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Tahera
Diamond Corporation

Abandonment and Restoration Plan
Jericho Diamond Mine, Nunavut

Submitted to:
Tahera Diamond Corporation
Toronto, Ontario

Submitted by:

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Burnaby, BC

July 2004
VE51295

TABLE OF CONTENTS

Page

TABLE OF CONTENTS

Page

LIST OF FIGURES

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF APPENDICES

EXECUTIVE SUMMARY

The reclamation plan for the mine has the objective of minimizing the environmental impact of mining operations to the extent practical, and of maintaining the overall present productivity of the site. The end-land use will be to leave disturbed areas so that they may return as quickly as possible to productive wildlife habitat.

The general reclamation program components will be as follows:

- salvage and stockpile soil from the areas of disturbance according to the soil salvage plan;
- immediately revegetate areas disturbed by the pre-production phase to the extent practical (see revegetation prescriptions below; in general mesic soils will not have agronomics seeded unless site-specific experience indicates this is necessary);
- reslope rock dumps to a maximum overall 2:1 slope angle (26°); this will be accomplished by grading off the benches which will be 10 m high and set back from the one below 15 m;
- prepare surfaces for the replacement of soil materials;
- recover stockpiled soil and spread it over reclaimed areas that would benefit from addition of soil;
- revegetate the prepared areas where appropriate and indicated from reclamation trials;
- establish test plots to optimize growth mediums; and
- monitor growth and develop performance objectives.

Overburden will be used to top dress most disturbed horizontal surfaces. Given uniform coverage of overburden in the pit area and a 400 m diameter pit, approximately 880,000 m^3 of sand and gravel may be available. This is adequate to place a minimum of 0.3 m of soil on these surfaces. The amount of organic soil salvageable from the open pit area remains to be determined.

The soil stockpile will be constructed to minimize potential for slope failures. This will be achieved by placing the stockpile(s) in low lifts using a scraper or by end-dumping with trucks.

Pre-existing native plant communities cannot be completely re-established. However, some reclamation is possible. Many species of wildlife (e.g. caribou, canids) should resume use of disturbed esker habitats when the infrastructure is removed. A cooperative approach will be sought with Ekati Diamond Mine™, Diavik and Snap Lake mines in information exchange on reclamation research in Arctic environments.

The target end land use is wildlife habitat and the aim of the Jericho reclamation is to promote, to the extent practical, rehabilitation of the land to this use. Vegetation prescriptions will be developed and tested based on the pre-disturbance ecological zones where the disturbed areas

are located. The aim will be to provide soil conditions similar to pre-disturbance conditions and to the extent possible, revegetate or encourage native species at the site similar to those that occurred prior to disturbance.

Reclamation trials will be used to determining what reclamation prescriptions are most likely to be successful in the Jericho Project area. However, work of others provides some guidance. Reclamation trials will be conducted throughout the mine life with greater intensity of activity during the initial years. The purpose of the trials will be to establish a database on establishment and growth success of vegetation on reclaimed land.

Reclamation will be progressive throughout the mine life up to closure and abandonment. Limited reclamation will be possible following construction. Major reclamation will occur following completion of open pit mining with reclamation of the waste dumps and infrastructure no longer required for the underground mining phase. Ore stockpile pads and portions of the processed kimberlite containment area no longer required will be reclaimed as the mine units become inactive. Final reclamation will occur after mine closure. All infrastructure will be removed, or buried on site. Hazardous wastes will be removed; any remaining contaminated soils will be remediated. The landfill and landfarm will be closed and covered over. Compacted surfaces will be scarified, top dressed with overburden and planted as indicated by reclamation trials. Where possible, drainages will be returned to their pre-mining courses. Tahera will address the issue of aesthetics on closure to the extent practical. All removable infrastructure will be taken off site. No scrap will be left; it will be burned, buried, or taken off site.

A post closure monitoring program will be undertaken to ensure the mine site is left in a stable condition and no contaminants are being exported off the site.

The open pit will require approximately 20 years to fill naturally; during the interim, all mine drainage will be directed to the pit which will act as a sump. Upon filling water will be directed either back into the C1 stream channel, or into a specially constructed open channel to Carat Lake as discussed in the mine Water Management Plan. Some in-pit treatment of water may be required.

A detailed reclamation and closure cost estimate is appended.

1.0 INTRODUCTION

Tahera Diamond Corporation (Tahera) plans to construct and operate a diamond mine in Nunavut. As part of operation on-going and final reclamation activities will be carried out. This plan provides details on how site restoration will be achieved. The purpose of this plan is to provide support for the Jericho Mine Water Licence application to Nunavut Water Board. The plan will be updated as required by terms and conditions of the Water Licence issued for the mine.

1.1 Basis of the Reclamation Plan

This reclamation plan is based on the project presented in the Jericho Final EIS as modified to address issues raised at the Jericho Public Hearings in January 2004 and presented elsewhere (SRK various 2004) in document supporting Water Licence application.

1.2 Reclamation Objectives

The reclamation plan for the mine has the objective of minimizing the environmental impact of mining operations to the extent practical, and of maintaining the overall present productivity of the site. The end-land use will be to leave disturbed areas so that they may return as quickly as possible to productive wildlife habitat.

The short-term reclamation objectives are to:

- progressively reclaim disturbed areas as soon as they are no longer active;
- minimize the risk and impact of water erosion and sediment transportation;
- stabilize slopes;
- restore drainage;
- cover ground to prevent soil drifting/dust;
- start to rejuvenate the soil and start soil building processes; and
- (where practical) create a green cover for aesthetic reasons.

Long-term objectives are to:

- maintain or improve the level of wildlife habitat; and
- (to the extent practical) create an aesthetically pleasing environment.

Specific commitments made by Tahera on the Jericho Diamond Project with respect to achieving our objectives include:

- to the extent practical, minimize disturbed areas through progressive reclamation;
- recover all soil practical;

- conduct reclamation trials through the mine life to determine what prescriptions work most effectively at Jericho;

- maintain an active liaison with other mines in the Canadian Arctic with respect to reclamation initiatives at their mine sites.

This abandonment and restoration plan has been developed consistent with the objectives of the *Mine Site Reclamation Policy for Nunavut* (INAC 2002).

1.3 Reclamation Activities

The general reclamation program components will be as follows:

- salvage and stockpile soil from the areas of disturbance where practical;

- immediately revegetate areas disturbed by the pre-production phase to the extent practical (see revegetation prescriptions below; in general mesic soils will not have agronomics seeded unless site-specific experience indicates this is necessary);

- reslope rock dumps to a maximum overall 2:1 slope angle (26°); this will be accomplished by grading off the benches which will be 10 m high and set back from the one below 15 m;

- prepare surfaces for the replacement of soil materials;

- recover suitable stockpiled soil and spread it over reclaimed areas that would benefit from addition of soil;

- depending on reclamation trials results, coarse PK may be substituted for soil if the PK proves to be a suitable growth medium;

- revegetate the prepared areas where appropriate and indicated from reclamation trials;

- establish test plots to optimize growth mediums, particularly on the PKCA where Ekati Diamond Mine™ experience has shown positive results; and

- monitor growth and develop performance objectives.

1.4 Mine Plan

Tahera will select an engineering firm as the engineers for the design, procurement, and construction management of the diamond plant and infrastructure and a mining contractor for open pit mine development.

The selected firms will provide engineering supervision for the project construction and commissioning. A project construction manager will have overall site responsibility. The engineering firm will appoint Canadian sub-contractors to erect the buildings, plant, fuel storage facility, power generators, camp, water services, and processed kimberlite disposal system. The construction program is scheduled to commence in March 2005 and be completed in December 2005.

Plant commissioning is scheduled for December 2005. The firm will provide experienced mechanical, instrumentation, and process engineers and, where appropriate vendors will provide commissioning engineers. Tahera Diamond Corporation will recruit plant employees, who will participate in the pre-commissioning period and the start up.

Nuna Logistics is an experienced mining contractor with extensive experience in the Northwest Territory and Nunavut. Tahera Diamond Corporation intends to appoint Nuna Logistics as the mining contractor for the project. Nuna Logistics has completed the pre-stripping for a major diamond mine in the NWT and is currently implementing site preparation for two other diamond projects in the NWT. Nuna Logistics will mobilize to the project site in February 2005. During February Nuna will complete the ice road from the Lupin Mine to Jericho and establish a camp, diesel storage facility, workshop, explosive storage facilities, and ice access roads on the site.

Tahera Diamond Corporation will appoint a project director and project manager to overview the design, procurement, and construction of the project. An accountant will be designated in 2005 to provide financial control services for the project development and the ongoing operation. Tahera will recruit employees for the plant operation during 2005 and implement a training program prior to plant commissioning.

A pre-strip pit will be excavated to expose sufficient kimberlite ore to permit a speedy start up of the processing plant. During the pre-stripping period the open pit will not generate any revenue. Due to the ultimate depth of the planned pit, successive pushbacks will be necessary following the completion of each pre-stripping pit. The width of the pushback will be based on minimum practical mining widths, equipment selection, the required ore schedule, safety, cost, efficiency, and other technical issues.

Mining will be by conventional open pit methods followed by underground mining using open benching or sublevel caving methods. High and medium grade ore from the F6 and F4N zones (central and northern lobes) will be stockpiled immediately north and east of the process plant. The remaining low grade kimberlite will be stockpiled close to the pit, separate from the high grade and waste material, in the event future diamond values increase and make the material economically viable. Also a sample from the south lobe will be taken and processed in the plant to evaluate more accurately the recoverable grade and value of the diamonds. Waste rock, consisting largely of granite, will be placed in dump sites 1 and 2 located immediately to the northeast and south, respectively, of the pit.

Underground access will be achieved via a portal in the pit. Ore and waste material from the underground operation will be placed on the high-grade ore stockpiles and the waste dumps. Waste from the underground will come mainly from the decline and level development.

Technical expertise for the construction of diamond processing plants (DMS) has historically been derived from South Africa. Depending on which mining engineer is contracted to supply the processing plant, there is the possibility that the DMS plant will be engineered and constructed in South Africa. Where possible, major equipment has been selected on the basis that it must be supported in Canada. The ore will be processed using conventional diamond processing techniques with the process flowsheet design based on the metallurgical characteristics of the kimberlite ore that was treated in the underground bulk sample program at Tahera's 10 tonne per hour process plant.

The site general arrangement amended to the currently proposed mine layout on closure is attached in Appendix A and provides a site layout for reference.

2.0 SOILS HANDLING PLAN

2.1 Surveys

Soils information at the Jericho Diamond site was derived from geotechnical surveys conducted to assess borrow materials (Bruce Geotechnical 1996a) and overburden properties (Bruce Geotechnical 1996b). Four test pits were dug and ranged from 0.4 to 0.7 m depth. Nine boreholes were also drilled in the esker containing the airstrip and to the east of the airstrip (Figure 2-1). Soil profiles were typical of eskers in that sand and gravel predominated. Up to 0.2 m of organic materials was found at two of the borehole sites. Soils on eskers are not representative of those present in other ecological zones, being thicker and having a much higher percentage of sand and gravel.

Seven boreholes were drilled in the area of the proposed 1996 waste rock dump (approximately co-incident with Waste Rock Dump #1) and the proposed open pit. Two additional holes were also drilled at the east end of Lynne Lake (Figure 2-2). Borehole logs indicate soils are composed predominantly of sand and gravels and vary in thickness from 0.6 to 12 m. One of the boreholes at the east end of Lynne Lake contained 1.8 m of organic overburden; this area is outside the zone of disturbance for the mine and thus organic soils from this location will not be available for reclamation. Average depth to bedrock was 7.1 m. The active layer at the site is between 0.3 and 2 m in soils and thus removal of overburden soils in any location with soils deeper than the active layer would result in a new active layer forming. Unless side slopes at the removal areas are kept shallow, some slumping can be expected.

Available drilling data suggest the overburden soils comprise mainly sand and gravel, with some zones of silt and till. The coarse fraction includes cobbles and, occasionally, boulders.

The total tonnage of overburden soils is estimated to be 1.6 million tonnes. The density of these soils after dumping could range from about 1.6 to 1.9 t/m^3. Due to the presence of ice, the settled density has been conservatively estimated to be 1.7 t/m^3, leading to an estimated dump volume of about 0.940 million m^3.

2.2 Salvage Requirements

The two waste rock dumps will encompass an estimated area of 20 ha. At a soil depth of 0.3 m, coverage would require 61,000 m^3. The dump slopes are not anticipated to be top dressed with soil. Priority areas for reclamation will be sites that have the highest chance of benefiting from soil addition, such as road and airstrip surfaces, infrastructure pads, etc.

Ore stockpiles will collectively cover an area of 20 ha. The North and Central Lobe ore stockpiles will be completely processed prior to mine closure, whereas the low grade ore stockpile may not. Sides of the low grade ore stockpile will not be covered, but the stockpile will be regraded similar to the waste rock dumps. With 0.3 m soil cover, 60,000 m^3 of soil will be required for reclamation of ore pads and stockpile.

Tahera Corporation	
	FIGURE 2.1
Date: 30/9/1999	Borehole and Test Pit Investigation Area
Author:	
Office: North Vancouver	
Drawing:	
Scale: 1:0	Projection: UTM Zone 12 (NAD 27 for Canada)

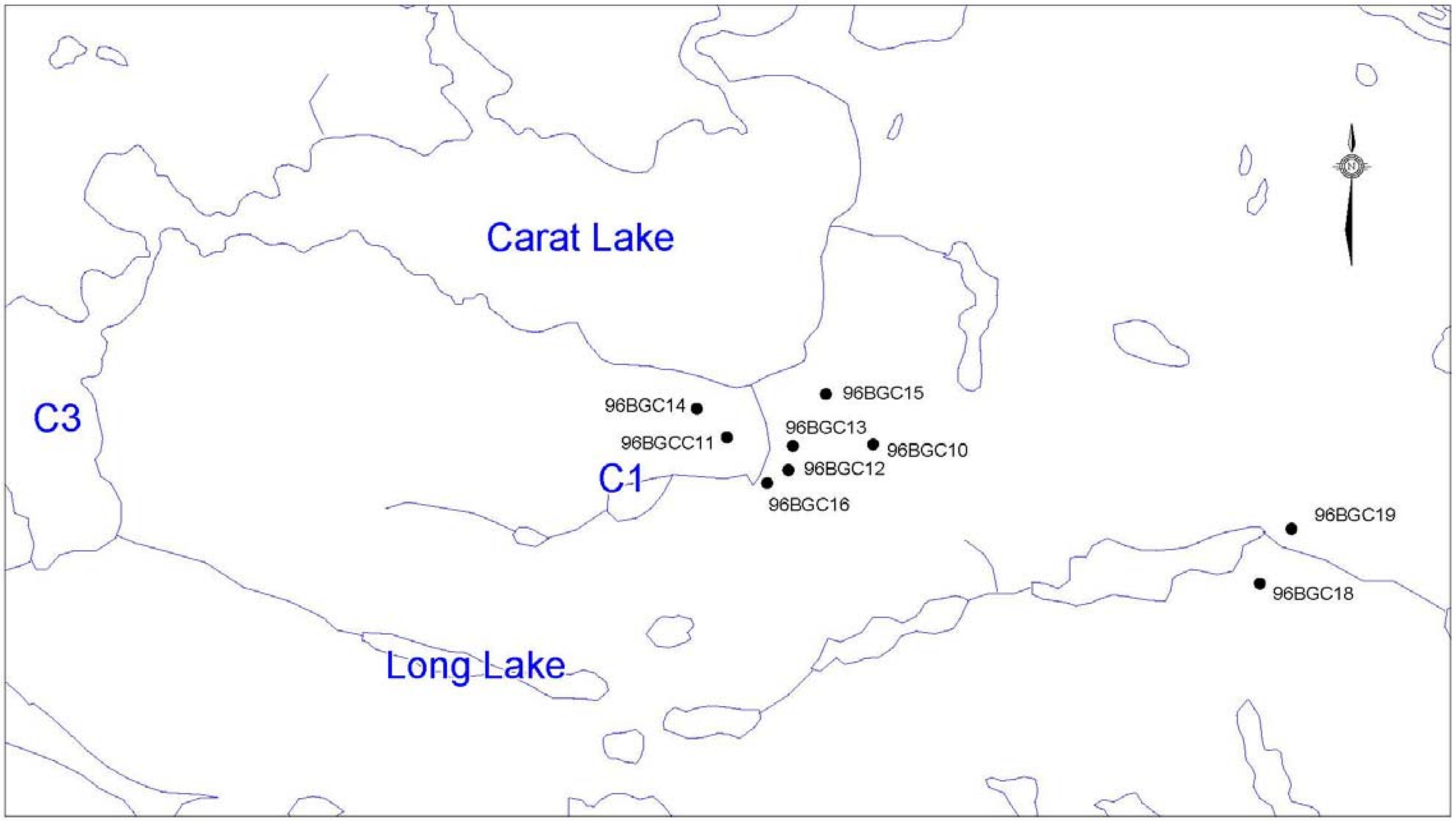


	FIGURE 2.2
Date:02/10/2000	Borehole Location Map
Author:	
Office: North Vancouver	
Drawing:	
	Projection: UTM Zone 12 (NAD 27 for Canada)

The PKCA will cover an area of 34.6 ha, including dams. As the PKCA is developed from east to west it will be progressively covered with coarse PK and rock. On dry and settled areas, vegetation trials will be carried out and if proven successful, the PKCA will be progressively revegetated. A cover of up to one metre of coarse kimberlite may be used. If growth trials indicate poor plant growth success on coarse kimberlite, suitable overburden soil cover may be placed to top dress the coarse PK. Use of overburden soil will pre-suppose successful vegetation trials on this growth medium. As shown on Drawing 1CT004.06 – G14 (Appendix A), a pond will remain at the close of the PKCA. A total of 90,900 m^3 soil will be required to reclaim the PKCA. Most of the coarse kimberlite stockpile will not be required for reclamation. It will be regraded similar to waste rock dumps. Planting and/or cover with overburden will be decided on the same basis as for the PKCA. The footprint area of the coarse kimberlite stockpile will be 16.67 ha upon completion of ore processing (discounting removal of 90,900 m^3 for reclamation of the processed kimberlite containment area (PKCA). A 0.3 m cover will require 50,000 m^3 of soil.

Roads, laydown areas, the plant, powerhouse, accommodation, mechanical shop, explosives storage, emulsion plant and explosives truck shop, and miscellaneous small areas will cover an additional approximately 37 ha. Top dressing will require 111,000 m^3.

The total area of disturbance of borrow areas and airstrip will be 36 ha, if borrow areas are completely exploited. As shown on Drawing 1CT004.06 – G14, only relatively small parts of the borrow areas are planned for extraction; a total estimated area of 6.8 ha will be disturbed. These facilities are/will be located on eskers and no top dressing with soil will be required, only regrading where required to eliminate steep slopes and add micro-contours where indicated.

The open pit is not slated for revegetation due to the steep side slopes. Rather it will be allowed to fill with water. Current plans call for discharge through a dedicated channel once the pit fills (estimated to be approximately 20 years post mine closure).

