Inc.
110 Industrial Road
Whitehorse, YT

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

1.0 INTRODUCTION.....1
2.0 PROJECT BACKGROUND
2.1 LOCATION AND ACCESS
2.2 SITE DESCRIPTION

3.0 RECLAMATION PLAN 8

3.1 RECLAMATION OBJECTIVES
3.2 RECLAMATION ACTIVITIES DURING OPERATIONS.....9
3.3 RECLAMATION ACTIVITIES UPON MINE CLOSURE
3.4 CHEMICAL STABILITY OF TAILINGS.....11
3.5 PHYSICAL STABILITY OF TAILINGS IMPOUNDMENT
3.6 AREA OF DISTURBANCE
3.7 OVERBURDEN STOCKPILING
3.8 TAILINGS IMPOUNDMENT
3.9 SEEPAGE COLLECTION POND.....12
3.10 STRUCTURES AND EQUIPMENT
3.11 WASTE DUMP RECLAMATION
3.12 WATER COURSES
3.13 RECLAMATION OF PITS.....13
3.14 RECLAMATION OF ROADS
3.15 EXPLORATION TRENCHES
3.16 EXISTING TAILINGS PONDS AND ORE DUMPS
3.17 PREVENTION AND CONTROL OF ACID MINE DRAINAGE.....14
3.18 REAGENT ,FUEL STORAGE
3.19 REFUGE, SEWAGE, CHEMICAL WASTE.....15
3.20 RECLAMATION COSTS.....18

4.0 WATER MANAGEMENT.....19
4.1 OBJECTIVES
4.2 DESCRIPTION OF WATER MANAGEMENT SYSTEM
4.3 CURENT WATER QUALITY 20
4.4 SPILLWAY DESIGN
4.5 WATER BALANCE.....21
4.6 SEEPAGE COLLECTION

5.0 FUTURE CONSIDERATIONS.....21
6.0 SCHEDULE OF RECLAMATION STUDIES.....22
7.0 SEEPAGE FROM THE PIT FLOOR
TO THE OLD UNDERGROUND ADIT.....23
8.0 CLOSURE SPILLWAY
9.0 PUBLIC CONSULTATION AND MEETINGS.....24

APPENDIX A	ARD Study July, 1997
APPENDIX B	Spill Contingency Plan
APPENDIX C	Reclamation Costs-Incurred and Expended
APPENDIX D	Current Water Quality
APPENDIX E	Water Balance
APPENDIX F	Multi-element ICP Analysis of Treated and Un-Treated Tails
APPENDIX G	Drawing D-3003 Closure Spillway

3.20 Reclamation Costs

A summary of Reclamation Costs -Incurred and Expended is included in Appendix C. The cost to reclaim areas disturbed by previous operators has been estimated at $504,420, while the estimated cost to reclaim areas distributed by the current project is $193,538. This is the total liability over the project life accrued due to a number of items including the open pit, waste dump, tailings pond, diversions and monitoring requirements. The incurred liabilities at the end of Year 1, 2, 3 and 4 have been estimated at $86,425, 41,500, $45,599 and $20,0140 with offsetting expenditures of $40,000, $127,925, $60,000 and $470,458.

Financial Security

To satisfy the bonding requirements for reclamation, B.Y.G. Natural Resources Inc. will post a bond of $150,000 at start-up with an increase to $200,000 after Year 3. This will ensure that sufficient funds are available to cover the cost of reclamation of disturbances caused by the current project should BYG fail to carry out the reclamation work as planned. This is an appropriate level of security given the current status of the site and degree of impact expected from mining and milling of the Brown-McDade oxide deposit. A large portion of the reclamation liability ($504,420) is due to site disturbance related to previous exploration and mining activities that are not the direct responsibility of BYG . However, BYG will assume full responsibility for reclamation of the current project area. The company will carry out reclamation activities in disturbed areas outside the current project area in agreement and consultation with the regulatory agencies. Some of this work will be carried out during active operation and not accrue as a liability at closure. The BYG's position regarding Financial Security is that it should not be required to post a security bond for reclamation of the previously disturbed areas as long as it commits to carry out the work required.
In the event that additional oxide reserves are delineated on other deposits in the claim group or milling of sulfide proves feasible, the reclamation costs and related bonding requirements will be revised to ensure that sufficient funds are set aside for reclamation.

B.Y.G. NATURAL RESOURCES INC.
MT. NANSEN PROJECT

RECLAMATION COSTS – INCURRED AND EXPENDED

EXISTING IMPACTS ON MT.NANSEN SITE

TYPE OF IMPACT	UNITS HECTARES OR NO.	UNIT COST TYPE	COST PER UNIT	COST EXISTING IMPACT	*SCHEDULE OF RECLAMATION WORK COMPLETED*				
					END OF YEAR 1	*END OF YEAR 2*	*END OF YEAR 3*	*END OF YEAR 4*	*TOTAL*
(1) Existing construction areas	11.3	(1)	$5,250	$59,325		*$15,000*	*$15,000*	*$29,325*	*$59,325*
(2) Existing roads	5.7	(2)	$2,350	$13,395			*$5,000*	*$8,395*	*$13,395*
(3) Existing trenches	11.4	(3)	$4,000	$45,600		*$15,000*	*$15,000*	*$15,600*	*$45,600*
(4) Existing mine portals	5	(4)	$10,200	$51,000				*$51,000*	*$51,000*
(5a) Existing frame buildings and trailers	14	(5a)	$2,500	$35,000	*$10,000*	*$10,000*		*$15,000*	*$35,000*
(5b) Existing steel and concrete buildings	1	(5b)	$105,000	$105,000				*$105,000*	*$105,000*
(6) Existing dams	3	(6)	$3,700	$11,100		*$7,500*		*$3,600*	*$11,100*
(7) Existing ore dumps	72,500	(7)	$2.15	$155,875	*$25,000*	*$75,000*	*$25,000*	*$30,875*	*$155,875*
(8) Existing waste dumps	22,500	(8)	$1.25	$28,125	*$5,000*	*$5,000*		*$18,125*	*$28,125*
TOTAL EXISTING IMPACTS				**$504,420**					
SCHEDULE OF RECLAMATION WORK					*$40,000*	*$127,500*	*$60,000*	*$276,920*	*$504,420*

Table B-2

1. APPLICATION

1.1 Shedule IV and Letter, 03.04.98

2. PUBLIC NOTICES

2.1 Letter to distribution list, 07.04.98

3. CORRESPONDENCE - BOARD TO APPLICANT

4. CORRESPONDENCE - APPLICANT TO BOARD

4.1 Notification of first date of exemption period (per amendment #3), 06.04.98

5. INTERVENTIONS

5.1 Environment Canada and Fisheries and Oceans Canada, 09.04.98
5.2 Yukon Salmon Committee, 09.04.98
5.3 Little Salmon Carmacks First Nation, 09.04.98
5.4 Yukon Conservation Society, 09.04.98

6. CORRESPONDENCE - BOARD TO INTERVENORS & BOARD TO ALL PARTIES

7. CURRENT/PREVIOUS WATER USE LICENCE(S)

7.1 Office Compilation of Water Use Licence QZ94-004, as amended by Amendments one & two.
7.2 Amendment three to water Use Licence QZ94-004
7.3 Reasons for Decision, Amendment #3

8. OTHER EXHIBITS

8.1 Weekly monitoring reports, Jan 26/98 to March 29/98

9. ENVIRONMENTAL ASSESSMENT (CEAA)

9.1 Letter, Indian and Northern Affairs Canada, 09.03.98

10. DECISION

B.Y.G.
NATURAL RESOURCES INC.

YUKON TERRITORY
WATER BOARD
1998 APR -3 P 3:59

April 1, 1998

Mr. Ron Johnson
Chairperson, Yukon Territory Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon
Y1A 3V1

RE: APPLICATION FOR AN EMERGENCY AMENDMENT TO LICENSE QZ94-004

Dear Sir:

I am requesting an emergency amendment to our water license to reflect our ability to deal with the greater than expected run off that occurs on a yearly basis.

We have previously been granted an emergency amendment to discharge water without having to pass the fish bioassay test. That amendment allowed BYG to discharge up to 72,000 m^3 of water over a period of time not to exceed 60 days.

During that 60 days we were not able to discharge 72,000 m^3 we could only discharge 32,000 m^3. Our inability to discharge the allowed amount of water was due to the following reasons:

Lack of chemicals
Inability to meet other license limits

Lack of chemicals

BYG was short of funds at two periods during the 60 day amendment, this shortage meant that certain chemicals required for the satisfactory operation of the plant were not available on site in time. BYG has recently completed a financing which combined with revenues from operations will allow BYG to have the required chemicals in plentiful supply at all times.

Inability to meet other license limits

For a period of ten days during March we were unable, by our own measurements, to meet the cyanide level of 0.1ppm allowing us to discharge. There were also several periods during the sixty days when we could not, by our own measurements achieve the zinc level 0f 0.3ppm. During these periods we stopped discharging to the environment and discharged to our tailings pond instead.

Cyanide Level

The inability to meet the cyanide level was due to a change in reclaim water temperature. We have now installed a heat exchanger system that takes heat from the cylinder heads of the gensets and

General Delivery, Carmacks, Yukon Territory Y0B 1C0 tel: 867 863 59136 fax: 867 863 6028 e-mail byg@unix.infoserve.net

QZ98-030
EXHIBIT /. /

utilizes this heat to keep the reclaim water well in excess of that temperature required to allow good cyanide destruction.

Zinc Level

We have made process changes that allow BYG to produce a zinc effluent that is consistently five or six times lower than that required by the Water License.

We are requesting an extension of the time to discharge the remainder of the 72,000m^3 of the previous emergency amendment. The extension to be an increase from 60 days to 120 days. All other conditions to remain the same.

As you can see we are still making changes to improve our water treatment plant at every opportunity. We did pass one fish bioassay test during the previous 60 days and are hopeful that we will be passing the test consistently before the expiration of the time we are requesting here.

I thank you in advance for your attention to this matter and hope that I can receive an early answer to this request.

Yours truly,

Graham C. Dickson
President, B.Y.G. Natural Resources Inc.

QZ98-030
EXHIBIT /. /

General Delivery. Carmacks. Yukon Territory Y0B 1C0 tel: 867 863 59136 fax: 867 863 6028 e-mail byg@unix.infoserve.net

YUKON TERRITORY WATER BOARD

Pursuant to the Yukon Waters Act and Regulations, the Yukon Territory Water Board hereby grants a Type A Water Use Licence for a quartz mining undertaking to:

B.Y.G. Natural Resources Inc.
Suite 208, 3190 St. John Street
Port Moody B.C. V3H 2C7

LICENCE NUMBER: QZ94-004

LICENCE TYPE: A **UNDERTAKING:** QUARTZ MINING

WATER SOURCE: Wells in the vicinity of ~~Hunker~~ Victoria Creek
WASTE DEPOSIT: Dome Creek

QUANTITY OF WATER: 527 m^3/day

EFFECTIVE DATE: The date upon which the signature of the Minister of Indian and Northern Affairs Canada is affixed

EXPIRY DATE: December 31, 2001

PURPOSE: The Licensee is hereby authorized to obtain and use water and to deposit a waste as proposed in water use application QZ94-004.

This Licence shall be subject to the restrictions and conditions contained herein and to the restrictions and conditions contained in the Yukon Waters Act and the Regulations made thereunder. Where there is a discrepancy between the application and the terms of this Licence, the terms of this Licence shall prevail.

Dated this 13th day of February, 1996.

Witness

YUKON TERRITORY WATER BOARD

Paul Hunter, Chairperson

Dated this 14th day of March, 1996.

Witness

Approved by:

Minister of Indian and Northern Affairs Canada

TERMS AND CONDITIONS OF WATER USE LICENCE QZ94-004

PART A - GENERAL

1. Definitions

a) "Act" means the Yukon Waters Act and any amendments thereto.

b) "Regulations" means the Regulations made under the Act.

c) "Board" means the Yukon Territory Water Board.

d) "Inspector" means any person designated as an inspector under the Act.

e) "Deleterious Substance" means deleterious substance as defined in Section 34(1) of the Fisheries Act.

f) "IEE" means the Initial Environmental Evaluation, submitted as exhibits 1 c) and 1 d) to water use application QZ94-004.

g) "Start Up Date" means thirty (30) days following the date that the Licensee begins milling tailings or ore through the mill, providing that the milling activity continues for a period of two successive days. If milling takes place for less than two successive days, then that date shall not be considered for the purposes of determining the start up date.

2. Representations, Warranties and Undertakings

The Board has relied on the representations, warranties and undertakings provided by the applicant in the material filed as application QZ94-004. Such representations, warranties and undertakings, where referenced in this Licence, are considered by the Board to be a part of the Licence, but shall be subject to the terms and conditions of this Licence.

3. Other Laws

No term of this Licence limits the application of any other Federal or Territorial Law.

4. Correspondence

Where any direction, notice, order, or report under this Licence is required to be in writing, it shall be given:

a) To the Licensee if left at, faxed, or mailed by registered mail to the following address:

B.Y.G. Natural Resources Inc.
Suite 208, 3190 St. John Street
Port Moody B.C. V3H 2C7

and shall be deemed to have been given to the Licensee on the day it was left or faxed or seven (7) days after the day it was mailed, as the case may be.

b) to the Board, if left at, faxed, or sent by registered mail to the following address:

Yukon Territory Water Board
Suite 106, 200 Range Road
Whitehorse, Yukon Y1A 3V1

and shall be deemed to have been given to the Board on the day it was left or faxed or seven (7) days after the day it was mailed, as the case may be.

5. Fees

The Licensee shall pay the water use fees prescribed in the Regulations annually, in advance, on the anniversary of the issuance of this Licence.

6. Non-Compliance

In the event that the Licensee fails to comply with any provision or condition of this Licence, the Board may, with the approval of the Minister and subject to the Act, cancel the Licence.

7. Deleterious Substances

The Licensee shall ensure that, subject to the provisions of this Licence, deleterious substances are used, transported, stored and disposed of in such a manner that they are not deposited in, or allowed to be deposited in, any waters.

8. Spills and Unauthorized Discharges

a) The Licensee shall apply the relevant procedures in the Spill Contingency Plan that has been filed with the Board as Exhibit 1g)v and as amended by exhibit 1i). The Licensee shall review the spill contingency plan annually and shall submit any revisions to that plan as a component of the annual report.

b) The Licensee shall comply with all existing federal and territorial requirements with respect to spill reporting, clean up and liability.

c) The Licensee shall immediately contact the 24-hour Yukon Spill Report telephone number (403) 667-7244, should a spill or an unauthorized discharge occur. A detailed written report on any such event, including but not limited to, dates, quantities, parameters, causes and other relevant details and explanations, shall be submitted to the Board not later than fifteen (15) days after its occurrence.

9. Term of Licence

a) This Licence shall take effect on the date on which the signature of the Minister of Indian and Northern Affairs Canada is affixed.

b) The expirty date of this Licence shall be December 31, 2001.

10. Reports

a) Unless otherwise specified in this Licence, all reports shall be submitted in an unbound form which is reproducible by standard photocopier and shall be accompanied by five (5) copies.

b) Water quality monitoring reports shall be submitted in printed form and on computer diskette, in an IBM compatible spreadsheet format.

11. Annual Reports

The Licensee shall submit annual reports to the Board. The initial report shall be from the effective date of this Licence to December 31, 1996 and shall be submitted to the Board on or before February 28, 1997. Subsequent reports shall be from January 1 to December 31 of each calendar year and shall be submitted to the Board on or before February 28 of the year next following the year reported.

PART B - SECURITY

12. The Licensee shall provide security in the total amount of $974,500, (nine hundred and seventy four thousand and five hundred dollars), which includes General Reclamation Security of $455,000. (four hundred and fifty five thousand dollars) and Chemical Stability Reclamation Security of $519,500. (five hundred and nineteen thousand and five hundred dollars).

13. General Reclamation Security

The schedule of payment for General Reclamation Security shall be as follows:

$50,000. within 30 (thirty) days of the effective date of this Licence, and

$250,000. on or before the start up date, and

$65,000. on or before the first anniversary of the start up date, and

$65,000.on or before the second anniversary of the start up date, and

$25,000. on or before the third anniversary of the start up date.

14. Chemical Stability Reclamation Security

The schedule of payment for Chemical Stability Reclamation Security shall be as follows:

$80,000. on the first anniversary of the start up date, and

$160,000. on the second anniversary of the start up date, and

$180,000. on the third anniversary of the start up date, and

$ 99,500. on the fourth anniversary of the start up date.

15. The form of all security that is required by this Licence shall be in accordance with the requirements of section 12(3) of the Regulations.

16. The Licensee shall notify the Board, in writing, of the date that has been determined to be the start up date, as defined in this Licence. This notice shall be provided at least one week prior to the start up date.

