

APPENDIX 18.I

Aquatic Effects Monitoring Program

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18.I.1 INTRODUCTION

18.I.1.1 Context

The conceptual Aquatic Effects Monitoring Program (AEMP) outlines how Fortune proposes to monitor aquatic effects from the NICO Project, including the proposed components for monitoring. The AEMP is conceptual outline of aquatics monitoring in relation to NICO Project effects at this stage, and detailed study designs, methods, procedures, and data sheets will be developed during the NICO Project permitting phase. For the communities, public, and regulatory authorities participating in the development of the AEMP, the final document should provide background, rationale, objectives, and information on data collection and analysis to determine if the AEMP will adequately monitor effects to aquatic organisms from the NICO Project.

The overall goals of the AEMP 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 aquatic effects monitoring;
- develop 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.

18.I.1.2 Purpose and Scope

The conceptual AEMP provides supporting information to meet the Terms of Reference, as outlined in Table 18.I.1-1.

Table 18.I.1-1: Aquatic Effects Monitoring – Concordance with the Terms of Reference

Section in Terms of Reference	Requirement
3.3.11	<p>Biophysical Environment Monitoring and Management Plan</p> <p>Monitoring in the environmental assessment is to focus only on monitoring activities required for recognizing potentially significant impacts and ensuring that they are mitigated by adapting the management of the development. For clarity, this excludes monitoring details related to routine regulatory compliance monitoring and state of the environment monitoring, <i>unless these relate to potentially significant impacts</i>.</p> <p>Describe conceptual plans for monitoring, evaluation and adaptive management for biophysical impacts. Specify which phase of the development each plan is for.</p> <p>Show that monitoring plans have representative baseline information, consider the natural range of variability, and will detect any relevant impacts before they become significant. Describe how project management will be adapted if necessary to prevent significant impacts.</p>
Appendix C	Water Quality
	13) Describe water quality monitoring and management during operations including:
	<p>d. conceptual plans for surface water and ground water monitoring; and</p> <p>e. whether and how Fortune will incorporate Wek'èezhii Settlement Area residents in environmental monitoring, and how it will report monitoring results to potentially-affected communities.</p>

Table 18.II.1-1: Aquatic Effects Monitoring – Concordance with the Terms of Reference (continued)

Section in Terms of Reference	Requirement
Appendix D	Closure and Reclamation
	6) Describe how closure and reclamation activities and monitoring will ensure long-term suitability of all fish-bearing waters potentially affected by the project for fish and fish habitat (using pre-fire background conditions and a lake that has been impacted by the forest fire for reference).
Appendix J	Biophysical Environmental Monitoring and Management Plans
	4) All conceptual monitoring and management plans as identified in the appendices, including: <ul style="list-style-type: none"> b. A conceptual framework for an integrated Aquatic Effects Monitoring Plan developed in discussions with Fisheries and Oceans and Environment Canada.
	5) Plans for communicating results of mitigation, monitoring and adaptive management programs to regulators, responsible government authorities and the public.
Appendix L	Cumulative Effects
	7) Describe any plans for the monitoring and evaluation of cumulative effects and the adaptive management of the NICO Project's contribution to cumulative effects.
	8) A description of how project-specific monitoring can contribute to and be compatible with regional monitoring programs such as the NWT Cumulative Impact Monitoring Program (see http://www.nwtcimp.ca for details).

The final AEMP will include provisions for biological monitoring as required under the Metal Mining Effluent Regulations (MMER) of the *Fisheries Act* (see Environment Canada 2002). The AEMP will consider the Indian and Northern Affairs Canada (INAC) Guidelines on designing and implementing aquatic effects monitoring programs in the Northwest Territories (INAC 2009a), and the draft Adaptive Management (Monitoring Response) guidelines from the Wek'èezhii Land and Water Board (WLWB) (2010), as appropriate.

Fortune intends to combine the AEMP with the Surveillance Network Program required by the NICO Project Water License and with the MMER program, to make certain that the AEMP uses all available monitoring data in the receiving environment. This will eliminate duplication and prevent data from being collected by different methods for different objectives.

Fortune initiated discussions with Environment Canada, Fisheries and Oceans Canada, and INAC on the AEMP design in 2009 and 2010 (Section 4). Tłıchq government representatives were also invited to attend the meetings. Fortune anticipates that the WLWB will wish to continue with the existing 'AEMP Working Group', which will include government and community participants to support and finalize the final AEMP design and annual reviews.

