CANTUNG MINE

RECLAMATION COST ESTIMATE

Prepared for:

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1. INTRODUCTION

1.1. OBJECTIVES

This report presents an estimate of the cost to complete closure of the Cantung Mine, which is owned by North American Tungsten Corporation Ltd. (Cantung or the company). The mine is located in western Northwest Territories. This estimate assumes that it becomes necessary for the government to carry out the reclamation of the site. It is expected that this cost estimate will be considered in the updating of security requirements for the project.

This report includes a review of the company's abandonment and reclamation (A & R) plan for completeness and the potential for success of the proposed measures.

Information sources are discussed in Section 2. Issues and deficiencies in the company's A & R plan are presented in Section 3. The reclamation cost estimate is presented in Section 4. Comments on matters pertaining to the security deposit are presented in Section 5. S ection 6 contains some recommended terms and conditions for any new Water Licence. Conclusions are presented in Section 7.

1.2. APPROACH

The approach taken in preparing this estimate involves a number of steps. These are:

1. Conduct a review of available information and carry out a site inspection in order to develop an understanding of the issues.
2. Assess the proposed reclamation measures for completeness and potential for success.
3. Break down the proposed reclamation measures into tasks to facilitate developing a cost estimate.
4. Describe a dditional o r a lternative r eclamation m easures w hich may be required in order to produce an acceptable closure scenario.
5. Compile the reclamation cost estimate.

All reclamation measures used in developing this estimate are based upon the application of best management practices, as called for in the "Mine Site Reclamation Policy for the

Northwest Territories", which was issued by the Minister of DIAND in May 2002 (the Reclamation Policy).

The existing documented standards "Guidelines for Abandonment and Restoration Planning for Mine in the Northwest Territories" as published the NWT Water Board in 1990 are dated and no longer meet generally accepted standards. The objectives and standards described in the Water Resources publication "Mine Reclamation In Northwest Territories and Yukon", dated 1992, are more appropriate for the Cantung Mine.

Step 4, described above, is a key part of this estimate. It is the intent of the Reclamation Policy to reduce the environmental liability which falls to the government, and, that closure alternatives are based on current and comprehensive technical information. In keeping with these intents, this estimate is based upon conservative assumptions where any one of the following arise:

- there are gaps or uncertainties in the data base of site information, or,
- the proposed reclamation measures are based on unproven technologies or optimistic application of existing technologies, or,
- reclamation measures have not been proposed to deal with specific issues (such as long-term physical and chemical stability) regarding the site closure.

A common question with this approach to developing the cost estimate is "Will the actual cost be lower than the estimated cost due to the conservative approach taken in this estimate?" It is possible that further assessment of the issues may find more economical solutions to some aspects of the work. However, it is common for further assessment to reveal issues which were not identified, are of greater magnitude, or which require more technically sophisticated solutions than were originally assumed.

The approach taken here is justified in that it is incumbent on the company to present a comprehensive reclamation plan which is based upon site specific data that support the proposed reclamation measures. Any plan which does not achieve this end is effectively attempting to transfer the potential liability associated with any uncertainties in the plan to the Crown. This is no longer acceptable in Northwest Territories.

1.3. LIMITATIONS

The reader should appreciate that this report presents only a preliminary reclamation cost estimate. The company's A & R plan and the supporting documents do not comprise a detailed and cohesive plan for reclamation of the Cantung Mine, as described in the following sections. There are several major issues with the A & R plan at this time. There is not sufficient information available at this time to determine the best or most suitable reclamation scenario.

Therefore, due to the above points, the reclamation cost estimate presented here should be considered as a preliminary or order of magnitude estimate. The focus is on the major reclamation items, lesser details and issues may have been overlooked. In engineering terms, it could be considered as a pre-feasibility level estimate. The reclamation measures described herein should not be considered as recommended.

2. INFORMATION SOURCES

2.1. INFORMATION RECEIVED

The information sources for this review are listed in Appendix A.

In addition to the sources listed in Appendix A, I inspected the Cantung Mine site on the following occasions:

- in October 1992 for Roscoe Postle Associates Inc. on behalf of Canada Tungsten Mining Corporation for the purpose of a corporate re-structuring, and,
- in 2002 on behalf of DIAND, Water Resources Division for the purpose of preparing this report.

3. REVIEW OF A & R PLAN

3.1. GENERAL

The elements of the proposed mine development and A & R plan are discussed in the following sections.

The company has announced that closure of the mine is expected as soon as early 2004 (June 2001 Operating Plan), although operations could continue for another 2 years depending upon reserves and economic conditions. Despite this, there is only an interim A & R plan. A comprehensive final plan has not been prepared. There are few specific statements regarding the reclamation objectives, particularly with respect to water quality.

The project geochemistry is briefly discussed before the sections on the mine components as this is common to many parts of the mine development.

3.2. GEOCHEMISTRY

There have been a number of evaluations of geochemistry relating to the Cantung Mine. All of these have focused on the surface tailings deposits. The most recent of these was prepared in 2001. None of the assessments address the potential for ARD or metal leaching from source rocks in the open pit or underground, waste rock piles or tailings used in mine backfill.

According to the A & R plan, only 3 samples of waste rock and 3 samples of low grade ore have been assessed for geochemical properties. It is not clear where the waste rock samples were taken from. The waste rock is reported to be non-acid generating but neither the data nor the numeric results are presented to support this conclusion. The low grade ore was found to have high potential for acid generation.

