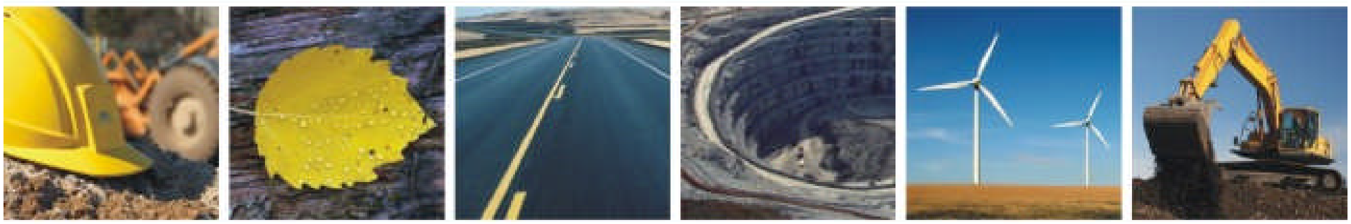
SHEAR DIAMONDS LTD.

CARE AND MAINTENANCE PLAN
JERICHO PROJECT, NUNAVUT



REPORT

JANUARY 2011
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ACRONYMS & ABBREVIATIONS

AEMP	Aquatic Effects Monitoring Plan
AIA	Aquatic Impact Assessment
AQMP	Air Quality Management Plan
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
CAMP	Care and Maintenance Plan
CMP	Contingency Management Plan
CPK	Coarse Processed Kimberlite
EIS	Environmental Impact Statement
FPK	Fine Processed Kimberlite
GMP	General Monitoring Plan
ICRP	Interim Closure and Reclamation Plan
INAC	Indian and Northern Affairs Canada
LFMP	Landfarm Management Plan
LFP	Landfill Management Plan
NWB	Nunavut Water Board
PHC	Petroleum Hydrocarbons
PKCA	Processed Kimberlite Containment Area
PKMP	Processed Kimberlite Management Plan
Shear	Shear Diamonds (Nunavut) Corp.
SWMP	Site Water Management Plan
TDC	Tahera Diamonds Corporation
WEMP	Wildlife Effects Management Plan
WMP	Waste Management Plan
WRMP	Waste Rock Management Plan
WTMP	Wastewater Treatment Management Plan

1.0 INTRODUCTION

1.1 General

The Jericho Diamond Mine is located approximately 260 km southeast of Kugluktuk, NU, and 30 km north of Lupin Mine. The Jericho Mine was constructed and operated by Tahera Diamond Corporation (TDC) between 2004 and 2008. In August 2010, Shear Diamonds (Nunavut) Corp. (Shear) purchased the Jericho Mine and its assets and assumed the responsibility for the site.

On January 16, 2008, TDC and its subsidiary Benachee Resources Inc. ("Benachee"), owners of the Jericho Diamond Mine, filed for protection under the *Companies' Creditors Arrangement Act* ("CCAA") due to a severe cashflow crisis. Pursuant to the initial order of the Ontario Superior Court of Justice, a stay of proceedings was granted, and all proceedings and enforcement processes against TDC and Benachee were stayed.

Through the course of the restructuring, TDC and Benachee identified two strategic goals to be achieved in the CCAA process. The first goal was to realize upon Benachee's non-strategic assets by selling its tax losses. The second goal was to restart the Jericho Diamond Mine through a recapitalization, a refinancing, a sale or some combination thereof. On June 3, 2009, after extensive negotiations and due diligence, TDC and Benachee achieved their first goal pursuant to a highly complex transaction with an income trust.

With respect to the second goal, during the CCAA process TDC and Benachee went through two unsuccessful attempts to find a purchaser for the Jericho Diamond Mine. On January 15, 2010, the Ontario Court approved and authorized TDC and Benachee to conduct a formal sales process inviting offers for either a sale *en bloc* to facilitate a going concern reopening or, alternatively, a liquidation, in whole or in part, of the Jericho Diamond Mine. After negotiations with various parties, TDC and Benachee entered into a letter of intent with Shear on May 5, 2010, which contemplated the sale of the Jericho Diamond Mine. The sale to Shear closed on August 27, 2010, and the Jericho Diamond Mine and substantially all the assets of TDC and Benachee were vested in Shear pursuant to an Order of the Ontario Court dated July 27, 2010.

The Jericho Mine Care and Maintenance Plan (CAMP), described herein, has been developed to provide a set of resources for Shear, its contractors, and the regulatory bodies to use while maintaining the Jericho Mine in a state of care and maintenance.

The plan fulfills the requirements specified in Part J, Item 6 and Part M, Item 1 of the Jericho water licence, NWB1JER0410. As part of the purchase process of the Jericho Diamond Project, Shear management entered discussions with the Nunavut Water Board (NWB) and Indian and Northern Affairs Canada (INAC). Shear committed to providing a CAMP outlining and describing activities and undertakings required to prevent the potential for harm to the environment and to maintain the site and infrastructure. This plan and the series of sub-plans contained herein are being submitted to the NWB based on the available information. However, comprehensive historical maintenance and monitoring records were not well maintained under previous ownership and management; therefore, available information is incomplete or lacking detail.

The CAMP is based on these existing records including previous site management plans, regulator comments, and external anecdotal information where available. That being said, the plan has been redeveloped for the current regulatory regime and to reflect Shear's commitment to the best practices in environmental stewardship. The property will remain under care and maintenance as Shear evaluates the mineral resource and confirms a mine plan.

1.2 Objective of the Care and Maintenance Plan

The primary objective of the CAMP is to ensure the protection of the environment and the site infrastructure during the care and maintenance phase. This plan will provide Shear and its designated contractors with a collection of working documents to manage site activities during this phase. Mining operations at Jericho were suspended in May 2008. Care of the site was managed by INAC until Shear acquired the property. Activities during this period were limited in scope and addressed only the most urgent requirements. This document addresses the specific management requirements related to care and maintenance activities and does not cover those required for mining operations.

Previous site management plans were based exclusively on Jericho as an operating mine and did not consider care and maintenance. Shear determined that several of the management plans change significantly when the mine is under care and maintenance and, as such, specific care and maintenance versions of these plans have been developed. These plans are as follows:

- Aquatic Effects Monitoring Plan (AEMP, Section 10.0)
- General Monitoring Plan (GMP, Section 9.0);
- Processed Kimberlite Management Plan (PKMP, Section 4.0);
- Site Water Management Plan (SWMP, Section 2.0);
- Waste Management Plan (WMP, Section)
- Air Quality Management Plan (AQMP, Section); and
- Wildlife Effects Management Plan (WEMP, Section)

Shear has determined that the requirements for the other site management plans remain largely the same under care and maintenance and therefore will be submitted as such with the water licence renewal application late February 2011.

2.0 SITE WATER MANAGEMENT

During care and maintenance, the management of site water remains a critical aspect of site activities. Annual precipitation and runoff must be managed to prevent potentially contaminated water from entering the receiving environment and to protect the integrity of site infrastructure such that structures designed to withhold, divert, and contain water are maintained.

A Site Water Management Plan – Care and Maintenance has been developed and is presented in Appendix A. The plan fulfills the requirements specified in Schedule F and Part F, Item 1 of the Jericho water licence and covers all aspects of site water management during care and maintenance. Once Shear has completed the resource evaluation and is able to confirm the mine plan, a Site Water Management Plan – Operations will be submitted to the NWB for review and approval at least 60 days before the project resumes operations.

3.0 WASTE MANAGEMENT

Personnel will reside at the Jericho site during care and maintenance to undertake the activities required under this plan and others associated with resource evaluation, construction, and maintenance. As such, Shear expects that the management of waste generated on site will follow the same procedures as when the mine is operating. A specific care and maintenance document has, therefore, not been produced; site personnel should refer to the Jericho Waste Management Plan (EBA 2011j). The plan fulfills the requirements specified in Schedule H and Part H of the Jericho water licence and covers all aspects of site water management during care and maintenance.

4.0 PKCA MANAGEMENT

The Processed Kimberlite Containment Area (PKCA) serves a dual role in managing both processed kimberlite and site water. As site water management remains a critical aspect of care and maintenance activities, a Processed Kimberlite Management Plan (PKMP) – Care and Maintenance has been developed to address water management in the PKCA including discharges to the receiving environment.

The PKMP, presented in Appendix B, fulfills the requirements specified in Schedule H and Part H, Item 1 of the Jericho water licence and covers all aspects of PKCA water management during care and maintenance. The PKMP – Operations will be submitted to the NWB for review at least 60 days before the project resumes operations.

5.0 WASTE ROCK MANAGEMENT

During care and maintenance activities in 2011, mining operations, and consequently waste rock generation, are suspended, so waste rock management is not required. If information on Waste Rock Management is required, it can be found in the Jericho Waste Rock Management Plan (WRMP, EBA 2011k) to be submitted to the NWB with the water licence renewal application late February 2011.

The plan fulfills the requirements specified in Schedule H and Part H, Item 3 of the Jericho water licence and covers the present requirements of waste rock management during operations.