18.I.2 MONITORING RESPONSE PROGRAM

The AEMP will function within an adaptive management framework, in which pre-defined effect levels will be linked to mitigation in a Monitoring Response Program located outside the AEMP (Section 18, Figure 18.3-1). Effect levels evaluated during each monitoring year will be reviewed in relation to effects thresholds and will represent triggers for response actions. The Monitoring Response Program will be developed during the licensing phase in consultation with an 'AEMP Working Group' established by Fortune and the WLWB. The Monitoring Response Program will be guided by the draft WLWB Adaptive Management Framework for AEMPs

(WLWB 2010). Further discussion of the relationship between monitoring and management is found in Section 18.

18.I.3 AQUATIC EFFECTS MONITORING PROGRAM

18.I.3.1.1 Outline of the Design Document

The final AEMP will be organized into the following sections:

- Introduction and Objectives;
- History Review;
- Data Review;
- Summary of Predicted Effects;
- Study Areas;
- Study Design;
- Detailed Methods; and
- Reporting.

These are briefly discussed below.

18.I.3.1.1.1 Introduction and Objectives

The introduction will include background information on the NICO Project, regulatory framework, AEMP objectives, and report organization.

Overall AEMP objectives will be stated in this section. It is anticipated that the objectives of the AEMP will include links to management responses, as follows:

- evaluate the short-term and long-term predicted effects of the NICO Project on the physical, chemical, and biological components of the aquatic ecosystem of the NICO Project area and downstream waterbodies;
- estimate the spatial extent of predicted effects;
- compare monitoring results to effect predictions;
- provide the necessary input for monitoring responses to potential unacceptable effects on the aquatic ecosystem; and
- evaluate the effectiveness of monitoring responses.

These overall objectives will be broken down into specific objectives for each monitoring component. It is anticipated that component-specific objectives and additional, specific objectives, will be developed for any new components under the updated AEMP, such as eutrophication indicators and weight-of-evidence evaluation.

18.I.3.1.1.2 History Review and Data Review

The intent of these sections of the AEMP is to provide the NICO Project description and history, summarize available baseline information, and highlight any new information since submission the DAR or licensing phase in the local and regional study areas. Fortune intends to use this section of the AEMP as the “Site Characterization” required under the biological monitoring components of the MMER.

The History Review section will include brief descriptions of the NICO Project development planning, relevant history of Water License conditions, and any changes in the NICO Project Description since that assessed in the DAR.

The Data Review section will include summaries of relevant trends and patterns in data collected during baseline (e.g., pre and post-fire) by monitoring component, and summaries of any other relevant studies, such as those required by a potential *Fisheries Act* Authorization for the NICO Project. Under each AEMP component, key results/trends will be illustrated graphically or in table format, with statistical testing of trends, where appropriate.

18.I.3.1.1.3 Summary of Predicted Effects

This section will provide a summary of DAR predictions by component.

The DAR predictions will be updated if any updated water quality model results, other relevant studies, or information gained since the submission of the DAR are found. Aquatic receptors and monitoring endpoints will be confirmed in conjunction with the Tłı̨ch̓, and, if required, new ones will be selected as dictated by the updated DAR predictions.

