Table of Contents

TABLES

FIGURES

9.0 KEY LINE OF INQUIRY: CLOSURE AND RECLAMATION

9.1 Introduction

9.1.1 Context

This section of the Developer's Assessment Report (DAR) for the NICO Cobalt-Gold-Copper-Bismuth Project (NICO Project) consists of the Key Line of Inquiry (KLOI): Closure and Reclamation (C&R). In the Terms of Reference (TOR) for the NICO Project's DAR issued on 30 November 2009, the Mackenzie Valley Review Board (MVRB) identified C&R as a NICO Project activity requiring a high level of consideration by the developer (MVRB 2009). This C&R Plan has also been developed to meet the requirements in the *Mine Site Reclamation Policy for the Northwest Territories* (DIAND 2002).

As identified within the TOR, this KLOI for closure details the conceptual C&R Plan for the NICO Project. In addition, this KLOI addresses the management and monitoring plans and visual representations of the site at intervals after closure.

All conceptual C&R Plans are discussed in this KLOI; however, issues addressed in the following KLOI, Subjects of Note (SON), or other sections may be overlapped by this KLOI:

- Project Description (Section 3);
- KLOI: Water Quality (Section 7);
- KLOI: Caribou and Caribou Habitat (Section 8);
- SON: Water Quantity (Section 10);
- SON: Fish and Aquatic Habitat (Section 12);
- SON: Terrain and Soils (Section 13);
- SON: Vegetation (Section 14);
- SON: Wildlife (Section 15);
- SON: Human Environment (Section 16); and
- Section 18: Biophysical Environment Monitoring and Management Plans.

To avoid undue repetition and verify that the DAR presents the information outlined in the TOR in as efficient a manner as possible, the relevant information presented in each of the aforementioned sections has been summarized and is reported herein. The present section has been designed to focus on the key findings of the analyses that are reported elsewhere in the DAR, and therefore, cross-referencing to other sections of the DAR has been used.

9.1.2 Purpose and Scope

The purpose of the KLOI: Closure and Reclamation is to present the conceptual C &R Plan and outline the long-term impacts related to closure to meet the TOR issued by the MVRB. The TOR for the KLOI: Closure and Reclamation are shown in Table 9.1-1. The entire TOR document is included in Appendix 1.I and the complete table of concordance for the DAR is in Appendix 1.II of Section 1.

The C&R Plan focuses on mitigating effects to water, fish, wildlife, and people during the closure and post-closure phases of the NICO Project. Information from other components of the DAR, including hydrology, geochemistry, hydrogeology, air quality, fish and aquatic habitat, terrain and soils, vegetation, and wildlife, as well as information from existing developments, were considered in developing the C&R Plan. More detailed information on the requirements of the DAR TOR for this KLOI can be found in Table 9.1-1.

Table 9.1-1: Key Line of Inquiry: Closure and Reclamation Concordance with the Terms of Reference

Section in Terms of Reference	Requirement	Section in Developer's Assessment Report
3.3.3	**Key Line of Inquiry: Closure and Reclamation** During the issues scoping process, long-term impacts related to closure and reclamation of the NICO Project were identified as a high priority by most interested parties. Fortune will present its preliminary Closure and Reclamation Plan for the NICO Project in the Developer's Assessment Report. The developer should consider existing guidance, such as Indian and Northern Affairs Canada's mine closure and reclamation policy and guidelines for the NWT when developing its reclamation plan for the NICO Project (see http://www.ainc-inac.gc.ca/ai/scr/nt/ntr/pubs/MSR-eng.asp). The developer is also advised to work with communities and other parties to determine clear closure objectives and link them to measureable closure criteria and indicators. The formation of a Closure and Reclamation working group composed of regulators and other groups will assist in the development of closure objectives and reclamation standards for the Closure and Reclamation Plan.	9.0
	The temporal scope of the Closure and Reclamation Plan should focus on impacts to water, fish, wildlife and people during the closure and post-closure phases of the NICO Project. Long-term project effects on caribou should specifically focus impact predictions in the context of the current serious decline in caribou populations, particularly the Bathurst herd. This discussion is not intended to duplicate the requirements of Section 3.3.4. The developer will:	9.1.3, 9.4.1.2, 9.4.4.4
	• Describe to what overall standard Fortune plans to reclaim the site, and how that standard was selected, including any recommended closure criteria and/or a process for defining closure criteria.	9.1.3.1, 9.4.4.2
	• Describe how and when the mine site will be reclaimed, including how plans will ensure that the site does not contaminate water or pose an ongoing hazard to people or wildlife.	9.4
	• Describe any alternative methods of waste management considered.	9.4.4.5.5
	• Describe plans for reclaiming the NICO access road.	9.4.4.5.4
	• Describe consultations with governments and communities regarding reclamation, and how plans have been adapted as a result.	9.4.2
	• Consider the role of climactic change in development of a closure and reclamation plan.	9.4.4.3
Appendix D	**Closure and Reclamation** 1) Describe policies, regulations and industry standards that Fortune considered in the development of its Conceptual Closure and Reclamation Plan.	9.1
	2) Provide a preliminary Conceptual Closure and Reclamation Plan, which will include:	9.4

Table 9.1-1: Key Line of Inquiry: Closure and Reclamation Concordance with the Terms of Reference (continued)

Section in Terms of Reference	Requirement	Section in Developer's Assessment Report
Appendix D (continued)	a. identification of the overall reclamation objectives, standards and criteria the Closure and Reclamation Plan is designed to achieve and over what time period;	9.4.1, 9.4.4.2
	b. a list of closure and reclamation components and activities including alternatives considered, a rationale for why Fortune chose a particular alternative and how it best meets the developer's reclamation objectives;	9.4.3, 9.4
	c. a description of how climatic change was considered in the development of the Closure and Reclamation Plan in order to ensure long-term physical integrity of permanent structures;	9.4.4.3
	d. an outline for the methods and locations for re-use or disposal of materials during reclamation;	9.4.4.5.3
	e. a conceptual program and schedule for any progressive reclamation envisioned; and	9.4.4.6
	f. a conceptual post-closure monitoring plan that includes a reporting strategy and a rationale for an "end-date" for monitoring.	9.6
	3) In the Conceptual Closure and Reclamation Plan, discuss management and monitoring programs for any materials/locations (including the underground works) that may cause acid rock drainage or metals leaching. Include:	9.4, 9.6
	a. creating a sufficient barrier for the prevention of tailings and waste rock oxidation at closure;	9.4.5.4
	b. the likely rate of movement of water (including groundwater) through the tailings, mine rock management area and underground workings, associated uptake of acids, metals or any other contaminants into groundwater or surface waters, and monitoring location requirements and contingency plans for greater than expected rates of contaminant release;	9.4.5.4
	c. the long-term physical integrity of permanent features including dams and Open Pit; and	9.4.5.1
	d. monitoring coverage required to track any other reasonably foreseeable post-closure contamination pathways.	9.4
	4) Visually show how the mine site is expected to look at one, ten and 25 years after closure and reclamation of the mine compared to its present and operating conditions. Include a plan view of the site and an illustration of visual impacts on the viewshed as seen from Marian River, Hislop Lake and other points along the Įdaà Trail.	Section 3.2-1 (Photos 3.2.1 to 3.2.4), Section 9.4.4 Figures 9.4-1 to 9.4-5
	5) Describe Fortune's plans for establishing the viability of a self-sustaining vegetation community at the mine site after closure, including:	9.4.4.5.2.2
	a. revegetation techniques, with a discussion on what species the developer will consider for this activity;	9.4.4.5.2.2
	b. an outline for how soon the area will return to a natural state of vegetation, if ever; and	9.4.4.5.2.2

Table 9.1-1: Key Line of Inquiry: Closure and Reclamation Concordance with the Terms of Reference (continued)

Section in Terms of Reference	Requirement	Section in Developer's Assessment Report
Appendix D (continued)	c. discussion of how revegetation objectives will ensure wildlife is not attracted to the site where they may be exposed to risks.	9.4.4.4
	6) Describe how closure and reclamation activities and monitoring will ensure long-term suitability of all fish-bearing waters potentially affected by the NICO Project for fish and fish habitat (using pre-fire background conditions and a lake that has been impacted by the forest fire for reference).	9.6.2.3, Section 12.0, Appendix 18.I
	7) Describe closure and reclamation plans associated with decommissioning of the NICO access road, including stabilization and revegetation of banks near water crossings.	9.4.4.5.4; 9.4.4.5.6
	8) Describe closure and reclamation plans associated with the airstrip.	9.4.4.5.4
	9) Describe how reclamation will manage ongoing hazards to wildlife on the mine site, and how reclamation will affect wildlife movements.	9.4.4.4
	10) Within the record of consultation that Fortune has had with potentially-affected communities, Aboriginal groups and responsible government agencies (see section 3.2.6), identify where there arose any concerns related to closure, reclamation, and long-term monitoring issues, and how the developer has adapted its plans to address the parties' concerns.	Section 4.0, Appendices 4.I to 4.III

The development components covered in this C&R Plan include the following:

- Open Pit;
- Mineral Processing Plant (the Plant);
- Co-Disposal Facility (CDF);
- thickened tailings distribution system;
- Plant Site Runoff Pond;
- Seepage Collection Ponds (SCP);
- Surge Pond;
- Contingency Pond;
- Effluent Treatment Facility (ETF);
- constructed Wetland Treatment Systems;
- camp site;
- internal access and haul roads;
- drainage control systems;
- pump house and fresh water intake on Lou Lake;

- fuel and chemical storage facilities;
- powder magazine;
- NICO Project Access Road (NPAR);
- Airstrip; and
- borrow areas.

Two important concepts for the NICO Project are “progressive reclamation” and “design for closure”. Closure and reclamation were considered during the selection of design alternatives. As such, C&R planning has been considered in all NICO Project phases, including design.

9.1.3 NICO Project Valued Components

Valued components (VCs) represent physical, biological, cultural, social, and economic properties of the environment that are considered to be important by society. Though not considered a VC, C&R was identified as a high priority activity for the NICO Project in the TOR (MVRB 2009). The VCs that may be influenced by C&R include surface and groundwater quality, hydrology, fish and aquatic habitat, soil, vegetation, wildlife, and people.

Assessment endpoints represent the key properties of the VC that should be protected for their use by future human generations, whereas measurement endpoints are quantifiable (i.e., measurable) expressions of changes to assessment endpoints (Section 6.2). Closure and reclamation do not have assessment endpoints (Section 6.2). Assessment endpoints for VCs influenced by C&R are presented in Table 9.1-2. In addition, the measurement endpoints, used to evaluate the assessment endpoints, are presented.

9.1.3.1 Closure Design Criteria

There are essentially 3 levels of study and design in the development of a mining project:

- Pre-feasibility – to establish project viability to determine if the project is worth proceeding to the next stage.
- Feasibility – a bankable document that should include final engineering decisions and preliminary design, environmental and social impacts, and cost estimates.
- Detailed design and construction.

This conceptual C&R Plan presents a design for the CDF, which is midway between the pre-feasibility and feasibility level of design. The cost estimating of the CDF will have ± 25 percent (%) level of accuracy, which is sufficient to establish the viability of the disposal option. The other C&R aspects are described at a conceptual level.

Table 9.1-3 summarizes the permits and authorizations that will be required for final closure. The C&R Plan outlined herein is intended to meet these requirements.

Table 9.1-2: Valued Components, Assessment and Measurement Endpoints Associated with Key Line of Inquiry Closure and Reclamation

Valued Component	Assessment Endpoints	Measurement Endpoints
Surface and groundwater quality	• Protection of surface water quality for aquatic and terrestrial ecosystems, and human use • Persistence of fish habitat and populations • Persistence of plant populations (including species at risk) and communities • Persistence of wildlife populations • Continued opportunity for traditional and non-traditional use of plants, fish, and wildlife	• Physical analytes (e.g., pH, conductivity, turbidity) • Major ions and nutrients • Total and dissolved metals
Hydrology		• Flow rate and the spatial and temporal distribution of water • Surface topography, drainage boundaries, and waterbodies (e.g., streams, lakes, and drainages)
Fish and aquatic habitat		• Habitat quantity and fragmentation • Habitat quality • Relative abundance and distribution of fish species • Survival and reproduction
Soil		• Soil quality, quantity, and distribution • Permafrost distribution • Reclamation suitability
Vegetation		• Plant community diversity • Plant community health • Relative abundance and distribution of plant species • Presence of invasive/exotic species
Wildlife		• Habitat quantity and fragmentation • Habitat quality • Relative abundance and distribution of wildlife species • Survival and reproduction
People		• Access to fish, traditional plants, and wildlife • Availability of fish, traditional plants, and wildlife • Human health

Table 9.1-3: Potential Permits, Authorizations, and Agreements Required by Jurisdiction for Closure

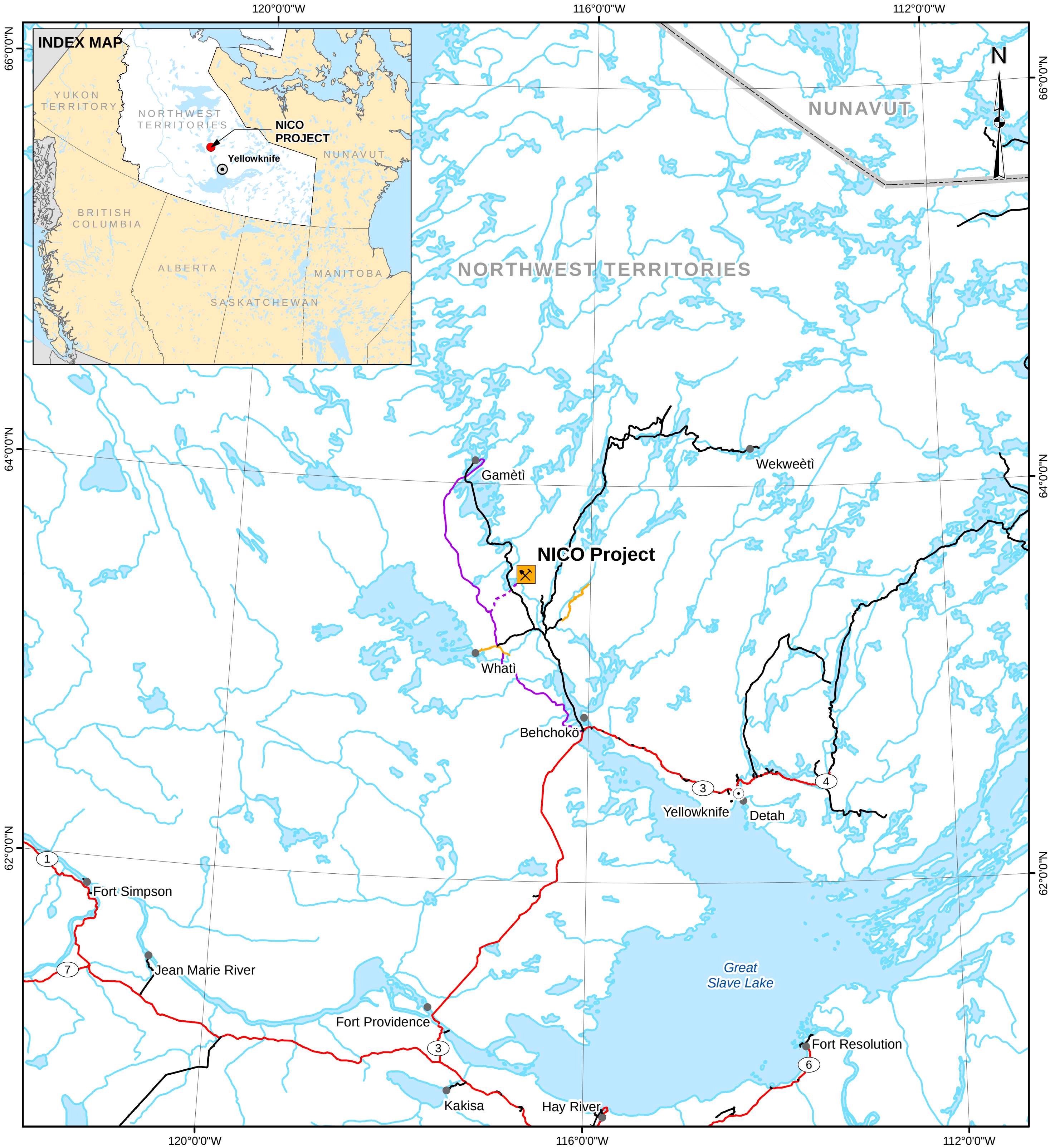
Type	Legislation	Responsible Authority
Land Lease License of Occupation	*Territorial Lands Act and Regulations* *Real Property Act*	Indian and Northern Affairs Canada
Mineral Lease	*Territorial Lands Act* *Canada Mining Regulations*	Mineral and Petroleum Resources Directorate, Indian and Northern Affairs Canada
Water License (Obtain Class A)	*Mackenzie Valley Resource Management Act* *Northwest Territories Waters Act* *Northwest Territories Water Regulations*	Wek'èezhìi Land and Water Board
Land Use Permit (LUP) (Renew Class A)	*Mackenzie Valley Resource Management Act* *Mackenzie Valley Land Use Regulations*	Wek'èezhìi Land and Water Board

9.1.4 Study Area

9.1.4.1 General Location

The NICO Project is located approximately 160 kilometres (km) northwest of Yellowknife, Northwest Territories (NWT) within the Marian River drainage basin, approximately 10 km east of Hislop Lake at a latitude of 63°33' North and a longitude of 116°45' West (Figure 9.1-1), and within the Taiga Shield and Taiga Plains Ecoregions (Ecosystem Classification Working Group 2007, 2008). The NICO Project is in the Wek'èezhìi Settlement Area of the NWT and is surrounded by, but not within, Tłįchǫ lands.