The tailings in Flat River and Pond 1 are considered to be net acid generating. Ponds 2 and 3 contain zones which are considered to be net acid generating. The reports do not provide any indication as to the water quality which may be expected from these sources, or how the water quality may be moderated as it passes through the alkaline zones. It is suggested that the onset of acidic conditions may be delayed for possibly as long as several decades, but no analysis is presented to support this prediction. The authors of the most recent report are not even aware of the scope of ongoing water quality monitoring (Robertson Geoconsultants Inc. Apr. 2001, Section 4).

The April 2001 report is contradictory with respect to segregation of the tailings. It refers to hydraulic sorting of material in Flat River and the difference between the material in Pond 1 and Pond 2. At the end of Section 3 the report refers to "... the production and deposition of the tailings, a significantly good blending of the AP and NP minerals occurs."

An airphoto (circa early to middle 1960's) in the Cantung mine office indicates that Ponds 1 and 2 were operated as a single pond. In that photo there does not appear to any central berm and there is a single central fan of tailings from the discharge point. These details are not consistent with the descriptions of Pond 1 decanting into Pond 2.

The same report suggests that control of ARD "could be greatly enhanced by additional measures such as the placement of oxygen limiting covers over the tailings." There is no discussion as to the degree to which oxygen must be excluded in order to achieve such an objective, nor is any conceptual design described. It is reported that the tailings become desaturated during non-operating periods; a condition which is conducive to acid generation.

Based on the information presented in the A & R Plan, there was approximately 1.35 million tons of ore produced from the open pit. The tailings from this source were deposited in Flat River and Ponds 1 and 2. Essentially all of these tailings are net acid generating. The total mass of tailings in these three areas is about 672,000 tons (172,000 in Flat River and 500,000 tons in Ponds 1 and 2). This implies that there is about 680,000 tons of potentially acid generating tailings in the bottom of Pond 3. This material is not addressed in any of the reports.

The fact that the tailings in Flat River and Ponds 1 and 2 are acid generating, suggests that there is potential for ARD in the source area for these tailings, namely the open pit. Pit wall rocks and possibly some of the material in the pit waste rock dump are likely to be potentially acid generating.

Early in the mine life, a copper concentrate was produced from the open pit ore, which was found to have a higher concentration of chalcopyrite than the underground ore. Leaching of copper from the open pit area and open pit derived tailings may occur.

It is reported in the A & R plan that "332,300 tons of coarse tailings were deposited underground as backfill". The hydraulic classification process to manufacture the coarse tailings would tend to concentrate the denser particles of the tailings stream into the coarse fraction. These denser particles are the sulphide minerals. The lighter particles, which include the acid neutralizing minerals, tend to be included with the fine fraction of the tailings which are discharged to the tailings pond. There is no discussion as to the possible addition of cement to the tailings. Consequently, it is expected that the backfill tailings are a potential source of acid generation, probably with greater potential than the surface tailings.

Some of the wall rock exposed in the underground workings may also be potentially acid generating. Much of this rock could have geochemical properties which are similar to the low grade ore which was found to have high potential for acid generation.

In summary, acid generating or potentially acid generating materials are believed to exist in the following components of the mine:

- Flat River tailings,
- Pond 1 and Pond 2,
- initially deposited tailings and at least the uppermost tailings layers of Pond 3,
- open pit wall rock,
- underground wall rock,
- underground tailings, and,
- possibly some areas of the rock piles at the portals and open pit.

The A & R plan and the geochemical assessments do not provide any certainty that acid generation or metal leaching from one or more of the potential ARD sources will not become a problem in the future, except to suggest that the problem may be several

decades away. This type of assessment does not meet current standards for assessment of mine site geochemistry.

An independent review of the site geochemistry has been prepared by Lorax Environmental Ltd. and is included in Appendix D.

In the absence of an appropriate data base and interpretation of site parameters provided by the company, this report is based on the assumption that measures will be required to prevent impacts associated with acid generation from all of the mine components in the bulleted list above.

PYRRHOTITE

A key aspect of the uncertainty with respect to ARD at the Cantung Mine seems to be associated with the pyrrhotite. The Cantung ore is reported to be variably magnetic. Pyrrhotite is observed at many sites to exhibit rapid onset of acid generation. At rare sites, such as the Goldstream Mine in southern B.C., the pyrrhotite is observed to be essentially non-reactive. Two forms of pyrrhotite exist, monoclinic which is magnetic, and, hexagonal, which in non-magnetic and was observed to be relatively non-reactive at the Goldstream Mine. It may be that some of the pyrrhotite at Cantung is hexagonal and may not be as reactive as implied by conventional ARD testing.

The company may pursue the pyrrhotite aspect of the mineralogy to support any future argument that some measures for the control of ARD are not warranted. However, due to the lack of case histories and research in this area, and the potentially adverse and significant impacts which could result from failure to implement the necessary control measures, an extremely thorough assessment would have to be presented.

3.3. PITS

No information has been presented regarding the extent of potentially acid generating or metal leaching rocks in the pit walls. Oxidized rocks are exposed on the pit floor and the west pit wall. Collection of ARD from these sources could be conducted by routing pit water into the underground workings. It would be necessary to construct a channel to route uncontaminated drainage past the oxidizing materials and into Sardine Creek.

It will be necessary to rehabilitate the pit access road in order to carry out portal closure, removal of assorted debris from the pit, and construction of ARD mitigation measures for the pit and rock pile.