Table 2-1 contains a summary of soil requirements for reclamation.

Table 2-1: Reclamation Soil Requirements

Facility	**Soil Required for 0.3 m Cover (m^3)**
Waste Rock Dumps	60,000
Ore stockpiles	60,000
PKCA	90,900
Coarse Kimberlite Stockpile	50,000
Roads, Plant, Miscellaneous	25,000
Total	**285,900**

2.3 Stockpile Locations

The largest proportion of soil will be removed in Years 1 and 2 and will be stockpiled on the overburden stockpile on Waste Dump 2 (Drawing 1CT004.06 – G14). Soil may temporarily (less than one season) be stockpiled at other locations where sedimentation in runoff can be controlled and where the area is already in a disturbed site, such as one of the pads with vacant space. Temporary storage may occur, if it allows placement of soil near its final location and if it is anticipated the soil will be placed at its final location within that year.

2.4 Soil Stockpile Design and Construction

The overburden stockpile will be used primarily to store soil, most of which will be frozen when it reports to the overburden stockpile. Some portion of the overburden stockpile is likely to thaw during the summer months and may require confinement. The design of the overburden stockpile is based on the assumption that waste rock will be used to provide confinement to the soils in the event they thaw and, due to excess water, show a propensity to slump or "run." For planning purposes, it has been assumed that a waste rock buttress will be constructed around parts of the overburden soils not confined by Waste Rock Dump 2 using centreline construction methods. The downstream slopes of the waste rock would be the same as for the two waste dump sites. As much as 8% of the waste rock could be used at the overburden stockpile.

Overburden will be hauled to its stockpile using off-road mine trucks on all-weather mine access roads. The overburden stockpile will be constructed over a two-year period (Years 1 and 2). The foundation preparation procedures for the waste rock will be the same as those used for the waste dumps. The waste rock will be placed by end dumping and spread with a dozer.

In order to preserve the frozen conditions within the base of the waste rock, a frozen foundation layer will be developed at the base of the overburden soil, to the extent practical. In addition, waste soil placement will be managed to try to lock in the frozen conditions within the foundation layer and prevent thawing of either the foundation layer or the underlying foundation.

2.5 Soil Placement Strategy

For reclamation, soil will be windrowed along the top dressing area in preparation for a dozer to replace the material. Stockpiles located remote to the replacement area will be hauled by truck, and again windrowed along the top dressing area for replacement.

The replacement of the soil will be under the direct supervision of in-house environmental personnel to ensure the required replacement thickness is achieved and to monitor the condition of the replaced soil. Weather or material conditions, which are not conducive to effective replacement, will require temporary suspension of the program or remediation measures. Any amendments to the soil, which are identified as being required based on reclamation trials, will be added during replacement.

3.0 EROSION AND SEDIMENT CONTROL PLAN

Sedimentation control structures and erosion control are discussed in the water management plan for the project. In summary, all clean water (runoff from undisturbed areas) will be routed around the site as required. All runoff from disturbed areas will be directed to sedimentation ponds for settling of suspended sediment and then released to the environment (in most cases, upland tundra). Alternatively, sediment pond water will be discharged to the PKCA if water licence criteria are not met. On closure mine area drainage will be directed to the open pit which will act as a sink until it fills and overflows, either into Stream C1 or an open channel to direct water away from Stream C1 (see Section 5.0).

Erosion will be controlled principally by slope angles of constructed facilities being kept less than the angle of repose or by rock armouring, as appropriate. Long-term sediment control will consist of revegetation, where such is feasible, or rock armouring where it is not, and where erosion control is required.

There will be areas where revegetation is not possible and rock armouring will be used in such areas. Because overburden material will be placed and revegetation will proceed on most flat surface areas, the un-revegetatated areas are likely to be the slopes of the waste rock, low grade ore (if not processed), coarse kimberlite and the remaining overburden stockpiles. The regraded surfaces will consist of coarse rock in most of these cases, so the requirement for additional erosion protection is likely to be very limited. Where it is necessary to import armouring for erosion protection, it will be obtained by screening suitably sized inert material from the waste rock or overburden stockpiles.

4.0 REVEGETATION PLAN

4.1 Introduction

Pre-existing native plant communities cannot be completely re-established, however some reclamation is possible. Many species of wildlife (e.g. caribou, canids) should resume use of disturbed esker habitats when the infrastructure is removed. A cooperative approach will be sought with Ekati Diamond Mine™, Diavik and Snap Lake mines information exchange on reclamation research at diamond mines in Arctic environments. Wherever possible islands of undisturbed vegetation will be left in disturbed areas. These islands will provide a seed source for adjacent areas once reclamation of those areas commences. This approach has been shown to be effective in temperate alpine areas (Bittman 1995), and also at preliminary trials at Ekati Diamond Mine™ (Reid 2002).

4.2 Ekati Diamond Mine™ Experience

Ekati Diamond Mine™ has conducted revegetation experiments at the mine since 1998. A recent series of reports details revegetation research and results at Ekati Diamond Mine™ (Kidd and Max 2000a, 2000b, 2001, 2002; Martens & Assoc. 2000, 2001, 2002; Reid 2001a, b, 2002). In summary Ekati Diamond Mine™'s findings are:

- except on mesic to moist, fine-grained soils, establishment of vegetation without amendments is problematic;
- addition of fertilizer will speed initial establishment, but, in combination with cultivars (agronomic species) can retard establishment of native vegetation;
- for treatment of erosion on mesic or wet sites, annual grasses (agronomic species) and fertilizer will produce an adequate cover in one season; there is no practical alternative to fast-growing agronomic species other than riprap;
- the availability of native Arctic vegetation, except for natural seed sources, is extremely limited;
- Coarse and fine PK do not make ideal growth media over the longer term and may result in elevated nickel in plants, although not at phytotoxic levels; some success in revegetation occurred in mesic to wet areas of the PKC.

Table 4-1 summarizes the seven years experience at Ekati Diamond Mine™.

Table 4-1: Summary of Revegetation Trials at Ekati Diamond Mine™

Location	Amendments	Plants	Results
Fox Portal test plots	Organic soil Esker sand Lake sediments	Native grass cultivars Indigenous seed Legume Shrub cuttings	Most favourable growth from organic soil and native grass cultivars (5-8% in 1 year, 6 – 20% in 2 years, 39-52% in 5 years); others negligible
Wetland (diversion)	None	Legume (*Epilobium*)	26% vegetative cover
PKC	Coarse kimberlite Fine kimberlite Potting soil (control)	Native grass cultivars	Less growth on kimberlite; high Ni in vegetation (not phytotoxic)
PKC	Fertilizer 1st year; reapplied 3rd year	Annual fall rye or regreen	28% cover in one year; suitable for erosion control
Channel banks	None	Polar grass (*Arctagrostis latifolia*)	Assist in stabilization
Riparian/aquatic	None	Willow cuttings	33% survival in 1 year
Airstrip graded banks	Contour to create hollows and add boulders	Native grass cultivars, native forb cultivars	41% survival in 1 year

Table 4-2 provides a list of the species of native cultivars used at Ekati Diamond Mine™.

Table 4-2: Native Cultivars Used for Revegetation at Ekati Diamond Mine™

Native Grass Cultivars	Native Forb Cultivars
Arctatgrostis latifolia (Polar Grass)[1]	*Astragalus alpinus*
Carex sp.	*Epilobium angustifolium*
Festuca rubra[1]	*Epilobium latifolium*
Poa alpigena	*Oxytropis viscida*
Poa glauca[1]	
Poa sp.	
Unidentified grass	

1 Best survival in revegetation trials.

4.3 Revegetation Objectives

The target end land use is wildlife habitat and the aim of Jericho reclamation is to promote, to the extent practical, rehabilitation of the land to this use. Vegetation prescriptions will be developed and tested based on the pre-disturbance ecological zones, where the disturbed areas are located. The aim will be to provide soil conditions similar to pre-disturbance conditions and to the extent possible, revegetate or encourage native species at the site similar to those that occurred prior to disturbance.

The active layer (permafrost) plays an important role in erosion, particularly thermokarst and slumping. An objective of reclamation activities will be to design rehabilitation so as to minimize any potential negative effects to the active layer (particularly increases) and prevent melting of ice lenses, which can lead to slumping and erosion from runoff. The principal control will be addition of soil or soil and rock cover.

A primary objective in some cases will be to retard wind and water erosion. In areas particularly susceptible to erosion, and this objective may require the use of agronomic species in favour of slower growing native species, with the realization that this will lead to retarding of natural successional processes and delay return of these sites to productive natural wildlife habitat. Failing relatively rapid establishment of vegetation, rock armouring may be required.

4.4 Mine Land Units

Mine land units at the Jericho Diamond Project are best visualized by superimposing the ecological zones existing at the site with the mine facilities. This superposition was shown on Map C of the Final EIS (Attached here in Appendix A). The mine land units considered together with the maximum disturbance areas of each are listed in Table 4-3. Disturbance is broken down by ecological zone based on Map C (with current mine footprint).

Table 4-3: Approximate Areas of Surface Disturbance by Ecological Zone[1]

Component	Ecological Zones and Areas Affected (ha)[2]							
	WGBM	MBM	DBT	DRT	LK	CRH	EKD	Total
Mine								
Open Pit	2.7		3.7	3.7				10
Waste Rock Dumps			12	8				20
Low Grade Ore Stockpile		5.3	2.7	5.07				13.1
Coarse Kimberlite Stockpile	1.85		5.95	6.7	2.14			16.6
Roads								
Haul (22 m width)	0.7	0.4	0.9	0.9			1.1	4
Access (13 m width)	1.4		3.2	4.7		1.1		10.4
Airport (10 m width)							1.5	1.5
Airstrip							2.4	2.4
Plant-Related + Ore Stockpiles				22.7				22.7
PKCA	2.07	0.9	9.6	10.9	11	0.14		34.6
Expl Camp, Truck Wash, Explosives		0.3	0.2	2			3	5.5
Sediment Collection Ponds	0.5	0.6		1.1				2.2
Borrow Areas							34	34
Subtotal Disturbance	**9.22**	**7.5**	**38.25**	**65.77**	**13.14**	**1.24**	**42**	**177**
% of Total	**5.2%**	**4.2%**	**21.6%**	**37.2%**	**7.4%**	**0.7%**	**23.7%**	**100%**

Notes
1 Based on maximum areal extent of surface disturbance
2 WGBM = Wet grass/birch meadow, MBM = Moist birch meadow, DBT = Dry barrenground tundra DRT = Dry rocky tundra, LK = Lake, CRH = Cliffs/rocky hills, EKD = Cliffs/rocky hills, Kame deltas

Maximum disturbance will occur at approximately Year 3 (excluding pit wall development) given that Borrow Area A3 will require development. A small reduction in disturbed area may be possible with preparation for revegetating parts of the camp and borrow areas not being actively used. Realistically, however, greening up will not have occurred in this short timeframe in that decades are normally required for revegetation of mesic sites and typically even longer for dry sites.

4.5 Vegetation Prescriptions

Reclamation trials will be used to determining what reclamation prescriptions are most likely to be successful in the Jericho Project area. However, work of others provides some guidance. Mined sites will vary from bare, steeply inclined rock (e.g. pit walls) to relatively lightly disturbed areas (e.g. winter road surfaces). On mesic sites where soil remains, revegetation with native species can be successful, due to the presence of seeds and living shoots in the ground and favourable moisture conditions. On these sites, unless immediate control of soil erosion is an issue, use of agronomic species tends to inhibit rapid re-establishment of native vegetation (Cargil and Chapin 1987). On sites where soil has been removed, or on ice-rich sites subject to cryoturbation, revegetation by native species will likely be slow and preparation of the soil by planting agronomic species, especially nitrogen-fixing legumes, may speed up the successional process. Salvaged overburden may be a repository of seed, but the effectiveness of this source after stockpiling and respreading on disturbed areas will need to be evaluated through reclamation trials.

On wet to moist sites, *Eriophorum* (cotton grass), *Ledum* (Labrador tea) and *Carex* (sedges) have been found to establish most readily; drier sites naturally revegetate to *Festuca rubra* and *Descurainia sopioides* (Bliss and Wein 1972). Seeding in spring during runoff or in early fall before snowfall have been found to be the best times to plant. During the summer, inadequate moisture may lead to excessive loss of seedlings (Bliss and Wein 1972). Bliss and Wein (1972) also found that addition of high nitrogen fertilizer significantly increased dry-weight production on test plots in the Mackenzie Delta. Loss of new plants to grazing by red-backed voles (*Clethrionomys gapperi*) may limit growth on replanted sites (Bliss and Wein 1972). Caribou grazing and trampling may also be problematic, especially if relatively large groups cross reclamation areas. Ekati Diamond Mine™ has found that Arctic hares (*Lepus arcticus*) have been found to be problematic at Ekati Diamond Mine™ (*pers. comm.* 2001).

As a starting point, the prescriptions in Table 4-4 are suggested for the Jericho Project Area.

Table 4-4: Potential Revegetation Prescriptions for the Jericho Project

Mining Land Unit	Overburden Treatment[1]	Plants	Fertilizer Application
Pit walls[2]	None	None	None
Bench and pit floors	None	None	None
Borrow Areas			
slopes	10 to 15 cm	*Arctagrostis latifolia* *Festuca rubra*	None
floors	10 to 15 cm	*Arctagrostic latifolia* *Poa glauca*	200 kg/ha N/P
Airstrip and roads dry areas	10 to 15 cm	*Festuca rubra* *Descurainia* *Calamagrostis* *Poa glauca*	200 kg/ha N/P
Roads mesic areas moist areas	None	*Eriophorum* *Carex* *Punccinellia* (*Astragalus* *Oxytropis* *Hedysarum*)	None, or 100 kg/ha N/P, depending on trials results. *Punccinellia* will allow faster succession if it will take[4]
Waste rock dumps			
Tops	10 to 15 cm	As per dry roads	100 kg N/P
Sides	None	None	
Pads	10 to 15 cm	As per dry roads	100 kg N/P

4.6 Reclamation Trials

Reclamation trials will be conducted throughout the mine life with greater intensity of activity during the initial years. The purpose of the trials will be to develop a database on establishment and growth success of vegetation on reclaimed land. As discussed previously, other diamond mine operators in the area will be canvassed as to their successes and failures. The reclamation literature will also be reviewed on an on-going basis. Conceptually, trials could include:

- the effects of soil cover on plant growth for a particular land unit;
- the effects of mixing organic and mineral soil;
- the success of establishment of various vegetation prescriptions;
- the effects of fertilizer mixtures and rates of application;
- the existence and rate of encroachment of native species;
- effects of water content of soil;
- effects of drainage characteristics of soil;
- soil characteristics measurements:
    - pH
    - organic carbon content
    - texture/particle size distribution
    - salinity (sodium adsorption ratio)
    - electro-conductivity (EC)
    - total N

Because some limited success with use of PK as a growth medium has been demonstrated by Ekati Diamond Mine™, test plots both on and off the PKCA will be established at Jericho to test the use of PK at the mine. As part of this program, the on going results at Ekati Diamond Mine™ and other diamond mines will be monitored by the Jericho Mine.

5.0 RECLAMATION PROGRAM

5.1 Reclamation Activities During Construction

5.1.1 Access Roads

Access roads were constructed as part of the exploration program. Existing access roads and other facilities are shown in Figure 5-1. The existing roads would be retained, except most of the road between the exploration camp and the "Minesite" would be routed to the east as shown on the site general arrangement (attached in Appendix A). Additional access roads would be required as shown on the general arrangement. Roads are all on relatively flat ground and no fill stabilization is anticipated to be required for erosion prevention. The winter road is not a permanent structure and does not result in ground disturbance; no reclamation is required. Should ground disturbance inadvertently occur on land portions of the road, these will be reclaimed the summer following the inadvertent disturbance according to the prescriptions suggested in Table 4-4, or as appropriate from reclamation trials results. Reclamation after construction will not be possible on the access roads shown on the general arrangement, as they will remain active throughout the mine life. Should small spurs be required for construction purposes only, these will be reclaimed at the end of their active use as per Table 4-4, or as appropriate.

5.1.2 Sedimentation Embankments and Ponds

Sedimentation embankments are anticipated to be required to train runoff water from waste rock dumps, as shown on the general arrangement. Ponds will collect water to allow settling of suspended solids prior to release or further treatment (in the PKCA). Seeding of berms and pond dikes with fertilizer and agronomics will be undertaken following construction, or dikes riprapped if immediate erosion protection is required; rip-rapped surfaces will not be vegetated.

No sediment berms, ditches or ponds will be reclaimed after construction, except any temporary ponds that may be required to control sediment from disturbed areas during the summer after construction.

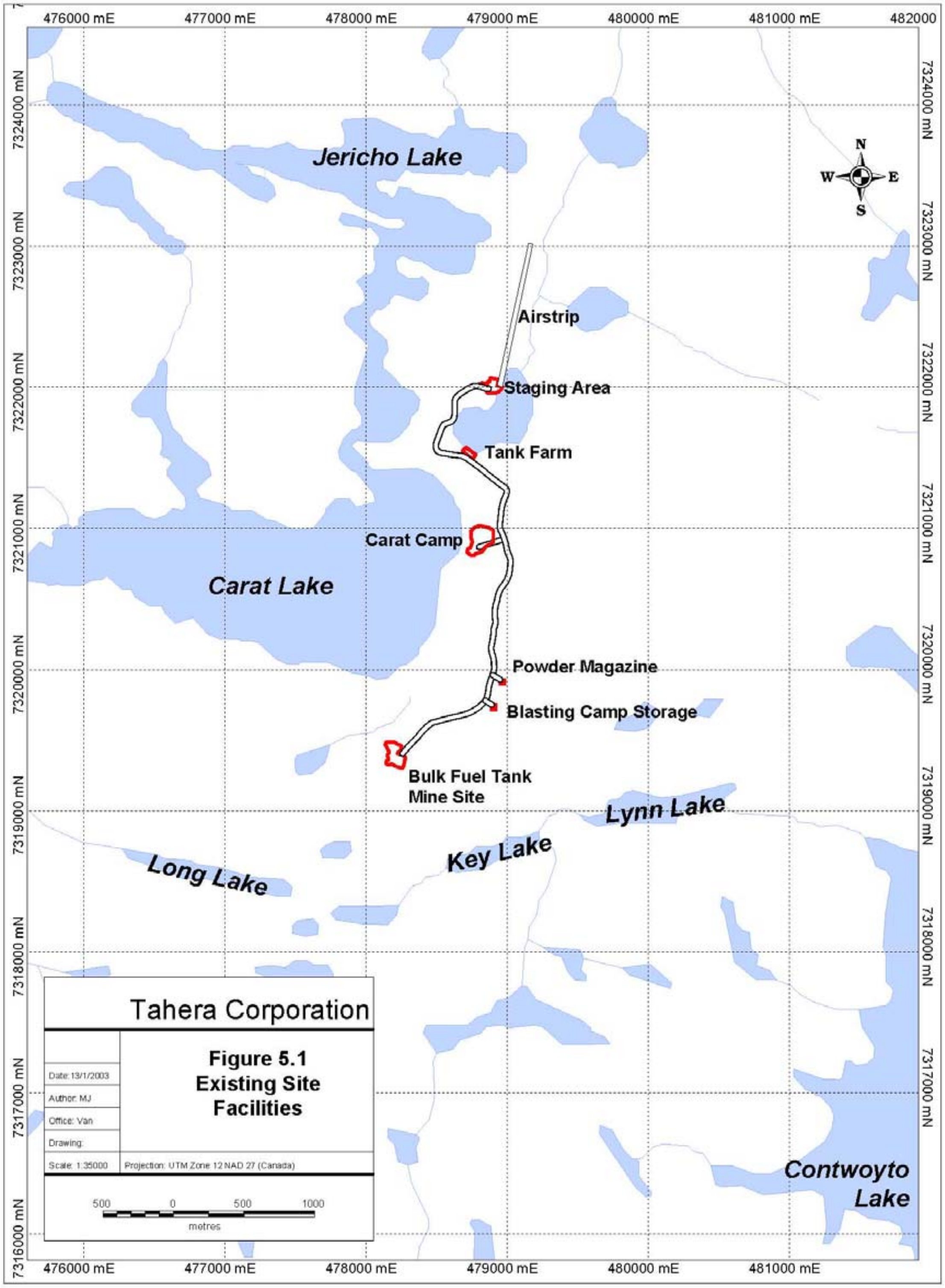
5.2 Temporary Shutdown

A temporary shutdown for this plan is defined as a cessation of mining and processing operations for a finite period with the intention of resuming operations as soon as possible after the reason for the shutdown has been resolved. Possible causes for such a shutdown could be a major mechanical equipment failure, late delivery of critical equipment or supplies, or labour conflict.