The NICO Project property can currently be accessed by float plane and by an existing winter road, which starts near the Tłįchǫ community of Behchokǫ̀ located on Highway 3 north-west Yellowknife, and extends north to the communities of Whatì and Gamètì. The NICO Project is located approximately 80 km north of Behchokǫ̀.



LEGEND

- NICO PROJECT
- TERRITORIAL CAPITAL
- POPULATED PLACE
- HIGHWAY
- EXISTING ALL-WEATHER ROAD
- EXISTING WINTER ROAD
- PROPOSED NICO PROJECT ACCESS ROAD
- PROPOSED TÂÎCHÔ ROAD ROUTE
- RAILROAD
- TERRITORIAL/PROVINCIAL BOUNDARY
- WATERCOURSE
- WATERBODY

100 0 100

SCALE 1:3,000,000 KILOMETRES

REFERENCE

Base data obtained from Atlas of Canada, DMTI, and ESRI.
Projection: Canada Lambert Conformal Conic

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

LOCATION OF THE NICO PROJECT

Golder Associates
Edmonton, Alberta

FILE No. E-Miss-002-GIS				
PROJECT NO. 09-1373-1004			SCALE AS SHOWN	REV. 0
DESIGN	JG	17 Jan. 2011	FIGURE: 9.1-1	
GIS	SC	8 Apr. 2011		
CHECK	GRA	3 Apr. 2011		
REVIEW	GRA	3 Apr. 2011		

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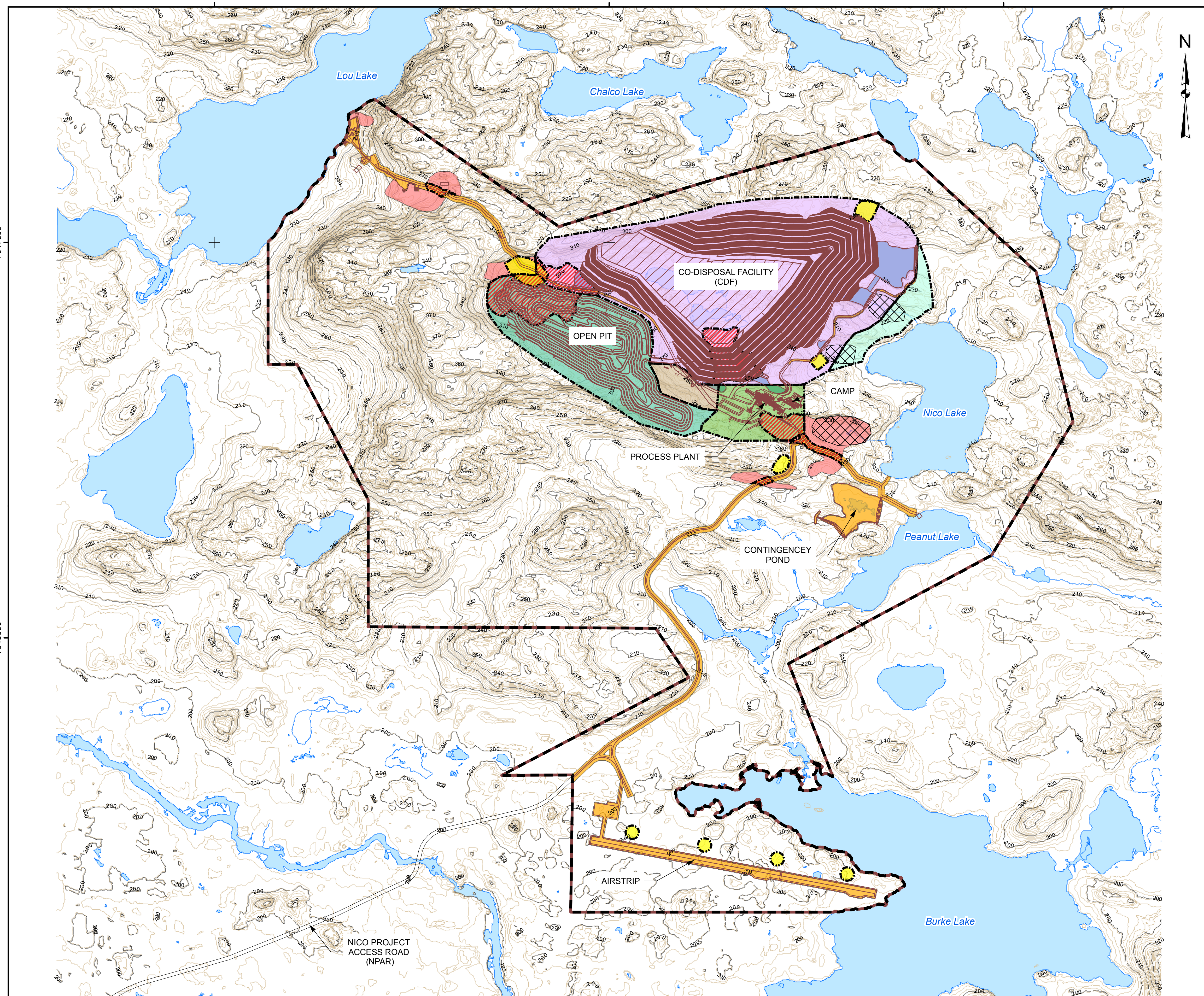
9.1.4.2 Study Area Boundaries

The study area boundaries for the KLOI: Closure and Reclamation were defined by the expected spatial extent of the immediate direct (e.g., NICO Project footprint) and indirect (e.g., air emissions) effects from the proposed mine on surrounding terrestrial and aquatic environments. Direct and indirect effects are identified as regional study areas (RSA) and local study areas (LSA) for both terrestrial (e.g., soil and terrain, vegetation, and wildlife biodiversity) and aquatics (e.g., water quality, fish, and aquatic habitat). Study areas were divided into an RSA and LSA for the proposed mine site and an RSA and LSA for the proposed NPAR.

The terrestrial RSA was defined to capture the large-scale direct and indirect effects that may extend beyond 1 km from the NICO Project, and to assess potential cumulative effects to the terrestrial environment in the broader regional area, including the Proposed Tłįchǫ Road Route. Based on studies on barren-ground and woodland caribou, the RSA for the mine is defined as a 15 km radius centred on the proposed mine site, and for the NPAR a 6.5 km buffer surrounding the road alignment. The RSA for aquatics includes those waterbodies within the LSA plus the Marian River to the north arm of Great Slave Lake.

The terrestrial LSA was defined by the anticipated extent of direct and indirect effects of the NICO Project on the terrestrial environment. The boundary is represented by a 500 metre (m) buffer around the NICO Project Lease Boundary, and includes the proposed alignment for the NPAR. The LSA for aquatics includes the entire hydrologic pathway from the main ore body downstream to the Marian River, including Grid Pond, Little Grid Pond, Nico Lake, Peanut Lake, Pond 11, Pond 12, Pond 13, Burke Lake, and the Marian River downstream of the Burke Lake confluence, and their interconnecting streams. The aquatics LSA also includes Lou Lake, which is where the exploration camp is located and is used as the potable water source, and Ponds 8, 9, and 10, which drain the south area of the main ore body into the Burke Lake watershed.

The conceptual C&R Plan is based on a reclamation development area boundary that encompasses the NICO Project, which includes the proposed development of the anticipated mine footprint (Figure 9.1-2) and will include major on-site infrastructure outlined in Section 9.1.2.



LEGEND

- PROJECT LEASE BOUNDARY
- PROPOSED NICO MINE SITE
- WATERCOURSE
- CONTOUR - *(2 m INTERVAL)*
- CONTOUR - *(10 m INTERVAL)*
- HAUL ROAD
- WATERBODY

AREAS OF DISTURBANCE

- BORROW SITE
- BORROW SITE WITHIN DISTURBED AREA
- CO-DISPOSAL FACILITY (CDF) FOOTPRINT
- GROWTH MEDIA STOCKPILE
- LAYDOWN AREA AND MINE PORTAL FOOTPRINT
- OPEN PIT FOOTPRINT
- OTHER SITE INFRASTRUCTURE
- POTENTIAL AREA OF DISTURBANCE
- PROCESS PLANT AND CAMP FOOTPRINT
- PROPOSED WETLAND TREATMENT SYSTEM
- SEEPAGE COLLECTION POND

REFERENCE

Topographic mapping obtained from Eagle Mapping, Fortune Minerals Limited, 2006 (File: Basemapping FML, 20060718).dwg)

Open Pit Configuration - Provided by P & E Mining Consultants Inc. (File: End_of_year2031.dxf Received 26 August, 2010)

Advanced Exploration Infrastructure - Provided by Aker Solutions (File: 0000g001D.dwg Received 25 October, 2010)

Projection: UTM Zone11 Datum: NAD 83

1 0 1

SCALE 1:25,000 KILOMETRES

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

PROJECT FOOTPRINT

FILE No. E-Miss-003-GIS

PROJECT NO. 09-1373-1004			SCALE AS SHOWN	REV. 0
DESIGN	SC	16 Feb. 2011	FIGURE: 9.1-2	
GIS	SC	8 Apr. 2011		
CHECK	GAR	3 Apr. 2011		
REVIEW	GAR	3 Apr. 2011		

Golder Associates
Edmonton, Alberta

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9.1.5 Content

To present the required material in an organized and readable format, this KLOI moves from introductory or background information, through a detailed development description, into the existing environment and the conceptual C&R Plan for the NICO Project.

The general organization of this KLOI is outlined in Table 9.1-4. To verify that the contents of the TOR are addressed in this report, a table of concordance that cross-references the TOR to the information and location in this DAR is contained in Table 9.1-1.

Table 9.1-4: Closure and Reclamation KLOI Organization

Section	Content
Section 9.1	**Introduction** – Provides an introduction to the closure and reclamation KLOI by defining the context, purpose, scope, and study areas, and providing an overview of the KLOI organization
Section 9.2	**Closure and Reclamation Objectives** – Provides the objectives of the Closure and Reclamation Plan
Section 9.3	**Existing Environment** – Provides a summary of the existing conditions that are present in NICO Project area
Section 9.4	**Conceptual Closure and Reclamation Plan** – Provides a summary of the conceptual closure and reclamation plans for the NICO Project
Section 9.5	**Uncertainty** – Provides a discussion of the uncertainty related to the effects and impact assessments completed in the environmental assessment
Section 9.6	**Monitoring and Follow-up** – Summarizes the objectives of the proposed monitoring and follow-up programs

9.2 Closure and Reclamation Objectives

This conceptual C&R Plan has been developed for the NICO Project, based on the concepts of “progressive reclamation” and “design for closure”. Closure and reclamation were considered during the selection of design alternatives. As such, C&R planning has been considered in all NICO Project phases, including design.

The overall goal of the reclamation plan is to limit the residual environmental impacts of operations to the extent practicable and to allow disturbed areas to return to productive fish and wildlife habitat as quickly as possible. The key objectives of the C&R Plan are:

- to establish Fortune’s management accountability and ownership of closure and remediation activity;
- to comply with relevant or applicable legislative requirements;
- to help to protect traditional values;
- to protect public health and safety using known safe, responsible reclamation practices;
- to reduce or eliminate residual environmental effects post closure;
- to establish conditions that allow the natural environment to recover from mining activities; and
- to establish physical and chemical stability in disturbed areas to reduce requirement for long-term monitoring.

Details of the key goals and the mitigation proposed to meet them are detailed in the remainder of this report.

9.3 Existing Environment

The following section provides a brief description of existing conditions within the terrestrial and aquatic RSAs and LSAs and places them into context with that of the surrounding environment. Components of the existing environment that are discussed include surface water quantity, fish and aquatic habitat, terrain and soils, vegetation, wildlife, and climate.

Existing conditions have been discussed in KLOI Caribou (Section 8), SON Water Quantity (Section 11), SON Fish and Aquatic Habitat (Section 12), SON Terrain and Soils (Section 13), SON Vegetation (Section 14), and SON Wildlife (Section 15). The following represents a summary of the key aspects of the information that has been reported in the SON and KLOI Sections outlined above.

9.3.1 Hydrology

The NICO Project is located within the Marian River drainage, which eventually drains into Great Slave Lake. Downstream of the NICO Project, the Marian River combines with the Emile River and the La Martre River. The Marian River drains into Marian Lake, which drains to the North Arm of Great Slave Lake. Great Slave is drained by the Mackenzie River, which discharges to the Beaufort Sea. A number of large lakes occur in the Marian River system upstream of the NICO Project, which provide a substantial level of attenuation in the drainage system.

Two local watersheds (the Burke Lake watershed and Lou Lake watershed) collect runoff from the NICO Project area, and both flow south to the Marian River. Burke Lake drains an area of 90.8 square kilometres (km^2), and Lou Lake drains an area of 58.5 km^2. Flow from these 2 drainages contributes a very small portion of the Marian River discharge. Only limited mine infrastructure will be constructed inside the Lou Lake watershed; however, Lou Lake will be the main source of fresh water for the NICO Project. Most of the mine infrastructure will be constructed in the Burke Lake watershed. Except for the Contingency Pond, the rest of the mine infrastructure will be located on the sub-watershed of Burke Lake, referred to as BL2. The Contingency Pond, which is located upstream of Peanut Lake, will be located on the sub-watershed of Burke Lake, referred to as BL4. The Contingency Pond is currently part of the proposed footprint; however, it would only be constructed if post-treatment polishing or flow balancing would be advantageous. If the additional effluent polish or storage is not required, then it will not be built. If it is built and only when required, water from the ETF would be discharged into the Contingency Pond prior to release into Peanut Lake.

9.3.2 Climate

The site has a continental-subarctic climate, marked by short summers with average temperatures of 15 degrees Celsius (°C). Winter temperatures typically range from -15 to -30 °C, with periodic lows of up to -45 °C. The mean freezing index in the region ranges from 3500 to 4000 degree Celsius-days (°C-days) (Boyd 1973).

Long-term mean precipitation for the NICO Project area was estimated to be 343.5 millimetres (mm). Approximately 48.2% of precipitation is expected to fall as snow. The mean annual snowfall was estimated to be 165.5 mm and the mean annual rainfall is estimated to be 177.9 mm.

The mean annual lake evaporation was estimated to be 478.5 mm and the relative humidity varies from 55.9% in June to 82.4% in October.

9.3.3 Geology

Ore occurs in 3 sub-parallel layers of highly altered meta-sedimentary rock, that are contained within a 200 m thick package of northwest-striking and northeast-dipping meta-sedimentary rocks, including ironstone and wacke (Section 3.4.1, Figure 3.4-1). The ironstone at the NICO ore deposit is defined as a meta-sedimentary rock that consists of minerals including iron rich biotite and amphibole, magnetite, hematite, and feldspar, with some chlorite and carbonate. The sedimentary rocks are overlain by volcanic rocks of rhyolitic to rhyodacitic composition. The sedimentary rocks are intruded by quartz-feldspar and quartz-porphyritic dykes. The ore is found mainly in the sedimentary units that have been subject to “Black Rock Alteration”. The Black Rock Ironstone formation dips at approximately 50° towards 030° (north-northeast). The major mineralized zones to be mined in this formation consist of 2 sub-parallel lenses, approximately 40 m apart.

The mineralized rock (Black Rock Altered Ironstone), the footwall rock (metamorphosed Siltstones), hanging wall/cap rock (potassium-feldspar altered Rhyolite), and feldspar dykes are all strong to very strong rocks with good to excellent rock quality designation.

Both the Black Rock and the meta-Siltstone have a low hydraulic conductivity, less than 10^{-8} metres per second. The dykes and volcanic cap rocks have higher hydraulic conductivity, attributed to the greater degree of fracturing observed in these rocks.

Static groundwater levels within the proposed Open Pit footprint generally follow topography. On the hills, the groundwater level is within 20 m of ground surface. At lower elevations, groundwater discharges to the surface, such as in the “Bowl Zone” valley on the northwest end of the NICO Project site. The groundwater discharge feeds the Grid Ponds, and is naturally elevated in some metals, such as arsenic, due to the geochemistry of the bedrock.

9.3.4 Fish and Aquatic Habitat

There are a number of lakes and streams within the NICO Project LSA. Grid Pond is a small, shallow waterbody located at the top of the watershed, which flows into Little Grid Pond. Little Grid Pond, also small and shallow, drains through muskeg into Nico Lake. Nico Lake is moderately deep and approximately 1.0 km long and flows into Peanut Lake. Ponds 8, 9, and 10 are hydrologically connected waterbodies (i.e., form a pond or wetland complex) with one small ephemeral inflow originating from the northwest and one small outflow from the east side of Pond 8 flowing through a series of beaver impoundments before entering Pond 11. Ponds 11, 12, and 13 are also small, shallow waterbodies. Ponds 11 and 13 discharge into Pond 12. Burke Lake is the largest lake in the aquatics LSA and has a large, shallow basin. Lou Lake, which is located to the west of the deposit area, is a 4 km long, narrow waterbody.

The aquatic RSA contains 4 drainage systems that flow into the Marian River (i.e., the Lou Lake watershed, the Hislop Lake watershed, the Burke Lake watershed, and the Reference Lake watershed). Mine development associated with the NICO Project would occur predominantly within the Burke Lake watershed, which encompasses the LSA. The Grid ponds at the top of the Burke Lake watershed are located in close proximity to the main ore body within an area naturally rich in arsenopyrite (iron arsenic sulphide [FeAsS]) and muskeg. The water quality of these ponds is characteristically different to that of other waterbodies within the LSA that are located farther downstream. The hydrological path extends from the Grid Ponds down through natural wetlands to Nico Lake, and then to Peanut and Burke lakes via connecting streams and ponds, and finally to the Marian River.