PART C - DESIGN, CONSTRUCTION AND MODIFICATION

17. a) The Licensee shall ensure that the tailings impoundment facilities and supporting facilities are constructed as proposed in the Final Design Report that was submitted to the Board as exhibit 1(h) of water use application QZ94-004, and in general accordance with the design specifications that are described in the Design Criteria Report that is appended as appendix 2 to this Licence.

b) For clarity, exhibit 1(h) of water use application QZ94-004 is a report entitled "B.Y.G. Natural Resources Inc., Mt. Nansen Gold Project. Tailings Impoundment Final Design Report, August 1995", prepared by Klohn Crippen and identified as PM5314.05.02.

c) The tailings impoundment shall be equipped with an emergency spillway. The top of any tailings within the impoundment must always be a minimum of one metre below the invert of the emergency spillway.

18. The Licensee shall comply with the relevant provisions of the Construction Quality Assurance Manual that is appended to this Licence as appendix 3.

19. The Licensee shall provide as-constructed plans and drawings of all structures within ninety days of completion of each phase of construction. The as-constructed plans shall be submitted to the Board as transparencies that are reproducible and shall be accompanied by five (5) copies.

PART D - OPERATING CONDITIONS

20. Water Use and Waste Deposit

The Licensee is hereby authorized

a) to obtain water, at a rate not to exceed 527 m^3 per day, from wells near Victoria Creek;

b) to use this water for a quartz mining undertaking and camp use;

c) to modify an existing mill facility, to operate that mill facility for the processing of oxide ore from a deposit that is known as the Brown McDade deposit and from such tailings and waste dumps that are in existence on the effective date of this Licence and which have been identified in application QZ94-004 and which are amenable to cyanide extraction;

d) to construct, modify and operate a tailings impoundment facility;

e) to reclaim water from the tailings facility for use in the mill and to release excess water, via a polishing pond, into Dome Creek, providing that any water that is released is first treated to meet the effluent quality standards of this Licence;

f) to divert water via a diversion of Dome Creek around a tailings impoundment, to construct and operate a system of intercept ditches for the collection of run-off water and to construct and operate a seepage collection pond for the storage of seepage water that will be returned to the tailings impoundment;

as proposed in water use application QZ94-004 and subject to this Licence. Where there is a discrepancy between water use application QZ94-004 and the terms and conditions of this Licence, then the terms and conditions of this Licence shall prevail.

21. Sulphide Ore
The mining and/or milling of sulphide ore is prohibited by this Licence.

PART E - EFFLUENT QUALITY STANDARDS

22. The Licensee shall ensure that all effluent which is discharged from the project, both during operation and at final decommissioning, shall meet the following effluent quality standards:

Parameter	Concentration
pH	6.0 to 8.5 pH units
Suspended solids	50 mg/l
Toxicity (LC_{50})	*100%
Weak Acid Dissociable Cyanide	0.1 mg/l
Total Cyanide	0.3 mg/l
Antimony (total)	0.15 mg/l
Arsenic (dissolved)	0.15 mg/l
Barium (total)	1.0 mg/l
Cadmium (total)	0.02 mg/l
Chromium (total)	0.04 mg/l
Copper (total)	0.2 mg/l
Iron (total)	1.0 mg/l
Lead	0.1 mg/l
Manganese	0.5 mg/l
Mercury	5.0 ug/l
Nickel (total)	0.3 mg/l
Silver	0.10 mg/l
Zinc (total)	0.30 mg/l

* Any effluent that is discharged must meet the non-toxicity requirement defined by the 96 hour LC50 bioassay, using rainbow trout (pH non-adjusted).

PART F - PROGRAMS AND STUDIES

23. The Licensee shall comply with the following monitoring programs and studies and, unless otherwise specified, shall submit the data which is compiled as a result of these programs and studies as a component of the Annual Report.

24. Surveillance Network

a) The Licensee shall comply with Monitoring Schedule that is appended to this Licence as Appendix 1.

b) Thermistors shall be installed with sufficient cable to allow the thermistor string to terminate at the downstream toe of the dam.

c) Piezometers shall be installed with sufficient tubing to allow for extension to the downstream toe of the dam. Each Piezometer shall be monitored when the thermistor strings show that the ground around the piezometer has thawed.

d) Settlement Pins shall be driven into the downstream crest of the tailings dam and protrude 50 mm from the dam crest.

e) Surveillance site E7 (Polishing Pond Discharge to Dome Creek) shall be activated when a discharge first occurs.

f) Surveillance site E8 must be activated only if a release of excess water occurs.

g) Data that is collected as a result of the monitoring schedule (schedule 1) will be compiled monthly and submitted to the Board within thirty days of the conclusion of each month in which the monitoring takes place and shall be included in summary form in the annual report.

25. Quality Assurance/Quality Control ("QA/QC")

The Licensee shall develop and comply with a QA/QC program for all surface water sampling stations. At a minimum, the QA/QC program will provide for split samples and blank samples.

26. Sediment Monitoring Program

a) The Licensee shall conduct a sediment monitoring program on an annual basis during summer low flow, which is generally July/August.

b) Sediment shall be collected as follows:

i) Sediment samples shall be collected in replicates of three from within the active channel, directly into high density plastic sample jars, using an aluminum or Teflon scoop.

ii) The samples shall be dried and screened, using sieves at ASTM mesh numbers 10, 20, 40, 60, 100, 140 and 270 (ASTM -E11-61) and the fraction weights shall be recorded.

iii) A sub-sample composed of material passing through the 100 mesh number sieve shall be analyzed for metals by a 33 element ICP scan. Loss on ignition (LOI) shall also be determined by heating the sample to 600°C.

c) The sediment sampling locations shall be at the following monitoring stations:

i) D1, Dome Creek, upstream of the mill and 3.5 km from the mouth

ii) D2, Dome Creek, 0.4 km from the mouth at the Nansen Road Creek

iii) D3, Dome Creek, 100 metres downstream of the tailings impoundment

iv) P1, Pony Creek, 0.6 km from the mouth.

d) Data analysis shall include an evaluation of the information against baseline information.

27. Effluent Treatment Studies

a) The Licensee shall design and complete a program of studies to determine effluent treatment options, to evaluate those options and to design an appropriate facility for the treatment of reclaim water.

b) Data derived from the program of studies shall be compiled monthly and shall be submitted to the Board within sixty days of the end of the month in which the data is acquired. Results of the program of studies shall be summarized in the annual reports for each year until the year following the year in which the program is completed.

c) At least six months prior to the release of any reclaim water from the tailings facility, the Licensee shall prepare a design for the reclaim water treatment system and shall submit this plan to the Board. The system shall be designed in such a manner so as to ensure compliance with the effluent quality standards of this Licence.

d) The Licensee shall construct the treatment system in accordance with the design that is submitted, except that, should the Board notify the Licensee that a public hearing will be held to discuss the proposed plan, then the Licensee shall not release any effluent until such time as a public hearing has been convened and the Board has concluded it's deliberations.

e) For clarity: any effluent which is released from the tailings pond (except return of reclaim water to the mill for reuse) must be treated so as to comply with the effluent quality standards of this Licence and must not be released until at least six months after the design for a water treatment system has been submitted to the Board.

28. Tailings Arsenic Stability and Groundwater Arsenic Attenuation Program

The Licensee shall comply with the relevant components of the Tailings Arsenic Stability and Groundwater Attenuation Program in accordance with the plan that is appended as appendix 4 to this Licence.

29. Acid Rock Drainage ("ARD") Program

a) The Licensee shall complete a Waste Rock ARD Study, in accordance with the relevant components of the plan that is appended as appendix 5 to this Licence.

b) The Licensee shall complete a Pit Wall and Floor ARD Study, in accordance with the relevant components of the program that is appended as appendix 6 to this Licence.

c) The Licensee shall complete a Tailings ARD Study, as described in the program that is appended as appendix 7 to this Licence.

30. Thaw Settlement Study

The Licensee shall complete a Thaw Settlement Study, in accordance with the relevant components of the program that is appended as appendix 8 to this Licence.

31. Tailings Impoundment Seepage Monitoring Program

The Licensee shall complete the Tailings Impoundment Seepage Monitoring Program, as described in appendix 9 of this Licence.

32. Design Review - Tailings Impoundment

a) If any of the following events occur, then the Licensee shall undertake to complete a review of the tailings dam design and performance:

i) If the measured settlements within the facility equal 450 mm or if there are any visual signs which would reasonably suggest potential instability of the tailings facility, or

ii) If pore pressures that are identified as a result of the Tailings Impoundment Seepage Monitoring Program indicate an equivalent r_u value of 0.5 or if there are any signs of concentrated discharge near the dam toe or along the downstream slope or any visual signs that there is a potential for unexpected seepage which could compromise the structural integrity or effectiveness of the tailings dam, or

iii) If thermistor readings that are acquired as a result of the Tailings Impoundment Seepage Monitoring Program indicate that foundation thawing has occurred to a depth of two metres below the prepared dam subgrade.

b) The Design Review that is required by this section of this Licence shall be undertaken, as soon as is reasonably practical, by a qualified engineer. The Licensee shall notify the Board of the name of the engineer and the proposed date for completion of the review. The results of the review shall be compiled in a report which is certified by the engineer. That report shall be submitted to the Board within thirty days of completion.

33. The Licensee shall complete the Liquefaction Monitoring Program that is appended to this Licence as appendix 10.

34. The Licensee shall submit a revised water balance report to the Board as a component of each monthly report. If the revised reports indicate a significant variation in water balance from that which was anticipated in water use application QZ94-004, then the Licensee shall submit a Water Balance Contingency Plan to the Board. The plan will include proposals for releasing excess water in advance of the schedule which was proposed in application QZ94-004. The plan will be submitted to the Board prior to any discharge of effluent from the tailings facility and, in any case, no later than December 31, 1997.

PART G DECOMMISSIONING AND RECLAMATION

35. The Licensee shall, by December 31, 1996, submit to the Board a detailed plan for temporary closure and shall implement this plan should any temporary closure occur. For purposes of this Licence, "temporary closure" shall occur when ore has not been processed in the mill for a six consecutive months.

36. Any temporary closure for a period which exceeds three (3) years shall, for the purposes of this Licence, be considered to be permanent closure.

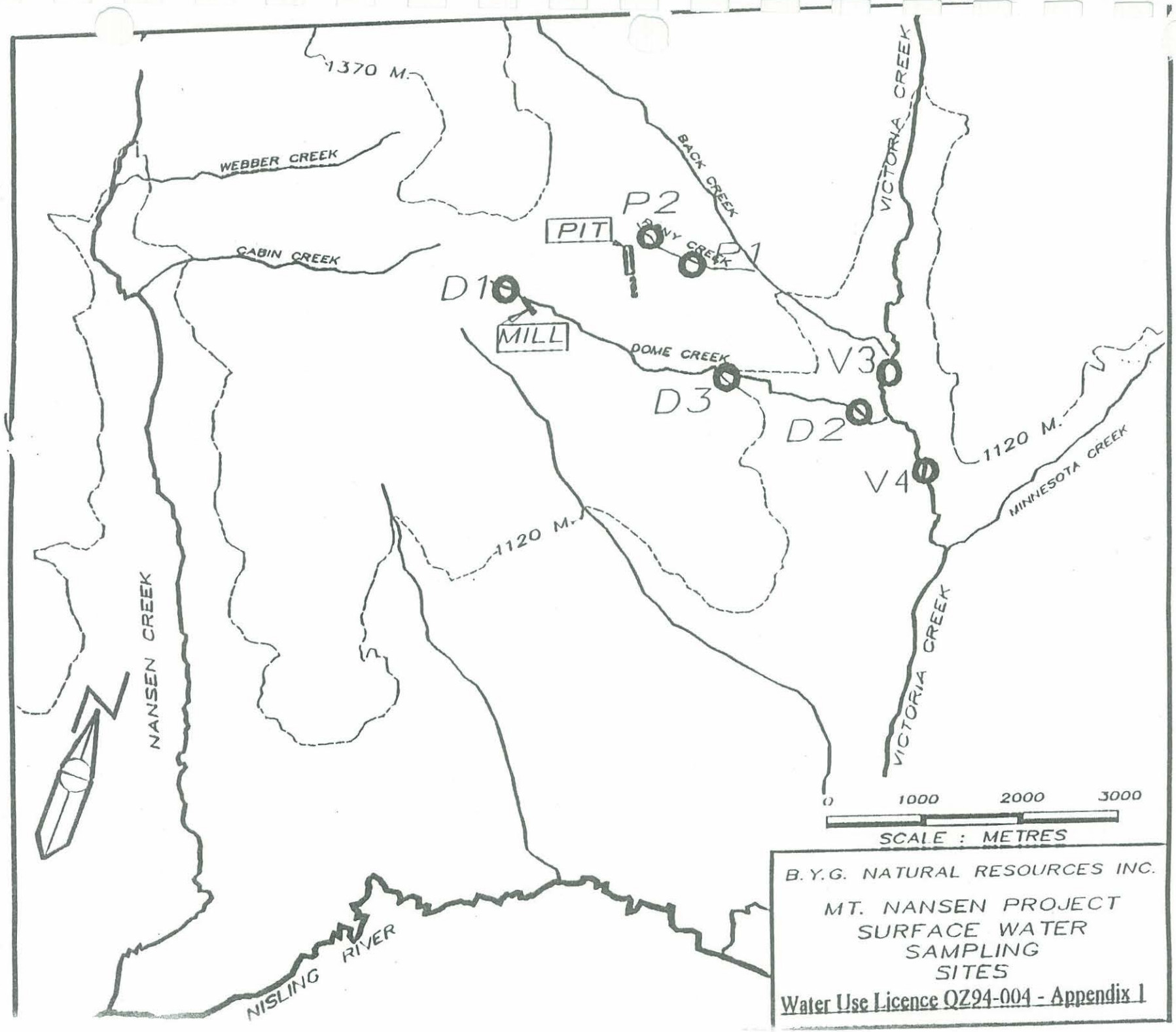
37. The Licensee shall, by December 31, 1997, submit to the Board a detailed decommissioning and reclamation plan.

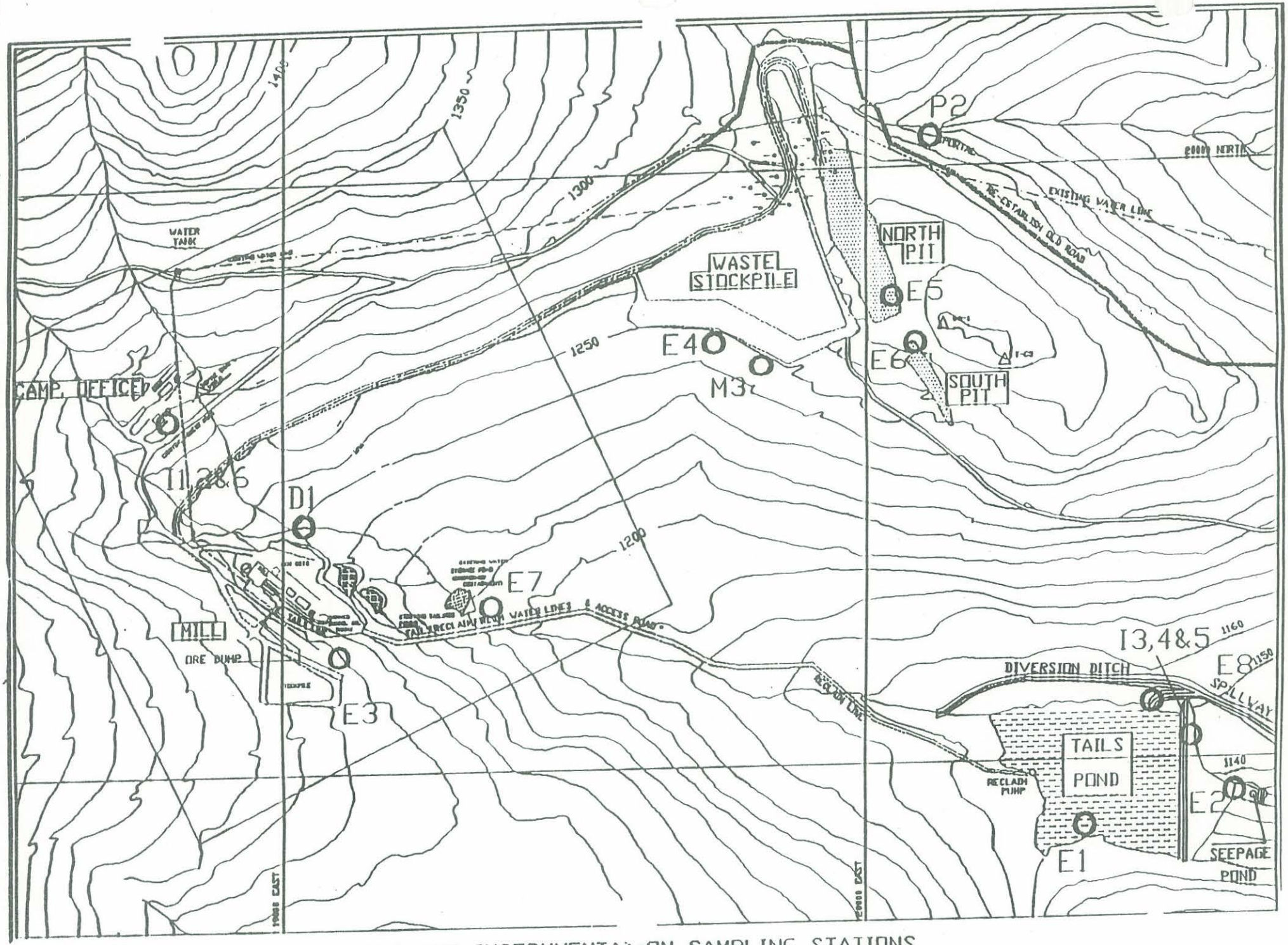
38. In the event of permanent decommissioning, then the Licensee shall implement the Decommissioning and Reclamation Plan that is required by this part of this Licence except that, should the Board notify the Licensee, within 90 days of the receipt of the Decommissioning and Reclamation Plan, that a public hearing will be held to review the Plan, then the Licensee shall not implement the plan until such time as a public hearing has been convened and the Board has concluded it's deliberations.

