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Aboriginal Affairs and Northern Development Canada – Nunavut Region

RECLAIM Cost Model for the Lupin Mine, Nunavut

Lupin Gold Project

Water Licence Renewal Application

October 22, 2015

Our Ref.:
702380-000

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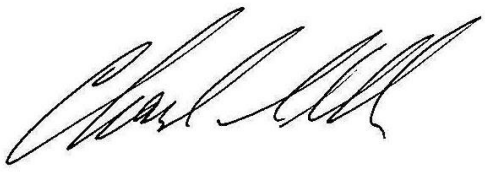

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FINAL

RECLAIM Cost Model for the Lupin Mine, Nunavut

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Executive Summary

The results of the site inspection work completed by ARCADIS Staff during a recent site visit, undertaken 19 to 20 August 2015, have determined that in general the conditions, as outlined in the Lupin Mines Incorporated (LMI) Lupin Mines Closure Estimate Update December 2014, remain unchanged. The assumptions used by LMI in their RECLAIM cost estimate are reflective of the site conditions save for the issues and concerns raised by ARCADIS in their memoranda of 31 December 2014 and 22 January 2015 regarding the LMI December 2014 RECLAIM cost estimate.

On the basis of the information collected during the recent site inspection, and the information included in our earlier reviews of the LMI RECLAIM cost estimate and subsequent correspondence, we have recompiled the RECLAIM estimate for the Lupin mine site and have determined that a quantum of security on the order of $45.5 million would be required to address the site closure requirements, as outlined in the LMI Interim Abandonment and Restoration Plan document, on the assumption that no progressive reclamation works were completed on the site. It is understood that the majority of the reclamation cost as derived herein are the result of mobilization of equipment and materials to decommission and remediate the site in its current condition and that any progressive reclamation work completed by LMI would result in a future reduction in the quantum of security presented herein. As noted in the terms and conditions of the existing water licence, the proponent has the opportunity to have the quantum of security adjusted at future dates as they see fit.

The majority of the reclamation cost is associated with mobilization/demobilization and supply of earthmoving and demolition equipment to complete the reclamation works on the assumption that the current mine operator will complete minimal to no reclamation works and the equipment fleet on site is not sufficient to complete the restoration of the site. While it is understood that in the near term some equipment on site could be used during the reclamation works the Crown cannot make this assumption as the condition of this equipment at the time the Crown were to take over responsibility for the site is unknown.

The largest risk to the overall reclamation program would be the assumption the petroleum hydrocarbon (PHC) impacted soils could be treated, used a landfarming technique, in one season. In the event landfarming of PHC impacted is not completed as part of any progressive reclamation work there is a risk that the amount of impacted soil could not be treated in a single season. This liability will need to be monitored and the quantum of security potentially adjusted upward as the cost to strand the earthmoving equipment required to continue landfarming of PHC impacted soils over an additional one or two seasons has not been accounted for in this estimate.

1. Introduction

The Lupin mine site (Lupin) is owned and operated by Lupin Mines Incorporated (LMI) and is located within the Kitikmeot region of Nunavut, approximately 400 km north of Yellowknife (568 km by winter road) and 285 km south of Kugluktuk. The geographic center of the property is 65° 45' 29" N and 113° 13' 20" W. A Key Plan and general location plan are provided in Figures 1 & 2. The site was an operational underground gold mine from 1982 to 2005 with temporary suspension of activities between January 1998 and April 2000 and again between August 2003 and March 2004. The mine resumed production in March 2004 until 2005. The site has been in a care and maintenance phase since 2005. During the period of 2011 to 2013 LMI completed works in preparation for a re-start of operations planned for 2015 however the drop in gold prices has postponed the re-start of the mine pending resurgence in the price of gold.

The Lupin site is in a remote location whereby all labour, equipment, supplies and materials must be mobilized to or from the site by air or winter road. There are three main operating areas (see Figures 2 to 5) on the site:

1. Mill Site which houses the mill plant, vehicle repair shop, vehicle parking, power house, emergency generators, office and changes rooms, fuel storage tank farm, freshwater system, sewage treatment plant and sewage line, incinerator, ore storage area, waste pad, mine shaft and raises, mine accommodations and access roads;

2. Tailings Containment Area; and

3. Airstrip, borrow pit esker, and water intake structure.

As part of the Nunavut Water Board (NWB) Water Licence approval process LMI prepared an Interim Abandonment and Restoration Plan (IARP) and submitted the IARP report to the NWB in March 2013 with the 2012 Annual Report. The details of the IARP were used to evaluate the quantum of security for this site.

In August 2015 AANDC commissioned ARCADIS Canada Inc. (ARCADIS) to undertaken a geotechnical inspection of the Lupin site and review site conditions to confirm the assumptions made in earlier restoration estimates prepared by ARCADIS as part of the water licence renewal process. The results of this site visit are incorporated into this document as applicable to assumptions made in preparing this quantum of security estimate.

2. Summary of Reclamation Plans

The reclamation plans for the site are outlined in detail within the LMI March 2013 IARP and are only summarized herein. Observations and any concerns with the assumptions related to the reclamation works are outlined in Sections 3 and 4.

2.1 Buildings and Contents

All building and their contents will be decommissioned, decontaminated, dismantled and removed from site. Combustible components of the system would be burned on site using an approved incinerator.

2.2 Freshwater Intake System

This system will be dismantled and removed from site. This includes all electrical and mechanical components and associated tanks. Combustible components of the system would be burned on site using an approved incinerator.

2.3 Sewage Disposal Facilities

This system would be dismantled and removed from site. The decommissioning work would include the removal of the rotating biological contactor, breakdown of the effluent discharge lines and demolition of the associated buildings. Any residual sludge will be drummed and shipped from site for disposal.

2.4 Access Roads and Airstrip

There are approximately 16 km of access road and a 2 km long airstrip on site that would require re-grading and scarifying upon closure of the site. This work would also include the removal and disposal off-site of 22 culverts currently in place along the site access roads. All ancillary equipment will be dismantled, consolidated and removed from site for disposal.

2.5 Fuel Storage

The existing fuel storage tank farms will be decommissioned with the tanks along with any residual fuels and sludge removed from site for disposal. The secondary containment systems will also be decommissioned with geomembrane liner removed from site and non-impacted containment berms

used in the backfilling of the underground workings. Petroleum hydrocarbon impacted soils would be treated (landfarmed) on-site to meet the applicable regulatory requirements. The treated soil would be graded out to provide positive drainage.

Currently there are 14 diesel tanks, a Jet A tank and nine individual tanks at the main tank farm; ten diesel tanks and two gasoline tanks at the satellite tank farm and two waste oil tanks; as well as five glycol tanks on site. The quantity of product on site as of September 2015 has not been confirmed by LMI further to our request during and post site inspection.

2.6 Explosives Magazine

There are no explosives currently on site. The steel frame and clad structures used to store the explosives will be dismantled and disposed of off-site as part of the site decommissioning program.

2.7 Borrow Pits and Quarry

The existing borrow sources will be used during the course of the reclamation works and as per the terms of the existing quarry permit it has been assumed that any borrow or quarry locations will be left in a condition acceptable to the regulatory authorities upon completion of any short term or long term shut downs or closures.

2.8 Underground Development

The existing portal, shaft and vent raises will be decommissioned in accordance with the regulatory requirements. An engineered cap will be designed and constructed at the vent raises and shaft while an engineered plug will be constructed at the portal entrance. The IARP does not provide any details on the methodologies being implemented by LMI. There is, however, sufficient waste rock on site that could be used in the preparation of the respective mine seals.

2.9 Waste Rock

The IARP states that up to 40% of the waste rock is potentially acid generating (PAG) and all PAG waste rock will be managed on site. The final volume of PAG has yet to be determined and will be subject of future analytical work to confirm the volume of PAG to be managed as part of the reclamation program.

Stockpiles or laydown areas of non-PAG waste rock would be used in the construction of mine seals and general earthworks as required. Surplus waste rock would be graded and contoured to match the surrounding topographic grades.

2.10 Tailings Containment Structure

The existing tailings containment structure (TCS) will continue to be capped and water moved between inactive and active cells as part of a progressive reclamation process. Details on the final closure plan are included in Section 2.5.2 of IARP and include decommissioning of the piping, construction of a spillway, capping of select areas and breaching of the J Dam to allow controlled discharge of impounded water to Pond 2. Local borrow and non-PAG waste rock will be used in the reclamation work for the TCS.

2.11 Re-vegetation

The IARP is silent on re-vegetation works.

2.12 Post-Closure Monitoring

The IARP states that post-closure monitoring will be undertaken in two phases. During Phase 1 annual monitoring will be undertaken for the first ten years after closure of the mine. Phase 2 would entail two monitoring periods only at 15 and 25 years post closure. .

The monitoring of soil conditions would not be required as the treatment of any petroleum hydrocarbon impacted soils would need to be completed as part of the reclamation program.

3. Summary of Site Conditions

The following general observations were made by ARCADIS staff during their recent site inspection work undertaken in August 2015:

1. The site conditions are effectively the same as described by LMI in their evaluation of the site and the contents of the various structures and equipment thereon.
2. There is potential for petroleum hydrocarbon impacts to be present within the overburden that had not been previously identified stemming from historic fuel storage practices as observed on site. For example heavy oil staining was observed within the tank farm areas and in the equipment laydown areas. The underground piping between the tank farm and day tanks are also a potential source of concern in the Camp area.

3. Based on visual observations only, the equipment on site appears to be in relatively good condition.
4. The waste rock pads are in areas that are elevated and dry relative to the surrounding terrain and as such water management from these areas is not anticipated.
5. The quantity of fuel on site was not confirmed during the site inspection.
6. Leaking drums were observed on site in the Mill area.

Observations on specific items included in the Interim Abandonment and Restoration Plan are provided below using the same section headers included in Section 2 of this document.

3.1 Buildings and Contents

The majority of the buildings on site are steel framed or modular and can be easily collapsed and transported off-site for disposal. None of the structures appeared to be constructed of materials that would require special material management (i.e. asbestos or lead paint) with the exception of some structures were asbestos containing materials are known to be present. The contents with the buildings will need to be managed appropriately as there are petroleum products and various chemicals in small quantities that will require appropriate management at the time of mine closure.

No concerns with the reclamation approach as outlined by LMI in the IARP.

3.2 Freshwater Intake System

The freshwater intake system is also relative modular and would be easy to dismantle and ship off-site for disposal. Small tools can be used to decommission the majority of the equipment and hydraulic equipment would be used to remove pumps and other heavier electrical/mechanical components. The decommissioning of the corrugated steel pipe shaft within the intake structure will require some work however this work could be easily done using an excavator.

No concerns with the reclamation approach as outlined by LMI in the IARP.

3.3 Sewage Disposal Facility

This system is also modular and can easily be decommissioned using small tools with some hydraulic equipment support. No concerns with the reclamation approach as outlined by LMI in the IARP.

3.4 Access Roads and Airstrip

The current condition of the site access roads are such that minimal improvements would be required to allow equipment to freely move between the airstrip, the borrow eskers, the tailings containment structure and the Mill Area. We concur with LMI that twenty-two culverts require removal.

While the IARP does state that the Airstrip is to be decommissioned consideration may be given to leaving the airstrip in place however identified as abandoned. For the purposes of this exercise it has been assumed that the reclamation work in this regard will match that outlined in the IARP.

The re-grading and scarifying of the access road and removal of culverts can be easily achieved using a dozer with a ripper and either a loader or excavator.

3.5 Fuel Storage

The existing tank farms can be easily decommissioned whereby the contents of the tanks can be decanted into tanker trucks or totes mobilized to site for the reclamation program. The portion of tanks could be loaded onto flatbed trailers to be transferred off-site for disposal while the larger tanks would need to be dismantled on site and the residual scrap metal shipped off-site along with any residual sludge. The volume of residual fuel on site was not confirmed during the course of the site visit and as such volumes calculated in earlier RECLAIM estimates have been assumed.

Inspection of the tank farm containment area and various equipment laydown areas did identify areas of heavy petroleum hydrocarbon staining that will need to be addressed as part of any future reclamation work. On the basis of surface impacts the volume assumed by LMI is consistent with estimates based on observations made by ARCADIS staff during the recent site visit. There is a risk however that given the nature of the liner material used for the secondary containment (a woven geotextile), and some evidence of perforations in the liner, that some leakage into the overburden underlying the tank farms has occurred which would increase the overall volume of impacted soil to be landfarmed. Given the time required to treat petroleum hydrocarbon (PHC) impacted soils in the North this represents a substantial risk to any future reclamation program. The true extent of the PHC concern will not be known until the time of reclamation. It would not be prudent to puncture the existing liner within the tank farm containment areas as part of any future environmental subsurface investigation program unless repairs were to be made to the containment liner. This concern applies to all tank farms on site as well as fuel/oil drum storage areas. The relatively minor staining noted in other parts of the site are not likely to result in a significant increase in the volume of impacted soil and as such are of less risk with respect to this component of the reclamation cost estimate. The volume of impacted soil is primary a function of what the impacts are within and beneath the existing and former tank farm containment structures.

3.6 Explosives Magazine

The existing magazines for both the explosives and blasting caps comprise a steel frame structure on a concrete pad that are presently empty. No concerns with the LMI reclamation plan for these units.

3.7 Borrow Pits and Quarry

No concerns were identified by the geotechnical inspector during the recent site inspection. No concerns with the LMI reclamation plan for these areas of the site. There will be sufficient plant on site during any reclamation work to address any potential concerns that may arise in the future.

3.8 Underground Development

The underground workings were not accessed during the recent site visit. The construction of the mine opening seals, as prescribed by LMI in their IARP, is consistent with industry practice and on the basis of the recent site visit there are no concerns with the proposed plan.

3.9 Waste Rock

The stability of the waste rock pad was reviewed as part of the recent geotechnical inspection of the site and no concerns were identified. The primary concern with respect to the waste rock pad, and waste rock in general, relates to the quantity of waste rock on site that may be acid generating. Limited information is available in this regard and as such the assumptions made in this estimate are conservative and consistent with the December 2014 estimate prepared by ARCADIS for this site. Additional testing is required to provide data that would reduce the uncertainty with respect to the volume of PAG rock on site that would require relocation into the underground workings.

No testing of the waste rock was undertaken during the recent site visit and as such in the absence of any new information in this regard the quantities of PAG rock have remained the same as previously assumed in earlier RECLAIM estimates.

3.10 Tailings Containment Structure

This area was also inspected and found, in general, to be stable by the geotechnical engineer. Issues identified by the geotechnical inspector were known to LMI and being addressed as part of their on-going care and maintenance work. No new concerns with the proposed reclamation plan for

this portion of the site subject to the additional testing of the waste rock as prescribed in Section 3.9. The concerns with the long term performance of the TCS, as previously identified in the December 2014 review document prepared by ARCADIS, remain however may be address through progressive reclamation works by LMI. For the purposes of this evaluation the comments and assumptions made by ARCADIS relating to the tailings containment structure will remain unchanged.

3.11 Re-vegetation

On the basis of site observations during the recent site visit it is confirmed that very little vegetation has established itself on the site access roads or other work areas on site since the site has gone into a care and maintenance phase (2005). It is unclear from the IARP what has been proposed by LMI in this regard. There is a program risk to this work element should the regulators want re-vegetation of the primary work areas.

3.12 Post Closure Monitoring

The monitoring program for the site will be outlined in the water licence and it is understood that some component or all of the monitoring stations will require some form monitoring into the future. The recent site inspection did not identify any areas of particular concern that should be incorporated into the sampling stations prescribed in the water licence.

4. Basis of RECLAIM Cost Estimate

This version of the Lupin mine site RECLAIM cost estimate is based on information collected during the recent site inspection works in August 2015 by ARCADIS staff and information included in the documentation provided by AANDC:

- LMI Interim Abandonment and Restoration Plan (March 2013);
- LMI RECLAIM cost estimate (December 2014) and Addendum documents ;
- ARCADIS RECLAIM cost estimate (December 2014) and Addendum documents (see Appendix C);
- AANDC Letter on the Water Licence Renewal Application by LMI (August 2015);
- Water Licence to Lupin Mine Incorporated from Nunavut Water Board (May 2015 – unsigned by Ministry of AANDC);
- Mine Site Reclamation Policy for Nunavut (INAC, 2002); and
- Mine Site Reclamation Guidelines for the NWT (INAC, 2007).

For ease of review we have included the same section headings used in the RECLAIM model. For the purposes of this evaluation the RECLAIM Version 7.0 model was used. As previously stated in our evaluation of the LMI RECLAIM cost estimate, we have used some of their quoted unit rates in lieu of the RECLAIM rates as they are in line with our experience on similar reclamation programs in the North.

4.1 Open Pit

This module of the RECLAIM model was not used as it is not applicable for the Lupin site.

4.2 Underground Mine

The assumptions made to prepare the RECLAIM estimate for this module include:

- 1,000 m^3 of waste rock or borrow material would be used to cap the engineered covers used to seal the shaft and vent raises. This quantity of material is based on observation of the work areas (five seals at 200m^3 each) and material take-offs from site maps provided in the IARP.
- Five engineered caps would be constructed to seal vertical openings. This quantity is based on the number of openings identified during the site visit.
- 2,500 m^3 of waste rock would be used to seal the portal opening. This quantity of material is based on observation of the work areas and material take-offs from site maps provided in the IARP (rounded 3 m x 3 m x 50 m plus 25 m x 40 m x 2 m avg.).
- Twenty man days (two workers ten days) would be required to decommissioning and decontaminate any underground equipment that will be left underground. This quantity has been taken to be consistent with the number of working days required to decommission other mine sites of similar site.

The rates used for the construction of the engineered caps were derived from recent experience with the closure work at the Outpost Island and Blanchet Island mines as well as the Meliadine Mine. The earthworks unit rates have been updated to the RECLAIM Version 7 estimates based on our review of the site conditions while the rates for the underground hazardous material removal is based on our experience with similar work.

The liabilities associated with this module would be assigned 100% to land as the works would have no impact to the local water sources. Details are provided in the worksheet (see Appendix A).

4.3 Tailings Impoundment

The assumptions made to prepare the RECLAIM estimate for this module include:

- 100,000 m^3 of waste rock or borrow material would be used to stabilize the tailings containment structures. In the absence of design information for the spillway structure the quantity of rip rap used by LMI has been used for this cost item.
- 375,000 m^3 of borrow material would be used to cover the balance of the tailings impoundment area. This quantity is based on an average cover thickness of 1.0 m across an area of 375,000 m^2 and is consistent with the assumptions outlined in the IARP.
- Fifty hectares of vegetation improvements would be required. This quantity is based on a nominal percentage (approximately 15%) of the total footprint of the TCA.
- 20,000 m^3 of waste rock or borrow material would be used to repair the existing tailings containment structure cover. This quantity is a provisional amount based on the observations made during the recent geotechnical inspections and in review of the assumptions made by LMI in their RECLAIM estimate.
- 6,000 m of piping would be decommissioned and dismantled for off-site disposal. This quantity is based on an approximate take off from existing site mapping as provided in the IARP.
- 30,600 m^3 of earthworks to construct a spillway. In the absence of design information for the spillway structure the quantity of rip rap used by LMI has been used for this cost item.
- 20,000 m^3 of waste rock/rip rap to line the spillway along with 7,000 m^2 of non-woven geotextile. In the absence of design information for the spillway structure the quantity of rip rap used by LMI has been used for this cost item.
- An allowance of $60,000 for the supply and installation of instrumentation to monitor the TCS. This allowance is based on experience with the supply and installation of monitoring wells at approximately $2000 per well and thirty wells.
- An allowance of $100,000 to manage and treat any water that may require treatment as discussed in the ARCADIS memorandum of 31 December 2014.

The quantities are based on the information compiled during the initial RECLAIM review in 2014 and confirmed during the course of the 2015 site visit. The unit rates have been updated from the December 2014 rates to refer those included in the RECLAIM Version 7 unit rate table.

The liabilities associated with this module would be a split between Land and Water liabilities as noted. Details are provided in the worksheet (see Appendix A).

4.4 Rock Pile

The work under this module will include the following:

- Earthworks using 400,000 m^3 of waste rock to complete various reclamation activities within the waste rock that underlies the mill area of the site. This quantity is comprised of two components whereby 100,000 m^3 of the waste rock would be used in the TCA cover and

300,000 m^3 of waste rock would be placed underground as per LMI RECLAIM estimate. These quantities have not been amended subject to confirmation with the results of waste rock testing however are conservative as it related to mitigating PAG rock issues.

- An allowance of $20,000 has been carried for waste rock testing to confirm quantity of material that would be deemed PAG rock.

For the purposes of this estimate the quantities of material remain unchanged from earlier RECLAIM estimates by both LMI and ARCADIS. In the absence of any new data with respect to the potential for PAG rock to be present the assumptions made in the January 2015 estimate prepared by ARCADIS remain unchanged. The unit rates used in the worksheet as presented in Appendix A are a mix of those rates provided in the most recent version of RECLAIM and as allowance for analytical work assuming that staff already on site would undertake the required sample procurement. For the purposes of this evaluation the liability for this module of work would be split between Land and Water as shown in the worksheet.

4.5 Building and Equipment

From the observations made by ARCADIS staff during the recent site visit it is confirmed that the magnitude of work for the decommissioning, decontamination and dismantling of the various buildings and pieces of equipment on site, as presented by LMI in their RECLAIM cost estimate is reasonable and consistent with our observations.