Arsenic is naturally elevated in the water column and sediments of some waterbodies within the Burke Lake watershed, particularly in the headwaters close to the main ore body (e.g., the Grid Ponds, Nico Lake). Arsenic concentrations typically decrease along the hydrological gradient from the Grid ponds to Burke Lake. The Grid ponds at the top of the watershed are located within close proximity of the main ore body, and in general, sediment metal concentrations in these ponds were naturally elevated in comparison to other lakes and ponds.

Potential spawning, rearing, holding, and over-wintering habitats were identified for northern pike (*Esox lucius*), lake whitefish (*Coregonus clupeaformis*), white sucker (*Catostomus commersonii*), longnose sucker (*Catostomus catostomus*), cisco (*Coregonus artedi*), burbot (*Lota lota*), and walleye (*Sander vitreus*) in the LSA lakes, ponds, and streams.

Northern pike and lake whitefish were the only species of fish common to most fish bearing waterbodies in the NICO Project aquatic LSA. Walleye were captured in Lou Lake, slimy sculpin (one specimen) was captured in Burke Lake, and ninespine stickleback were captured in the Peanut Lake Outflow, Burke Lake, and Reference Lake. Fish were not captured in Grid Pond, Little Grid Pond, Ponds 8, 10, and 11, and these waterbodies are assumed to be non-fish bearing.

Spawning habitats for northern pike were identified in Nico, Peanut, and Burke lakes, as well as Ponds 11, 12, and 13, and several inflows and outflows to these waterbodies. Lake whitefish spawning and rearing habitats were identified in Peanut, Burke, and Lou lakes, as well as Lou Lake Inflow and Outflow. Walleye spawning and rearing habitat was identified in Lou Lake and Lou Lake Outflow. The lakes in the study area and the Marian River provide overwintering habitat for fish; however, the ponds and streams are typically shallow and likely freeze to the substrate or near to the substrate most winters.

9.3.5 Terrain and Soils

The northeast portion of the terrestrial RSA is a nearly level to rolling and hilly Precambrian bedrock with thin, bouldery, coarse-textured (sandy) veneers. Fine-textured (clayey) lacustrine deposits can be found in low lying areas between bedrock exposures and at lower elevations. Common peatland types include peat plateaus, peat palsas, floating fens, and shore fens.

The southwest portion of the terrestrial RSA includes extensive low-lying plains with upland areas characterized by hill systems with level to very gentle slopes. The dominant surficial material is level to undulating, and hummocky till that has been deeply grooved by glacial ice movement in some areas. In these areas, common peatland types include peat plateaus and polygonal peat plateaus.

Upland mineral soils observed in the terrestrial RSA included Brunisolic and Regosolic soils. Brunisolic soils identified included Orthic Brunisol, Eutric Brunisol, and Dystric Brunisol. Regosolic soils identified included Orthic Regosol and were typically associated with bedrock outcrops. Wetland soils observed included Gleysolic, Organic, and Cryosolic soils. Gleysolic soils indentified included Rego Gleysol and peaty Rego Gleysol. Peaty refers to an organic layer less than 40 centimetres (cm), but greater than 15 cm deep. Organic soils observed included Terric Mesisol, Terric Humic Mesisol, and Terric Fibrisol. Terric Organics indicate that mineral soil was encountered at depths less than 160 cm. Peat depth of Terric Organics observed in the terrestrial RSA and LSA ranged from 40 to 125 cm. Cryosolic (frozen) soils observed included Gleysolic Static Cryosol, Terric Mesic Organic Cryosol, Terric Fibric Organic Cryosol, Mesic Organic Cryosol, and Fibric Organic Cryosol.

Thermistors were installed in a total of 9 boreholes within the NICO Project site during the 2003, 2004, and 2006 geotechnical investigation campaigns to measure the ground temperature. The measurements confirmed that permafrost was discontinuous. Permafrost conditions were recorded at 4 boreholes drilled in valley floors where the surface peat layer is thick and the vegetation cover is dense. The active zone in these boreholes ranged in thickness from 2 to 4 m. Unfrozen conditions were recorded in the boreholes drilled in the valley slopes, bedrock hills, and ridges where the vegetation cover is generally sparse (Golder 2010d).

Permafrost across the landscape that contains the RSA has been mapped and described as extensive discontinuous permafrost (NRC 1993). The mean annual temperature is -4.7 °C. The average freezing index in the region varies between 3500 to 4000 °C-days (Boyd 1973).

9.3.6 Vegetation

The northeast portion of the terrestrial RSA is dominated by jack pine (*Pinus banksiana*) and mixed spruce forests on bedrock outcrops. White spruce (*Picea glauca*) and trembling aspen (*Populus tremuloides*) stands are found in low-elevation areas that contain adequate nutrient and water supplies. Peat plateaus, shore fens, and floating fens are scattered throughout the area.

The southeast portion of the terrestrial RSA is dominated by closed to open white spruce and black spruce (*Picea mariana*) forests with shrub, moss, and lichen understories, or regenerating dwarf birch (*Betula pumila*) shrublands. Pond and fen complexes are scattered throughout, and closed mixed-wood, white spruce, and jack pine stands occupy rolling to ridged glacial flutings.

The most common vegetation community within the terrestrial RSA is the upland coniferous spruce type and is characterized by upland black spruce stands on very rapidly to moderately drained soils. The tree canopy averages 21% cover and consists of black spruce and white spruce. Dominant shrub species include twinflower (*Linnaea borealis*) and Labrador tea (*Ledum groenlandicum*). Dominant moss species include Schreber's moss (*Pleurozium schreberi*) and stair-step moss (*Hylocomium splendens*). Arctic wintergreen (*Pyrola grandiflora*) is the dominant forb species. Dominant lichens include green reindeer lichen (*Cladina mitis*) and grey reindeer lichen (*Cladina rangifera*).

Wetlands cover approximately 10% of the terrestrial RSA and are typically treed bogs and treed fens. The treed bogs are characterized by stunted black spruce stands that occur on poorly drained soils. Tamarack (*Larix laricina*) is typically absent in these areas. Black spruce and Labrador tea are dominant shrubs in treed bogs. Black spruce and tamarack trees are characteristic of the treed fens. The dominant shrubs include dwarf bilberry (*Vaccinium caespitosum*) and dwarf birch.

9.3.7 Wildlife and Wildlife Habitat

Wildlife habitat in the northeast part of the terrestrial RSA is characterized by many lakes, wetlands, and open forests. Trees are small, and tree coverage generally is low. Jack pine habitat is found in low coverage along hilltops in association with small black spruce, reindeer lichen, and exposed bedrock. Habitat in the southwest portion of the terrestrial RSA is characterized by more tree coverage, many wetlands, and fewer lakes. Spruce forests tend to be comprised of larger trees of more uniform size. Dense stands of large jack pine are present, and treed fens are common.

In the summer of 2008, wildfire burned approximately 10% of the proposed mine RSA. This change on the landscape may affect wildlife species to varying degrees. Moose (*Alces alces*), black bear (*Ursus americanus*), beaver (*Castor canadensis*), and muskrat (*Ondatra zibethicus*) are expected to be positively influenced by fire because fire increases the amount of shrubby and herbaceous vegetation in an area. Caribou (*Rangifer tarandus groenlandicus* and *R. tarandus caribou*), lynx *(Lynx canadensis*), marten (*Martes americana*), and wolverine (*Gulo gulo*) may be negatively impacted by wildfire, since these species avoid early successional habitats. Barren-ground caribou may not be negatively affected by fire if their home range is large enough for them to be able to use alternative, unburned areas for foraging.

Wildlife species composition in the study area is consistent with that expected based on traditional knowledge and literature on the species. The NICO Project is within the barren-ground caribou wintering grounds. As a result, carnivore species that rely on the caribou herds are regular inhabitants within the study area. Habitats in the terrestrial RSA provides den sites, forage, and cover for large and small carnivore species. Habitats in the study area support a variety of songbird and waterbird species, as well as raptors.

Mammalian species documented to occur within the terrestrial RSA include caribou, moose, black bear, boreal (timber) wolf (*Canis lupus albus*), tundra (grey) wolf (*Canis lupus*), lynx, wolverine, marten, beaver, and muskrat. In total, 38 upland breeding bird species were identified within the terrestrial RSA.

Wolverine, lesser yellowlegs (*Tringa flavipes*), boreal chickadee (*Poecile hudsonicus*), blackpoll warbler (*Dendroica striata*), and white-throated sparrow (*Zonotrichia leucophrys*) are species listed as At Risk, May be At Risk or Sensitive in the General Status Ranks in the NWT (Environment and Natural Resources 2010) that were observed within the terrestrial RSA. Common nighthawk (*Chordeiles minor*), olive-sided flycatcher (*Contopus cooperi*), and rusty blackbird (*Euphagus carolinus*) are federally listed species by the by the Committee on the Status of Endangered Wildlife in Canada (2010) or under *Schedule 1* of the Species At Risk Act (2011) that were recorded within the RSA.

At least 25 different species of waterbirds have been observed in the terrestrial RSA, and 14 species were identified as producing young. The most numerous waterbirds observed were scaup species (*Aythya affinis* or *Aythya marila*) followed by buffleheads (*Bucephala albeola*), mallard (*Anas platyrhynchos*), American widgeon (*Anas americana*), surf scoter (*Melanitta perspicillata*), and white-winged scoter (*Melanitta fusca*). Horned grebe (*Podiceps auritus*) was the only federal listed waterbird species recorded within the RSA. Surf scoter, white-winged scoter, northern pintail, and long-tailed duck are territorial listed species that were observed within the RSAs. Scaup species were observed in the RSA; however, greater and lesser scaup are difficult to differentiate in the field, so it is possible that the territorial listed lesser scaup may be present within the RSA. Raptors documented in the RSA included bald eagles (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), red-tailed hawk (*Buteo jamaicensis*), and great grey owl (*Strix nebulosa*).

9.4 Conceptual Closure and Reclamation Plan

9.4.1 Approach to Closure and Reclamation Planning

This section describes specific C&R principles for the NICO Project. The objectives of this section are to summarize the overall goals of mine closure and environmental management practices that will be implemented throughout the life cycle of the NICO Project.

Fortune uses the concept of C&R planning to highlight the mitigation methods planned to re-establish the site to useable conditions after closure. Throughout the mine planning process, a considerable amount of effort has been expended to look at the various mine development options available given the ore body and land base associated with the development area. Where possible, the designs of mine waste disposal areas, dams, dykes, and mine water management facilities have been chosen or modified to reduce the overall impact of the development.

This C&R Plan summarizes the mitigation process for the NICO Project and incorporates Fortune's operational experience as well as applicable regional experience. Also addressed will be the timing and schedule for implementation of reclamation design measures and the setting of performance monitoring indicators.

9.4.1.1 Progressive Closure and Reclamation and Goals

Fortune's C&R goal is to eventually achieve maintenance free, self sustaining ecosystems with land uses similar to pre-development conditions. 'Maintenance free reclamation' means that routine maintenance activities will be reduced to the minimum practicable level. This does not imply an unchanging state, as landforms will experience normal successional processes leading to ongoing landscape evolution. Self-sustaining ecosystems will evolve on reclaimed areas, from new plantings and natural early seral colonization to mature vegetation communities typical of the region. Following initial re-establishment of ecosystem processes, minimal management input is expected. The original and closure land uses cannot be identical, but the post-closure land use will be designed with acceptable changes based on consultation with people interested in the NICO Project.

Goals and principles for the reclamation and closure of the NICO Project include the following:

- establish Fortune's management accountability and ownership of closure and remediation activity;
- comply with relevant or applicable legislative requirements;
- progressive reclamation will be undertaken whenever practicable;
- landforms will be geotechnically stable;
- drainage systems will be designed to minimize erosion rates and substance loadings;
- reclaimed areas will eventually develop into self-sustaining ecosystems with an acceptable degree of biodiversity;
- help to protect indigenous values;
- establish physical and chemical stability in disturbed areas to reduce requirement for long-term monitoring;
- protect public health and safety using known safe, responsible reclamation practices; and
- natural colonization and recruitment of native vegetation will be encouraged in ecologically receptive areas.

Corporate policies relevant to the ongoing closure process will include the following:

- end land use objectives will be developed in consultation with people interested in the NICO Project;
- there will be an ongoing consultation process with regulators and those interested in the NICO Project; and
- adaptive management of the C&R Plan will be pursued through the incorporation of results of Fortune's site specific studies and any available regional research.

Basic end land use goals for the NICO Project include the following:

- reclaim the landscape to optimize the value of watershed, wildlife habitat, fish habitat, or other resources and taking into account preferences for people interested in the NICO Project;
- protect the aesthetic qualities of the landscape; and
- provide for traditional land uses (e.g., hunting and trapping) as preferred by individuals interested in the NICO Project.

Areas where progressive reclamation and closure is planned include the following:

- The cover on the sideslopes of the CDF (i.e., the CDF Perimeter Dyke) will be placed and revegetated progressively throughout the operational life of the NICO Project.
- Once underground mining is completed, the mobile equipment will be removed, decommissioned, and shipped off-site.
- The underground mine workings will be sealed and the portal will be filled with rock shortly after underground mining is completed.
- Wetland Treatment Systems Nos. 1, 2, and 3 will be constructed and tested during the operational life of the NICO Project to confirm they are fully operational when closure occurs.

9.4.1.2 Monitoring and Adaptive Management

Fortune's adaptive management approach involves establishing end land use objectives according to predevelopment land use, site-specific conditions, and input of people interested in the NICO Project. As reclamation proceeds, monitoring of its performance over time will allow land use objectives to be reviewed and, when required, adjustments made to site expectations based on the success, failures, and lessons learned from the reclamation processes that are underway or occurring. Adaptive management is intended to proactively assess, facilitate, and respond to soil replacement and re-vegetation processes that have been implemented to meet specific objectives. Fortune will incorporate adaptive management techniques as routine components in all of its environmental management activities. These techniques provide the opportunity to develop and fine-tune the reclamation program using data collected on-site and from other regional operators.

9.4.1.2.1 Adaptive Management Responses

Wetland Treatment System Performance

As a base case, it is assumed that water that accumulates in SCP Nos. 1, 2, 3, and 5, as well as the Surge Pond, will be passively treated in constructed Wetland Treatment Systems (Nos.1 to 3) and then released directly into Nico Lake. This is subject to the demonstration of the technical performance of Wetland Treatment Systems. It is proposed that the Wetland Treatment Systems Nos. 1 to 3 be constructed during the mine operational period to allow them to be tested during the last years of the mine operation. If the technical performance of the Wetland Treatment Systems is not demonstrated prior to closure, then the contingency will be to continue to pump water from SCP Nos. 1, 2, 3, and 5, as well as from the Surge Pond, into the Open Pit. Initially, water will accumulate in the Open Pit. Just prior to pit overflow, the water quality at the top of the Open Pit will be evaluated, and a decision will be made about post-overflow treatment. The options include the following:

- passive treatment of the overflow water through Wetland Treatment System No. 4, prior to discharge into Peanut Lake with no further requirement for treatment;
- relying on the stratification of water in the Flooded Open Pit, (i.e., the development of a chemocline and thermocline), to establish surficial water quality that is suitable for discharge to Peanut Lake;
- as a contingency, the Flooded Open Pit water can be treated in the pit by chemical or biological means, prior to the discharge of the overflow through Wetland Treatment System No. 4 into Peanut Lake; and
- as a contingency, a new ETF can be constructed and used to treat Flooded Open Pit water without spillover, with discharge through a diffuser into Peanut Lake.

Unexpected Seepage Geochemistry

Modelling indicates that the quantity and geochemical quality of the seepage from the CDF will be such that it can be adequately treated by Wetland Treatment Systems Nos. 1 to 3 and directed into Nico Lake. If this proves to be not the case, then one of the available adaptive management responses will be to actively pump water that collects in the SCPs to the Open Pit or treat the water through the existing ETF. If the reason for the poor geochemical quality relates to poor performance of the cover on the CDF, then another response could be to repair, augment, or reconstruct the cover.

Excessive Runoff

The Water Management Ponds are designed to accommodate extreme precipitation events (i.e., intense, prolonged or above average rainfall – snowmelt events), up to return periods that are acceptably long. Should longer return period events occur, the dams forming the ponds are designed to include spillways to protect against overtopping (in the absence of spillways, overtopping could otherwise lead to dam failure).

Loss of Vegetation

The CDF covers rely on vegetation to limit erosion and also to reduce infiltration by means of evapo-transpiration. A considerable amount of effort will be put into establishing self-sustaining vegetation. The possibility remains that the vegetation could be damaged by fire, drought, disease, or pests. In such a case, the vegetation will be re-established by seeding, fertilizing, or adding necessary amendments.

Monitoring

Fortune will continue to work with local community representatives to establish criteria and monitoring programs (acceptable to all parties) that clearly demonstrate progress toward environmentally sound sustainable ecosystems.

9.4.1.3 Research and Development

9.4.1.3.1 Revegetation

There are few examples of successful and well-documented re-vegetation programs in northern latitudes, especially for large-scale, intrusive disturbances. Emerging technology and program techniques from southern locales are not directly relevant to northern areas. A revegetation plan that can fulfill the reclamation objectives will need to be flexible and developed through the operational life of the NICO Project to take advantage of key findings obtained at other mine sites. At the Ekati and Diavik diamond mines, active reclamation research has been ongoing for several years with the goal of developing the best revegetation strategies for disturbed northern areas (HMA 2005; Naeth et. al. 2005). These research projects have involved the use of various combinations of amendments, soil materials, fertilizers, and vegetative species to maximize growth and develop a self-sustaining vegetative cover.