18.I.3.1.1.4 Study Areas

Regional Study Area

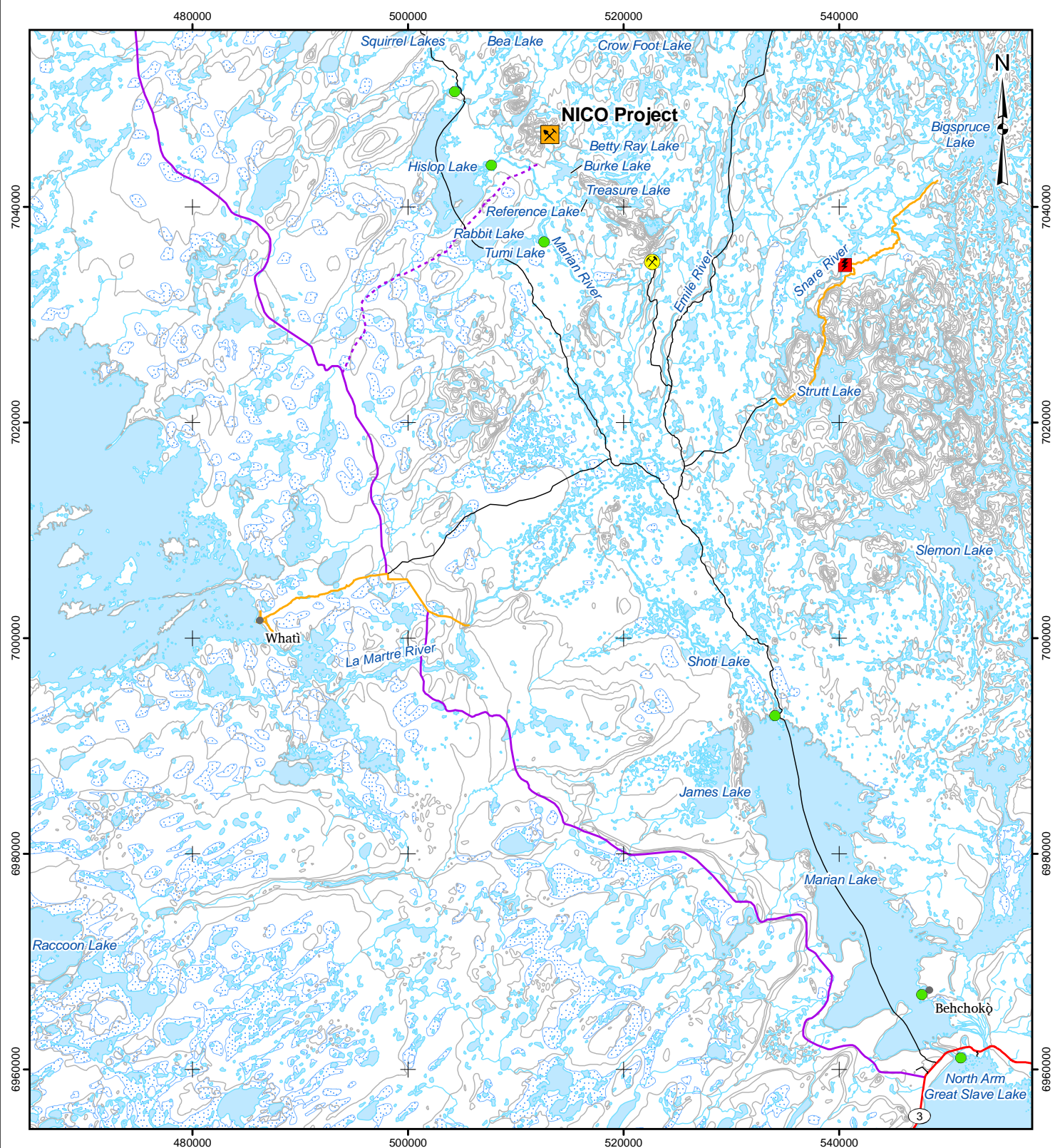
The regional study area includes waterbodies within the local study area, plus the Marian River to the north arm of Great Slave Lake (Figure 18.I.3-1). In addition, one lake located outside the area of potential impact was selected as a reference site (Reference Lake). Reference Lake was selected based on similar water quality and fauna characteristics to lakes found in the local study area and because it will not be impacted by the NICO Project (see Section 12 for details).

Local Study Area

The extent of the local study area is defined as the expected limit of potential direct effects on the aquatic ecosystem from the NICO Project. The local study area includes the entire hydrologic pathway from the main ore body downstream to the Marian River, including 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 (Figure 18.I.3-2).

18.I.3.1.1.5 Study Design

This section will include the sampling design. It is anticipated that major components of the aquatic ecosystem to be monitored will be water quality, sediment quality, benthic invertebrate community, and fish (health and usability [fish tissue]). Table 18.I.3-1 contains a preliminary outline of the study design components, locations, and frequency.



LEGEND

- | | |
|-----------------------------------|--|
| NICO PROJECT | PROPOSED Tłı̨chǫ ROAD ROUTE |
| POPULATED PLACE | TERRITORIAL/PROVINCIAL BOUNDARY |
| DECOMMISSIONED MINE | WATERCOURSE |
| SNARE HYDRO LOCATION | WATERBODY |
| CONTOUR (20 METRE INTERVAL) | WETLAND |
| HIGHWAY | POTENTIAL REGIONAL WATER QUALITY SAMPLING LOCATION |
| EXISTING ALL-WEATHER ROAD | |
| EXISTING WINTER ROAD | |
| PROPOSED NICO PROJECT ACCESS ROAD | |