3.4. UNDERGROUND

The A & R plan does not address several aspects of closure for the underground workings. These include;

- the potential for ARD associated with the 332,300 tons of tailings or wall rocks
- only three main openings are identified for closure, this list is not complete, portals are observed at the following locations:
  - two at the 815 level (main portal)
  - two at the ventilation level,
  - one at the lower end of the conveyor gallery,
  - one at the upper raise near to the open pit, and,
  - one at the exploration decline near to the open pit.
- there is no proposal for removal of hazardous materials such as fuel, waste oil, batteries, or hydrocarbon products from any equipment which may remain in the mine.

Rock drains are proposed as part of the portal closures to allow mine water to escape. This is acceptable in concept. However, ice build-up during the winter months will cause mine water to be trapped in the mine. At other sites this has resulted in excess water pressure and a "blow-out" of the portal closure. The closure must designed to prevent this occurrence, particularly at the bottom of the conveyor gallery where there will be the greatest potential for build-up of water pressure.

It is assumed that portal drainage will eventually become unacceptable for release. Measures for collection and treatment of this drainage will be required.

3.5. TAILINGS CONTAINMENT

The tailings are addressed as three separate areas, as follow.

FLAT RIVER TAILINGS

The tailings which are located in Flat River are currently acid generating.

Flat River is a naturally meandering river. As can be seen at the right side of Photograph 1, Flat River has already cut one meander path through the old tailings. This meander is not evident in the airphoto on the wall in the Cantung Mine office.

Its path is likely to continue to change in the future and continue to erode the deposited tailings. The limited rip rap erosion protection which has been placed on some bends in the river will not prevent the river from meandering in the future.

There has not been an impact or risk assessment presented to show that leaving these tailings where they are is acceptable, either now or in the long-term. Therefore, it is assumed that this material should be removed from the river, amended to reduce current levels of acidity and mobile metals, and placed in a secure containment which prevents future acid generation.

PONDS 1 AND 2

Ponds 1 and 2 contain potentially acid generating material. They have been capped with a sandy gravel till which is reportedly up to 1 m thick. This cover is not uniform as exposed tailings can be seen in the lay down area near the western edge (roughly at the location of the discharge fan in the mine office airphoto). There is no data to show that the cover is preventing acid generation or flushing of ARD products. Iron staining associated with seepage from the tailings can be observed at several locations along the eastern edge at the toe of the embankment.

No proposal has been prepared which describes how the tailings could be stabilized against erosion. The potential for erosion of the dam and tailings due to future meanders of Flat River is essentially the same as for the tailings in Flat River.

Considering both the expected ongoing acid generation and the lack of secure long-term containment, is it assumed that the tailings should be relocated to a secure containment. The tailings should be amended to reduce acidity levels and stabilize any mobile metals.

Currently, there does not appear to be a good location for long-term containment of the tailings from Flat River or Ponds 1 and 2. Several options exist for relocation; Pond 4, Pond 3, underground, or a new impoundment. Pond 4 probably has a maximum capacity of 260,000 tonnes of tailings or about one third of the required storage volume. Pond 3 is expected to be full to freeboard level at the time of the end of operations. It has a storage capacity of about 110,000 m3 per m of elevation. A seven metre raise would be required to store all of the tailings. It is not known if sufficient storage capacity could be found in the underground workings. A new impoundment, possibly the proposed Pond 5 area, could be developed for storage of the tailings. It seems unlikely that permits could be obtained for a new storage area which does not provide long-term prevention of ARD.

A practical solution may be to fill Pond 4, possibly in conjunction with a minor raise of the dam, and raise Dam 3 to provide sufficient storage for the remaining tailings. As is discussed below in the Pond 3 assessment, additional physical stabilization measures are likely to be required. These measures could be implemented in conjunction with the raising of Dam 3. This approach is assumed in the cost estimate. However, a optimization study would be required to determine the best configuration. This estimate is based upon rough quantity take-offs.

POND 3

It is estimated by the company that about 55% of the uppermost tailings in Pond 3 are potentially acid generating. The lowermost tailings in the pond are expected to have similar geo-chemical properties to the currently acid generating material in Flat River and Ponds 1 and 2.

It is reported that the water level in the tailings drops after the end of tailings discharge. In discussions with Mr. N. Skermer, geotechnical consultant to Cantung, it was reported that the water level in the dam dropped to about the elevation of the original ground

surface. It is likely therefore, that after closure, the phreatic surface (the saturated water level) in the tailings would drop to a level approaching the bottom of the tailings deposit for at least some periods of the year.

The sandy gravel of which the dam is composed will not be impermeable to oxygen. Even if a cover were constructed over the tailings to reduce infiltration of oxygen, as suggested by the company, oxygen infiltration through the dam would permit oxidation and eventually acid generation. A cover will still be required on the tailings to prevent dispersion by wind.

A review of the dam stability (Golder, 1976) suggests that the dam has an adequate factor of safety against deep-seated failure under static conditions. However, no assessment of the stability under seismic conditions has been presented. The site is located within Zone 1 of the National Building Code of Canada map of seismic acceleration (Canadian Geotechnical Society, 1987). Seismic accelerations under severe events, such as a 1 in 1000 year return period earthquake, are likely to result in liquefaction of the tailings if they are saturated. Maintaining the tailings in an un-saturated condition is probably the best option for preventing a major failure. Unsaturated containment will allow ongoing oxidation and thus measures for long-term water treatment will be required.