Some key research findings that will be considered at the NICO Project include the following:

- At the Ekati Diamond Mine, for selective mine units, including a diversion channel, a former exploration topsoil stockpile, and a lake sediment stockpile, seedlings and willow (*Salix* spp.) cuttings have had some success.
- Similarly, a combination of dwarf birch, fireweed (*Epilobium angustifolium*), and bluejoint (*Calamagrostis canadensis)* were successfully established in esker areas at the Ekati Diamond Mine, whereas direct seeding of the tundra has not been successful.
- Care needs to be taken in stockpiling soil materials for reclamation, with free dumping proving to be more effective at maintaining soil physical properties than levelling the piles.
- Site re-contouring and landscaping have improved moisture conditions, which in turn have improved vegetation success.
- Creating microhabitat, such as small boulder piles and mild depressions to trap moisture, has shown to be effective in enhancing plant growth opportunities, although boulder piles have only worked where vegetation is already established.
- At the Ekati Diamond Mine, native plant cultivars applied at a low seeding rate have been the most successful in encouraging native plant re-colonization.
- Sewage sludge has had mixed success at the Ekati Diamond Mine, but it has been a key part of plant establishment at the Diavik Diamond Mine (A.M. Naeth, University of Alberta, 2007, pers. comm.).
- Based on experience at the Ekati Diamond Mine, careful control of the application of sludge is required to prevent depressions from over-concentrating sludge and preventing plant establishment.
- Summer planting has not proven successful with seeds failing to germinate or seedlings dying from moisture stress; fall or spring planting shows the most promise.
- Grazing of newly established vegetation has been problematic at the Ekati Diamond Mine, and some method of discouraging grazers may be required.
- Salvaged glacial materials containing a preponderance of till yield a soil with improved texture that has proved successful in promoting plant growth.

Studies similar to those underway at the Ekati and Diavik diamond mines will be completed at the NICO Project to develop a revegetation plan that is expected to help in the successful reclamation of the site. Test plots will be prepared to evaluate the application and suitability of various reclamation techniques on the different ecological land classes disturbed as a result of NICO Project activity. The evaluation will consider the physical aspects of revegetation, such as re-contouring, erosion control techniques, seedbed preparation, surface roughening, and the use of soil amendments, which collectively promote natural secondary succession. Test plots will also be used to assess the effectiveness of various seed mixtures and their application on different growth media. In addition, the feasibility and practicality of collecting seeds from local species will be evaluated.

The overall objective of the revegetation management plan will be to create a stable landscape that encourages natural colonization, encroachment, and regeneration of endemic plant species; however, intermediate steps may be required to control soil and slope stability over a particular time period. Alternative reclamation methods, such as rock armouring, may also be used to provide long-term stability of rock slopes or other site features that may not be suitable for revegetation.

9.4.1.3.2 Wetland Treatment Systems

The configuration and performance of the Wetland Treatment Systems needs to be established before closure. Wetland Treatment Systems Nos. 1, 2, and 3 will be constructed in year 17 of the operating life of the mine. A monitoring program will be established to test and verify their performance. The results will be used to optimize the design and operation of these systems.

9.4.1.3.3 Co-Disposal Facility Covers

A program will be undertaken to optimize the design of the CDF covers. This will include the following:

- sampling and laboratory testing of the cover materials (i.e., till and sand) as well as the tailings;
- test pitting to verify the quantity and properties of the borrow sources for cover materials;
- modelling of the cover performance, considering climate variation; and
- test plots using various cover designs over top of tailings and actual Open Pit Mine Rock. These plots will be constructed, instrumented, and monitored early in the mine life, when representative samples of Mine Rock become available. The focus will be on measuring rates of infiltration and oxygen flux.

9.4.1.3.4 Geochemical Test Program

Geochemical testing will be undertaken on an ongoing basis through the mine life. This will focus on the geochemical characterization of Mine Rock and its variability over the mine life. The testing program will also include on-site testing, such as barrel leaching tests as well as covered test plots equipped with lysimeters.

9.4.2 Consideration of Public and Community Feedback and Traditional Knowledge in Developing the Plan

9.4.2.1 Overview of the Engagement Process

Fortune has established relationships with the Tłįchǫ Government and local communities, and has been interacting with their representatives since the first Land Use Permit in 1996 (Appendix 1.IV). Fortune has maintained a record of all communications, which shows that the company has routinely provided timely information, both verbal and written, on progress with the NICO Project development (Section 4, Appendices 4.I to 4.III). The local communities are interested not only in employment or business opportunities, but also in the potential improvements to the local roads and power supply. Numerous local residents have worked at the site during the exploration activities from 1998 to present day.

Pre-development land use is considered to be wildlife habitat with infrequent transitory use by Aboriginal people for subsistence hunting and trapping. Fortune's reclamation objective is to allow for the re-establishment of self-sustaining habitat that is suitable and usable for wildlife. In the short- to medium-term, some basic human support facilities will be maintained to facilitate ongoing monitoring and potential contingency implementation.

This residual usage should not be in conflict with the land use objectives. In the long-term, land usage will return to a state consistent with the original conditions.

Fortune recognizes the importance of protecting local community values, and will continue to respect and protect the long-term community values in future plans and activities.

9.4.2.2 Summary of Received or Identified Information

Feedback from community members, including Aboriginal attendees, was generally focused around broad concerns or objectives. Specific recommendations as to the standards and methods for reclamation were rarely discussed or brought forward.

The following are some of the key issues identified:

- employment and business opportunities;
- wildlife availability may be reduced, thereby negatively impacting game hunting and fishing, a source of income and sustenance;
- community health, including drinking water quality;
- traditional hunting, trapping, and fishing lifestyle will be compromised by lessened wildlife availability and contaminated food sources; and
- site and road footprint will impede traditional land uses.

Issues identified are outlined in Section 4.5 and Section 5.3.1.

9.4.2.3 Incorporation of Feedback and Traditional Knowledge into the Design of the Closure and Reclamation Plan

The following community feedback and considerations of traditional knowledge have influenced the C&R Plan:

- The decision to go with the CDF considered that it would have the smallest footprint of the 3 potential alternatives (Section 9.4.3), that it would be entirely contained in the Grid Pond area, and that it would not be visible from the Įdaà Trail.
- The decision to construct a boulder wall to prevent “inadvertent access” by people rather than surround the Open Pit with a fence was based on feedback received that wolves will herd caribou up against a fence and slaughter them.
- The decision to put a capillary break under the top cover on the CDF was to prevent the vegetation on the top from uptaking arsenic and other metals. The concern is that the caribou would graze on the vegetation and arsenic would enter the food chain.
- The decision to build the hydro-metallurgical facility in Saskatchewan was based in part on concerns from the Tłįchǫ on residual chemicals from the process and water quality at closure.

9.4.3 Alternatives Considered

Golder (2010a) discusses 3 different methods of disposal for tailings and Mine Rock that were considered and compared. These were as follows:

- Disposal of tailings and Mine Rock in Separate Sites;
- Separate disposal of tailings and Mine Rock in the Grid Ponds Area; and
- Co-disposal of tailings and Mine Rock in the Grid Ponds Area.

The third alternative, using a CDF in the Grid Ponds area, was selected in part because it was expected that it would provide superior environmental performance after closure. It was noted that the proposed cover would limit the infiltration into the Co-disposed Tailings and Mine Rock. The top surface would be contoured to promote runoff by gravity into the Open Pit. As such, the volume of water reporting to the SCPs would be reduced.

9.4.3.1 Covering of the Co-Disposal Facility

Golder (2010a) discussed several closure options for the CDF, which included progressive grading and reclamation, cover material selection (e.g., clean fill or overburden) and the composition of the waste material (i.e., Mine Rock, thickened tailings, and paste rock). Closure of the CDF was designed to minimize wind and water erosion, effectively shed water and reduce infiltration. The selected cover design for the top surface of the CDF will comprise 2 layers of soil: 0.5 m of overburden on surface underlain by 0.25 m of sand. The lower layer will act as a "capillary break", which will prevent the vegetation on the surface from uptaking arsenic and other metals from the underlying tailings. Mine Rock will not be a substantial source of arsenic uptake, so the cover on the sloped Mine Rock Perimeter Dyke will consist of a single 0.5 m thick layer of overburden without a capillary break layer.

9.4.3.2 Post-closure Treatment of Seepage Water

Water that has been affected by contact with tailings will continue to seep out of the toe of the CDF after closure, albeit at a reduced rate because of the cessation of active tailings deposition and the application of the closure cover, which will reduce infiltration. This seepage water will continue to be collected in the SCPs over the long-term, and will require treatment prior to release. Several alternatives were considered for the treatment of the toe seepage, including the following:

- pumping the water to the Open Pit;
- continuing to pump the water to the ETF for active treatment prior to discharge into Peanut Lake (i.e., the same treatment as during the operational period of the mine); and
- treatment of the seepage water in 3 Wetland Treatment Systems to be constructed prior to closure for discharge into Nico Lake.

The third alternative was selected because it is a "passive" approach, which requires far less human intervention than the other approaches.

9.4.3.3 Post-closure Treatment of Flooded Open Pit Water

Water balance modelling indicates that water will slowly accumulate in the Flooded Open Pit until it will eventually overflow from the pit through the former haul road at about Elev. 260 m. The main sources of water that will contribute to the formation of the Flooded Open Pit will include precipitation, runoff from the pit walls, groundwater inflow, upgradient runoff, and runoff from the CDF. It is projected that overflow will occur about 120 years after closure.

The results of the hydrodynamic model for the Open Pit suggest that a limited monolimnion (approximately 3% of the filled volume of 28 000 000 cubic metres) will form. The remaining volume of Flooded Open Pit will be fully mixed. Post-closure Flooded Open Pit water quality predictions were performed assuming fully mixed conditions, as it is unlikely that the monolimnion will make a substantial difference to the composition of the Flooded Open Pit water at initial discharge. Parameters that could occur at concentrations in excess of the Site-Specific Water Quality Objectives after the Open Pit has reached the spill-point elevation include aluminum, arsenic, cobalt, copper, and selenium (Section 7, Appendix 7.II).

Ultimately, it will be necessary to analyse the quality of the water at the top of the Flooded Open Pit prior to overflow. Several alternatives were considered for the treatment of the overflow water, including the following:

- relying on stratification of water in the Flooded Open Pit to verify that the surficial water is suitable for discharge to Peanut Lake;
- treating the water in the Flooded Open Pit prior to overflow by chemical or biological means;
- building a new ETF for active treatment prior to discharge into Peanut Lake (i.e., the same general type of treatment as during the operational period of the mine); and
- treatment of the overflow water in Wetland Treatment System No. 4 prior to discharge into Peanut Lake.

The base case assumption, inferred from the hydrodynamic modelling, is that the water in the Open Pit will require and will be amenable to passive treatment in Wetland Treatment System No. 4, which will be constructed on the west shore of Peanut Lake. This approach requires far less human intervention than the other approaches.

9.4.3.4 Backflooding of the Open Pit

Water balance modelling indicates that, in the absence of other actions, the Open Pit will slowly fill with water until overflow occurs about 120 years after mine closure. As discussed in Golder (2010b), consideration was given to the possibility of accelerating the rate of pit flooding by pumping water into the pit after closure. The scenario that was considered involved constructing a pumphouse and a pipeline to abstract water from the Marian River and to fill the Flooded Open Pit within 10 years after closure. Modelling of Flooded Open Pit water quality predicted that active pumping would not remove the need for on the treatment of Flooded Open Pit overflow water. It was concluded, therefore, that the cost of constructing and operating the abstraction system was not justified. The decision was made to let the Open Pit flood back passively.

9.4.4 Summary of the Closure and Reclamation Plan

9.4.4.1 Introduction

As part of NICO Project approvals, a Preliminary C&R Plan will be submitted separately to the Wek’èezhìi Land and Water Board. The plan is intended to provide the Wek’èezhìi Land and Water Board with a description of all the studies and plans related to C&R of the proposed mine and all of the related proposed mine facilities at the NICO Project. It addresses the physical stability, chemical stability, and future land use and aesthetics for each component of the proposed mine. It gives an approach of what would be done to close the NICO Project site following completion of the mining operations, either temporarily or permanently. The C&R Plan will be submitted following the approval of the DAR by regulatory authorities. The following section outlines the conceptual C&R Plan.

9.4.4.2 Design Objectives

The overall objective of the reclamation plan is to minimize the lasting environmental impacts of operations to the extent practicable and to allow disturbed areas to return to productive fish and wildlife habitat as quickly as possible.

Short-term C&R objectives include the following:

- progressively reclaim disturbed areas during operations as soon as they are no longer required;
- establish physical and chemical stability at the site, consistent with conditions existing prior to the start of operations;
- minimize the risk of erosion and sediment loss as a result of on-site runoff;
- stabilize slopes on all structures to maintain safe working conditions and facilitate reclamation activities;
- cover ground to prevent soil drifting and dust production; and
- maintain an environmentally safe site.

Long-term objectives consist of the following:

- re-establish or replace the natural fish habitat that may have been lost, altered, or disturbed as a result of the NICO Project, if required;
- return the site to a state that is similar to other habitats in the same region that are not affected by the NICO Project, which should facilitate similar wildlife use to baseline conditions; and
- create, to the extent practicable, an aesthetically pleasing final landscape.

Closure and reclamation will be progressive and will begin as soon as possible and applicable during the operating life of the mine. Most of the active closure measures will be completed within 2 years after operations cease, although a few measures need to be deferred. This period will be followed by post-closure monitoring and maintenance, which will extend 10 years after mine closure and may include maintaining the ETF for that time period, if required.

9.4.4.3 Role of Climatic Change in Development of Closure and Reclamation Plan

Scientific evidence has suggested that the earth is undergoing a period of climate change. This has implications for the vegetation and wildlife in northern Canada, including for current and future reclamation scenarios. Predictions include increased temperatures, increase precipitation in winter months and drought conditions in summer months (Stewart et al. 1997). These changes may lead to variation in species composition, increased risk of insects and disease, and variations in forest succession patterns in the boreal forest.

Climate change issues need to be considered when planning for a long-term sustainable reclamation environment. To mitigate the potential effects of climate change, reclamation plantings may include insect and drought tolerant native species, and areas may be planted to benchmark communities of surrounding disturbed areas. The principles of adaptive management will be applied to promote the success of reclaimed areas. The impacts of climate change in northern Canada are uncertain; therefore, monitoring of reclamation success is necessary to confirm reclamation techniques are being adapted to changing conditions.

Freeze induced displacement of soil (i.e., frost jacking) and thaw induced displacement (i.e., subsidence) of soil are the main issues related to permafrost degradation (i.e., loss or alteration). Changes to thaw penetration and thickness of the active layer can influence surface stability through thaw settlement, frost heave, and bearing capacity, as well as slope stability (Tarnoicai et al. 2004). Changes can also affect hydrology, soil moisture, and nutrient availability, thereby influencing the ecology of an area by affecting vegetation.

The CDF and the dams associated with the Water Management Ponds do not rely on permafrost to operate correctly. They are designed to be physically stable even if any existing ground ice in the foundations of the structures thaws. The environmental performance of the CDF does not rely on freezing of the waste materials or the cover materials. The rate of infiltration assumes that the cover is thawed; frozen conditions would reduce the rate of infiltration. Similarly, the rate of oxygen influx into the CDF assumes that the cover and the CDF are thawed. The possible development of frozen horizons would reduce oxygen influx.

The creation of permanent Water Management Ponds will change the local thermal regime and will likely thaw any ground ice in the soils below the ponds. The investigations indicate that the presence of ground ice is limited in areal extent and thickness. For this reason, the resulting differential settlements are expected to be minor and tolerable by the dams and infrastructure.

The construction of the CDF structure will change the thermal regime that pre-existed in the Grid Ponds area. After closure, there will no longer be any standing water in the area and the active freeze thaw zone will be at the surface of the raised CDF structure. For this reason, permafrost may aggrade in the area. As discussed above, this could have the positive effect of decreasing the infiltration and the oxygen ingress into the tailings and Mine Rock materials.

General mitigation measures to reduce the potential for permafrost degradation, and subsequent subsidence of areas around the mine site include the following:

- during winter months, clear areas for construction using a snow packed surface;
- revegetate disturbed areas as soon as possible;
- manage drainage around infrastructure to reduce pooling of water at the surface;
- insulate thaw-sensitive slopes;
- limit the mine footprint disturbance area;
- limit the road footprint disturbance area, while maintaining safe construction and operation practices;
- use coarser materials for road construction to minimize frost effects;
- building foundations will be built on bedrock not susceptible to frost heave to minimize thawing of permafrost in sensitive areas; and
- stripping of organic horizons containing ice-rich permafrost will be limited to areas where it is absolutely necessary, such as the footprint areas of the Water Management Pond dams, to reduce the potential for an increase in thaw depth and related thaw subsidence.

9.4.4.4 Wildlife Considerations

Caribou herds regularly show dramatic fluctuations in population size; however, the size of the Bathurst herd has declined rapidly in the past 5 years, owing to high mortality rates and previous years of failed recruitment of calves into the adult population (Nesbitt and Adamczewski 2009; Adamczewski et al. 2009). Although there is considerable evidence to suggest that the annual caribou harvest has played a key role in accelerating the rate of decline in recent years, there are many factors contributing to the decline, and the dynamics of the herd are complex. A recent workshop incorporating scientific information and Traditional Knowledge identified fire on the winter range, disease, timing of spring, predators, hunter harvest, as well as human development as possible contributing factors (Nesbitt and Adamczewski 2009; Adamczewski et al. 2009).

The NICO Project location overlaps with the winter range of Bathurst caribou herd. Pathway analysis identified and assessed the issues and linkages between the ecology of caribou and the NICO Project components and activities. Many pathways were eliminated or identified as being secondary because of the environmental design features and mitigation incorporated during the development of the NICO Project. Other potential pathways were considered to be primary and to result in expected changes to population abundance and distribution, and traditional and non-traditional use of Bathurst caribou, after implementing environmental design features and mitigation. There were 2 primary pathways that were likely or highly likely to lead to negative residual (after mitigation) effects on caribou and human use of caribou and were summarized as direct effects from changes in habitat quantity and fragmentation from the physical footprint of the NICO Project and access roads, and as indirect effects from the NICO Project. Indirect effects included sensory disturbances (e.g., presence of people, lights, smells, vehicles) that can change the quality of adjacent habitats, alter animal movements and behaviour, and ultimately influence survival and reproduction.