The work under this task will include the following (given the level of detail provided in this module the reader is directed to the worksheet in Appendix A to review material quantities):

- Decommissioning, dismantling, containerization and transfer off-site of building and equipment components for disposal.
- Transfer and disposal of mine/earthmoving equipment off-site for disposal
- Deconstruction of tank farms (including the secondary containment structures)
- Consolidation and management of barrels and totes on site.
- Consolidation and disposal of boneyard debris
- Grading and contouring of areas impacted by mine activities
- Removal and disposal of existing culverts (22 in total)
- Scarifying of 16 km of road and the 2 km airstrip (based on a 3 m wide roadway and 42.5 m wide airstrip)
- The building footprint areas as provided in the RECLAIM estimate are based on site observations and review of the quantities reported by LMI
- The allowance used to mitigate concerns with the boneyard are based on 35 working days to complete stabilization work at a rate of $10,000 per day for all labour, equipment and supplies

- The allowance used for the construction of the landfill are based on 45 working days to complete the construction of the landfill at a rate of $10,000 per day for all labour, equipment and supplies

Note that it was the IARP that stated the airstrip was to be scarified. ARCADIS is not opposed to leaving the airstrip as it currently exists.

For the purposes of this estimate the material quantities remain unchanged between the LMI and ARCADIS RECLAIM estimates. The unit rates used in the worksheet as presented in Appendix A are mix of those provide by LMI (were consistent with industry rates for the work) and the latest rates as provided in Version 7.0 of the RECLAIM model. The majority of the work under this module will be done to address concerns related to Land liabilities however a portion of the work will ensure Water liabilities are address. Details of the land and water liabilities are provided on the work sheet in Appendix A.

4.6 Chemicals, Hazardous Materials and Contaminated Soils

A detailed inventory of the chemicals and other hazardous materials on site was not completed by ARCADIS during the recent site visit given the timeframe of the site visit. The cataloguing of all chemicals and hazardous materials was deemed to be outside the scope of work however an evaluation of the material quantities was undertaken so as to assess the quantum of material that would require management. In general the quantities provided by LMI in their RECLAIM estimate have been used herein unless otherwise noted. The work involved under this module includes:

- Completion of a Phase I/II ESA to characterize the environmental liabilities on site (the rate for this work was increased to reflect levels of effort recently quoted by ARCADIS for the assessment of environmental liabilities at other mine sites).
- An allowance was added for asbestos abatement work (the abatement budget could be amended once the asbestos assessment report was reviewed by ARCADIS).
- Containerization and disposal of 100,000 litres of waste oil is new to the estimate and is based on observations made during the August 2015 site visit. The quantity of waste oil is based on the 55 totes (~1000 L each) located in the hazardous materials laydown area and on the order of 40 to 50 totes observed in the accessible areas of the warehouse on site.
- Containerization and disposal of 2,344,460 litres of fuel (2,177,211 of diesel and 167,249 of Jet A as measured by Delta Carter on 23 August 2014.
- Consolidation and disposal of 1000 kg of hazardous material (reagent and other chemicals)
- Consolidation and disposal of 100 kg of batteries
- Consolidation and disposal of 5000 kg of miscellaneous chemicals and solvents as observed in various buildings around the site during the August 2015 site visit
- Consolidation and disposal of 100 drums of hazardous material

- Management (consolidation, treatment and grading) of 50,000 m^3 of petroleum hydrocarbon impacted soil (increased from 40,000 m^3 estimated in the LMI RECLAIM estimate whereby the condition of the liners within the tank farms suggest that there will be additional PHC impacted soils beneath the tank farms). The increased volume is based on an area of 200 m by 50 m by an average depth of 1 m beneath the main tank farm. The original PHC impacted soil volume of 40,000 m^3 was also included in the estimate and is based on the areas of the site observed to be impacted with PHC staining and/or olfactory impacts. The estimated area of impact centered primarily on the tank farms, powerhouse, satellite tank farm and drum cache areas is estimated to be on the order of 30,000 to 40,000 m^2 with an inferred depth of impact between 1 to 1.5 m.
- An allowance for the transfer of 500 m^3 of impacted soil off site that cannot be treated on site and is based on 1% of the total PHC volume estimate.

The unit rates for the above referenced work come from a mix of rates provided in earlier estimates and updated RECLAIM rates as provided in Version 7 of the model. In general the work under this module relates to land based liabilities however a portion of the liability has been assign to water. Details of the cost breakdown are provided in the module worksheet (see Appendix A).

4.7 Water Management and Short Term Water Treatment

This module of the RECLAIM model was not used for this evaluation. Allowances for water management have been included in other modules of this estimate.

4.8 Post-Closure Water Treatment

This module of the RECLAIM model was not used as it is not applicable for the Lupin site. Allowances have been included in the Post Closure costing module.

4.9 Interim Care and Maintenance

This module was not part of the RECLAIM version 6.1 Model and as such the evaluation of the Interim Care and Maintenance costs is new for this site. For the purposes the following assumptions have been made:

- A five year period has been assumed.
- Crew would consist of a supervisor and three skilled workers for two man months a year supplemented by an electrician and mechanic on the basis of one man month per year respectively.

- Fuel consumption per annum would be 20,000 L.
- Accommodations would not be required however consumables would need to be transferred in as required (an allowance equal to the accommodation rate in the Version 7 rate table has been assumed).

The unit rates for the above referenced work have been taken from RECLAIM model rates as provided in Version 7. In general all the work within this module relates to liabilities associated with water as outlined in the work sheet provided in Appendix A.

4.10 Post-Closure Monitoring and Maintenance

The post-closure monitoring and maintenance for this site will need to be involved that the twelve site visits over twenty-five years as assumed by LMI. The potential for an adverse impact on the local environment as a result of a failure within the tailings containment structure is too great and as such a more involved post-closure monitoring program has been assumed herein consistent with the program previously in earlier versions of the ARCADIS RECLAIM estimate (see Appendix C). The recommended scope of work to be undertaken under this module would include:

- Preparation of final Closure and Permit Plans as well as a final site Audit
- Annual site inspection monitoring, not including geotechnical/environmental, would be done annually for up to 100 years post closure. Although the tailings remain a potential hazard and may require monitoring, care and maintenance beyond 100 years, the net present value of these costs is not material. Furthermore, technological developments would be expected over the next 100 years which are likely to mitigate long terms concerns and perhaps allow a permanent walk-a-way solution. For example, tailings could be re-mined in future for metal recovery.
- Geotechnical inspections of the site would continue annually for the first ten years and then every five years between Years 11 and 100 post closure. These costs have been discounted at 3%/annum and are required as noted above.
- Environmental Monitoring would be completed every year for the initial post-closure phase (Phase 1 – years 1 to 10 post closure) and then once every ten years starting 15 years post closure during Phase 2 (years 11 to 100).
- A nominal allowance has also been included to cover erosion repair work and potential water treatment concerns during the post-closure period.

The costs included for this work are consistent with those previously included in the ARCADIS December 2015 RECLAIM estimate.

4.11 Mobilization and Demobilization

The LMI RECLAIM estimate assumed that the reclamation of the entire Lupin site could be accomplished in one season. On the basis of the recent site visit we concur that subject to the results of additional subsurface investigation work related to PAG rock and potential petroleum hydrocarbon contamination not already accounted for in this estimate the reclamation work could be done in a single season provided sufficient resources were assigned to the work.

The current condition of the equipment on site suggests that the existing fleet could be used to do a large portion of the work however for the purposes of this estimate we have to assume the equipment is not available and equipment will need to be mobilized to site over an ice road in and an ice road out the following winter road season. As previously noted in earlier RECLAIM estimates the NWB want the winter road construction to be independent of any potential combined operations with the other mine sites along the existing winter road alignment and as such we have assumed a winter road between Yellowknife and the Lupin mine (568 km one way).

The following work would be undertaken within this module:

- Mobilization of an equipment fleet (excavators 2, dump truck 4, dozer 2, front end loader 2, crane 1, demolition shears 1 and light duty truck 3)
- Mobilization of workers, fuel, supplies, tools and consumables as well as a temporary camp during the reclamation work
- Construction of two 568 km long winter roads (includes for winter road tariffs)

The material quantities used to derive this module cost are provided in the work sheet located in Appendix A. For the purposes of this estimate the unit rates are based on a mix of rates provided by LMI and updated RECLAIM Version 7 rates. The liability costs have been split as a function of the direct cost ratio between land and water liabilities as compared to the overall direct costs.

4.12 Other Considerations

The following assumptions have been made with respect to Indirect Costs:

- Project Management costs would be 5% of Direct Costs as is consistent with industry standards for this type of work.
- Engineering Costs would be 10% of Direct Costs based on recent experience with mine reclamation programs in the north where the Crown has had to assume responsibility for the mine clean-up program.
- Health and Safety would be 1% of Direct Costs based on the level of effort observed by ARCADIS on recent mine reclamation works.
- Bonding and Insurance would be 1% of Direct Costs as is consistent with industry standards for this type of work.

- Contingency Factor has been lowered to 20% to account for additional work items added to the ARCADIS RECLAIM estimate as compared to the latest LMI RECLAIM Versions 6.1 estimate. The contingency factor remains high given the uncertainty with respect to the total volume of PAG rock and possible petroleum hydrocarbon impacts as may exist beneath the tank farm liners which may result in an additional season of on-site soil treatment.
- Market Price Factor Adjustment has been set to 0%.

The percentage split of Indirect Costs associated with Land vs Water liabilities has been set by the ratio of Direct Costs for these liabilities at a ratio of 42% to 58%.

5. Summary of Costs

The final breakdown of costs by module is provided below. Detailed work sheets for each module are presented in Appendix A.

CAPITAL COSTS	COMPONENT NAME	COST	LAND LIABILITY	WATER LIABILITY
OPEN PIT		$0	$0	$0
UNDERGROUND MINE		$506,380	$501,380	$5,000
TAILINGS FACILITY		$7,231,080	$2,826,750	$4,404,330
ROCK PILE		$3,580,000	$1,780,000	$1,800,000
BUILDINGS AND EQUIPMENT		$6,577,883	$3,549,215	$3,028,668
CHEMICALS AND CONTAMINATED SOIL MANAGEMENT		$7,212,041	$2,062,271	$5,149,771
SURFACE AND GROUNDWATER MANAGEMENT		$0	-	$0
INTERIM CARE AND MAINTENANCE		$644,488	-	$644,488
SUBTOTAL: Capital Costs		**$25,751,872**	**$10,719,616**	**$15,032,256**
PERCENT OF SUBTOTAL			**42%**	**58%**

INDIRECT COSTS		COST	LAND LIABILITY	WATER LIABILITY
MOBILIZATION/DEMOBILIZATION		$8,078,895	$3,362,965	$4,715,930
POST-CLOSURE MONITORING AND MAINTENANCE		$2,186,376	$910,113	$1,276,263
ENGINEERING	10%	$2,575,187	$1,071,962	$1,503,226
PROJECT MANAGEMENT	5%	$1,287,594	$535,981	$751,613
HEALTH AND SAFETY PLANS/MONITORING & QA/QC	1%	$257,519	$107,196	$150,323
BONDING/INSURANCE	1%	$257,519	$107,196	$150,323
CONTINGENCY	20%	$5,150,374	$2,143,923	$3,006,451
MARKET PRICE FACTOR ADJUSTMENT	0%	$0	$0	$0
SUBTOTAL: Indirect Costs		**$19,793,464**	**$8,239,336**	**$11,554,128**
TOTAL COSTS		**$45,545,336**	**$18,958,952**	**$26,586,384**

Appendix A

RECLAIM Version 7 Model Worksheet Tables

SUMMARY OF COSTS

CAPITAL COSTS	COMPONENT NAME	COST	LAND LIABILITY	WATER LIABILITY
OPEN PIT		$0	$0	$0
UNDERGROUND MINE		$506,380	$501,380	$5,000
TAILINGS FACILITY		$7,231,080	$2,826,750	$4,404,330
ROCK PILE		$3,580,000	$1,780,000	$1,800,000
BUILDINGS AND EQUIPMENT		$6,577,883	$3,549,215	$3,028,668
CHEMICALS AND CONTAMINATED SOIL MANAGEMEN		$7,212,041	$2,062,271	$5,149,771
SURFACE AND GROUNDWATER MANAGEMENT		$0	-	$0
INTERIM CARE AND MAINTENANCE		$644,488	-	$644,488
	SUBTOTAL: Capital Costs	**$25,751,872**	**$10,719,616**	**$15,032,256**
	PERCENT OF SUBTOTAL		**42%**	**58%**

INDIRECT COSTS		COST	LAND LIABILITY	WATER LIABILITY
MOBILIZATION/DEMOBILIZATION		$8,078,895	$3,362,965	$4,715,930
POST-CLOSURE MONITORING AND MAINTENANCE		$2,186,376	$910,113	$1,276,263
ENGINEERING	10%	$2,575,187	$1,071,962	$1,503,226
PROJECT MANAGEMENT	5%	$1,287,594	$535,981	$751,613
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MARKET PRICE FACTOR ADJUSTMENT	0%	$0	$0	$0
	SUBTOTAL: Indirect Costs	**$19,793,464**	**$8,239,336**	**$11,554,128**

TOTAL COSTS	**$45,545,336**	**$18,958,952**	**$26,586,384**

1 **Underground Mine Name** **UG Mine # *1***

ACTIVITY/MATERIAL	Notes	Unit	Qty	Code	Unit Cost	Cost	Land	Land Cost	Water Cost
CONTROL ACCESS									
Fence		m		#N/A	$0.00	$0		$0	$0
Signs		each		#N/A	$0.00	$0		$0	$0
Block roads		m3		#N/A	$0.00	$0		$0	$0
Berm		m3		#N/A	$0.00	$0		$0	$0
Concrete wall in portals		m3		#N/A	$0.00	$0		$0	$0
Backfill portal #1		m3	1,000	RR4	$7.60	$7,600	100%	$7,600	$0
Backfill portal #2		m3		#N/A	$0.00	$0		$0	$0
Cap raise - 5 total		each	5	#N/A	$85,656.00	$428,280	100%	$428,280	$0
Cap raise #2		m3		#N/A	$0.00	$0		$0	$0
Cap shaft #1		m3		#N/A	$0.00	$0		$0	$0
Cap shaft #2		m3		#N/A	$0.00	$0		$0	$0
Backfill adits		m3		#N/A	$0.00	$0		$0	$0
Backfill open stope		m3	2,500	sc3h	$14.20	$35,500	100%	$35,500	$0
Concrete cap over open stope		m3		#N/A	$0.00	$0		$0	$0
Other - crown pillar study		LS	1	#N/A	$25,000.00	$25,000	100%	$25,000	$0
REMOVE HAZARDOUS MATERIALS									
Remove hazardous materials, U/G labor		mandays	20	#N/A	$500.00	$10,000	50%	$5,000	$5,000
Remove/decontam. stationary & elect. equip		mandays		#N/A	$0.00	$0		$0	$0
Remove/decontam. mobile equipment		each		#N/A	$0.00	$0		$0	$0
Remove misc. haz. mat & explosives		kg		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
INSTALL BULKHEADS									
Bulkheads to control water flow		each		#N/A	$0.00	$0		$0	$0
Grout bulkhead		m3		#N/A	$0.00	$0		$0	$0
FLOOD MINE									
Supply/install pump		each		#N/A	$0.00	$0		$0	$0
Supply/install piping system		each		#N/A	$0.00	$0		$0	$0
Operate pumps to flood workings		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
INSTALL GROUNDWATER COLLECTION SYSTEM									
Excavate/install sumps		m2		#N/A	$0.00	$0		$0	$0
Install pumping wells		m3		#N/A	$0.00	$0		$0	$0
Install pumps/pipelines/power supply		LS		#N/A	$0.00	$0		$0	$0
SPECIALIZED ITEMS									
Install water quality monitoring pipes		each		#N/A	$0.00	$0		$0	$0
Install permanent pumping system		each		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
					Total	$506,380		$501,380	$5,000
					% of Total			99%	1%

1 **Tailings Impoundment Name:** **Pond # *1***

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
CONTROL ACCESS									
Fence		m		#N/A	$0.00	$0		$0	$0
Signs		each		#N/A	$0.00	$0		$0	$0
Berm		m3		#N/A	$0.00	$0		$0	$0
Block roads		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
STABILIZE EMBANKMENT(S)									
Toe buttress, drainage layer		m3		#N/A	$0.00	$0		$0	$0
Toe buttress, bulk fill		m3		#N/A	$0.00	$0		$0	$0
Rip rap	Quarry Rock for Dam Resploing and Spillway	m3	100000	RB2	$17.80	$1,780,000	50%	$890,000	$890,000
Vegetate		ha		#N/A	$0.00	$0		$0	$0
Raise crest		m3		#N/A	$0.00	$0		$0	$0
Flatten slopes		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
COVER TAILINGS									
Grade/shape tailings surface		m3		#N/A	$0.00	$0		$0	$0
Liner bedding		m3		#N/A	$0.00	$0		$0	$0
Subgrade preparation - compact		m2		#N/A	$0.00	$0		$0	$0
Supply geotextile/geosynthetic		m2		#N/A	$0.00	$0		$0	$0
Install geotextile/geosynthetic		m2		#N/A	$0.00	$0		$0	$0
Soil cover	Uncovered area 375000 m2	m3	375000	SC4L	$9.30	$3,487,500	50%	$1,743,750	$1,743,750
Rock cover		m3		#N/A	$0.00	$0		$0	$0
Vegetate		ha	50	VHF	$4,000.00	$200,000	50%	$100,000	$100,000
Other	Cov er repair	m3	20000	SC4L	$9.30	$186,000	50%	$93,000	$93,000
BURY PAG ROCK									
Relocate PAG rock		m3		#N/A	$0.00	$0		$0	$0
Place cover over PAG rock		m3		#N/A	$0.00	$0		$0	$0
Raise crest of dam		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
STABILIZE DECANT SYSTEM									
Excavate and replace		m3		#N/A	$0.00	$0		$0	$0
Plug/backfill with concrete or clay		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
REMOVE TAILINGS DISCHARGE									
Cyclones		m3		#N/A	$0.00	$0		$0	$0
Pipe		m	6000	ppls	$57.33	$343,980		$0	$343,980
Remove reclaim barge		allow		#N/A	$0.00	$0		$0	$0
CONSTRUCT DIVERSION DITCHES									
Excavate ditches -soil		m3		#N/A	$0.00	$0		$0	$0
Excavate ditches -rock		m3		#N/A	$0.00	$0		$0	$0
Rip rap in channel base		m3		#N/A	$0.00	$0		$0	$0
FLOOD TAILINGS									
Doze tailings to final contour		m3		#N/A	$0.00	$0		$0	$0
Raise crest of dam		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
UPGRADE SPILLWAY									
Excavate channel, rock		m3		#N/A	$0.00	$0		$0	$0
Excavate channel, soil		m3	30600	SC3H	$14.20	$434,520		$0	$434,520
Concrete		m3		#N/A	$0.00	$0		$0	$0
Rip rap		m3	20000	RB4H	$30.75	$615,000		$0	$615,000
Geotextile		m2	7000	GSTL	$3.44	$24,080		$0	$24,080
CONSTRUCT SEEPAGE COLLECTION POND									
Excavate seepage collection pond		m3		#N/A	$0.00	$0		$0	$0
Doze & spread excavated material		m3		#N/A	$0.00	$0		$0	$0
Vegetate spread material		ha		#N/A	$0.00	$0		$0	$0
Bedding layer		m3		#N/A	$0.00	$0		$0	$0
Supply geomembrane		m2		#N/A	$0.00	$0		$0	$0
Install geomembrane		m2		#N/A	$0.00	$0		$0	$0
Erosion protection layer		m3		#N/A	$0.00	$0		$0	$0
INSTALL GROUNDWATER COLLECTION SYSTEM									
Excavate/install sumps		m3		#N/A	$0.00	$0		$0	$0
Install pumping wells		m3		#N/A	$0.00	$0		$0	$0
Install pumps/pipelines/power supply		LS		#N/A	$0.00	$0		$0	$0
SPECIALIZED ITEMS									
Install permanent instrumentation, supply & technican		each	1	#N/A	$30,000.00	$30,000		$0	$30,000
Install permanent instrumentation, drilling		each	1	#N/A	$30,000.00	$30,000			$30,000
TREAT SEEPAGE - see "Water Management" and "Water Treatment"									
TREAT SUPERNATANT									
Pump water (to pit, U/G)		m3		#N/A	$0.00	$0		$0	$0
Equipment maintenance and parts		allow	1	#N/A	$100,000.00	$100,000		$0	$100,000
Supply reagents		tonne		#N/A	$0.00	$0		$0	$0
					Annual treatment costs	$100,000			
Number of years of treatment		years	1						
					Total treatment costs	$100,000			$100,000
					Total	$7,231,080		$2,826,750	$4,404,330
					% of Total			39%	61%

* for construction of passive treatment system refer to "Water Management"