It is assumed that long-term water management measures will consist of ongoing pumping of the seepage monitoring wells which are located at the toe of the dam. Additional wells may be required to ensure that no seepage by-passes the collection system.

The dam face is sloped at about 4H:3V or about 37 degrees. This is at or near to the angle of repose of the material. Gully erosion is evident on the face of the dam. Any seismic event will cause raveling. The combination of these two processes over time will result in a loss of containment of the tailings. The external dam face should be flattened and made resistant to erosion. It is assumed here that a buttress placed around the outer face of the dam could achieve this objective and could be constructed in combination with measures to provide additional storage for the tailings from Flat River and Ponds 1

and 2. Reducing the dam face from a slope of 37 degrees to 32 degrees will increase the factor of safety of the face against raveling to about 1.2. Flatter slopes could be required.

3.6. ROCK PILES

Rock piles are present at the open pit and below the portals. It is understood that the rock pile at the main portal is to be completely removed for use in mine backfill. The vent raise portal rock could also be relocated into the mine as part of the ARD mitigation measures.

The pit rock pile is situated in Sardine Creek. It is likely composed mostly of limestone, although some low grade ore is probably contained in the pile. Collection of drainage from this pile, if required, would include collection of the entire flow of Sardine Creek. This flow would probably overwhelm even a vary large treatment plant in the spring. As this would be impractical, it is assumed here that sufficient mitigation from this source could be achieved by construction of a low permeability barrier over the horizontal upper surface of the rock pile.

3.7. BUILDINGS & EQUIPMENT

All buildings must be removed as part of the site reclamation. Unless another party assumes responsibility for the structures, it is assumed that the cost for demolition and disposal is the responsibility of the mine.

Prior to demolition, all hazardous materials must be removed from the buildings. This includes at least PCB light ballasts, mercury thermometers, asbestos, and fuel oil tanks.

A minor provision for decontamination and disposal of stationary equipment in the mill is also required. Decontamination of the power plant will require more work.

Once decontaminated, the buildings will not represent a significant environmental hazard. The company has not proposed a disposal site for the demolition waste. The existing landfill south of the airstrip does not have sufficient capacity. Therefore, this estimate is based upon disposal of demolition waste in the Pond 5 area, where any adverse leachate

could be collected by the Pond 3 seepage collection system. A cover of sand and gravel should be placed over the waste once disposal activities are complete.

All equipment which is to be disposed of on site must be decontaminated first. This should include removal of batteries and all fluids (oils, fuel, coolant).

3.8. CHEMICALS & CONTAMINATED SOILS

At closure, it will be necessary to remove all chemicals from the site. This will include process reagents, raw materials for explosives, surplus fuel, laboratory chemicals, and waste hydrocarbon products such as oils and lubricants.

The mine was constructed prior to the phase out of PCB's in Canada in 1979. There are many active and inactive PCB bearing units at the site. Many of these do not appear to be stored according to Environment Canada regulations. The omission of PCB's from the Spill and Contingency Plan suggests that these materials are poorly managed. It is assumed that light ballasts in all of the townsite buildings contain PCB oil. There may be PCB contamination of soils in areas where units were previously used or are currently stored.

There is approximately 250 m3 of diesel contaminated soil in the former copper concentrate storage shed. There may be copper contamination of the soil in the vicinity of this shed.

3.9. LANDFILL

A landfill on site has been used for disposal of general refuse throughout the mine life. Incineration of waste and disposal of the ash has been conducted in this area. Some clean-up work is being conducted on an inactive landfill located near to the mill.

3.10. ROADS

All roads must be scarified and revegetated at closure. Culverts must be removed and stable drainage patterns re-established. It is assumed that the road to the site will be maintained by others.

3.11. OTHER RECLAMATION ISSUES

Other disturbed areas, such as laydown areas or exploration disturbances should be cleaned of any debris and re-vegetated. Distribution of soil suitable for grasses and amendment with fertilizer before seeding with native species should be conducted.

3.12. INITIAL CARE AND MAINTENANCE

In the event that the company were to abandon the site, it would be necessary for the government to continue with necessary care and maintenance duties until reclamation activities are completed. It is expected that the following steps would be required leading up to the completion of the reclamation work:

- year 1, confirmatory studies, sampling and analyses,
- year 2, final design, preparation of final A & R report for approval by the Water Board,
- year 3, permitting and tendering of reclamation contracts,
- year 4, primary reclamation work,
- year 5, primary monitoring, repairs and final reclamation work.

Care and maintenance activities are assumed to consist of:

- year-round site presence,
- conduct operation and electrical/mechanical maintenance of the power generation plant and personnel accommodation facilities as required,
- carry out water management activities,
- continue all monitoring and reporting as per the Water Licence,
- supply of fuel and water treatment reagents by road,
- bi-weekly supply of food and miscellaneous provisions by road.

After the five year period, the period of post-closure water treatment and monitoring would begin.

The time frame indicated above is consistent with that which is occurring at other federally managed mine reclamation projects in northern Canada, namely; Colomac and Giant in NWT and Mt. Nansen in Yukon.

3.13. MOBILIZATION

It is assumed that all of the mining equipment that is currently on site is either non-functional or will have been removed at the time of abandonment of the site. Therefore, this estimate assumes that all equipment that is required for reclamation is brought to the site by the reclamation contractor. It is assumed that the most efficient approach to reclamation of the site is to conduct all of the waste relocation, cover construction and demolition in a single season.