Although the number of human developments in the caribou effects study area has generally increased over time, human developments have directly affected less than 1% of the landscape. With the application of the NICO Project and reasonably foreseeable developments, this cover value will remain low and below 1% of the landscape. The current and projected percentage of disturbed cover in the caribou effects study area, therefore, is well below the 40% threshold value identified in the peer-reviewed literature on the effects of habitat loss (reviewed in Swift and Hannon 2010). Research has shown that when disturbance cover exceeds 40%, the configuration of the landscape can change and the influences of habitat fragmentation on populations of wildlife become apparent.

In addition to direct habitat effects, sensory disturbances produced from the NICO Project may indirectly affect caribou. The combination of direct (physical footprint) and indirect effects can create a zone of influence. Based on previously completed research, it was assumed that the zone of influence was 15 km around the NICO Project (707 km^2). In addition, incremental local and regional effects from the NICO Project, roads and other developments can accumulate together to influence the quality of available habitat and the number of animals that the landscape can support (i.e., carrying capacity). Resource selection models showed that the majority of preferred habitats (i.e., good and high-quality habitats) lost to development occurred prior to 2000, and that cumulative effects peaked in 2006. Analyses showed that cumulative impacts from historical pre-disturbance conditions through to a scenario with the NICO Project and reasonably foreseeable developments were low in magnitude (i.e., less than 10%).

Another objective of the effects analysis was to assess the ‘energy’ implications of cumulative encounters with developments during the rut/autumn and early winter seasons on caribou energy balance and calf production in the Bathurst herd. The intention was to better understand effects from the natural environment and human developments on caribou body condition, which is functionally related to vital rates, such as fecundity (i.e., ability to become pregnant in autumn and deliver a calf in spring) and calf survival. Results showed that although human developments during fall and early winter movements in the winter range of the Bathurst herd may affect the demography of the herd, this effect is relatively small compared to weather-related factors. The anticipated stress from poor conditions in spring was much greater than the anticipated effects of sensory disturbances from developments in the caribou effects study area. Bergerud et al. (1984) contend that there is little to no evidence that sensory disturbance activities affect productivity. Further, information on the current condition of Bathurst cows suggests that animals are in good condition and that pregnancy rates are high (Adamczewski et al. 2009). This suggests that large-scale improvements in environmental conditions may be occurring across the landscape.

The above-mentioned pathways were associated with changes to habitat quantity, habitat quality, behaviour, survival, and fecundity. The duration of cumulative and incremental impacts from the NICO Project on caribou population abundance and distribution, and traditional and non-traditional use of caribou for the majority of pathways is anticipated to be reversible over the long-term (approximately 2 caribou life spans). The RSA currently supports low numbers of caribou (0.8 caribou/km^2) and direct disturbances to habitats within the development footprint will be irreversible within the temporal boundary of the assessment. Overall, the NICO Project should not have a significant adverse affect on the persistence of Bathurst caribou. There is a moderate degree of uncertainty associated with this prediction, which is primarily related to the duration of impacts and the variability inherent to long-term predictions in ecology; however, conservative estimates in a number of analyses and models consistently generated low magnitude of effects, which indicates that the predicted impacts were not underestimated.

Infrastructure (e.g., buildings, ditches, road berms, the Airstrip, and Open Pit) and blasting activities associated with the NICO Project may be hazardous to wildlife species. Wildlife injury or mortality may occur by collisions with vehicles, ingesting contaminated water, sediment, or invertebrates, becoming mired in tailings deposits, or by entering the CDF or Open Pit, especially during blasting activities. Environmental design features and mitigation, as well as current wildlife management practices used on the Ekati, Diavik, and Snap Lake mine sites, will be implemented at the NICO Project to limit wildlife injury and mortality. Environmental design features and mitigation that will be implemented at the NICO Project include the following:

- boulder barrier around Open Pit;
- blasting will be temporarily suspended when wildlife (ungulates and carnivores) are spotted within the “safe zone”;
- the CDF will be regularly monitored for wildlife activity and wildlife hazards;
- reflectors or other deterrents will be installed to discourage wildlife from crossing the roads;
- at closure, borrow pits, the Plant area, stockpile areas, etc. will be re-contoured to reduce hazards to wildlife;
- ditches will be contoured at closure as appropriate to remove any hazards to wildlife; and
- wildlife deterrent actions will be implemented by knowledgeable and trained personnel.

The potential physical hazards from the NICO Project (e.g., buildings, open pits, ditches, road berms, Airstrip berms, and blasting activities) are predicted to result in a minor change to mortality of individuals relative to baseline conditions. The small area that will be unreclaimed is not expected to affect wildlife movements. The unreclaimed areas (e.g., Open Pit) will constitute a part of the home range of a few individuals of wildlife and the decrease in habitat for some individuals. Both physical hazards and habitat loss and fragmentation are expected to have negligible residual effects on the persistence of wildlife populations.

9.4.4.5 Key Closure and Reclamation Activities

9.4.4.5.1 Soil and Overburden

During the development of the mine, overburden will be removed to expose the top of the deposits and to allow surface mining of the deposits to proceed. To the extent possible and practicable, these materials will be stockpiled and used for construction and/or reclamation activities.

In a similar fashion, soils disturbed during the construction of the plant site, Airstrip, and other on-site facilities will be, to the extent possible and practicable, initially stockpiled in Growth Media Stockpiles (Figure 9.1-2). As progressive reclamation occurs, soils will be recovered from the stockpiles and spread over reclaimed areas that would benefit from additional soil.

9.4.4.5.2 Co-Disposal Facility

The C&R Plan for the CDF has 4 main components:

- progressive grading of the CDF during operations to promote runoff into the Reclaim Pond and eventually into SCP No. 4 to the Open Pit;
- installation and vegetation of closure covers over the entire surface of the CDF;
- drainage of runoff water from the surface of the CDF into the Open Pit to increase the rate of pit filling (i.e., Flooded Open Pit formation); and
- collection and management of water that seeps out of the toe of the CDF in the SCPs.

Details of these closure measures are provided in the following subsections.

9.4.4.5.2.1 Covers

A closure cover will be placed over the entire surface area of the CDF, effectively encapsulating the co-disposed tailings and Mine Rock. The proposed closure cover has been selected to minimize wind and water erosion, and to reduce infiltration into the CDF. Over the long-term, reducing infiltration will reduce the volume of water that will seep out of the toe of the CDF and report to the SCPs. The proposed closure cover system is intended to be effective at shedding water (primarily of benefit during the spring freshet), and also to provide adequate store and release capacity to minimize infiltration during the dry summer months.

Where the cover is underlain by co-disposed tailings and Mine Rock (i.e., on the top surface of the CDF), the surface of the cover will comprise 0.5 m of glacial till underlain by 0.25 m of sand. Where the cover will be underlain by Mine Rock alone (i.e., on the sloped perimeter dyke), the cover will comprise a single 1.0 m thick layer of glacial till (without an underlying sand layer). The top surface of the closed CDF will slope towards the west at about 2%, and this slope will substantially enhance the water shedding capacity, reducing net infiltration rates to between 10 to 15% of the total precipitation. The 0.25 m sand layer will serve as a capillary break, to minimize the potential for upward flux of tailings pore water, reducing the potential for arsenic uptake by vegetation. Because the glacial till and Mine Rock alone will not be a major source of arsenic uptake, there is no need to include a capillary break under the CDF Perimeter Dyke cover.

Field testing of both cover details is recommended to evaluate their relative performance in terms of net infiltration rates. This could be achieved by constructing 2 large scale lysimeters, one containing co-disposed tailings and Mine Rock and one containing Mine Rock, and then covering these materials with their respective covers.

9.4.4.5.2.2 Revegetation

Revegetation in northern areas is challenging because of limitations associated with cool short summers, low precipitation levels, cold winters, permafrost, and other biotic and abiotic influences that are not always readily identifiable or controllable. Other challenging factors include the limited availability of soil, a less-than-comprehensive understanding of indigenous plant physiology and associated succession processes, and the general absence of endemic plant seeds or other propagules in sufficient quantities for use in large-scale planting or seeding. As a result, growth and establishment of vegetation in northern areas is often slow and patchy.

As outlined in Section 9.4.1.3, Fortune will study the feasibility and applicability of using various plant species and planting or site preparation techniques as part of their revegetation program; however, the current revegetation management objective will be to create a stable and favourable landscape that will encourage natural colonization, encroachment and regeneration of endemic plant species. This will be complemented by planting or seeding where required. A list of potential species to be considered as part of a planting or seeding program is provided in Table 9.4-1.

It is standard engineering practice that trees should not be allowed to grow on dams because roots from mature trees can damage the various components of the dams (i.e., fill zones, liners, geotextiles, etc), when the trees die. For this reason, no trees will be planted on the dams which form the water management ponds. Trees that naturally propagate into dam surfaces will be periodically cut down. To make periodic tree cutting unnecessary after closure, the decision may be made at closure to place a layer of bouldery Type 1 mine rock on the upstream face and crest of the dams. Similarly, no trees will be planted on the CDF cover; however, removal of volunteer trees after closure should not be necessary on the CDF.

Table 9.4-1: Potential Species to Consider for Revegetation

Ecological Land Classification	Vegetation Layer	Latin Name	Common Name
Bedrock open conifer	Trees	*Picea mariana*	black spruce
		Pinus banksiana	jack pine
	Shrubs	*Arctostaphylos uva-ursi*	bearberry
		Empetrum nigrum	crowberry
		Juniperus communis	ground juniper
		Ledum groenlandicum	Labrador tea
		Rubus idaeus	wild red raspberry
		Salix species	willow species
	Grass	*Agrostis scabra*	rough hair grass
		Calamagrostis canadensis	bluejoint
		Deschampsia species	hair grass species
		Poa glauca	timberline bluegrass
Coniferous pine	Trees	*Pinus banksiana*	jack pine
	Shrubs	*Alnus viridis ssp crispa*	green alder
		Arctostaphylos uva-ursi	bearberry
		Empetrum nigrum	crowberry
		Juniperus communis	ground juniper
		Ledum groenlandicum	Labrador tea
		Rosa acicularis	prickly rose
		Shepherdia canadensis	Canada buffaloberry
		Vaccinium vitis-idaea	bog cranberry
		Viburnum edule	low-bush cranberry
	Grass	*Oryzopsis pungens*	northern rice grass

Table 9.4-1: Potential Species to Consider for Revegetation (continued)

Ecological Land Classification	Vegetation Layer	Latin Name	Common Name
Coniferous spruce	Trees	*Picea glauca*	white spruce
		Picea mariana	black spruce
	Shrubs	*Alnus viridis ssp crispa*	green alder
		Arctostaphylos rubra	alpine bearberry
		Arctostaphylos uva-ursi	bearberry
		Empetrum nigrum	crowberry
		Juniperus communis	ground juniper
		Ledum glandulosum	glandular Labrador tea
		Ledum groenlandicum	Labrador tea
		Ledum palustre	northern Labrador tea
		Linnaea borealis	twinflower
		Myrica gale	sweet gale
		Potentilla fruticosa	shrubby cinquefoil
		Rosa acicularis	prickly rose
		Salix bebbiana	beaked willow
		Salix discolor	pussy willow
		Salix glauca	smooth willow
		Salix lucida (also S. lasiandra)	shining willow
		Salix myrtillifolia	myrtle-leaved willow
		Shepherdia canadensis	Canada buffaloberry
		Vaccinium vitis-idaea	bog cranberry
		Viburnum edule	low-bush cranberry
	Grass	*Agrostis scabra*	rough hair grass
		Calamagrostis canadensis	bluejoint

Table 9.4-1: Potential Species to Consider for Revegetation (continued)

Ecological Land Classification	Vegetation Layer	Latin Name	Common Name
Mixedwood spruce-paper birch-aspen	Trees	*Betula papyrifera*	white birch
		Picea glauca	white spruce
		Picea mariana	black spruce
		Populus tremuloides	aspen
	Shrubs	*Alnus viridis ssp crispa*	green alder
		Ledum groenlandicum	Labrador tea
		Potentilla fruticosa	shrubby cinquefoil
		Ribes oxyacanthoides	northern gooseberry
		Ribes triste	wild red currant
		Rosa acicularis	prickly rose
		Salix bebbiana	beaked willow
		Salix planifolia	flat-leaved willow
		Salix glauca	smooth willow
		Salix maccalliana	velvet-fruited willow
		Salix myrtillifolia	myrtle-leaved willow
		Shepherdia canadensis	Canada buffaloberry
		Vaccinium vitis-idaea	bog cranberry
		Viburnum edule	low-bush cranberry
Deciduous aspen-paper birch	Trees	*Betula papyrifera*	white birch
		Populus tremuloides	aspen
	Shrubs	*Alnus viridis ssp crispa*	green alder
		Arctostaphylos uva-ursi	bearberry
		Juniperus communis	ground juniper
		Ledum groenlandicum	Labrador tea

Table 9.4-1: Potential Species to Consider for Revegetation (continued)

Ecological Land Classification	Vegetation Layer	Latin Name	Common Name
		Rosa acicularis	prickly rose
		Salix glauca	smooth willow
		Salix species unknown	willow species unknown
		Shepherdia canadensis	Canada buffaloberry
		Vaccinium vitis-idaea	bog cranberry
		Viburnum edule	low-bush cranberry
	Grass	*Oryzopsis asperifolia*	white-grained mountain rice grass
		Oryzopsis pungens	northern rice grass
Marsh/graminoid fen	Forbs	*Calla palustris*	water arum
		Triglochin maritima	seaside arrow-grass
		Typha latifolia	cattail
	Grass and Grass-like	*Calamagrostis canadensis*	bluejoint
		Carex aquatilis	water sedge
		Carex utriculata	small bottle sedge
		Eriophorum angustifolium	tall cotton-grass
		Glyceria grandis	common tall manna grass

9.4.4.5.2.3 Wetland Treatment and Adaptive Management Options

As a base case, it is assumed that water that accumulates in SCPs Nos. 1, 2, 3, and 5, as well as the Surge Pond, will be passively treated in constructed wetlands and then released directly into Nico Lake. This is subject to the demonstration of the technical feasibility of wetland treatment. The wetlands will be constructed and tested during the operating life of the mine. If the technical feasibility of wetland treatment is not demonstrated prior to closure, then the contingency will be to continue to pump water from SCPs Nos. 1, 2, 3, and 5, as well as from the Surge Pond, into the Open Pit.

The Open Pit has an ultimate depth of 185 m, and a bottom elevation of 95 m. At closure, pumping of water out of the Open Pit will cease and the Open Pit will slowly fill with water. Flooding of the Open Pit is beneficial in that higher water levels will reduce any localized areas of potentially acid generating rock that will be exposed to atmospheric conditions, thus reducing the total metal loading from the pit wall runoff over time. The rate of flooding will be accelerated by directing runoff from the top surface of the CDF into the Open Pit. This will be accomplished by installing culverts to direct flow from SCP No. 4 under the site road into the Open Pit. Modelling indicates that it will take roughly 120 years for the pit water level to rise to Elev. 260 m, at which time the Flooded Open Pit will begin to overflow through the haul road ramp. A bulkhead will have to be installed in the decline for water to overflow. At this point, the flow from the Open Pit will be routed for passive treatment in Wetland Treatment System No. 4. The base case assumption, inferred from the hydrodynamic modelling, is that the water in the Open Pit will require and will be amenable to passive treatment. The water from Wetland Treatment System No. 4 will discharge into Peanut Lake, and it will be constructed at least 2 years prior to overflow (i.e., around 118 years after closure).

9.4.4.5.2.4 Boulder Wall

After closure, a boulder wall will be constructed around the Flooded Open Pit to prevent inadvertent access by wildlife and people. The wall will be constructed outside of a ‘safe-line’ of approximately 50 m from the edge of the Open Pit beyond any area of potential pit instability. According to Ontario Mine Development and Closure Regulation (Ontario Regulation 240/00), boulders used for fencing should be a minimum of 1.25 m in height, and be no further than 0.6 m apart. If the Flooded Open Pit is accessed inadvertently, the haul road will act as an exit ramp. No caribou mortalities from entering the open pits at other mines in the NWT have been reported (BHPB 2010; DDMI 2010; De Beers 2010).

9.4.4.5.3 General Demolition and Disposal Procedures

After mining has ceased, C&R of the plant site will begin. Mobile mining equipment will be shipped off-site. Some of the construction equipment will remain on-site for up to 10 years to assist in closure, but after that, it too will be shipped off-site.

Where it is economic to do so, processing equipment, generators, camp trailers, pumps, valves, etc. will be decommissioned and shipped off-site for salvage. Materials with scrap value (e.g., stainless steel, copper, and possibly also structural steel) will be removed from site and sold as scrap. Buildings will be demolished and the debris will be hauled to an industrial non-hazardous waste landfill to be established in the CDF. Equipment that cannot be salvaged or sold as scrap will also be placed in the landfill. The landfill will be covered after it is no longer required. Building foundations and slabs on grade will be left in place, punctured to allow drainage and covered with till or gravel to provide a medium for subsequent surface revegetation.

The ETF, including the pumps and pipelines and the Peanut Lake diffuser, will be decommissioned and mothballed. It will remain in place as a contingency in case it becomes necessary to treat any site water prior to release into Peanut Lake. If the ETF system is not required after 10 years, it will be demolished. Should active treatment of Open Pit overflow water become necessary after overflow occurs, then a new ETF system would be constructed.