5.2.1 Open Pit Mine

The follow procedures will be undertaken:

- All mobile equipment will be removed from the pit and stored in the plant area.
- During the summer, electricity to the pit will be maintained and the sump pumps operated as required to keep the pit drained; if maintenance of power to the pit is not practical, diesel pumps will be substituted for the normal sump pumps. During the winter this precaution is not necessary.
- All hazardous materials will be taken from the pit and stored in appropriate central locations.
- The pit will be inspected daily to ensure overall integrity.


476000 mE
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7320000 mN
7319000 mN
7318000 mN
7317000 mN
7316000 mN
N
W
E
S
Jericho Lake
Airstrip
Staging Area
Tank Farm
Carat Camp
Carat Lake
Powder Magazine
Blasting Camp Storage
Bulk Fuel Tank
Mine Site
Lynn Lake
Key Lake
Long Lake
Contwoyto
Lake
Tahera Corporation
Figure 5.1
Existing Site
Facilities
Date: 13/1/2003
Author: MJ
Office: Van
Drawing:
Scale: 1:35000
Projection: UTM Zone 12 NAD 27 (Canada)
500
0
500
1000
metres

5.2.2 Processing Plant

The plant will be shut down in a planned and orderly sequence to prevent damage to equipment, piping and instrumentation. The following preparatory measures will be taken:

- The plant will be run if feasible until all kimberlite in the process stream is through the plant.
- The plant will be purged of all diamondiferous materials.
- All diamonds will be removed from the site.
- All slurry lines will be flushed of solids.

Procedures during the shutdown will be as follows:

- Minimal heating to the process building will be maintained to prevent equipment freezing.
- Electricity to the building will be maintained.
- All major equipment will be run periodically to ensure lubrication and integrity of the rotating parts.
- Ferrosilicon will be recirculated once per day to prevent setting up in the circulating medium tanks.

5.2.3 Surface Infrastructure

During temporary shutdown, the site infrastructure will be placed into a care and maintenance mode to ensure environmental stability and orderly restartup as follows:

- Minimal heating to critical facilities will be maintained to prevent equipment freezing.
- All non-critical equipment will be shut down.
- All necessary support facilities and services for care and maintenance personnel will continue to operate:
    - freshwater intake and potable water treatment;
    - sewage treatment;
    - power plant;
    - waste heat recovery and glycol heating system;
    - diesel fuel storage and distribution;
    - part of the accommodation and kitchen facilities.
- All major equipment will be run periodically to maintain operability.
- All hazardous materials stored within site facilities will be collected and stored in a central secure area, e.g., hazardous materials storage building.

5.2.4 Mine Waste and PKCA

The following actions will be taken:

- PK slurry lines will be purged, flushed and drained.
- Dust control operations will be maintained.
- Routine dam inspections will be continued.
- Pump back equipment below dams (except the reclaim water system) will continue to operate.
- The reclaim pump and line will be purged, flushed and drained.

5.2.5 Water Management Facilities

Collection sumps and ditches around the site will be maintained to manage runoff from the site.

5.3 Indefinite Shutdown

For this plan, indefinite shutdown is a cessation of mining and processing operations for an indefinite period with the intention of resuming operations in the future. During indefinite shutdown the site will be placed into a mode of minimal operating expense while maintaining safety and environmental stability. Possible causes included prolonged unfavourable market conditions or protracted labour dispute.

5.3.1 Open Pit Mine

Procedures similar to those for temporary closure will be followed.

5.3.2 Processing Facilities

Procedures similar to those for temporary closure will be followed. In addition:

- Equipment and gearboxes will be drained of lubricants, which will be stored in sealed drums in the maintenance shop.
- Tanks will be drained.
- Remaining ferrosilicon will be pumped to the PKCA.
- All water, glycol and slurry lines will be flushed and drained. Glycol will be stored in sealed drums.
- Reagents will be removed from the site.
- The entire process plant will be locked and all heating and electricity turned off.

5.3.3 Surface Infrastructure

Procedures similar to those for temporary closure will be followed.

5.3.4 Mine Waste and PKCA

Procedures similar to those for temporary closure will be followed.

5.3.5 Water Management Facilities

Procedures similar to those for temporary closure will be followed.

5.4 On-Going Reclamation

Table 5-1 lists areas of disturbance and the year reclamation will be carried out.

Table 5-1: Reclamation Areas by Year

Facility	Area (m^2)	Year Reclaimed
Waste Rock Dump 1 top	119,662	Year 4
Waste Rock Dump 2 top	83,527	Year 8
Low Grade Ore (assumes uneconomic)	131,000	Year 4
Overburden		n/a
Roads	159,000	Year 9
Airstrip	24,000	Year 9
PKCA	303,000	on going

Facility	Area (m^2)	Year Reclaimed
Coarse PK	166,000	on going
Central Ore Pad	40,000	Year 8
Northern Ore Pad	40,000	Year 9
Diamond Processing Plant	2,386	Year 9
Accommodation	10,000	Year 9
Process Laydown	5,600	Year 9
Mine Laydown	5,600	Year 7
Mine Shop	3,600	Year 9
Magazines, Ammonium Nitrate	5,000	Year 8
Exploration Camp	50,000	Year 9
Borrow Area A1	31,000	on going
Borrow Area A2	8,000	on going
Borrow Area A3	29,000	on going

5.4.1 Borrow Areas

Once borrow areas are no longer required, they will be reclaimed. Borrow pits are exclusively on eskers or kame deltas and soils are granular, thus not presenting surfaces easily eroded by wind. However, any steep micro-slopes will be subject to water erosion during the summer. Removal of esker surface material will increase the depth affected by freeze-thaw. As well, there is a potential to expose ice-rich soils, which could result in further melting and slumping; geotechnical investigations by Bruce Geotechnical (1996b) suggest limited existence of ice lenses in areas proposed for extraction. This in turn may lead to additional potential for erosion. During active use, esker borrow areas will be managed so as to minimize any potential for water erosion. Once areas are no longer active, steep slopes will be regraded to the angle of repose or 3:1, as appropriate, and revegetated as per Table 4-4, or as indicated by reclamation trials.

5.4.2 Waste Rock Dumps

Waste rock dumps will remain active until the end of open pit mining. Given that the mine is planned to switch to underground, in Year 4 dumps will be reclaimed, except for a small portion of one of the dumps required for underground waste rock (estimated 57,000 tonnes). Open pit mine equipment on site for that phase of mining will be used for reclaiming the dumps. Dumps will be constructed in step-back lifts; final regrading of slopes will be to attain a 2:1 slope (26°), or less, by pushing material down onto benches. Top surfaces will be compacted from traffic use and will be ripped or scarified to loosen the surface and provide microhabitat for plants. Dumps are expected to be dry microhabitats and inimical to plant growth. If revegetation trials indicate the potential for successful revegetation of the dump tops, salvaged soil will be placed on the top or flat surface of the dump to a depth of up to 0.3 m. This soil will be fertilized and seeded as per Table 4-4, or as indicated by reclamation trials. Consideration will be given to placement of boulders on the dump top surfaces to provide perches for raptors. Ramps will be built into lifts to allow safe caribou transit across the dump slopes.

Portions of the dumps that remain active throughout the mine life will be reclaimed at closure in the manner indicated above. The side slopes will be left in a stable condition not subject to water or wind erosion, but will not be revegetated. Slopes will be coarse rock to retard water and wind erosion. Both moisture content and the probability of successful revegetation on these slopes will be very low. Organic soils will be scarce, making their use in areas with a low probability of successful revegetation unwise. Any planting will take place in the spring or fall so as not to moisture stress seedlings during summer months.

Figure 5-2 illustrates reclamation regarding concepts for dumps.

5.4.3 Open Pit

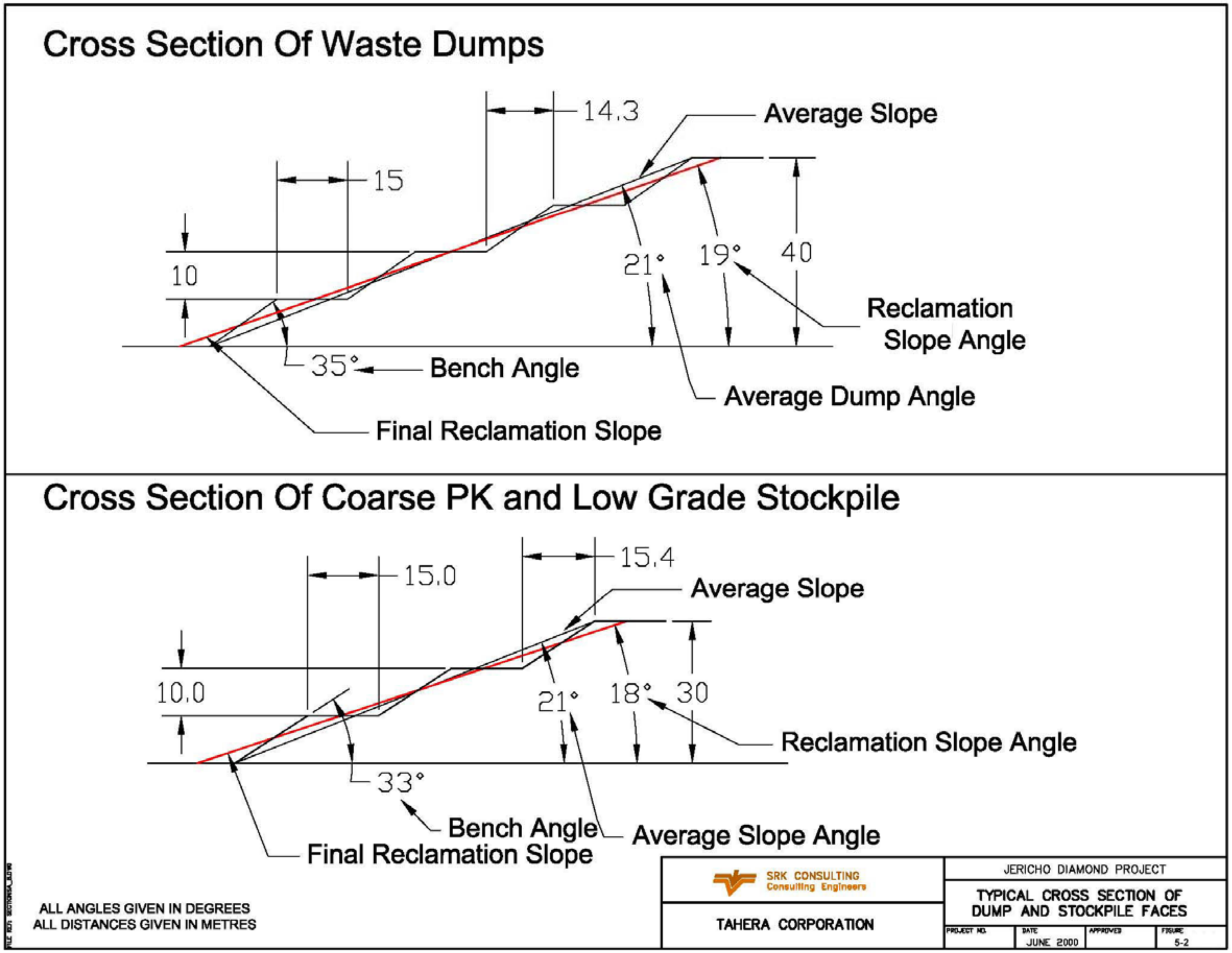
The open pit will remain for a number of years as a large opening in the ground. To prevent accidental entry or fall into the pit by animals such as caribou, or by people that may visit the site after closure, a rock berm will be placed around the lip of the pit. The rock berm will be built of rock mined from the open pit after it is pushed back to its final position. Waste rock from the mine will be directly dumped in place and dozed into a berm. The berm will remain unfinished at the access road point until pit closure. A swale, box culvert, or bridge will be placed at the location in the berm where the natural channel of Stream C1 would exit once the pit fills. There are a number of options for managing pit water on closure that have been considered and these are discussed in Section 5.3.2.2. The present plan, subject to change pending on results of monitoring after closure, is for a channel to direct pit water, once it fills, back into the Stream C1 channel if water quality is acceptable or away from the lower Stream C1 channel to the east where the water will enter Carat Lake either with or without in pit treatment. In pit treatment is discussed by John Chapman in a memorandum to SRK (Appendix C).

5.4.4 Central Ore Stockpile

The central ore stockpile will be completely processed at the end of Year 6. During the summer of Year 7 the pad will be reclaimed by scarifying and grading down the perimeter as required. Top dressing the margins with overburden will be undertaken, if reclamation trials indicate probable success.

5.4.5 Access Roads

Access roads are anticipated to be required throughout the mine life. Should access roads no longer be required, these roads will be reclaimed during the mine life before closure. The road surface will be scarified, or ripped, and the surface revegetated as per prescriptions listed in Table 4-4, or as indicated from reclamation trials.


Cross Section Of Waste Dumps
14.3
Average Slope
15
10
21°
19°
40
Reclamation Slope Angle
35°
Bench Angle
Average Dump Angle
Final Reclamation Slope
Cross Section Of Coarse PK and Low Grade Stockpile
15.0
15.4
Average Slope
10.0
21°
18°
30
Reclamation Slope Angle
33°
Bench Angle
Average Slope Angle
Final Reclamation Slope
ALL ANGLES GIVEN IN DEGREES
ALL DISTANCES GIVEN IN METRES
SRK CONSULTING
Consulting Engineers
TAHERA CORPORATION
JERICHO DIAMOND PROJECT
TYPICAL CROSS SECTION OF DUMP AND STOCKPILE FACES
PROJECT NO.
DATE
JUNE 2000
APPROVED
FIGURE
5-2

5.5 Final Reclamation

5.5.1 Waste Rock Dumps and Low Grade Ore Stockpile

Dumps that remain active throughout the mine life and the low grade ore stockpile (if not processed) will be reclaimed at closure in the manner indicated in Section 5.2.2. The tops of the dumps and low grade ore stockpile may be revegetated. The side slopes will be left in a stable condition not subject to water or wind erosion, but will not be revegetated. The principal reasons for this are:

- the impracticality of making granular mineral soils remain in place on angle of repose rock slopes;
- the low probability of successful revegetation on these slopes considering the high probability of very low moisture content; and
- the probable scarcity of soil available for top dressing, making its use in areas with a low probability of successful revegetation unwise.