3.14. POST-CLOSURE WATER MANAGEMENT

The post-closure water treatment scenario assumed for this cost estimate is based upon the following:

- operating the groundwater pumping wells,
- treating and discharging the underground drainage plus the groundwater throughout the year, (seasonal treatment during summer months could be less costly if a lined storage facility for up to 250,000 m3 was constructed),
- carry out monitoring and reporting as required,
- supply fuel, reagents and personnel for water treatment.

4. RECLAMATION COST ESTIMATE

4.1. GENERAL

The primary purpose of this report is to present an estimate of the current reclamation liability at the Cantung Mine. This estimate is to form the basis of financial security so that in the event that the company does not fulfill its obligations, then the Government would able to do so without any burden to the citizens of Canada.

As noted in Section 3, there is potential for ARD from many sources at the mine. There is essentially no discussion or analysis from the company to show that these sources will not cause water quality impacts at some future date. Provision for long-term collection and treatment of mine water is assumed to be necessary.

It is possible that passive measures for ARD control could be used. These could consist of flooding the underground workings and maintaining the tailings in a saturated

condition. However, limestone rocks are known for high permeability which may preclude mine flooding, and dam stability would be compromised if the ponds were to remain flooded. Therefore, passive control options have been rejected for the purpose of this assessment.

This estimate assumes that the company abandons the site essentially in its current configuration, because no major changes to the site are planned. This estimate does not allow for the costs associated with any major event such as a dam failure.

This estimate is based on the following assumptions:

- the company goes bankrupt or abandons the property,
- there is no allowance for the progressive reclamation which is currently proposed until after it is completed,
- all work is based on independent contractor rates,
- all costs are 2002 Canadian dollars,
- the cost estimate does not include revenue from recovery of assets.

It is recognized that calculation of the reclamation liability without allowance for progressive reclamation is financially punitive to the company. However, until this work is completed it is still an outstanding liability just like any reclamation which is put off until final closure of the mine. Therefore, financial security should be established to ensure that this work is conducted as proposed. If the company carries out progressive reclamation as proposed, such as removal of waste rock into the underground mine during operations, then the company's costs may be lower than estimated here.

The estimate has been developed using the RECLAIM model (DIAND, 2001), a spreadsheet developed for estimation of mine reclamation costs. The model is based, as much as possible, upon costs from other mine reclamation activities completed in the north.

This cost estimate is based upon the specific reclamation activities described in the RECLAIM model in Appendix B and the supporting notes in Appendix C.

4.2. ESTIMATED RECLAMATION LIABILITY

The estimated total reclamation liability for the Cantung Mine is listed by mine component in the following table.

ESTIMATED RECLAMATION LIABILITY
CANTUNG MINE

COMPONENT	COST
Open Pits	$102,500
Underground	$34,906
Tailings	$4,296,543
Rock Dumps	$113,264
Buildings & Equipment	$1,57,580
Chemicals & Contam. Soil	$372,091
Interim Care & Maintenance	$1,500,000
Mob./Demob.	$1,390,238
Monitoring & Maintenance	included in post-closure
Post-Closure Maintenance (Water treatment)	$16,021,894
Sub-total	$26,319,016
Project Management at 3%	$789,750
Engineering at 3%	$789,750
Contingency at 25%	$6,579,754
Grand Total	**$34,477,912**

In keeping with conventional engineering practice, and considering the status of reclamation planning and the uncertainties described herein, this estimate includes a contingency of 25%. A lower contingency would be indicative of a plan based on a comprehensive da ta base of site specific parameters, detailed engineering, and proven reclamation measures.

As noted above, there are uncertain and optimistic elements of the closure plan. Resolution of these issues may increase the cost of specific items beyond the amount provided here. Some reclamation issues may have been missed or under-stated in this estimate. The reclamation cost estimate presented here should be considered as a pre-feasibility or order of magnitude estimate. Therefore, the contingency is an integral part of the cost estimate and the estimated cost is not complete without it.

In the event that the Government must carry out reclamation work at the Cantung Mine, then the Government would probably incur additional costs. These costs, which are not included in this cost estimate, would be for activities such as:

- increased frequency of inspections leading up to assuming responsibility for the site,

- internal administration of contracts for planning and implementing the reclamation work,
- legal costs associated with "orphaning" of the site and making claims against the security deposit, and,
- interest charges on outlays until recovery of funds from any security deposit which has been provided,
- long-term maintenance of the road from Watson Lake.

5. SECURITY DEPOSIT

5.1. GENERAL

This estimate of the reclamation liability for the Cantung Mine is expected to be considered in the establishment of a security deposit to be provided by the company.

This estimate assumes that the company has not carried out any progressive reclamation. When the company does conduct this work it should be entitled to a reduction in the security requirements.

The ideal form of security deposit is cash or Government of Canada bonds. Both of these deposits will accumulate interest and may adequately counter the negative effects of inflation on the value of the deposit. Any interest on funds held in escrow by the company accrue to the company's benefit, and the result is a gradual decline in the value of the escrowed funds.

If the company proposes a letter of credit (L.O.C.) and it is accepted by the Water Board, then the L.O.C. should include an annual adjustment for inflation. It is suggested that this adjustment be linked to the Canadian Consumer Price Index or other accepted measure of the effects of inflation.