6.0 WASTEWATER TREATMENT MANAGEMENT

Personnel will reside at the Jericho site during care and maintenance to undertake the activities required under this plan and others associated with resource evaluation, construction, and maintenance. As such, the main camp will be opened and the facility's wastewater treatment plant (WWTP) will be operational. The management of the WWTP will follow the same procedures as when the mine is operational. The Wastewater Treatment Management Plan (EBA 2011l), to be submitted late February 2011, fulfills the requirements specified in Schedule H and Part H, Item 5 of the Jericho water licence.

7.0 LANDFILL MANAGEMENT

Personnel will reside at the Jericho site during care and maintenance to undertake the activities required under this plan and others associated with resource evaluation, construction, and maintenance. The management of waste landfilled on site will follow the same procedures as when the mine is operating; therefore, a specific care and maintenance document is not required. The Landfill Management Plan (EBA 2011g) fulfills the requirements specified in Schedule H and Part H, Item 5 of the Jericho water licence and will be submitted late February 2011 with the water licence renewal application.

8.0 LANDFARM MANAGEMENT

TDC submitted a landfarm design and management plan that was never approved or constructed. Shear will be submitting a Landfarm Management Plan as part of the water licence renewal application. The plan will include an engineered design and specific operational procedures. In summer 2011, Shear will confirm the volume of contaminated material on site and sample the material to establish the extent of the contamination in order to confirm the design. Placement of the facility will also be investigated during the summer with input from the engineers and regulators. The Landfarm Management Plan (EBA 2011f) fulfills the requirements specified in Schedule H and Part H, Item 5 of the Jericho water licence.

9.0 CONTINGENCY MANAGEMENT

The mine rescue team and full-scale medical resources will not be necessary while the site is on the reduced activities of care and maintenance. A first aid responder and/or medic will be on site as required by the *Nunavut Mine Health and Safety Act*. The Contingency Management Plan (EBA 2011c) will be submitted with the water licence renewal. This plan fulfills the requirements specified in Schedule J and Part J, Items 1 and 6 of the Jericho water licence and covers all aspects of Contingency Management.

10.0 GENERAL MONITORING

During care and maintenance, the monitoring of site water and infrastructure remains an important aspect of site activities. While mine operations are suspended, site water continues to flow and accumulate, posing potential harm to the environment and jeopardizing the integrity of structures designed to withhold, divert, and contain water. A General Monitoring Plan – Care and Maintenance has been developed to address this risk, presented in Appendix C. The plan fulfills the requirements specified in Schedule L and Part L, Item 1 of the Jericho water licence and covers all aspects of general monitoring during care and maintenance. The Site Water Management Plan – Operations will be submitted to the NWB for review and approval at least 60 days prior to commencing mining operations.

11.0 AQUATIC EFFECTS MONITORING

Although water use is reduced during care and maintenance, monitoring discharge water and its effect on the receiving environment remains a critical aspect of site activities. An Aquatic Effects Monitoring Plan (AEMP) — Care and Maintenance has been developed and is presented in Appendix D. The AEMP during care and maintenance is the same program proposed for operations with the exception of frequency and fish sampling.

The plan fulfills the requirements specified in Schedule K and Part K of the Jericho water licence and covers all aspects of aquatic effects monitoring during care and maintenance. The AEMP – Operations will be submitted to the NWB for review and approval at least 60 days prior to commencing mining operations.

12.0 CLOSURE AND RECLAMATION

In 2011, Shear will resume vegetation studies collaboratively with the University of Alberta. The Interim Closure and Reclamation Plan (ICRP, EBA 2011e) will be submitted with the water licence renewal application late February 2011.

The plan fulfills the requirements specified in Schedule M and Part M, Item 2 of the Jericho water licence and represents the current conditions, infrastructure, and requirements of closure and reclamation planning.

13.0 CLOSURE

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2011 WATER LICENCE RENEWAL DOCUMENTS

Management Plans

EBA, A Tetra Tech Company (EBA), 2011a. Aquatic Effects Monitoring Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011b. Care and Maintenance Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011c. Contingency Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011d. General Monitoring Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011e. Interim Closure and Reclamation Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011f. Landfarm Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011g. Landfill Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011h. Processed Kimberlite Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011i. Site Water Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011j. Waste Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011k. Waste Rock Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

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Design Reports

EBA, A Tetra Tech Company (EBA), 2011m. C1 Diversion Construction Summary, Jericho Diamond Mine, Nunavut. Prepared for Tahera Diamond Corporation, February 2011.

EBA, A Tetra Tech Company (EBA), 2011n. Geotechnical Design Report – Set 3 Tank Farm of Fuel Storage Facilities, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

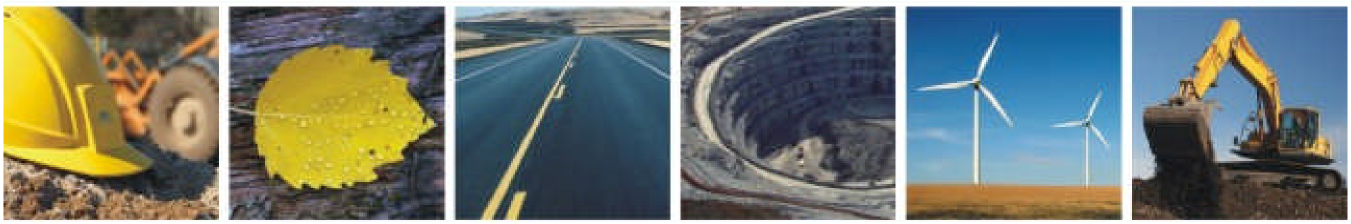
EBA, A Tetra Tech Company (EBA), 2011o. Preliminary Landfarm Design Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

APPENDIX A

APPENDIX A SITE WATER MANAGEMENT PLAN

SHEAR DIAMONDS LTD.

SITE WATER MANAGEMENT PLAN CARE AND MAINTENANCE JERICHO DIAMOND MINE, NUNAVUT



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ACRONYMS & ABBREVIATIONS

AA	Atomic Absorption Spectrophotometry
AEMP	Aquatic Effects Monitoring Plan
AIA	Aquatic Impact Assessment
ANCOVA	Analysis of Covariance
ANOVA	Analysis of Variance
AQMP	Air Quality Management Plan
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
BACI	Before-after-control-impact
CAEAL	Canadian Association for Environmental Analytical Laboratories
CAMP	Care and Maintenance Plan
CMP	Contingency Management Plan
CPK	Coarse Processed Kimberlite
DO	Dissolved Oxygen
EC	Electric Conductivity
EIS	Environmental Impact Statement
FPK	Fine Processed Kimberlite
GC/FID	Gas Chromatograph - Flame Ionization Detector
GMP	General Monitoring Plan
ICP-MS	Inductively Coupled Plasma – Mass Spectrometry
ICRP	Interim Closure and Reclamation Plan
INAC	Indian and Northern Affairs Canada
LFMP	Landfarm Management Plan
LFP	Landfill Management Plan
KIA	Kitikmeot Inuit Association
MANOVA	Multivariate Analysis of Variance
NIRB	Nunavut Impact Review Board
NWB	Nunavut Water Board
PHC	Petroleum Hydrocarbons
PKCA	Processed Kimberlite Containment Area
PKMP	PKCA Management Plan
RPD	Relative Percent Difference
Shear	Shear Diamonds (Nunavut) Corp.
SWMP	Site Water Management Plan
TDC	Tahera Diamonds Corporation
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
WEMP	Wildlife Effects Management Plan
WMP	Waste Management Plan
WRMP	Waste Rock Management Plan
WTMP	Wastewater Treatment Management Plan
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

1.1 General

The Jericho Mine Site Water Management Plan (SWMP), described herein, has been developed to provide a methodology for the collection, treatment and discharge of site water whose quality may be influenced by site infrastructure or operations.

The plan fulfills the requirements specified in Part F and Schedule F of the Jericho Mine Water Licence NWB1JER0410 (issued December 21, 2004). However, this plan is being submitted to the Nunavut Water Board (NWB) in the absence of complete historical information as Shear Diamonds (Nunavut) Corp. (Shear) only assumed control of the project in August 2010. Since that time, Shear has discovered that detailed information on the present site water conditions is limited. Comprehensive historical site water monitoring records were not well maintained under previous ownership and management, and the available information that is incomplete or lacking detail.

The Site Water Management Plan (SWMP) is based on existing records including previous site water management plans, regulator comments, and external anecdotal information where available. The plan has been redeveloped for the current regulatory requirements and to reflect Shear's commitment to the best practices in environmental stewardship.

The plan presents general descriptions of known water management infrastructure and a predicted site water balance while under care and maintenance. Once Shear has had an opportunity to thoroughly investigate the site and gather information in 2011, the SWMP will be revised (if required). Subsequent revisions of the SWMP will be submitted for review and approval prior to resuming mining operations or commencing closure and reclamation activities.

1.2 Objective of Site Water Management Plan

The primary objective of the SWMP is to ensure that water from the site, including accumulated melt and storm water, does not enter the receiving environment until the quality of that water meets regulated discharge criteria established by the NWB. At the time of the water licence renewal application, mining operations have been suspended and the site is under care and maintenance. This document will therefore address the specific site water management requirements at the present time. In addition to being a management tool, the SWMP was developed to assist Shear and the regulatory agencies with mine closure planning and the development of Jericho's Interim Closure and Reclamation Plan (EBA 2011e).

It is Shear's intention that all water collected on site during the care and maintenance phase will be pumped or directed to the Processed Kimberlite Containment Area (PKCA) and that no water will be discharged directly to the receiving environment.