REFERENCE

Base data obtained from Atlas of Canada, DMTI, and GeoGratis.
Projection: UTM Zone 11 Datum: NAD 83

10 0 10
SCALE 1:500,000 KILOMETRES



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NICO DEVELOPER'S ASSESSMENT REPORT

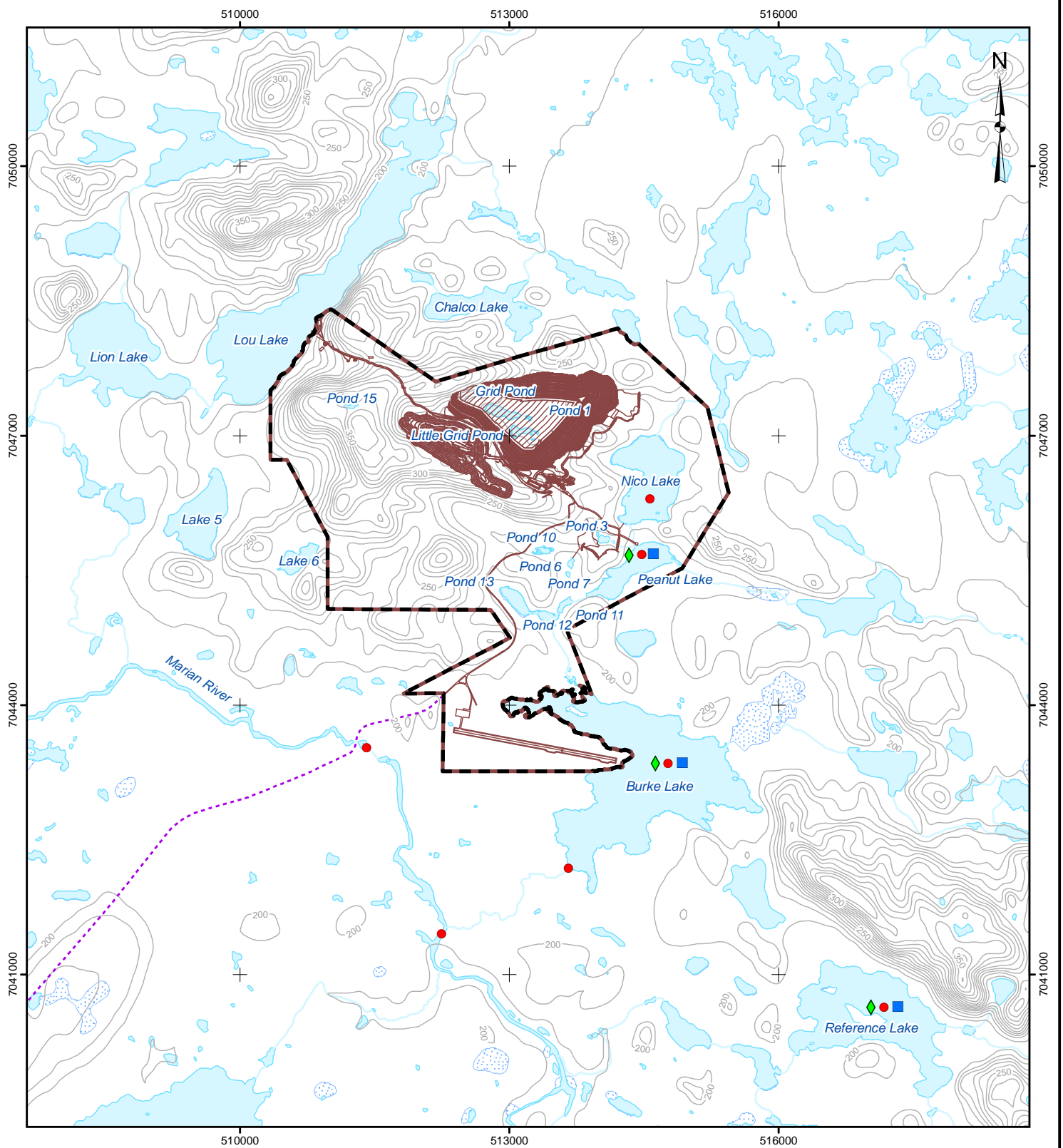
TITLE
AQUATIC EFFECTS MONITORING PROGRAM -
REGIONAL STUDY AREA (PRELIMINARY)