There is an additional issue related to the use of a LOC. If an L.O.C. is used then it should be established in a manner which ensures that it remains in effect and accessible to the Government for a period sufficiently long for the Government to contract and carry

out the necessary reclamation work. It is suggested that the bond should remain in effect for a minimum of two years past the date at which the site is legally declared an orphan and becomes the responsibility of the government.

The mine is due to shut down as soon as early 2004. It is recommended that a security deposit for the full reclamation liability be in place prior to shut down of the mine. This will place the onus on the company to carry out the necessary reclamation work in an expedient and cost-effective manner rather than post-pone the work for as long as possible.

5.2. CORPORATE CAPACITY

The consolidated balance sheets for North American Tungsten Corporation Ltd. as at September 30, 2001 have been obtained from The Canadian Securities Administrators web site. They show that the company has $3.55 million in escrow funds for reclamation liability. This amount is based on $2.65 million in a reclamation fund plus the $900,000 posted for the Water Licence. The company has drawn down the fund by $1million for the start up of the current operations. Therefore, the company currently has fund of $2.55 million for mine reclamation.

The company does not have any major source of income, other than the Cantung Mine. The company's total assets, including escrowed funds for reclamation are only $11 million, of which $5.4 million is property, plant and equipment. Examination of the $5.4 million asset show that $3.2 million is the Cantung property acquisition cost and about $2.2 million is the plant and equipment at the site. Considering the age of the facilities, it is doubtful that the assets have a recoverable value of $2.2 million.

The company has presumably either spent or committed to cash flow, its current assets. The company has recorded the value of the Mactung property at $0.59 million.

At this stage it appears that the company has little or no assets or capacity to cover the difference between its $2.55 million funds in escrow and the potential liability of up to $34.5 million. The only hope for building funds for reclamation is from the profits from

ongoing operations. However, any profits which are distributed to shareholders will not be recoverable.

There is a significant risk that the company will be unable to meet its reclamation liability much beyond the amount currently in escrow. Considering the expected short mine life, some form of monthly addition to the security bond should be implemented in order that the are sufficient funds to carry out the reclamation work.

6. WATER LICENCE – TERMS & CONDITIONS

Operation of the Cantung Mine is conducted according to the terms and conditions as described in the NWT Water Licence N2L2-0004. Although the licence expired on September 29, 2002, it is expected to be renewed for a one year period with no other changes other than revision of the expiry date.

The anticipated renewal licence will not be adequate to ensure that the Licencee will undertake the site assessment, studies and planning which is required to produce an acceptable and demonstrable closure plan. Following are recommended terms and conditions which should be considered in the drafting of any new licence, and by the company, even if these items are not included in any interim licence.

1. Conduct geochemical assessment of all potential sources of ARD and metals. Static and kinetic results should be sufficient to characterize current conditions and anticipated future release rates. Seep surveys in the vicinity of potential ARD sources should be conducted.
2. Assessment of potential impacts and options for mitigation of ARD effects from sources of concern.
3. Assessment of underground hydrogeology.
4. Assessment of long-term stability of dams considering erosion and seismic processes.
5. Selection and design of a landfill for demolition waste, and development of QA/QC protocol for waste disposal.
6. Prepare inventory lists and disposal plans for hazardous materials.

The above list is preliminary in nature. It could be expanded to provide additional detail if necessary.

7. CONCLUSIONS

Based on the information reviewed and the above assessment, the following conclusions have been reached.

1. The A & R plan prepared by the company is not complete with respect to addressing all of the issues at the site. In addition, many of the proposed measures are unlikely to meet current closure objectives because they are: based on dated reclamation standards or insufficient site characterization, or the proposed measures do not fully address the long-term physical or chemical stability issues at the site.
2. The estimate of reclamation liability presented here should be considered as a pre-feasibility level estimate because of the outstanding issues.
3. The estimated total cost for reclamation of the Cantung Mine, including provision for post-closure water management and monitoring, is $34.5 million.
4. Cash is the preferred form of security deposit. If a letter of credit is proposed then it should include terms for inflation adjustment and duration of the security well after any failure of the company to fulfill its obligations.
5. The company has accrued up to $2.55 million for reclamation of the site. Additional reclamation security should be obtained as a burden on operating revenue, as the company appears to have minimal other assets to cover the liability.
6. Additional costs, above those identified here, would be incurred by the Government if it were to carry out the reclamation. These costs relate to contract administration, legal, contract timing and scope and financial carrying costs.

This report presents a review of the reclamation issues and an estimate of the cost for reclamation of the Cantung Mine. Should there be any questions regarding the approach or conclusion of the report, please contact the undersigned.

Yours truly,

Brodie Consulting Ltd.