The SWMP includes the following:

- Descriptions of Jericho's current site water management infrastructure;
- Descriptions of completed infrastructures;

- Descriptions of infrastructures that are planned to be built;
- Descriptions of infrastructures that are potentially required based on the progress of the project;
- A site water balance for the care and maintenance in 2011; and
- Description of flow monitoring and site water quality.

Once water is discharged into the PKCA it is no longer falls under the SWMP. Aspects of water management within the PKCA are described in the Jericho Processed Kimberlite Management Plan (EBA 2011h).

1.3 Background Information

The Jericho Diamond Mine is located approximately 260 km southeast of Kugluktuk, NU and 30 km north of Lupin Mine. The Jericho Mine was constructed and operated by Tahera Diamond Corporation (TDC) between 2004 and 2008. In January 2008, mining operations were suspended by TDC, and the site was subsequently placed under care and maintenance. Shortly thereafter, Indian and Northern Affairs Canada (INAC) assumed control of the care and maintenance activities for the site. In August 2010, Shear purchased the Jericho Mine and its assets and assumed the responsibility for the site.

Presently, the mine remains under care and maintenance as Shear evaluates the mineral resource. Once the evaluation is complete, a mine plan and operations schedule for the project will be established.

1.4 Linkage to Other Management Plans

The SWMP is part of the site wide management system. Other management plans that are related to or refer to the SWMP include:

- Aquatic Effects Monitoring Plan (AEMP);
- General Monitoring Plan (GMP);
- Processed Kimberlite Management Plan (PKMP);
- Waste Rock Management Plan (WRMP);
- Wastewater Treatment Management Plan (WTMP);
- Landfarm Management Plan (LFMP);
- Interim Closure and Reclamation Plan (ICRP); and
- Care and Maintenance Plan (CAMP) during periods where mining and processing operations are suspended.

2.0 SITE WATER MANAGEMENT FACILITIES

2.1 General Description

The general site layout and the location of existing, planned, and potential water management infrastructure for the Jericho Mine are presented in Figure 1. The existing infrastructure was constructed during the initial development of the site. These structures are functioning but may only be partially complete, such as PKCA. Planned infrastructure will be constructed once the project reaches a certain stage of development. An example would be the development of the C4 Diversion structure, which will be constructed as waste rock placement is extended adjacent to the C4 catchment. Potential infrastructure, such as Ponds A, B, and C, are contingency structures and will be constructed if water quality monitoring determines that runoff flows to the receiving environment are being influenced by site activities or infrastructure such that the water no longer meets the specified quality criteria.

The major water management facilities are summarized in Table 1.

Table 1: Water Management Structures

Structure	Location	Function	Status
Fresh Water Intake and Causeway	At south side of Carat Lake, and west of Stream C1	Pump fresh water from Carat Lake for the uses in the processing plant and the camp.	**Existing:** Functioning
C1 Diversion	West and north of the Jericho Pit	Direct outflows from Lake C1 around the pit perimeter and back into the natural Stream C1 channel	**Existing:** Functioning
C4 Diversion	East of Waste Rock Dump Site 1	Divert clean runoff water from migrating towards the waste rock dump. Water is diverted to the southeast into Lake C4	**Planned:** To be constructed. Construction date to be determined prior to resuming mining operations
Pit Sumps	Series of sumps within and around the perimeter of the open pit	Temporarily store runoff water flowing into the Jericho pit. Runoff and seepage from Waste Dump Site 1 and 2 are also directed to the Pit Sump. Stored water is to be pumped to the East Sump or directly to the PKCA.	**Planned:** Location varied based on progress of the pit excavation
East Sump	A natural depression, east of the ore storage and process plant.	Collect runoff from the area around the plant and camp facilities, and function as a transfer point for pit water destined for the PKCA.	**Existing**: Functioning as sump for the Plant Site Catchment Area.
PKCA	Located at Long Lake incorporates the East Dam, Southeast Dam, North Dam, Divider Dyke A, Divider Dyke B, and West Dam	Store fine processed kimberlite and treat water from the processing plant, wastewater treatment plant, and water collected from other site water management infrastructure.	**Existing:** Functioning but incomplete resulting in limited capacity.
Pond A	Northwest of Waste Dump Site 1	Collect runoff and potential seepage from Waste Dump Site 1	**Potential:** Not constructed. Necessity of construction to be evaluated during the Care and Maintenance Phase.
Pond B	North of Waste Dump Site 2	Collect runoff and potential seepage from Waste Dump Site 2	
Pond C	North of Low Grade PK Stockpile	Collect runoff and potential seepage from the Ore and Coarse PK Stockpile	

2.2 Fresh Water Intake

The fresh water intake and causeway are located approximately 200 m to the west of the Stream C1 outlet. The causeway was constructed of coarse rock fill containing minimal fines and extends approximately 90 m into Carat Lake. The water intake is located approximately 5 m under the water surface to allow operation under the lake ice during the winter. The design flow capacity for the intake is approximately 35 to 40 m^3/h allowing for process water makeup and potable camp water use. A provision has been made in the Process Plant to reclaim process water discharged to the PKCA. Reclaiming water from the PKCA will reduce the intake from Caret Lake. Details of the causeway, intake and pumping facilities can be found in the Specification for the Fresh Water Intake Causeway (SRK 2005a).

During 2011, Shear will draw fresh water from Carat Lake for domestic use in the camp facility and for evaluating the mill and process plant prior to commissioning. It is expected that the camp will accommodate approximately 30 people during care and maintenance operations.

2.3 Diversion Channels

2.3.1 C1 Diversion

The purpose of the C1 Diversion channel is to direct outflows from Lake C1 so water circumvents the Jericho open pit and naturally occurring runoff water is diverted away from the open pit. The C1 Diversion channel was designed to convey a peak flow of 0.7 m^3/s from a total catchment area of 115 ha, a flow rate equivalent to a 1-in-200 year wet weather event. A detailed design and description of the C1 Diversion channel are available in the C1 Diversion Design Plan, to be submitted to the NWB in February 2011 (EBA 2011m).

The C1 Diversion Channel will be inspected during the annual geotechnical inspection in 2011 to evaluate the integrity and performance of the channel. The assessment will take place during the freshet period when the channel is conveying the maximum yearly flow. Following the assessment, modifications to the channel may be implemented as recommended by the assessing engineer. Water quality samples will be taken from the channel as part of the routine monitoring specified in the General Monitoring Plan (GMP) (EBA 2011d).

2.3.2 C4 Diversion

Overland runoff from the up-gradient area of Waste Rock Dump 2 will penetrate into the waste rock pile and may increase low quality seepage flow. The purpose of the C4 Diversion channel is to prevent up-gradient overland flow in the C4 Catchment Area (Figure 2) from entering the Waste Rock Dump Site 1 and Catchment Area A.

The C4 Diversion will be constructed prior to expanding Waste Dump 1 northwards into the area that lies between the C4 catchment and Carat Lake. The C4 channel will be designed to convey a peak 1-in-200 wet year flow of 0.2 m^3/s from a total catchment area of approximately 15 ha.

In 2011, or while the project remains under care and maintenance, the mine plan will be reviewed and a timeline for the construction of the C4 Diversion channel will be established. A preliminary design of the C4 diversion channel is included in Appendix A (SRK 2004c). The detailed C4 Diversion channel design report will be submitted to the NWB for review and approval at least 60 days prior to commencing construction.

2.3.3 Collector Ditches and Site Grading

Based on the projects historical documents, Shear understands that the site's component areas (plant site, waste dumps, and stockpiles) were graded to direct local runoff towards Jericho pit or the PKCA, incorporating a series of ditches as required (design drawing included in Appendix A). Site Water Management Plans developed previously by SRK and TDC (SRK 2004c; AMEC 2005b) indicate that collector ditches were located on the upslope side of local access and haul roads and have capacities in excess of the 1–in-200 wet year flows. In addition, excavated "cut" sections for ditches were avoided to minimize the potential for permafrost degradation and erosion protection measures were constructed as required.

Shear has not been present on site to monitor the condition and performance of this infrastructure or indeed confirm its existence. During the spring and summer of 2011, Shear will initiate an assessment of all collection ditch infrastructure and site grading. The assessment will be conducted by a qualified engineer and will evaluate the structural integrity and effectiveness of the ditches and grading. A survey of the infrastructure may be undertaken to reconcile the grading and ditching with site documentation. Adjustments to the ditches will be implemented according to the results of the survey and the recommendations of the geotechnical assessment.

2.4 Pit Sump

It is understood that, during previous mining operations, sumps were constructed within Jericho pit to dewater active mining areas. Runoff inflow to the pit was collected in sumps and then pumped to the East Sump or directly to the PKCA. The location and size of the pit sump(s) would have varied depending on the mining plan and the active mining face.

Based on site observations by Shear in January 2011, the estimated depth of the current ponded pit water and ice is approximately 30 m equating to a pit water volume of approximately 660,000 m^3. Dewatering of the pit is expected to occur throughout the care and maintenance period to prepare the pit for additional exploratory drilling and the eventual resumption of mining activities. All pit water will be pumped to the PKCA and discharged in Cell A, upstream of Divider Dyke A. The pit dewatering schedule will take into consideration the holding capacity and water discharge schedule of the PKCA. Once the pit is dewatered, the existing pit sump(s) will be inspected and used to collect any inflows to the pit. The quality of the water in the pit sump will be routinely monitored. A description of the data collection and interpretation is available in Section 7.0 of the GMP.