FILE No. E-AEMP-001-GIS			
PROJECT No. 09-1373-1004	SCALE AS SHOWN	REV. 0	
DESIGN HM	24 Mar. 2011		
GIS BS	24 Mar. 2011		
CHECK JG	03 May 2011		
REVIEW JV	03 May 2011		

FIGURE: 18.I.3-1

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LEGEND

- | | |
|-----------------------------------|---|
| PROJECT LEASE BOUNDARY | POTENTIAL BENTHIC INVERTEBRATES SAMPLING SITE |
| PROPOSED NICO MINE SITE | POTENTIAL FISH SAMPLING SITE |
| CONTOUR (10 METRE INTERVAL) | POTENTIAL WATER QUALITY SAMPLING SITE |
| PROPOSED NICO PROJECT ACCESS ROAD | |
| WATERCOURSE | |
| WATERBODY | |
| WETLAND | |

REFERENCE

Base data obtained from GeoGratis.
Projection: UTM Zone 11 Datum: NAD 83

1.5 0 1.5
SCALE 1:60,000 KILOMETRES



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NICO DEVELOPER'S ASSESSMENT REPORT

TITLE
AQUATIC EFFECTS MONITORING PROGRAM -
LOCAL STUDY AREA (PRELIMINARY)



FILE NO. E-AEMP-002-GIS			
PROJECT No.	09-1373-1004	SCALE AS SHOWN	REV. 0
DESIGN	HM 24 Mar. 2011	FIGURE: 18.1.3-2	
GIS	BS 05 Apr. 2011		
CHECK	JG 03 May 2011		
REVIEW	JV 03 May 2011		

FORTUNE MINERALS LIMITED DEVELOPER'S ASSESSMENT REPORT

Table 18.I.3-1: Preliminary Outline of Components of the NICO Project Aquatic Effects Monitoring Program

Component	Description	Study Area	Frequency	Harmonization
Effluent characterization	Physical, chemical, and toxicological characteristics of the NICO Project effluent, summarized from data collected as part of the SNP and MMER	Local Study Area	Will include daily, weekly, monthly, and quarterly requirements	Harmonize with MMER and SNP requirements
Effluent plume characterization	Distribution of the effluent plume and percent effluent concentration in Nico Lake and downstream waterbodies	Local Study Area Regional Study Area	Will include monthly, and quarterly requirements	Harmonize MMER Plume Characterization Study and SNP requirements
Water quality	Physical and chemical characteristics of surface waters of Nico Lake and downstream waterbodies	Local Study Area Regional Study Area	Will include monthly and quarterly requirements	Harmonize with MMER and SNP requirements
Sediment quality	Physical and chemical characteristics of bottom sediments in Peanut, Burke, and Reference lakes	Local Study Area	Likely every 3 years for lakes as part of biological monitoring for the MMER	Harmonize with MMER requirements for sediment monitoring as part of biological monitoring of benthic invertebrates
Benthic invertebrates	Biomass and community characteristics in Peanut, Burke, and Reference lakes	Local Study Area	Likely every 3 years as part of biological monitoring for the MMER	Harmonize with MMER requirements biological monitoring of benthic invertebrates
Fish habitat	Physical aspects of fish habitat such as water level and flows, water temperature, and dissolved oxygen concentration	Local Study Area	Will include monthly and quarterly requirements, and will be done as part of water quality monitoring	Harmonize with <i>Fisheries Act</i> Authorization monitoring, if required
Fish health	Standard Environmental Effects Monitoring style survey of 2 species of fish in an exposure and reference lake; may include additional exposure lakes in the near-field area, pending site-specific conditions and effluent plume characterization	Local Study Area	Likely every 3 years as part of biological monitoring for the MMER	Harmonize with MMER requirements biological monitoring of fish
Fish usability	Fish tissue chemistry including full metal suite	Local Study Area	Likely every 3 to 5 years as part of biological monitoring for the MMER	Harmonize with MMER requirements biological monitoring of fish

MMER = Metal Mining Effluent Regulations of the *Fisheries Act*; SNP = Surveillance Network Program required by Water License.