5.5.2 Open Pit

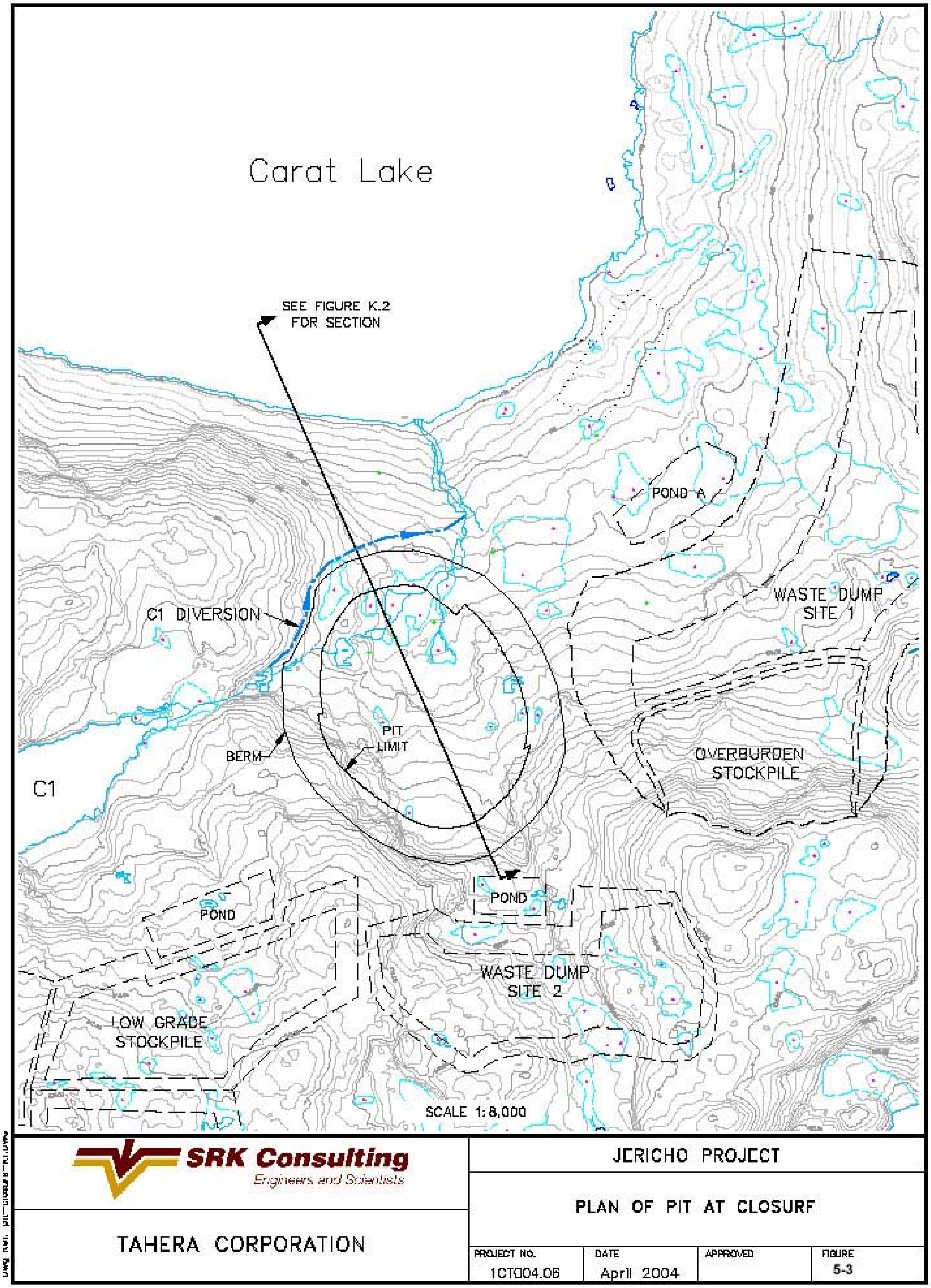
5.5.2.1 Final Configuration

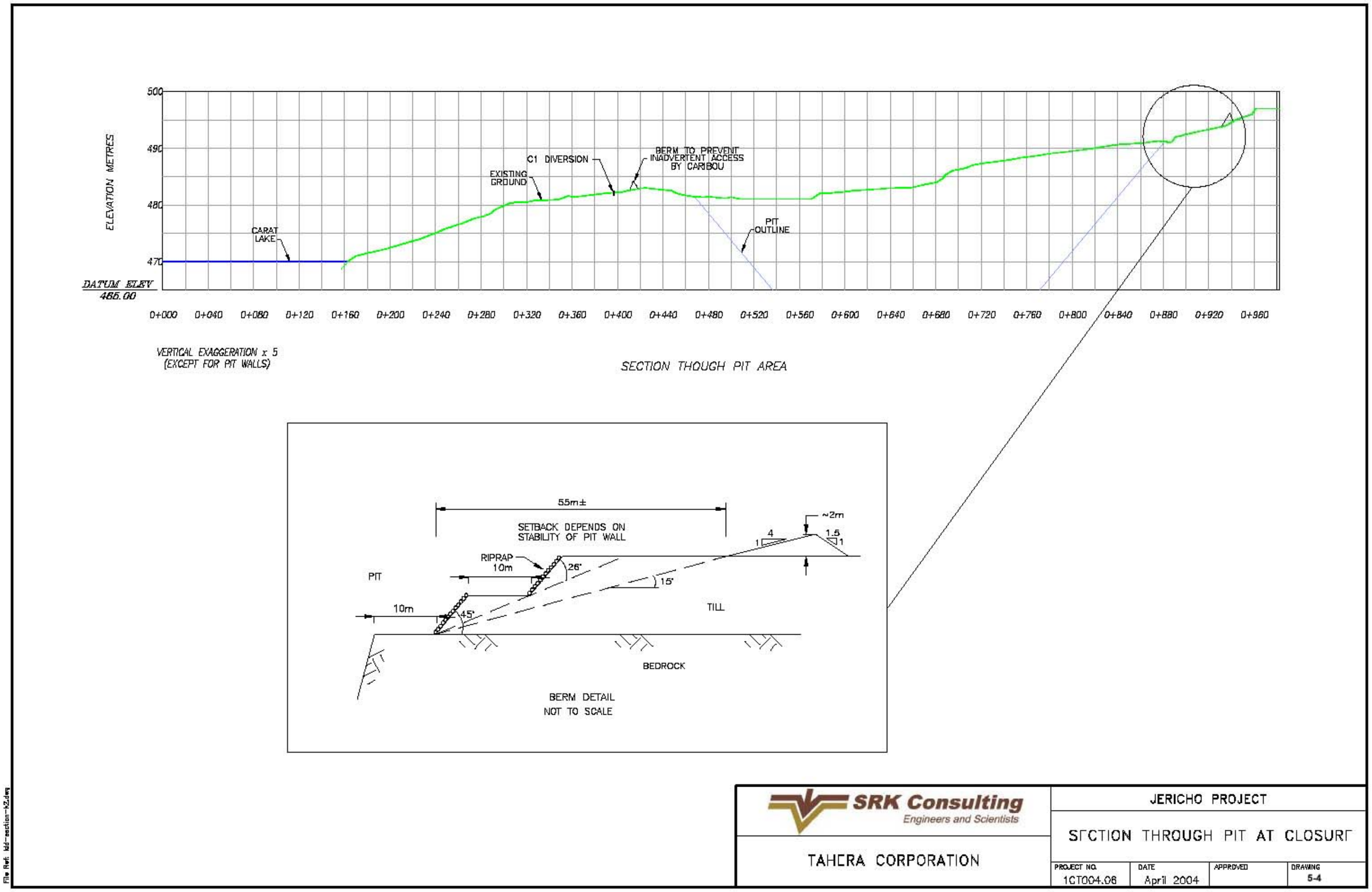
A plan and cross-section showing the expected closure configuration of the pit are presented in Figures 5-3 and 5-4.

The till unit will be insulated with a waste rock cover, as part of the initial stages of pit development. Post-closure, the slopes may ravel or degrade to a slope as flat as approximately 15°. The bedrock below the till will also ravel back over the very long term. This is common in all rock slopes, and is the reason why there is no requirement for long-term stabilization of pit slopes in most mine reclamation guidelines.

A safety berm will be constructed beyond the ultimate crest of the till slope. The berm will be constructed with a steep outer face to discourage caribou entry, and a flatter inner face to allow any caribou to exit. The setback distance will be adjusted as necessary to allow snowmobiles and caribou that happen to cross over the berm sufficient time and space to stop before reaching the pit edge.

The final pit will have steep walls and a ramp road connecting the bottom and top of the pit. Walls will be entirely in bedrock. The pit will be allowed to flood on closure which will require approximately 15 - 20 years if all mine area drainage is directed to the pit. If pit water quality on filling is of adequate quality (assumed to be CCME), Stream C1 will be re-directed back into its natural channel. Alternatives for pit closure water management are discussed in Section 5.3.2.2.


Carat Lake
SEE FIGURE K.2 FOR SECTION
POND A
C1 DIVERSION
WASTE DUMP SITE 1
PIT LIMIT
BERM
OVERBURDEN STOCKPILE
C1
POND
POND
WASTE DUMP SITE 2
LOW GRADE STOCKPILE
SCALE 1:8,000
SRK Consulting
Engineers and Scientists
TAHERA CORPORATION
JERICHO PROJECT
PLAN OF PIT AT CLOSURF
PROJECT NO. 1CT004.06
DATE April 2004
APPROVED
FIGURE 5-3


ELEVATION METRES
500
490
480
470
DATUM ELEV
465.00
C1 DIVERSION
EXISTING GROUND
BERM TO PREVENT INADVERTENT ACCESS BY CARIBOU
CARAT LAKE
PIT OUTLINE
0+000 0+040 0+080 0+120 0+160 0+200 0+240 0+280 0+320 0+360 0+400 0+440 0+480 0+520 0+560 0+600 0+640 0+680 0+720 0+760 0+800 0+840 0+880 0+920 0+960
VERTICAL EXAGGERATION x 5
(EXCEPT FOR PIT WALLS)
SECTION THOUGH PIT AREA
55m±
SETBACK DEPENDS ON STABILITY OF PIT WALL
~2m
RIPRAP
10m
26°
15°
PIT
10m
45°
TILL
BEDROCK
BERM DETAIL
NOT TO SCALE
SRK Consulting
Engineers and Scientists
TAHERA CORPORATION
JERICHO PROJECT
SECTION THROUGH PIT AT CLOSURE
PROJECT NO.
1CT004.06
DATE
April 2004
APPROVED
DRAWING
5-4

Approximately 7 million m^3 of water will be required to fill the pit. Runoff, precipitation, and melt water will not exit the pit until it is filled. The pit will form a deep, relatively small lake. Some shallows will be present near the lip of the pit, especially where the access ramp enters. Once the pit is filled, water will flow out and into Carat Lake. Pit water quality estimates on closure were provided by SRK (2003) in Technical Memorandum F and re-examined taking into account probable partial freeze back in a subsequent memorandum (SRK 2004a, Appendix B).

An alternative to allowing the pit to flood would be to backfill with waste rock. This alternative was examined and rejected on economic and practical grounds. Cost to backfill the pit would be approximately $2 per tonne; total cost $16 million plus mobilization / demobilization. Backfill could not occur until the end of mining in Year 7. At that time much of the mass of waste rock dumps is expected to be infiltrated by permafrost. Any use of this rock would require re-blasting, which would further raise costs. Finally, because there would be void spaces in the backfilled rock, only about two thirds of the 13 million tonnes of waste rock could be backfilled into the pit without overtopping the pit rim. Any runoff water from the pit would require treatment for some years after pit backfill to reduce ammonia levels to acceptable discharge concentrations. This alternative approach to reclaiming the pit would make mining the deposit uneconomic and also increase, rather than decrease, environmental impacts.

5.5.2.2 Exploration Portal

The existing exploration portal (Figure 5-1) will not be removed by open pit development. Therefore, on mine closure, the portal will be sealed with concrete a per requirements of the *Northwest Territories Mine Health and Safety Act and Regulations*.

5.5.2.3 Post-Closure Water Management

It is estimated that the pit will take between 15 and 20 years to fill, which should allow ample time for flushing and removal of any residual blasting residues from the dumps. Freeze back of the dumps is also expected to occur in the first few years following deposition, which will reduce the exposed surface area and therefore available loading from the rock. During this period, flows to Stream C1 will be maintained to ensure this area remains acceptable for fish habitat.

Current estimates of long-term water quality using the conservative assumptions discussed in SRK Technical Memorandum Q (SRK 2004a, Appendix B) indicate that the pit lake may not meet CCME guidelines for freshwater aquatic life. Monitoring of seepage and runoff during operations and the post closure filling period will result in improved estimates of long term water quality.

If the updated estimates indicate the pit water will meet CCME guidelines for freshwater aquatic life or can be demonstrated to have negligible impacts on aquatic life, the pit will be allowed to spill into the original Stream C1 channel, and Stream C1 will be redirected into the pit. If the revised estimates indicate the pit will not meet CCME guidelines, but could be discharged without significant impacts to the shore of Carat Lake, it will be discharged via a constructed channel to the northeast of Stream C1. The location will be determined when the need is identified and in consultation with regulators. In the unlikely event that the pit water quality would be unacceptable for discharge, contingency measures such as in-pit biological treatment could be used to reduce concentrations to acceptable levels for discharge (SRK 2004b, Appendix C). Current estimates of post-closure concentrations in the pit discharges are presented in Table 5-2.

Table 5-2: Post-Closure Estimates of Pit Water Quality

	Discharge Scenario	TDS mg/L	TSS	Alk	Ca	Cl	K	Mg	Na	SO4	TAl* mg/L
1	Discharge from Pit Lake without Stream C1	372	2	16	38	161	13	62	8	70	0.15
2	Long-term Discharge from Pit Lake with Stream C1 redirected to pit.	231	2	14	24	96	8	37	5	42	0.13
	CCME Aquatic Life Guidelines	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*0.1*
	Health Canada Guidelines	*500*	*na*	*na*	*na*	*250*	*na*	*na*	*na*	*500*	*0.1*
	Carat Lake Baseline Data	*11*	*1.4*	*4.7*	*2.3*	*3.4*	*2.0*	*0.8*	*2.0*	*1.2*	*0.052*

	Discharge Scenario	TAs mg/L	TCd mg/L	TCr mg/L	TCu mg/L	TFe* mg/L	TMo mg/L	TNi mg/L	TPb mg/L	TU mg/L	TZn mg/L
1	Discharge from Pit Lake without Stream C1	0.0005	0.0003	0.0017	0.009	0.20	0.032	0.015	0.0020	0.063	0.006
2	Long-term Discharge from Pit Lake with Stream C1 redirected to pit.	0.0004	0.0002	0.0012	0.007	0.24	0.019	0.009	0.0013	0.038	0.004
	CCME Aquatic Life Guidelines	*0.005*	*1.7E-05*	*0.0089*	*0.002*	*0.3*	*0.073*	*0.025*	*0.001*	*na*	*0.03*
	Health Canada Guidelines	*0.025*	*0.005*	*0.05*	*1.0*	*0.3*	*na*	*na*	*0.01*	*0.02*	*5*
	Carat Lake Baseline Data	*0.00016*	*0.00005*	*0.0025*	*0.0020*	*0.025*	*0.00005*	*0.0005*	*0.00005*	*0.00020*	*0.0020*

Notes:

Assumptions and Calculations are provided in SRK (2004a)

1 Assumes all sources of water entering the pit have reached post-closure water quality by the start of filling
2 Reflects mixed water quality in the pit in the long term, once steady-state mixing has been reached (approximately 30 years after pit is filled)

Tahera has 8 years during operation to establish expected end-pit water quality, and 15 to 20 years following closure to work out appropriate mitigation before discharge to Carat lake is required.

5.5.3 PKCA

During operation, the PKCA will be progressively filled from east to west (Site Water Management Plan, SRK 2004c). As areas are filled to design height, they will be covered by a 0.3 to 0.5 m layer of coarse kimberlite to act as a filter for runoff and to improve drainage characteristics of the cap. Coarse kimberlite will be taken from the stockpile for reclamation. The plant front end loader and dump truck will be used for this operation. Once the coarse kimberlite buffer is placed, one of three scenarios will follow:

1. If vegetation trials indicate vegetation can be successfully established on the coarse kimberlite, finished areas will be revegetated. Ekati Diamond Mine™ has had some success at planting directly onto dried fine kimberlite in the mine's PKC and, pursuant to further favourable results, PKCA beaches at Jericho will be treated the same way, i.e., by direct planting on the dry beaches. In 2004 there was some question about the long-term suitability of PK as a growth medium.
2. If vegetation trials indicate overburden promotes successful revegetation, areas will be top dressed with up to 0.3 m of overburden from the overburden stockpile. This will occur in either winter or summer, depending on the driving conditions on the cell.
3. If vegetation cannot be demonstrated to establish successfully, PKCA finished areas will be covered with coarse kimberlite and run-of-mine rock to retard erosion and to provide perching areas for rodents and birds.
4. Revegetation, as indicated from reclamation trials, will take place either in the spring or fall, depending on timing of completion of the overburden placement. Organic overburden will be retained for reclamation of the PKCA as this facility has the best chance of successful revegetation. The proposed facility will occupy a shallow valley, where water naturally collects (a lake and meadows presently occupy the site) and therefore, with the proposed impermeable east and west embankments, can be expected to provide a moist microhabitat for plant growth after closure and reclamation.

5.5.4 Coarse Kimberlite and Recover Plant Rejects Stockpiles

The remainder of the coarse kimberlite and recovery plant reject stockpiles not used for reclamation will be sloped to 26° and covered with up to 0.3 m of overburden to prevent dust generation from fines should dusting become problematic (not expected since coarse rejects are thoroughly washed in the processing plant). A small amount of runoff may occur in the spring when the stockpile surface is frozen. A shallow ditch will be constructed on the down slope side of the stockpile to retard export of sediment overland in the initial years after reclamation and prior to surface consolidation. Monitoring will continue at the site through this time allowing sediment removal from ditches if required.

5.5.5 North Ore Stockpile Pad

The ore stockpile pad will be scarified and revegetated if success is indicated from reclamation trials. Overburden will be added to the perimeter of the pad, if reclamation trials indicate probable plant growth success.

5.5.6 Mine and Access Roads

When no longer required, mine and access roads will be scarified or ripped and possibly revegetated (as discussed above). Road edges will be graded off to form a gentle slope, yet minimize additional disturbance of tundra. The road between the camp and the airstrip will be left in a stable condition until final closure and may be left un-reclaimed at final closure, if requested by a government agency or by a third party who agreed to assume responsibility for its maintenance.

5.5.7 Sediment Ponds, Berms and Ditches

On closure, all mine drainage will be directed to the open pit and sediment ponds, berms and ditches no longer required will be reclaimed. Ditches will be stabilized where they pass through overburden; ditch portions in bedrock will remain as constructed. To the greatest extent possible, ditches will be altered to return drainage to pre-disturbance conditions. For pre-mining areas draining to Lake C1, this would pre-suppose runoff meets CCME guidelines; otherside, water would be directed to the open pit. Prior to levelling, any sediment in ponds would be removed and placed on one of the dumps, then covered with waste rock or overburden to retard wind or water erosion. Conceptually, all dikes and berms would be flattened and revegetated. Any remnant of berms or pond dikes left after resloping would be stabilized and revegetated, assuming reclamation trials suggest probable success.

5.5.8 Borrow Areas

Any borrow areas active to the end of mine life will be reclaimed and revegetated as discussed above. Some borrow material may be required for final reclamation and thus this borrow area would be one of the last sites to be reclaimed and revegetated.

5.5.9 Airstrip

The airstrip will be scarified or ripped and vegetated when no longer required, pursuant to probable success as shown in reclamation trials. However, the strip will be left for others to use, if requested by government agencies or by a third party willing to assume the airstrip land lease. The airstrip will be kept open until final closure for use by Tahera Diamond Corporation reclamation personnel.

5.5.10 Infrastructure

Infrastructure at mine closure will include:

- portal to the underground access ramp;
- vent raise (if outside the pit);
- the accommodation and mine office;
- the fuel farm;
- the explosives magazines;
- truck shop;
- the laydown areas;
- the landfill; and
- the landfarm.

Infrastructure associated with explosives (emulsion plant, ammonium nitrate storage, explosives truck shop) will be removed and the areas reclaimed/revegetated at the end of the mining phase.

Upon closure infrastructure will be removed and the site graded. The portal, and vent raise will be sealed. All buildings will be torn down. If acceptable to permitting authorities, building scrap will be placed on the edge of the waste dumps and covered during final resloping efforts. If not, buildings will be removed from the site (considered the base case for costing). Foundations will be covered with soil. The fuel farm tanks will be emptied into tanker trucks, disassembled and removed, as will all warehousing and trailers. At least part of the exploration camp will be maintained for post closure activities accommodation. Tents can be air freighted from the site at abandonment. The explosives magazine trailers (likely steel bulk shipping containers) will be removed. Pipes will be removed from the water intake causeway and buried. The causeway will be left in place. Non-salvageable scrap metal left at closure will also be placed in the waste dumps and covered, or removed from the site as per buildings. Any supplies, such as ammonium nitrate, will be removed at the time the emulsion plant building is removed. All necessary removal of infrastructure will take place the first winter of final closure, thus obviating the necessity of constructing the winter road beyond the end of mine life plus one year.

All mine-related mobile equipment will be trucked out on the winter road the first opportunity after completion. Since the equipment will belong to the mine contractors, this will be the contractor's responsibility. Tahera Diamond Corporation, as holder of the land leases for the site, will however retain ultimate responsibility for removal of equipment from Jericho.

All pads used for buildings will be scarified and possibly revegetated as previously discussed.