2.5 East Sump

The East Sump is a natural surface depression located in the Plant Site Catchment Area. The sump collects drainage from the catchment that encompasses the camp and plant facilities, the fuel tank farm, the ore stockpile, and coarse processed kimberlite (CPK) Stockpiles 3 and 4. Accumulated melt and storm water in the sump is pumped directly to the PKCA. The quality of the water in East Sump will be routinely monitored. A description of the data collection and interpretation is available in Section 7.0 of the GMP. If water in the East Sump is found to meet the applicable water licence discharge criteria, it may be used for earthwork construction within the site's managed catchment areas.

2.6 PKCA Facility

Site water collected from the collector ditches, pit sump, potential contingency ponds, and all other facilities will be transferred to the PKCA for treatment and storage. Subject to meeting the applicable water quality criteria specified in the water licence, water in the PKCA will be discharged to Lake C3 on a seasonal basis as discussed in Jericho's Processed Kimberlite Management Plan (PKMP, EBA 2011h) to be submitted to NWB in February 2011.

The PKCA is situated within the former Long Lake and is bounded by the natural high ground and a series of dams, as shown in Figure 1. Ostensibly, the PKCA is divided into three cells: Cell A, Cell B and Cell C; however, Cell B and Cell C are presently a single cell until the construction of Divider Dyke B is completed. Divider Dyke A has been partially constructed with the filter zone at a minimum elevation of 521.5 m. The design elevation for the dyke is 524.0 m. Fine processed kimberlite (FPK), process water, and effluents from other site water management facilities are discharged into Cell A. Supernatant water in the cell drains towards the permeable Divider Dyke A and suspended solids in the water are removed as the water passes through the structure into the combined Cell B/C. The quality of filtered water in the cell will be monitored and a description of the data collection and interpretation is available in Section 7.0 of the GMP. If the water in Cell B/C is found to meet the applicable water licence discharge criteria, it will be pumped over the West Dam and released into Stream C3 in accordance to the discharge schedule discussed in the PKMP.

Shear anticipates discharging from the PKCA as early as possible in the spring of 2011. Upon assuming ownership of the site, Shear discovered that sufficient water had not been discharged from the facility during the summer of 2010 and is therefore at risk of exceeding the allowable freeboard during freshet 2011. The water balance and water flows associated with the PKCA including estimated monthly release of excess water from the PKCA to Stream C3 for the year 2011 is presented in the Jericho PKMP.

2.7 Contingency Ponds A, B, C

The main objectives of constructing contingency retention structures are to collect runoff water for potential treatment before discharge into PKCA and to contain high runoff flow in order to reduce the short-term loading in the Pit Sump and PKCA.

The need for one or more of the intra-area collection ponds cannot be evaluated until Shear resumes mining activities. If, after resuming mining activities, it is determined that the volume of water cannot be contained within the natural topography or that mining operations are resulting in a demonstrable decline in water quality, the collection ponds will be constructed. Seepage quality is monitored through the annual Seepage Survey, as discussed in the GMP.

The original planned locations and general arrangements of Ponds A, B, and C are shown on Figure 2 with preliminary designs included in Appendix A. The location and function for each area pond is as follows:

- Pond A will be located at northwest of the Waste Dump Site 1, to collect runoff and potential seepage from Waste Dump Site 1.

- Pond B will be located between the Waste Dump Site 2 and the Mine Pit , to collect runoff and potential seepage from Waste Dump Site 2.
- Pond C will be located north of the low grade ore stockpile area, to collect runoff from the ore stockpiles, coarse tailings area and plant site area if the East Sump becomes filled with CPK.

Detailed engineering designs and drawings will be provided to the NWB for review at least 60 days prior to commencing pond construction.

2.8 Hydrocarbon Containment Facilities

2.8.1 Fuel Tank Farm

The Fuel Tank Farm facility consists of two lined bermed enclosures sharing a common centre berm. In addition to the Tank Farm, there are two other fuel containment berms at the Jericho site: the Generator Tank Containment Area and the Airstrip Tank Containment Area.

The tank enclosures prevent the uncontrolled release of fuel oil to the surrounding environment if a fuel tank is compromised. Over time, precipitation and snowmelt accumulate in the facilities and require discharge so containment volume can be maintained. Previous fuel spills contained within the tank farm mean that residual fuel will affect the water accumulating in the structures. Water accumulation within the Tank Farm will be treated prior to discharge into the PKCA. Treatment options for hydrocarbon-affected water are discussed in Section 2.8.3.

2.8.2 Landfarm

Based on records of historical spills and the volume of stored contaminated soil, Shear expects that a land farm facility will need to be constructed at Jericho before resuming mining operations. A preliminary design for the structure has been developed and is presented in the Jericho Landfarm Design Plan (EBA 2011o). A landfarm is a lined, bermed enclosure used to treat hydrocarbon-affected soil through atmospheric ventilation and biodegradation. As with the Tank Farm, storm and meltwater accumulate in the enclosure and, as a result, come into contact with the contaminated soil. Water accumulation within the Landfarm will be treated prior to discharge into the PKCA.

2.8.3 Water treatment

Shear will collect, monitor, and treat any hydrocarbon-affected water on site so that it meets the applicable water quality criteria before it is discharged to the PKCA.

Water ponded in tank farm and land farm will be tested for benzene, toluene, ethylbenzene, and xylene (BTEX) and petroleum hydrocarbon (PHC) F1 through F4. The analytical results of BTEX in the water will be compared with the guideline values in the Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 2007). Since no known federal or territorial guideline values were established for PHC F1 to F4 in water, the applicable criteria in the *Ontario Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act* (ON-MOE, 2009) will be adopted. If the impounded water exceeds the applicable criteria indicated above, it will be treated in a portable hydrocarbon water treatment unit. A description of the proposed treatment unit is described in the Jericho Landfarm Management Plan (LFMP, EBA 2011f).

2.9 Other Facilities

Small diameter culverts may be required under site roads crossing minor natural drainage paths. The locations of any existing or required crossings will be determined during the 2011 care and maintenance activities. Culvert installations will be carried out in accordance with the appropriate Nunavut regulations and guidelines, including the Department of Fisheries and Ocean's Operational Standards, and will be reviewed by a qualified geotechnical engineer. As part of the geotechnical monitoring specified in the GMP, regular inspections and maintenance of the culverts will be carried out to ensure they are functioning as intended.

3.0 OPERATION PHASE

As indicated in Section 1.0, an exploratory drilling program is planned for 2011 to evaluate the mineral resource in Jericho Pit. Shear will also determine the status and working condition of the milling and processing plant. Once the evaluation is complete, a mine plan and operations schedule for the project will be established. The SWMP required for mining operations may vary significantly from the plan required under care and maintenance activities. If required, a revised Site Water Management Plan for Mining Operations will be submitted to the NWB for review and approval at least 60 days prior to commencing mining activities at Jericho.

The following principals and activities will be addressed in any updated Site Water Management Plan:

- The use of the reclaimed water from the PKCA will, where possible, be maximized to reduce the water intake from Carat Lake.
- All existing site water management structures will be maintained in serviceable condition.
- Structures, such as Diversion Ditch C4, West Dam, North Dam and Divider Dyke B, will be completed or constructed to satisfy the requirements of the current mine plan.
- The necessity of constructing the contingency ponds will be determined.

4.0 POST-CLOSURE PHASE

The site closure and reclamation plan will be presented in the Interim Closure and Reclamation Plan, (ICRP, EBA 2011) to be submitted to the NWB in February 2011. As discussed in the ICRP, the following water management activities are expected to be undertaken upon completion of mining and processing activities:

- Significant flows from mine infrastructure will be directed into the open pit.
- Drainage from reclaimed areas around the process plant and stockpile areas will be directed to the open pit or PKCA drainage system.
- Prior to filling the open pit, an in-pit water quality assessment will be conducted to determine the desirable fill rate and, if required, alternative methods of treatment.

- The C1 Diversion channel will remain in place to bypass water around the open pit. If a faster rate of pit filling is desirable, some or all of the channel flow may be directed into the pit.
- After the pit has filled and water quality testing determines the pit water to be acceptable for release, flows from the pit could be directed into the C1 stream channel. Alternatively, flows may be directed into a separate open channel discharging along the east shore of Carat Lake. The final configuration of pit water release options will be determined once a thorough site evaluation is completed and sufficient monitoring data is available to refine the present pit water quality estimates.
- After confirming the water quality within the PKCA is suitable for release, the West Dam will be breached or completely removed to minimize or eliminate stored water. Runoff will flow through the (breached) West Dam and directly into Stream C3 and on to Lake C3. A detailed description of the PKCA reclamation is presented in the ICRP.