1 **Rock Pile Name:**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
STABILIZE SLOPES									
Flatten slopes with dozer		m3		#N/A	$0.00	$0		$0	$0
Flatten "bubble dump" areas		m3		#N/A	$0.00	$0		$0	$0
Divert runon, ditch mat'l A		m3		#N/A	$0.00	$0		$0	$0
Divert runon, ditch mat'l B		m3		#N/A	$0.00	$0		$0	$0
Toe buttress, drain mat'l		m3		#N/A	$0.00	$0		$0	$0
Toe buttress, fill mat'l A		m3		#N/A	$0.00	$0		$0	$0
Toe buttress, fill mat'l B		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
COVER ROCK PILE									
Subgrade preparation - doze surface		m3		#N/A	$0.00	$0		$0	$0
Soil cover - excavate,haul,spread&compact		m3		#N/A	$0.00	$0		$0	$0
Rock cover - excavate,haul & spread		m3		#N/A	$0.00	$0		$0	$0
Excavate downslope drainage channel & chute		m3		#N/A	$0.00	$0		$0	$0
Rip rap drainage channel and chute		m3		#N/A	$0.00	$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
VERY LOW PERMEABILITY COVER (in addition to above)									
Liner subgrade preparation - compact		m2		#N/A	$0.00	$0		$0	$0
Supply geomembrame		m2		#N/A	$0.00	$0		$0	$0
Install geomembrane		m2		#N/A	$0.00	$0		$0	$0
Protective cover - excavate,haul,spread&compact		m3		#N/A	$0.00	$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
Install infiltration/seepage instrumentation		allow		#N/A	$0.00	$0		$0	$0
CONSTRUCT DIVERSION DITCHES									
Excavate ditches -soil		m3		#N/A	$0.00	$0		$0	$0
Excavate ditches -rock		m3		#N/A	$0.00	$0		$0	$0
Rip rap in channel base		m3		#N/A	$0.00	$0		$0	$0
CONSTRUCT SEEPAGE COLLECTION POND									
Excavate seepage collection pond		m3		#N/A	$0.00	$0		$0	$0
Doze & spread excavated material		m3		#N/A	$0.00	$0		$0	$0
Vegetate spread material		ha		#N/A	$0.00	$0		$0	$0
Bedding layer		m3		#N/A	$0.00	$0		$0	$0
Supply geomembrane		m2		#N/A	$0.00	$0		$0	$0
Install geomembrane		m2		#N/A	$0.00	$0		$0	$0
Erosion protection layer		m3		#N/A	$0.00	$0		$0	$0
INSTALL GROUNDWATER COLLECTION SYSTEM									
Excavate/install sumps		m3		#N/A	$0.00	$0		$0	$0
Install pumping wells		m3		#N/A	$0.00	$0		$0	$0
Install pumps/pipelines/power supply		allow		#N/A	$0.00	$0		$0	$0
RELOCATE DUMPS									
Load, haul, dump or doze		m3	400000	SC3L	$8.90	$3,560,000	50%	$1,780,000	$1,780,000
Add lime		tonne		#N/A	$0.00	$0		$0	$0
Contour reclaimed area		ha		#N/A	$0.00	$0		$0	$0
Other	Waste Rock Survey (100 samples)	allow	1	#N/A	$20,000.00	$20,000		$0	$20,000
SPECIALIZED ITEMS									
Install permanent instrumentation		each		#N/A	$0.00	$0		$0	$0
Install permanent instrumentation, drilling		each		#N/A	$0.00	$0		$0	$0
TREAT ROCK PILE SEEPAGE - see "Water Management"									
HEAP LEACH SEEPAGE TREATMENT - Cyanide Detox									
Cyanide destruction water treatment pumping		m3		#N/A	$0.00	$0		$0	$0
Reagents		tonnes		#N/A	$0.00	$0		$0	$0
Electrician/mechanic to maintain treatment plant		allow		#N/A	$0.00	$0		$0	$0
Equipment maintenance and parts		allow		#N/A	$0.00	$0		$0	$0
				Annual treatment costs		$0			
Number of years of treatment		years							
				Total treatment costs		$0			$0
HEAP LEACH SEEPAGE TREATMENT - ARD/ML**									
Upgrade/modify pumping system - report to WTP		allow		#N/A	$0.00	$0			$0
					Total	$3,580,000		$1,780,000	$1,800,000
					% of Total			50%	50%

* For construction of passive treatment system refer to "Water Management". ARD/ML seepage treatment becomes post-closure water treatment cost

**Heap leach ARD/ML seepage treatment becomes post-closure water treatment cost

1 **Chemicals/Soil Area Name:**

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

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
HAZARDOUS MATERIALS AUDIT									
Hazardous materials audit	primarily an asbestos survey but also need a chemical inventory at the time of closure	allow	1	#N/A	$25,000.00	$25,000	100%	$25,000	$0
BUILDING DECONTAMINATION & CONSOLIDATION OF HAZARDOUS MATERIALS									
Environmental technician/coordinator		mandays		#N/A	$0.00	$0		$0	$0
Decontaminate: oil, fuel	work done by local unskilled workers	ınhours	8490	lab-usH	$43.98	$373,390	50%	$186,695	$186,695
Decontaminate maintenance shop		mandays		#N/A	$0.00	$0		$0	$0
Decontaminate power plant		mandays		#N/A	$0.00	$0		$0	$0
Decontaminate bulk fuel storage		mandays		#N/A	$0.00	$0		$0	$0
Decontaminate ANFO plant		mandays		#N/A	$0.00	$0		$0	$0
Decontaminate offices/warehouse/accom	Covers decontamination of these and other facilities not listed on this line item.	m2	24582	BDAL	$25.60	$629,299	50%	$314,650	$314,650
Removal of asbestos siding on buildings	provisional amount based on the fact there is some asbestos present in the camp however the quantity has not be confirmed	m2	5000	BDAL	$25.60	$128,000	100%	$128,000	$0
Removal of friable asbestos on equipment		m2		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
HAZARDOUS MATERIALS REMOVAL									
Waste oils	warehouse container numerous oil totes	litre	100000	ORH	$1.20	$120,000		$0	$120,000
Waste fuel		litre	2344460	ORH	$1.20	$2,813,352	50%	$1,406,676	$1,406,676
Waste batteries		kg	100	#N/A	$25.00	$2,500	50%	$1,250	$1,250
Assay & environmental lab reagents		kg	1000	#N/A	$25.00	$25,000		$0	$25,000
Machine shop paints, solvents etc	an allowance	litre	5000	#N/A	$0.00	$0		$0	$0
Glycol	assume volume is in fuel volume	litre		#N/A	$0.00	$0		$0	$0
Process reagents		kg		#N/A	$0.00	$0		$0	$0
Nuclear sources		allow		#N/A	$0.00	$0		$0	$0
Other hazardous materials	assumes no ANFO reamins on site	allow		#N/A	$0.00	$0		$0	$0
HAZARDOUS MATERIALS									
Transportation to disposal facility	in demob costs	allow		#N/A	$0.00	$0		$0	$0
Disposal fees		drum	100	#N/A	$250.00	$25,000		$0	$25,000
Other				#N/A	$0.00	$0		$0	$0
CONTAMINATED SOILS									
Contam. soil investigation - Phase 1	based on a worsecase scenario	each	1	#N/A	$100,000.00	$100,000		$0	$100,000
Contam. soil investigation - Phase 2	based on a worsecase scenario	each	1	#N/A	$500,000.00	$500,000		$0	$500,000
CONTAMINATED SOIL REMOVAL									
Excavate and transport to onsite facility	Based on site visit this volume may be low however given the over contingency recommended additional work would be covered	m3	50000	csrl	$47.00	$2,350,000		$0	$2,350,000
Manage hydrocarbon remediation at facility		m3		#N/A	$0.00	$0		$0	$0
Reagents/stabilizing agent		m2		#N/A	$0.00	$0		$0	$0
Excavate and transport to offsite facility	allowance for material that can not be treate	m3	500	csrh	$146.00	$73,000		$0	$73,000
Contour decontaminated area		m3	50000	dsl	$0.95	$47,500		$0	$47,500
CONTAMINATED SOIL VERY LOW PERMEABILITY COVER									
Supply geomembrame, HDPE, ES3, GCL		m2		#N/A	$0.00	$0		$0	$0
Upper and lower bedding layers		m3		#N/A	$0.00	$0		$0	$0
Install geomembrane, HDPE, ES3, GCL		m2		#N/A	$0.00	$0		$0	$0
Erosion protection layer		m3		#N/A	$0.00	$0		$0	$0
Vegetate		m2		#N/A	$0.00	$0		$0	$0
Install infiltration/seepage instrumentation		allow		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
OTHER									
				#N/A	$0.00	$0		$0	$0
					Total	$7,212,041		$2,062,271	$5,149,771
					% of Total			29%	71%

1 **Building / Equip Name:** **Bldg / Equip #:** ***1***

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
DISPOSE MOBILE EQUIPMENT									
Decontaminate and ship off-site	Part of Demob Program	allow		#N/A	$0.00	$0		$0	$0
Decontaminate and dispose on-site		allow		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
REMOVE BUILDINGS - see note below									
Accomodation Complex	All Bldg sizes based on LMI areas	m2	7329	brs1s	$128.00	$938,112	100%	$938,112	$0
Process Facilities		m2	7437	brs1s	$128.00	$951,936	100%	$951,936	$0
Offices, Repair, Lab, Warehouse		m2	6526	brs1s	$128.00	$835,328		$0	$835,328
Storage Facilites		m2		#N/A	$0.00	$0		$0	$0
Water and Wastewater Treatment Facilities		m2	177	brs1s	$128.00	$22,656		$0	$22,656
U/G Heating Plant		m2		#N/A	$0.00	$0		$0	$0
Emulsion Plant		m2		#N/A	$0.00	$0		$0	$0
AN Storage Facility		m2	412	brs1s	$128.00	$52,736		$0	$52,736
Warehouse, Shops and Other		m2	2756	brs1s	$128.00	$352,768		$0	$352,768
Storage Facility at Laydown/Airstrip		m2		#N/A	$0.00	$0		$0	$0
Fuel tanks	tanks	m2	8490	brs2h	$100.00	$849,000		$0	$849,000
Fuel Tanks	piping	m	2000	plrh	$72.00	$144,000		$0	$144,000
Freshwater intake		m2		#N/A	$0.00	$0		$0	$0
Reclaim pumps		m2		#N/A	$0.00	$0		$0	$0
Outfall & Diffuser		m2		#N/A	$0.00	$0		$0	$0
Airstrip lighting, navigation, electrician		mandays		#N/A	$0.00	$0		$0	$0
Airstrip lighting, navigation, mechanical		mandays		#N/A	$0.00	$0		$0	$0
Break foundation slabs	total of all buildings	m2	24637	brcs	$6.00	$147,822	100%	$147,822	$0
Consolidate & dump boneyard debris		allow	1	#N/A	$350,000.00	$350,000	50%	$175,000	$175,000
Other	Isolate Buildings	m2	24637	bdcs	$12.63	$311,165	100%	$311,165	$0
LANDFILL FOR DEMOLITION WASTE									
Place rock cover		m3		#N/A	$0.00	$0		$0	$0
Place soil cover	cost to construct the landfill assumes local borrow with a short haul	allow	1	#N/A	$450,000.00	$450,000	100%	$450,000	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
GRADE AND CONTOUR PADS									
Accomodation Complex		ha		#N/A	$0.00	$0		$0	$0
Process Facilities		ha		#N/A	$0.00	$0		$0	$0
Offices, Repair, Lab, Warehouse		ha		#N/A	$0.00	$0		$0	$0
Storage Facilites		ha		#N/A	$0.00	$0		$0	$0
Water and Wastewater Treatment Facilities		ha		#N/A	$0.00	$0		$0	$0
U/G Heating Plant		ha		#N/A	$0.00	$0		$0	$0
Emulsion Plant		ha		#N/A	$0.00	$0		$0	$0
Warehouse, Shops and Other		ha		#N/A	$0.00	$0		$0	$0
Place rock cover		m3		#N/A	$0.00	$0		$0	$0
Vegetate	assumes islands of vegetation	ha	5	VHFL	$4,000.00	$20,000	50%	$10,000	$10,000
Other	grade and contour entire mine site	m2	230000	sb2l	$4.60	$1,058,000	50%	$529,000	$529,000
PUNCTURE LINED SUMPS									
Puncture liner and place soil cover		m3		#N/A	$0.00	$0		$0	$0
RECLAIM ROADS									
Remove culverts		each	22	#N/A	$1,000.00	$22,000		$0	$22,000
Remove bridges		each		#N/A	$0.00	$0		$0	$0
Scarify and install water breaks		ha		#N/A	$0.00	$0		$0	$0
Scarify airstriip		ha	8.5	scfyh	$6,030.00	$51,255	50%	$25,628	$25,628
Scarify laydown areas		ha		#N/A	$0.00	$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
Other	scarify roads	ha	3.5	scfyh	$6,030.00	$21,105	50%	$10,553	$10,553
SPECIALIZED ITEMS									
Dispose of misc. debris and laydown area refuse				#N/A	$0.00	$0		$0	$0
					Total	$6,577,883		$3,549,215	$3,028,668
					% of Total			54%	46%

Note: Unit costs are based on 3m high, single storey building. Scale larger building areas accordingly. E.g. 10m high building multiply area by 3.3 (10/3)

1 **Capital Expenditures and Short Term Water Treatment identified in 'Instructions' worksheet**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
BREACH DYKE EMBANKMENT						
Remove fill		m3		#N/A	$0.00	$0
Contour water intake area		m3		#N/A	$0.00	$0
STABILIZE SEDIMENT PONDS/WATER MANAGEMENT PONDS						
Place soil cover		m3		#N/A	$0.00	$0
Doze & spread excavated material		m3		#N/A	$0.00	$0
Vegetate spread material		ha		#N/A	$0.00	$0
Rip rap in channel base		each		#N/A	$0.00	$0
REDIRECT RUNOFF/CONSTRUCT DIVERSION DITCHES						
Excavate ditches -soil		m3		#N/A	$0.00	$0
Excavate ditches -rock		m3		#N/A	$0.00	$0
Stabilize side slopes		m3		#N/A	$0.00	$0
Rip rap in channel base		m3		#N/A	$0.00	$0
BREACH DITCHES						
Excavate breaches		m3		#N/A	$0.00	$0
Backfill/recontour		m3		#N/A	$0.00	$0
Install flow dissipation		m3		#N/A	$0.00	$0
Vegetate remainder of ditch		m2		#N/A	$0.00	$0
DECOMISSION FRESH WATER SUPPLY						
Breach embankment		m		#N/A	$0.00	$0
Remove pump		LS		#N/A	$0.00	$0
Remove pipeline		m		#N/A	$0.00	$0
WATER CONTROL IN RECLAMATION QUARRY						
Install pumping system		LS		#N/A	$0.00	$0
Remove pumping system		LS		#N/A	$0.00	$0
REMOVE PIPELINES						
Remove pipes		m		#N/A	$0.00	$0
Concrete plug deep pipes		m3		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
GROUNDWATER COLLECTION SYSTEM						
Excavate/install sumps		m3		#N/A	$0.00	$0
Install pumping wells		m3		#N/A	$0.00	$0
Install pumps/pipelines/power supply		LS		#N/A	$0.00	$0
CONSTRUCT CONTAMINATED WATER STORAGE POND						
Excavate pond		m3		#N/A	$0.00	$0
Doze & spread excavated material		m3		#N/A	$0.00	$0
Vegetate spread material		ha		#N/A	$0.00	$0
Bedding layer		m3		#N/A	$0.00	$0
Supply geomembrane		m2		#N/A	$0.00	$0
Install geomembrane		m2		#N/A	$0.00	$0
Erosion protection layer		m3		#N/A	$0.00	$0
CONSTRUCT PASSIVE TREATMENT SYSTEM (e.g. Constructed Wetland)						
Construct access roads		km		#N/A	$0.00	$0
Install HDPE piping system from collection pond		m		#N/A	$0.00	$0
Inter-cell flow structures		allow		#N/A	$0.00	$0
Install liners		m2		#N/A	$0.00	$0
Install growth media		m3		#N/A	$0.00	$0
Wetland vegetation		ha		#N/A	$0.00	$0
CONSTRUCT WATER TREATMENT PLANT						
Build treatment plant		LS		#N/A	$0.00	$0
Build sludge containment facility		LS		#N/A	$0.00	$0
					Total	$0

For cost of long-term/post-closure water treatment see "WATER TREATMENT" Worksheet"

1 **Post Closure Water Treatment - Identified as long term/post-closure in 'Instructions' worksheet**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
ADDITION OF REAGENTS TO WTP						
H2O2		kg		#N/A	$0.00	$0
lime		kg		#N/A	$0.00	$0
ferric sulphate		kg		#N/A	$0.00	$0
ferrous sulphate		kg		#N/A	$0.00	$0
flocculents		kg		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
LABOUR AND SUPPLIES						
Annual fuel		litres		#N/A	$0.00	$0
Annual power		kW-h		#N/A	$0.00	$0
Electrician/mechanic to maintain treatment plant		allow		#N/A	$0.00	$0
Equipment maintenance and parts		allow		#N/A	$0.00	$0
Misc. supplies, hoses, tools		allow		#N/A	$0.00	$0
Communications		allow		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
WTP WATER SAMPLING AND ANALYSES						
Sampling equipment		allow		#N/A	$0.00	$0
Analyses		allow		#N/A	$0.00	$0
Shipping to laboratory		allow		#N/A	$0.00	$0
Reporting		allow		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
SITE ACCESS						
Road maintenance (incl. snow removal)		allow		#N/A	$0.00	$0
Winter road tariff		allow		#N/A	$0.00	$0
Truck rental		allow		#N/A	$0.00	$0
Air support		allow		#N/A	$0.00	$0
				Annual water treatment costs		$0
Number of years of water treatment		years				
				Total		$0

	Annual Inspection Monitoring	Water Sampling	Maintenance	geotech review	EEM	total
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11	$20,000					$20,000
12	$20,000					$20,000
13	$20,000					$20,000
14	$20,000					$20,000
15	$20,000	$12,360	$200,000	$22,923		$255,283
16	$20,000					$20,000
17	$20,000					$20,000
18	$20,000					$20,000
19	$20,000					$20,000
20	$20,000			$22,923		$42,923
21	$20,000					$20,000
22	$20,000					$20,000
23	$20,000					$20,000
24	$20,000					$20,000
25	$20,000		$100,000	$22,923		$142,923
26	$20,000					$20,000
27	$20,000					$20,000
28	$20,000					$20,000
29	$20,000					$20,000
30	$20,000			$22,923		$42,923
31	$20,000					$20,000
32	$20,000					$20,000
33	$20,000					$20,000
34	$20,000					$20,000
35	$20,000		$100,000	$22,923		$142,923
36	$20,000					$20,000
37	$20,000					$20,000
38	$20,000					$20,000
39	$20,000					$20,000
40	$20,000			$22,923		$42,923
41	$20,000					$20,000

42	$20,000			$20,000
43	$20,000			$20,000
44	$20,000			$20,000
45	$20,000	$100,000	$22,923	$142,923
46	$20,000			$20,000
47	$20,000			$20,000
48	$20,000			$20,000
49	$20,000			$20,000
50	$20,000		$22,923	$42,923
51	$20,000			$20,000
52	$20,000			$20,000
53	$20,000			$20,000
54	$20,000			$20,000
55	$20,000	$100,000	$22,923	$142,923
56	$20,000			$20,000
57	$20,000			$20,000
58	$20,000			$20,000
59	$20,000			$20,000

NPV 3%	Annual regulatory costs		
	Flight	$6,000	Charter
	Labour	$4,000	2people 2 days
	Manageme	$10,000	
		$20,000	
	Water sam	$12,360	Per LMI
	Maintenace-		
	allow 200,000 in year 15		inlcudes all costs for e
$14,448	allow 100,00 every 10 years		inlcudes all costs for e
$14,028			
$13,619			
$13,222			
$163,856			
$12,463			
$12,100			
$11,748			
$11,406			
$23,765			
$10,751			
$10,438			
$10,134			
$9,839			
$68,261			
$9,274			
$9,004			
$8,742			
$8,487			
$17,684			
$8,000			
$7,767			
$7,541			
$7,321			
$50,792			
$6,901			
$6,700			
$6,505			
$6,315			
$13,158			
$5,953			

$5,779
$5,611
$5,447
$37,794
$5,135
$4,985
$4,840
$4,699
$9,791
$4,429
$4,300
$4,175
$4,053
$28,123
$3,821
$3,709
$3,601
$3,497

1 Post-Closure Monitoring & Maintenance:

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
MONITORING & INSPECTIONS						
Annual geotechnical inspection		each	5	#N/A	$23,000.00	$115,000
Survey inspection		each		#N/A	$0.00	$0
Regulatory costs*		each	10	#N/A	$15,500.00	$155,000
Site water monitoring (AEMP and SNP)		each	10	#N/A	$25,000.00	$250,000
- Active closure and flooding		each		#N/A	$0.00	$0
- Post pit flooding		each		#N/A	$0.00	$0
Air Quality Monitoring Program (AQMP)		each		#N/A	$0.00	$0
Wildlife Effects Monitoring Program (WEMP)		each		#N/A	$0.00	$0
Vegetation Monitoring		each		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
COVER MAINTENANCE						
Repair erosion - infill gullies		allow		#N/A	$0.00	$500,000
Repair erosion - upgrade diversion ditches		allow		#N/A	$0.00	$0
Remove problem vegetation		allow		#N/A	$0.00	$0
Repair animal damage		allow		#N/A	$0.00	$0
Repair/upgrade access controls		allow		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
SPILLWAY MAINTENANCE						
Repair erosion		m3		#N/A	$0.00	$100,000
Clear spillway		each		#N/A	$0.00	$0
CWTS MAINTENANCE						
Maintain flow, restore vegetation		allow		#N/A	$0.00	$0
POST-CLOSURE WATER TREATMENT						
Annual water treatment cost, from "Water Treatment"			2		$100,000.00	$200,000
Subtotal, Annual post-closure costs for Year 1 to 10						$1,320,000
Subtotal, Annual Post-Clsoure Costs for Year 11 to 100						$866,376
Discount rate for calculation of net present value of post-closure cost, %			3.00%			
Number of years of post-closure activity			100	years		
Present Value of payment stream						$2,186,376

*Regulatory costs - annual reporting, management plans, progress reports etc.