Most of the mine camp, including trailer modules will be removed on final closure. Portable housing, such as tents which can be flown off site by aircraft, will be used by reclamation crews once buildings are removed. Alternately, if a third party agrees to assume the land lease for the camp, the applicable part of the mine camp will be retained and signed over to the third party assuming the land lease.

5.5.11 Soils Testing

Any soils suspected of being contaminated (stained) with petroleum hydrocarbons, and not previously remediated, will be tested and those not meeting criteria for industrial purposes in place at the time of mine closure will be remediated. Remediation will preferably be done on site, e.g., by land farming, but may be done off site, in which case soils would be transported off site by truck during the first year after mine closure, or later by aircraft if required. The success of land farming will be investigated during mine life and treatment on closure will be based on this investigation. Any spills in areas where additional routine spills are unlikely to occur will be decontaminated prior to end of active mining.

6.0 MINE ABANDONMENT

Mine abandonment refers to the stage at which all reclamation activities aimed at rehabilitation and stabilization have been completed, all infrastructure removed (or transferred to third parties to manage and the only activity is post closure monitoring.

Site layout at closure is provided in Appendix A. The objectives of the abandonment plan are as follows:

- show the abandonment condition of the mine site;
- show the final drainage plan; and
- provide the monitoring plan after abandonment.

6.1 Infrastructure

Infrastructure remaining at abandonment will depend on the intended use of the site. Assuming complete closure, all buildings will have been removed, all roads and the airstrip rehabilitated and permanently stabilized against erosion. At the election of Transport Canada, or other government agency, the airstrip may be left intact, likely with removal of the landing lights and associated cabling. The generator and airstrip outbuilding will be removed. The airstrip will only remain if the federal land lease for the airstrip can be terminated by Tahera while leaving an un-reclaimed airstrip.

6.2 Drainage Controls

Natural drainage patterns will be re-established at closure to the extent possible. At abandonment all drainage systems will be confirmed to be stable. The Stream C1 diversion channel will remain intact to ensure the lower end of the stream does not dewater. The diversion dike will be stabilized for long-term maintenance-free operation either by having sufficient vegetation established during its lifetime, or more likely given climatic conditions, by additional armouring with rip rap. Mine area runoff water will be directed to the open pit.

6.3 Sedimentation Ponds

Sedimentation ponds will be removed on closure and all water directed to the pit until CCME guidelines attainment is demonstrated to the satisfaction of regulators. Reclamation of sedimentation ponds will consist of berm removal (by spreading soil used in their construction and removing any liners, if present) and pond surface revegetation as indicated from reclamation trials.

6.4 Land Use at Abandonment

6.4.1 Wildlife Habitat

Disturbed areas, other than mesic and moist soil microhabitats will only very slowly revegetate. Wildlife habitat lost to create dumps, pads, and roads will regain pre-disturbance productivity at the same rate as vegetation returns. Every practical effort will be made to accelerate this process as previously discussed. Upon successful establishment of vegetation, wildlife habitat in these areas should return to pre-mining conditions. The area is currently used by a number of wildlife species discussed in the Jericho Final EIS. Caribou, muskox, carnivores, small mammals (ground squirrels, lemmings, and voles) and birds (passerines, raptors, waterfowl, and upland game birds) use the site to some extent. The dumps may be used by raptors as lookout perches for prey. Ground squirrels are known to den in natural piles of rock and may use crevices in dumps as burrows where adjacent vegetated areas can provide forage. Tops of dumps will be used by birds, small mammals, and carnivores for foraging. The open pit will be flooded and the area of the pit would be permanently lost as terrestrial wildlife habitat.

6.4.2 Fish Habitat

Based on pre-operations modelling, the filled open pit is predicted to have water quality that does not meet 2004 CCME criteria for the protection of aquatic life. Therefore current plans call for use of the pit as a treatment facility and not as fish habitat. Should water quality be found to be suitable upon pit filling, it could potentially serve as fish habitat. Under this latter scenario, once the pit fills and water once again flows in the pre-mining Stream C1 channel, fish will have access to the filled open pit, which will form a small lake. The lake will be deep (approximately 180 m), but will have narrow shallow margins around the edge and a somewhat larger shallow area where the pit access road slopes into the pit (shallow area estimated to be 4800 m^2. The pit lake will follow a primary succession sequence and thus will remain devoid of rooted aquatic vegetation for a considerable length of time. Food chains will consist of freshwater bacteria, phytoplankton, zooplankton, and possibly fish, if they access the pit lake. Diatoms and periphyton (attached algae) will colonize shallow rock surfaces readily and will provide food for grazing macrobenthos once these organisms invade the pit lake. Fish-eating birds will forage for fish, should they invade the pit lake, or result from fertile fish eggs carried into the pit lake by birds. The pit lake will not likely provide suitable spawning habitat for Arctic char or lake trout; grayling would spawn in the inlet stream. The lake will likely remain permanently oligotrophic, similar to Carat and other lakes in the area.

6.4.3 Recreation

There will be no recreational opportunities at the Jericho site, unless people chose to fish at Carat Lake (unlikely given the lack of access and proximity to Contwoyto Lake, which supports large game fish). However, should a guide-outfitter decide to make use of the site, some of the site facilities could be used for recreational purposes, such as hunting and fishing (the latter likely at Contwoyto Lake, since Carat Lake is too small to support sustained sport fishing). Since caribou frequent the site occasionally in large numbers; wildlife photography could also be promoted.

6.5 Monitoring After Abandonment

Monitoring after mine closure will be in two phases:

- immediately post closure, until Tahera is assured long-term facilities, such as waste rock dumps and the C1 stream diversion are stable; revegetation success will also be monitored during this period; and
- longer-term monitoring of water quality to ensure the predicted return to receiving environment guidelines from site runoff and maintenance of receiving environment water quality is achieved.

6.5.1 Post Closure Monitoring

During this period immediately after mine closure, sedimentation ponds, berms, and outfall (if required) will be maintained. Water quality will be monitored monthly as indicated below for parameters controlled by the Jericho Project Water Licence in place at the time of closure.

Rock dumps and infrastructure associated with the Stream C1 diversion will be inspected on closure by a qualified geotechnical engineer for stability and their report recommendations implemented.

Seven water quality sites are proposed for monitoring and are shown on Figure 6-1:

- Lake C1 at its outlet;
- Stream C1 at its mouth;
- Lake C3 at its southern (principal inlet);
- Carat Lake at its inlet;
- Carat Lake at its outlet;
- Jericho Lake at its inlet;
- Jericho River on Inuit owned land.

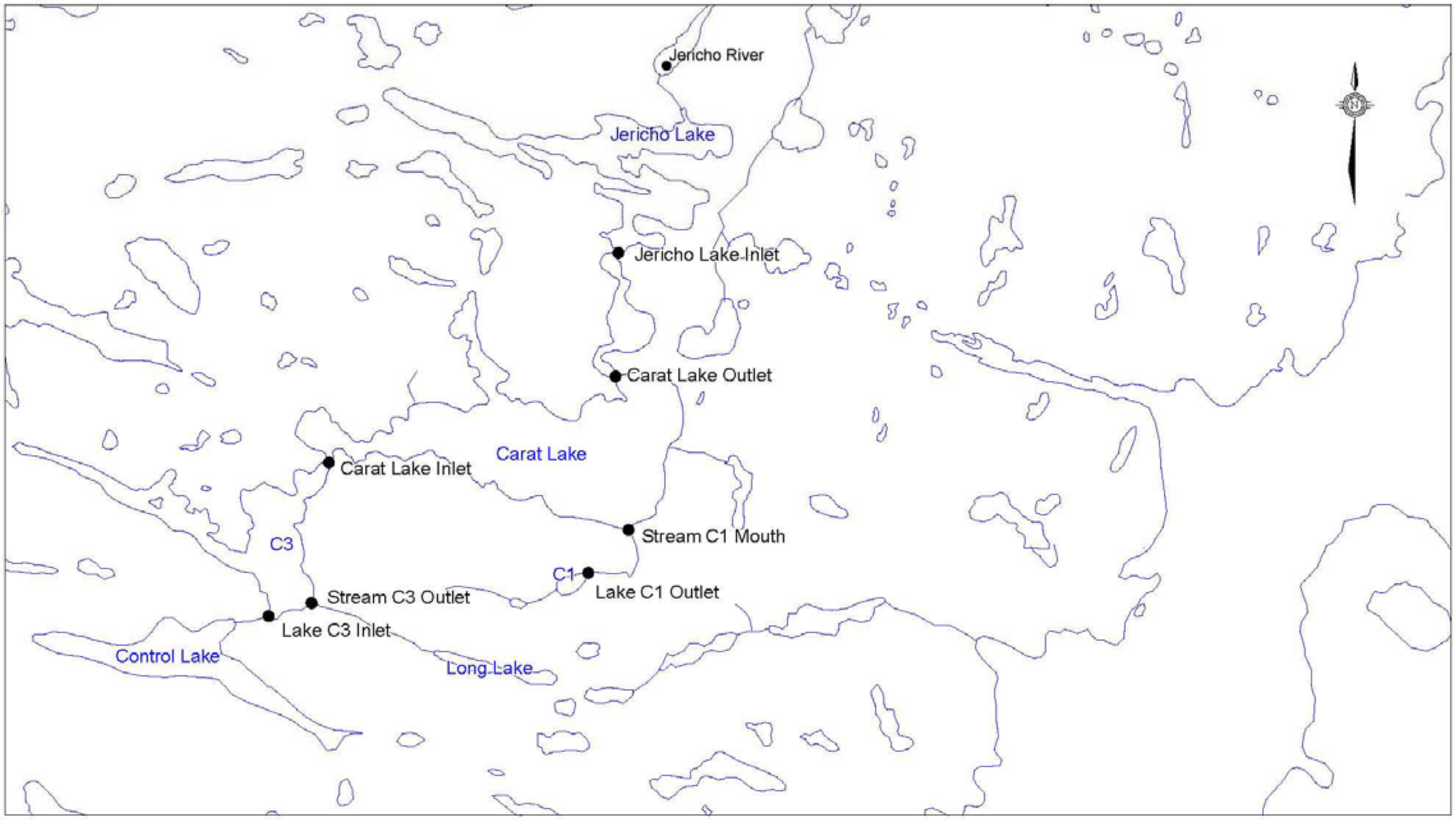
Monitoring will be monthly during the open water period (July, August, September) and once during late winter/early spring (April). Depending on results of the aquatic effects monitoring program for the mine, additional aquatic monitoring, such as for periphyton growth, etc. may be warranted.

6.5.2 Post Abandonment Monitoring

Post abandonment monitoring will be continued until Nunavut Water Board agrees to cessation. For mines without an acid generation problem, monitoring for a five-year period after closure is typical; each mine is judged on its own merits however. Monitoring will include annual visual inspection of rock dumps and the Stream C1 diversion as well as the seven water quality monitoring sites sampled once annually in mid to late summer.

Biological monitoring will not be continued unless indicated by runoff water quality. The trigger to cease biological monitoring will be runoff water quality from the site (as determined by grab samples during spring from ephemeral stream sites near waste rock dumps) achieving receiving environment guidelines or better.

Once the open pit is close to filling, water quality will be determined plans finalized for discharge of the water either in Stream C1 or an open channel, as previously discussed.



Tahera Corporation	
	FIGURE 6.1
Date:02/10/2000	Aquatic Monitoring Sites
Author:	
Office: North Vancouver	
Drawing:	
	Projection: UTM Zone 12 (NAD 27 for Canada)

7.0 AESTHETICS

Tahera will address, to the extent practical, the issue of aesthetics on closure. To maintain topographic consistency, the stockpiles have been designed so that their height does not exceed the height of surrounding landforms. All removable infrastructure will be taken off site or buried. No scrap will be left; it will be burned, buried, or taken away. All areas that can be practically revegetated will be. All remaining stained soils will be scraped up and remediated or removed from site. Evidence of past mining will still remain however. It will not be practical to level the waste rock dumps (two planned) nor to completely refill the open pit prior to final abandonment. Waste rock dumps will be approximately the same elevation as the lower of the surrounding hills. The small diversion around Stream C1 will be required to ensure the bottom 100 m of the stream does not dewater and thus potentially harmfully alter fish habitat. The site will slowly green up, but such processes take decades on the Arctic tundra and therefore, bare rock and soil will be visible for many years after mining. However, a significant portion of the site prior to mining is lichen-covered rock.

The probable aesthetics of the reclaimed and abandoned mine site must, however, be viewed in the context of the setting. The Jericho Project is in a remote location with access limited to snowmobiles in the winter and aircraft year round. Prior to exploration activity in the early 90's, people did not use the site to any significant extent. This is evidenced by archaeological studies and the completely undisturbed state of the site when exploration commenced. Further, the site was not visited casually by anyone not connected to mining activities throughout the period from 1992 (when exploration commenced until the present time). Finally, the site is relatively small (a total of 177 ha disturbed by mining) in the context of the vastness of the Arctic.

8.0 COST

A detailed discussion of costs is provided in Appendix D (which see).

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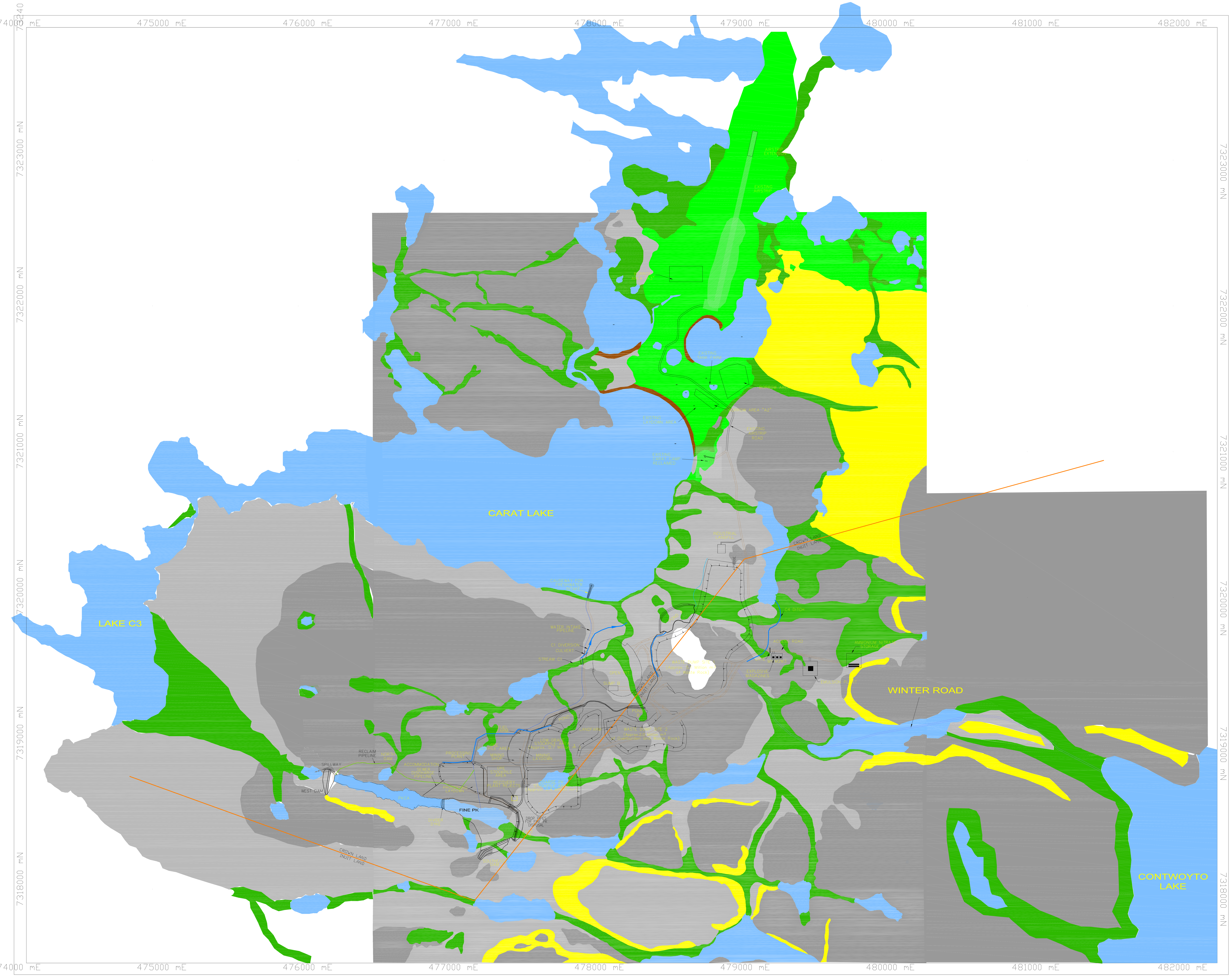
APPENDICES

APPENDIX A

MAPS



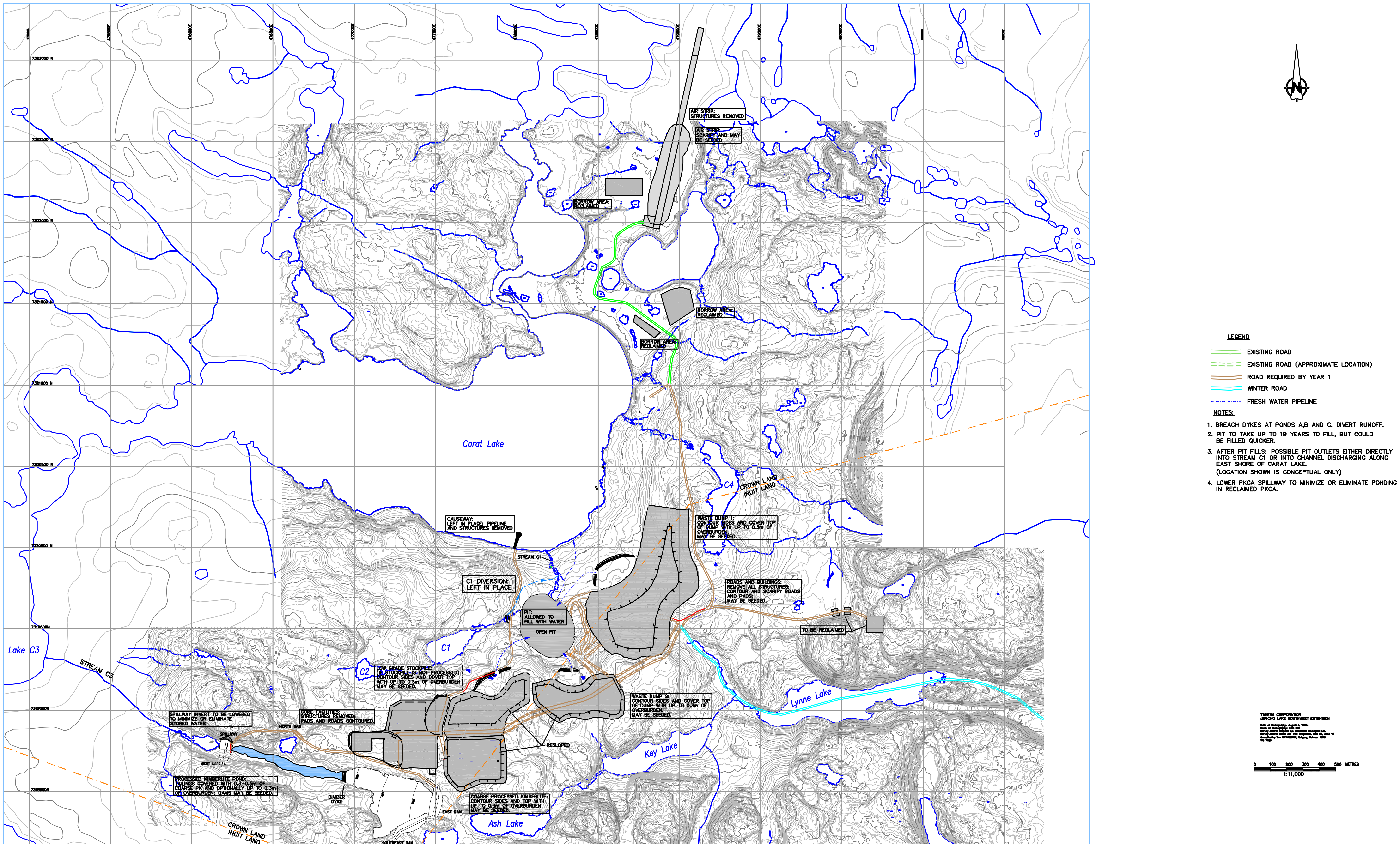
	Rock Tundra Dry Rock Tundra		Land Tundra Dry Barren Land Tundra
	Water Water		Wet Grass Wet Grass and Birch Meadows
	Cliff Cliff/Rocky Hill		Esker Esker/Kame Delta
	Birch Birch Brush		Beach Beach Shorline