5.0 SITE WATER BALANCE

5.1 General Description

A specific site water balance has been developed for the Jericho site while it is under care and maintenance. A continuous simulation water quantity and quality model was developed by Clearwater Consultants for Jericho during the mine's original water licence application. The analysis and model, found in the 2004 Site Water Management Plan (SRK 2004c), used monthly time steps to simulate inflows and outflows from the various project components. The Clearwater Consultants model, along with the 2004 and 2009 Jericho Site Water Management Plans (SRK 2004c; EBA 2009), was used as a basis for the present water balance. Shear has not been present on site to verify the accuracy of the previous models and management plans; as such, Shear is expecting that models for both care and maintenance activities and mining operations will be refined once a thorough evaluation of site conditions is completed in 2011 and new monitoring data is gathered.

5.2 Estimated 2011 Water Balance

While Jericho remains under care and maintenance, Shear has elected to maintain conservative assumptions regarding precipitation levels and water volumes collected in the site's retention structures. During 2011, Shear intends to further assess the historical assumptions used to develop the site water balance while also gathering new data. Any new information will be used to update and refine the predictions for the 2012 and subsequent years. The NWB will be notified of any changes to the SWMP and the water balance.

As described in the 2005 Site Water Management Plan (TDC 2005b), permafrost aggrading into the waste rock reduces dump runoff as most of the infiltrating rainfall and snowmelt becomes permanently frozen within the dump. In addition, "wetting" of the waste rock (i.e., abstraction of the water that adheres to waste rock particles) will also reduce the volume of runoff, and hence, the contaminant load generated by the waste dump.

Based on the Jericho Mine climate and hydrology study carried out by SRK (SRK 2003a), the following parameters were also adopted in the current water balance analyses:

- Annual precipitation of 330 mm for a mean (1 in 2 return period) year;
- Mean annual runoff of 225 mm corresponding to a mean runoff coefficient of 0.682;
- Annual lake surface evaporation of 270 mm; and
- The monthly distributions of the runoff and lake surface evaporation are listed in Table 2.

Table 2: Monthly Distributions of Runoff and Lake Surface Evaporation

Month	Monthly Percentage of Runoff (%)	Monthly Percentage of Open Water Evaporation (%)	Monthly Runoff (Mean) (mm)	Monthly Lake Surface Evaporation (mm)
May	3%	5%	7	14
June	57%	29%	128	78
July	16%	36%	36	97
August	10%	21%	23	57
September	13%	9%	29	24
October	1%	0%	2	0
November to April	0%	0%	0	0
Annual	100%	100%	225	270

The site water balance for 2011 including detailed calculations is presented in Table 3 (attached). The inflows to the PKCA in 2011 will include:

- Effluents discharged from the Waste Water Treatment Plant;
- Pit water pumped during dewatering activities; and
- Surface water runoff collected from various facilities and catchments.

Shear estimates that approximately 660,000 m^3 of water will need to be pumped from the Jericho pit prior to resuming mine operations. Pit water is expected to be the largest water input source to the PKCA during the first year of care and maintenance. Strictly speaking, the discharge of pit water into the PKCA is part of the SWMP; however, a detailed discussion of the discharge requirements and a schedule for pit water pumping has been included in the PKMP.

6.0 WATER FLOW AND QUALITY MONITORING

Flows and water quality at the mine are monitored at key locations described in detail in the GMP. Locations of the site water flow and quality monitoring are shown in Figure 1 and 2 and summarized below.

Water Flow Monitoring

- JER-SWM-01 – Freshwater Intake Pump
- JER-SWM-02 – PKCA Discharge Pump
- JER-SWM-03 – Pump for Discharging Pit Water to PKCA

- JER-SWM-04 – Pump for Discharging Wastewater Treatment Plant Effluent
- JER-SWM-05 – Pump for Processing Plant Freshwater Intake
- JER-SWM-06 – Pump for Discharging Processing Plant Water to PKCA
- JER-SWM-07 – Pump for Reclaim PKCA Water to Processing Plant
- JER-SWM-08 – C1 Diversion
- JER-SWM-09 – Catchment Area A Collection Discharge (currently from collector ditch)
- JER-SWM-10 – Catchment Area B Collection Discharge (currently from collector ditch)
- JER-SWM-11 – Plant Site Area Collection Discharge (currently from East Sump)

Seepage Survey Program

- JER-SPG-01 – Waste Rock Dump 1 Seepage
- JER-SPG-02 – Waste Rock Dump 2 Seepage
- JER-SPG-03 – CPK Stockpile 1 Seepage (currently not constructed)
- JER-SPG-04 – CPK Stockpile 2 Seepage (currently not constructed)
- JER-SPG-05 – CPK Stockpile 3 Seepage (currently not constructed)
- JER-SPG-06 – CPK Stockpile 4 Seepage
- JER-SPG-07 – Ore Stockpile Seepage
- JER-SPG-08 – Low Grade Ore Stockpile Seepage (currently not constructed)

Site Water Quality Monitoring Program

- JER-SWQ-01 – Wastewater Treatment Plant Effluent
- JER-SWQ-02 – Pit Sump
- JER-SWQ-03 – Process Plant Supernatant
- JER-SWQ-04 –Discharge Pump Intake in PKCA
  - Note: JER-SWQ-04 is used to determine compliance of discharge criteria in water licence before discharge, whereas JER-AEM-04 in the AEMP is used to determine compliance during discharge
- JER-SWQ-05 – Collector Ditch for Catchment Area A or Pond A
- JER-SWQ-06 – Collector Ditch for Catchment Area B or Pond B
- JER-SWQ-07 – East Sump or Potential Pond C

7.0 CONCLUSIONS

This report presents the designs of the site water management facilities and a summary of the Jericho Project overall site water balance during the Care and Maintenance Phase in 2011. A water balance for the site in 2011 provides estimates of monthly and annual inflows and outflows based on hydrological data. The water balance will be confirmed following the completion and analysis of the monitoring programs in 2011.

8.0 CLOSURE

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2011 WATER LICENCE RENEWAL DOCUMENTS

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TABLES

Table 3 Site Water Balance Sheet in 2011

Table 3: Site Water Balance Sheet in 2011

1) Annual Average Precipitation and Evaporation [1]

Precipitation =	330	mm/yr
Runoff =	225	mm/yr
Runoff coefficient =	0.682	
Open Water Evaporation =	270	mm/yr
Precipitation - Open water evap =	60	mm/yr

2) Water Consumption

Daily Domestic Water Consumption [2] =	0.329	m^3/person/day
Number of camp occupants =	30	Person

Month	Day	Monthly Percentage of Runoff	Monthly Percentage of Open Water Evaporation	Water Intake: Pumped Water [3]	Open Pit: Catchment Area	Open Pit: Prec + Runoff - Evap	Open Pit: Recharge from Area A	Open Pit: Recharge from Area B	Open Pit: Recharge from Area C	Open Pit: Discharge to PKCA	Open Pit: Ponded Water
		(%)	(%)	(m^3)	(m^2)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)
Jan-11	31	0%	0%	306	269,031	0	0	0	0		
Feb-11	28	0%	0%	276	269,031	0	0	0	0		
Mar-11	31	0%	0%	306	269,031	0	0	0	0		
Apr-11	30	0%	0%	296	269,031	0	0	0	0		
May-11	31	3%	5%	306	269,031	1,816	0	0	0		
Jun-11	30	57%	29%	296	269,031	34,503	3720.65	1207.09	2080.2		
Jul-11	31	16%	36%	306	269,031	9,685	70692.3	22934.7	39523.8		
Aug-11	31	10%	21%	306	269,031	6,053	19843.5	6437.81	11094.4		
Sep-11	30	13%	9%	296	269,031	7,869	12402.2	4023.63	6934.01		
Oct-11	31	1%	0%	306	269,031	605	16122.8	5230.72	9014.21		
Nov-11	30	0%	0%	296	269,031	0	1240.22	402.363	693.401		
Dec-11	31	0%	0%	306	269,031	0	0	0	0		
Year 2011 Total	365	100%	100%	3603	269,031	60,532	124,022	40,236	69,340		

Month	Area A Catchment: Catchment Area	Area A: Prec + Runoff - Evap	Area A: Discharge to Pit or PKCA	Area A: Discharge Destination	Area A: Collected Water	Area B Catchment: Catchment Area	Area B: Prec + Runoff - Evap	Area B: Discharge to Pit or PKCA	Area B: Discharge Destination	Area B: Ponded Water
	(m^2)	(m^3)	(m^3)	-	(m^3)	(m^2)	(m^3)	(m^3)	-	(m^3)
Jan-11	551,207	0	0	Pit	0	178,828	0	0	Pit	0
Feb-11	551,207	0	0	Pit	0	178,828	0	0	Pit	0
Mar-11	551,207	0	0	Pit	0	178,828	0	0	Pit	0
Apr-11	551,207	0	0	Pit	0	178,828	0	0	Pit	0
May-11	551,207	3,721	0	Pit	0	178,828	1,207	0	Pit	1,207
Jun-11	551,207	70,692	3,721	Pit	3,721	178,828	22,935	1,207	Pit	22,935
Jul-11	551,207	19,843	70,692	Pit	70,692	178,828	6,438	22,935	Pit	6,438
Aug-11	551,207	12,402	19,843	Pit	19,843	178,828	4,024	6,438	Pit	4,024
Sep-11	551,207	16,123	12,402	Pit	12,402	178,828	5,231	4,024	Pit	5,231
Oct-11	551,207	1,240	16,123	Pit	16,123	178,828	402	5,231	Pit	402
Nov-11	551,207	0	1,240	Pit	1,240	178,828	0	402	Pit	0
Dec-11	551,207	0	0	Pit	0	178,828	0	0	Pit	0
Year 2011 Total	551,207	124,022	124,022	-	0	178,828	40,236	40,236	-	0