39. In the event that the Board notifies the Licensee that a public hearing will be held to review the Decommissioning and Reclamation Plan, and in the event that permanent closure has occurred or is likely to occur, then the Licensee shall ensure that all physical structures are either removed or left in stable condition and that all discharges from the operation comply with the effluent quality standards which required by Part E of this Licence.

40. In the event that permanent closure occurs prior to the submission of the detailed decommissioning and reclamation plan, then the Licensee shall ensure that all physical structures are either removed or left in stable condition and that all discharges from the operation comply with the effluent quality standards which required by Part E of this Licence.

41. If, by December 31, 1997, a concrete bulkhead has not been installed in the Brown-McDade adit, then the Decommissioning Plan shall include a long term monitoring plan to monitor seepage of pit water into that adit.


1370 M.
WEBBER CREEK
CABIN CREEK
BACK CREEK
VICTORIA CREEK
P2
PIT
TONY CREEK
1
D1
MILL
DOME CREEK
V3
D3
D2
1120 M.
V4
MINNESOTA CREEK
1120 M.
NANSEN CREEK
VICTORIA CREEK
NISLING RIVER
0
1000
2000
3000
SCALE : METRES
B.Y.G. NATURAL RESOURCES INC.
MT. NANSEN PROJECT
SURFACE WATER
SAMPLING
SITES
Water Use Licence QZ94-004 - Appendix 1



EFFLUENT AND INSTRUMENTATION SAMPLING STATIONS

MONITORING SCHEDULE

		Inspection Survey	Flow Rate	Flow Recorder	Sediment Sample	PARAMETERS					CYANIDES				NFR	FR	ANIONS					Tot & Dis Metals	Bioassay Pass/Fail
						Pressure	pH	Cond.	Temp	Turbidity	Total	WAD	CNO	SCN			Arsenic	Alkaline	SO_4	NH_3	NO_3 & NO_2		
	Effluents																						
E1	Reclaim Water Intake	W	C	Manual			W	W	W	W	W	M	M	M	M		W	M	M	W	M	M	
E2	Tailings Pond Seepage		C	Manual			W	W	W	W	M	BM	BM	BM	M		W	M	M	W	M	M	
E3	Ore Storage Run Off		W	Manual			W	W	W	W					W		W	W	W	W	M	M	
E4	Waste Dump Run Off		W	Manual			W	W	W	W					W		W	W	W	W	M	M	
E5	North Pit Mine Water		W	Manual			W	W	W	W					M		W	W	W	M	M	W	
E6	South Pit Mine Water		W	Manual			W	W	W	W					M		W	W	W	M	M	W	
E7	Polishing Pond Discharge to Dome Creek		C	Automatic			D	D	D	D	D	W	W	W	W	W	W	W	W	W	W	W	2A
E8	Spillway Discharge - Intermittent		D	Manual			D	D	D	D	D	W	W	W	W	W	W	W	W	W	W	W	Q
	Surface Waters																						
D1	Dome Creek - Upstream Control Site		BM	Manual	A		BM	BM	BM	BM	BM				BM	BM	BM	BM	BM	BM	BM	BM	
D2	Dome Creek 0.4 km from mouth		M	Manual	A		M	M	M	BM	BM	BM	BM	BM	BM	BM	BM	BM	BM	BM	BM	BM	
D3	Dome Creek 100m down from Tailings Pond		M	Manual	A		M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	
P1	Pony Creek 600m from mouth		BM	Manual	A		BM	BM	BM	BM	BM				BM	BM	BM	BM	BM	BM	BM	BM	
P2	Brown-McDade Adit Entrance		M	Manual			M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	
V3	Victoria Creek - Pump House		Q	Manual			Q	Q	Q	Q	Q				Q	Q	Q	Q	Q	Q	Q	Q	
V4	Victoria Creek - Downstream of Dome Creek		Q	Manual			Q	Q	Q	Q	Q				Q	Q	Q	Q	Q	Q	Q	Q	
	Instrumentation																						
I1	Outdoor Thermometer								D														
I2	Rainfall Gauge	D																					
I3	Thermistors								M														
I4	Piezometers					M																	
I5	Crest Pins	M																					
I6	Snow Pack- February to May	M																					
	Physical Inspections																						
M1	Tailings Dam	M																					
M2	Seepage Dam	M																					
M3	Waste Rock Pile	M																					
M4	Diversion Ditch	M																					
M5	Spillway	M																					
M6	Tailings Volume	M																					

LEGEND							
C	Continous when flowing	W	Weekly	M	Monthly	2A	Semi-annually
D	Daily	BM	Bimonthly	Q	Quarterly	A	Annually in triplicate

DESIGN CRITERIA REPORT

TABLE OF CONTENTS

PAGE

1. INTRODUCTION 2

2. TAILINGS DAM DESIGN 3
   - 2.1 General 3
   - 2.2 Thermal Analyses 6
     - 2.2.1 General 6
     - 2.2.2 Analysis of Existing Site Conditions 6
     - 2.2.3 Thaw-Induced Pore Pressures 7
     - 2.2.4 Two-Dimensional Analysis of Long-Term Dam Conditions 8
   - 2.3 Thaw-Settlement Analyses 10
   - 2.4 Stability Analyses 12
     - 2.4.1 General 12
     - 2.4.2 Soil Parameters 13
     - 2.4.3 Static Analyses 14
     - 2.4.4 Seismic Analyses 15
   - 2.5 Seepage Analyses 16
     - 2.5.1 General 16
     - 2.5.2 Seepage Analyses 18
     - 2.5.3 Geosynthetic Clay Liner (GCL) 19
   - 2.6 Instrumentation 19
   - 2.7 Borrow Assessment 21

3. HYDROLOGY AND WATER MANAGEMENT 23
   - 3.1 Meteorological Stations 23
   - 3.2 Annual Precipitation 24
   - 3.3 Lake Evaporation 25
   - 3.4 Short Duration Storms 26
   - 3.5 Diversion Channel and Emergency Spillway Design 28
     - 3.5.1 General 28
     - 3.5.2 Diversion Channel 28
     - 3.5.3 Emergency Spillway 30
     - 3.5.4 Closure Spillway 32
   - 3.6 Water Balance 32
     - 3.6.1 Tailings Level 33
     - 3.6.2 Average Year Water Balance 33
     - 3.6.3 200 Year Water Balance 34

1. INTRODUCTION

B.Y.G. Natural Resources Inc. (BYG) intends to develop an open pit gold mine on the Mt. Nansen property located approximately 60 km west of Carmacks, Yukon (see Drawing A-5314-001). Development of the gold mine will require construction of stream diversion facilities and an embankment dam for tailings impoundment on Dome Creek. Several earlier investigations were carried out at the Mt. Nansen property by Klohn-Crippen, in order to evaluate potential dam sites for tailings impoundment and select a preferred site. Results of these earlier investigations by Klohn-Crippen are summarized in the following reports:

- Letter report related to Mt. Nansen Project. Tailings Disposal and Leach Pad Sites, dated November 1985.
- Mt. Nansen Gold Project. Tailings Dam Preliminary Design Report, dated December 1988.
- Mt. Nansen Gold Project. Tailings Facility, Preliminary Design Report, dated May 1990.
- Mt. Nansen Gold Project, Nansen Creek, Road Upgrading, dated September 1994.
- Mt. Nansen Gold Project. Tailings Dam Storage Study, dated September 1994.
- Mt. Nansen Gold Project. Tailings Dam Cost Estimate, dated October 1994.
- Mt. Nansen Gold Project, Tailings Impoundment Feasibility Design Update, dated April 1995.

Based on the results of the earlier investigations and evaluation of several alternatives, Site #4 was recommended by Klohn-Crippen as the preferred site due to the overall economy of a smaller dam combined with greater storage when compared to other site options. BYG has subsequently decided to proceed with final design and construction of a tailings impoundment facility at Site #4.

The scope of this final design investigation and report included the following:

- Summarize work carried out to date and provide details of site selection.
- Carry out test hole drilling at Site #4 to investigate in detail the foundation areas for the tailings dam, seepage collection dam, diversion ditch, emergency spillway, and closure spillway.
- Install thermistor strings to monitor and record the ground temperatures at several locations at the tailings dam site.
- Carry out field and laboratory tests to measure index properties of overburden soils including bulk density, moisture content, grain size, compaction density and permeability.
- Carry out analyses for final design including thermal modelling, static and seismic stability, seepage and settlement of the tailings dam due to thaw settlement.
- Review hydrology and water balance for impoundment accounting for details of tailings disposal, runoff inflows and reclaim water.
- Determine final design requirements for the tailings dam, seepage recovery dam, diversion ditch and spillways.
- Provide Construction Quality Assurance (CQA) requirements for construction of the tailings impoundment structures.
- Identify performance monitoring requirements and future design considerations.

Authorization to proceed with this investigation and final design were received from Mr. Jim Smith of BYG during a meeting with Mr. Bill Chin on June 5, 1995.

2. TAILINGS DAM DESIGN

.1 General

The Site #4 tailings impoundment dam is designed with a capability of storing 300 000 tonnes or 240 000 m^3 of tailings based on a settled tailings density of 1.25 tonnes/m^3. The reservoir storage-elevation curve for this site as shown on Drawing A-5314-006 indicates that the flat tailings level for this volume of tailings is elevation 1149.2 m. In order to provide sufficient additional storage for a minimum two month millwater circulation volume of 30 000 m^3 throughout the initial three year mine life, the design pond level should be at elevation 1149.7 m. The design requires a temporary emergency spillway to pass flood flows until such time as the mine operations are complete and a closure spillway is constructed. The temporary spillway is located on the north abutment in order to utilize the same outlet channel as the diversion ditch. The closure spillway will eventually be located on the south abutment due to the presence of suitable rock at this location.

The emergency spillway invert should be set at the pond level of 1149.7 m in order to discharge excess inflows during operation. The dam crest is set at elevation 1151.5 m, 1.8 m above the invert level in order to safely pass the design 200 year flood flow and at least 50% of the Probable Maximum Flood (PMF). The dam is considered to be in the low to significant hazard potential category and therefore a capacity discharge of 50% PMF is considered an appropriate safety standard.

An additional allowance for settlement is required for the initial dam crest elevation to ensure adequate freeboard at the end of mine operation. The settlement allowance should be at least 0.6 m resulting in a final dam crest elevation of 1151.5 m. The settlement allowance provides sufficient freeboard only for any short term settlements which occur in the first three years of operation. It is understood that prior to the end of year three of operation, the decision to raise the dam or alternatively to install a permanent closure spillway will be made. If a permanent closure spillway is constructed, raising of the dam may also be required to accommodate further long term

settlements which may occur. Any decisions regarding raising of the dam at that time will be based on the dam performance as observed during the initial three year monitoring period.

The dam cross-section as shown on Drawing B-5314-007 includes a 6 m wide crest, an upstream slope at 2.5H:1V with toe berm and a downstream slope at 3.5H:1V with no berm. The downstream berm has been eliminated from the feasibility design on the basis that the thermal analyses indicate the shallow foundation soils are thaw-stable and the deeper soils below the active layer will not thaw in the long term. The downstream berm would only be required to control seepage and to enhance seismic stability for the event of deep foundation thawing. In the event, the downstream foundation area does eventually thaw, the need for the berm will be determined by further investigations to characterize the dynamic properties of the foundation soils. If necessary for stability purposes, the downstream berm can be constructed with waste mine rock or sand borrow.

The dam cross-section will include a Bentofix NW geosynthetic clay liner on the upstream slope to restrict seepage through the dam embankment. Details of the geosynthetic clay liner are shown on Drawing B-5314-008. A beach will be spiggotted against the upstream face of the dam during summer months to provide long term seepage control in the event that the geosynthetic clay liner deteriorates in the long term. To avoid ice lensing, all tailings will be placed subsequently during winter. Should seepage be a concern at a later date after a period of operation, a downstream berm could be constructed to include drains into the berm cross-section. The need for drains to control seepage at the downstream toe is best determined after observation of the dam performance and instrument monitoring. In order to assist in any future decisions regarding the dam performance, an instrumentation plan has also been incorporated with the dam design. The instrumentation system will include thermistors, pneumatic piezometers and settlement pins, as shown on Drawing B-5314-009.

Gravel protection will also be placed on the downstream slope to prevent runoff erosion of the fine sands in the embankment.

The following sections discuss the analyses carried out to arrive at the design cross-section for the dam.

.2 Thermal Analyses

.1 General

Thermal analyses were carried out to predict the short-term and long-term thermal changes in the tailings dam foundation during the operation and closure phases of the tailings impoundment. The principal objectives of the analyses were to predict the depth and rate of thawing of the foundation soils and to estimate the magnitude of the resulting settlements for determination of freeboard allowance and thaw-induced excess pore pressures for stability assessment as presented in subsequent sections.

The thermal parameters for soils at the Mt. Nansen site were estimated by comparison with published correlations for similar materials as shown on Figure A3-1 in Appendix III. Based on the available data, the thermal parameters summarized on Figure A3-2 were adopted. A check on the suitability of these parameters was made by analyzing the existing site conditions as discussed in the following sections.

.2 Analysis of Existing Site Conditions

A one-dimensional thermal analysis of the existing site was carried out using the computer program THERM1 by Nixon Geotechnical Ltd. The soil column and assumed thermal properties of the soils are shown on Figure A3-3. The soil column was modelled with an initial temperature of -1.5°C based on thermistor readings observed to date and the model then subjected to cyclic thermal boundary changes at the ground surface. The assumed air temperatures were assumed to be equivalent to the mean monthly air temperatures for Carmacks less 3°C to account for an elevation variation of approximately 600 m.

Ground surface and snow surface temperatures were derived from the corresponding air temperature by multiplying by the thermal "n" factor. A winter freezing n-factor of 0.9 was assumed to determine snow surface temperatures based on ambient air temperatures. The average snow cover thickness was estimated based on Environmental Canada records for Carmacks. The summer n-factor was assumed to be 1.3 in peat covered areas and a value of 1.5 was used for areas without peat such as the main dam and tailings area. The resulting ground temperature profile for the months of January, April, July, and October at test hole location DH95-10 was calculated by THERM1 as shown on Figure A3-3 for a time period of 25 years. The depth of the active layer and the temperature profile at depth did not change significantly after 25 years. The graph on Figure A3-3 shows good correlation between the estimated and measured ground temperatures as observed at the end of July. The thermal model was then analyzed for a typical soil column on the terrace slope in the vicinity of test holes DH95-04 and DH95-05 where ground temperatures were warmer at approximately -0.2 to -0.5°C. At these locations the sand soils with little to no organic cover showed the calculated and measured values both as having deep active zones with temperatures slightly below freezing in the permafrost zone.

In the event of complete thawing, the one dimensional thermal model also shows freezeback for each of the typical soil columns, however, the rate of freezeback is expected to be very slow and significant freezeback should not be expected in the sand fill or tailings areas for several decades after the end of operation.