Tahera Corporation

Map C
Ecological Zones Around
Jericho Project Site

Date:27/4/2000
Author: MJ
Office: VAN
Drawing:
Scale: 1:10,000
Projection: UTM Zone 12 (NAD 27)

150 0 150 300
metres



NOTES:

1. BREACH DYKES AT PONDS A,B AND C. DIVERT RUNOFF.
2. PIT TO TAKE UP TO 19 YEARS TO FILL, BUT COULD BE FILLED QUICKER.
3. AFTER PIT FILLS: POSSIBLE PIT OUTLETS EITHER DIRECTLY INTO STREAM C1 OR INTO CHANNEL DISCHARGING ALONG EAST SHORE OF CARAT LAKE. (LOCATION SHOWN IS CONCEPTUAL ONLY)
4. LOWER PKCA SPILLWAY TO MINIMIZE OR ELIMINATE PONDING IN RECLAIMED PKCA.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	
DRAWING G-9	AMMONIUM NITRATE STORAGE LAYOUT		
DRAWING G-8	BORROW AREAS PLAN & SECTION		
DRAWING G-7	TERRAIN EVALUATION MAP		
DRAWING G-6	BEDROCK GEOLOGY MAP		
DRAWING G-5	QUATERNARY GEOLOGY MAP		
DRAWING G-4	EXISTING THERMISTOR INSTALLATION PLAN	DRAWING G-13	GENERAL ARRANGEMENT APRIL 2013
DRAWING G-3	SITE INVESTIGATION MAP	DRAWING G-12	GENERAL ARRANGEMENT APRIL 2008
DRAWING G-2	SITE VICINITY MAP	DRAWING G-11	GENERAL ARRANGEMENT APRIL 2007
DRAWING G-1	PROJECT LOCATION AND DRAWING INDEX	DRAWING G-10	GENERAL ARRANGEMENT APRIL 2006

REFERENCE DRAWINGS

No.	DESCRIPTION	CHK'D	APP'D	DATE

REVISIONS

REV.	ISSUE PURPOSE	AUTH. BY	DATE
A	WATER LICENSE APPLICATION	CCS	JULY 2004

ISSUE AUTHORIZATION

WATER LICENSE APPLICATION

SRK Consulting
Engineers and Scientists

DESIGNED BY: CCS	DRAWN BY: JM
DATE: JULY 2004	DATE: JULY. 2004
CHECKED BY: CCS	DISCIP. ENGR.
DATE: JULY 2004	DATE:
PROJ. MGR:	PROJ. ENGR.
DATE	DATE

SRK PROJECT NUMBER: 1CT004.06

Tahera Corporation

JERICHO PROJECT

DRAFT

CLOSURE CONCEPTS FOR WATER MANAGEMENT AT END OF DECEMBER 2014

DRAWING NUMBER: 1CT004.06 – G14

REV. A

FILE NAME: P:\Tahera Corp (Lytton minerals)\Mapping and Drawings-2004 dwgs\general-figures(2004)\figure6A-year1

APPENDIX B

SRK May 2004 Closure Pit WQ Memo

SRK Consulting
Engineers and Scientists

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Tel: 604.681.4196
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Memo

To:	Greg Missal, Tahera Corporation	**Date:**	May 6, 2004
cc:	Rick Pattenden, Mainstream Aquatics	**From:**	Kelly Sexsmith
Subject:	Technical Memorandum Q: Post Closure Pit Lake Quality	**Project #:**	1CT004.06

SRK Consulting has completed additional calculations to demonstrate the potential effects of partial freezing of the dumps on the long-term water quality in the pit lake. The results were used to assess the suitability of using the pit lake for fish habitat and to support negotiations with the Department of Fisheries and Oceans (DFO) for the habitat compensation plan for the Jericho project.

The assessment is based on the mine plans, data and calculations presented in the EIS (Tahera, 2003) and supplemental information provided to the Nunavut Impact Review Board by Tahera, AMEC and SRK Consulting in October 2003. Minor changes in the final design of the waste rock dumps and water management facilities have also been considered.

The first part of Table 1 provides a summary of the operational and revised post-closure estimates of water quality for each source of water that will be directed to the pit during closure, i.e. Ponds A, B, and C, runoff from the pit. Key assumptions were as follows:

- The operational water quality estimates were derived following the methods described in Technical Memorandums F and I (SRK 2003). These estimates were updated to account for minor changes in the design of the waste and water management facilities, which will be documented in the Water Licence Application.
- Post-closure TDS and metal concentrations were assumed to be 3x lower than estimates for the operations period due to an approximately 2/3 freeze back of the dumps and stockpiles, resulting in removal of 2/3 of the pile from interaction with infiltration and runoff.
- Post-closure concentrations of total aluminum and total iron were assumed to approach dissolved values due to high residence times in the pit.
- Post-closure concentrations in Pond C were further reduced to account for depletion of the North and Central Lobe Stockpiles at the end of the mine life.

Further concentration reductions resulting from depletion of soluble minerals have not been considered in this analysis because the magnitude of decrease cannot be reliably predicted. However, these processes are expected to result in further reduction of many of the components.

The second part of Table 1 presents initial and revised estimates of water quality in the pit lake:

- Estimate 1 is the revised estimate from the updated water and load balance (SRK 2004, *in preparation*).

- Estimate 2 assumes water in the pit would be a mixture comprised entirely of sources that have reached a post-closure condition, which would apply after freeze back has occurred in the dumps. The Stream C1 Diversion would be maintained and Stream C1 would not enter the pit.

- Estimate 3 also assumes all of the sources will have reached post-closure water quality, but that Stream C1 would be returned to the pit once the pit reaches the spill point. Due to the large volume of water in the pit, it would take approximately 30 years after the pit lake reaches the spill point to approach these steady-state mixing concentrations (Figure 1).

Estimates of nutrient concentrations have been excluded from this presentation, but are expected to reach background levels by the time the pit lake reaches the spill point.

These estimates suggest that concentrations of several parameters could exceed the CCME guidelines for protection of aquatic life or Health Canada guidelines for drinking water quality. While these guidelines do not necessarily indicate that fish would be adversely affected by the pit water quality, they suggest that it may not provide appropriate conditions for the long-term health of fish that may colonize this area.

Regular monitoring of seepage and runoff from the waste rock and low-grade ore stockpiles, throughout operations, and water quality in the pit during the 15 to 20 year filling period will be required to further refine these estimates. Due to the conservative nature of the water quality estimates, it is possible that the monitoring data may indicate improved water quality in the pit lake.

In conclusion, the current estimates of long-term water quality in the pit lake indicate that it may not meet CCME guidelines for the protection of aquatic life. Until the mine is in operation and there is additional monitoring data, further improvement of the accuracy of these estimates are not possible. Therefore, it would be advisable to eliminate the pit from potential habitat compensation alternatives at this time.

Please contact me if you have any questions regarding this assessment.

Yours truly,

Kelly Sexsmith
Senior Environmental Geochemist

Table 1 - Assessment of Pit Water Quality for Different Assumptions of Source Concentrations

Flows and Concentrations of Water Sources to the Open Pit

Source Concentrations	Source	Annual Flow	TDS mg/L	TSS	Alk	Ca*	Cl*	K	Mg*	Na	SO4	TAl* mg/L	TAs mg/L	TCd mg/L	TCr mg/L	TCu mg/L	TFe* mg/L	TMo mg/L	TNi mg/L	TPb mg/L	TU mg/L	TZn mg/L
Estimated Water Quality during	Pond A	126,668	529	5	41	133	86	23	63	31	144	0.19	0.0014	0.0005	0.0046	0.050	0.28	0.029	0.015	0.0042	0.24	0.021
Operations Period	Pond B	48,839	481	5	39	119	78	21	56	28	128	0.18	0.0013	0.0004	0.0041	0.045	0.27	0.026	0.014	0.0050	0.23	0.020
(from Revised Water and Load Balance)	Pond C	118,173	3176	9	89	161	1674	100	586	27	520	0.04	0.0027	0.0025	0.0084	0.0039	0.20	0.26	0.12	0.0065	0.11	0.022
	Pit Runoff	34,120	167	7	14	40	77	5	17	5	24	0.34	0.0004	0.0001	0.0059	0.0078	1.1	0.0047	0.070	0.0033	0.066	0.013
Estimated Water Quality	Pond A	126,668	176	2	14	44	29	8	21	10	48	0.06	0.0005	0.0002	0.0015	0.017	0.09	0.010	0.0051	0.0014	0.079	0.0072
Post-Closure Period	Pond B	48,839	160	2	13	40	26	7	19	9	43	0.06	0.0004	0.0001	0.0014	0.015	0.09	0.009	0.0046	0.0017	0.076	0.0066
(see *)	Pond C**	118,173	762	2	23	38	397	24	140	7	123	0.30	0.0007	0.0006	0.0020	0.0014	0.30	0.07	0.029	0.0032	0.052	0.0063
	Pit Runoff	34,120	56	2	5	13	26	2	6	2	8	0.112	0.00012	0.00004	0.0020	0.0026	0.37	0.002	0.023	0.0011	0.022	0.004
Baseline Data (average of 2003 Seeps)	Stream C1	224,045	24	2	12	2.8	0.5	2	1.2	0.70	1	0.093	0.00025	0.00005	0.0005	0.0034	0.31	6.5E-05	0.00073	0.00014	0.0010	0.0015

Water Quality in the Pit Lake

Contributing Sources	TDS mg/L	TSS	Alk	Ca	Cl	K	Mg	Na	SO4	TAl* mg/L	TAs mg/L	TCd mg/L	TCr mg/L	TCu mg/L	TFe* mg/L	TMo mg/L	TNi mg/L	TPb mg/L	TU mg/L	TZn mg/L
1 A+B+C+Pit sump (Revised Water and Load Balance)	**1081**	7	47	109	**467**	37	180	23	202	0.70	0.0015	0.0009	0.0048	0.027	0.81	0.092	0.043	0.0061	**0.18**	0.018
2 A+B+C+Pit Runoff - Revised Post closure estimates	372	2	16	38	161	13	62	8	70	0.15	0.0005	0.0003	0.0017	0.009	0.20	0.032	0.015	0.0020	**0.063**	0.006
3 A+B+C+Pit+Ice+Stream C1 (after steady state mixing is reached)	231	2	14	24	96	8	37	5	42	0.13	0.0004	0.0002	0.0012	0.007	0.24	0.019	0.009	0.0013	**0.038**	0.004
CCME Aquatic Life Guidelines	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*0.1*	*0.005*	*1.7E-05*	*0.0089*	*0.002*	*0.3*	*0.073*	*0.025*	*0.001*	*na*	*0.03*
Health Canada Guidelines	*500*	*na*	*na*	*na*	*250*	*na*	*na*	*na*	*500*	*0.1*	*0.025*	*0.005*	*0.05*	*1.0*	*0.3*	*na*	*na*	*0.01*	*0.02*	*5*
Carat Lake Baseline Data	*11*	*1.4*	*4.7*	*2.3*	*3.4*	*2.0*	*0.8*	*2.0*	*1.2*	*0.052*	*0.00016*	*0.00005*	*0.0025*	*0.0020*	*0.025*	*0.00005*	*0.0005*	*0.00005*	*0.00020*	*0.0020*

Notes:

* Post Closure Water Quality reflects a 3x reduction in TDS and metal conentrations,
which accounts for freeze back of 2/3 of the rock in the dumps and stockpiles
and dissolved source concentrations for aluminum and iron, reflecting the large retention times in the pit lake.
This reduction does not account for any reductions caused by flushing of the more soluble constituents from the pile.

** Post Closure water quality is further improved in Pond C due to depletion of the ore stockpiles.

1 Estimates from Revised Water and Load Balance, using source concentrations from operations, but post-closure flows

2 Assumes all sources of water entering the pit have reached post-closure water quality by the start of filling

3 Reflects mixed water quality in the pit in the long term, once steady-state mixing has been reached (approximately 30 years after pit is filled)

Yellow highlight indicates values exceed CCME criteria for Aquatic Life

Bold Bold indicates values meet CCME criteria, but exceed Health Canada guidelines for community water supplies.

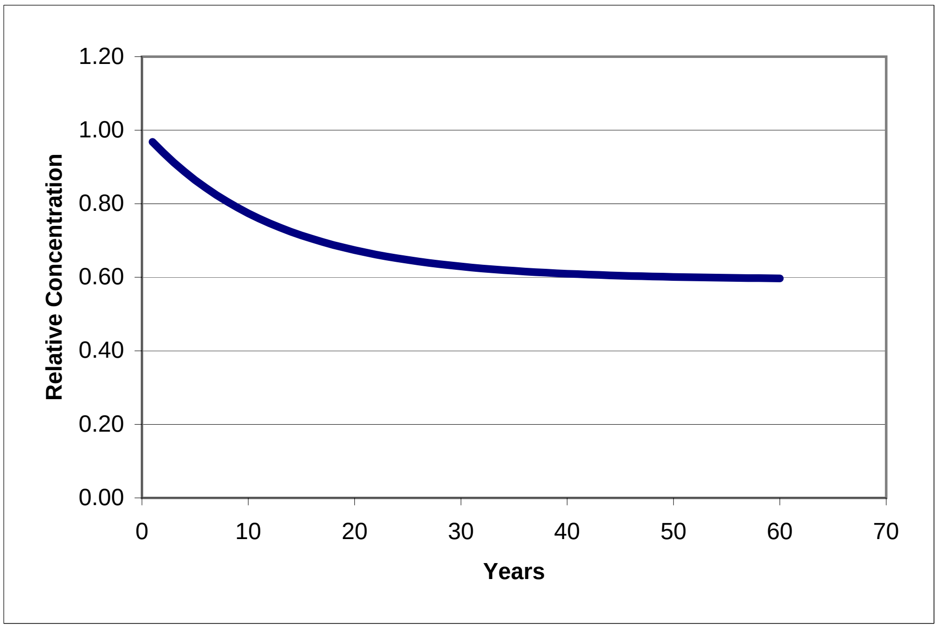

Figure 1 - Effect of diverting Stream C1 water into the pit lake, assuming Ponds A, B and C are also discharged to the pit. The pit lake and the collection pond discharges are assumed to be at a concentration of 1. Therefore, the maximum dilution within the pit from Stream C1 is approximately 60%

Appendix C

SRK Pit Water Treatment Memorandum

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Memorandum

To:	Project File	**Date:**	July 22, 2004
cc:	Kelly Sexsmith, SRK Cam Scott, SRK	**From:**	John Chapman
Subject:	Technical Memorandum R Jericho Post Closure Pit Lake Water Treatment	**Project #:**	1CT004.06

1 Introduction

1.1 Objectives

SRK Consulting has developed estimates of long-term post closure water quality in the Jericho Pit Lake (*Technical Memorandum Q: Post Closure Pit Lake Quality, SRK 2004, In: Abandonment and Restoration Plan, AMEC 2004)*. The current predictions suggest that concentrations of some contaminants may slightly exceed CCME guidelines for the protection of freshwater aquatic life. Given the proximity to the receiving environment, a contingency for post closure water quality management may be required to reduce contaminant concentrations in the pit lake to levels that are appropriate for discharge into Carat Lake.

The purpose of this memorandum is to provide "proof of concept" for use of an in-pit treatment system as a contingency to remove contaminants from the pit lake in the event water quality does not meet acceptable limits.

1.2 Background

Development of treatment strategies for water contained in pit lakes is dependant on site specific requirements. The evaluation and design of associated measures for treatment of the pit lakes should consider factors such as capacity, reliability, longevity, as well as monitoring and maintenance requirements.

Chemical treatment has a long track record. It is robust and reliable and is the technology of choice where the contaminant loads are high or there is no opportunity for experimentation. However, depending on the volume of water that has to be treated from a pit lake, the cost may be high. Biological treatment in some instances, where volumes are high and contaminant concentrations are low, have been shown to be cost effective and represent a viable alternative to conventional chemical treatment.

As discussed below, the current estimates of metal concentrations in the pit lake are within levels that may be treated with a biological treatment system. The intent would be to first revise the long-term estimates of pit water quality once actual seepage and runoff water quality data for the waste rock and pit wall runoff become available. If this data indicates that post-closure treatment may be required to meet discharge criteria, then verification would be completed during or shortly after operations cease, so that by the time the pit is flooded, the full scale system performance can be optimized. In the following sections, the likely performance of such a system is assessed and recommendations to verify the performance and develop specific design and implementation criteria are provided.

2 Biological Treatment Concept

A number of studies have been conducted on the use algae for the in-situ treatment of and pit lake water (Steinberg *et al.*, 2001; Pohler *et al.*, 2002; Poling *et al*., 2003). Typically, *in-situ* biological remediation involves the addition of nutrients to pit lakes to stimulate the growth of primary producers, mainly photosynthetic unicellular algae or phytoplankton. The algae remove metals from the top water layer through absorption and/or adsorption and eventual settling to the lake bottom where the decomposition of organic material creates biological oxygen demand that may in turn create suitable anoxic conditions for biological sulphate reduction (SRB). Under anoxic conditions, SRB can reduce sulphate to sulphide through a series of enzymatic reactions. The sulphide thus generated can form sulphide minerals with dissolved metals to reduce dissolved metal concentrations to very low levels. The cycling of iron from the sediment to the water column under anoxic conditions can also contribute to the co-precipitation of dissolved metals with Fe(III) oxy-hydroxide formed in the oxygenated zones of the pit lake.