1 Mobilization/Demobilization:

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
MOBILIZE HEAVY EQUIPMENT						
Excavators	Includes rental for the duration of reclamation works and winterization of equipment when it is stranded on site	each	2	#N/A	150000	$300,000
Dump trucks		each	4	#N/A	50000	$200,000
Dozers		each	2	#N/A	150000	$300,000
Demolition shears		each	1	#N/A	200000	$200,000
Crane		each	1	#N/A	100000	$100,000
Loader		each	2	#N/A	150000	$300,000
Compactor		each		#N/A	0	$0
Light duty vehicles		each	3	#N/A	25000	$75,000
MOBILIZE MISC. EQUIPMENT						
Pump shipping		each		#N/A	0	$0
Pipe shipping		m		#N/A	0	$0
Minor tools and equipment		allow	1	#N/A	100000	$100,000
Truck tires		allow		#N/A	0	$0
Other				#N/A	0	$0
MOBILIZE CAMP						
Reclamation activities		allow		#N/A	0	$0
Long term reclamation activities (eg pump flooding)		allow		#N/A	0	$0
MOBILIZE WORKERS						
Reclamation activities - transport		each	40	MWL	4500	$180,000
Reclamation activities - travel time	ten workers two hours two trips	ınhours	40	#N/A	1000	$40,000
Long term reclamation activities (eg pump flooding) - transport		each		#N/A	0	$0
Long term reclamation activities (eg pump flooding) - travel time		each		#N/A	0	$0
Monitoring Airfare		each	5	mwl	4500	$22,500
WORKER ACCOMODATIONS						
Reclamation activities		manmonths	275	#N/A	2225	$611,875
Long term reclamation activities (eg pump flooding)		manmonths		#N/A	0	$0
MOBILIZE FUEL						
Fuel freight - reclamation activities		litre	1400000	fcdh	1.39	$1,946,000
Fuel freight - long term reclamation activities		litre		#N/A	0	$0
Fuel freight accomodations		litre		#N/A	0	$0
WINTER ROAD						
Construction and operation		km		#N/A	0	$0
Limited winter use		km		#N/A	0	$0
Winter road tarriff		km		#N/A	0	$0
DEMOBILIZE HEAVY EQUIPMENT						
Excavators		km		#N/A	0	$0
Dump trucks		km		#N/A	0	$0
Dozers		km		#N/A	0	$0
Demolition shears		km		#N/A	0	$0
Crane		km		#N/A	0	$0
Loader		km		#N/A	0	$0
Compactor		each		#N/A	0	$0
Light duty vehicles		km		#N/A	0	$0
Other		km		#N/A	0	$0
DEMOBILIZE CAMP						
		allow		#N/A	0	$0
DEMOBILIZE WORKERS						
crew travel time		mandays		#N/A	0	$0
crew transportation		each		#N/A	0	$0
WINTER ROAD						
Construction and operation	includes for mobilization and demob	km	1172	wrcl	2000	$2,344,000
Limited winter use		km		#N/A	0	$0
Winter road tarriff		tonnekm	4688000	wrul	0.29	$1,359,520
					Total	**$8,078,895**

Unit Cost Table (for refining unit costs see "Estimator" worksheet)

Filter by unit

ITEM	Detail	COST CODE	UNITS	LOW $	HIGH $	SPECIFIED $	COMMENTS
Accomodation							
		ACCM	manday	100.00	175.00		
Buildings - Decontaminate							
	Asbestos	BDA	m2	25.60	51.20		Low: removal of asbestos siding & flooring; High: removal of insulated pipes,
Buildings - Remove							Unit costs are based on 3m high, single storey building. Scale areas accordi
	Wood	BRW	m2	27.50	41.00		
	Concrete	BRC	m2	40.00	65.00	6.00	Specified: puncture concrete foundation slabs
	Steel - teardown	BRS1	m2	45.00	65.00		
	Steel - for salvage	BRS2	m2	67.00	100.00		
Concrete work							
	Small pour	CSF	m3	426.50	639.75		Low: YK; High=1.5xLow
	Large pour	CLF	m3	353.50	530.25	2,130.00	Specified: concrete crown pillar
Contaminated Soils							
	ESA Phase 1	CS1	each	7500.00			Low: small, "clean" site
	ESA Phase 1	CS2	each	50000.00			Low: small, "clean" site
	Remediate on site	CSR	m3	47.00	146.00		
Dozing							
	doze rock piles	DR	m3	1.05	2.40		Low cost: doze crest off dump
	doze overburden/soil piles	DS	m3	0.95	3.80		High cost: push up to 300 m
Excavate Rock; Low Spec's and QA/QC							
	drill/blast/load/short haul	RB1	m3	11.40	17.05		Low:quarry operations for bulk fill
	drill/blast/load/long haul	RB2	m3	12.05	17.80		
	RB1 + spread and compact	RB3	m3	12.05	17.80		
	RB2 + spread and compact	RB4	m3	12.50	30.75		
	Specified activity	RBS	m3				
Excavate Rock; High Spec's and QA/QC							(e.g. ditch/spillway excavation)
	drill/blast/load/short haul	RC1	m3	12.05	17.80		Low:foundation excavation;High:spillway excavation
	drill/blast/load/long haul	RC2	m3	12.70	18.40		
	RC1 + spread and compact	RC3	m3	12.70	18.40		e,g, cover construction
	RC2 + spread and compact	RC4	m3	13.50	19.20		e,g, cover construction
	Specified activity	RCS	m3			175.00	Specified-drift excavation
Excavate Rip Rap							
	drill/blast/load/short haul/place	RR1	m3	13.50	17.75		High: quarry & place rip rap in channel
	drill/blast/load/long haul/place	RR2	m3	14.20	20.65		
	source is waste dump/short haul	RR3	m3	7.00			cost includes sorting
	source is waste dump/long haul	RR4	m3	7.60			
	Specified activity	RRS	m3				
Excavate Soil; Low Spec's and QA/QC							
	clear & grub	SBC	m2	3.40	5.00		
	excavate/load/short haul	SB1	m3	4.30	5.90		
	excavate/load/long haul	SB2	m3	4.60	7.30		
	SB1 + spread and compact	SB3	m3	5.10	8.90		Low: non-engineered; High:engineered
	SB2 + spread and compact	SB4	m3	5.50	11.00		Low: non-engineered; High:engineered
	Specified activity	SBS	m3	3.20	6.30		Low: rehandle waste rock dump by dozing; High:rehandle waste rock by hauli
	Tailings	SBT	m3	1.35	3.70	15.50	High:contour surface - wet or frozen; Specified:haul/place wet infill
Excavate Soil, High Spec's and QA/QC							
	excavate/load/short haul	SC1	m3	6.80	9.30		
	excavate/load/long haul	SC2	m3	7.10	11.75		
	SC1 + spread and compact	SC3	m3	8.90	14.20		Low: non-engineered; High:engineered
	SC2 + spread and compact	SC4	m3	9.30	23.20		Low: non-engineered; High:engineered (e.g. complex covers, low volume dar
	Specified activity	SCS	m3			18.80	Backfill adit with waste rock
Fence							
		FNC	m	13.55	203.00		
Fuel and Electricity							
	Fuel cost - gas	FCG	litre	1.05	1.40		
	Fuel cost - diesel	FCD	litre	0.99	1.39		
	Fuel mobilization	FCM	litre	0.22	0.42		High: winter road usage
	Electricity	FCE	kW-h	0.17	0.19	0.49	Low and High:Yellowknife; Specified:diesel generator
Geo-Synthetics							
	geotextile	GST	m2	3.44			Supply and install

Unit Cost Table (for refining unit costs see "Estimator" worksheet)

	Filter by unit				
geogrid	GSG	m2	5.75		
liner, HDPE	GSHDPE	m2	7.95		Supply and install; large quantity
liner, ES3	GSES3	m2	20.20		FOB Yellowknife
geosynthetic installation	GSI	m2	3.16	14.00	Low:geotextile; High:ES3 or HDPE
bentonite soil ammendment	GSBA	tonne	308.30	348.50	FOB Edmonton, add shipping & mixing
Grouting (/m3 of rock grouted)					
	grout	m3	236.55	286.75	High: cement, FOB Yellowknife
Labour & Equipment Rates					
Site manager	sman	$/hr	125.00	152.00	
Supervisor	super	$/hr	52.00	91.84	
Registered engineer	eng	$/hr	95.00	220.00	
Environmental coordinator	envco	$/hr	74.16	130.00	
Evironmental technologist	envtech	$/hr	36.00		
Electrician	elec	$/hr	74.00	95.00	
Journeyman - various	journey	$/hr	44.00	71.79	
Labour - skilled	lab-s	$/hr	41.00	49.60	
Labour - unskilled	lab-us	$/hr	31.00	43.98	
Equipment operator	oper	$/hr	41.00	65.00	
Heavy duty mechanic	mech	$/hr	49.00	72.85	
Water treatment plant operator	oper-wt	$/hr	41.00	59.86	
Security / first aid	safety	$/hr	36.00	66.97	
Administative staff	admin	$/hr	38.00	57.89	
Equipment rates include operator and fuel					
Loader - 4 cu.yd (3.06m3)	load-s	$/hr	175.00		
Loader - 7 cu.yd (5.35m3)	load-l	$/hr	315.00		
Excavator - 26.76-30.84 tonnes	exc-s	$/hr	190.00		
Excavator - 68.95+tonnes	exc-l	$/hr	420.00		
Grader	grad	$/hr	190.00		
Dump truck off hwy 30-50 tonnes	truck-s	$/hr	225.00		
Dump truck off hwy 55-75 tonnes	truck-l	$/hr	300.00		
dozer, small	dozers	$/hr	205.00	260.00	
dozer, large	dozerl	$/hr	490.00	565.00	
smooth drum compactor	comp	$/hr	155.00		
scooptram, 6 yd3 bucket	scoop	$/hr	170.00		
flat bed truck with hiab	hiab	$/hr	155.00		
fuel truck	ftruck	$/hr	150.00		
water truck	wtruck	$/hr	58.00	150.00	
Mobilize Heavy Equipment					
Road access	MHER	kmtonne	3.40	10.25	
Air access	MHEA	kmtonne	12.00		cargo rate>500lb
Mobilize Camp					
Road access	MCR	each	50000.00		refurbish existing camp
Mobilize Workers					
flight	MW	each	4500.00	9100.00	Low:e.g. 8 passenger; High: Dash 7
Oil Removal					
oil removal	OR	litre	0.43	1.20	Low:waste oil heater; High: ship offsite
PCB Removal					
Remove from site	PCBR	litre	40.20	46.90	Low: shipping, handling & disposal from Yellowknife
Pipes, small (<6in dia.)					
remove/dispose on site	PSR	m	1.00	24.00	Low: remove/dispose on site; High: remove/re-use
supply	PSS	m	6.10	11.10	Low:supply; High:supply and ship
install	PSI	m	25.00		
Pipes, large (>6in dia.)					
remove/dispose on site	PLR	m	22.00	72.00	Low: remove/dispose on site; High: remove/re-use
supply	PLS	m	129.00	143.00	Low:supply; High:supply and ship
install	PLI	m	50.00		
Power Lines					
remove/dispose on site	POWR	m	25.50		
Process Chemicals					
Remove from site	PCR	kg	0.45	2.50	Low: shipping, handling & disposal from Yellowknife
Pumps					
Pump capital cost	PC	each	########		

Unit Cost Table (for refining unit costs see "Estimator" worksheet)

	Filter by unit					
Pump shipping	PS	each	2500.00			
Pump operating cost	POC	m3	0.12			pump operating costs should be calculated based on pump capacity, fuel cos
Pump maintenance	PM	allow	25000.00			
Pump sand BackFill						
	PBF	m3	85.00	300.00		
Scarify - road/mine site						
	SCFY	ha	4300	6030	2150	
Shaft, Raise & Portal Closures						
Shaft & Raises	SR	m2	645.00	2132.00		Low:pre-cast concrete slabs, little site prep. Area=shaft+>1m all around
Portals	POR	m3	18.80	250.00	1200.00	Low:unit cost code SCS;High:excavate & backfill collapsed portal;Spec: insta
Site Inspection Report						
	RPT	each	10000.00	20000.00		
SpillWay - Clear						
	SW	each	3000.00	7000.00		
Survey/Instrumentation						
	SI	each	1800.00	3600.00		2 person crew
Treatment Plant - Construct						
Small (< 1000 m3/d)	TPS	lump sum	9000000	15000000		
Large (> 1000 m3/d)	TPL	lump sum	15000000	46000000		
Constructed Wetland	CWTS	ha	200000	300000		
Treatment Plant - Operate						
	TPO	m3	0.35	2.00		
Treatment Chemicals						
ferric sulphate	ferric	kg	1.19			
ferrous sulphate	ferrous	kg	1.32			
lime	lime	kg	0.56			
hydrogen peroxide, 35%	hperox	kg	1.50			
Sodium Metabisulfate	Nametab	kg	1.18			
Caustic soda, 50%	caustic	kg	0.74			
Sulfuric acid, 93%	sulfuric	kg	0.31			
flocculant	flocc	kg	6.00			
copper sulphate	copper	kg				
shipping	shipping	kg	0.20			
Vegetation						
Hydroseed, Flat	VHF	ha	4000.00			
Hydroseed, Sloped	VHS	ha	4500.00			
Veg. blanket/erosion mat	VB	ha	13000.00			
Tree planting	VT	ha	2600.00	6000.00		
Wetland species	VW	ha			47.72	Specified= /m3, Wetland Growth Media Substrate mixed and installed (sand,
Water Sampling/Analysis/Reporting						
	WS	each	7000.00	10000.00		
Winter Road						
Construction	WRC	km	2000.00	11500.00		
Usage	WRU	kmtonne	0.29			

Appendix B

Figures

REFERENCE:
SRK CONSULTING, JOB No.: 1CL008.001, FIG. 1.1, OCT. 2014

ARCADIS

ABORIGINAL AFFAIRS AND NORTHERN DEVELOPMENT CANADA

2015 RECLAIM ESTIMATE

LUPIN MINE, NUNAVUT

KEY PLAN

Drawn By: I.S.Z.	Approved By: B.H.C.	Project No: 702380
Date: SEPT. 2015	Scale: N.T.S.	FIGURE 1

REFERENCE:
GOOGLE IMAGERY 2013

ARCADIS

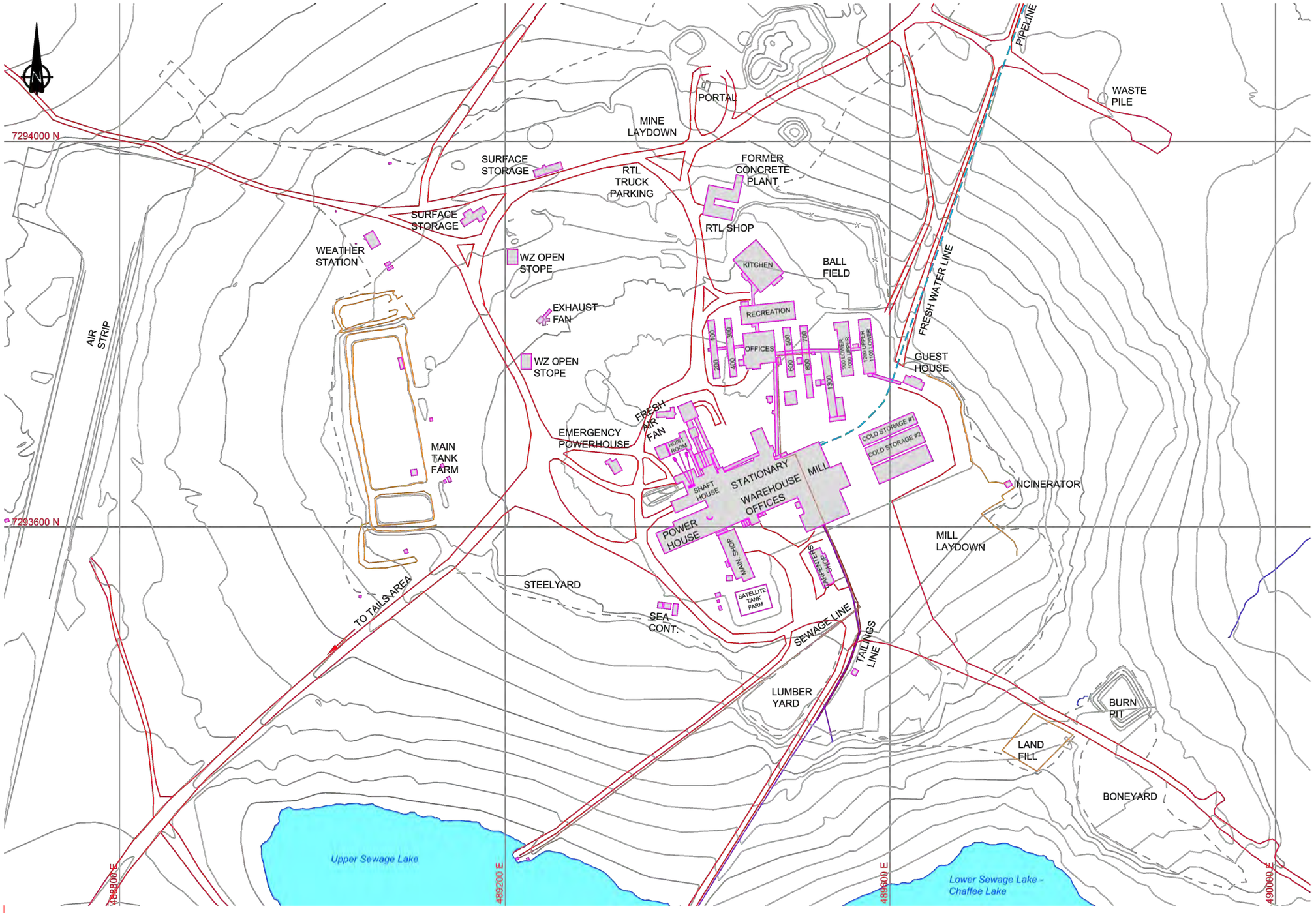
ABORIGINAL AFFAIRS AND NORTHERN DEVELOPMENT CANADA

2015 RECLAIM ESTIMATE

LUPIN MINE, NUNAVUT

SITE PLAN

Drawn By:	I.S.Z.	Approved By:	B.H.C.	Project No:	702380
Date:	SEPT. 2015	Scale:	N.T.S.		FIGURE 2



Coordinate System: Nad_1983_UTM_Zone_12N
NTS Map Sheets 076E11 and 076E14

LEGEND

- Lake Pond
- Tank Farm Berm Outline
- Building
- Water Pipeline (8 in Diam) (Not in Use)
- Tailings Line Route (Not in Use)
- Sewage Pipeline (6 in Diam) (Not in Use)
- Lake Shore, Drainage
- Contour 1 m
- Contour 5 m
- Roads
- Site Features Miscellaneous
- Cleared Area
- Berm Area
- Slope Toe
- Slope Top
- Culvert
- Fence

REFERENCE:
SRK CONSULTING, JOB No.: 1CL008.001, FIG. 2.2, OCT. 2014

ARCADIS

ABORIGINAL AFFAIRS AND NORTHERN DEVELOPMENT CANADA

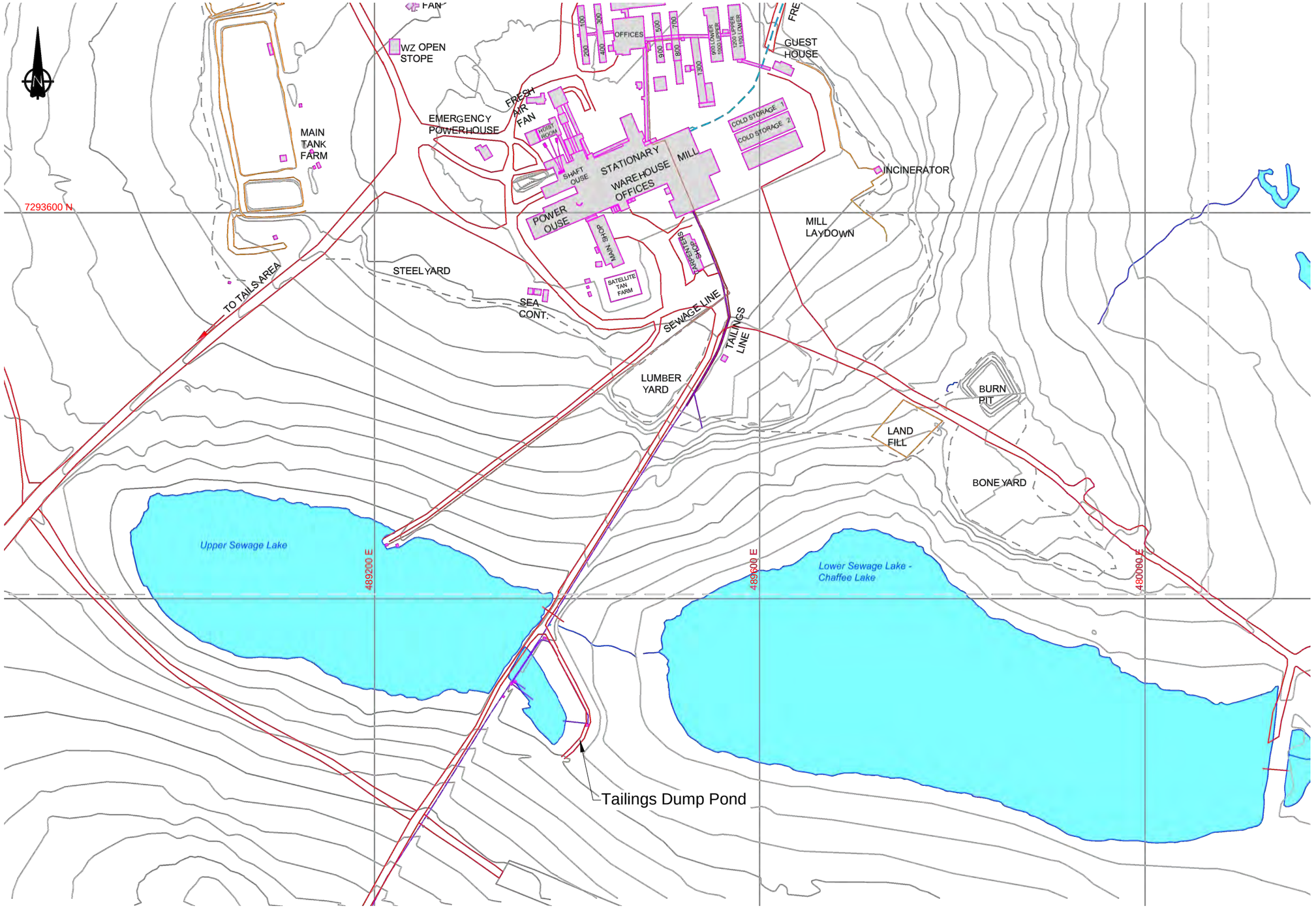
2015 RECLAIM ESTIMATE

LUPIN MINE, NUNAVUT

MILL SITE PLAN

Drawn By: I.S.Z.	Approved By: B.H.C.	Project No: 702380
Date: SEPT. 2015	Scale: AS SHOWN	FIGURE 3