.3 Thaw-Induced Pore Pressures

Thaw-induced pore pressures in the foundation soils may influence the stability of the tailings dam slopes, if the rate of thaw is faster than the rate of pore pressure dissipation at the thaw front. A conservative assessment of the rate of thawing of the foundation soils beneath the upstream dam slope was made by conducting a one-dimensional analysis of the rate of thaw beneath the reservoir with water only presen

and no tailings. The soil column and soil properties considered are shown on Figure A3-4. The temperature of the pond water was varied monthly using the reported reservoir temperatures at the Kelsey Generating Station in Northern Manitoba. These temperatures, given on Figure A3-4, agree with our experience at other lakes in the NWT were seasonal temperatures have been measures at the bottom of the lakes.

The predicted rate of thaw for a period of 25 years is plotted on Figure A3-4 in terms of the square root of time. The slope of the plot is the thaw constant (α). The predicted value of α is 6.2×10^{-4} m/s$^{0.5}$ (0.62 mm/s$^{0.5}$) which falls in the middle of the typical range of α between 0.2 and 1.0 mm/s$^{0.5}$ (Nixon and McRoberts, 1973).

The amount of excess pore pressure generated on thaw is related to the rate of thaw, and the soil's ability to dissipate pore pressure represented by the coefficient of consolidation, as follows:

$$u = \frac{\gamma' . d}{1 + \frac{1}{2R^2}}$$

Where:
- u = excess pore pressure (kPa)
- γ' = submerged unit weight = $\gamma_t - \gamma_w$ (kN/m^3)
- d = depth (m)
- R = thaw consolidation ratio = $\alpha / 2\sqrt{c_v}$
- α = rate of thaw (m/s$^{0.5}$)
- C_v = coefficient of consolidation (m^2/s)

This relationship has been plotted on Figure A3-5. Using a lower bound C_v from Figure A2-4 in Appendix II of 1×10^{-6} m^2/s and $\alpha = 6.2 \times 10^{-4}$ m/s$^{0.5}$. The predicted excess pore pressure from the chart is 16% of the initial effective stress. Pore pressures of this amount were accounted for in the subsequent stability analyses.

.4 Two-Dimensional Analysis of Long-Term Dam Conditions

In order to evaluate and demonstrate the long-term thermal performance of the tailings dam, a two-dimensional finite element analysis of the tailings impoundment was carried out using the computer program TEMP/W developed by Geo-Slope International. The two-dimensional mesh used in the analyses is shown on Figure A3-6. The design includes an upstream berm which reduces the rate of thaw and enhances stability at the upstream toe of dam. This area will be subjected initially to thawing due to ponding of water and tailings disposal during the initial mine operations startup and the berm will therefore provide additional thermal protection.

The analysis conservatively considered the impact of the three year operating impoundment life by assuming a full pond water level with no tailings for the entire three year period. Closure conditions starting in Year 4 were then modelled by a tailings beach with the pond set back 50 m from the dam crest. The monthly varying ground surface temperatures were derived for each typical soil column (i.e. tailings sand, sand fill and native foundation soils with peat cover) using the one dimensional analysis and these values then input into the two dimensional model. The analyses were then extended for a total duration of 25 years. Figure A3-7 shows the representative sections which were analyzed and the depths of the thaw boundaries (0°C isotherm) after years 1, 2, 3, 5, 10, 15, 20 and 25 years.

The results of the analyses show:

- The zone of thawing in the foundation soils will extend only one-third of the width of the tailings dam from the upstream toe. The thawing is indicated to be confined to the upper 1 to 2 m of the foundation soils in the area underlying the upstream slope of the dam and up to 5 m under the pond. The subsequent thaw settlement analyses presented in the next section, assume a conservative depth of thaw of 4 m under the dam.

- In the event the tailings pond is operated for only three years, complete freeze back of the foundation soils beneath the dam is predicted after approximately 25 years. Extension of the mine life will however increase depths of thaw and the time for freeze back.

- Partial freezing of the downstream portion of the dam fill is predicted during the operating phase of the impoundment. The rate of freezing

can be accelerated by removal of snow on the downstream slope of the dam.

- In the long-term, complete freezing of the dam is predicted with the final thaw boundary lying within the upstream deposited tailings.

To better assess the potential for thawing in the foundation soils, an additional analysis was made which took the operating conditions with full pond to a long-term operation life of 50 years. The results of this analysis, shown on Figure A3-8, showed that the thaw front (0°C isotherm) beneath the impoundment would extend down through the foundation soils into the underlying bedrock. The analyses however, estimate that the thaw front would not extend downstream of the dam centreline.

The above analyses do not consider the effects of convective heat transfer by seepage beneath the dam. The effects of such seepage will be minimized by the presence of a tailings beach and the geosynthetic clay liner in the dam which will cutoff seepage through the dam and the upper part of the foundation. Seepage under the dam will be restricted by the presently ice-saturated, frozen foundation soils.

The thermal analysis yields two important conclusions:

- Complete thaw of the foundation soils beneath the dam is not predicted during the operational phase of the impoundment thereby reducing potential thaw-settlements; and

- After mine closure, the regional permafrost will aggrade upwards into the dam in the long-term resulting in a strong and impermeable dam.

Irrespective of the above, the design takes into consideration long term measures which are required in the event of complete thaw of the foundation soils under the worst case condition. The thermal performance of the dam and underlying foundation and the influence of the tailings will be monitored throughout the operational life of the impoundment to determine which long term solutions are required.

.3 Thaw-Settlement Analyses

Settlement of the dam will occur in areas where the foundation soils thaw and consolidate under the embankment loading. Thermal analyses predict that the foundation soils under the upstream slope will only partially thaw during mine operations due to the warming influence of the tailings pond. These analyses predict that during the three year design life of the mining operation, thawing of the foundation soils will occur to a maximum depth of approximately 5 m under the pond area and less than 2 m below the upstream portion of the dam. The depth of thaw for the settlement calculations has therefore conservatively been assumed as 4 m.

In assessing the settlement due to thaw consolidation, the in situ frozen bulk densities were compared to empirical relationships which have been derived from published laboratory measurements and case history data of thaw settlement for various frozen soils ranging from frozen clays and silts to frozen sands. A series of correlations are shown on Figure A3-9 which show the relationship between the initial frozen bulk density and the normalized thaw consolidation ratio (i.e. ratio of settlement to initial height). For a given bulk density, higher plasticity soils generally speaking yield a higher thaw settlement than non-plastic silts and sands.

The median relationship between thaw settlement and frozen bulk density (γ_f) for all soils is given by the following equation:

$$\frac{\Delta H_T}{H} = 0.57\,(1.97 - \gamma_f)$$

The upper bound relationship between thaw-settlement and frozen bulk density for sands is given by:

$$\frac{\Delta H_T}{H} = 0.57\,(2.1 - \gamma_f)$$

The area considered to have the greatest potential for thaw settlement is located in the base of the creek valley. Three test holes including DH95-06, DH95-08 and DH95-09 were drilled in this area. An average of the frozen bulk densities in the upper 4 m of these three holes indicated an initial bulk density of approximately 1760 kg/m^3. Comparison of this initial bulk density to the design graphs for thaw consolidation on Figure A3-9 indicates an estimated settlement after three years of pond operation ranging from 0.5 m for the median case to 0.8 m for the upperbound case.

Bulk density values in the lower sand deposits below a depth of 4 m indicated an average bulk density of 1900 kg/m^3. Based on an assumed thickness of 16 m, the estimated additional settlement due to complete thawing of the foundation could vary from 0.7 m to 1.7 m for the median and upper bound cases respectively. In the event of complete thaw of the foundation soils, total settlements are estimated to vary from 1.2 m to 2.5 m for the median and upperbound cases.

The proposed dam cross-section allows for a potential 0.6 m settlement during the first three years based on the estimated thaw settlement in the upper 4 m. The dam performance over the first three years will be monitored for various behaviour aspects including the depth of thaw and dam crest settlement. Prior to completion of three years of operation, BYG are required to make a decision regarding raising of the dam for additional tailings storage or construction of the closure spillway for long term abandonment of the tailings impoundment. At that time the dam crest height should be reviewed and any additional allowance for longterm settlement made at that time. Should the dam performance and instrument monitoring suggest freezeback will occur after mine closure; then additional raising of the dam may not be required for settlement purposes.

.4 Stability Analyses

.1 General

Stability of the main dam embankment will initially be controlled by the presence of permafrost in the underlying foundation soils. The tailings dam overlying a frozen foundation is expected to behave more than adequately and stability is not an issue of concern. The design must however consider the long term possibility of the foundation thawing. Stability analyses were therefore carried out to determine the cross-sectional geometry required to ensure stability of the dam under static and seismic conditions with an unfrozen foundation.

Limit equilibrium analyses were used throughout the stability evaluation for the main tailings dam. The computer program SLOPE/W by Geo-Slope International was used to analyze the various stability models using the circular Bishop method.

A stability model was developed for the central valley Section 'B', as shown on Figure A4-1, where the dam height is a maximum of about 18 m. A review of the foundation stratigraphy indicated that the dam foundation could be conservatively modelled as a homogeneous sand despite the presence of frequent gravel layers in the foundation. The dam geometry was based on the preliminary design cross-section with upstream slopes of 2.5H:1V and downstream slopes of 3.5H:1V. As previously discussed, construction of the downstream berm was omitted, but a 4 m thick upstream berm was included to protect the upstream toe of the dam from rapid thawing and possible instability due to warm pond water during mine startup. Dependant on the dam foundation performance, a downstream berm may eventually be required, however, construction of the berm can be delayed without serious ramifications until the actual performance of the dam can be monitored by the foundation instrumentation.

For design, the minimum allowable factor of safety against failure for static conditions was taken to be 1.5.

.2 Soil Parameters

Standard proctor densities were measured for the proposed embankment fill as part of the borrow material evaluation. Maximum dry densities were measured at 1766 kg/m^3 and 1850 kg/m^3 for the typical sand material which will be used in the embankment. For an average value of 1808 kg/m^3 at 95% standard Proctor density and 13% moisture content, the estimated average bulk density of the embankment fill is 1940 kg/m^3 or 19.0 kN/m^3. During the recent field investigation, bulk densities were also measured in the various soil strata underlying the main dam embankment. These values are recorded on Figure A2-2. For the foundation soils underlying the base of creek valley, the average bulk density is estimated to vary from an average of 1760 kg/m^3 in the upper soils, to be between 1900 kg/m^3 and 2000 kg/m^3 in the lower layers. An average unit weight of 19.0 kN/m^3 was adopted in the analyses. Based on our experience with similar tailings at other mine sites, the dry density of the tailings is estimated at 1250 kg/m^3. With an average water content of about 40%, the estimated bulk density of the tailings is about 1730 kg/m^3 or 17.0 kN/m^3. The frictional strengths of the fine sands and tailings are estimated based on the typical grain size when compared to published values and experience with similar materials. The sand soils are all considered cohesionless. The soil parameters used in the stability analyses are summarized as follows:

SOIL TYPE	BULK UNIT WEIGHT (γ) (kN/m^3)	FRICTIONAL STRENGTH (ϕ) (Degrees)	COHESION (kPa)
Compacted Embankment Fill	19	34°	0
Foundation Sand	19	30°	0
Tailings	17	30°	0

.3 Static Analyses

To assess the effect of foundation pore pressures on the factor of safety, a number of parametric analyses were undertaken to relate the factor of safety to the pore pressure

parameter r_u which is defined as the ratio of excess pore pressure (u) to the effective stress ($\gamma'.d$) at a specific depth. From the equation in Section 7.2.3, the pore pressure parameter is calculated based on the pore pressure generated on thaw relative to the rate of thaw as follows:

$$r_u = u/(\gamma'.d) = \frac{1}{1 + \frac{1}{2R^2}}$$

Where:
- u = excess pore pressure (kPa)
- γ' = submerged unit weight = $\gamma_t - \gamma_w$ (kN/m^3)
- d = depth (m)
- R = thaw consolidation ratio = $\alpha / 2\sqrt{c_v}$
- α = rate of thaw (m/s$^{0.5}$)
- C_v = coefficient of consolidation (m^2/s)

The results of the slope stability analyses for the downstream slope are summarized on Figure A4-1. The upstream slope is contained by the tailings beach and stability is therefore not a concern by the time the foundation thaws. As shown, for the downstream slope, the minimum factor of safety for the downstream slope occurs at a r_u value of approximately 0.55. The predicted r_u value based on the rate of thaw ($\alpha = 6.2 \times 10^{-4}$ m/s$^{0.5}$) and the coefficient of consolidation ($c_v = 1 \times 10^{-6}$ m^2/s) of the material, as discussed in Section 7.2.3, is approximately 0.16 which results in a factor of safety in excess of 2.

.4 Seismic Analyses

The Mt. Nansen minesite lies within a seismically active area of the Canadian north in Seismic Zone 2, as defined by the National Building Code of Canada, 1990. The site lies within the Northern British Columbia (NBC) source zone between the McKenzie (MKZ) zone and the Denali Shakwak (DSK) zone.

A probabilistic assessment of the seismic risk at the site has been undertaken by the Pacific Geoscience Centre for the Mt. Nansen site (October 1988). Based on this assessment, a peak horizontal ground acceleration of approximately 10% g is expected with probability of exceedance no greater than 0.0021 per annum, or one in 475 years.

while a peak horizontal acceleration of 12% g is expected with a return period of .001, or one in 1 000 years.

The dam foundation consists primarily of fine sands and hence, if sufficiently loose, can be potentially liquefiable. The governing parameters regarding the liquefaction of the sand are the thawed in situ density and the design earthquake in terms of magnitude (M) and acceleration (a_h). Current engineering practice to determine liquefaction susceptibility in foundation soils, requires the measurement of Standard Penetration Test (SPT) corrected blow counts ($(N_1)_{60}$) either by SPT or cone penetration methods. If an analysis of the blow count profiles with depth indicates that the foundation is potentially liquefiable then the residual strength for the material can be estimated and a corresponding factor of safety can be calculated. However, based on the current frozen nature of the foundation and the predictions from the thermal analysis related to future thawing, the following approach is recommended:

- Monitor the actual performance of the dam and foundation over the 3 years of operation.
- At time of mine closure review seismic stability including the design earthquake and SPT data from thawed zones (if any).
- Review liquefaction potential and, if required, include a downstream berm in the mine closure plan.

.5 Seepage Analyses

.1 General

The design of the main tailings dam is intended to minimize seepage of the pond water downstream of the dam into Dome Creek. This will ensure release of water from the tailings pond is controlled through treatment facilities and/or the emergency spillway and will also ensure that piping and loss of material does not occur at the downstream toe of dam due to uncontrolled seepage pressures.

The proposed dam embankment is expected to be constructed of fine to medium sand with a silt content typically varying from 10% to 40%. The foundation soils underlying the dam similarly consist of these type of sand materials. The fine grained sands are moderately pervious and a seepage barrier is therefore required. The presence of an ice saturated frozen foundation will provide an initial barrier against seepage, however, the design must account for the long term potential of the foundation thawing with a corresponding increase in foundation permeability.

The primary barrier to impede seepage through the dam will consist of the tailings which will be deposited on the upstream slope throughout the period of mine operation. The tailings to be stored in the impoundment are expected to have a high content of clay size particles with a corresponding low permeability. The thickness of tailings will increase throughout the mine operation as the level of required protection also increases due to higher pond levels and a greater potential for thawing in the foundation. A secondary seepage barrier is provided by inclusion of a geosynthetic clay liner on the upstream slope. The clay liner will provide seepage protection during the initial pond startup when water will be ponded against the upstream slope prior to tailings deposition. Seepage protection is also provided by the geosynthetic clay liner in the event foundation thawing occurs which may result in differential settlement and cracking of the dam. Cracking is not however considered a major concern due to the self healing nature of the cohesionless sand fill and the thick covering of tailings on the upstream slope.

The initial dam cross-section to be constructed does not include a downstream berm. In the event that seepage does develop and seepage pressures at the downstream toe are reason for concern, a downstream berm can be constructed with drains which can control seepage without piping or loss of material at the toe.

The limited seepage expected through the embankment and underlying foundation will be collected upstream of the seepage recovery dam where it can be returned to the tailings pond by pumping or released downstream if acceptable water quality is

achieved. This small embankment for the seepage recovery dam will also be provided with a geosynthetic liner which will be keyed into the underlying permafrost. Details of the main dam, seepage recovery dam and geosynthetic clay liner are shown on Drawings B-5314-007 and -008.

.2 Seepage Analyses

Seepage analyses were carried out using the two dimensional finite element computer program SEEP/W by Geo-Slope International. The seepage model is shown on Figure A5-1 and the hydraulic parameters are listed below:

MATERIAL	HYDRAULIC CONDUCTIVITY (cm/s)	Kh/Kv
Bedrock	$1x10^{-7}$	1
Frozen Sand Foundation	$1x10^{-7}$	1
Thawed Sand Foundation	$1x10^{-3}$	1
Dam	$1x10^{-3}$	1
Tailings	$1x10^{-5}$	1

The design values of the hydraulic conductivity were based on laboratory testing and assumed values for similar type soils. For comparison, falling head permeability tests on recompacted samples of the foundation sand gave permeability values of $2x10^{-5}$ cm/s to $9x10^{-4}$ cm/s. All materials were assumed to be isotropic with the ratio of horizontal and vertical permeabilities equal to unity.