Nutrient additions usually comprise phosphorous and nitrogen sources to stimulate phytoplankton growth. Nutrient additions to stimulate the growth of phytoplanktonic algae to promote dissolved metal removal have been successful at the Island Copper and at Landusky pit lakes (Adams, 2002). Successful results were also obtained from pilot-scale tests at Equity Silver mine (Martin *et al.*, 2003; Crusius *et al.*, 2003; McNee *et al.*, 2003). The growth of phytoplanktonic algae has also been stimulated by phosphorus addition at the Colomac Mine site within large contained areas exposed to ambient weather conditions (albeit that the primary purpose was ammonia removal), which demonstrated algae growth in a northern climate.

In a northern climate, heating by the sun causes the surface layer of water in a lake to warm up. The density of the warmer water in the surface layer is lower than the colder water at depth, resulting in a stratification of the lake during the summer months. It is this warmer surface layer of water that is productive. Phytoplanktonic growth would be supported to the depth of light penetration.

During fall, the surface water cools down to about 4 ^{o}C when it reaches its maximum density. This generally causes the now heavier water to sink to the bottom of the lake causing complete mixing of the lake. Typically lakes would also turn over in spring soon after ice-melt when the surface water temperature again approaches 4 ^{o}C.

In general, a similar sequence of events would be expected to occur in the pit lake. However, certain pit lakes may become permanently stratified if the water at depth is more saline, i.e. the water at depth consistently has a density that is higher than the surface water. The shape and depth of the pit lake, the thickness of the ice that forms during the winter and the energy of the flows into the pit lake are additional factors that will determine whether or not this condition, known as meromixis, would develop in the pit lake.

In the case of the Jericho pit lake, the post closure continuous flow through of water and the low salinity conditions would prevent the build-up of salinity and it is therefore unlikely that meromixis would develop. The kinetic energy input from the inflows would also promote mixing. Therefore, the water in the pit lake is likely to be mixed on a regular basis.

In concept, implementation of a biological treatment system in the Jericho pit lake in a post-closure situation would require that nutrients be dispersed throughout the productive surface layer of the pit lake throughout summer. This is generally done by discharging a liquid containing dissolved nutrients into the propeller wash of a small boat as it traverses the surface of the pit lake. The timing and the frequency of the nutrient additions would depend on the productivity and the rate of nutrient consumption to ensure that elevated nutrient concentrations are not released to the receiving environment.

In the next section, a brief assessment of the likely performance of biological treatment system is completed.

3 Application to Jericho Site

3.1 Site Conditions

The rate of growth of phytoplankton will depend on the depth of light penetration, solar radiation, the temperature in the surface layer, and, the availability of nutrients.

The water flowing into the pit is not expected to contain elevated levels of suspended solids, therefore light penetration is not expected to represent a constraint on phytoplankton growth. In the following sections, the climatic conditions at the site are compared to those at the Colomac site, where phytoplankton growth has successfully been demonstrated through nutrient additions.

3.1.1 Sunlight

Table 3-1 below compares the average sunshine hours for nearby meteorological stations, and the exposure profiles are shown in Figure 3-1. The Jericho site is located at a latitude of about 66^{o}N, and is therefore expected to have sunshine exposures similar to that of Kugluktuk of about 1,629 hours of sunshine per annum. The sunshine exposure for Colomac, at a latitude of 64^{o}N is expected to similar to that of Baker Lake, i.e. 1,843 hours per annum. Both Kugluktuk and Baker Lake had approximately 300 hours of sunshine during July and 200 hours of sunshine during August. Based on these comparisons, the Jericho and Colomac sunshine profiles, and peak sunshine hours are expected to be similar. Therefore, during these peak exposure months (June and July) primary production of phytoplankton at Jericho is expected to similar to that observed at the Colomac Site. While the overall annual exposure is lower, this is of no consequence since the difference occurs primarily in the fall and winter when no growth would be expected anyway.

Table 3-1
Total Bright Sunshine (hours)

Station	Latitude	Longitude	Annual
Baker Lake	64 18 N	96 05 W	1843
Kugluktuk (Coppermine A)	67 50 N	115 7 W	1629
Norman Wells A	65 17 N	126 48 W	1854
Yellowknife A	62 28 N	114 27 W	2277

(Source: Environment Canada 1951-1980 Climate Normals)

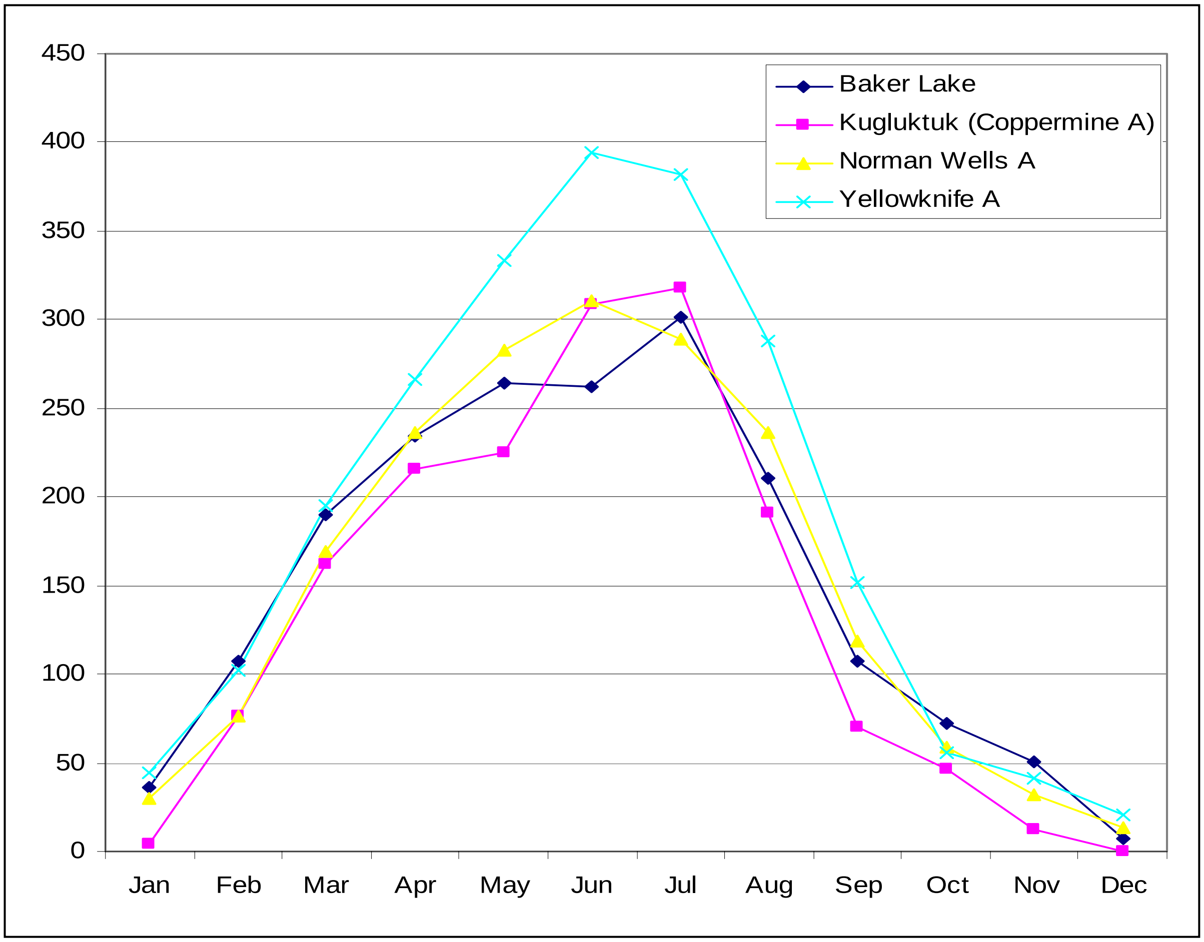

Figure 3-1 Average Annual Sunshine Profiles

3.1.2 Thermal Profile/Stratification

As discussed above, the solar radiation in the summer months is expected to be similar to that for the Colomac site. Therefore, the thermal stratification and peak temperatures are likely to be similar. At the Colomac Pit, thermal stratification occurs to a depth of about 5 meters, and the temperature increases to about 15 ^{o}C. (It should be noted that phytoplankton and metal removal occurs at temperatures as low as 4 ^{o}C at the Island Copper Pit Lake.)

It is therefore concluded that the climatic conditions at the site will be suitable for phytoplankton growth.

3.1.3 Nutrients

The treatment strategy requires that nutrients be added to the pit lake at concentrations that would stimulate phytoplankton growth. Baseline characterization of the receiving surface water quality indicated oligotrophic conditions (i.e. low nutrient conditions), which suggest that nutrient management within the pit lake will be key to the success of an in-situ treatment system.

3.2 Predicted Water Quality

Table 3-2 provides a summary of the initial estimates of key parameters for each source of water that will be directed to the pit lake. These comprise discharges from Ponds A, B, and C and runoff from the pit walls. The table includes the initial estimates of the pit water quality, as presented in Technical Memorandum F (SRK 2003), and revised estimates of pit water quality which consider the effects of partial freezing of the waste rock dumps (SRK 2004). The pit lake water quality, as shown in the second part of the table, represents estimated long-term steady state conditions. The long-term steady state concentrations are shown to indicate the effect of the net loadings to the pit lake, since it will be possible to remove most of the accumulated contaminants before discharge occurs.

Table 3-2
Assessment of Pit Water Quality for Different Assumptions of Source Concentrations

Flows and Concentrations of Water Sources to the Open Pit									
Source Concentrations	**Source**	**Annual Flow**	**T-Al mg/L**	**T-Cd mg/L**	**T-Cu mg/L**	**T-Fe mg/L**	**T-Pb mg/L**	**T-U mg/L**	**T-Zn mg/L**
Estimated Water Quality during Operations Period (from Revised Water and Load Balance)	Pond A	126,668	0.19	0.0005	0.050	0.28	0.0042	0.24	0.021
	Pond B	48,839	0.18	0.0004	0.045	0.27	0.0050	0.23	0.020
	Pond C	118,173	0.04	0.0025	0.0039	0.20	0.0065	0.11	0.022
	Pit Runoff	34,120	0.34	0.0001	0.0078	1.1	0.0033	0.066	0.013
Estimated Water Quality Post-Closure Period	Pond A	126,668	0.06	0.0002	0.017	0.09	0.0014	0.079	0.0072
	Pond B	48,839	0.06	0.0001	0.015	0.09	0.0017	0.076	0.0066
	Pond C	118,173	0.30	0.0006	0.0014	0.30	0.0032	0.052	0.0063
	Pit Runoff	34,120	0.112	0.00004	0.0026	0.37	0.0011	0.022	0.004
Baseline Data (avg. of 2003 Seeps)	Stream C1	224,045	0.093	0.00005	0.0034	0.31	0.00014	0.0010	0.0015
Predicted Water Quality in the Pit Lake									
Contributing Sources			**T-Al mg/L**	**T-Cd mg/L**	**T-Cu mg/L**	**T-Fe mg/L**	**T-Pb mg/L**	**T-U mg/L**	**T-Zn mg/L**
A+B+C+Pit+Ice+Stream C1 (at steady state)			0.13	0.0002	0.007	0.24	0.0013	0.038	0.004
CCME Aquatic Life Guidelines			*0.1*	*1.7E-05*	*0.002*	*0.3*	*0.001*	*na*	*0.03*
Health Canada Guidelines			*0.1*	*0.005*	*1.0*	*0.3*	*0.01*	*0.02*	*5*
Carat Lake Baseline Data			*0.052*	*0.00005*	*0.0020*	*0.025*	*0.00005*	*0.00020*	*0.0020*
Ratio of Pit Lake to CCME Aquatic Guidelines			*1.3*	*12*	*3.5*	*0.8*	*1.3*	*-*	*0.1*

Table 3-2 also provides a ratio of the estimated pit lake water quality to the CCME Guidelines for the protection of freshwater aquatic life. As shown, cadmium and copper are the primary contaminants of concern, whereas aluminium and lead may marginally exceed the guidelines. Iron and zinc would meet the CCME guidelines for the protection of freshwater aquatic life.

At neutral pH conditions, it is anticipated that the total aluminium is likely to be present as a suspended precipitate, which would in part be removed within the lake due to gravitational settlement. It is not expected to represent a concern in the downstream receiving environment. In the next section, the performance of a biological treatment system is estimated.

3.3 Biological Treatment Performance Assessment

In this section the Island Copper experience will be used to assess the potential performance that could be expected at the Jericho Pit Lake. The Island Copper in-situ pit lake treatment system for metals removal is a full scale system with several years of operational data that has been well documented. Although the Island Copper project is located at a latitude of only 51.7^{o}N, in the winter the site experiences significantly lower solar radiation and lower water temperatures than will be expected at the Jericho Pit Lake. Therefore, the Island Copper winter performance data can be used to provide a conservative indication of the potential performance at Jericho.

3.3.1 Contaminant Loading and Removal Rates

The metal concentrations and flows presented in Table 3-2 can be used to calculate specific loadings to the pit lake. The estimated contaminant loadings to the Jericho pit, calculated as grams per hectare of pit lake surface area per year, are shown in the first row in Table 3-3.

Table 3-3 also summarises the removal rates achieved at the Island Copper Mine (Poling et al. 2003). Note that the removal rates are given in units of g/ha/**day**, as opposed to the units of g/ha/**year** in which the loadings are reported. The annual average, winter (December to February) and summer (June to August) removal rates are shown. (Removal rates in test cells or limno corrals at the Equity Silver mine yielded similar rates of metal removal.) Typically the rate of removal at the Island Copper Mine decreases in the winter due to reduced sunshine and colder weather. In the winter, the surface water temperature in the Island Copper Pit Lake may decrease to below 5 ^{o}C. Apart from the latitude of the Island Copper site, the predominantly rainy winter (overcast) also limits solar radiation so that the winter conditions are significantly less conducive to phytoplankton growth than would be the case during the summer at the Jericho site. Therefore, estimating contaminant removals that may be achieved at Jericho using the winter rates observed at the Island Copper site will provide a conservative indication of the pit lake treatment performance.

The last row in Table 3-3 provides an estimate of the time that would be required to remove the annual metal loading from the Jericho Pit Lake, estimated from the Island Copper winter removal rates. As shown by the results, the cadmium removal would require the longest treatment time (at about 22 days). This would mean that 3 to 4 fertilizer applications spaced 10 days apart should be sufficient to achieve metal removals equivalent to the annual loadings.

Table 3-3
Estimated Contaminant Loadings and Removal Rates

Description	Units	T-Cd	T-Cu	T-Pb	T-Zn
Jericho Pit Lake Loadings	g/ha/year	6.6	227	41	145
Island Copper Removal rates					
Annual Average	g/ha/day	0.91	25	n/a	66
Low (Winter)	g/ha/day	0.30	18	n/a	40
High (Summer)	g/ha/day	1.6	37	n/a	160
Time to achieve removal (using winter rates from Island Copper)	Days	22	13	n/a	4

3.3.2 Retention Time

In the previous section it was shown that within a treatment period of less than 1 month it is possible to remove the equivalent of an entire years loading to the pit lake. The potential for contaminant release from the pit lake would depend on the retention time within the pit lake. Effectively, if the retention time exceeds the time required to treat the equivalent loading, the net release of contaminants would effectively be limited. On the other hand, if the retention time is much shorter than the treatment time, the risk for contaminant release will be significant.

The pit lake will have a total flooded volume of about 6.5 million m^3. For completely mixed conditions it can be shown that the retention time of the annual flow into the pit lake will be about 20 years. In the event that meromixis develops, the retention time in the surface layer would be approximately 1.5 years. In either event, the retention time significantly exceeds the treatment time indicating an insignificant risk for contaminant release.

3.3.3 Water Quality

The Island Copper Pit Lake metal loadings are significantly greater than those indicated for the Jericho Pit Lake (as can be inferred from the metal removal rates). The retention time of the surface layer in the Island Copper Pit Lake is approximately 1 year, compared to a more favourable minimum retention time of about 1.5 years at Jericho. Therefore metal concentrations at Jericho are expected to similar or lower than at Island Copper. At the Island Copper Pit Lake, copper concentrations are typically lowered from about 0.02 to 0.03 mg/L to less than 0.004 mg/L; lead from about 0.009 mg/L to less than 0.00005 mg/L; zinc from in excess of 5 mg/L to less than 0.002 mg/L; and cadmium from 0.03 mg/L to less than 0.001 to 0.002 mg/L. It should be noted that the surface water of the Island Copper Pit Lake is brackish, with a salinity of about 3 parts per thousand, because it is partially mixed with seawater. The resultant elevated chloride content, which strongly complexes cadmium and to a lesser extent copper and zinc, is limiting the extent of metal removal. In the case of the Jericho Pit Lake, chloride concentrations will be lower, and complexing reactions are not expected to affect metal removal. It is therefore likely that metal concentrations will be reduced below those observed for the Island Copper site.

Results from limno-corral tests conducted at the Equity Silver mine (McNee et al, 2003) indicated that copper decreased from about 0.005 mg/L to <0.001 mg/L and cadmium decreased from about 0.005 mg/L to < 0.0002 mg/L. Similar reductions in metal concentrations would be expected for the Jericho Pit Lake, which suggests that water quality approaching CCME guidelines may be achieved by in-situ biological treatment.

3.3.4 Fertilization and Nutrients

At the Island Copper Site, liquid fertilizer is applied at a frequency of about 10 days throughout the entire year. The program is designed to coincide with the phytoplankton growth cycle. Typically, dissolved otho-phosphate is maintained at less than 0.005 mg/L (as P) at the time of fertilization which decreases to less than 0.001 mg/L by the end of the 10 day fertilization cycle. Total nitrogen is maintained at less than 0.5 mg/L (as N).

It is anticipated that at Jericho, fertilization would be undertaken only during the ice free period and only for about 2 months of the year. The fertilization would be undertaken every 10 days during July and August, once the majority of the spring runoff has discharged from the pit, and the thermocline has established in the pit lake. A liquid fertilizer mix would be prepared, and dispensed from a small boat that would traverse the surface of the pit lake. The liquid fertilizer would be released to the propeller wash of the boat, which would disperse the fertilizer. Studies elsewhere have shown this to be an effective method of fertilizing. The volume of liquid fertilizer that would be added would be determined from the residual nutrient concentration in the surface layer, the composition of the fertilizer and the volume of the surface layer.

Discharges from the pit lake during the fertilization period would be minimal and could be controlled with an appropriate spillway design. Treated water would be released by gravity the following spring. Assuming nutrients levels would be maintained at level similar to those for the Island Copper Lake, nutrient levels are not expected to impact on the receiving environment, even though it is oligotrophic.

3.3.5 Conclusions

As discussed in the previous sections, biological in-situ treatment represents a feasible contingency in the event that unacceptable water quality results in the Jericho Pit Lake.