To support on-site personnel during the initial C&R phase of the NICO Project, suitable site services, including potable water treatment, sewage treatment, and communications, will be maintained. A small portion of the camp site from operations will be left intact for this purpose. It is expected that these site facilities will be not be needed after approximately 10 years. At that time, they will be decommissioned, dismantled, and disposed of, as appropriate. They will be replaced, as appropriate, with smaller, temporary facilities in support of post-closure monitoring activities Subsequent maintenance and monitoring on-site will be carried out largely by local residents. Should it be necessary to mobilize specialists to the site, they will fly in from Yellowknife by float plane or helicopter. Should any additional equipment or supplies be required, they will be brought to site by means of a winter road.

9.4.4.5.4 NICO Proposed Access Road and Airstrip

After the closure phase (approximately 5 years after mine operations have stopped), the NPAR and Airstrip will no longer be required for the NICO Project. Fortune will offer the NPAR and Airstrip to the Tłįchǫ Government. If they don’t want the NPAR or Airstrip transferred to them, they will be closed and reclaimed by Fortune.

Site roads not required for post-closure maintenance and monitoring will be decommissioned and reclaimed at the end of the closure phase. The Airstrip will be reclaimed near the end of the site closure phase of the NICO Project. Lighting, navigation equipment, and the airstrip will be de-registered with Transport Canada. Culverts or stream-crossing structures will be removed and the corresponding surface area contoured to eliminate potential hazards to wildlife and to re-establish natural drainage.

Reclamation for both the roads and Airstrip will involve scarifying and loosening the surface to encourage natural revegetation. Where erosion or sedimentation is a concern, the surface will be contoured to a stable profile to mitigate the influence of erosion and sediment deposition. Post-closure access to the site will be achieved primarily by float plane and/or by winter road.

9.4.4.5.5 Waste Petroleum Products, Chemicals, and Explosives

Any unused explosives, reagents, or other chemicals that remain after production ceases will be shipped off-site. Fuel tanks will be pumped out and hauled off-site. Studies (i.e., Phase 1 and Phase 2 Environmental Site Assessments) will be undertaken to determine the existence and extent of any hydrocarbon or other by-product contamination. The landfarm (i.e., a bioremediation cell) already established on-site will treat hydrocarbon contaminated soils. Remediated soils will be placed in the CDF.

Prior to demolition, buildings and equipment will be inspected so that potentially hazardous materials are correctly identified and flagged for appropriate removal and disposal. All equipment will be drained of fluids and cleaned so that potentially hazardous materials are not placed within the CDF.

Before beginning these activities, a non-hazardous solid waste disposal site will be established in the CDF. The appropriate authorizations will be obtained as required from the relevant regulatory agencies that deal with land leases and water use, such as the Wek’èezhìi Land and Water Board, and Indian and Northern Affairs Canada.

Any and all hazardous wastes will be shipped off-site for disposal in a licensed facility (Appendix 3.V). Hazardous materials are generally expected to consist of waste oil, glycol, lubricants, solvents, paints, batteries, and miscellaneous chemicals. Some of these materials may be suitable for recycling, if appropriate facilities off-site are available. Hazardous materials will be stored in sealed containers and drums in a lined waste transfer area or temporary enclosure. The equipment and materials will be shipped to appropriate disposal, recycling, or salvage facilities.

The potential for ground contamination around the maintenance building and other structures will be assessed. Other assessed areas will include the airstrip de-icing area and fuel storage pad, the Plant, power plant, accommodations complex, service complex, waste management facilities, and storage facilities. Soils in these areas will be sampled during decommissioning and analyzed for contaminants, such as hydrocarbons and glycol. Any contaminated soils will be excavated and either permanently encapsulated in a secure area, treated on-site to an acceptable standard, or stored in appropriate sealed containers for off-site shipment and disposal.

9.4.4.5.6 Erosion Control

During the processes of site development and closure, the quantity of soils available for site reclamation may be reduced due to wind and water erosion. Erosion is a concern within the NICO Project footprint during soil salvage and stockpiling due to removal of the vegetation cover. Also, stockpiles maintained through the operation phase may be susceptible to erosion due to factors such as steep slopes and desiccation.

Erosion will be controlled principally by keeping slope angles of constructed facilities at less than the angle of repose or by rock armouring, as appropriate. Where feasible, long-term sediment control will be achieved by revegetation. Rock armouring will be done where revegetation is not possible and erosion control is required. The rock will be obtained by screening suitably sized inert material from the Mine Rock stockpile.

The final top surface of the CDF will be sloped gently (at 2%) towards the west and vegetation will be established on the surface of the till cover to prevent erosion. The sideslopes of the CDF will have 3:1 (horizontal:vertical) slopes interrupted by benches every 10 m vertically. Runoff will be collected at each bench and transmitted downslope from bench to bench through rock lined chutes at regular spacings. The till covers on the sloped faces will be revegetated to protect them against erosion by local runoff. It should be noted that the entire sloped surface of the CDF comprises the CDF Perimeter Dyke and will be constructed of Type 2 Mine Rock.

Some specific erosion control practices available for the general NICO Project area include the following:

- minimize soil exposure and control surface runoff, especially during wet weather and in areas close to watercourses;
- construct temporary cross ditches to redirect surface runoff;
- construct temporary berms of imported logs, construction timbers, sandbags, or other material as appropriate and available;
- construct roads so natural drainage patterns are not impeded and in a manner that runoff to road ditches enters natural drainage systems or contoured containment areas;
- use temporary erosion control measures, such as mulches, mats, and netting, to control erosion prior to establishment of a protective vegetative cover;

- apply tackifiers, where necessary, to stabilize soils and use hydroseeders for seeding on steep slopes; and
- promptly seed exposed areas and topsoil stockpiles with a self-sustaining, erosion controlling seed mix appropriate to the region.

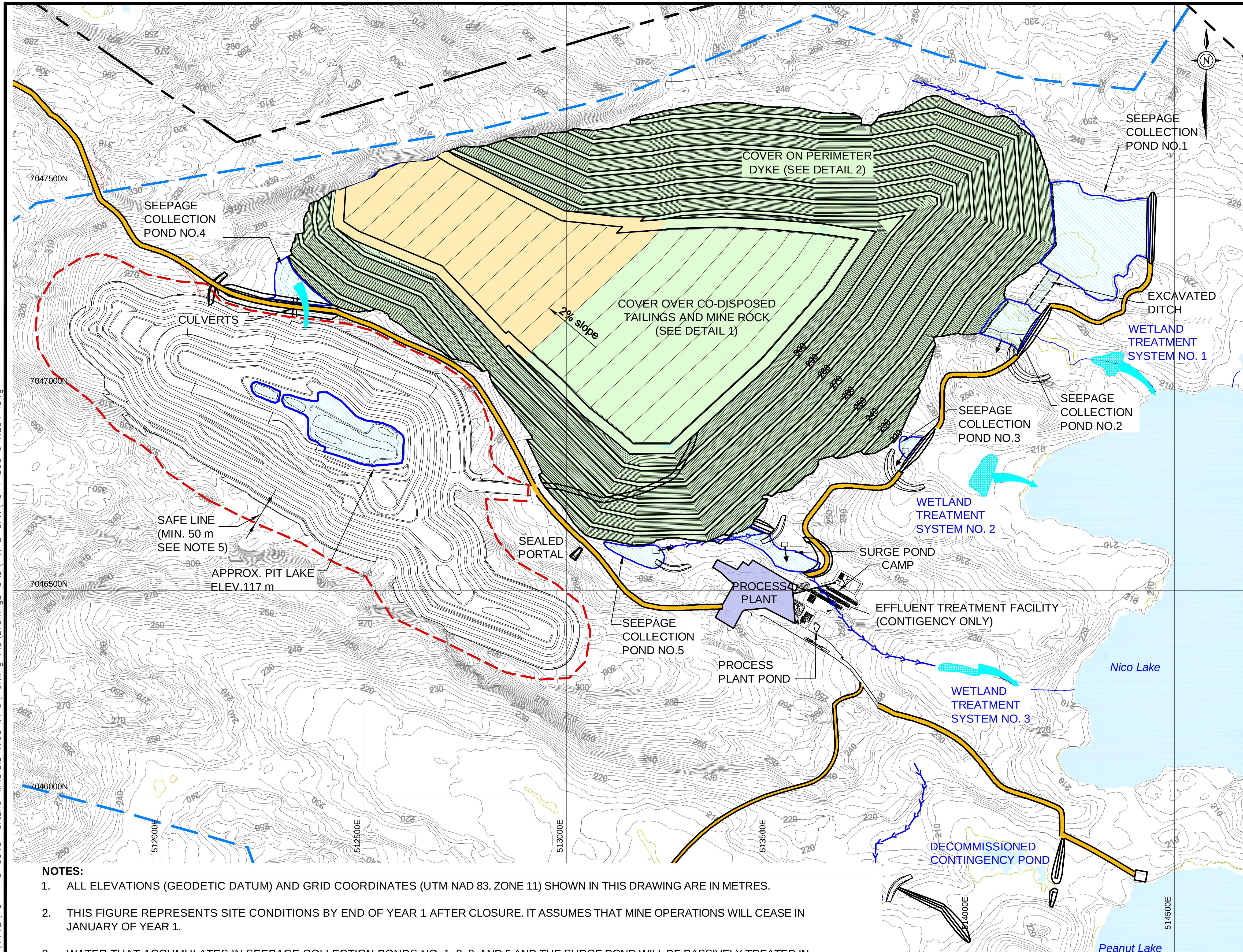
9.4.4.6 Schedule of Key Activities

The cornerstone of the NICO Project's C&R Plan is progressive reclamation, whereby any disturbed area that is no longer in use is reclaimed as soon as possible or practicable. As a result, C&R activities will occur throughout the 18-year operational life of the NICO Project. Key milestones in the C&R schedule are outlined in Table 9.4-2.

Table 9.4-2: Closure and Reclamation Schedule

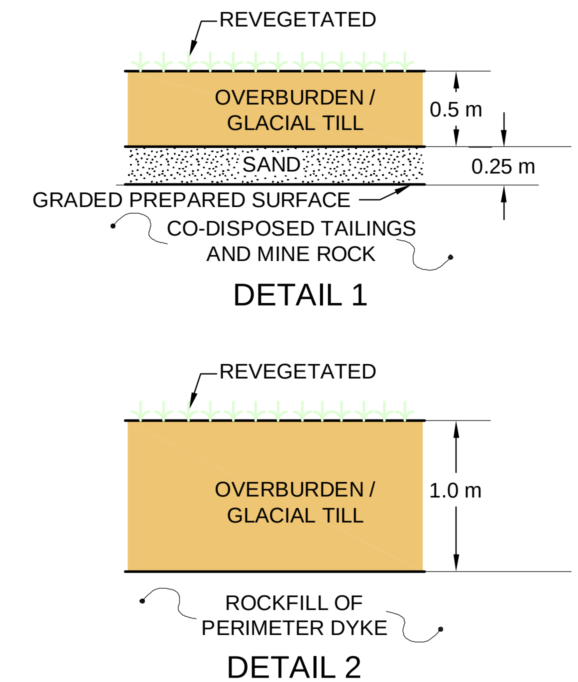
Activity / Milestone	Operation Year	Closure Year
Begin progressive reclamation of Co-Disposal Facility	2	-
Remove underground equipment, seal adit	2	
Wetland Treatment Systems Nos. 1, 2, and 3 construction and testing	17	-
Decommissioning and salvage of on-site facilities	-	1
Demolish on-site facilities, debris to landfill		1,2
Remove main fuel storage tanks	-	1
Excavation and removal of potentially contaminated sites	-	1
Demolish operational Effluent Treatment Facility system, if not required	-	10
Breaching of Contingency Pond dams	-	10
Reclaim on-site roads		10
Close camp facilities		2,10
Reclaim NICO Project Access Road	-	5
Reclaim airstrip	-	5
Place cover on Co-Disposal Facility and revegetate	-	1,2
Barricade Open Pit with boulder wall	-	1 or earlier
Begin naturally flooding the Open Pit	-	1
Revegetation of borrow and disturbance areas	-	1
Construct winter road to move equipment to site to construct Wetland Treatment System No. 4	-	117
Construct road and ditch from Open Pit to Wetland Treatment System 4		118
Wetland Treatment System No. 4 construction and testing	-	118
Construct new Effluent Treatment Facility, if required	-	118

Visual representations of the mine 1 year, 2 years, 10 years, 25 years, and 120 years after closure are presented in Figures 9.4-1 to 9.4-5.



LEGEND

- PUMP STATION (CONTINGENCY ONLY)
- BOULDER WALL
- DIVERSION DITCH
- PROJECT LEASE BOUNDARY
- WATERSHED
- ACCESS ROAD
- SEEPAGE COLLECTION POND DAM
- EMERGENCY SPILLWAY
- CO-DISPOSED TAILINGS AND MINE ROCK
- CONSTRUCTED WETLAND TREATMENT SYSTEM
- DEMOLISHED AND REVEGETATED
- RE-VEGETATED COVER OVER CO-DISPOSED TAILINGS AND MINE ROCK
- WATER BODY



REFERENCE

Base mapping provided in digital format by Fortune Minerals Limited received 20 February 2004.

Process plant and mine infrastructure provided by Aker Solutions filename 0000g001d (plant site oct252010).dwg provided 26 OCTOBER 2010. Revised pits provided by P & E Mining Consultants, ultimate pit and topo.dxf on 26 January 2010.

Project lease boundary provided by Fortune (8 October 2008) with comments provided 19 December 2009.

200 0 200 400

SCALE 1:10,000 METRES

NOTES:

1. ALL ELEVATIONS (GEODETIC DATUM) AND GRID COORDINATES (UTM NAD 83, ZONE 11) SHOWN IN THIS DRAWING ARE IN METRES.
2. THIS FIGURE REPRESENTS SITE CONDITIONS BY END OF YEAR 1 AFTER CLOSURE. IT ASSUMES THAT MINE OPERATIONS WILL CEASE IN JANUARY OF YEAR 1.
3. WATER THAT ACCUMULATES IN SEEPAGE COLLECTION PONDS NO. 1, 2, 3, AND 5 AND THE SURGE POND WILL BE PASSIVELY TREATED IN WETLAND TREATMENT SYSTEMS AND RELEASED DIRECTLY TO NICO LAKE.
4. SEE SECTION 9.4 OF THE DEVELOPERS ASSESSMENT REPORT FOR WATER TREATMENT ADAPTIVE MANAGEMENT RESPONSES IN CASE WETLAND TREATMENT SYSTEM DOES NOT OPERATE AS PLANNED.
5. A BOULDER WALL WILL BE CONSTRUCTED AROUND THE OPEN PIT FOR SAFETY REASONS (TO PREVENT INADVERTENT HUMAN ACCESS). A MINIMUM SAFE LINE OF 50 m HAS BEEN ASSUMED, THIS WILL BE CONFIRMED IN THE OPEN PIT STABILITY AND SET-BACK STUDY TO BE CARRIED OUT BY THE END OF THE MINE LIFE OPERATION.

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

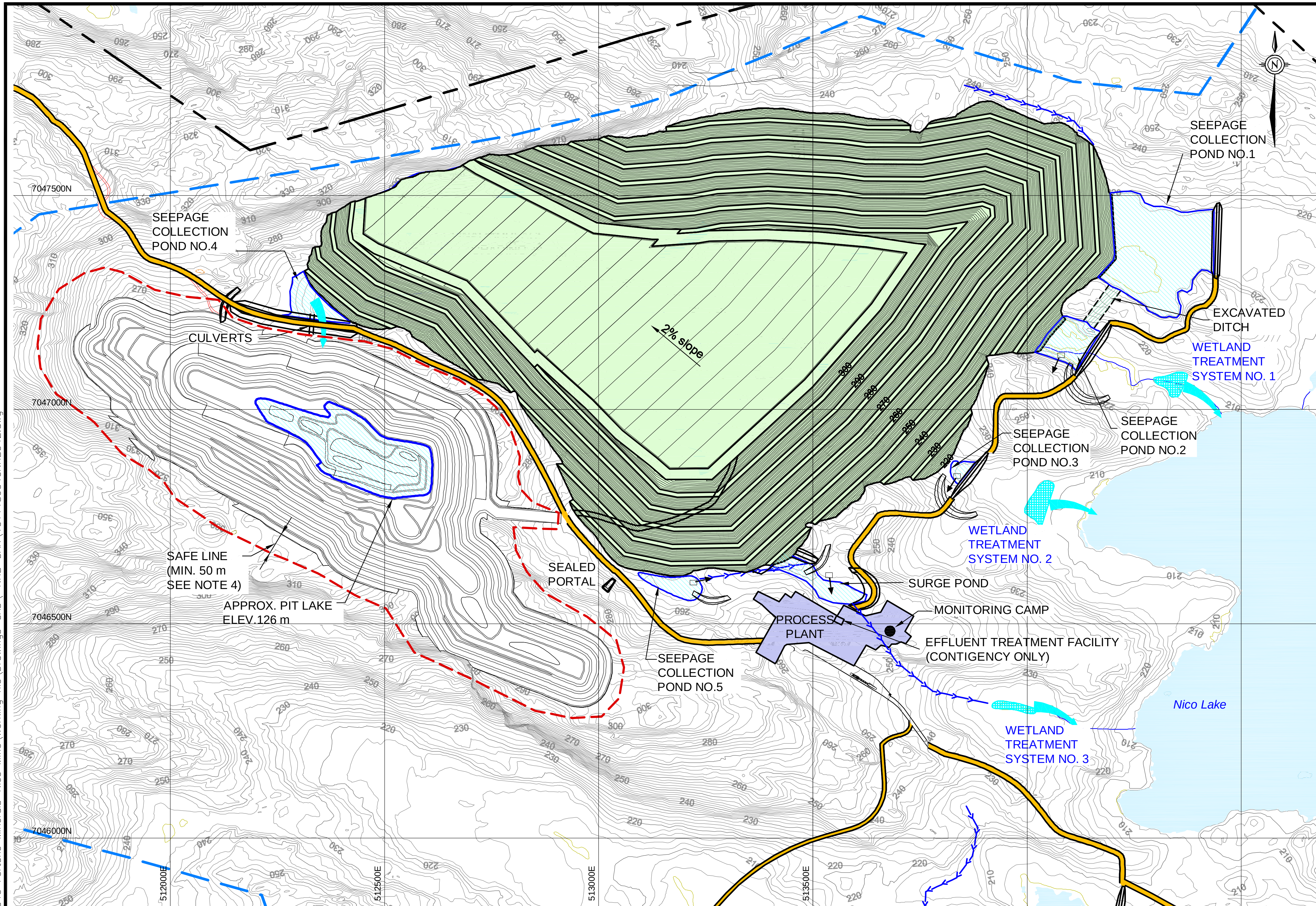
CLOSURE YEAR 1

FILE No: E-Miss-004-CAD.dwg

PROJECT No: 09-1373-1004			SCALE AS SHOWN	REV. 0
DESIGN	IM	15 Feb. 2011	FIGURE: 9.4-1	
CAD	TDR	15 Feb. 2011		
CHECK	IM	15 Feb. 2011		
REVIEW	KAB	15 Feb. 2011		

Golder Associates
Edmonton, Alberta

PLOT DATE: April 12, 2011
FILENAME: N:\Active\2010\1118\10-1118-0046 Fortune Minerals-Nico Mine\Working file\Drawings-CAD\-NHB-DAR\1011180046NHB941.dwg



LEGEND

- PUMP STATION (CONTINGENCY ONLY)
- BOULDER WALL
- DIVERSION DITCH
- PROJECT LEASE BOUNDARY
- WATERSHED
- ACCESS ROAD
- SEEPAGE COLLECTION POND DAM
- EMERGENCY SPILLWAY
- CO-DISPOSED TAILINGS AND MINE ROCK
- CONSTRUCTED WETLAND TREATMENT SYSTEM
- DEMOLISHED AND REVEGETATED
- REVEGETATED COVER OVER CO-DISPOSED TAILINGS AND MINE ROCK
- WATER BODY

REFERENCE

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Project lease boundary provided by Fortune (8 October 2008) with comments provided 19 December 2009.