Month	Plant Site Catchment Area: Catchment Area	Plant Site: Prec + Runoff - Evap	Plant Site: Discharge to Pit or PKCA	Plant Site: Discharge Destination	Plant Site: Ponded Water	Waste Water Treatment Plant: Water pumped to Camp	WWTP: Influent to WWTP	WWTP: Effluent to PKCA
	(m^2)	(m^3)	(m^3)	-	(m^3)	(m^3)	(m^3)	(m^3)
Jan-11	308,178	0	0	Pit	0	306	306	306
Feb-11	308,178	0	0	Pit	0	276	276	276
Mar-11	308,178	0	0	Pit	0	306	306	306
Apr-11	308,178	0	0	Pit	0	296	296	296
May-11	308,178	2,080	0	Pit	2,080	306	306	306
Jun-11	308,178	39,524	2,080	Pit	39,524	296	296	296
Jul-11	308,178	11,094	39,524	Pit	11,094	306	306	306
Aug-11	308,178	6,934	11,094	Pit	6,934	306	306	306
Sep-11	308,178	9,014	6,934	Pit	9,014	296	296	296
Oct-11	308,178	693	9,014	Pit	693	306	306	306
Nov-11	308,178	0	693	Pit	0	296	296	296
Dec-11	308,178	0	0	Pit	0	306	306	306
Year 2011 Total	308,178	69,340	69,340	-	0	3,603	3,603	3,603

Month	PKCA: Catchment Area	PKCA: Cell B and C Area	PKCA: Water Level	PKCA: Prec + Runoff - Evap	PKCA: Recharge from Pit	PKCA: Recharge from Area A	PKCA: Recharge from Area B	PKCA: Recharge from Area C	PKCA: Recharge from WWTP	PKCA: Discharge to Stream C3	PKCA: Remaining Capacity	PKCA: Ponded Water
	(m^2)	(m^2)	(m)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)
Jan-11	534,700	50,657		0		0	0	0	306			
Feb-11	534,700	50,657		0		0	0	0	276			
Mar-11	534,700	50,657		0		0	0	0	306			
Apr-11	534,700	50,657		0		0	0	0	296			
May-11	534,700	50,657		3,425		0	0	0	306			
Jun-11	534,700	50,657		62,958		0	0	0	296			
Jul-11	534,700	50,657		18,519		0	0	0	306			
Aug-11	534,700	50,657		11,534		0	0	0	306			
Sep-11	534,700	50,657		14,429		0	0	0	296			
Oct-11	534,700	50,657		1,089		0	0	0	306			
Nov-11	534,700	50,657		0		0	0	0	296			
Dec-11	534,700	50,657		0		0	0	0	306			
Year 2011 Total	534,700	50,657		111,954		0	0	0	3,603			

\+ 954,130

294,130

1,066,084

954,130

0

0

0

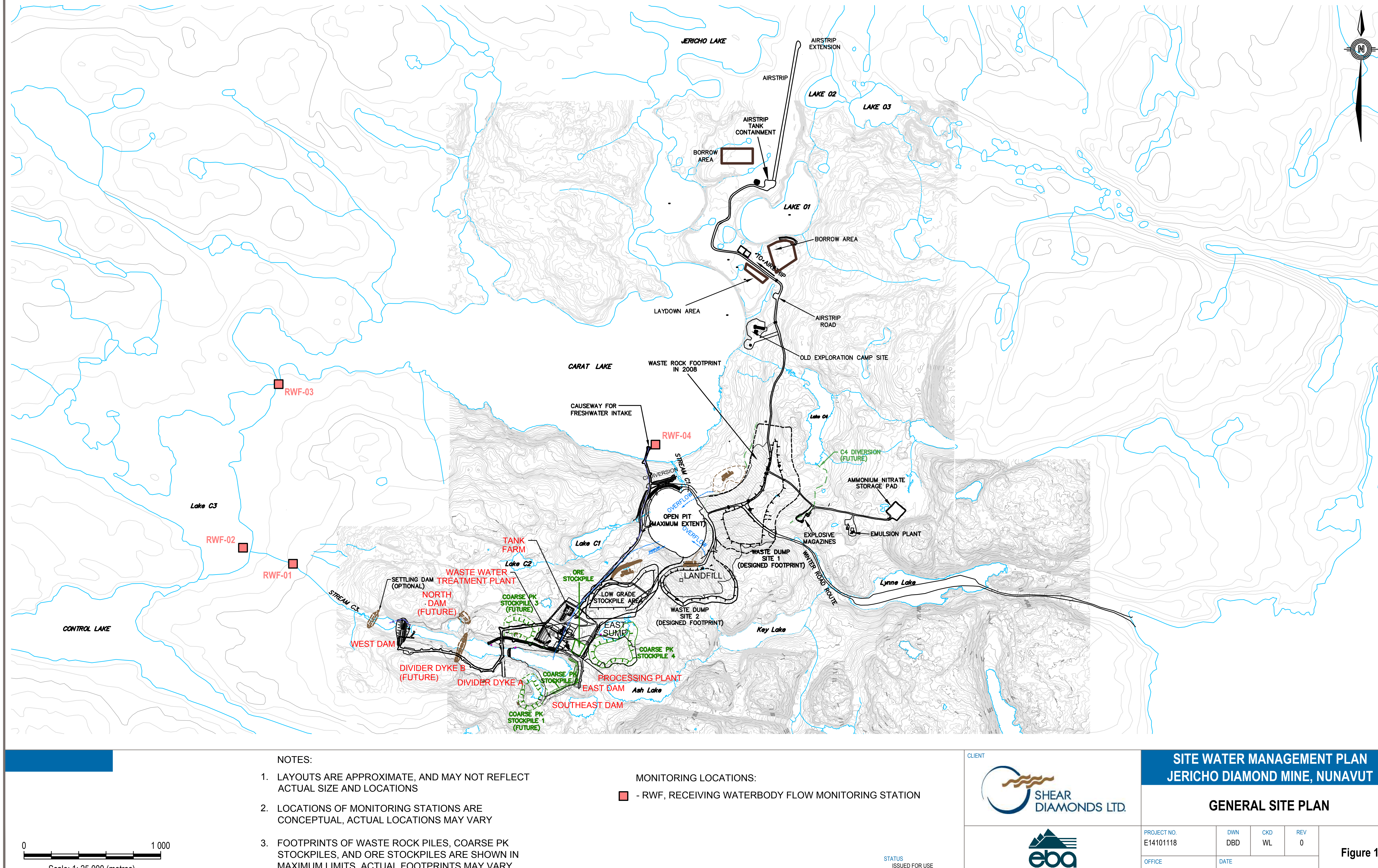
Note

1. Values obtained from SRK (2003), Supplemental Climate and Hydrology, Jericho Project, Nunavut
2. Values obtained from Environment Canada (2010), Wise Water Use [Online] http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=F25C70EC-1
3. Additional 10% of estimated water consumption rate was counted to cover losses during transporting
4. Volume of ponded water (highlighted in grey) in the Pit will be estimated following the field measurement in February 2011. The pit dewater and PKCA discharge schedules in 2011 will then be established accordingly.

FIGURES

Figure 1 General Site Plan
Figure 2 Site Infrastructure Plan
Figure 3 Catchment Areas and Monitoring Stations Plan
Figure 4 Site Water Management Flowsheet

Q:\Edmonton\Drafting\CIVIL3D\E141\E14101118\acad\Task 12_Site Water Management Plan\E14101118_Figure 1_Site Water Management Plan.dwg [FIGURE 1] January 31, 2011 - 3:48:08 pm (BY: DAS, DEBASHIS)



NOTES:

1. LAYOUTS ARE APPROXIMATE, AND MAY NOT REFLECT ACTUAL SIZE AND LOCATIONS
2. LOCATIONS OF MONITORING STATIONS ARE CONCEPTUAL, ACTUAL LOCATIONS MAY VARY
3. FOOTPRINTS OF WASTE ROCK PILES, COARSE PK STOCKPILES, AND ORE STOCKPILES ARE SHOWN IN MAXIMUM LIMITS, ACTUAL FOOTPRINTS MAY VARY

MONITORING LOCATIONS:

- RWF, RECEIVING WATERBODY FLOW MONITORING STATION

STATUS: ISSUED FOR USE

CLIENT: SHEAR DIAMONDS LTD.