The seepage model consisted of a typical dam cross-section with dam crest set at elevation 1151.5 m, a pond elevation of 1149.7 m and a 50 m wide tailings beach. The downstream water elevation was set at 1136 m. The presence of a geosynthetic clay liner was not included in the analyses and therefore the estimated seepage quantities are expected to be conservatively higher than anticipated. The seepage analyses indicate that the phreatic surface will be low in the downstream portion of the

dam, as shown on Figure A5-1, and quantities of seepage through the dam should also be low at approximately a maximum of 0.2 l/sec for the case of a frozen foundation and unfrozen dam over a 200 m wide seepage zone. At this rate of seepage, the seepage recovery pond should fill to the crest level after two months operation. Figure A5-1 also presents the variation of predicted seepage with depth of thaw under the dam. With about 16 m of thawed foundation, the maximum predicted seepage increases to about 2.4 l/s assuming a 200 m wide seepage zone (14 days capacity in the seepage recovery pond). It is important to note that these seepage rates are dependant on the development of a tailings beach on the upstream face of the dam.

.3 Geosynthetic Clay Liner (GCL)

The proposed GCL consists of Bentofix NW by Terrafix. The Bentofix NW is a sandwiched composite of two non woven geotextiles with an intermediate bentonite clay layer. The Bentofix is needle punched across its entire surface to bind the two geotextiles together. The needle punching laterally confines the bentonite to control swelling during hydration and also provides a high degree of internal shear strength. As a result, the Bentofix GCL's internal friction within the composite is relatively high at approximately 34° so that in the hydrated state, no potential plane of weakness exists within the composite.

.6 Instrumentation

An instrumentation system is required to adequately monitor the tailings dam performance both during and after mine operation. The proposed instrumentation plan should include thermistors, pneumatic piezometers and settlement pins in the area of the main tailings dam and seepage collection dam. Drawing B-5314-009 presents the proposed instrumentation details.

A series of six thermistor strings were installed during the recent field program at various depths up to 15 m in the foundation areas of the main dam and seepage recovery dam. The thermistors were supplied by R.S. Technical Instruments of Port

Coquitlam, British Columbia and were accurate to ±0.2°C. The thermistor cables are presently protected with steel casings at the ground surface at each test hole location. During construction of the dam, each cable should be extended to the toe of dam by splicing on additional cable and burying the cable horizontally in the embankment fill. An additional thermistor string with six thermistors spaced at 14 m intervals should be placed horizontally within the embankment fill approximately 5 m above the foundation base, as shown on Drawing B-5314-009. All thermistor strings should be labelled and extended to a suitable readout location near the downstream toe. Monitoring of the thermistors should be continued throughout construction as well as the subsequent mine operation period to measure temperature changes and possible thawing in the foundation soils. Monitoring of this data is extremely important as the inclusion of any future design measures is dependant on the presence or absence of permafrost in the foundation.

Pneumatic piezometers are also recommended at several locations as shown on Drawing B-5314-009. In total, fifteen pneumatic piezometers are proposed underlying and within the dam embankment. The pneumatic piezometers should consist of P-100 General Purpose piezometers as supplied by R.S. Technical Instruments. Eleven of these pneumatic piezometers are proposed along a central line down the centre of the creek valley. The pneumatic piezometers should be installed at depths ranging from 3 m to 10 m below foundation level and up to 2 m above foundation level. An additional two piezometers should be installed on each abutment with each set consisting of one piezometer 3 m below foundation level and the other piezometer 1 m above foundation level. Pneumatic piezometer tube lines should be buried in the embankment fill and extended laterally to the toe of dam. Monitoring of the pneumatic piezometers is only recommended in zones which are known to have thawed. Measurement of pneumatic piezometers in frozen zones is not required as these instruments will not reliably measure pore pressures until the surrounding soils thaw. Once thawing has occurred, the pneumatic piezometers will, however, allow measurement of the foundation pore pressures which are caused due to thaw-consolidation and will also allow measurement of any seepage pressures present in the

embankment. Monitoring of the pneumatic piezometers therefore need only be initiated after pond filling has commenced and the temperature regime indicates thawing is occurring.

Settlement pins are also required along the crest to monitor settlements after completion of the embankment construction. The settlement pins should consist of 25 mm diameter iron bars at least 1.5 m long which are driven into the embankment fill along the downstream edge of the dam crest. The settlement pins should be positioned across the crest as shown on Drawing B-5314-009. The frequency of survey measurements for the settlement pins will depend on the performance history of the dam and should be reviewed as settlement data is collected.

.7 Borrow Assessment

Approximately 100 000 m^3 of Zone 1 sand fill is required for construction of the tailings dam embankment. The borrow areas which have been identified for construction use in the dam embankment include three sand ridges on the south valley slope upstream of the dam (Borrow Areas A, B and C, see Drawing B-53147-003) and the operating spillway excavation (Borrow Area D) on the north valley slope located downstream of the dam. It is estimated that these borrow areas should be sufficient to provide the necessary quantities for dam construction. The primary borrow material from each of these areas is a fine to medium grained silty sand. The sand is generally frozen below the depth of active zone and thawing of any frozen materials will be required prior to compaction.

The silt content for the sand borrow material typically varies from 10% to 40%. Two standard Proctor density tests were carried out in accordance with ASTM D698 which showed maximum dry densities varying from 1766 kg/m^3 to 1850 kg/m^3. The optimum moisture content to achieve the required maximum dry density varied from 13.3% to 12.8% respectively for each of these two tests. (See test results on Figure A2-5 in Appendix II.)

Borrow Area A contained a surficial layer of fine sand to a depth of 6.25 m which is expected to be suitable for embankment construction. The sand is at or below optimum moisture content in the upper 3 m and then increases above optimum moisture content up to 20% below the 3 m depth. The lower strata in this area, below 6.25 m depth, as observed in DH95-17, consist of silt with sandy zones. Moisture contents in this strata are generally much higher at 30% and use of this zone is most likely not feasible due to the additional drying and conditioning of the wet material which is anticipated prior to compaction.

Borrow Area B is located further upstream on another sand ridge. Similar to Area A, test holes DH95-18 to DH95-20 generally showed a trend towards increasing moisture content with depth. For the most part moisture contents were generally within the 15% to 20% range in the fine sands. Silt layers were observed at various depths which may not be useable in the main dam embankment. It is expected the thickness of useable material may vary from about 9 m on the outer edges of this ridge tapering to less than 2 m towards the south valley slope.

Borrow Area C indicated the presence of significant silt layers in test holes DH95-21 to DH95-23. It is anticipated that the use of these silt soils will not be practical due to high moisture contents which were evident after thawing samples in the field. An upper layer of suitable sand borrow was, however, observed to a depth of 2.4 m near the edge of the deposit.

In addition to the borrow areas upstream of the dam, it is anticipated that a significant quantity of borrow will be obtained from the operating spillway excavation on the north valley slope in the vicinity of test hole DH95-26. It is expected that this excavation will be widened on either side to include a portion of the sand ridge which parallels Dome Creek. Test hole DH95-27 was drilled east of the spillway excavation on this sand ridge. Both of these holes in this area indicate good potential for sand borrow to depths up to 9 m and possibly deeper. Similar to other areas, there is a trend towards increasing moisture content with depth. Again, moisture contents were observed to be

less than 20%, except in zones near the ground surface where moisture contents are less than 10%.

Operation of the borrow areas will require that the sand borrow be excavated in a manner to allow thawing prior to placement and compaction. In some cases, it is anticipated that ripping will be required to accelerate the thawing process. Operation of several borrow areas simultaneously will also maximize the amount of thawed material suitable for placement. Excavation should also be carried out in a manner which will mix dry soils with wet soils. This may best be carried out by sloping excavations in order to mix soils from different layers. The deeper sands are otherwise expected to be wet of optimum and drying will be required prior to compaction. The use of a dozer or grader is recommended to blade materials across the embankment fill or in situ in borrow areas to allow sufficient aeration and drying.

3. HYDROLOGY AND WATER MANAGEMENT

.1 Meteorological Stations

The long term meteorological station located closest to the site is Carmacks which has available about 22 years of data. The station is located about 60 km to the east of the site at an elevation of 524 m, or about 600 m to 800 m below the minesite elevation. Other long term stations reviewed as part of this study are listed in Table 1 along with their location with respect to the site.

Table 1 - Meteorological Stations

Station Name	Station Number	Location	Record Interval	Years of Record
Carmacks	2100300	60 km east	1963-1991	29
Whitehorse	2101300	180 km southeast	1942-1990	49
Pelly Ranch	2100880	80 km north	1951-1990	40
Mayo Airport	2100700	185 km north-northeast	1925-1990	66
Haines Junction	2100630	145 km south	1945-1984	40
Burwash Airport	2100182	135 km southwest	1966-1991	26
Aishihik	2100100	80 km southeast	1943-1966	24
Braeburn	2100167	90 km southeast	1974-1991	18

.2 Annual Precipitation

Precipitation at Mt. Nansen occurs primarily as snow from November to the end of April. On average approximately 40% of the annual precipitation falls as snow which corresponds to the typical snowpack of 1 m as observed at the site. Some rainfall occurs as early as April, but the majority of rainfall occurs from June to August.

An analysis of regional weather stations indicates that the average annual precipitation is consistent from about Burwash Landing, northeast to Mayo and as far south as Whitehorse and north to Dawson. Although most of these stations are located at elevations substantially lower that the minesite, increases in precipitation with elevation are not expected at this site given the local rolling topography and the overwhelming effect of the St. Elias range in removing moisture from air masses moving to the northeast. Precipitation does however, begin to significantly increase further northeast of Mayo.

For the reasons mentioned above, Carmacks monthly precipitation data was taken as representative of the site. Mean annual precipitation values on a monthly basis are summarized in Table 2 along with a 200-year return period wet year and a 10-year return period dry year.

.3 Lake Evaporation

The closest station for which lake evaporation data is available is Pelly Ranch (formerly Fort Selkirk) which is located about 80 km north of the minesite at an elevation of 454 m. The lake evaporation data from this station was taken as representative of the site.

There are 17 to 28 years of evaporation data available at Pelly Ranch, depending on the month (May and September have missing data). The data is shown in Table 2. During the summer months of May through August, evaporation exceeds average precipitation indicating a soil moisture deficit. In the wettest month (July) lake evaporation is about twice the precipitation.

Table 2 - Summary of Monthly Precipitation and Evaporation

MONTH	PRECIPITATION			EVAPORATION
	Average Year (mm/month)	10-Year Return Period Dry Year	200-Year Return Period Wet Year	Average Monthly (mm/month)

		(mm/month)	(mm/month)	
January	17.5	13.0	26.5	0.0
February	12.0	8.9	18.2	0.0
March	6.8	5.0	10.3	0.0
April	6.6	4.9	10.0	0.0
May	19.6	14.5	29.8	105.0
June	33.7	25.0	51.2	121.3
July	53.8	39.9	81.7	111.2
August	38.5	28.5	58.5	80.0
September	30.0	22.2	45.6	36.6
October	18.7	13.9	28.4	0.0
November	17.9	13.2	27.2	0.0
December	14.9	11.0	22.6	0.0
TOTAL	270	200	410	454

.4 Short Duration Storms

Weather data has been collected at Carmacks station since 1964. For the years of 1964 to 1984 rainfall data is available in IDF format from Atmospheric Environmental Services which gives annual extreme rainfall for durations from 5 minutes to 24 hours. The IDF format is based on a moving window average over the duration of the rainfall in question. From 1984 to present this level of detailed rainfall information is not available and only once daily measurements are available to determine annual "daily" extreme rainfall. The daily data is available from 1964 to present and thus represents a significantly longer period of record. To account for differences in sampling techniques between the IDF and daily data methods, the daily data is typically scaled up by a sampling factor of 1.13.

The longer term extreme daily data from Carmacks was compared to other stations in the region. The results showed that the Carmacks extreme daily data was low and thus a scaling factor of 1.4 was applied to represent site conditions. Since the longer term daily data is more reliable, the shorter duration IDF data was scaled to match the 24-

hour IDF to the daily data. A frequency analysis was done using this data to determine 20 year and 200 year data for durations of 5 min to 24 hour data as shown in Table 3.

The 24-hour Probable Maximum Precipitation (PMP) was determined from the Carmacks daily data using the Hershfield method. This value was scaled by 1.4 to obtain the 24-hour PMP for the site. Individual Hershfield analyses were carried out for the IDF data for each duration and these were scaled up to match the IDF 24 hour PMP to long term daily 24 hour PMP. The PMP values are shown in Table 3.

For design of the diversion ditch and emergency spillway and to provide estimates of required dam freeboard over the spillway invert, a short duration storm for the 20 year and 200 year return period and the PMP event was required. The rainfall runoff model OTTHYMO was used to determine peak flow in the diversion ditch and the inflow hydrograph for pond routing. Based on the estimated time of concentration of the catchment, a storm of 6 hours was selected. Six hour storms were assembled for each event with an interval of 5 minutes using rainfall data as shown in Table 3 incorporating an alternating block method.

Table 3 - Short Duration Rainfall Data

DURATION	RAINFALL (mm)		
	20 year	200 year	PMP
5 min	8.8	12.9	22.1
10 min	12.0	17.8	41.2
15 min	14.3	21.2	48.1
30 min	16.8	24.1	57.8
1 hr	18.8	26.9	86.1
2 hr	21.7	30.0	101
6 hr	26.0	35.5	124
12 hr	31.9	44.0	146
24 hr	35.7	49.2	170

.5 Diversion Channel and Emergency Spillway Design

.1 General

For operating conditions the recommended level of design is a 20 year return period for the diversion channel and 200 year return period for the emergency spillway. By designing the diversion channel for only the 20 year event, the required channel size and erosion protection are reduced. BYG have indicated that in order to minimize storage requirements for excess water in the tailings pond, water treatment will be performed if water quality standards are not achieved. Therefore, any flows larger than the 20 year return period will be routed through the tailings pond which lowers downstream channel requirements. The general layout and section details of the diversion channel and spillways are shown on Drawings B-5314-003 and B-5314-010.

.2 Diversion Channel

To divert the flow of Dome Creek around the tailings pond, a diversion channel could be constructed on the north abutment of the dam, as shown on Drawing B-5314-003.

Water from the diversion would enter the emergency spillway channel downstream of the dam centreline. If required during mine operation, it would be possible to construct an outlet from the channel into the tailings pond to allow water into the pond if a water deficit were to occur.

A catchment area of approximately 2.3 km^2 contributes flow to the diversion channel. The 20 year peak flow in the diversion channel was calculated to be 6.4 m^3/s. The channel depth is shown in Table 4 for 0.1% and 6% gradients. The channel was assumed to have a 3 m wide invert and 2H:1V sideslopes.

The material underlying the diversion channel is a silty sand which will require protection against erosion. The flat gradient section of the diversion upstream of the dam centreline will require a 300 mm thick layer of Zone 2 gravel consisting of 75 mm minus pitrun gravel, while the steeper section will require a heavier Zone 3 riprap up to 300 mm diameter with a 300 mm thick bedding layer of Zone 2 gravel. Recommended gradations for riprap and bedding materials are provided in Section 9.4 and are summarized on Table 5. The heavier riprap should be extended 10 m upstream of the grade change to prevent scour in the transition from tranquil to supercritical flow. As an alternative, an appropriate geotextile filter cloth (Terrafix 600R or equivalent) could be substituted for the bedding material underlying the riprap.

Due to the permeability of the underlying material, water is expected to seep out of the channel. The amount of seepage is estimated to be in the order of 4500 m^3/month during the summer when the ground is not frozen. An impermeable liner, which would reduce the seepage to almost zero, may be cost effective when considering water treatment costs. The liner could be installed at a later date if pond inflow is deemed too large based on first year operating data.

In the spring, when snow-melt begins and rainstorms may occur, excessive ice, snow and snow drifts must be cleared from the channels to allow for the safe diversion of surface runoff. Every spring and fall, the channel must be checked for vegetation build-

up and subsidence due to frost action. Either of these may reduce the effectiveness of the drainage channels and therefore must be monitored.

The present design shows a temporary diversion channel which bypasses the emergency spillway channel. It is anticipated that dam construction will be carried out coincidentally with the emergency spillway excavation which will provide a significant amount of borrow for the dam. A temporary diversion channel is therefore required during the period of construction. Riprap placement and activation of the emergency spillway channel may be delayed till the end of dam construction as the reservoir is initially empty and excess flood flows could be stored in the reservoir if necessary until riprap could be placed. The temporary diversion channel is also subject to erosion during major flows. Construction should therefore be scheduled so as to minimize the operation period for this channel.