200 0 200 400

SCALE 1:10,000 METRES

NOTES:

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2. WATER THAT ACCUMULATES IN SEEPAGE COLLECTION PONDS NO. 1, 2, 3, AND 5 AND THE SURGE POND WILL BE PASSIVELY TREATED IN WETLAND TREATMENT SYSTEMS AND RELEASED DIRECTLY TO NICO LAKE.
3. SEE SECTION 9.4 OF THE DEVELOPERS ASSESSMENT REPORT FOR WATER TREATMENT ADAPTIVE MANAGEMENT RESPONSES IN CASE WETLAND TREATMENT SYSTEM DOES NOT OPERATE AS PLANNED.
4. A BOULDER WALL WILL BE CONSTRUCTED AROUND THE OPEN PIT FOR SAFETY REASONS (TO PREVENT INADVERTENT HUMAN ACCESS). A MINIMUM SAFE LINE OF 50 m HAS BEEN ASSUMED, THIS WILL BE CONFIRMED IN THE OPEN PIT STABILITY AND SET-BACK STUDY TO BE CARRIED OUT BY THE END OF THE MINE LIFE OPERATION.

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

CLOSURE YEAR 2

Golder Associates
Edmonton, Alberta

FILE No: E-Miss-005-CAD.dwg				
PROJECT No: 09-1373-1004			SCALE AS SHOWN	REV. 0
DESIGN	IM	15 Feb. 2011	FIGURE: 9.4-2	
CAD	TDR	15 Feb. 2011		
CHECK	IM	15 Feb. 2011		
REVIEW	KAB	15 Feb. 2011		

PLOT DATE: April 12, 2011
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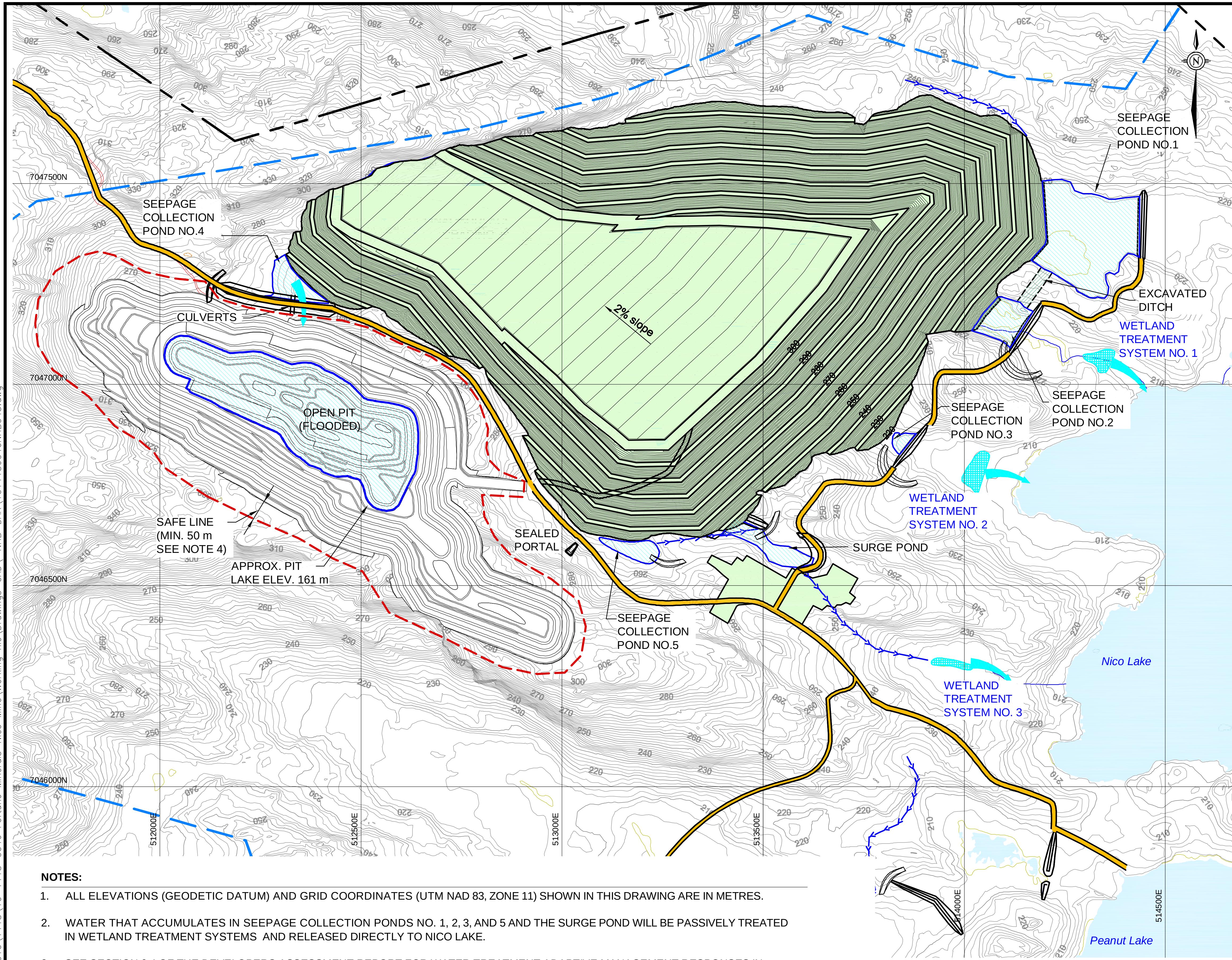

LEGEND

- BOULDER WALL
- DIVERSION DITCH
- PROJECT LEASE BOUNDARY
- WATERSHED
- ACCESS ROAD
- SEEPAGE COLLECTION POND DAM
- EMERGENCY SPILLWAY
- CONSTRUCTED WETLAND TREATMENT SYSTEM
- REVEGETATED
- WATER BODY

NOTES:

1. ALL ELEVATIONS (GEODETIC DATUM) AND GRID COORDINATES (UTM NAD 83, ZONE 11) SHOWN IN THIS DRAWING ARE IN METRES.
2. WATER THAT ACCUMULATES IN SEEPAGE COLLECTION PONDS NO. 1, 2, 3, AND 5 AND THE SURGE POND WILL BE PASSIVELY TREATED IN WETLAND TREATMENT SYSTEMS AND RELEASED DIRECTLY TO NICO LAKE.
3. SEE SECTION 9.4 OF THE DEVELOPERS ASSESSMENT REPORT FOR WATER TREATMENT ADAPTIVE MANAGEMENT RESPONSES IN CASE WETLAND TREATMENT SYSTEM DOES NOT OPERATE AS PLANNED.
4. A BOULDER WALL WILL BE CONSTRUCTED AROUND THE OPEN PIT FOR SAFETY REASONS (TO PREVENT INADVERTENT HUMAN ACCESS). A MINIMUM SAFE LINE OF 50 m HAS BEEN ASSUMED, THIS WILL BE CONFIRMED IN THE OPEN PIT STABILITY AND SET-BACK STUDY TO BE CARRIED OUT BY THE END OF THE MINE LIFE OPERATION.

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Process plant and mine infrastructure provided by Aker Solutions filename 0000g001d (plant site oct252010).dwg provided 26 OCTOBER 2010. Revised pits provided by P & E Mining Consultants, ultimate pit and topo.dxf on 26 January 2010.

Project lease boundary provided by Fortune (8 October 2008) with comments provided 19 December 2009.

200 0 200 400

SCALE 1:10,000 METRES

FORTUNE MINERALS LIMITED

NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

CLOSURE YEAR 10

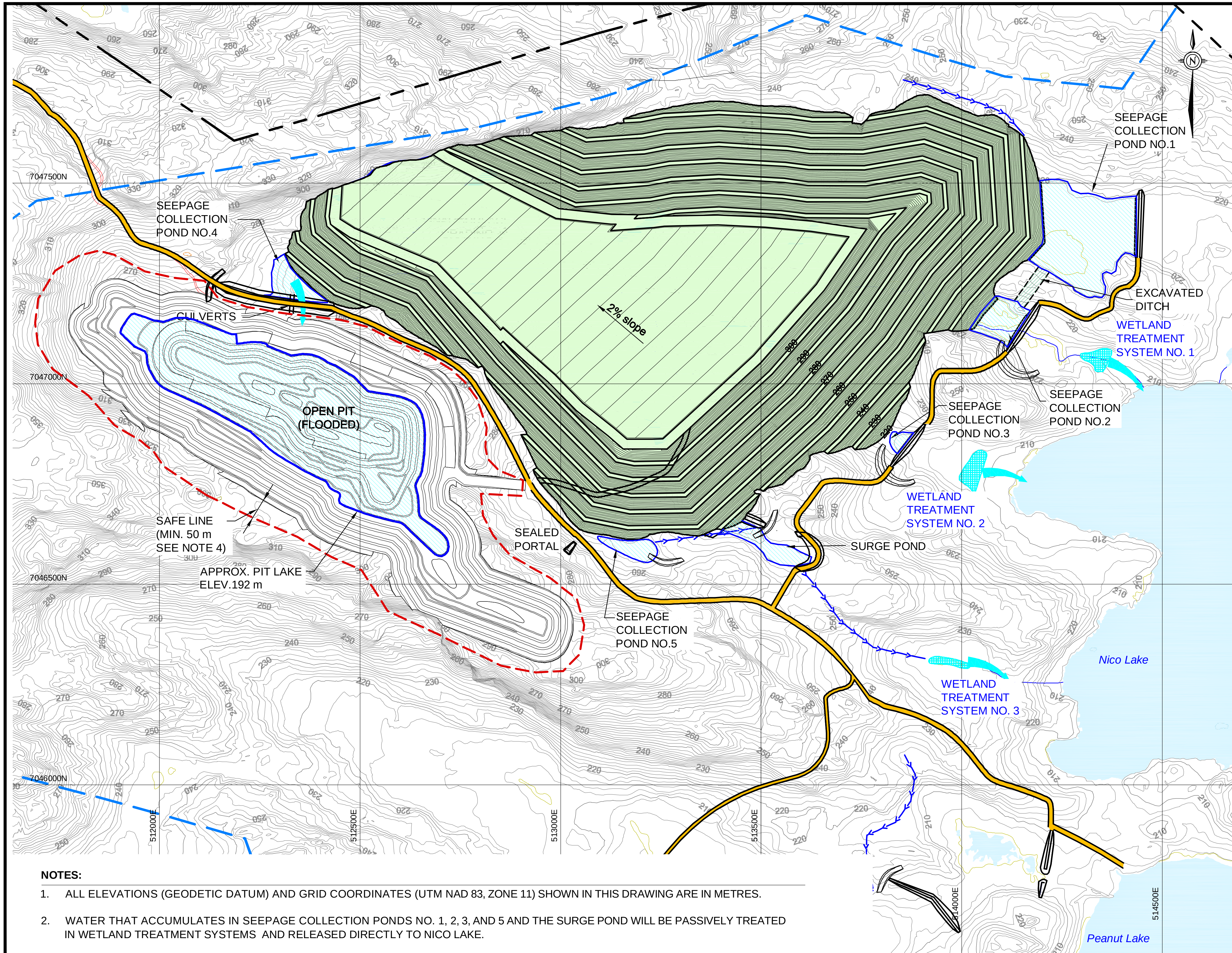
Golder Associates

Edmonton, Alberta

FILE No: E-Miss-006-CAD.dwg				
PROJECT No: 09-1373-1004			SCALE AS SHOWN	REV. 0
DESIGN	IM	15 Feb. 2011	FIGURE: 9.4-3	
CAD	TDR	15 Feb. 2011		
CHECK	IM	15 Feb. 2011		
REVIEW	KAB	15 Feb. 2011		

PLOT DATE: April 12, 2011

FILENAME: N:\Active\2010\1118\10-1118-0046 Fortune Minerals-Nico Mine\Working file\Drawings-CAD\-NHB-DAR\1011180046NHB943.dwg



LEGEND

- BOULDER WALL
- DIVERSION DITCH
- PROJECT LEASE BOUNDARY
- WATERSHED
- ACCESS ROAD
- SEEPAGE COLLECTION POND DAM
- EMERGENCY SPILLWAY
- CONSTRUCTED WETLAND TREATMENT SYSTEM
- REVEGETATED
- WATER BODY

REFERENCE

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Process plant and mine infrastructure provided by Aker Solutions filename 0000g001d (plant site oct252010).dwg provided 26 OCTOBER 2010. Revised pits provided by P & E Mining Consultants, ultimate pit and topo.dxf on 26 January 2010.

Project lease boundary provided by Fortune (8 October 2008) with comments provided 19 December 2009.

200 0 200 400

SCALE 1:10,000 METRES

NOTES:

1. ALL ELEVATIONS (GEODETIC DATUM) AND GRID COORDINATES (UTM NAD 83, ZONE 11) SHOWN IN THIS DRAWING ARE IN METRES.
2. WATER THAT ACCUMULATES IN SEEPAGE COLLECTION PONDS NO. 1, 2, 3, AND 5 AND THE SURGE POND WILL BE PASSIVELY TREATED IN WETLAND TREATMENT SYSTEMS AND RELEASED DIRECTLY TO NICO LAKE.
3. SEE SECTION 9.4 OF THE DEVELOPERS ASSESSMENT REPORT FOR WATER TREATMENT ADAPTIVE MANAGEMENT RESPONSES IN CASE WETLAND TREATMENT SYSTEM DOES NOT OPERATE AS PLANNED.
4. A BOULDER WALL WILL BE CONSTRUCTED AROUND THE OPEN PIT FOR SAFETY REASONS (TO PREVENT INADVERTENT HUMAN ACCESS). A MINIMUM SAFE LINE OF 50 m HAS BEEN ASSUMED, THIS WILL BE CONFIRMED IN THE OPEN PIT STABILITY AND SET-BACK STUDY TO BE CARRIED OUT BY THE END OF THE MINE LIFE OPERATION.