The technology and understanding of the metal removal processes is rapidly evolving and finding application elsewhere. However, at present, laboratory and field scale demonstration of the technology would be required to verify its application to the Jericho Pit. Considering the estimated time-scale to complete flooding of the pit lake (25 to 30 years), sufficient time is available to complete such a demonstration during or after operations. In the next section, recommendations for the demonstration in-situ biological treatment of the Jericho Pit Lake are provided.

4 Requirements for Demonstration

Water quality and flow monitoring during the first three to five years of operation will be required to refine the current estimates of long-term water quality in the pit lake, and therefore determine the need for the in-situ treatment. The demonstration program would be implemented if the refined predictions indicate that treatment is required.

As noted before, the technology is evolving rapidly and it will be necessary to stay abreast of developments through continued literature reviews. The following presents a program that would demonstrate the applicability of the technology to the Jericho site. However, adjustments may be required to accommodate future developments.

A program for the demonstration of the effectiveness of biological treatment as a contingency measure would comprise three phases as follows.

4.1 Phase I – Bench Scale Assessment

The objectives of the bench scale investigation address the following questions:

- Can phytoplankton blooms be established in water from the site (that would represent the estimated long term pit lake water quality)?
- What are the minimum nutrient requirements to initiate a phytoplankton bloom, and how frequently should fertilization occur to maintain phytoplankton growth?
- Will metal removal rates exceed metal loadings and will sufficiently low metal concentrations be achieved?

To address these objectives, it is recommended that a laboratory program be undertaken on site in large containers (20 to 200 L vessels) that are exposed to ambient solar radiation and that are maintained at a temperature equivalent to that which develops in the surface layer of the local lakes.

The vessels would be filled with seepage from the waste rock piles or simulated pit lake water, and fertilized with different concentrations of nutrients. The rate of phytoplankton growth, dissolved nutrient concentrations and contaminant concentrations would be monitored on a regular basis. Typically the tests would be completed over a 6 to 8 week period.

Typically this scale of testing provides good information on the nutrient demand and the rate of phytoplankton growth. However, metal removal rates and achievable water quality are more onerous to demonstrate at this scale due to the short duration of the tests.

Results from the phase of the program would be used to design a larger scale field test that would be undertaken in Phase II of the program.

4.2 Phase II – Field Scale Demonstration

The purpose of the field scale tests would be to provide large scale demonstration of metal removal rates and nutrient requirements. The larger scale would enable easy scale-up to a full-scale system. This phase of testing would follow the initial bench scale program.

Larger scale tests would then be undertaken to more accurately evaluate metal removal. The larger scale tests would comprise limno-corrals that would be established in the PKCA, water management pond or a local lake as soon as thermal stratification occurs. (Limno-corrals are simple open ended enclosures that comprise a circular vertical curtain suspended from a floatation ring to isolate a column of water from the surrounding water body. While the enclosure is open-ended at the base, isolation is achieved due to thermal stratification in the water body.) If the water quality in the waterbody does not reflect the pit lake water quality, the surface water layer within the limno-corral would be replaced with water at an appropriate quality. The surface layer would then be fertilized at a rate and schedule determined from the laboratory program. The water quality would be monitored to establish metal removal rates and terminal concentrations. The limno-corrals would also be equipped with sediment traps to verify the fate of the metals. Further testing would also be undertaken on the sediments to assess the potential for nutrient recycling.

4.3 Phase III – Full Scale Verification

The objectives of this phase of investigation would be to verify the results from the field scale demonstration and to treat the pit lake water so that it meets discharge criteria before reaching the spill point. This phase of the investigation would be undertaken during the flooding of the pit.

Once a sizeable water body has been established in the pit, it is recommended that the water quality profiling be undertaken on a regular basis to monitor the water quality and mixing regime of the pit lake. Since numerous seasons will be available before the water level reaches the spill elevation, it is recommended that intermittent fertilization programs be undertaken to verify metal removal and treated water quality. At this time, nutrient recycle rates can also be established to ensure that over-fertilization does not occur once full scale flow-through operations commence.

5 Conclusions and Recommendations

The evaluation of in-situ biological treatment as a contingency treatment process for the Jericho Pit Lake after closure presented herein suggests that in-situ biological pit lake treatment may achieve water quality approaching CCME guidelines. In addition, nutrient concentrations are not expected to significantly impact the receiving environment. As such, it is appropriate to consider biological treatment as a post closure treatment strategy to remove contaminants from the pit lake.

Water quality monitoring during the first three to five years of operations will be required to refine the current estimates of water quality in the pit lakes. If the refined estimates indicate there is a need for water treatment after closure, staged demonstration of the treatment process will be required to verify residual metal and nutrient concentrations.

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Appendix D

Reclamation Cost Estimate

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August 16, 2004

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Dear Sir:

RE: <u>COST ESTIMATE - POST-CLOSURE JERICHO MINE</u>

Nuna Logistics is pleased to provide our estimate for the post-closure reclamation of the Jericho mine site. The estimate is based on a scenario in which the property is left abandoned but intact and we mobilize contractor equipment and fuel to site, utilize the abandoned camp, shop, tankage, and other facilities throughout the demolition period; and demobilize contractor equipment and Jericho equipment and facilities. This approach requires three camp "openings" which are now included in the estimate. The first opening is to prepare for mobilization during the first winter road season. The second opening is for the reclamation program beginning early spring. The third opening is to prepare for the demobilization over the second winter road.

We have based the estimate on our current schedule of rates in constant current dollars with no allowance for escalation. The estimate includes reclamation of the current design only and does not allow for expanded footprint or upset events such as significant spills, breaches, etc.

The estimate is based on quantities and requirements provided in the past by Tahera Corporation and modified to reflect the current design.

We have assumed that forward-thinking environmental design and practices such as stepped waste dumps and water management ponds will be employed throughout the mine life. The stepped waste dumps carry the same net overall slope as the post-reclamation slope. Therefore, dozing the bench crests creates the required slope. The water management ponds provide, as a secondary benefit, erosion control which is important from a reclamation standpoint.

We have assumed that most of the reclamation will occur post-closure. Notable exceptions are exploration facilities (Carat Camp) and the pit perimeter access control berm. We have assumed that these items will be completed relatively early in operations, and therefore, we have not included them in the estimate. Although, progressive reclamation should be undertaken when possible, the reality is that most of the constructed site is required through to closure. Completed sections of the waste dumps may be reclaimed early, however, for the purposes of the estimate, we have assumed post-closure reclamation.

Revegitation and post-closure monitoring have not been included in the estimate.

The Reclamation Model developed for DIAND by Brodie Consulting Ltd. offers a listing of relevant reclamation items and objectives to which we comment as follows:

Open Pit

A. **Objective: Control Access**
A control berm will be constructed around the ultimate pit boundary early in operations with minor completions (pit accesses) during reclamation. Fencing and signage are not included in the estimate.

B. **Objective: Stabilize Slopes**
Not expected to be required. Additionally, it is planned that the pit will be naturally flooded.

C. **Objective: Cover/Contour Slopes**
Not required.

D. **Objective: Spillway**
The equivalent functionality of the spillway is included in the construction and operation phases. The spillway equivalent will not be required to operate until after the pit naturally fills (approximately 20 years after closure).

E. **Objective: Flood Pit**
This is expected to occur naturally. Dewatering pipes will be removed during reclamation and is included in facilities demolition in the estimate. Water quality additives are not included in the estimate. During the monitoring stage, it may be determined if the requirement exists or not.

F. **Objective: Develop Wetland**
Not applicable.

Underground

Seal openings as required.

PKC Area

A. **Objective: Control Access**
Not required.

B. **Objective: Stabilize Embankment**
Not required. The dams will be constructed as relatively low angle stable structures.

C. **Objective: Cover Tailings**
Tailings will be covered with 500 mm of coarse processed kimberlite and topped with 300 mm of overburden/waste rock.

D. **Objective: Flood PKC**
Not applicable.

E. **Objective: Treat Supernatant**
Not required.

F. **Objective: Upgrade Spillway**
On completion of operations, spillway or dam will be lowered to allow clean water overflow resulting in a small PKC area settling pond to remain.

G. **Objective: Stabilize Decant System**
Not applicable.

H. **Objective: Remove Tailings Discharge**
The removal of the tailings discharge is included in the facilities demolition.

I. **Objective: Specialized Items**
Not applicable.

Waste Dump

A. **Objective: Stabilize Slopes**
The waste dumps will be dozed to a slope of about 18 degrees (approximately ½ the natural angle of repose of the material).

B. **Objective: Cover Dump**
The top bench will be covered with 300 mm of overburden material.

C. **Objective: Relocate Dumps**
Not applicable.

D. **Objective: Collect and Treat**
Waste Dump runoff will be diverted to the open pit.

Chemicals

A. **Objective: Laboratory Chemicals**
Laboratory chemicals will be hauled off site and disposed of appropriately.

B. **Objective: PCB's**
Not applicable.

C. **Objective: Fuel**
D. **Objective: Waste Oil**
Excess fuel and waste oil will be hauled off-site.

E. **Objective: Process or Treatment Chemicals**
Not applicable.

F. **Objective: Explosives**
Explosives will be hauled off-site.

G. **Objective: Contaminated Soils**
No allowance has been made in the estimate for significant spills. It is expected that contaminated soils will be remediated when/if the events occur. The material underlying the tank farm and power plant will be encapsulated within the waste dump as a precautionary measure.

H. **Objective: Hazardous Material Testing and Assessment**
Not applicable.

Water

A. **Objective: Stabilize Embankment**
The estimate allows for excavation of the causeway to below water level.

B. **Objective: Upgrade Spillway**
C. **Objective: Stabilize Sediment Containment Ponds**
The water management structures are developed during construction and operations and are intended to remain in operation post-closure with excess water diverted to the open pit.

D. **Objective: Breach Embankment**
Not applicable.

E. **Objective: Stabilize Ditches**
The CI Diversion ditch is intended to remain in operation post-closure.

F. **Objective: Breach Ditches**
Not applicable.

G. **Objective: Remove Pipelines**
H. **Objective: Remove Storage Tanks**
Pipelines and storage tank removal are included in facilities demolition in the estimate. The materials will be buried in the waste dump.

I. **Objective: Collect Drainage for Treatment**
The water management structures and drainage collection are established during construction and operations and remain in operation post-closure with excess water diverted to the open pit.

J. **Objective: Treat Drainage**
Ongoing Treatment costs are not included in the estimate. This will not be required until after the open pit fills (15 to 20 years). No treatment is expected to be required.

Mobilization

A. **Objective: Mobilize Heavy Equipment**
Included in estimate.

B. **Objective: Mobilize Camp**
We have included the openings of the operations camp and the mobilization of a small well-site during final demolition of the operations camp.

C. **Objective: Mobilize Workers**
D. **Objective: Mobilize Miscellaneous Supplies**
E. **Objective: Mobilize and House Workers**
F. **Objective: Winter Road**
Included in estimate.

G. **Objective: Bonding**
H. **Objective: Taxes**
Performance bonding and GST are not included in the estimate.

I. **Objective: Insurance**
Typical contractor insurances are included in the estimate.

Monitoring

An allowance is applied at $20,000 per year for ten years.

Post-Closure Site Maintenance

In the closure plan, there is no requirement for site maintenance.

Ongoing Water Treatment Costs

Not required.

Thank you for the opportunity to present our reclamation estimate. The total cost has increased since our last estimate due to labour market pressures, and the requirement to start from an abandoned site scenario. The total cost-to-scope ratio is consistent with other northern sites that Nuna Logistics and others have estimated. If your have questions regarding this estimate, please contact myself or Peter Gillies at (604) 682-4667.

Yours truly,

NUNA LOGISTICS LIMITED
per:

Court Smith, P.Eng.
Vice President
CS/jaz

NUNA

Reclaim Waste Dumps

Load and Haul Overburden			
Cycle time 992 loader (min/load)	4	min/load	
Cycle time 992 loader (load/hr)	12	load/hr	
Cycle time 777 Off-Highway Truck (min/load)	15	min/load	
Cycle time 777 Off-Highway Truck (load/hr)	4	load/hr	
Number of 992 Loaders Used	1		
Number of 777 Off-Highway Trucks Used	3		
Total Cycles Available - 992 Loader	12	(load/hr)	
Total Cycles Available - 777 Off-Highway Truck	12	(load/hr)	
Capacity (m^3/hr)	50	m^3/hr	
Capacity (LCM's/hr)	600	LCM's/hr	
Capacity (ECM's/hr)	480	ECM's/hr	
Quantity Waste Dump	87,900	m^3	
Total 992 Loader Hours Required	87,900	/ 480 x 1 machine	**183 hrs**
Total 777 Off-Highway Truck Hours Required	87,900	/ 480 x 3 machine	**549 hrs**

Equipment	**Fuel/hr (litres)**	**Total Hrs**	**Machine $ Cost/hr**	**Operator $ Cost/hr**	**Machine Cost $**	**Operator Cost $**	**Fuel Cost $**	**Total Cost $**
D10	84	901	200	58.33	180,168	52,546	56,753	289,467
992	78	183	317	60.16	58,011	11,009	10,706	79,726
777	70	549	190	53.77	104,310	29,520	28,823	162,652
16G (allocation)	44	141	114	58.83	16,074	8,295	4,653	29,022
Cost to Reclaim Waste Dumps					358,563	101,370	100,934	**560,867**

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Reclaim Remaining Area

Contour		
Assume D10 can contour at a rate of:	1,000	m^2/hr
PK Dam		
Distance to Contour	1,000	m
Area to Contour	60	m^2/m
Total Area to Contour	60,000	m^2
Roads/Airstrip		
Distance to Contour	15,000	m
Area to Contour	10	m^2/m
Total Area to Contour	150,000	m^2
Pads		
Distance to Contour	5,000	m
Area to Contour	5	m^2/m
Total Area to Contour	25,000	m^2
Coarse Tailings Waste Dump	75,000	m^2
Low Grade Stockpile	70,000	m^2
Total Area to Contour	**380,000**	m^2
Total D10 Hours Required	**380**	**hrs**

Reclaim Remaining Area

Disturbance Areas to Cover				
PK Dam Overburden				
Area to Cover	150,000	m^2		
Volume of Overburden @ 0.3m			45,000	m^3
PK Dam Coarse Rejects				
Area to Cover	150,000	m^2		
Volume of Overburden @ 0.5m			75,000	m^3
Roads				
Distance 6m Roads	3,500	m		
Area to Cover / Meter	10	m^2		
Area to Cover	35,000	m^2		
Volume of Overburden @ 0.3m			10,500	m^3
Distance 9m Roads	9,000	m		
Area to Cover / Meter	10	m^2		
Area to Cover	90,000	m^2		
Volume of Overburden @ 0.3m			27,000	m^3
Distance 18m Roads	2,000	m		
Area to Cover / Meter	10	m^2		
Area to Cover	20,000	m^2		
Volume of Overburden @ 0.3m			6,000	m^3
Pads				
Area to Cover	25,000	m^2		
Volume of Overburden @ 0.3m			7,500	m^3
Coarse PK Waste Dump				
Area to Cover	99,400	m^2		
Volume of Overburden @ 0.3m			29,820	m^3
Low Grade Stockpile				
Area to Cover	15,000	m^2		
Volume of Overburden @ 0.3m			4,500	m^3
Total Area to Cover			**205,320**	m^3
Capacity (ECM's/hr)			**480**	**ECM's/hr**
Total D10 Hours Required	205,320	/ 1,000		**205 hrs**
Total 992 Loader Hours Required	205,320	/ 480 x 1 machine		**428 hrs**
Total 777 Off-Highway Truck Hours Required	205,320	/ 480 x 3 machine		**1283 hrs**

Equipment	Fuel/hr (litres)	Total Hrs	Machine $ Cost/hr	Operator $ Cost/hr	Machine Cost $	Operator Cost $	Fuel Cost $	Total Cost $
D10	84	585	200	58.33	117,000	34,123	36,855	187,978
992	78	428	317	60.16	135,676	25,748	25,038	186,462
777	70	1283	180	53.77	230,940	68,987	67,358	367,284
16G	44	214	114	58.33	24,396	12,483	7,062	43,941
Cost to Reclaim Remaining Area					508,012	141,341	136,313	**785,666**

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Dissassembly, Freight to Site, Assembly	Cost/Load	# of Units	Pieces/Load	# of Loads	Total Cost $
D10	6,000	2	1.5	3	18,000
992	6,000	2	3.5	7	42,000
777	6,000	3	3.0	9	54,000
16G	6,000	1	2.0	2	12,000
Cat 345	6,000	1	1.0	1	6,000
Crane	12,000	1	1.0	1	12,000
Dissassembly (allocation)					15,000
Assembly (allocation)					15,000
		10		23	**174,000**

Transport South is included under Transport Southbound at End of Reclamation

Disassembly of Facilities	Fuel/hr (litres)	Total Hrs	Machine $ Cost/hr	Operator $ Cost/hr	Machine Cost $	Operator Cost $	Fuel Cost $	Total Cost $
Crane	75	2,189	220	61.98	642,048	180,882	123,120	946,050
Cat 345	40	2,189	250	58.33	547,200	127,673	65,664	740,537
Welders/Riggers				64.73	n/a	566,724		566,724
Labourers				49.19	n/a	861,337		861,337
					1,189,248	1,736,616	188,784	**3,114,648**

	# of Operators	Months	Days/Month	Hrs/Day
Crane Op	1	6	30.4	16
Excavator Op	1	6	30.4	12
Welders and Riggers	4	6	30.4	12
Labourers	8	6	30.4	12

Cat 345 excavator is fitted out with Hydraulic Hammer and Shears

Nuna Overheads	# of Operators	Months	Days/Month	Hrs/Day	Operator $ Cost/hr	Total Cost $
Site Supervisors	1	6	30.4	12	89.40	195,679
Foreman	2	6	30.4	12	73.34	321,053
Safety	1	6	30.4	12	63.72	139,470
Administrator	1	6	30.4	12	52.84	115,656
Operator	1	6	30.4	12	58.33	127,673
						899,531

Support Equipment	Months	Cost per Month	
(Bobcat, Tractor Lowboy, IT 28)	6	30,000	**180,000**

Facilities Support	Months	Cost per Month	
	8	90,000	**720,000**

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Transport South Bound at End of Reclamation		# of Loads	Cost per Load	Total Cost $
	Building	30		
	Plant facilities	40		
	Gen Sets	6		
	Fuel Tanks	16		
	Mobile Equipment	23		
	Misc.	20		
		135	5,200	702,000

Transportation	# of Trips	Price per Trip	Total Cost
	180	800.00	144,000

Catering	# of People	Months	Days/Month	Cost/day	Total Cost $
Earthworks	5	6	30.4	45	41,040
Plant Decommission	12	6	30.4	45	98,496
Administration	6	6	30.4	45	49,248
					188,784

Monitoring	Amt.per Year	No of Years	Total
	$ 20,000	10	200,000

Subtotal	8,436,325
Contingency - 10%	843,633
Total Cost Including Contingency	9,279,958

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