.3 Emergency Spillway

The purpose of the emergency spillway is to prevent overtopping of the dam crest during peak inflow. The design level of flood protection is equivalent to the 200 year inflow to which freeboard has been added. To determine peak outflow, the 200 year inflow was routed through the pond to account for storage effects. The reservoir volume elevation curve used in the assessment is shown on Drawing B-5314-006 and the stage discharge curve was determined using a backwater computer model assuming critical flow occurs at the spillway transition from a 0.1% gradient to a 2% gradient.

The calculated emergency spillway flow is 3.7 m^3/s assuming the diversion channel is breached during the event and a starting water level at the spillway invert is 1149.7 m. The flow and channel depths for the emergency spillway are shown in Table 4 for various gradients. Downstream of the intersection with the diversion channel the design flow is 6.4 m^3/s which is equivalent to the diversion channel spillway 20 year peak flow. The channel was assumed to have a 5 m wide invert and 2H:1V sideslopes.

Table 4 - Diversion ditch and Emergency Spillway Hydraulics

Channel Description	Return Period (yrs)	Flow (m^3/s)	Slope (%)	Water Velocity (m/s)	Flow Depth (m)	Channel Depth (m)
North Diversion (3m width)	20 20	6.4 6.4	0.1-0.2 6	0.9 3.2	1.4 0.5	1.4 0.5
Emergency Spillway (5 m width) u/s of intersection with diversion	200 200	3.7 3.7	0.1-0.2 3	0.9 2.3	0.8 0.5	1.1 0.8
Emergency Spillway (5 m width) d/s of intersection with diversion	200 200	6.4 6.4	6 10	2.7 3.0	0.5 0.4	0.8 0.7

Note: Emergency Spillway depth includes 0.3 m freeboard.

The material underlying the emergency spillway is also a silty sand which will require protection against erosion. The flat gradient section of 0% to 0.2% will require a 300 mm thick layer of Zone 2 gravel, while the steeper sections of 2% to 10% will require either Zone 3 or Zone 4 riprap with a bedding layer of Zone 2 gravel or a geotextile filter fabric as shown on Table 5 and Drawing B-5314-010. The heavier riprap should be extended 10 m upstream of the grade change, to prevent scour in the transition from tranquil to supercritical flow. An appropriate geotextile filter cloth (Terrafix 600R or equivalent) could be substituted for the bedding material.

Table 5 - Recommended Diversion Channel and Emergency Spillway Riprap and Filter Sizes

Channel Description	Return Period (yrs)	Slope (%)	Riprap Zone	Riprap				Filter Size
				d15 (mm)	d50 (mm)	d100 (mm)	Thickness (mm)	
North Diversion (3 m width)	20 20	0.1-0.2 6	Zone 2 Zone 3	* 130	* 200	* 300	300 450	no filter 300 mm Zone 2 Gravel or Geotextile**
Emergency Spillway (5 m width) u/s of intersection with diversion	200 200	0.1-1.02 2-3	Zone 2 Zone 3	* 130	* 200	* 300	300 450	no filter 300 mm Zone 2 Gravel or Geotextile**
Emergency Spillway (5 m width) d/s of intersection with diversion	200	6-10	Zone 4	200	300	500	750	300 mm Zone 2 Gravel or Geotextile**

* Denotes (75 mm minus)
** Geotextile fabric should consist of Terrafix 600R or equivalent

The routing of the 200 year inflow produced a maximum pond level of 1150.5 m. Adding a freeboard of 0.4 m to this value results in a dam crest elevation of 1150.9 m. The effective protection of this dam crest level with zero freeboard is 50% of the PMF which is reasonable given the size of the dam and the downstream and financial consequences of failure.

.4 Closure Spillway

For mine closure, a permanent spillway should be constructed in rock on the south abutment. For longterm abandonment, the design flood discharge is assumed to be 100% of the Probable Maximum Flood (PMF). Assuming a spillway invert width of 5 m, channel sideslopes in rock of 0.5H:1V, an invert elevation of 1149.2 m (final tailings level) and PMF conditions, a routed maximum pond level of 1151.3 m was calculated. Including freeboard for waves and wind setup a dam crest of up to 1151.8 m may be required. This exceeds the current planned dam crest elevation of 1150.9 m by 0.9 m indicating that the dam would require raising at closure. Depending on the final level of the tailings it may be acceptable to reduce the invert of the spillway thereby reducing the requirement to raise the dam crest at closure. Alternatively a 10 m wide spillway could be constructed which results in a PMF pond level of 1150.8 m requiring a final dam crest of 1151.3 m, reducing the amount of the dam raise at closure to 0.4 m. The final design of the closure spillway should be determined when the final orientation of the tailings and the settled dam height is known. The analysis should include provisions for wave protection and overtopping.

.6 Water Balance

A combined water and tailings balance was carried out to determine the final tailings level and the amount of excess water that would require treatment. Because the tailings impoundment clearly operates with an excess of water for the average year and given that the diversion channel could be breached if more water were required, a dry year analysis was not done.

The water balance assumes that there is no seepage from the diversion ditch except that expected during July, August and September. During these months precipitation falling uphill of the diversion channel will infiltrate and pass underneath the diversion channel through the thaw zone. For the rest of the year the ground is frozen and runoff will flow into the diversion ditch. Thus, the pond catchment area with diversion channel is 75.8 ha for July to September and 50.9 ha for the remaining months.

Spring runoff was assumed to occur in the month of May, with the amount of snowmelt runoff equal to 80% of the cumulative precipitation from October to May. The remaining 20% accounts for overwinter losses in the snowpack, including base melt. For the summer months the runoff was assumed to be 60% which accounts for the presence of an impermeable permafrost at shallow depth, minimal ponding on the slopes, and relatively permeable thawed soils.

Mill water circulation was assumed to be 30 000 m^3/month with 100% recycle from the tailings pond year round. Seepage from the tailings impoundment is assumed to be minimal. Domestic and sewage water, which would be discharged with the tailings, have not been accounted for. However, their volumes would be small compared to the other factors and would not have a significant effect on this level of water balance calculation.

.1 Tailings Level

Assuming 3380 m^3/month of tailings reporting to the impoundment and an in situ void ratio of 1.0 a final average tailings elevation of 1149.2 m is estimated at the end of Year 3. A void ratio of 1.0 reflects the use of subaqueous deposition in winter to prevent the formation of ice lenses in the tailings. The average tailings elevation estimate is based on a resultant flat tailings level after deposition.

.2 Average Year Water Balance

The average year water balance results indicate that, with the diversion in place, there will be 237 300 m^3 of excess water over the 3 year mine life. The water level reaches

1149.7 m based on storing a minimum two-month mill water circulation volume of 30 000 m^3/month. During the winter there is a net loss of pond water due to minimal inflow and losses to tailings voids. In an average year, winter losses are estimated to be 2000 m^3/month. The results for the average year monthly water balance are shown in Appendix VI.

.3 200 Year Water Balance

If a 200 year wet year is added in year 2, with the remaining years being average, results indicate that, with the diversion in place, there will be 298 360 m^3 of excess water over the 3 year mine life. The maximum water level of 1149.7 m is unchanged since it is based on the tailings level plus 2 months volume of mill water circulation. The results for the 200 year monthly water balance are also shown in Appendix VI.

CONSTRUCTION QUALITY ASSURANCE MANUAL

Definition of Operations and Responsiblities

Parties who may be involved in the production, delivery and installation of materials and construction with on-site materials for the project are listed and defined below.

Designers:
Klohn Crippen. Responsible for the design, contract drawings and specifications for the constuction listed above.

Contractor:
Responsible for all the work on the Project. The contract has not yet been let.

Supplier:
Responsible for the manufacture and supply of geosynthetic products to the Installer. Depending on the Installer the supplier may also be the manufacturer and fabricator of the product.

Installer:
Responsible for field handling, storing, placing, seaming and other site specific aspects of geosynthetics. The Installer may also be responsible for transportation to site. Responsible for anchor trenches and all temporary anchoring or loading required to suport the geosynthetics during installation. Installer will be responsible to the Contractor.

Owner:
BYG Natural Resources Inc. is the Owner and will be responsible for operating and maintaining the facility and interfacing with the regulatory agencies. The owner will appoint a representative to coordinate filed activities. The Contractor will be responsible to the Owner's representative.

Engineer:
To be a party hired by and responsible to the Designer, independent of the Owner and the Contractors, responsible for the observation and documentation of activities pertaining to the assurance of the quality of the installation of manufactured products and the construction of on-site products. The Engineer will certify compliance with design.

Quality Assurance Monitors:
Work for and report to the Engineer.

Communications:
During construction the QA Monitors will report items complying with the specifications to the Engineer and those not complying, to the Engineer and directly to the Owner, who will direct the Contractors in the actions to be taken to enforce compliance. Remedial action will be tracked and reported to theEngineer and to the Owner by the QA Monitors. QA Monitors will report only compliance or non compliance and will not direct or instruct the Contractors.

Meetings

An initial meeting will be held at site with all parties involved in the construction and quality assurance. This meeting will be used to review critical details in design, construction scheduling, and quality control and quality assurance procedures, responsibilities and authorities of the parties, lines of communication, methods for documenting and reporting and for the distribution of such documents and reports.

The Owner will hold meetings at least once a week with the Contractors, and the QA Monitors to review progress, scheduling, items of concern and the resolution of any outstanding issues relating to Quality Assurance.

Site Clearing/Foundation Preparation

Site clearing and foundation preparation is required in the areas of work including the borrow areas, dam footprint area, seepage recovery dam, diversion ditch and emergency spillway. Performance of this work should be carried out as follows:

1. Remove all trees, shrubs and bushes and stockpile separately in the designated disposal areas shown on the drawings or approved otherwise by the Engineer.

2. Excavate surficial organic materials in areas of work including moss, peat and organic silts to expose native sands. Surficial organic soils may be used for future reclamation purposes and should therefore be stockpiled separately from surface vegetation in designated areas shown on the drawings. Excavation of organic soils in the base of Dome Creek valley underlying the dam embankment should be a minimum of 1 m and may vary up to a maximum of 2 m.

3. Remove all frozen lumps, ice or otherwise unsuitable material from the foundation area. Seepage from excavation side slopes should be controlled by positive drainage or pumping.

4. Foundation excavation and preparation in the base of Dome Creek valley should only be carried out after diversion of the creek flows and at such time as fill material is ready for placement on the prepared frozen subgrade. Immediately after the subgrade is exposed, the fill material should be placed and compacted in lifts as specified up to at least the original grade.

5. Subcuts are required along the upstream toe of tailings dam and seepage recovery dam for placement of the geosynthetic clay liner. These excavations should only be completed at such time as the liner material and backfill material are ready for placement.

Embankment Construction

Compacted earthfill embankments are required for the main tailings dam and seepage recovery dam. Performance of this work should be carried out as follows:

1. Supply Zone 1 embankment fill consisting of native sand material with a maximum of 50% fines passing the 75 mm size. The maximum size should not exceed 150 mm except in layers adjacent to the geosynthetic clay liner where the maximum size should not exceed 50 mm.

2. Ensure all Zone 1 fill materials are thawed prior to compaction.

3. Aerate or add water where necessary or mix dry soils with wet soils to achieve moisture contents within ± 3% of optimum moisture content as determined by ASTM D698.

4. Condition moisture content in Zone 1 embankment fill by blading, rolling or otherwise working material with a dozer or grader.

5. Place Zone 1 embankment fill in near horizontal lifts not exceeding a compacted lift thickness of 250 mm.

6. Compact embankment fill material to a minimum of 95% standard Proctor maximum dry density as determined by ASTM D698.

7. Compact embankment fill materials with a vibratory smooth or tapered pad drum roller with a minimum operating weight of 8000 kg.

8. Overbuild the upstream slope of the main tailings dam and seepage recovery dam to allow trimming and final grading of the fill surface prior to placement of the geosynthetic clay liner. Trim slopes for placement of liner using a smooth bucket excavator.

9. Ensure stones or rocks in excess of 50 mm are not exposed on the upstream fill surface prior to placement of the geosynthetic clay liner.

Geosynthetic Clay Liner (GCL) Installation

A geosynthetic clay liner is required on the upstream slope of the main tailings dam and seepage recovery dam. Supply and installation of the GCL should be performed as follows:

1. The geosynthetic clay liner should consist of Bentofix NW as produced by Terrafix Geosynthetics Inc. and should be supplied in rolls 4.62 m wide by 30.5 m long (packaged weight approximately 600 kg). BYG will supply the Bentofix GCL for installation by the Contractor.

2. During all stages of shipping, handling and storage of the Bentofix NW GCL, exercise care to prevent puncturing or other damage to the protective covering and GCL material and to protect against wetting of the rolls. Provide adequate storage facilities for the GCL materials while on-site prior to installation.

3. Remove protective coverings only immediately prior to deployment of the materials.

4. Any GCL materials that are exposed to precipitation or are otherwise wetted, should be set aside for examination by the Engineer to establish the degree of damage. Prior to deployment, examine any rolls of Bentofix that become contaminated with foreign materials to ensure that the material has not been compromised. In some cases, the material may be salvaged, but significant wetting of the Bentofix may complicate or even impede deployment and the normal course of action should be that the material be discarded.

5. In areas along the upstream toe of dam where the Bentofix is to be deployed directly above the in situ soil materials, remove all roots, large (>50 mm diameter) rocks, frozen lumps, debris or other foreign materials at the surface of the subgrade.

6. Ensure the final subgrade surface is smooth. If the subgrade is frozen and irregular, place a levelling layer of fine sand and roll with a smooth drum roller. The Engineer should record the soil type for the subgrade surface and approve the condition of this prepared surface prior to the deployment of any Bentofix.

7. Install sections of the Bentofix from the highest point to the lowest.

8. On slopes, install Bentofix down, not across the slope.

9. Cut Bentofix using only approved cutters, and take care to ensure that materials underlying them are not damaged during cutting.

10. The bentofix should be kept as clean as possible at all times up to and including the time of placement of the next layer of material covering them. Cover joint areas with a temporary layer of Terrofix 600 R geotextile until such time as joints are ready for placement of overlying layers of Bentofix.

11. Place adjacent panels of Bentofix parallel and overlap a minimum of 150 mm along the side joints, and 300 mm at end joints.

12. Treat overlap joints by the addition of powdered bentonite comprised of the same bentonite as used in the Bentofix sandwich, both between the overlapped sheets and along the exposed edge of the joint.

13. At the perimeter of the installation, as well as at the top of slopes, anchor the Bentofix layer into a trench. This anchor trench should be located at least 600 mm beyond the crest of the slope, and should be a minimum of 450 mm deep. Place the Bentofix into this trench extending down the inside face and across the bottom of the trench. Secure the material by the controlled placement and compaction of backfill into the trench in such a manner as to not damage the composite. In all cases, provide appropriate anchorage to prevent the ingress of any surface runoff beneath the Bentofix, and to secure the GCL for stability and performance.

14. Mark all areas requiring repair due to damage during shipping, handling, or deployment, or manufacturing flaws in the materials. In cases where the material is pervasively damaged and repair is impractical, the material so affected should be marked accordingly, removed, and set aside or removed from the site so as to avoid reuse. All repairs made by the placement of a patch of the same material over the flaw or damage should extend at least 300 mm beyond the flaw or damage in every direction.

15. Within 48 hours, after placement of the Bentofix GCL, completely cover the GCL with a layer of Zone 1 sand and protect the GCL against damage. Ensure all procedures for placement of the GCL and cover layer are carried out in a manner which does not tear or damage the GCL.

Erosion Protection

Gravel armour is required to prevent erosion in the diversion channel upstream of the dam centerline and also on the crest and downstream slope of the main tailings dam and seepage recovery dam. Riprap is required for erosion protection on the steep gradient sections of the diversion channel and emergency spillway on the north abutment. Supply and installation of erosion protection materials should be carried out as follows:

1. Zone 2 gravel armour should consist of the following:

Size	Percent Passing by Mass
75 mm	100 %
40 mm	55% - 90%
20 mm	40% - 65%
5 mm	20% - 40%
1.25 mm	7% - 25%
80 mm	0% - 5%

2. Zone 3 riprap should consist of the following:

Size	Percent Passing by Mass
300 mm	80% - 100%
200 mm	40% - 60%
100 mm	10% - 30%
50 mm	0% - 10%

3. Zone 4 riprap should consist of the following:

Size	Percent Passing by Mass
500 mm	80% - 100%
300 mm	40% - 60%
150 mm	10% - 30%
50 mm	0% - 10%

4. The ratio of maximum to minimum dimension for riprap particles should not exceed 3.0.

5. Gravel armour and riprap should consist of sound, hard particles, free of organic matter and which meets the following minimum requirements for soundness and durability:

Test	Method of Test	Minimum Requirements
Abrasion	Los Angeles Machine	Less than 40% loss of weight after 500 revolutions
Resistance	ASTM C535	
Soundness	Magnesium Sulphate Solution, ASTM C88	Less than 10% loss of weight after 5 cycles
Specific Gravity	ASTM C127	2.60 minimum
Absorption	ASTM C127	2.0% maximum

6. Supply Terrafix 600R geotextile on smooth prepared subgrade underlying areas of riprap.

7. Overlap joints of Terrafix 600 R geotextile by minimum of 600 mm. Joints should be oriented in a manner such that the upper geotextile layer is placed upstream of the lower geotextile layer.