eba — A TETRA TECH COMPANY

SITE WATER MANAGEMENT PLAN JERICHO DIAMOND MINE, NUNAVUT

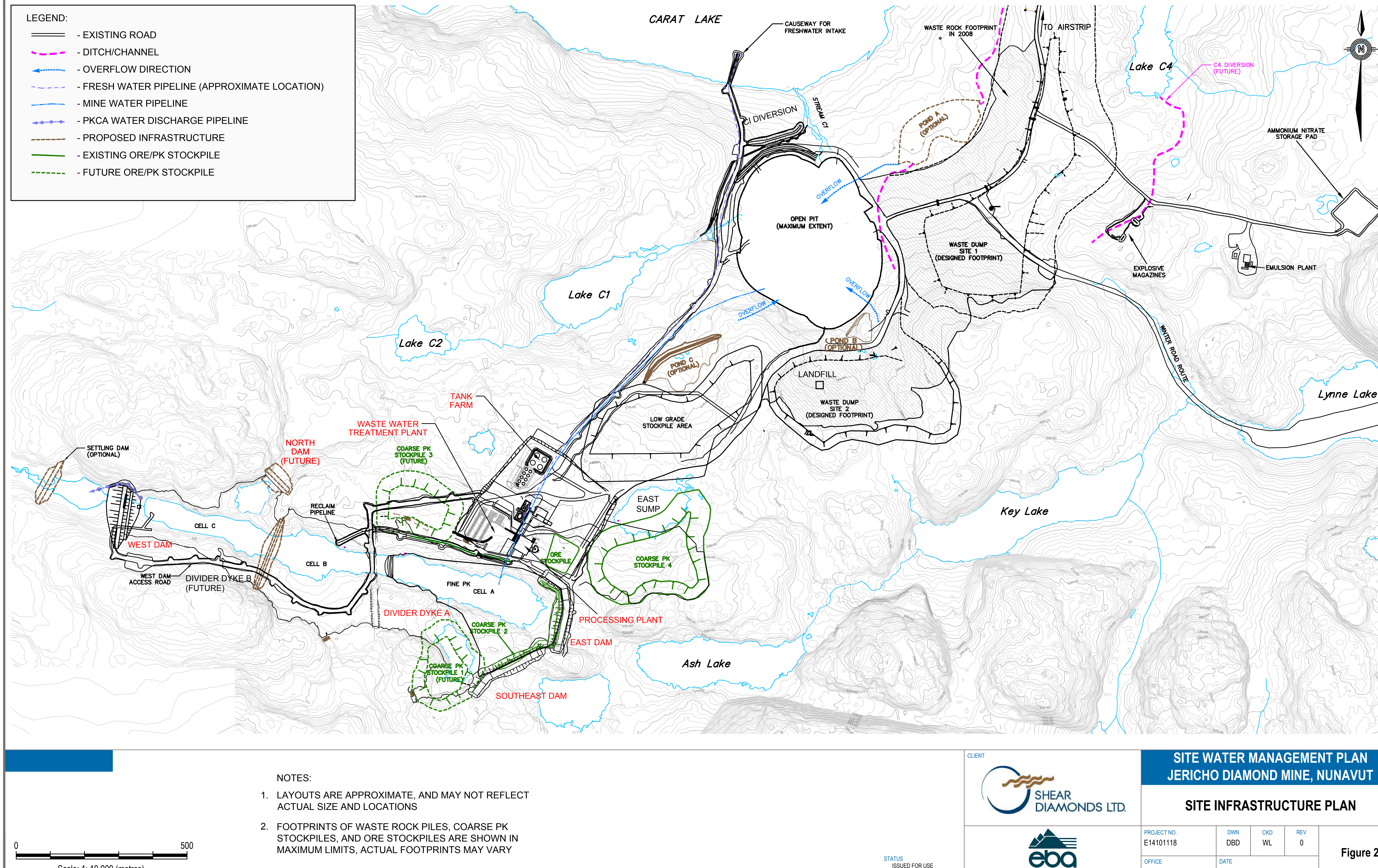
GENERAL SITE PLAN

PROJECT NO.	DWN	CKD	REV
E14101118	DBD	WL	0

OFFICE	DATE
EBA-EDM	January 31, 2011

Figure 1

Q:\Edmonton\Drafting\CIVIL3D\E141\E14101118\acad\Task 12_Site Water Management Plan\E14101118_Figure 2_Site Water Management Plan.dwg [FIGURE 2] January 31, 2011 - 3:50:58 pm (BY: DAS, DEBASHIS)



NOTES:

1. LAYOUTS ARE APPROXIMATE, AND MAY NOT REFLECT ACTUAL SIZE AND LOCATIONS
2. FOOTPRINTS OF WASTE ROCK PILES, COARSE PK STOCKPILES, AND ORE STOCKPILES ARE SHOWN IN MAXIMUM LIMITS, ACTUAL FOOTPRINTS MAY VARY

STATUS
ISSUED FOR USE

CLIENT

SHEAR DIAMONDS LTD.

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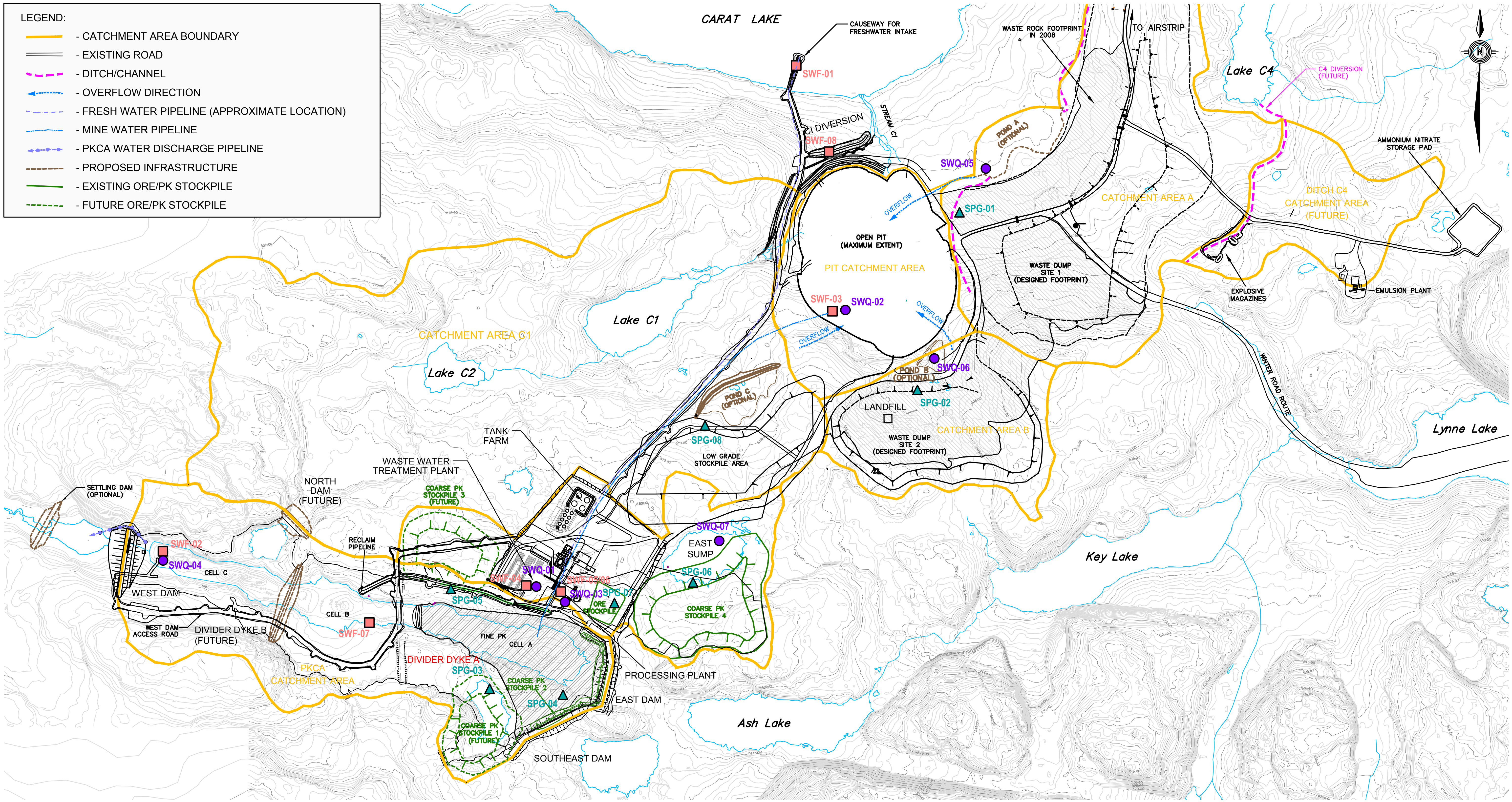
SITE WATER MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

SITE INFRASTRUCTURE PLAN

PROJECT NO.	DWN	CKD	REV	
E14101118	DBD	WL	0	Figure 2
OFFICE	DATE			
EBA-EDM	January 31, 2011			

Q:\Edmonton\Drafting\CIVIL3D\E141\E14101118\acad\Task 12_Site Water Management Plan\E14101118_Figure 3_Site Water Management Plan.dwg [FIGURE 3] January 31, 2011 - 3:53:23 pm (BY: DAS, DEBASHIS)



NOTES:

1. LAYOUTS ARE APPROXIMATE, AND MAY NOT REFLECT ACTUAL SIZE AND LOCATIONS
2. LOCATIONS OF MONITORING STATIONS ARE CONCEPTUAL, ACTUAL LOCATIONS MAY VARY
3. FOOTPRINTS OF WASTE ROCK PILES, COARSE PK STOCKPILES, AND ORE STOCKPILES ARE SHOWN IN MAXIMUM LIMITS, ACTUAL FOOTPRINTS MAY VARY
4. LOCATIONS OF SWF-09, 10 AND 11 WILL BE DETERMINED ON-SITE IN 2011

MONITORING LOCATIONS:

- SWF, SITE WATER FLOW MONITORING LOCATION
- SWQ, SITE WATER QUALITY MONITORING LOCATION
- SPG, SEEPAGE SURVEY LOCATION

0 500

Scale: 1: 10 000 (metres)

STATUS ISSUED FOR USE

CLIENT SHEAR DIAMONDS LTD.