M. J. Brodie, P. Eng.

8. REFERENCES

1. Mine Site Reclamation Policy for the Northwest Territories", dated 2002, Indian Affairs and Northern Development.

2. Guidelines for Abandonment and Restoration Planning for Mine in the Northwest Territories, 1990, NWT Water Board.

3. Mine Reclamation In Northwest Territories and Yukon, 1992, DIAND, Northern Water Resources Studies Program.

4. Canadian Geotechnical Society, 1987, Canadian Foundation Engineering Manual, 2nd Edition, BiTech Publishers Ltd.

5. DIAND 2001, RECLAIM Version 4.1 for Microsoft Excel.

Photograph 1
View of Flat River tailings

APPENDIX A

INFORMATION SOURCES

The following information was reviewed in preparation of the reclamation cost estimate:

- Cantung Mine Abandonment and Restoration Plan, November 2001,
- Report to Canada Tungsten Mining Corporation On Tailings Disposal Pond No. 3, Golder Associates, 1976,
- Proposed Improvements to Tailings Pond 3, Cantung Mine, EBA June 2001,
- Construction Report Tailings Pond 3, Cantung Mine, EBA November 2001,
- Assessment of the Results of Recent Geochemical Testing of the Cantung Tailings, Robertson Geoconsultants, April 2001,
- Cantung Mine Tailings Acid Generation Potential Static Testing Assessment, Robertson Geoconsultants, June 1995,
- Operating Plan for Cantung Mine, NWT, North American Tungsten Corporation Ltd. June 2001,
- Geotechnical Site Inspection Tailings Dams, Tungsten NWT, EBA Oct 2000.
- 2000 Annual Report – Water Licence N3L2-0004, Tungsten, NWT, North American Tungsten Corporation Ltd., March 2001,
- assorted reference materials as contained in the compilation of reports for the "Round Table Discussion Cantung Summary", Gartner Lee, April 2002,
- verbal discussions and observations made with site personnel during the Aug. 2001 site inspection.

Audited Financial Statements as at September 2001 were obtained from The Canadian Securities Administrators web site at www.sedar.com

APPENDIX B

RECLAMATION COST ESTIMATE

APPENDIX C

RECLAMATION COST ESTIMATE SUPPORTING DETAILS

CANTUNG MINE
RECLAMATION COST ESTIMATE
SUPPORTING DETAILS FOR INPUT TO RECLAIM MODEL

Pits

- drill drain hole for ARD water to underground workings, mobilize drill, drill ~ H size hole, 600 m at – 30 degrees, install stainless steel collar and trash rack,
- excavate ditches to route uncontaminated runoff around ARD collection sump, allow for 150 of ditch, 2 m deep and 2 m base width to reduce maintenance requirements, volume is 8 m3/m, total volume is 1200 m3,
- assorted minor debris is removed,
- rehab. the pit access road; remove rockfall, trim loss rock, rebuild collapsed section.

Underground

- reclamation requirements for the underground workings will consist of removal of hazardous materials in shops and any equipment to be disposed underground,
- portals and raises are sealed, fill is 4 x 4 x 8 m = 64 m3/portal, drill and blast portal roof onto fill, 7 portals total,

Tailings containment

- remove 172,000 m3 of tailings from Flat River, add lime at 0.1 kg/tonne, place in Pond 4,
- remove 500,000 m3 of tailings from Flat River, add lime at 0.1 kg/tonne, place in Pond 3,
- add lime at 0.1 kg/tonne into 672,000 tonnes = 67 tonnes
- place rip rap to create stable banks along Flat River, allow 700 m length and 1 m3/m on both banks = 1400 m3,
- revegetate disturbed areas of Flat River and Pond 1 and 2, Flat River area approx. 600 x 150 m = 90,000 m2, Pond 1 and 2 area 245 x 120 m = 29,400 m2
- construct a raise on Pond 3 using upstream construction 6 m high to contain the tailings from Ponds 1 and 2, approximate volume is 25.5 m3/m of crest over 1080 m crest length, total volume is 27,540 m3,
- construct a buttress around Pond 3 to flatten slopes from 1.3:1 to 1.6:1, volume is 54 m3/m on east, south and west sides with a total length of 800 m for a sub-total of 43,200 m3, plus 24.3 m3/m on north side with a total length of 180 m for a sub-total of 4,375 m3, total fill volume is 47,575 m3, most of this material must be placed by dozing down from the top,
- dust control cover, Pond 3, 320 x 210 m = 67,200 m2, Pond 4, 170 x 100 m = 17,000 m2; provide 0.5 m thick cover, volume is 33,600 m3 on Pond 3 and 8,500 m3 on Pond 4, total volume is 42,100 m3,
- vegetate tailings cover and dam faces, horizontal area is 84,200 m2 and slope area is 43,350 m2 on Dam 3 and 4000 m2 on Dam 4, total area is 127,550 m2,

Rock piles

- ventilation portal rock, relocate to underground, allow for removal of about 1/3 of 3360 m3 first rock mined was ARD inert,
- main portal rock, relocate to underground, allow for removal of about 1/3 of 6300 m3 first rock mined was ARD inert,
- open pit rock pile, construction of low permeability cover over horizontal top surface, area to be covered is roughly estimated to be 1800 m2, grade surface, supply and install geosynthetic clay liner (GCL), place 0.5 m rock cover using rock from pit ditch and local in-pit rock,

Buildings & equipment

- remove wooden townsite buildings, demolition area scaled upward to account for higher buildings, buildings included in this group are: Dorm A, Cookhouse, 80 man bunkhouse, Rec. complex, Apt's 1, 2, 3, Condo's 1, 2, 3, School, houses, skating rink, and assorted minor structures. Effective demolition area is 15,796 m2 of wood and 5304 m2 of masonry/steel.
- remove mill complex with crusher, powerhouse and adjacent warehouse, Effective demolition area is 17,632 m2 of steel.
- remove lower warehouse, maintenance shop, upper warehouse, Effective demolition area is 2616 m2 of steel.
- remove copper conc. storage and office, Effective demolition area is 1056 m2 of wood.
- allow for removal of fuel and water tanks and piping, Effective demolition area is 455 m2 of steel.
- assume all demolition waste reduced in volume to 25% of erected volume and disposed in quarry, disposal volume is 9,389 m3
- rock cover over demolition waste is 2 m thick over waste placed in 10 m lift with sloped edges, rock volume is 2800 m3,
- after removal of buildings, the mill and town site will be graded and rock or overburden will be placed over concrete foundations, allow for 0.5 m3/m2 on 19,400 m2,
- allowance for soil, fertilizer and grass seed on affected area is provided, areas are 19.4 ha,
- reclamation of the roads is included in this part of the cost estimate, scarify roads remove culverts and vegetate, 3.6 ha,