8. Place armour and riprap materials in continuous layers of uniform thickness.

9. Place primary riprap and bedding materials on slopes by backhoe or similar lifting equipment. End dumping of materials on slopes and pushing into place will not be permitted. Adequately interlock particles and dress slopes as required.

10. Place riprap and bedding materials in a manner such that smaller stones shall fill the voids between larger stones so that there is no unfilled space which could permit the escape of lower layers of placed materials. Compaction of materials is not required, however, there shall be no tendency of stones to move or slide after placement.

11. Construction traffic will not be permitted upon placed riprap for armour layers.

12. Do not place riprap until the riprap bedding or underlying geotextile has been accepted by the Engineer.

13. Do not break individual pieces of riprap after placement either by blasting or mechanical methods.

14. Place riprap to its full course thickness in one operation and in such a manner as to avoid disturbance or displacement of the underlying bedding materials or geotextile material. Remove riprap to repair disturbed or displaced bedding materials or geotextile.

15. Obtain the desired distribution of the various sizes of particles throughout the mass by selective loading at the quarry or other stockpile source, by controlled dumping of successive loads during placing, or by other methods of placement which will produce the specified results.

16. Place riprap and armour layers with a thickness at least as great as that shown on the Drawings.

Instrumentation

Installation of new instruments and extension of cables for existing instruments is required within the tailings dam. Performance of this work should be carried out as follows:

1. BYG will supply the instruments for installation by the Contractor. Drilling is required for installation of pneumatic piezometer tips below foundation grade. Installation of pneumatic piezometers will be supervised by the Engineer. Cooperate with Engineer and provide access for drilling and installation of pneumatic piezometers in the foundation.

7. Record pumping rates for determination of spigot, seepage and reclaim volumes.

8. Record rainfall and measurement of snow pack in late winter should be required to assess runoff inflows.

9. Record spillway discharges during operation to determine volumes of water which are diverted past the tailings pond. Comparison of diversion flows to runoff quantities will also provide an estimate of groundwater seepage inflows through the active zone.

10. Monitor the tailings beach development by survey to determine volume requirements and assist in planning of spigotting operations.

11. Record quantities and measured profiles of settled tailings to determine tailings densities and assess storage volume requirements.

12. Sample and measure the tailings gradation for assessment of the settling rate and permeability.

13. Monitor winter operations and tailings placement methods. Subaqueous deposition has been assumed for winter operations in order to minimize reservoir storage requirements.

14. Monitor performance of diversion and spillway channels to determine maintenance requirements. Monitor and remove snow in the diversion channel to prevent blockage.

15. If thawing of foundation soils occurs under the dam embankment, then test hole drilling should be carried out for measurement of SPT blow counts or cone penetration resistance. This data will allow assessment of seismic stability.

WASTE ROCK CHARACTERIZATION AND HANDLING

Assessment of Construction Materials

The upper portion of the pit consists mainly of altered granodiorite which is a weathered friable material without any significant potential for generation of acidic drainage. This waste rock will be used for construction purposes since it has a mean NPR of 4.2 and Mean Net NP of 29. All waste rock used for construction will be sampled and tested for ABA using approximately 30 representative samples. These test results will be used to verify the use of these materials for construction purposes. The location and rock types for these samples will also be recorded to assist is assessing expected pit wall characteristics as discussed above in Section 2.0. Altered granodiorite waste rock will be used in the construction of the haul road to the mill, the tailings dam and the waste dump base.

2. Splice existing thermistor cables with additional cable sufficient to terminate at the downstream toe of dam. Splicing should be carried out in accordance with manufacturer's recommendations under the supervision of the Engineer. Pneumatic piezometers will be supplied with sufficient tubing at the time of installation to allow extension to the downstream toe of dam.

3. Excavate shallow trenches approximately 1 m deep in the Zone 1 sand fill for installation of the pneumatic piezometer tubing and thermistor cables.

4. Place all pneumatic piezometer tubing and thermistor cables on the base of trench in a zigzag manner to allow sufficient length for any deformations due to settlement. Backfill overtop tubing and cables in specified lift thicknesses. Compact lifts with compaction equipment not exceeding 1000 kg unless otherwise approved by the Engineer.

5. Drive steel bar settlement pins at the downstream edge of the dam crest with a stick-up of approximately 50 mm.

3.9 Performance Monitoring

Performance performance of the embankment and foundation will be monitored throughout the mine operation period. The field monitoring program should include the following:

1. Record temperatures for each of the thermistor installations to determine rate and extent of thaw.

2. Record pore pressures for each of the pneumatic piezometers in embankment and foundation zones which are unfrozen. This will assist in determining seepage through the dam and will allow measurement of actual thaw-induced pore pressures for stability assessment.

3. Record settlements of dam crest by regular surveys of settlement pins. Settlements will be correlated with the depth of thaw and pore pressure dissipation to provide a basis for future settlement estimates.

4. Record daily maximum and minimum temperatures at the Mt. Nansen site. Comparison of data at the site with similar data recorded at the Environment Canada Station at Carmacks will provide a basis for adjustment of temperature data used in long term prediction models.

5. Record precipitation data at the Mt. Nansen site to determine runoff inflows.

6. Record tailings pond levels as well as inflow and outflow volumes. Quantities required for water balance assessment should include reclaim, seepage, evaporation and spillway discharges.

Assessment of the Minerals Responsible for Neutralization

The analyses used to characterize the acid generation potential of the Brown-McDade waste rock consisted of standard acid base accounting procedures including paste pH using the "EPA" method (Sobek *et al.*, 1978). Total Sulphur was determined via the Leco Furnace method while Neutralization Potential (NP) was determined by the conventional EPA titration method. The results of these tests were provided in Tables 4-4 and 4-5 of the IEE.

Recent ARD prediction work has focused on the development of new methods aimed at measuring both the reactivity of sulphide and the speciation of the minerals present that are responsible for neutralization. For example, in reference to neutralization capacity, calcite is generally considered to be reactive and readily available to neutralize acid under neutral and acidic pH conditions while silicates which are considerably less reactive, are generally not considered to responsible for neutralization until porewater pH drops. Research is currently being conducted to develop procedures to differentiate between the different types of minerals responsible for neutralization (Lawrence, 1995).

One procedure currently being developed involves addition of acid at a fixed rate to a slurry of pulverized material together with continuous measurement of the resultant pH. The hypothesis is that if neutralization is due to the presence of calcite, the slurry pH will be buffered at a higher pH than if neutralization capacity is due to silicates. This approach will be followed in a similar research program using three samples of pulp from Brown-McDade waste rock. The procedure will be as follows;

1) Assay pulps of Footwall Granodiorite will be sourced. Samples selected are 88-83 24-30m, 88-97 23-27 and 88-72 40-42m (see Table 4-4 and 4-5 of the IEE).

2) The total quantity of acid that should be consumed will be estimated from the original NP test results.

3) An automatic titrator will be set-up to add acid at a fixed addition rate such that the total quantity of acid estimated from the above calculation is delivered over a 4hr period.

4) The resultant pH will be recorded continuously using a strip chart recorder.

The results of this testwork will be assembled into a lab report and distributed to the RERC for review and comment once the work is complete. However it should be noted that these procedures are currently in the developmental stage and the results may not be conclusive. The data generated from the titration procedure may however provide useful qualitative information. In the absence of a recognized standard procedure for assessing the minerals responsible for neutralization, the ABA data generated using the EPA titration method will be used for overall assessment and planning purposes.

Waste Management Plan

The handling of waste rock will be controlled by a Waste Management Plan. This program will be supervised by a qualified geologist. The individual rock types will be identified during mining based on a combination of location, visual characteristics, Au assay, ABA and other suitable analyses. The geologist will maintain detailed records for all materials brought to surface with the information logged according to quantities, waste characteristic and disposal locations.

Waste Rock Monitoring During Operation

To verify waste rock characteristics, additional representative samples will be collected for each rock type and analyzed for ABA. The mine superintendent or geologist will be responsible for collecting samples of the waste rock that are considered representative of the waste rock deposited in the stockpile. This data will be used to update projections on the overall characteristics of the waste.

Special Handling Considerations

Special handling procedures will not be required for most of the waste rock other than the need to sample and characterize the materials according to ABA. However when the pit encounters Footwall Granodiorite at the base it may be necessary to utilize some extra measures if the ABA data indicates that the Footwall Granodiorite has a significant theoretical potential to generate acid. In this case, the rock would be either milled, left on the floor of the pit or encapsulated in the dump depending on its Au content and ABA characteristics.

Supplemental ARD Test Work

In summary, the following supplemental ARD testwork will be conducted:

1) A research program involving titration procedures will be conducted to assess the minerals responsible for neutralization using three Footwall Granodiorite samples. The results of this program will be provided to the RERC as soon as they are available.

2) All waste rock used for construction will be sampled and tested for Acid Base Accounting using approximately 30 representative samples. The location and rock types for these samples will also be recorded to assist is assessing expected pit wall characteristics.

3) After completion of the pit approximately 20 samples will be collected from the pitwall to demonstrate that the wall does not contain potentially acid generating materials.

4) During operation, representative samples will be collected for each rock type and analyzed for ABA to update projections on the overall characteristics of the waste dump.

Future Considerations

The current design assumes a three year mine operation after which no further tailings will be deposited. Based on this operation plan, the thermal analyses indicate limited thawing under the upstream portion of the dam with eventual freezeback of the tailings after mine operations are ceased. Should the mine life be extended it is anticipated that thaw penetration will continue which must be accounted for in future assessments of the settlement, stability and seepage. Incorporation of a downstream berm has been considered as a future solution to several of the technical concerns. The need for a downstream berm should be determined based on the observations of the performance monitoring program.

Raising of the dam will require new diversion and emergency spillway facilities at a higher elevation. Excavations at higher elevations will be more difficult due to steeper slopes further up the valley slope. In addition, the existing diversion channel design does not include an impervious liner. If seepage losses are excessive, a liner may be required in the future.

Raising of the dam must also consider the method of future embankment construction. Raising of the dam on the existing centerline will require embankment construction of the upstream slope of dam overtop of the tailings beach which may have technical concerns. Shifting the dam crest centreline downstream will allow all construction to occur above the existing compacted embankment, however quantities of new fill will be greater and the downstream toe of dam may encroach on the seepage recovery dam.

The winter tailings deposition method will also affect the tailings density and beach slope. Subaqueous deposition is assumed, however, if beach spigotting occurs during the winter significant ice may build up, thereby reducing available storage densities and potential reclaim water.

A closure spillway is eventually required on the south abutment where bedrock can be exposed at the channel invert for long term protection. The downstream outlet channel of the spillway may, however, be constructed on overburden soils which will require erosion protection. It is anticipated that the riprap protection will be much larger than the riprap installed at the temporary emergency spillway. Waste rock which is large in size and may be suitable as riprap should therefore be salvaged from the mine operation over the next three years. The alignment of the closure spillway will be dependant on the eventual dam crest elevation. The invert of this channel should be situated in bedrock at least as far as the downstream toe of dam before descending the slope in the outlet channel. In order to finalize the alignment of the closure spillway, it will be necessary to eventually obtain additional rock depth information in the area downstream of the dam centreline on this abutment.

TAILINGS ARSENIC STABILITY AND GROUNDWATER ARSENIC ATTENUATION PROGRAM

4.1 Tailings Arsenic Stability

4.1.1 Objectives

1. The tailings arsenic stability program will be conducted to:

2. Evaluate alternatives for stabilizing arsenic in the tailings and

3. Assess the attenuation of arsenic in the groundwater if release of contaminated seepage occurs after closure.

4. Provide information on closure options for the tailings pond.

4.1.2 Study Methodology

1. A 24 hour composite sample of raw un-treated tailings will be collected within 30 days of mill start-up and, provided that the sample contained a measurable amount of leachable arsenic, subjected to equilibrium tests under both mixed and un-mixed conditions.

   i) The mixed sample will consist of a 4-5 kg sample slurried to 40% solids. The slurry will be placed in a 20 L bottle and placed on roll apparatus. The slurry will be sampled and assayed for dissolved metals after 1, 3, 10 and 30 days.

   ii) The un-mixed sample will be placed in an identical stationary container and sampled and assayed as in (i) above.

2) A 24 hour composite sample of tailings treated using the Inco SO_2-Air process will be collected within 30 days of mill start-up and, provided that the sample contained a measurable amount of leachable arsenic, subjected to equilibrium tests identical to the program for untreated tailings above in 1), i and ii.

3) A sample of treated tailings will subjected to ferric sulfate addition tests as follows:

   i) Ferric sulphate solution will be added to a 40% slurry of treated tailings at Fe/As ratios of 5, 10, 20 and 50 based on the soluble As concentration in the slurry. Each sample will be reacted for 10 min.

ii) After ferric sulphate addition the slurry will be neutralized to pH 7.5 with lime (if necessary) and placed on bottle roll apparatus for two 24 h distilled water leaching cycles. The slurries will be dewatered via filtration between cycles.

iii) The starting solutions and the solution after each cycle will be assayed for dissolved metals via ICP-AES.

4) The optimum ferric sulphate dosage would then be selected from the results of Item 3 and used to treat a bulk sample of treated tailings. This sample would then be subjected to equilibrium tests under mixed and un-mixed conditions as outline above in 1).

5) Assuming that work conducted as per Item 4 is successful in stabilizing arsenic in place, direct ferric sulphate addition to treated mill tailings would commence on a full scale basis. Samples of final tailings slurry after ferric sulphate addition would then be collected at 1, 3, 7 days and then weekly for a one month period to verify that arsenic was being fully stabilized. These samples would be subjected to 24h distilled water leaching with the solutions assayed for dissolved metals via ICP-AES. Sampling and assaying of final treated mill tailings for soluble arsenic would continue monthly using the samples collected for ABA assays described in Section 3.0.

4.2 Groundwater Attenuation

4.2.1 Objectives

1) Assess the attenuation of arsenic in the ground water if release of contaminated seepage occurs after closure.

2) To determine the capacity of the soils to attenuate arsenic in the groundwater.

4.2.2 Study Methodology

1) A large sample of native soils and materials would be collected downstream of the impoundment. Sieve analyses would then be conducted to determine particle size distribution.

2) This native material would be placed in a 100 mm to 150 mm diameter column to a predetermined bed depth. A tailings reclaim solution spiked with soluble arsenic at 5 mg/L would then be fed to the column at a rate of 0.2 to 1.0 $L/m^2/min$.

3) The column leachate would be collected after 1, 3, 7 days and then weekly and assayed for dissolved metals via ICP-AES. The test would be continued until breakthrough.

4) The native material used in the above test would then be subjected to a distilled water leach to see if the arsenic that had been absorbed was able to be remobilised.

4.3 Schedule

The tailings stability tests would commence within 30 days of mill start-up. Once direct ferric sulphate addition to the tailings has been demonstrated on a bench basis, full-scale implementation would commence - potentially within 60 days of mill start-up.

The groundwater attenuation program would commence within three months of start-up once the reclaim water has reached equilibrium with the tailings.

4.4 Report Submission

A report on work items listed in parts 1), 2) and 3) of subsection 4.1.2 of this appendix will be completed within 30 days of completion of test program - approximately 60 days after mill start-up.

The report for work outlined in subsection 4.2.2 of this appendix would be issued 30 days after completion of the work - approximately 7 months after mill start-up.

4.5 Decision Criteria

The feasibility of direct ferric sulphate addition as a means of stabilizing arsenic in the tailings will be assessed on the following factors:

1) If the process successfully stabilizes arsenic and prevents it from re-solubilizing in the longer term tests that are outlined in subsection 4.1.2 of this appendix.

2) If the full-scale trial as outlined subsection 4.1.2 demonstrates that full scale implementation is feasible.

If direct sulphate addition is not feasible, it will be necessary to install a secondary system for treatment of reclaim water.