Z:\702000 Series\702380 AANDC\dwg\702380 Lupin_Reclaim Estimate.dwg LAYOUT: 3 SAVED: 10/5/2015 10:56 AM PLOTTED: 10/5/2015 10:59 AM BY: IZABELA ZIBA



LEGEND

- Lake Pond
- Tank Farm Berm Outline
- Building
- Water Pipeline (8 in Diam) (Not in Use)
- Tailings Line Route (Not in Use)
- Sewage Pipeline (6 in Diam) (Not in Use)
- Lake Shore Drainage
- Contour 1 m
- Contour 5 m
- Roads
- Site Features Miscellaneous
- Cleared Area
- Berm Area
- Slope Toe
- Slope Top
- Culvert
- Fence

REFERENCE:
SRK CONSULTING, JOB No.: 1CL008.001, FIG. 2.2, OCT. 2014

ARCADIS

ABORIGINAL AFFAIRS AND NORTHERN DEVELOPMENT CANADA

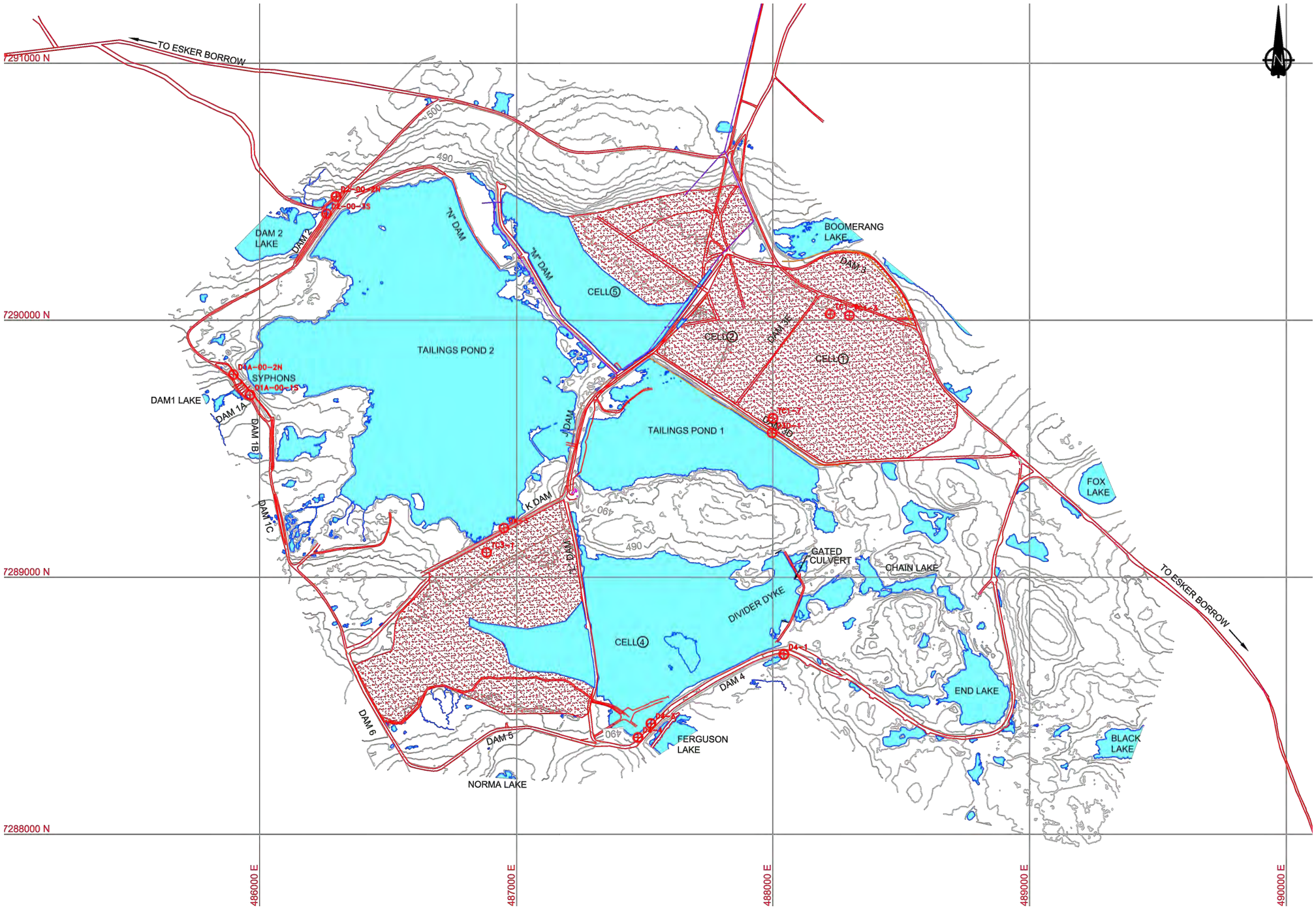
2015 RECLAIM ESTIMATE

LUPIN MINE, NUNAVUT

SEWAGE PONDS PLAN

Drawn By: I.S.Z.	Approved By: B.H.C.	Project No: 702380
Date: SEPT. 2015	Scale: AS SHOWN	FIGURE 4

Z:\702000 Series\702380 AANDC\dwg\702380 Lupin_Reclaim Estimate.dwg LAYOUT: 4 SAVED: 10/5/2015 10:56 AM PLOTTED: 10/5/2015 10:59 AM BY: IZABELA ZIBA



LEGEND

- Water Body
- Granular Tailings Cover
- Lake Shore, Drainage
- Tailings Line Route (Not in Use)
- Contour 1 m
- Contour 5 m
- Roads
- Berm Area
- Thermistor

REFERENCE:
SRK CONSULTING, JOB No.: 1CL008.001, FIG. 2.3, OCT. 2014

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ABORIGINAL AFFAIRS AND NORTHERN DEVELOPMENT CANADA

2015 RECLAIM ESTIMATE

LUPIN MINE, NUNAVUT

TAILINGS CONTAINMENT AREA PLAN

Drawn By: I.S.Z.	Approved By: B.H.C.	Project No: 702380
Date: SEPT. 2015	Scale: AS SHOWN	FIGURE 5

Z:\702000 Series\702380 AANDC\dwg\702380 Lupin_Reclaim Estimate.dwg LAYOUT: 5 SAVED: 10/5/2015 10:56 AM PLOTTED: 10/5/2015 11:00 AM BY: IZABELA ZIBA

Appendix C

ARCADIS RECLAIM Review Documents (December 2014)

SENES Consultants
AN ARCADIS COMPANY

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MEMORANDUM – DRAFT for Discussion

TO: Jean Allen, AANDC Nunavut 400094

FROM: Randy Knapp, January 22, 2015
CC Shelagh Montgomery

SUBJ: Lupin Mines Inc. Water Licence Renewal Application – **SENES Comments on Response to Final Submissions Regarding 2AM-LUP0914 Renewal and Amendment Application – New Information received 22 January 2015.**

We received the LMI comments today and offer our comments for your consideration. Please let me know if you require additional information.

1.0 Review of New Information Submitted in December 2014

1.1 Fuel Inventory

Recommendation
AANDC recommends that the quantity of all fuel on site, including fuel stored in other vessels, is provided prior to the Public Hearing (i.e. number of vessels including drums). If the total amount of fuel remains unknown following the Public Hearing, the precautionary approach should be used to assume the highest reclamation liability on site when setting the financial security (i.e. assume all vessels are full).

LML Response to 1.1
LML has responded that they have met their commitments and never agreed to measure fuel in other vessels. They have agreed to complete this is 2015 as it could not reasonably completed before the hearing. **This is a rational compromise**. It should be noted AANDC did not allow for additional costs for the reclamation estimate for management of fuel and assumed this would be covered in the contingency.

1.2 Landfarm Management Plan
Recommendation

AANDC recommends that a) landfarm construction is only considered during mine operations and not during care and maintenance; b) the licence require a final Landfarm Management Plan a minimum of 60 days prior to construction of a landfarm; c) that interested parties are provided an opportunity to comment on the final Landfarm Management Plan; and d) construction of a landfarm not occur until the plan is approved, in writing, by the Board.

LML Response to 1.2
LML has confirmed that the landfarm is proposed for the care and maintenance period. A final decision for treating soils at closure has not been made (LML assume landfarming for the liability estimate).

LMI has not agreed to update the plan to address comments from third parties within 90 days and request the plan be approved as is. LMI note that a Construction Summary Report is likely to be required. This report will be prepared by a qualified engineer and should be a preliminary plan should be adequate to confirm the landfarm is in accordance with the conceptual plan.

LMI further state the proposed landfarm should be available during the care and maintenance period for progressive reclamation of petroleum hydrocarbon contaminated soil that is currently present outside of the fuel containment facility. **SENES would support this position**.

LMI has adequately addressed the comments and questions raised by AANDC on the Landfarm Management Plan.

1.3 Errata for Interim Abandonment and Restoration Plan

Recommendation
AANDC recommends that a) the licence require an updated IARP within 90 days of licence issuance; b) the updated plan is prepared in accordance with the Mine Site Reclamation Guidelines for the Northwest Territories, (INAC, 2007) and consistent with the Mine Site Reclamation Policy (INAC, 2002) as required in Schedule I, Item 1 of the existing licence; c) the plan is circulated for comments by interested parties prior to approval; d) a change in status (i.e. mining operations) not commence until the plan is approved, in writing, by the Board; and e) the precautionary approach is used where sufficient information is not provided in the IARP and the reclamation estimate when setting financial security.

LMI Response to 1.3
LMI has agreed with the 90-day submission timeframe reflected at (a) as well as (b) and (c).

LML does not agree that final approval be provided before mining operations commence. **SENES would support this position given that the IARP is a fluid document which will change as progressive reclamation is completed and new information becomes available.**

LMI objects to the wording of item e). We assume they object to the term of using precautionary approach "sufficient information" is not available. LMI believe sufficient information is available and we do not concur. There is uncertainty about the performance of the cover, the

quantity of contaminated soils, the quantity of acidic rock etc. The quantities used in the RECLAIM estimate were typically the same as used by LMI. The difference is addressed in the contingency applied. LMI uses a low value of 10% while SENES used 25% contingency (a precautionary approach).

1.4 Revised Reclamation Cost Estimate

Recommendation
AANDC recommend that the reclamation liability for the closure plan be increased to at least $43.5 million. There remains substantial uncertainty in the reclamation estimate and these costs could increase further.

AANDC further recommend that a) LMI be required to provide all outstanding information regarding the reclamation estimate prior to the Public Hearing; and b) where information is incomplete at the Public Hearing, the precautionary principle be used by the Board when making a determination regarding financial security.

LMI Response to 1.4
LMI has responded that the estimate is complete and fully meets requirements. The only item LMI specifically address was asbestos (note no allowance was included in SENES liability estimate). LMI note that asbestos has been identified and remediation may be included in the demolition estimate (contractor was told asbestos present). This is not specifically identified in the estimate.

LMI did not address or comment any other deficiencies (e.g. no fuel mobilization, no treatment of on-site fuel, no allowance for EA requirements and Final Closure Plan, no allowance for Long term Care and maintenance beyond 25 years, mobilization of additional equipment, no allowance for vegetation and no comment on unit rates used for cover and waste haulage/disposal).

2.0 Outstanding Issues

2.1 Windblown Tailings

Recommendation
AANDC recommends that a) a study framework for the windblown material be submitted for review and approval prior to issuance of a licence; b) a precautionary approach be used when setting the financial security and that it is based on the assumption that this material is tailings, until proven otherwise; and c) the investigation and report on windblown tailings be a condition of the licence which is to be submitted by December 31, 2015.

LMI has committed to sampling the localized area proximal to DAM 6 in 2015. LMI has not agreed to conduct a wider area sampling program.

LMI has indicated it cannot proceed with the study plan framework before the licence is issued until it better understands what AANDC requires. LMI did commit to ongoing clarification of

the area to ensure sampling targets the correct area. It is LMIs position that tailings dust, even if present in the tundra area, is not amenable to removal without extensive damage to the environment. **SENES would concur and would strongly suggest that the investigation program include visual inspections of the complete tailings perimeter to identify if there are any areas with material levels of windblown deposition**. Should these be identified and sampled. If material areas with windblown dust are identified then a risk assessment based plan should developed to address remedial measures if necessary.

It should be noted no allowances were included in the SENES liability estimate for cleanup of windblown tailings. It was assumed this could be addressed with the contingency.

2.2 Porewater Quality Monitoring

Recommendation
AANDC recommends that the licence require a) porewater quality monitoring in the sand cover; and b) annual sampling of the piezometers.

LMI Response to 2.2

LMI has indicates that water levels monitoring will demonstrate the cover is functioning as designed and furthermore Pond monitoring will confirm that water quality meets requirements. As such they see little benefit is conduction porewater monitoring. Porewater monitoring is simply another confirmatory measurement however **SENES concurs with LMI that it is not essential.**

2.3 Hazardous Waste

Recommendation
AANDC recommends a) that a current inventory of hazardous waste as committed by LMI is submitted for review prior to the Public Hearing; b) that annual removal of hazardous waste be required to prevent the over-accumulation of hazardous waste on site; c) that LMI confirm that removal of hazardous waste is included in the reclamation estimate (and indicate where in the estimate it is accounted for); d) the storage of hazardous waste on site is limited to the maximum amount of stored hazardous waste used to calculate the reclamation cost estimate (i.e. 2 truckloads) and if LMI cannot commit to limiting storage to 2 truckloads of hazardous waste, then adjustments to the reclamation estimate are recommended to ensure that the total estimated costs for the removal of hazardous waste covers the maximum quantity of hazardous waste proposed for storage on site.

LMI Responses to 2.3

a) LMI responded that they attempted to complete the inventory before the hearing but were delayed by weather as such it would not be possible to submit before the hearing. LMI states it committed to completing this task during the 2015 season it should not be viewed as something LMI did not address.

b) LMI states that it removes hazardous waste at every opportunity but does not agree with annual removal during the care and maintenance period.
c) LMI has stated the removal/disposal cost is in their RECLAIM estimate but did not address where this can be found in the estimate.
d) LMI does not accept that 2 truckloads of waste accumulation is reasonable. The storage facility is lined and it is LMIs position that storage area is capable of storing additional material if needed and does not pose a risk to the environment. Given LMIs commitment to remove hazardous waste at every opportunity, **this restriction is onerous**.

2.4 Management Plans

Recommendation
AANDC recommends that a) the licence require LMI to submit updated plans within 60 days of licence issuance; b) that commitments made by LMI are reflected in the water licence; and c) monitoring of internal pond water quality be included as a condition of the licence.

LMI Response to 2.4
LMI has agreed to all conditions but has requested 90 days rather than 60 days to allow for a suitable time to address all Management Plans.

2.5 Care and Maintenance

Recommendation
AANDC recommends that a) Part E, Item 6f of the existing licence remain as a condition during mining operations; and b) the licence include a condition that LMI investigate the feasibility of remote surveillance for remote monitoring during care and maintenance.

LMI Response to 2.5
LMI provided a long response. We glean from this response that LMI accept the conditions for monitoring for operations but request reduced frequencies as they proposed for Care and maintenance and the ramp up period. **Given that ramp up does not include mining and milling, we concur this is not unreasonable.**

LMI also agreed to continue to investigate the potential for remote monitoring during the care and maintenance period.

2.6 Progressive Reclamation

Recommendation
Due to the potential risk that the mine does not resume operations during the life of the proposed licence, AANDC recommends that the licence require a) progressive covering of the exposed tailings during C&M and b) LMI to submit an updated progressive reclamation plan as part the update to the IARP. This plan should provide a schedule for the progressive decommissioning

and reclamation of these areas.

LMI Response: LMI does not propose or see any benefit of reclaiming the currently uncovered tailings. AANC has requested a schedule for progressive reclamation and we assume this will be provided in the updated IARP.

LMI indicate the Landfarm Management plan will allow for progressive historic spill at the satellite tank farm. They further note that ongoing removal of waste from the site will continue but a fixed schedule cannot be provided as this material is removed on an opportunistic basis.

3.0 Other Issues

3.1 Acid Generating Waste Rock

AANDC Comment-
In the original closure plan documentation, waste rock was generally believed to be non-acid generating.

LML Response
LMI indicate it is not clear on where the above statement comes from and requests that AANDC provide the source. LMI is correct. The basis was assumed from the original licensing when no special provisions were included to identify and manage acid rock. The material issue is that there is on-site today potentially large quantities of acid generating waste.

Recommendation
AANDC requests that a detailed waste rock characterization study is required by the licence to address the acid rock issue and its potential effect on the environment. The study should identify the totally quantity of potentially contaminated waste rock and the proposed a management plan for this material. This investigation is required to provide an improved estimate of the quantity of waste rock that may require relocation and management for the reclamation liability estimate.

LMI Response to 3.1
LMI agrees that additional studies will be required to assess the various remedial options available for dealing with potentially acid generating waste rock in order to develop a final reclamation and closure plan. If the preferred option requires segregation of the PAG rock, it is acknowledged that further work will be required to assess methods for identifying this material during excavation. However, segregation may not be the most cost effective approach for some of the options under consideration, such as consolidating and covering the waste. Therefore, LMI proposes to complete a more detailed options evaluation prior to closure, and then tailor any further investigations required to support further advancement of the preferred option. **SENES supports this position**.

3.2 Asbestos

Recommendation
AANDC recommends that the licence require LMI to conduct an investigation to confirm that asbestos is not present on site.

LMI Response
LMI has responded that they have conducted investigations that confirm asbestos is present on site and the need for special handling of certain materials has been taken into consideration in the demolition plans.

Major Conclusions and Findings

Here are my thoughts.

- LMI have committed to updating plans including the IARP.
- LMI has also agreed to a windblown tailings assessment. As long LMI agree to:
  i) Complete the investigation program;
  ii) Include visual inspections of the complete tailings perimeter to identify if there are any areas with material levels of windblown deposition (include Dam 6 area;)
  iii) If areas are identified, they should be sampled and characterized (quality, areal extent and depth) and;
  iv) If material areas with windblown dust are identified then a risk assessment based plan should developed to address remedial measures if necessary;

  then, I believe this addresses AANDC issues.
- The most significant issue is the Reclamation Liability. To me this dwarfs all other concerns. The objective has to be get the liability provision increased. Perhaps this could go to arbitration.

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TO: Jean Allen, AANDC Nunavut 400094

FROM: Charles Gravelle P. Eng NWT, Randy Knapp, December 31, 2014
CC Shelagh Montgomery

SUBJECT: Lupin Mines Inc. Water Licence Renewal Application – **SENES Comments on Revised December LMI 2014 RECLAIM Estimate and Other LMI Submissions**

RECLAIM ESTIMATE BY LMI

OVERVIEW

We have completed a review of the December 2014 Revised RECLAIM Estimate prepared by LMI and find there are a number of items that are deficient and/or the costs do not include adequate funds for completion of the work. In general the RECLAIM model was developed to assure all items were accounted for in the estimate and this LMI estimate appears to have omitted many of the items included in the RECLAIM model.

The LMI estimate with the background write-up is an improvement over the 2012 estimate filed in 2013. There is still considerable confusion over where much of the unit rate data have come from and most unit rates are simply based upon vendor quotes with no backup. Although we may not concur with some of the unit rate data, given they were based upon contractor quotations, we have adopted many of these rates in our review of the estimate. These items are listed below.

We have prepared a RECLAIM estimate based upon the best available information (Appendix A presents the RECLAIM worksheets). The comparison between the SENES and LMI estimates is summarized in Table 1.

ADDITIONAL ITEMS AND PROVISIONS FOR THE RECLAIM COST ESTIMATE

1) The Underground Mine
    - No provision for inspection and removal of hazardous materials from the mine. LMI indicate a cleanup was completed however we have been provided no details as to what residual liabilities remain so have included a small allowance for residual cleanup and removal of hazardous materials.
    - LMI has used a unit rate for backfilling the portal and pillar of $\$3.449/m^3$ to excavate, haul and dump waste rock. It is our opinion this is too low and we have used the RECLAIM default value of $\$7.08/m^3$.

2) Tailings Area
    - LMI indicates the current covered areas have 1-2 m of cover. There remains about 250,000 m^2 of area to be covered. LMI has used data from 2004/5 when the mine had equipment and fully operational infrastructure and prorated the data to 2014 per unit area. We believe this will result in a bias estimate and future costs will be higher. For this estimate we have used the RECLAIM default value of $\$7.08/m^3$ for excavation and placement of sand cover. LMI used $\$7.24/m^2$ as a total cost. We have also allowed for 25% additional material to be placed to assure an average depth of 1 m is attained. An additional provision of 20,000 m^3 was included for repairs and touch-ups to the existing cover which was completed about 10 years ago.
    - LMI have made no allowance for vegetation yet the water licence requires vegetation. As a minimum, we would suggest selected areas be vegetated. We would allow for 50 ha at $4000/ha.
    - LMI have no allowance for dewatering ponds or treating pond water if required. This cost is highly uncertain as no treatment may be necessary but labour will be required to dewater the ponds. For planning we have allowed for a modest cost of **$100,000** to manage water discharges at closure (includes costs for lime). We have assumed the pond will need to be treated on 2 more occasions but no long term treatment is necessary.
    - LMI have allowances for rip rap but no allowances for excavation of the spillways. We have included allowances for excavation of the spillways and placement of geotextile.

3) Buildings and Equipment
    - It was assumed that the estimates are complete and include full remediation and removal of the buildings.

- No documentation was provided confirming that the process piping did not contain any asbestos insulation nor was documentation provided confirming that there was no asbestos within the building materials used to construct the housing units. Given the age of the structures on site we would expect to see some asbestos. The asbestos abatement if required could add another $1M to the site decommissioning especially if the material has to be disposed of off-site rather than an on-site landfill.
- LMI has no provision for vegetation. We have includes 5 ha of vegetation islands over the disturbed area.