Using the monitoring components, and the outline in Table 18.I.3-2, an overall study design will be developed according to currently accepted statistical design principles using INAC AEMP guidance, as applicable (INAC 2009 a, b). The study design will include selection of and justification for the overall design approach, such a gradient versus, control/impact study, or a combination thereof. The number of monitoring areas, including reference and exposure areas, will be chosen based on effluent dispersion, updated water quality modelling results, and availability of suitable waterbodies in the NICO Project region. The number of stations within each monitoring area will be determined using statistical power analysis of baseline data, and regulatory and community guidance. The intensity, or frequency, of sampling will be variable and dependent on the findings from a given year of monitoring. For example, if monitoring results indicate a low-level of effect, then the monitoring intensity/frequency may be increased to a pre-defined level.

Once sufficient monitoring data has been obtained, it is anticipated that the AEMP will integrate the results of individual monitoring components using a formal weight-of-evidence analysis. The results of the weight-of-evidence analysis, in combination with monitoring results generated by individual components, will be used to evaluate the need for environmental management response to reduce potential unacceptable adverse effects. Results will be used to confirm that monitoring effort is appropriately allocated and directed toward the effects of greatest importance.

Traditional Knowledge in the Aquatic Effects Monitoring Program

Fortune used input from Traditional Knowledge holders provided during the scoping and work of the DAR (Section 5) to develop the conceptual AEMP study design. The design of the final AEMP will reflect monitoring priorities identified by community input during the environmental assessment and the licensing phase. The final AEMP design will incorporate Traditional Knowledge on fish and water and the interactions between these components. Fortune will consider the draft INAC guidance on incorporation of Traditional Knowledge into AEMPs, as appropriate (INAC 2009b).

Fortune intends to hire staff from local communities to assist with environmental monitoring sampling. Specifically, Fortune would like to have community members involved in the water quality monitoring programs, particularly those stations near communities (Figure 18.I.3-1). Site-specific Traditional Knowledge may be gathered during field programs, if approved by communities.

18.I.3.1.1.6 Detailed Methods

This section of the final AEMP will include detailed field methods and data analysis methods by component, including Quality Assurance and Quality Control procedures. The AEMP will use standard protocols for monitoring, such as those recommended by the Northwest Territories Cumulative Impact Monitoring Program (e.g., IMG-Golder Corp. 2008; Kavik-AXYS Inc. 2008), where applicable.

18.I.3.1.1.7 Reporting

This section will describe the AEMP reporting approach, including reporting schedule for annual reports and anticipated report organization for the annual AEMP reports. It will also describe the frequency of periodic AEMP reviews to summarize trends and provide an opportunity to update the study design, if appropriate. The annual report will be provided to the WLWB and will be available on the public registry for regulator and stakeholder review and input. Reports will also be filed with Environment Canada and a Technical Advisory Panel to satisfy the biological components of the MMER (Environmental Effects Monitoring). Data on fish and benthic

invertebrate monitoring will be entered to a federal government website for integration into a national dataset on biological monitoring at metal mines (Environment Canada 2002).

Fortune intends to work with Environment Canada and the WLWB to harmonize the scheduling and reporting requirements for the AEMP and the biological (Environmental Effects Monitoring) components of the MMER. Fortune anticipates having one report format that meets the needs of both agencies.

18.1.4 REFERENCES

Environment Canada. 2002. Metal mining guidance document for aquatic environmental effects monitoring 2002.

IMG-Golder Corp. 2008. Standardized protocols for collection of monitoring information for the NWT cumulative impact monitoring program working group and valued components advisory teams. Prepared for Indian and Northern Affairs Canada. 141 pages 10 appendices. Available at: <http://www.nwtcimp.ca/documents/MonitoringFinalReportApril3008.pdf>. Accessed: March 2011.

INAC (Indian and Northern Affairs Canada). 2009a. Designing and implementing aquatic effects monitoring programs for development projects in the Northwest Territories. Prepared by MacDonald Environmental Services Ltd., Zajdlik and Associates Inc., and Water Resource Divisions, INAC, Yellowknife. Volumes 1 to 6 plus appendices.

INAC. 2009b. Draft toolbox for applying traditional knowledge in aquatic effects monitoring plans (AEMPs) in the NWT. Prepared by Water Resource Divisions, INAC, and Brenda Parlee, University of Alberta. December 2009 draft. 30 p. + appendices.

Kavik-AXYS Inc. 2008. Data collection protocols for The Northwest Territories cumulative impact monitoring program. valued components: caribou fish habitat, population & harvest water & sediment quality. Prepared for: Indian and Northern Affairs Canada. 237 pp. Available at: http://www.nwtcimp.ca/documents/CdIMPDataCollectionProtocols_e.pdf. Accessed: March 2011.

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