Chemicals & contaminated soils

- allow for haz. mat. audit
- allow for removal of haz. mat.
- allow for 22 m3 of sludge in tank farm tanks, 0.1 m depth of sludge in all tanks, amount includes provision for tank cleaning prior to demolition,
- metal and hydrocarbon contaminated soil will be disposed of in the underground workings or tailings area, metals – from load out by concentrate storage, allow for 50 m3 to underground disposal, hydrocarbon soil - allow for disposal of ?? m3,

- allow 6 days for electrician & laborer to remove light ballasts from townsite buildings,
- allow for removal of PCB units, allow $7500 each

Interim Care & Maintenance (costs are shown in Mobilization section of RECLAIM)

- allow for 4 years interim care and maintenance,
- assume on-site care-tender at $95,000/yr,
- fuel and supplies at $50,000/yr,
- electrician, 2 weeks per year at $600/day
- mechanic, 2 weeks per year at $600/day
- one pick-up truck at $12,000/year
- one dozer for miscellaneous tasks, allowance $25,000/yr,
- one excavator for miscellaneous tasks, allowance $25,000/yr
- 1 snow machine at $3000/yr
- allow $20,000/year for communications,
- allow $25,000/year for Water Licence sampling analyses and reporting
- allow $15,000/year for geotechnical assessment, (incl. travel),

Mobilization & Demobilization

- it is assumed that the loaders, haul trucks and dozers are not on site at closure and must be supplied in order to carry out the reclamation work,
- all reclamation and demolition equipment will be mobilized from Whitehorse area,
- assume reclamation equipment to consist of 1 drill, 2 front end loaders (D980 and D988), 2 dozers (D8 and D9), 10 dump trucks (3 x C771 and 7 x C775B), 3 excavators (330L),
- mobilization cost is based on 775 km one way distance to site, costs include demob travel distance,
- fuel will be required for site maintenance and operation of equipment during reclamation year, allow for 400,000 l, cost is for shipping to site only, purchase price included in equipment operation costs,
- personnel transport is by road,
- accommodation for 25 men for 4 months is required, use of existing facilities is expected,

Post-Closure Water Treatment

- post-closure is expected to be required, possibly commencing as soon as five years after mine the end of operations,
- need to construct water treatment plant, allow for treatment of 410,000 m3/yr (300,000 m3 from U/G, 45,000 m3 from pit and 65,000 m3 from wells around tailings pond),
- treatment is to consist of addition of lime at the rate of 1.5 kg/m3 of water,

- the volume to be treated is assumed to 410,000 m3/year, which will require addition of 40 tonnes of lime per year, at $270/tonne FOB Vancouver plus $150/tonne shipping by truck, total cost is $320/tonne
- flocculent, allow $30,000/yr,
- fuel and supplies at $50,000/yr,
- assume on-site care-tender at $95,000/yr,
- electrician, 2 week per year at $600/day
- mechanic, 2 week per year at $600/day
- 1 technician at $400/day and 1 laborer at $300/day,
- one pick-up truck at $12,000/year
- one excavator for misc. tasks and spillway maintenance, machine remains on site, allowance $50,000/yr
- allow $20,000/year for communications, allow $25,000/year for Water Licence sampling analyses and reporting
- allow $15,000/year for geotechnical assessment, (incl. travel),

Post-Closure Monitoring & maintenance

- monitoring and maintenance costs consist primarily of geotechnical inspections, and water quality sampling during the post-closure period, costs are included in post-closure section of RECLAIM,

Reclamation summary

- in addition to the cost of the primary reclamation activities, an allowance of 3% of the cost is included for each of project management and engineering for the reclamation work,
- a contingency of 25% is allowed.

APPENDIX D

ARD REVIEW – LORAX ENVIRONMENTAL LTD

November 12, 2002

Mr. David Milburn, Manager
Department of Indian Affairs and Northern Development
Water Resources Division
Box 1500 4914 - 50th Street
Yellowknife, NT, X1A 2R3

RE: CANTUNG MINE – RECLAMATION COST ESTIMATE

Dear David,

Attached is the final report which presents a review of the A & R plan for the Cantung Mine and an independent estimate of the cost for reclamation of the site.

Please note that the allowances for hazardous materials and contaminated soils may need to be revised pending the final assessment of these liabilities by Gartner Lee Limited.

It may be possible for the company to demonstrate that elements of the cost estimate are not necessary or may be reduced in scope. The company's approach of reporting past performance is not adequate to substantiate that there will not be problems in the future. It will be necessary for the company to undertake detailed scientific and engineering studies in order to defend an argument for a lower reclamation cost.

I trust that this report addresses your requirements for this project. Please call if you any questions.

Yours truly,
Brodie Consulting Ltd.

M. J. Brodie, P. Eng.

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