WASTE ROCK ACID ROCK DRAINAGE ("ARD") STUDY

5.1 Objectives

1. Ensure that waste rock used for construction has a high NPR (i.e > 3) and does not pose a risk of ARD.
2. Verify the Waste Rock ARD assessment work completed as part of the IEE program.
3. Collect additional waste rock characterization data to assist in reclamation planning.
4. Identify and segregate material that poses a risk of ARD.

5.2 Study Methodology

1. The mine superintendent will be responsible for collecting samples of waste rock that are considered representative of each rock type grouping and the overall waste to be deposited in the stockpile.
2. Approximately 30 representative samples will collected during excavation of the pit. The samples will be catalogued according to rock type, location, and physical characteristics.
3. All samples will be assayed for Acid Base Accounting using the Modified Procedure. Analyses on all samples will include Total Sulphur, Sulphide Sulphur, Sulphate and Total Metals via Inductively Coupled Plasma - Atomic Emission Spectroscopy (ICP-AES).
4. Variability within each rock type grouping will be assessed using frequency and cumulative distribution plots of Maximum Potential Acidity (MPA) or Percent Sulphide ($\%S^{=}$), Neutralization Potential (NP), Net Neutralization Potential (Net NP) and Neutralization Potential Ratio (NPR).

5.3 Waste Management Plan

The waste management plan will ensure that all handling of waste rock is supervised by the mine superintendent, qualified geologist or mining engineer. The plan will dictate the following;

1. All individual rock types will be identified during mining based on a combination of location, visual characteristics, Au assay, ABA and other suitable analyses (depending on location).
2. Detailed records will be maintained for all materials distributed during mining and left on surface. The information will be logged according to quantities, waste characteristic and disposal locations.

3. The waste rock disposal logs will be reviewed by the mine manager on a regular basis to ensure that waste rock with a potential for acid generation are handled so as to eliminate or minimize risk associated with ARD from the waste dump.

5.4 Schedule

The Waste Rock ARD program will commence with development of the pit prior to the commencing of milling. The samples will be logged on a regular basis as development of the pit proceeds. The primary focus of this program will be to ensure that the construction materials do not have any potential for ARD. Most of the samples and ABA data will be collected during the first year of operation based on the current mine plan.

5.5 Report Submission

A report will be prepared to present the data 60 days after the first phase of pit development is complete and milling has commenced. This report will assess the potential for ARD occurring in each rock type grouping and compare the data with the waste rock characterization work conducted as part of the IEE.

5.6 Decision Criteria

The criteria used to assess the potential for ARD from waste rock will be based on the characteristics and quantities of each rock type identified in the above report. The Waste Rock ARD program will verify the assessment completed as part of the IEE.

The decision criteria with therefore consist of drawing comparisons with the IEE predictions. If the waste rock exhibits substantially higher potential for ARD, judged by the fact that the material is in the top 5% percentile for ARD potential it will be necessary to implement sub-aqueous disposal either in a flooded pit or alternatively by processing the material through the mill and disposing of it in the tailings impoundment.

PIT WALL AND FLOOR ACID ROCK DRAINAGE ("ARD") STUDY

6.1 Objectives

The objective of this program will be to collect sufficient mineralogical and chemical data to determine whether exposure of the pit wall and floor at closure could result in a release of ARD to the environment. If the data demonstrates that there a risk that a release ARD could occur, options for mitigation will be evaluated and implemented as part of Reclamation activities. Selection of the preferred option will be supported by the technical data.

6.2 Study Methodology

ARD assessment data on the pit wall and floor will be collected as follows:

1) After completion, the pit wall will be sampled directly to determine rock type and ARD characteristics.

2) Approximately 20 samples will be collected from the pit wall and pit floor. These samples will be representative of the individual rock types exposed after mining is complete.

3) The samples will be catalogued according to rock type, location, and physical characteristics. All samples will be assayed for Acid Base Accounting using the Modified Procedure. Analyses on all samples will include Total Sulphur, Sulphide Sulphur, Sulphate and Total Metals via Inductively Coupled Plasma - Atomic Emission Spectroscopy (ICP-AES).

4) Variability within each rock type grouping will be assessed using frequency and cumulative distribution plots of Maximum Potential Acidity (MPA) or Percent Sulphide ($\%S^{=}$), Neutralization Potential (NP), Net Neutralization Potential (Net NP) and Neutralization Potential Ratio (NPR).

5) Monitoring of seepage from the pit wall will also be conducted during operation to verify the ARD prediction testwork.

6.3 Schedule

The pit wall sampling and ARD assessment program will be conducted during operation.

6.4 Report Submission

A report will be prepared to present the data within 60 days of completion of the testwork, or as soon after the completion of the testwork as is reasonably possible. This report will assess the potential for ARD occurring in the wall rock for each rock type grouping. The report will also outline proposed mitigation measures (if required) for review and approval.

6.5 Decision Criteria

The criteria used to assess the potential for ARD from the pit wall and floor after closure will be based on the characteristics and quantities of each rock type identified in the above report. Wall rock with a substantial potential for ARD such as material containing a high percent sulphur, would likely require that the pit be flooded as soon as possible after closure.

TAILINGS ACID ROCK DRAINAGE ("ARD") PROGRAM

7.1 Objectives

1) Determine the ARD characteristics of the tailings using sufficient data to assess variability and to verify the conclusion that acid generation from the tailings will not occur after closure.

2) Collect additional tailings characterization data to assist in reclamation planning

7.2 Study Methodology

1) Composite tailings samples will be collected on a monthly basis during operation and assayed for ABA using the Modified Procedure. Analyses on all samples will include Total Sulphur, Sulphide Sulphur, Sulphate and Total Metals via Inductively Coupled Plasma - Atomic Emission Spectroscopy (ICP-AES).

2) Variability will be assessed using frequency and cumulative distribution plots of Maximum Potential Acidity (MPA) or Percent Sulphide (%S), Neutralization Potential (NP), Net Neutralization Potential (Net NP) and Neutralization Potential Ratio (NPR).

3) A kinetic humidity cell test will be conducted on a tailings composite generated after 60 days of operation. A second humidity cell test will commence after the first year of operation using a "worst case" tailings sample. This sample will consist of a composite of tailings which exhibits an elevated theoretical potential for ARD relative to the mean, (i.e. greater than 75 percentile of the group). Each humidity cell test will operate for a total of 30 weeks.

7.3 Schedule

Collection of tailings samples for ABA will commence at start-up and continue during the life of the mine. The first humidity cell test will commence 60 days after the start of milling while the second "worst case" humidity cell test will commence one year after the start of operation.

7.4 Report Submission

ABA tailings data will be submitted on monthly basis and summarized in the Annual Report. The results of the humidity cell tests will also be updated monthly with the final results submitted within 6 weeks of completion of the work.

7.5 Decision Criteria

The criteria used to assess the potential for ARD from the tailings will be based on a comparison between the data collected during operation with data used to assess ARD potential during the IEE program. If the data indicates that the tailings have a substantial potential for ARD, it will necessary to ensure that the tailings are flooded at closure. Alternatively if the tailings exhibit a low but measurable potential for ARD it may be adequate to cover the tailings at closure with non-acid materials such as overburden. In any event tailings dispersement shall be accomplished in such a manner that no tailings are deposited at any point that is above one meter below the invert of the emergency spillway. In this way the tailings will always be covered by one metre of water.

THAW SETTLEMENT PROGRAM

8.1 Objectives

1. Determine the thermal performance of the dam and underlying foundations.

2. Collect additional data to verify the conclusion that the maximum settlement of the dam crest will be 0.6 m and the conclusion that after closure the regional permafrost will aggrade upwards into the dam resulting in a strong and impermeable structure.

8.2 Study Methodology

1. Record temperatures for each of the thermistor installations to determine rate and extent of thaw.

2. Record pore pressures for each of the pneumatic piezometers in embankment and foundation zones which are unfrozen. This will assist in determining seepage through the dam and will allow measurement of actual thaw-induced pore pressures for stability assessment.

3. Record settlements of dam crest by regular surveys of settlement pins. Settlements will be correlated with the depth of thaw and pore pressure dissipation to provide a basis for future settlement estimates.

4. Record daily maximum and minimum temperatures at the Mt. Nansen site. Comparison of data at the site with similar data recorded at the Environment Canada Station at Carmacks will provide a basis for adjustment of temperature data used in long term prediction models.

5. Record precipitation data at the Mt. Nansen site to determine runoff inflows.

6. Record tailings pond levels as well as inflow and outflow volumes. Quantities required for water balance assessment should include reclaim, seepage, evaporation and spillway discharges. Pumping rates should be recorded for determination of spigot, seepage and reclaim volumes. Rainfall records and measurement of snow pack in late winter should be required to assess runoff inflows. Spillway discharges should also be measured during operation to determine volumes of water which are diverted past the tailings pond. Comparison of diversion flows to runoff quantities will also provide an estimate of groundwater seepage inflows through the active zone.

7. Monitor the tailings beach development by survey to determine volume requirements and assist in planning of spigotting operations.

8. Record quantities and measured profiles of settled tailings to determine tailings densities and assess storage volume requirements.

9. Sample and measure the tailings gradation for assessment of the settling rate and permeability.

10. Monitor winter operations and tailings placement methods. Subaqueous deposition has been assumed for winter operations in order to minimize reservoir storage requirements.

8.3 Schedule

Collection of data will begin as soon as the tailings dam stucture has been completed and will continue until closure of the mine. Prior to completion of three years of operation, BYG are required to make a decision regarding raising of the dam for additional tailings storage or construction of the closure spillway for long term abandonment of the tailings impoundment. At that time the dam crest height should be reviewed and any additional allowance for longterm settlement made at that time. Should the dam performance and instrument monitoring suggest freezeback will occur after mine closure; then additional raising of the dam may not be required for settlement purposes.

The thermal performance of the dam and underlying foundation and the influence of the tailings will be monitored throughout the operational life of the impoundment to determine which long term solutions are required.

Dependant on the dam foundation performance, a downstream berm may eventually be required, however, construction of the berm can be delayed without serious ramifications until the actual performance of the dam can be monitored by the foundation instrumentation.

8.4 Report Submission

Thaw settlement data will be submitted on a quarterly basis and summarized in the Annual Report. The final report detailing the predictions for the long term behaviour of the dam will be produced within three months of closure.

TAILINGS IMPOUNDMENT SEEPAGE MONITORING PROGRAM

9.1 Objectives

1. Determine the seepage through the dam and underlying foundations.

2. Collect additional data to verify the conclusion that the foundations of the dam will remain frozen and that seepage under the dam structure will not occur.

3. Collect additional date to verify the conclusion that the geosynthetic liner and tailings beach reduces the seepage by the required amount.

9.2 Study Methodology

1. Record pore pressures for each of the pneumatic piezometers in embankment and foundation zones which are unfrozen. This will assist in determining seepage through the dam and will allow measurement of actual thaw-induced pore pressures for stability assessment.

2. Sample and measure the tailings gradation for assessment of the settling rate and permeability.

3. Measure the flow of seepage into the seepage recovery pond.

9.3 Schedule

Collection of data will begin as soon as the tailings dam stucture has been completed and filled with water and as soon as the temperature regime indicates that thawing has occured. The monitoring will then continue until freezing takes place or until closure of the mine.

The seepage performance of the dam and underlying foundation and the influence of the tailings will be monitored throughout the operational life of the impoundment to determine which long term solutions are required.

Dependant on the dam foundation performance, a downstream berm may eventually be required, however, construction of the berm can be delayed without serious ramifications until the actual performance of the dam can be monitored by the foundation instrumentation.

9.4 Report Submission

Seepage data will be submitted on a quarterly basis and summarized in the Annual Report. The final report detailing the predictions for the long term behaviour of the dam will be produced within three months of closure.

9.5 Decision Criteria

The criteria used to assess any potential problem from seepage will be based upon a comparison between the data collected from the instrumentation that will be installed on and in the tailings dam, and the values assumed for the purposes of predicting the dam performance.

This data, along with the monthly visual inspections, will be used to trigger special reviews of the design and performance of the dam.

More specifically, the special reviews will take place, if the pore pressures measured by the piezometers approach an equivalent r_u value of 0.5, or if visual inspections by the mine staff identify any signs of concentrated discharge near the dam toe or along the downstream slope, "sand" boils near the dam toe and/or areas of erosion.

10.4 Report Submission

Liquefaction data will be submitted on a quarterly basis and summarized in the Annual Report. The final report detailing the predictions for the long term behaviour of the dam will be produced within three months of closure.

10.5 Decision Criteria

The criteria used to assess any potential problem from liquefaction will be based upon a comparison between the data collected from the instrumentation that will be installed on and in the tailings dam, and the values assumed for the purposes of predicting the dam performance.

This data along with the monthly visual inspections will be used to trigger special reviews of the design and performance of the dam.

More specifically, the special reviews will take place, if the thermistor readings indicate that foundation thawing has occurred to a depth of 2m or more below the prepared dam subgrade.

REASONS FOR DECISION
WATER USE LICENCE QZ94-004
B.Y.G. NATURAL RESOURCES INC.

The Yukon Territory Water Board (the Board") has concluded it's deliberations pertaining application QZ94-004.

The Licensee, B.Y.G. Natural Resources Inc., made application to the Board for a Type A water use licence for quartz mining undertaking in the area known as Mount Nansen.

Indian Northern Affairs Canada ("DIAND") completed an environmental assessment ("EA") of this project, in accordance with the requirements of the federal Environmental Assessment and Review Process Guidelines Order.

The Initial Environmental Assessment for this project was submitted to DIAND in November, 1994 and the application for a water use licence was submitted to the Board in March, 1995.

At the request of the applicant, a public hearing was held in June, 1995 and notice of public hearing was provided in accordance with the requirements of the Yukon Waters Act. DIAND and EP/DFO did not participate in the public hearing because the EA had not been completed at that time. The public hearing was adjourned until such time as the EA was completed.

On November 15, 1995, DIAND submitted the EARP Screening Report for public review and the Decision Report was issued on December 27, 1996. The determination was 12(c), "potentially y adverse effects that may be caused by the proposal are insignificant or mitigable with known technology". For the most part, the EARP mitigation recommendations consisted of requiring the applicant to provide additional information as part of the water use application. This additional information was submitted to the Board by mid-December 1995.

No party requested that the public hearing be reconvened. In it's review of this application, the Board considered the application itself, the EA (Screening Report and Decision Report), an intervention from DIAND and a joint intervention from Environmental Protection and Fisheries and Oceans Canada ("EP/DFO"), the transcript of the public hearing, and the Board's authorities and responsibilities under the Yukon Waters Act.

In the interval between the public hearing and the completion of the EA, the applicant and the government agencies reached agreement on many issues, to the extent that there were no issues presented to the Board for decision. The Board has adopted most of the agreements which the parties have reached, including the requirement for the completion of several studies. However, the Board has differed from the agreements of the parties on some matters:

With regard to Security: Although BYG and DIAND were originally at variance regarding the amount of security, there was, at the end, complete agreement as to amount. However, the Board does not agree with the schedule that was proposed by DIAND and, instead, has imposed a schedule which is more straight forward. The end result is the same.

In their intervention, DIAND recommended that some of the security could be revised or deleted from the licence if, during the course of the licence, certain studies that the Licensee will complete were to lead to conclusions that certain potential environmental effects, largely related to chemical stability of the tailings impoundment, were not likely to occur.

The Board notes that any licensee may, at any time, make application to the Board to amend a water use licence. However, the Board is not willing to predetermine what circumstances would lead to the approval of such an amendment. Therefore, the security that was agreed to by all parties has been included in the licence. It will be up to the Licensee to satisfy the Board that the circumstances which led to the determination of that amount of security have changed to the extent that the Licence should be amended.

With regard to the Brown-McDade Adit: The EA included a concern that there could be a potential for pit water to seep from the pit and through the old adit to the surface. The Licensee proposes to seal the adit prior to decommissioning, so that the pit could be filled with water in order to prevent the generation of acid rock drainage at the pit floor and walls.

DIAND recommended that the licence should include a requirement to plug the adit. However, the Board is not satisfied that installation of a hydraulic bulkhead is appropriate. Since the Licensee will be undertaking further studies in order to develop the final decommissioning plan, the Board has not, at this time, included sealing of the adit as a requirement of the licence. In making this decision, the Board notes that effluent quality standards will have to be maintained throughout the life of the licence as well as after decommissioning. The Board also included monitoring requirements at the adit.

The Board notes that the effluent quality standards that were proposed by the Licensee in the original application were supported by both intervenors and have been incorporated into the licence.

The Board is pleased to have concluded it's deliberations and have forwarded water use licence QZ94-004 to the Minister of Indian and Northern Affairs for approval.

Paul S. Hunter

Paul Hunter, Chairperson

FEBRUARY 13, 1996

date