4) Chemicals

- No allowance for management of the existing fuel inventory 2.3 million litres. We have assumed this residual fuel would be disposed off-site at a total cost of $2/L. Note that LMI assume the on-site fuel will be used for the reclamation work. This is *not allowed for in RECLAIM* as the on-site fuel may not be useable in future when the reclamation activity occurs.
- We could not find an allowance for management and disposal of the existing hazardous materials inventory in barrels (the actual inventory is unknown). Allow **10,000 kg @ $2.5/kg =$25,000** for removal and disposal. LMI has indicated this is included somewhere in the estimate (2 truckloads).

5) Waste Rock

In the original closure plan documentation, waste rock was generally believed to be non-acid generating. During development studies, waste rock was alkaline and had near neutral net neutralization potential. Morrow (2006) collected a large number of samples and reported that about 44% of this waste rock samples had already become acidic and some leached elevated levels of metals (see Figure 1 in Morrow 2006). Morrow found acidic ground waters in drainage from waste rock and also measured the median concentration of arsenic in the waste at 1,140 mg As/kg. Morrow recommended that additional ground water quality monitoring would need to be conducted to assess the long-term impact of seepage from the waste.

In the revised A&R plan developed by Kinross in 2005, the potential for ARD was identified. This was addressed by removing waste rock to the underground mine where it would be frozen or capped and no longer a long term residual liability. Morrow also suggested that cover in place may also be a suitable option. LMI has suggested some waste rock be relocated to the tailings area.

The actual quantity of waste rock that may require management in not known and additional study will be required. It is assumed that 40 % of the rock requires

management (Note that 44% of samples of development rock were already acidic in 2005). LMI in the revised estimate allowed for relocation of the waste rock at $\$4.72/m^3$. We believe this unit rate is too low and have used the RECLAIM default low value of $\$7.08/m^3$.

6) Mobilization

The mobilization assumes all work can be completed in 1 calendar year. This is possible but if the work extended beyond 1 year, there would be additional costs. There is also an increased requirement for fuel to operate equipment (more cover, move waste rock etc.) than was included in the previous RECLAIM estimate. We have not allowed for extension of the project beyond 1 year. The additional costs would include:

- Mobilization of additional equipment to relocate waste rock and handle more esker sand.
- Mobilization of additional fuel (Note that LMI has allowed for no fuel to be brought to the site and assumes they will use fuel on-site.) This is not permitted in determining closure liabilities.

7) Long Term Care and Maintenance

LMI has assumed that the site will be monitored for 25 years and provide costs to conduct this monitoring. After 25 years they assume the site will be abandoned. They include no costs for maintenance of the closure works after 25 years and no costs for longer term inspections, no costs for long term maintenance of spillways, dams, ditches, etc. The site contains arsenic-bearing acidic tailings in an engineered storage basin that cannot be abandoned and must be maintained. Based upon the annual geotechnical inspections, maintenance has been required virtually every year. In the longer term, monitoring, care and maintenance requirements will reduce, however they must be completed and the owner should be liable for these costs. Although the actual costs are not known and allowances are debateable, it is certain these costs will be incurred. We have estimated costs for years 1-10 and 10-100. Costs for years 10-100 have been discounted at 3%/year (see Appendix A).

8) Other Factors

LMI has not provided costs for:

- Preparation and environmental review and permitting of the final closure plan. We have allowed **$900,000** to complete this work.
- No allowance for insurance although they indicate insurance is included in the unit rates. We have allowed **1%** of the estimated direct cost.

- Contingency: LMI has allowed for 10%. Given there has been no detailed engineering and this is a highly conceptual plan, we would not use less than **25%**. We have reduced the contingency for buildings to 10%.
- LMI has allowed for 4% for the engineering work. This includes final design and field supervision of the works. We would recommend engineering costs of at least **10%** for this project.
- Project management costs were set at 4%. This is likely on the low side and we suggest **5%** be used. This could be much higher.
- Future site characterization could find much larger inventories of contaminated soils especially below the tank farm areas. We have not made provisions for additional contaminated material but have assumed there is adequate contingency to address these costs.

SUMMARY

It is our opinion that closure costs as developed by LMI are low at $24 million. Based upon this preliminary review we would increase the costs as shown in Table 1 to **at least $43.5 million**.

There is a strong potential that closure costs could also increase above those described above. These items include:

- The potential need for asbestos remediation. This would delay and increase costs for building demolition. This could increase costs by about $1,000,000.
- The likely potential that contaminated soil quantities will increase. An increase of 50% would add $1,200,000 to the costs.
- For a government run mine closure, project management costs are likely to be much greater than 5% of the direct costs given the additional requirements for public review and oversight. These costs could easily reach 10-15% and could add as much as $2,000,000 to the costs.
- The need for long term treatment. The budget estimate assumes this will not be required. Lime addition has been required to meet pH discharge limits. If long-term treatment was required, this could add several million dollars to the closure costs.
- The budget assumes that all work can be completed within one year. With a large crew this is possible for most items. However, on-site bioremediation of the hydrocarbon contaminated soils could take several years to complete and will require labour and equipment to monitor and manage the bio-piles. This could add substantially to the costs.

These additional items alone could add more than $5 million to the costs.

TABLE 1 Comparison of RECLAIM Estimates

Closure Cost	LMI Estimate	SENES Estimate
Underground Mine	$439,639	$463,580
Tailings Areas	$3,935,562	$5,648,333
Building /infrastructure Demotion	$6,664,708	$6,682,152
Chemicals	$2,498,718	$7,222,882
Waste Rock	$1,887,702	$2,852,000
Post Closure Monitoring	$830,013	$2,205,670
Subtotal Direct Costs	**$16,256,343**	**$25,074,617**
Closure Plan, hearings and reports		$900,000
Mobilization/Demobilization	$4,917,904	$8,227,267
Project Management (4%, 5%)	$650,254	$1,253,731
Insurance (0%, 1%)	$0	$250,746
Engineering (4%, 10%)	$650,254	$2,507,462
Contingency (10%, 10-25%)	$1,625,634	$5,266,332
Subtotal Indirect Costs	**$7,844,046**	**18,405,538**
Total Costs:	**$24,100,389**	**$43,480,155**

COMMENTS ON OTHER LMI SUBMISSIONS

LANDFARM MANAGEMENT PLAN

LMI has requested approval for a landfarm to treat hydrocarbon contaminated soils. The plan is preliminary in nature and we have no material concerns. The landfarm could be used to treat small quantities of soil but would not meet the requirements for treatment of the 40,000 m^3 of inventory of contaminated soils identified during the site investigation in 2005. The proposed landfarm could likely manage about 500-4,000 m^3/year and as such would take more than 5 years to remediate the hydrocarbon contaminated soils using this landfarm. LMI propose to treat all of the soil within 1 year.

COMMITMENTS

LMI prepared a list of commitments arising from the October 22-23 technical meetings. LMI indicated they would install piezometers to monitor water levels in the esker sand cover. AANDC also requested that porewater samples be collected and this was not stated.

Appendix A

SENES RECLAIM Estimate Worksheets

SUMMARY OF COSTS

CAPITAL COSTS

COMPONENT TYPE	COMPONENT NAME	TOTAL COST
OPEN PIT	0	$0
UNDERGROUND MINE	0	$463,580
TAILINGS	0	$5,648,333
ROCK PILE	0	$2,852,000
BUILDINGS AND EQUIPMENT	0	$6,682,152
CHEMICALS AND SOIL MANAGEMENT		$7,222,882
WATER MANAGEMENT		$0
POST-CLOSURE MONITORING AND MAINTENANCE		$2,205,670
	SUBTOTAL	**$25,074,617**
		PERCENTAGES
MOBILIZATION/DEMOBILIZATION		$8,227,267
PROJECT MANAGEMENT	5%	$1,253,731
Site Assessment, closure plan, & permitting		$900,000
Insurance	1%	$250,746
ENGINEERING	10%	$2,507,462
CONTINGENCY		
U/G mine	25%	$115,895
Tailings	25%	$1,412,083
Rock pile	25%	$713,000
Buildings	10%	$668,215
Chemicals and Soil Management	25%	$1,805,721
POST-CLOSUREMONITORING AND MAINTENANCE	25%	$551,418
Market Price Factor Adjustment	0%	$0
GRAND TOTAL - CAPITAL COSTS		**$43,480,155**

Open Pit Name: **Pit # *1***

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
OBJECTIVE: CONTROL ACCESS								
Fence	m		#N/A	0.00	$0		$0	$0
Signs	each		#N/A	0.00	$0		$0	$0
Berm at crest	m3		#N/A	0.00	$0		$0	$0
Block roads	m3		#N/A	0.00	$0		$0	$0
Other			#N/A		$0		$0	$0
OBJECTIVE: STABILIZE SLOPES			#N/A					
Off-load crest, soil A	m3		#N/A	0	$0		$0	$0
Off-load crest, soil B	m3		#N/A	0	$0		$0	$0
Doze/trimoverburden at crest	m3		#N/A	0	$0		$0	$0
Drill & blast pit crest	m3		#N/A	0	$0		$0	$0
buttress slope	m3		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
OBJECTIVE: COVER/CONTOUR SLOPES			#N/A					
Place fill, soil A	m3		#N/A	0	$0		$0	$0
Place fill, soil B	m3		#N/A	0	$0		$0	$0
Rip rap	m3		#N/A	0	$0		$0	$0
Vegetate slopes	ha		#N/A	0	$0		$0	$0
Vegetate pit floor	ha		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
OBJECTIVE: SPILLWAY			#N/A					
Excavate channel, soil A	m3		#N/A	0	$0		$0	$0
Excavate channel, soil B	m3		#N/A	0	$0		$0	$0
Concrete	m3		#N/A	0	$0		$0	$0
Rip rap	m3		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
OBJECTIVE: FLOOD PIT			#N/A					
remove stationary equipment (sump pump)	each		#N/A	0	$0		$0	$0
remove power lines	each		#N/A	0	$0		$0	$0
Embankment/dam - Soil A	m3		#N/A	0	$0		$0	$0
Embankment/dam - Soil B	m3		#N/A	0	$0		$0	$0
supply/install pump & piping system	each		#N/A	0	$0		$0	$0
operate pumps to flood pit	each		#N/A	0	$0		$0	$0
LIme addition, _____ kg/m3 of water	tonne		#N/A	0	$0		$0	$0
Lime, purchase and shipping	tonne		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
RECLAIM QUARRIES			#N/A					
Contour slopes	m3		#N/A	0	$0		$0	$0
Berm at crest	m3		#N/A	0	$0		$0	$0
Place overburder	m3		#N/A	0	$0		$0	$0
Vegetate	m3		#N/A	0	$0		$0	$0
OTHER ITEMS			#N/A					
			#N/A	0	$0		$0	$0
			#N/A	0	$0		$0	$0

	Cost	Pct Land	Total Land	Total Water
Subtotal	$0	0%	$0	$0

Underground Mine Name

ACTIVITY/MATERIAL	Unit	Qty	Cost Code	Unit Cost	Cost	Source and comments
OBJECTIVE: CONTROL ACCESS						
Fence	m		#N/A	$0.00	$0	
Signs	each		#N/A	$0.00	$0	
Ditch, mat'l A	m3		#N/A	$0.00	$0	
, mat'l B	m3		#N/A	$0.00	$0	
Berm	m3		#N/A	$0.00	$0	
concrete wall in 2 portals	m3		#N/A		$0	
backfill portal #1	m3	1,000	RR4	$7.60	$7,600	LMI Quantity
backfill portal #2	m3		#N/A	$0.00	$0	
cap 5 raises	m3		#N/A	$0.00	$0	
cap raise #2	m3		#N/A	$0.00	$0	
cap shaft - 5	each	5	SRS	$85,656.00	$428,280	LMI Quantity
cap shaft #2	m3		#N/A	$0.00	$0	
backfill audits	m3		#N/A	$0.00	$0	
backfill open stope	m3	2,500	SC3	$7.08	$17,700	LMI Quantity
concrete cap over open stope	m3		#N/A	$0.00	$0	
other - crown pillar		0	#N/A	$25,000.00	$0	crown pillar study complete
	m3		#N/A	$0.00	$0	
OBJECTIVE: FLOOD MINE			#N/A			
Bulkheads to control water flow	each		#N/A	$0.00	$0	
supply/install pump & piping system	each		#N/A	$0.00	$0	
operate pumps to flood workings	m3		#N/A	$0.00	$0	
	m3		#N/A	$0.00	$0	
other			#N/A	$0.00	$0	
OBJECTIVE: HAZARDOUS MATERIALS			#N/A			
remove hazardous materials, U/G labor	mandays	1	#N/A	$10,000.00	$10,000	Allowance-assume minimal requirements- Mine has been mostly cleaned and equipment removed.
off-site disposal costs on Chemicals sheet			#N/A			
remove/decontam. stationary & elect. equ	mandays		#N/A		$0	
remove/decontam. mobile equipment	each		#N/A	$0.00	$0	
Remove misc. haz. mat & explosives	kg		#N/A	$0.00	$0	
cont soil portal to u/g	m3		sc1h		$0	
SPECIALIZED ITEMS			#N/A			
install water quality monitoring pipes	each		#N/A	$0.00	$0	
intall permanent pumping system	each		#N/A	$0.00	$0	
other			#N/A	$0.00	$0	
				Subtotal	$463,580	

COMMENTS:

Tailings Impoundment Name:

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	Source and comments
OBJECTIVE: CONTROL ACCESS						
Fence	m		#N/A	0	$0	
Signs	each		#N/A	0	$0	
Ditch, mat'l A	m3		#N/A	0	$0	
, mat'l B	m3		#N/A	0	$0	
Berm	m3		#N/A	0	$0	
Block roads	m3		#N/A	0	$0	
Other			#N/A	0	$0	
Reslope/stabilize dams			#N/A			
	m3		#N/A	0	$0	
Total quarrry rock	m3	100,000	RB2	16.41	$1,641,000	Quarry Rock for Dam Resloping and spillways
OBJECTIVE: COVER TAILINGS - favourable case			#N/A			
quarry soil cover mat'l	m3		#N/A	0.00	$0	
Soil cover - uncovered areas assume 375000 m2	m3	301,660	SC4	7.08	$2,135,753	LMI used old estimate from 2004/5 and updated to 2014- This is inappropriate as the mine infrastructure was operational. We have used low cost fom RECLAIM
Cover repair upgrade (allowance)	m3	20,000	SC4	7.08	$141,600	Assume only small areas require maintenance.
Vegetate 50 ha	ha	50	VHF	4000.00	$200,000	Allows for islands of vegetation to enhance natural recolonization
other	m3		#N/A	0.00	$0	
OBJECTIVE: BURY PAG ROCK			#N/A			
Relocate PAG rock	m3		#N/A	0.00	$0	
place cover over PAG rock	m3		#N/A	0.00	$0	
Raise crest	m2		#N/A	0	$0	
Other	m3		#N/A	0	$0	
OBJECTIVE: FLOOD TAILINGS			#N/A			
Ditch, mat'l A	m3		#N/A	0	$0	
, mat'l B	m3		#N/A	0	$0	
Doze Tailings to final contour	m3		#N/A	0	$0	
Raise crest of dam	m3		#N/A	0	$0	
Other			#N/A	0	$0	
OBJECTIVE: TREAT SUPERNATANT			#N/A			
Treat effluent		allow			$100,000	Treated during closure works
OBJECTIVE: UPGRADE/Construct SPILLWAYS			#N/A			
Excavate channel, rock	m3		#N/A	0	$0	
excavate channel, soil	m3	30600	SC1	14.2	$434,520	
Concrete	m3		#N/A	0	$0	
Rip rap	m3	20000	RB4	28.37	$567,400	
geotextile	m2	7000	gsth	3.44	$24,080	
OBJECTIVE: CONSTRUCT TRENCH						
Excavate channel, rock	m3		rc1h		$0	
OBJECTIVE: STABILIZE DECANT SYSTEM			#N/A			
excavate and replace	m3		#N/A	0	$0	
Plug/backfill with concrete or clay	m3		#N/A	0	$0	
Other			#N/A	0	$0	
OBJECTIVE: REMOVE TAILINGS DISCHARGE			#N/A			
Cyclones	m3		#N/A	0	$0	
Pipe	m	6000	ppls	57.33	$343,980	
Remove reclaim barge	each		#N/A	0	$0	
SPECIALIZED ITEMS			#N/A			
install permanent instrumentation, supply & technican	each	1	#N/A	30000	$30,000	
install permanent instrumentation, drilling	each	1	#N/A	30000	$30,000	
				Subtotal	$5,648,333	

Rock Pile Name:

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	Source and comments
OBJECTIVE: STABILIZE SLOPES						
Flatten slopes with dozer	m3		#N/A	$0.00	$0	
Flatten "bubble dump" areas	m3		#N/A		$0	
Divert runon, ditch mat'l A	m3		#N/A	$0.00	$0	
, ditch mat'l B	m3		#N/A	$0.00	$0	
Toe buttress, drain mat'l	m3		#N/A	$0.00	$0	
, fill mat'l A	m3		#N/A	$0.00	$0	
, fill mat'l B	m3		#N/A	$0.00	$0	
Other			#N/A	$0.00	$0	
OBJECTIVE: COVER DUMP			#N/A			
Mat'l A	m3		#N/A	$0.00	$0	
Mat'l B	m3		#N/A	$0.00	$0	
Rip rap	m3		#N/A	$0.00	$0	
Vegetate	ha		#N/A	$0.00	$0	
Other			#N/A	$0.00	$0	
VERY LOW PERMEABILITY COVER			#N/A			
supply geomembrame, HDPE, ES3, GC	m2		#N/A	$0.00	$0	
upper and lower bedding layers	m3		#N/A	$0.00	$0	
install geomembrane, HDPE, ES3, GCL	m2		#N/A	$0.00	$0	
erosion protection layer	m3		#N/A	$0.00	$0	
vegetate	ha		#N/A	$0.00	$0	
install infiltration/seepage instrumentatic	allow		#N/A	$0.00	$0	
OBJECTIVE: RELOCATE DUMPS			#N/A			
Load, haul, dump or doze	m3	400000	SC3	$7.08	$2,832,000	Used low unit default rate
Add lime	tonne		#N/A	$0.00	$0	
Contour reclaimed area	ha		#N/A	$0.00	$0	
Other			#N/A	$0.00	$0	
SPECIALIZED ITEMS			#N/A			
install permanent instrumentation			#N/A	$0.00	$0	
install permanent instrumentation, drilling			#N/A		$0	
other		100	#N/A	$200.00	$20,000	Waste rock survey to identify PAG across the site (allow 100 samples @200/sample)
				Subtotal	$2,852,000	

Building / Equip Name:

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	Source and comments
OBJECTIVE: DISPOSE MOBILE EQUIPMENT						
Decontaminate and ship off-site	each		#N/A	0	$0	
Decontaminate, dispose on-site	each		#N/A	0	$0	
Other	each		#N/A	0	$0	
OBJECTIVE: BUILDING DECONTAMINATION & HAZ. MATERIAL REMOVAL			#N/A			
Decontaminate, oil, fuel and glycol systems	mandays	8490	LMI	22.8	$193,572	LMI contractor quote. We assume the quantity is not in man-hours as noted by LMI.
Decontaminate, general	mandays		#N/A	660	$0	
mechanical	mandays		#N/A	660	$0	
Electrical	mandays		#N/A	660	$0	
Decontaminate maintenance shop	each		#N/A	0	$0	
Decontaminate power plant	each		#N/A	0	$0	
Decontaminate bulk fuel storage	each		#N/A	0	$0	
Decontaminate ANFO plant	each		#N/A	0	$0	
Deontaminate offices/warehouse/accom	m2	24562	bdcs	12.63	$310,218	From LMI. Do not know how this unit rate was derived as it does not come from the RECLAIM model?
Removal of asbestos siding on buildings	each		#N/A	0	$0	
Removal of friable asbestos on equipment	each		#N/A	0	$0	
Other			#N/A	0	$0	
OBJECTIVE: REMOVE BUILDINGS - **ALL BUILDING AREAS SCALED TO ACCOU**			#N/A			
Sleepers and Offices	m2	7329	brs1s	128.00	$938,112	LMI
Hoist Room and Travel Ways	m2	463	brs1s	128.00	$59,264	
Shaft House	m2	1253	brs1s	128.00	$160,384	
Warehouse	m2	4671	brs1s	128.00	$597,888	
Mill	m2	2864	brs1s	128.00	$366,592	
Powerhouse	m2	1645	brs1s	128.00	$210,560	
Headframe	m2	413	brs1s	128.00	$52,864	
Airlock Building and Freshair Intake	m2	366	brs1s	128.00	$46,848	
Pastefill Plant	m2	316	brs1s	128.00	$40,448	
Cold Storage 2 buildings	m2	1855	brs1s	128.00	$237,440	
Surface Mobile Shop	m2	1008	brs1s	128.00	$129,024	
Carpenter Shop	m2	482	brs1s	128.00	$61,696	
As Treatment Plant Building	m2	177	brs1s	128.00	$22,656	
Pumphouse	m2	74	brs1s	128.00	$9,472	
Explosives Storage	m2	412	brs1s	128.00	$52,736	
Fire house	m2	31	brs1s	128.00	$3,968	
Emergency Power House	m2	117	brs1s	128.00	$14,976	
Weather Station and Storage Buildings	m2	566	brs1s	128.00	$72,448	
Shop	m2	379	brs1s	128.00	$48,512	
Batch Plant	m2	118	brs1s	128.00	$15,104	
ATV Building	m2	172	brs1s	128.00	$22,016	
	m2		#N/A	0.00	$0	
Airstrip lighting, navigation, electrician	mandays		#N/A	0.00	$0	
Airstrip lighting, navigation, mechanical	mandays		#N/A	0.00	$0	
consolidate & dump boneyard debris	m3		#N/A	0.00	$0	
other	m2		#N/A	0.00	$0	
OBJECTIVE: BREAK BASEMENT SLABS			#N/A			
Sleepers and Offices	m2	7329	brcs	7.28	$53,355	LMI estimate
Hoist Room and Travel Ways	m2	463	brcs	7.28	$3,371	
Shaft House	m2	1253	brcs	7.28	$9,122	
Warehouse	m2	4671	brcs	7.28	$34,005	
Mill	m2	2864	brcs	7.28	$20,850	
Powerhouse	m2	1645	brcs	7.28	$11,976	
Headframe	m2	413	brcs	7.28	$3,007	
Airlock Building and Freshair Intake	m2	366	brcs	7.28	$2,664	
Pastefill Plant	m2	316	brcs	7.28	$2,300	
Cold Storage 2 buildings	m2	1855	brcs	7.28	$13,504	
Surface Mobile Shop	m2	1008	brcs	7.28	$7,338	
Carpenter Shop	m2	482	brcs	7.28	$3,509	
As Treatment Plant Building	m2	177	brcs	7.28	$1,289	
Pumphouse	m2	74	brcs	7.28	$539	
Explosives Storage	m2	412	brcs	7.28	$2,999	
Fire house	m2	31	brcs	7.28	$226	
Emergency Power House	m2	117	brcs	7.28	$852	
Weather Station and Storage Buildings	m2	566	brcs	7.28	$4,120	
Shop	m2	379	brcs	7.28	$2,759	
Batch Plant	m2	118	brcs	7.28	$859	
ATV Building	m2	172	brcs	7.28	$1,252	
other	m2					
OBJECTIVE:REMOVE TANKS /PIPES						
3 - 360,000 gallon tanks	m3	1638	BRS2S	91.57	$149,992	LMI
7 - 350,000 gallon tanks	m3	3822	BRS2S	91.57	$349,981	
3 - 187,000 gallon tanks	m3	1020	BRS2S	91.57	$93,401	
6- 14,000 gallon tanks	m3	390	BRS2S	91.57	$35,712	
11 - 20,000 gallon tank	m3	1540	BRS2S	91.57	$141,018	
2- 5,000 gallon tanks	m3	80	BRS2S	91.57	$7,326	
Piping	m	2000	PPLS	57.33	$114,660	
OBJECTIVE: LANDFILL FOR DEMOLITION WASTE			#N/A			
Place soil cover	m3		#N/A	0.00	$0	
bone yard cleanup		1		350000.00	$350,000	LMI
operation of landfill		1		450000.00	$450,000	LMI
Vegetate	ha		#N/A	0	$0	
Landfill disposal fee	tonne		#N/A	0	$0	
OBJECTIVE: GRADE AND CONTOUR			#N/A			
Building 1- Accom. Complex	ha		#N/A	0	$0	
Building 2 -Process Facilities	ha		#N/A	0	$0	
Building 3 -Offices, Repair, Lab, Warehouse	ha		#N/A	0	$0	
Building 4 -Storage Facilites	ha		#N/A	0	$0	
Building 5 -Water and Wastewater Treatment Facilities	ha		#N/A	0	$0	
Building 6 -U/G Heating Plant	ha		#N/A	0	$0	
Building 7 - Emulsion Plant	ha		#N/A	0	$0	
Building 8 -Warehouse, Shops and Other	ha		#N/A	0	$0	
place rock cover	m3		#N/A	0	$0	
Vegetate	ha	5	#N/A	4000	$20,000	Assume islands of vegetation
grade and contour entire mine site	m2	230000	sb2l	4.47	$1,028,100	LMI
OBJECTIVE: LINED SUMPS			#N/A			
puncture liner and place soil cover	m3		#N/A	0.00	$0	
OBJECTIVE: RECLAIM ROADS			#N/A			
Remove culverts	each	0		1000	$0	LMI indicate this is covered elsewhere
Remove bridges	each		#N/A	0	$0	
Scarify and install water breaks	km	12	scfyh	6272.39	$75,269	LMI
Grade airstrip	km		scfyh	20000	$20,000	LMI
scarify laydown areas	ha		#N/A	0	$0	
Vegetate	ha		#N/A	0	$0	
other			#N/A	0	$0	
SPECIALIZED ITEMS			#N/A			
Dispose of misc. debris and laydown area refuse	m3		#N/A	0	$0	
				Subtotal	$6,682,152	

1 Chemicals and Soil Contamination:

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	Source and comments
Note: The procedures, equipment and packaging for clean up and removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be consulted on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have been conducted.						
HAZARDOUS MATERIALS AUDIT						
Phase 1 audit	each		#N/A	50000	$50,000	
Phase 2 audit	each		#N/A	25000	$25,000	
HAZARDOUS MATERIALS TO BE CONSOLIDATED FOR REMOVAL						
Waste oils	litre		#N/A	0.00	$0	
Fuel - Type 1, eg diesel dregs	litre	2,345,581	#N/A	2	$4,691,162	Estimates cost for demobilization and disposal of residua fuel. This cost would decrese if on-site flaring was permitted.
Fuel - Type 1, eg gasoline dregs	litre		#N/A	0	$0	
waste batteries	kg		#N/A	0	$0	
assay & environmental lab reagents	pallet		#N/A	0	$0	
machine shop, paints, solvents etc	litre		#N/A	0.9	$0	
contaminated soils - hydrocarbon	m3		#N/A	0	$0	
metal contam. soil at conc. load-out	m3		#N/A	0	$0	
glycol	litre		#N/A	1.15	$0	
HAZARDOUS MATERIALS			#N/A			
Transportation to disposal facility	allow		#N/A		$0	
Disposal fees	Kg	10000	#N/A	2.5	$25,000	Assume 10000 kg of chemical/barreled waste requiring offsite disposal
other			#N/A	0	$0	
CONTAMINATED SOILS			#N/A			
Contam. soil investigation - technical	each		#N/A	0	$0	
Contam. soil investigation - drilling & samplin	each		#N/A	0	$0	
CONTAMINATED SOIL REMOVAL	m3		#N/A		$0	
contaminated soils - hydrocarbon	m3	40000	csrl	60.17	$2,406,800	could be much higher
metal contam. soil at conc. load-out	m3	2000	SC3	8.9	$17,800	could be much higher
other contaminate	m3	800	SC3	8.9	$7,120	
Reagents/stabilizing agent	m2		#N/A	0	$0	
Contour reclaimed area	m3		#N/A	0	$0	
Type 2, heavy fuel and oil	m3		csrs	56.78	$0	
CONTAMINATED SOIL VERY LOW PERMEABILITY COVER			#N/A			
supply geomembrame, HDPE, ES3, GCL	m2		#N/A	0	$0	
upper and lower bedding layers	m3		#N/A	0	$0	
install geomembrane, HDPE, ES3, GCL	m2		#N/A	0	$0	
erosion protection layer	m3		#N/A	0	$0	
vegetate	m2		#N/A	0	$0	
install infiltration/seepage instrumentation	allow		#N/A	0	$0	
other			#N/A	0	$0	
OTHER			#N/A			
			#N/A	0	$0	
			Subtotal		$7,222,882	

Water Management :

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
A	OBJECTIVE: WATER SUPPLY EMBANKMENT								
	Toe buttress, drain mat'l	m3		#N/A	0	$0		$0	$0
	, fill mat'l A	m3		#N/A	0	$0		$0	$0
	, fill mat'l B	m3		#N/A	0	$0		$0	$0
	Rip rap	m3		#N/A	0	$0		$0	$0
	Vegetate	ha		#N/A	0	$0		$0	$0
	Breach dam	m3		#N/A	0	$0		$0	$0
	Other			#N/A	0	$0		$0	$0
B	OBJECTIVE: UPGRADE SPILLWAY			#N/A					
	Excavate channel, mat'l A	m3		#N/A	0	$0		$0	$0
	, mat'l B	m3		#N/A	0	$0		$0	$0
	Concrete	m3		#N/A	0	$0		$0	$0
	Rip rap	m3		#N/A	0	$0		$0	$0
	Other			#N/A	0	$0		$0	$0
	OBJECTIVE: BREACH EMBANKMENT			#N/A					
	remove fill	m3		#N/A	0	$0		$0	$0
	contour water intake area	m3		#N/A	0	$0		$0	$0
E	OBJECTIVE: STABILIZE SEDIMENT PONDS			#N/A					
	place soil cover	m3		#N/A	0.00	$0		$0	$0
	doze & spread excavated material	m3		#N/A	0	$0		$0	$0
	Vegetate, spread material	ha		#N/A	0	$0		$0	$0
	Rip rap in channel base	each		#N/A		$0		$0	$0
F	OBJECTIVE: BREACH DITCHES			#N/A					
	Excavate breaches	m3		#N/A	0	$0		$0	$0
	backfill/recontour	m3		#N/A	0	$0		$0	$0
	install flow dissipation	m3		#N/A	0	$0		$0	$0
	vegetate remainder of ditch	m2		#N/A	0	$0		$0	$0
G	OBJECTIVE: REMOVE PIPELINES			#N/A					
	Remove pipes	m		#N/A	0	$0		$0	$0
	Concrete plug deep pipes	m3		#N/A	0	$0		$0	$0
	Other			#N/A	0	$0		$0	$0
H	Groundwater Collection - Long-term	Collection System		#N/A					
	excavate/install sumps	m2		#N/A	0	$0		$0	$0
	install pumping wells	m3		#N/A	0	$0		$0	$0
	install pumps/pipelines/power supply			#N/A	0	$0		$0	$0
I	OBJECTIVE: COLLECT DRAINAGE FOR TREATMENT			#N/A					
	Excavate channel	m3		#N/A	0	$0		$0	$0
	doze & spread excavated material	m3		#N/A	0	$0		$0	$0
	Vegetate, spread material	ha		#N/A	0	$0		$0	$0
	Rip rap in channel base	each		#N/A	0	$0		$0	$0
	Construct contaminated water storage pond			#N/A					
	Excavation	m3		#N/A	0	$0		$0	$0
	supply geomembrame, HDPE, ES3, GCI	m2		#N/A	0	$0		$0	$0
	upper and lower bedding layers	m3		#N/A	0	$0		$0	$0
	install geomembrane, HDPE, ES3, GCL	m2		#N/A	0	$0		$0	$0
	erosion protection layer	m3		#N/A	0	$0		$0	$0
J	OBJECTIVE: TREAT DRAINAGE (see "ONGOING			#N/A					
	Build treatment plant	LS		#N/A	0	$0		$0	$0
	build sludge containment facility	LS		#N/A	0	$0		$0	$0
				Subtotal		$0	0%	$0	$0
							Pct Land	Total Land	Total Water

Mobilization:

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost	Source and comments
A	MOBILIZE HEAVY EQUIPMENT									
	Equipment to regional centre									
.	Excavators	each		#N/A	150000	$0		$0	$0	
.	Dump trucks	each		#N/A	50000	$0		$0	$0	
	Dozers	each		#N/A	150000	$0		$0	$0	
	Demolition shears	each		#N/A	200000	$0		$0	$0	
	Crane	each		#N/A	0	$0		$0	$0	
	Light duty vehicles	each		#N/A	0	$0		$0	$0	
.	loader	each		#N/A	150000	$0		$0	$0	
.	Other	each		#N/A	0	$0		$0	$0	
	Equipment, regional centre to site			#N/A						
.	Excavators	each	2	#N/A	150000	$300,000		$0	$300,000	
.	Dump trucks	each	4	#N/A	50000	$200,000		$0	$200,000	
	Dozers	each	2	#N/A	150000	$300,000		$0	$300,000	
	Demolition shears	each	1	#N/A	200000	$200,000		$0	$200,000	
	Crane	each	1	#N/A	100000	$100,000		$0	$100,000	
	Light duty vehicles	each	3	#N/A	25000	$75,000		$0	$75,000	
.	loader	each	2	#N/A	150000	$300,000		$0	$300,000	
.	scoop tram	each		#N/A	50000	$0		$0	$0	
B	MOBILIZE CAMP			#N/A						
.		allow		#N/A	100000	$0		$0	$0	
C	MOBILIZE WORKERS			#N/A						
	crew travel time	andays	20	#N/A	600	$12,000		$0	$12,000	LMI.Given the number of workers involved this seems too low and not consistent with the number of man-days listed for the work.
.	crew transportation	each	40	#N/A	4000	$160,000		$0	$160,000	
D	MOBILIZE MISC. SUPPLIES			#N/A						
.	Fuel	litre	1400000	#N/A	1.3	$1,820,000		$0	$1,820,000	
.	Minor tools and equipment	allow	1	#N/A	100000	$100,000		$0	$100,000	
.	Truck tires	allow		#N/A	50000	$0		$0	$0	
	Delivery	k loads		#N/A	6033	$0		$0	$0	
E	WORKER ACCOMODATIONS			#N/A						
.		Manmon	275	#N/A	2224.79	$611,817		$0	$611,817	LMI estimate +25% for additional work requirements
F	WINTER ROAD			#N/A				$0	$0	
.	Mobilization	km		wrh	2706450	$2,706,450		$0	$2,706,450	LMI
.	Demobilization	km		#N/A	1342000	$1,342,000		$0	$1,342,000	LMI
.	Winter road tariff, 4,000T x 814 km	km		#N/A		$0		$0	$0	included in line 36/37
G	Care and maintenace during remediation			#N/A						
	Total C&M cost	years	$1	#N/A				$0	$0	
					Subtotal	$8,227,267	0%	$0	$8,227,267	
							Pct Land	Total Land	Total Water	

1 Post-Closure Monitoring & Maintenance:

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost	Source and comments
A	OBJECTIVE: MONITORING & INSPECTIONS									
	Annual geotechnical insp.	each	5	#N/A	$22,923	$114,615		$0	$114,615	every 2 years
.	Regulatory costs/inspections	each	10	#N/A	$15,500	$155,000		$0	$155,000	see details
.	Surface water sampling	each	10	#N/A	$6,180	$61,800		$0	$61,800	
	Groundwater Sampling	each		#N/A	$0	$0		$0	$0	???
	EEM survey	each		#N/A	$0	$126,079		$0	$126,079	
	Monitoring program as per plan	each	10	#N/A	$6,180	$61,800		$0	$61,800	
.	on-site transportation	each		#N/A	$0	$0		$0	$0	
	transporation to site	each	5	#N/A	$4,000	$20,000		$0	$20,000	for geotech
.	other		1	#N/A						
B	OBJECTIVE: COVER MAINTENANCE			#N/A						
.	Repair erosion - infill gullies	allow		#N/A	$0	$0		$0	$500,000	
.	Repair erosion - upgrade diversion ditch	allow		#N/A	$0	$0		$0	$0	
.	Remove problem vegetation	allow		#N/A	$0	$0		$0	$0	
.	Repair animal damage	allow		#N/A	$0	$0		$0	$0	
.	Repair/upgrade access controls	allow		#N/A	$0	$0		$0	$0	
	Other			#N/A	$0	$0		$0	$0	
C	SPILLWAY MAINTENANCE			#N/A						
	Repair erosion	m3		#N/A	$0	$0		$0	$100,000	
	Clear spillway	each		#N/A	$0	$0		$0	$0	
	Other			#N/A	$0	$0		$0	$0	
D	POST-CLOSURE WATER TREATMENT			#N/A						
	Annual water treatment cost, from Ongoing wate		2	#N/A	$100,000	$200,000		$0	$200,000	Year 3,6

Subtotal,post-closure costs year 1-10		$0	$1,339,294
Subtotal long term costs year 10-100			$866,376
Number of years of post-closure activity	1 years		
Present Value of payment stream		$2,205,670	$2,205,670
	Pct Land	Total Land	Total Water

Post-Closure Monitoring & Maintenance: year 10-100

see Revised LT Monitor and Care spreadsheet			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0
			$0	$0

Subtotal, post-closure costs	$866,376	see spresdsheet Revised LT onitor and Care	$0	$0
Discount rate for calculation of net prese	3.00%			

see spreadsheet -revised LT Monitor and Care for details

	Annual Inspection Monitoring	Water Sampling	Maintenance	Geotech Review	EEM	Total	NPV 3%			
1										
2								Annual regulatory costs		
3										
4								Flight	$6,000	Charter
5								Labour	$4,000	2people 2 days
6								Mgt Plans/reporting	$10,000	
7										
8									$20,000	
9										
10								Water sampling	$12,360	Per LMI
11	$20,000					$20,000	$14,448			
12	$20,000					$20,000	$14,028			
13	$20,000					$20,000	$13,619	Maintenace-		
14	$20,000					$20,000	$13,222	allow 200,000 in year 15	(inlcudes all costs for equipment fuel labour)	
15	$20,000	$12,360	$200,000	$22,923		$255,283	$163,856	allow 100,000 every 10 yr	(inlcudes all costs for equipment fuel labour)	
16	$20,000					$20,000	$12,463			
17	$20,000					$20,000	$12,100			
18	$20,000					$20,000	$11,748			
19	$20,000					$20,000	$11,406			
20	$20,000			$22,923		$42,923	$23,765			
21	$20,000					$20,000	$10,751			
22	$20,000					$20,000	$10,438			
23	$20,000					$20,000	$10,134			
24	$20,000					$20,000	$9,839			
25	$20,000		$100,000	$22,923		$142,923	$68,261			
26	$20,000					$20,000	$9,274			
27	$20,000					$20,000	$9,004			
28	$20,000					$20,000	$8,742			
29	$20,000					$20,000	$8,487			
30	$20,000			$22,923		$42,923	$17,684			
31	$20,000					$20,000	$8,000			
32	$20,000					$20,000	$7,767			
33	$20,000					$20,000	$7,541			
34	$20,000					$20,000	$7,321			
35	$20,000		$100,000	$22,923		$142,923	$50,792			
36	$20,000					$20,000	$6,901			
37	$20,000					$20,000	$6,700			
38	$20,000					$20,000	$6,505			
39	$20,000					$20,000	$6,315			
40	$20,000			$22,923		$42,923	$13,158			
41	$20,000					$20,000	$5,953			
42	$20,000					$20,000	$5,779			
43	$20,000					$20,000	$5,611			
44	$20,000					$20,000	$5,447			
45	$20,000		$100,000	$22,923		$142,923	$37,794			
46	$20,000					$20,000	$5,135			
47	$20,000					$20,000	$4,985			
48	$20,000					$20,000	$4,840			
49	$20,000					$20,000	$4,699			
50	$20,000			$22,923		$42,923	$9,791			
51	$20,000					$20,000	$4,429			
52	$20,000					$20,000	$4,300			
53	$20,000					$20,000	$4,175			
54	$20,000					$20,000	$4,053			
55	$20,000		$100,000	$22,923		$142,923	$28,123			
56	$20,000					$20,000	$3,821			
57	$20,000					$20,000	$3,709			
58	$20,000					$20,000	$3,601			
59	$20,000					$20,000	$3,497			
60	$20,000			$22,923		$42,923	$7,285			
61	$20,000					$20,000	$3,296			
62	$20,000					$20,000	$3,200			
63	$20,000					$20,000	$3,107			
64	$20,000					$20,000	$3,016			
65	$20,000		$100,000	$22,923		$142,923	$20,926			
66	$20,000					$20,000	$2,843			
67	$20,000					$20,000	$2,760			
68	$20,000					$20,000	$2,680			
69	$20,000					$20,000	$2,602			
70	$20,000			$22,923		$42,923	$5,421			
71	$20,000					$20,000	$2,452			
72	$20,000					$20,000	$2,381			
73	$20,000					$20,000	$2,312			
74	$20,000					$20,000	$2,244			
75	$20,000		$100,000	$22,923		$142,923	$15,571			
76	$20,000					$20,000	$2,115			
77	$20,000					$20,000	$2,054			
78	$20,000					$20,000	$1,994			
79	$20,000					$20,000	$1,936			
80	$20,000			$22,923		$42,923	$4,034			
81	$20,000					$20,000	$1,825			
82	$20,000					$20,000	$1,772			
83	$20,000					$20,000	$1,720			
84	$20,000					$20,000	$1,670			
85	$20,000		$100,000	$22,923		$142,923	$11,586			
86	$20,000					$20,000	$1,574			
87	$20,000					$20,000	$1,528			
88	$20,000					$20,000	$1,484			
89	$20,000					$20,000	$1,441			
90	$20,000			$22,923		$42,923	$3,002			
91	$20,000					$20,000	$1,358			
92	$20,000					$20,000	$1,318			
93	$20,000					$20,000	$1,280			
94	$20,000					$20,000	$1,243			
95	$20,000		$100,000	$22,923		$142,923	$8,621			
96	$20,000					$20,000	$1,171			
97	$20,000					$20,000	$1,137			
98	$20,000					$20,000	$1,104			
99	$20,000					$20,000	$1,072			
100	$20,000			$22,923		$42,923	$2,233			
	$1,800,000		$1,000,000	$412,614	$0	$3,224,974	**$866,376**			

NPV

Unit Cost Estimator

Equipment Productivity Figures and Graphs have been reproduced from Caterpillar Performance Handbook - Edition 32

EXCAVATION

PRODUCTIVITY	Cat 345 B		
bucket capacity	m3	2.4	
fill factor	%	75%	
cycle time	seconds	45	
operator skill	%	75%	
machine availability	%	83%	
Altitude adjustment	%	100%	
Hourly productivity	m3/hr	89.64	

OPERATING COSTS

use contractor supplied cost or insert cost components			
Hourly rate - contractor supplied		$150.00	
Excvation cost		1.67	$/m3
Cost of:			
ownership, daily			$/day
maintenance			$/hr
fuel			$/hr
consumables (cutters, tires)			$/hr
operator			$/hr
	total hourly cost	0	$/hr
Excavation cost		0.00	$/m3

Haul and Dumping

PRODUCTIVITY	769 rock truck		
Truck capacity	m3	24	
	0		
Cycle time			
load time	min.	6.0	
haul distance	km	1.5	
average velocity	km/hr	20.0	
haul time + return time	min.	9.0	
wait time	min.	0.5	
dump time	min.	1.0	
machine availability	%	83%	
Altitude adjustment	%	100%	
	0 e. min/cycle	16.33	
Hourly productivity	**m3/hr**	**88.2**	