FORTUNE MINERALS LIMITED

NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

CLOSURE YEAR 25

Golder Associates

Edmonton, Alberta

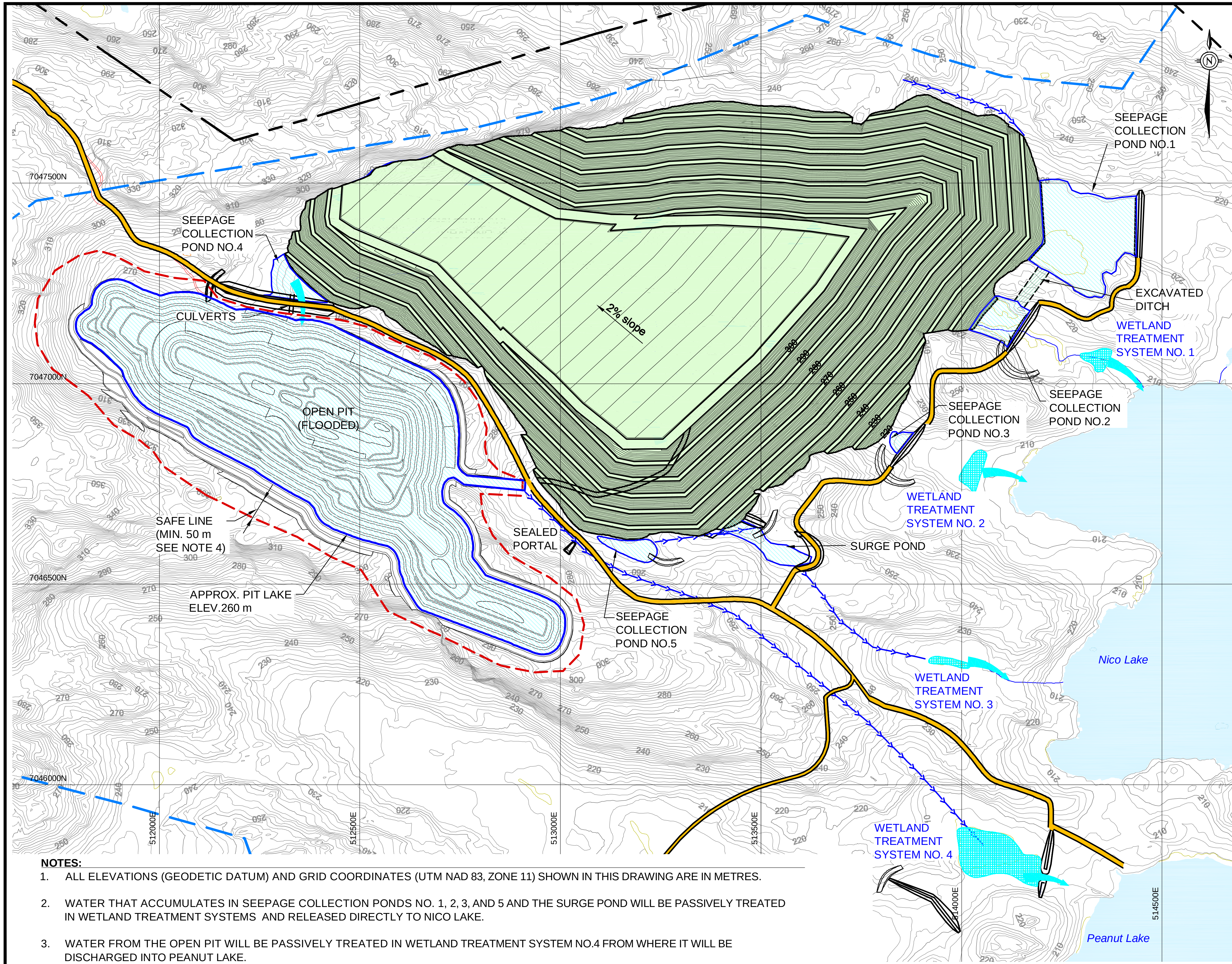
FILE No: E-Miss-007-CAD.dwg

PROJECT No: 09-1373-1004		SCALE AS SHOWN	REV. 0
DESIGN	IM	15 Feb. 2011	
CAD	TDR	15 Feb. 2011	
CHECK	IM	15 Feb. 2011	
REVIEW	KAB	15 Feb. 2011	

FIGURE: 9.4-4

PLOT DATE: April 12, 2011

FILENAME:



LEGEND

- BOULDER WALL
- DIVERSION DITCH
- PROJECT LEASE BOUNDARY
- WATERSHED
- ACCESS ROAD
- SEEPAGE COLLECTION POND DAM
- EMERGENCY SPILLWAY
- CONSTRUCTED WETLAND TREATMENT SYSTEM
- REVEGETATED
- WATER BODY

REFERENCE

Base mapping provided in digital format by Fortune Minerals Limited received 20 February 2004.

Process plant and mine infrastructure provided by Aker Solutions filename 0000g001d (plant site oct252010).dwg provided 26 OCTOBER 2010. Revised pits provided by P & E Mining Consultants, ultimate pit and topo.dxf on 26 January 2010.

Project lease boundary provided by Fortune (8 October 2008) with comments provided 19 December 2009.

200 0 200 400

SCALE 1:10,000 METRES

NOTES:

1. ALL ELEVATIONS (GEODETIC DATUM) AND GRID COORDINATES (UTM NAD 83, ZONE 11) SHOWN IN THIS DRAWING ARE IN METRES.
2. WATER THAT ACCUMULATES IN SEEPAGE COLLECTION PONDS NO. 1, 2, 3, AND 5 AND THE SURGE POND WILL BE PASSIVELY TREATED IN WETLAND TREATMENT SYSTEMS AND RELEASED DIRECTLY TO NICO LAKE.
3. WATER FROM THE OPEN PIT WILL BE PASSIVELY TREATED IN WETLAND TREATMENT SYSTEM NO.4 FROM WHERE IT WILL BE DISCHARGED INTO PEANUT LAKE.
4. SEE SECTION 9.4 OF THE DEVELOPERS ASSESSMENT REPORT FOR WATER TREATMENT ADAPTIVE MANAGEMENT RESPONSES IN CASE WETLAND TREATMENT SYSTEM DOES NOT OPERATE AS PLANNED.
5. A BOULDER WALL WILL BE CONSTRUCTED AROUND THE OPEN PIT FOR SAFETY REASONS (TO PREVENT INADVERTENT HUMAN ACCESS). A MINIMUM SAFE LINE OF 50 m HAS BEEN ASSUMED, THIS WILL BE CONFIRMED IN THE OPEN PIT STABILITY AND SET-BACK STUDY TO BE CARRIED OUT BY THE END OF THE MINE LIFE OPERATION.

PLOT DATE: April 12, 2011
FILENAME:

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

CLOSURE YEAR 120

Golder Associates
Edmonton, Alberta

FILE No: E-Miss-008-CAD.dwg				
PROJECT No: 09-1373-1004			SCALE AS SHOWN	REV. 0
DESIGN	IM	15 Feb. 2011	FIGURE: 9.4-5	
CAD	TDR	15 Feb. 2011		
CHECK	IM	15 Feb. 2011		
REVIEW	KAB	15 Feb. 2011		

9.4.5 Long-Term Viability of the Plan

9.4.5.1 Physical Integrity of Co-Disposal Facility

A stability analysis (Golder 2010c) was completed for the CDF to identify potential failure mechanisms under static and pseudo-static (earthquake) conditions. The results show that the CDF is stable under both conditions. The CDF does not rely on permafrost to operate correctly. It is designed to be physically stable even if any existing ground ice in the foundations of the CDF Perimeter Dyke thaws. The environmental performance of the CDF does not rely on freezing of the waste materials or the cover materials. The rate of infiltration assumes that the cover is thawed; frozen conditions would reduce the rate of infiltration. Similarly, the rate of oxygen influx into the CDF assumes that the cover and the co-disposed tailings and Mine Rock are thawed. The possible development of frozen horizons would reduce oxygen influx.

The creation of permanent Water Management Ponds will change the local thermal regime and will likely thaw any ground ice in the soils below the ponds. The investigations indicate that the presence of ground ice is limited in areal extent and thickness. For this reason, the resulting differential settlements are expected to be minor and tolerable by the dams and infrastructure.

The CDF has been configured to be resistant to erosion over the long-term. The final top surface of the CDF will be sloped gently (at 2%) towards the west, and vegetation will be established on the surface of the till cover to prevent erosion. The sideslopes of the CDF will have 3:1 (horizontal:vertical) slopes interrupted by benches every 10 m vertically. Runoff will be collected at each bench and conducted downslope from bench to bench through rock lined chutes at regular spacings. The till covers on the sloped faces will be revegetated to protect them against erosion by local runoff. It should be noted that the entire sloped surface of the CDF comprises the CDF Perimeter Dyke and will be constructed of non-erodible Type 2 Mine Rock.

9.4.5.2 Flooded Open Pit

Based on water balance modelling, the pit will fill and overflow into a constructed Wetland Treatment System (No. 4) for passive treatment approximately 120 years after closure. If it cannot be demonstrated that the Wetland Treatment System will be adequate to treat the Flooded Open Pit water, then other contingencies are available, as discussed in Section 9.4.3.3. To guarantee that adequate water treatment occurs, a sustainable fiscal arrangement will be established, such as a fund vested in the government.

9.4.5.3 Water Quality

Construction and operation of the NICO Project potentially could affect water quality; however, C&R activities and monitoring programs will be implemented to re-establish or maintain long-term suitability of the receiving environment.

Several components of the C&R Plan will help to maintain suitability of water quality:

- A cover will be placed on the entire surface area of the CDF to minimize infiltration. This will reduce the amount of seepage that could directly enter Nico Lake and other surface waters, where it could compromise the ability of the receiving environment to support aquatic life.
- At closure, pumping of water out of the Open Pit will cease, which will allow it to slowly fill with water. Backflooding of the pit will help reduce the area of potentially acid generating rock that will be exposed to

atmospheric conditions, thus reducing the total metal loading from the pit wall runoff over time that could enter Nico Lake or other surface waters.

- Water that accumulates in SCPs Nos. 1, 2, 3, and 5, as well as the Surge Pond, will be treated by flowing through Wetland Treatment Systems prior to being released directly into Nico Lake. This component of closure is designed so that water entering Nico Lake will meet the site specific water quality guidelines required to support aquatic life.

9.4.5.4 Acid Generation Potential of Tailings

The NICO Project tailings have a low potential for acid generation, but the results of geochemical characterization indicate that the tailings have a short and long-term potential for metal leaching. The Mine Rock has a mixed potential for acid generation: sub-economic, mineralized Mine Rock has a higher potential for acid generation than Mine Rock that is not in close contact to the ore zones. Mine Rock; however, also has a potential for metal leaching in the short- and long-term. The results of geochemical characterization of tailings and Mine Rock from the NICO Project are presented in the Geochemical Characterization Report (Annex A).

One of the objectives of the design of the tailings and Mine Rock CDF is to reduce the potential for acid rock drainage and metal leaching from the CDF during the operations and closure stages of the NICO Project. During operations, tailings and Mine Rock will be co-disposed using layered deposition into small cells in the CDF. Cells will be constructed using Mine Rock, and thickened tailings will be discharged into the cells. The intermixing of thickened tailings and Mine Rock is useful and will be encouraged by the design and the intended mode of placement of the wastes. During the first 5 years of operation, the Mine Rock to tailings ratio will be high due to the higher stripping ratio in the Open Pit. The ratio of Mine Rock to tailings will become lower in the subsequent years of operations; therefore, the base of the CDF will be predominantly Mine Rock. The top of the CDF will be predominantly tailings, which will ensure that Mine Rock will be dressed with lower permeability material.

Filling of the Mine Rock void space with thickened tailings together with the introduction of discrete layers of tailings will both help maintain a higher level of saturation in the tailings and Mine Rock, which could then reduce the rate of oxygen ingress into the co-disposed mass, thereby reducing the rate of sulphide oxidation and acid rock drainage/metal leaching.

During operations, most Mine Rock will be placed in the CDF; a lesser amount of Mine Rock will be used for the purpose of site construction. Preliminary criteria have been developed for the purpose of Mine Rock classification at the NICO Project. The objective of the Mine Rock classification criteria is to reduce the potential for acid rock drainage and metal leaching during operations and closure:

- During operations, rock with a high potential for acid generation and metal leaching is to be contained within the perimeter embankment of the CDF; all contact water from the CDF will be collected in SCPs and then pumped to the Surge Pond for treatment.
- Only Mine Rock with a low potential for acid generation and metal leaching will be used for the purpose of site construction.

A preliminary Mine Rock Management Plan (Appendix 3.I) outlines the appropriate use of rock for site construction.

A closure cover will be placed over the entire surface of the CDF, effectively encapsulating the co-disposed tailings and Mine Rock. The objective of the closure cover is to minimize wind and water erosion, and to limit infiltration into the CDF to effectively reduce the volume of water that will seep from the CDF and report to the SCPs. The cover will be constructed using glacial till, which testing has shown has a low potential for acid generation and metal leaching, and the required grain size characteristics to meet the objectives of the closure cover. The CDF will be graded to promote runoff of water in contact with the closure cover into the Open Pit. Seepage water that collects in the SCPs will be passively treated in constructed Wetland Treatment Systems, and then released into Nico Lake.

Field trials will be carried out during operations to test the relative performance of the proposed cover designs with respect to net infiltration rates. Field tests will also be required to test the performance of the Wetland Treatment Systems for the purpose of post-closure treatment of water in the SCPs. A post-closure water quality monitoring program may be required to evaluate the composition of the water in the SCPs over time, for the purpose of confirming the effectiveness of the closure covers and Wetland Treatment Systems.

9.5 Uncertainty

The identified uncertainties include the following:

- Technical feasibility of Wetland Treatment Systems. It is proposed that the Wetland Treatment Systems Nos. 1 to 3 be constructed and tested during the operating life of the mine, as previously mentioned. It is important to note that Golder has designed and constructed similar systems at cold environments in the Canadian Rocky Mountains (Rutkowski and Hanson 2010), central Montana (Blumenstein and Gusek 2007), and the Peruvian Andes Mountains, Colorado (Reisman et al. 2008).
- Field testing of both closure cover designs is recommended to evaluate their relative performance in terms of net infiltration rates. This could be achieved by constructing 2 large scale lysimeters, one containing Co-disposed Tailings and Mine Rock and one containing Mine Rock, and then covering these materials with their respective covers.
- Surficial water quality within the Flooded Open Pit may or may not meet requirements for discharge after treatment in Wetland Treatment System No. 4.
- Erosion of CDF cover from fire, non-sustainable vegetation cover, extreme desiccation under frozen conditions.

Although there are inherent uncertainties, as identified above, the C&R plan has identified alternative contingency plans. Fortune is committed to protecting of the environment using other options in the event that the initial or preferred options do not perform as expected.

9.6 Monitoring and Follow-Up

Pursuant to the assessment approach outlined in Section 6, there are 3 main types of monitoring are planned for the NICO Project:

- compliance inspection;
- environmental monitoring; and

- follow-up monitoring.

9.6.1 Compliance Inspection

Compliance inspection will verify that NICO Project components are built to approved design standards and that environmental design features and mitigation practices and policies described in the DAR are implemented. As each component of the NICO Project is built, constructed features will be inspected to show that they comply with standard protocols, and that any variance from standard protocols has been completed with regulatory permission (as appropriate). A check list will also be developed to show that agreed-upon environmental design features are constructed as required, and that Fortune is meeting conditions of approval and company commitments.

Compliance monitoring will extend throughout the life of the NICO Project, but will likely not be applicable to the post-closure period.

9.6.2 Environmental Monitoring

Environmental monitoring is used to track conditions or issues during the lifespan of the NICO Project and apply adaptive management if required. Examples of environmental monitoring include:

- monitoring the effectiveness of erosion control structures during construction and operation;
- verifying the effectiveness of water diversion and control structures during the life of the NICO Project; and
- determining the effectiveness of the Wetland Treatment Systems.

9.6.3 Follow-up Monitoring

Follow-up monitoring programs are designed to test impact predictions, reduce uncertainty, determine the effectiveness of environmental design features and mitigation, and provide appropriate feedback to operations for modifying or adopting new mitigation designs, policies, and practices. Follow-up monitoring activities are expected to include water sampling in and around the Open Pit and a Reference Lake to confirm the accuracy of the influent water quality profiles used to complete the effects assessment. An Aquatic Effects Monitoring Program will be implemented to test key impact predictions and mitigation designs. Limited follow-up monitoring activities are anticipated in downstream waterbodies. Upon approval of the NICO Project, a Wildlife Effects Monitoring Program will be implemented to limit effects to wildlife and wildlife habitat, determine the effectiveness of mitigation, and test key impact predictions. Vegetation monitoring is designed to work in conjunction with other programs such as monitoring of the C&R Plan. Terrestrial and aquatic monitoring plans are outlined in Section 18 of the DAR.

9.6.3.1 Aquatic Effects Monitoring

Long-term monitoring will be performed to compare closure and post-closure conditions with both pre- and post-fire background conditions. Exposure lakes (Peanut, Nico, Burke, and Lou lakes) will be monitored, in addition to a Reference Lake. Details regarding monitoring will be outlined in the Aquatic Effects Monitoring Program developed for the NICO Project (Section 18; Appendix 18.I). Upon approval of the NICO Project, an Aquatics Effects Monitoring Program will be implemented to test impact predictions (Appendix 18.I). The final Aquatic Effects Monitoring Program will include provisions for biophysical monitoring as required under the Metal Mining Effluent Regulations of the *Fisheries Act* (see Environment Canada 2002).

9.6.3.2 Terrestrial Monitoring

Vegetation

Construction of the NICO Project will lead to the direct loss and alteration of vegetation and other natural features such as various types of forest cover, bedrock open conifer, shrubland, ponds, and wetlands. These changes will predominantly occur during construction. Following initial construction of the NICO Project and the NPAR, expansion of the NICO Project footprint will be at a much slower rate and smaller spatial extent, primarily associated with the development of the Open Pit and the CDF through operations. The Wildlife Effects Monitoring Program includes a survey to delineate the NICO Project footprint at the end of construction, to compare the actual loss of vegetation communities (habitat) to that predicted in the DAR and in the land use permit application. It is anticipated that monitoring of revegetation techniques and success will be required during the NICO Project, but the objectives, measurement endpoints, and methods of revegetation will need to be determined with input from regulators and the communities.

Wildlife

Upon approval of the NICO Project, a Wildlife Effects Monitoring Program will be implemented to limit effects to wildlife and wildlife habitat, determine the effectiveness of mitigation, and test impact predictions (Section 18.5). The principal goal of the Wildlife Effects Monitoring Program is to provide information required for the NICO Project Environmental Management System to adaptively manage the NICO Project to protect wildlife and wildlife habitat.

Additional goals of the Wildlife Effects Monitoring Program are to:

- meet regulatory requirements and corporate commitments for monitoring;
- provide a process for regulators, communities, and other people interested in the NICO Project to participate in the development and review of wildlife effects mitigation and monitoring;
- provide a process to provide results of monitoring to communities, governments, and the public; and
- provide mine managers with clear reasons for making decisions regarding environmental management.

More information regarding the Wildlife Effects Monitoring Program can be found in Section 18, Appendix 18.II.

9.7 References

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