OPERATING COSTS

use contractor supplied cost or insert cost components			
Hourly rate - contractor supplied		$140.00	
Excvation cost		1.59	$/m3
Cost of:			
ownership, daily			$/day
maintenance			$/hr
fuel			$/hr
consumables (cutters, tires)			$/hr
operator			$/hr
	total hourly Cost	0	$/hr
Excavation cost		0.00	$/m3

Spreading - Dozing

spreading

PRODUCTIVITY	Cat D8		
Estimate production using example curves below or	m3/hr	600	
equivalent from other supplier			
operator skill		0.75	
material type, see table		0.80	
slot dozing		1.00	
side by side dozing		1.00	
visibility		1.00	
job efficiency		0.83	
Altitude adjustment		1.00	
slope adjustment		1.00	
Hourly productivity	**m3/hr**	298.8	

OPERATING COSTS

use contractor supplied cost or insert cost components			
Hourly rate - contractor supplied		$190.00	
Excvation cost		0.64	$/m3
Cost of:			
ownership, daily			$/day
maintenance			$/hr
fuel			$/hr
consumables (cutters, tires)			$/hr
operator			$/hr
	total hourly Cost	0	$/hr
Excavation cost		0.00	$/m3

Sum of costs for excavate load haul dump rock cover on tailings		3.90
	ripping in excavation area	0.25
	testing	0.2
Faro Costs		$4.35 /m3
Cat D11	565	
Cat D10	490	
Cat D7	260	
Cat D6	205	
Cat 385	420	
Cat 330	220	
Cat 325	190	
Cat 988	315	
Cat 950	175	
Cat 773	225	
Cat 740	260	
Cat 563	155	
Cat 16H	190	

Example Performance Factors

Excavator

Fill Factor					
Material	% of heaped bucket capacity				
Moist loam or sandy clay	100 - 110				
sand and gravel (not till)	95 - 110				
hard tough clay	80 - 90				
rock - will blasted	60 - 75				
rock - poorly blasted	40 -60				
	0				
Cycle Times - Typical	Seconds				
description		Cat 320	Cat 325B	Cat 375	
heaped bucket capacity, m3		1.5	2.2	5.4	
easy digging, shallow diggin	excellent	16	18	20	
med. To hard digging, rocky	average	23	23	25	
toughest digging, sandstone	poor	27	29	35	
	0				
Operator Skill		poor	average	good	
	0	0.6	0.75	1	
	0				
Machine availability		poor	average	good	
		0.9	0.95	1	

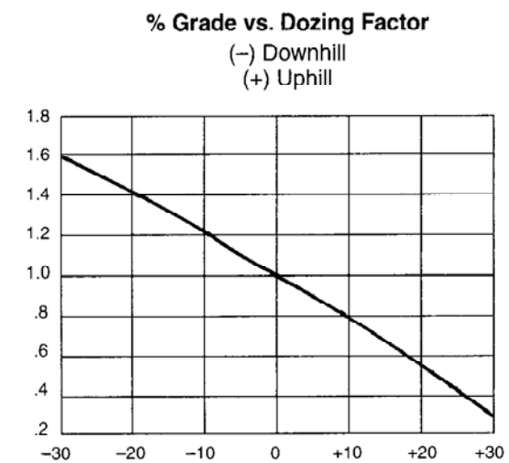
Trucking

#N/A

0	Cat 771 D	Cat 777D	Cat 789C
Truck capacity - heaped, m3	27.5	60.5	137

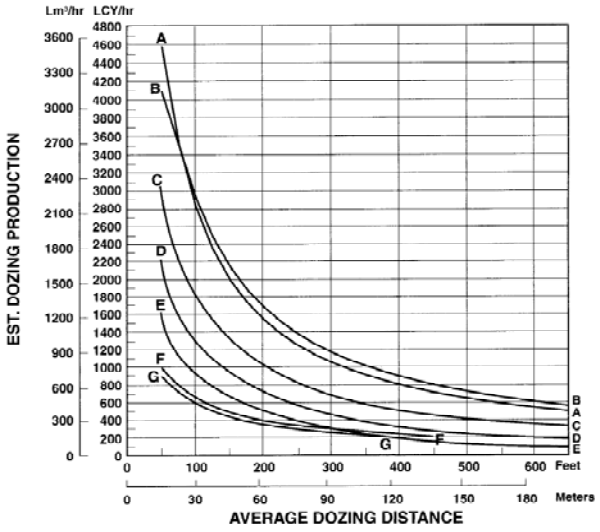
Machine availability	poor	average	good
	0.9	0.95	1

Dozing



http://www.spec-check.com/komatsu/spec.cfm?cid=794488109

ESTIMATED DOZING PRODUCTION • Universal Blades • D7G through D11R



KEY
A — D11R-11U
B — D11R CD
C — D10R-10U
D — D9R-9U
E — D8R/D8R Series II-8U
F — D7R Series II-7U
G — D7G-7U

NOTE. This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

JOB CONDITION CORRECTION FACTORS

	TRACK-TYPE TRACTOR	WHEEL-TYPE TRACTOR
OPERATOR —		
Excellent	1.00	1.00
Average	0.75	0.60
Poor	0.60	0.50
MATERIAL —		
Loose stockpile	1.20	1.20
Hard to cut; frozen —		
with tilt cylinder	0.80	0.75
without tilt cylinder	0.70	—
Hard to drift; "dead" (dry, non-cohesive material) or very sticky material	0.80	0.80
Rock, ripped or blasted	0.60-0.80	—
SLOT DOZING	1.20	1.20
SIDE BY SIDE DOZING	1.15-1.25	1.15-1.25
VISIBILITY —		
Dust, rain, snow, fog or darkness	0.80	0.70
JOB EFFICIENCY —		
50 min/hr	0.83	0.83
40 min/hr	0.67	0.67
BULLDOZER*		
Adjust based on SAE capacity relative to the base blade used in the Estimated Dozing Production graphs.		
GRADES — See following graph.		

***NOTE:** Angling blades and cushion blades are not considered production dozing tools. Depending on job conditions, the A-blade and C-blade will average 50-75% of straight blade production.

WATER TREATMENT COSTS

ANNUAL VOLUME OF WATER (m3) _____

Reagent addition rates

Reagent	kg reagent/m3 water		cost in $/kg, FOB site	Annual reagent cost
H2O2		kg/m3		$0
lime		kg/m3		$0
ferric sulphate		kg/m3		$0
ferrous sulphate		kg/m3		$0
flocculents		kg/m3		$0
			TOTAL	$0

Supplies and Labour

power, kW-hr		rate, $/kW-hr	$0
misc. supplies, hoses, tools			
sampling equip.			$0
equip. maintenance and parts			$0
water analysis			
reporting			$0
truck rental			
air support			
communications			
road maintenace & snow plowing			$0
electrician/mechanic for treatment plant & power supply			
		Annual cost	$0
labor, hourly rate	$55.00		
men per day for water treatment work			0
on site, days per year			0
spring/fall maintenance, extra work			
hours worked per year			0
annual labor cost			$0
		Total, labour and supplies	$0
TOTAL ANNUAL COSTS, reagents + labour + supplies + site access			$0
Average treatment cost, $/m3			$0.00

Water analyses	
samples per month	0
analysis cost/sample	110
shipping	220
Total Water Sampling	220

Site Access	
road	$0
air	$0
winter road	$0
annual site access cost	$0

Unit Cost Table

this version updated May-11 2% added to all costs for inflation

for additional construciton cost data check the associations below, or use the Estimator Worksheet

Alberta Road Builders & Heavy Construction Association
BC Road Builders Blue Book
at : www.roadbuilders.bc.ca

ITEM	Detail	COST CODE	UNITS	LOW $	HIGH $	SPECIFIED $	
excavate Rock, Bulk							COMMENTS
	drill, blast, load short haul (<500m) Dump	RB1	m3	10.51	15.73	#N/A	quarry operations for bulk fill
	RB1 + long haul, up to 1500 m	RB2	m3	11.12	16.41	#N/A	
	RB1 + spread and compact	RB3	m3	11.12	16.41	#N/A	
	RB1 + long haul + spread and compact	RB4	m3	11.74	28.37	#N/A	
	RB1 + Specified activity	RBS	m3	12.0865	#N/A	#N/A	use low and add 15% premium for work done in winter
excavate Rock, Controlled							
	drill, blast, load short haul (<500m) Dump	RC1	m3	26.01	37.08	#N/A	low - foundation excavation, high - spillway excavation
	RC1 + long haul, up to 1500 m	RC2	m3	11.74	16.97	#N/A	
	RC1 + spread and compact	RC3	m3	11.12	16.41	#N/A	
	RC1 + long haul + spread and compact	RC4	m3	12.47	17.67	#N/A	
	RC1 + Specified activity	RCS	m3	#N/A	#N/A	159.73	$145/M3-drift excavation
excavate Soil, Bulk							
	clear & grub	SBC	m2	3.12	0.00		
	excavate, load short haul (<500m) dump	SB1	m3	3.96	5.45	#N/A	LOW cost: excavation of loose soil, high volume
	SB1 + long haul, up to 1500 m	SB2	m3	4.66	6.71	6.84	LOW cost: excavation of loose soil, 1.5 km haul, high volume, SPEC Lupin
	SB1 + spread and compact	SB3	m3	4.16	5.97	#N/A	
	SB1 + long haul + spread and compact	SB4	m3	5.06	10.06	#N/A	LOW cost: excavation of loose soil, 1.5 km haul, high volume, const. of simple soil cover
	SB1 + Specified activity	SBS	m3	2.60	7.17	12.06	LOW cost: rehandle waste rock dump into pit, >500,000 m3, 2 km haul
	other			0.00	0.00	0.00	SPECIFIED cost: rehandle waste rock, haul 3 km, place & compact on dam
	Soil, tailings	SBT	m3	1.25	3.40	14.28	LOW cost: doze frost heaves HIGH cost: contour - wet or frozen, Specialized - haul/place wet infill
excavate Soil, Controlled							
	excavate, load short haul (<500 m), dump	SC1	m3	6.30	8.60	#N/A	
	SC1 + long haul, up to 1500 m	SC2	m3	7.81	10.83	#N/A	
	SC1 + spread and compact	SC3	m3	6.30	13.10	#N/A	HIGH cost: for simple soil covers
	SC1 + long haul + spread and compact	SC4	m3	7.08	21.41	#N/A	HIGH cost: for complex covers & dam construction, spillway repair, LOW volume
	SC1 + Specified activity	SCS	m3	#N/A	22.89	17.35	SPECIFIED cost: backfill adit with waste rock, High - sand bedding layer for liners
Geo-synthetics							
	geotextile, filter cloth	GST	M2	1.11	3.44	#N/A	high - Faro
	geogrid	GSG	M2	5.31	0.00	#N/A	
	liner, HDPE	GSHDPE	M2	6.62	0.00	#N/A	faro 3.44 supply and 3.16 place
	liner, ES3	GSES3	m2	18.62	0.00		low, FOB Yellowknife
	liner, PVC	GSPVC	M2	0.00	0.00	#N/A	
	geosynthetic installation	GSI	m2	0.93	13.01	#N/A	low, geotextile, high - ES3 or HDPE
	bentonite soil ammendment	GSBA	tonne	284.28	321.36	#N/A	FOB Edmonton, add shipping & mixing
Shaft, Raise & Portal Closures							
	Shaft & Raises	SR	m2	595.52	1966.36	80823.00	LOW cost: pre-cast concrete slabs, little site prep. HIGH cost: for hand construction, remote site
	Portals	POR	m3	0.00	230.34	1101.60	HIGH cost: for excavate & backfill collapsed portal SPECIFIED cost: installed pressure plug
Concrete work							
	Small pour, no forms	CS	m3	333.72	668.56	#N/A	
	Large pour, no forms	CL	m3	264.05	393.27	#N/A	
	Small pour, Formed	CSF	m3	393.27	1966.36	#N/A	
	Large pour, Formed	CLF	m3	325.85	460.69	#N/A	
Vegetation							
	Hydroseed, Flat	VHF	ha	1792.19	5561.98	#N/A	
	Hydroseed, Sloped	VHS	ha	2076.47	6241.78	#N/A	faro 4000/ha
	veg. Blanket/erosion mat	VB	ha	12359.95	14831.94	#N/A	
	Tree planting	VT	ha	12359.95	14831.94	#N/A	
	Wetland species	VW	ha	61799.76	92699.64	#N/A	

Unit Cost Table this version updated May-11 2% added to all costs for inflation

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Alberta Road Builders & Heavy Construction Association

Pumps						
Small, <	PS	each	3370.90	6741.79	#N/A	
Large, >	PL	each	5618.16	112363.20	#N/A	large - 250 hp Gould w/diesel motor
PiPes						
Small, < 6 inch diameter	PPS	m	0.56	5.62	#N/A	LOW cost: pipe removal, HIGH cost: supply new pipe
Large, > 6 inch diameter	PPL	m	1.12	202.25	54.10	LOW cost: pipe removal, HIGH cost: supply 24" 100 psi HDPE pipe, FOB Edm., SPEC Lupin
						add shipping & installation
pump sand BackFill	BF	m3	6.18	18.54	#N/A	
Fence	F	m	12.48	187.27	#N/A	
Signs	S	each	12.36	37.08	#N/A	
rock, Drill and Blast only	DB	m3	12.36	24.72	#N/A	
excavate Rip Rap						
drill, blast, load short haul (<500 m) dump and spread	RR1	m3	12.30	18.37	#N/A	
RR1 + long haul	RR2	m3	12.47	19.05	#N/A	HIGH cost: quarry & place rip rap in channel
excavate rock from waste dump, short haul, spread	RR3	m3	4.72	6.49	#N/A	LOW cost: removal of 18 in minus from dump, long haul and spread
RR3 + long haul	RR4	m3	5.26	7.02	#N/A	
specified rip rap source	RR5	m3	#N/A	#N/A	#N/A	
Import LimeStone	ILS	tonne	9.89	14.83	#N/A	
Import LiMe	ILM	tonne	187.27	556.61	#N/A	LOW cost: bulk shipping, high volume, FOB Vancouver/Edmonton HIGH cost: bags delivered to central Yukon, small volume
Grouting	G	m3	218.12	264.38	#N/A	HIGH cost: cement, FOB Yellowknife
Dozing						
doze Rock piles	DR	m3	0.96	2.19	#N/A	LOW cost: doze crest off dump
doze overburden/Soil piles	DS	m3	0.88	3.49	#N/A	HIGH cost: push up to 300 m
		each	0	0	#N/A	
		each	0	0	#N/A	
Buildings - Decontaminate						
Chemicals	BDC	m3	#N/A	#N/A	11.98	SPEC: Lupin
Asbestos	BDA	m2	23.60	47.19	#N/A	LOW cost: removal of asbestos siding & flooring HIGH cost: removal of insulated pipes, friable
			0.00	0.00	0.00	
Buildings - Remove						
areas are per floor on 3 m average height			0.00	0.00	0.00	LOW cost: removal and on-site disposal - small wooden structures
Wood - teardown	BRW1	m2	24.16	37.08	#N/A	
Wood - burn	BRW2	m2	6.18	11.24	#N/A	**high cost: wooden tent structures**
Masonry	BRM	m2	26.57	37.08	#N/A	
Concrete	BRC	m	37.08	55.62	6.88	spec-lupin
Steel - teardown	BRS1	m2	39.55	59.33	264.38	Lupin mothball bldings 135.793
Steel - salvage	BRS2	m2	61.80	92.70	24.07	spec Lupin for removing tanks
Power & Pipe Lines						
Power lines, remove	POWR	each	23.48	5191.18	#N/A	
		kg	0.00	1.77	#N/A	
Laboratory Chemicals						
Remove from site	LCR	pallet	1966.36	2606.83	#N/A	
Dispose on site	LCD	each	#N/A	#N/A	#N/A	
PCB - Remove from site	PCBR	litre	37.08	43.26	#N/A	LOW cost: shipping, handling & disposal from Yellowknife
			0.00	0.00	0.00	
Fuel						
Remove from site	FR	kg	1.23	1.77	#N/A	
Burn on site	FB	kg	#N/A	#N/A	#N/A	
Oil						
Remove from site	OR	litre	0.39	1.15	#N/A	
Burn on site	OB	litre	0.39	0.62	#N/A	

Unit Cost Table

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Alberta Road Builders & Heavy Construction Association

Process Chemicals						
Remove from site	PCR	kg	0.39	2.30	#N/A	
Dispose on site	PCD	kg	#N/A	#N/A	#N/A	
Explosives						
Remove from site	ER	kg	0	2.47	#N/A	
Dispose on site	ED	kg	#N/A	#N/A	#N/A	
Contaminated Soils						
Remediate on site	CSR	m3	43.26	134.84	56.78	LOW cost: bio-remediate on-site. HIGH cost: ship off-site to landfil as haz. Waste SPEC-lupin
environmental investigation	CSEI	each	2080.80	0.00		
consolidate & cover	Use cost code items		0	0	0.00	
cover in place	Use cost code items		0	0	0.00	
Mobilize Heavy Equipment						
Road access	MHER	$/km	3.16	9.46	2.26	SPECIFIED cost: $/tonne/km in cargo plane
Air access	MHEA	each	#N/A	#N/A	1514.7	SPECIFIED cost: helicopter cost, $/hr of operation
Mobilize Camp						
<20 persons Road access	MC<R	each	#N/A	#N/A	#N/A	
<20 persons Air access	MC<A	each	1530	#N/A	#N/A	**cost of tents and equipment**
Mobilize Workers						
mobilize	MM<	person	3121.20	6138.36	0.00	**crew flight from yellowknife low:turbo beaver, high helicopter/twin otter**
>20 persons	MM>	person	3121.20	6138.36	#N/A	
crew travel time	MTT	hr	39.33	42.66	0.00	
ACCoModation	ACCM	month	1483.19	2224.79	#N/A	LOW cost, accom in existing camp, per man, HIGH cost: - supply new camp
Mobilize Misc. Supplies	MMS	each	#N/A	#N/A	1473.90	**removal of 20 kw generator 404 kg; 10 100lb propane**
Winter Road	WR	km	1483.19	2943.92	1890.06	Speicalized winter road to 40,000 kg capactiy
Visual site Inspection	VI	each	3955.18	7977.79	11016.00	
Survey site Inspection	SI	each	#N/A	#N/A	#N/A	
annual geotech inspection	GI	each			20,000.00	assumes 2 days on site and report
Water Sampling	WS	each	6179.98	10112.69	#N/A	
site inspection RePorT	RPT	each	#N/A	12359.95	#N/A	
haz mat	HZ	each			75706.00	spec from luin - tech, analysis, drilling and report 37853 21630 16223
Security Guard	SG	pers/mon	6179.98	8651.97	#N/A	
Maintain Pumping	MP	month	3707.99	#N/A	#N/A	
Clear SpillWay	CSW	each	2101.19	5932.78	#N/A	
Build Treatment Plant						
Small (< 1000 m3/d)	BTPS	lump sum	1123632	2247264	#N/A	
Large (> 1000 m3/d)	BTPL	lump sum	2247264	3932712	#N/A	
Operate Treatment Plant	OTP	m3	0.32585	1.853993	#N/A	
SCariFY road and	SCFY	ha	3960.8	5789.73	1982.88	
install water breaks					0.00	
Water Treatment Chemicals						
ferric sulphate	ferric	kg	0.75	0.00	0.00	
ferrous sulphate	ferrous	kg	0.49	0.00	0.00	
lime	lime	kg	0.34	0.00	0.00	
hydrogen peroxide, 50%	hperox	kg	1.61	0.00	0.00	
Sodium Metabisulfate	Nametab	kg	1.11	0.00	0.00	
Caustic soda, 50%	caustic	kg	0.70	0.00	0.00	
Sulfuric acid, 93%	sulfuric	kg	0.29	0.00	0.00	
flocculant	flocc	kg	6.06	0.00	0.00	
copper sulphate	copper	kg	0.00	0.00	0.00	
typical shipping, to Whitehorse or Yellowknife		kg	0.08	0.00	0.00	
			0.00	0.00	0.00	
Typical Labour & Equipment Rates			0.00	0.00	0.00	updated may 2011
Site manager	Sman	$/hr	77.11	88.13	0.00	
Mine superintendent	super	$/hr	57.12	66.10	0.00	
Environmental coordinator	env-co	$/hr	57.12	66.10	0.00	
Journeyman (mech, elec, weld)	trade	$/hr	60.00	66.10	0.00	
surveyor/mech		$hr	63.75	0.00	0.00	
Equipment operator	oper	$/hr	58.65	60.59	0.00	
labour - skilled	lab-s	$/hr	65.00	75.00	46.97	specified - water treatment plant operator

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Alberta Road Builders & Heavy Construction Association						
labour - unskilled	lab-us	$/hr	60.00	70.00	0.00	
Security / first aid	safety	$/hr	38.66	52.88	0.00	
Admin.	admin	$/hr	46.27	53.98	0.00	
			0.00	0.00	0.00	
Front end loader, ?, Cat992	loader	$/hr	282.54	363.53	0.00	low - 988 loader, high - 992 loader
excavator, Cat325	excav	$/hr	193.80	192.78	0.00	fuel and operator
dump truck - tandem	dumpt	$/hr	0.00	0.00	0.00	
dump truck off road, Cat 777	dumpo	$/hr	291.92	0.00	0.00	
dozer, D8, D10	dozer	$/hr	229.50	330.48	0.00	fuel & oper. Incl.
smooth drum compactor, Cat CS563	comp	$/hr	96.90	0.00	0.00	fuel & oper. Incl.
scooptram, 6 yd3 bucket	scoop	$/hr	150.96	0.00	0.00	
flat bed truck with hiab	hiab		133.62	0.00	0.00	fuel & oper NOT included
certified mech with truck		$hr	204.00	0.00	0.00	