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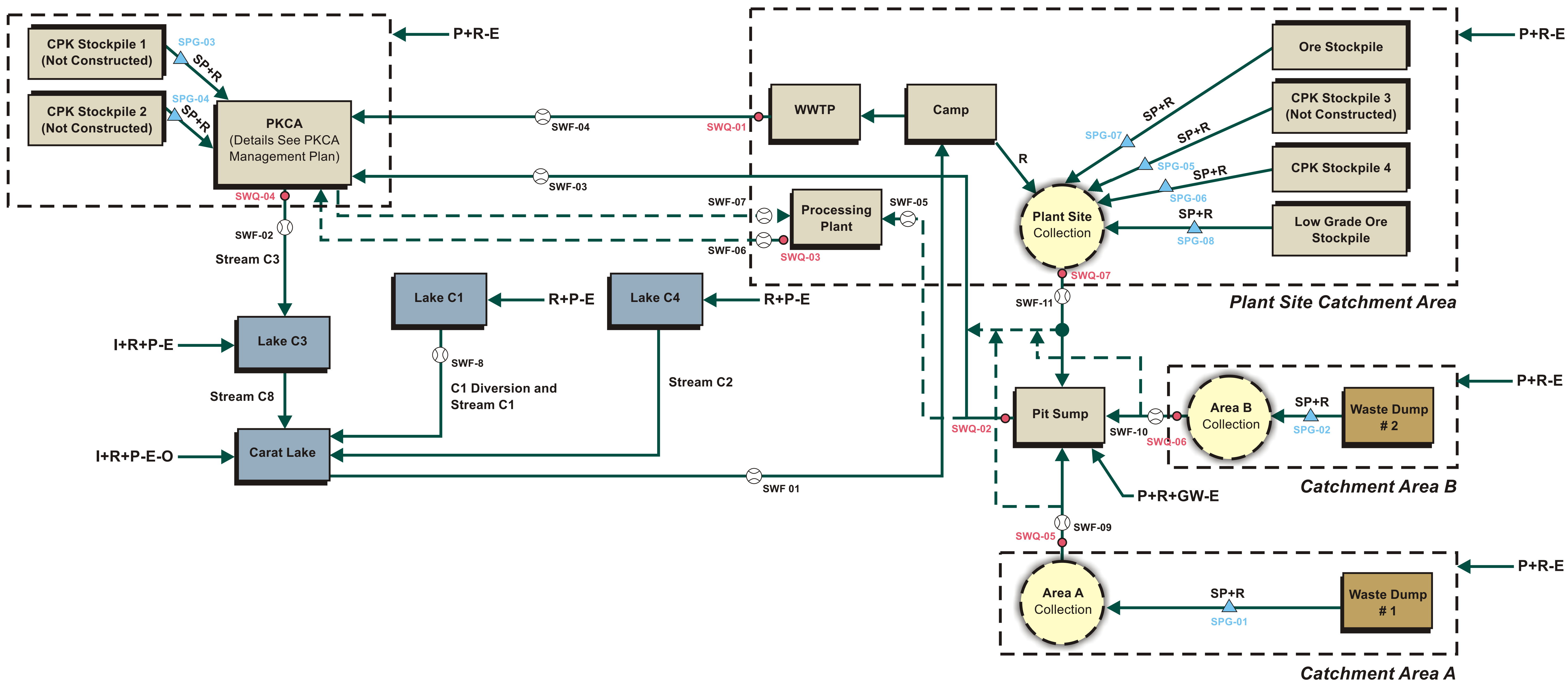
SITE WATER MANAGEMENT PLAN JERICHO DIAMOND MINE, NUNAVUT

CATCHMENT AREAS AND MONITORING STATIONS PLAN

PROJECT NO.	DWN	CKD	REV
E14101118	DBD	WL	0

OFFICE	DATE
EBA-EDM	January 31, 2011

Figure 3



LEGEND

- Sub-Watershed in Area of Impact
- Flow
- Potential Flow Path

P - Precipitation
R - Surface Runoff
E - Evaporation/Transpiration
I - Inflow
O - Outflow
Gw - Groundwater Inflow
Sp - Seepage
- Flow Meter
- SWQ Water Quality Monitoring Location
- Seepage Survey Location

Area A Collection : Collector Ditch or Potential Pond A
Area B Collection : Collector Ditch or Potential Pond B
Area C Collection : East Sump or Potential Pond C

STATUS
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SITE WATER MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

SITE WATER MANAGEMENT FLOWSHEET

PROJECT NO.	DWN	CKD	APVD	REV
E14101118	DBD	WL	WL	0

OFFICE	DATE
EBA-EDM	January 31, 2011

Figure 4

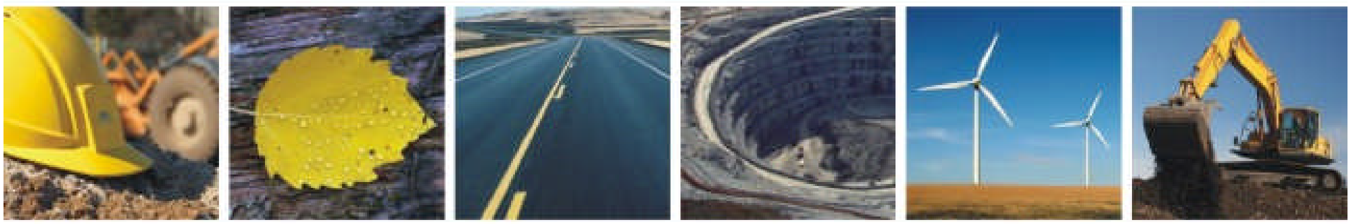
E14101118_Figure 5_PKCA Management Plan.cdr

APPENDIX B

APPENDIX B PROCESSED KIMBERLITE MANAGEMENT PLAN

SHEAR DIAMONDS LTD.

PKCA MANAGEMENT PLAN
CARE AND MAINTENANCE
JERICHO DIAMOND PROJECT, NUNAVUT



REPORT

JANUARY 2011
ISSUED FOR USE
EBA FILE: E14101118

SHEAR DIAMONDS LTD.

eba
A TETRA TECH COMPANY

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14940 - 123 Avenue
Edmonton, AB T5V 1B4 CANADA
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Figure 6 Stage Storage Curve for Cells B and C

ACRONYMS & ABBREVIATIONS

AA	Atomic Absorption Spectrophotometry
AEMP	Aquatic Effects Monitoring Plan
AIA	Aquatic Impact Assessment
ANCOVA	Analysis of Covariance
ANOVA	Analysis of Variance
AQMP	Air Quality Management Plan
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
BACI	Before-after-control-impact
CAEAL	Canadian Association for Environmental Analytical Laboratories
CAMP	Care and Maintenance Plan
CMP	Contingency Management Plan
CPK	Coarse Processed Kimberlite
DO	Dissolved Oxygen
EC	Electric Conductivity
EIS	Environmental Impact Statement
FPK	Fine Processed Kimberlite
GC/FID	Gas Chromatograph - Flame Ionization Detector
GMP	General Monitoring Plan
ICP-MS	Inductively Coupled Plasma – Mass Spectrometry
ICRP	Interim Closure and Reclamation Plan
INAC	Indian and Northern Affairs Canada
LFMP	Landfarm Management Plan
LFP	Landfill Management Plan
KIA	Kitikmeot Inuit Association
MANOVA	Multivariate Analysis of Variance
NIRB	Nunavut Impact Review Board
NWB	Nunavut Water Board
PHC	Petroleum Hydrocarbons
PKCA	Processed Kimberlite Containment Area
PKMP	PKCA Management Plan
RPD	Relative Percent Difference
Shear	Shear Diamonds (Nunavut) Corp.
SWMP	Site Water Management Plan
TDC	Tahera Diamonds Corporation
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
WEMP	Wildlife Effects Management Plan
WMP	Waste Management Plan
WRMP	Waste Rock Management Plan
WTMP	Wastewater Treatment Management Plan
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

1.1 General

The Jericho Processed Kimberlite Management Plan (PKMP) – Care and Maintenance has been developed to provide a methodology for managing the Processed Kimberlite Containment Area (PKCA) and the processed kimberlite and water contained within the facility.

The plan fulfills the requirements specified in Part H, Item 1 and Schedule H of the Jericho Mine Water Licence NWB1JER0410 (issued December 21, 2004). This plan is being submitted to the Nunavut Water Board (NWB) in the absence of complete historical information as Shear Diamonds (Nunavut) Corp. (Shear) only assumed control of the project in August 2010. Since that time Shear has discovered that detailed information on the present site conditions is limited. Comprehensive historical monitoring and maintenance records were not well maintained under previous ownership and management, so the available information is incomplete or lacking detail.

The PKMP is based on these existing records including previous management plans, regulator comments, and external anecdotal information where available. The plan has been redeveloped for the current regulatory regime and to reflect Shear's commitment to the best practices in environmental stewardship.

The plan presents general descriptions of existing and planned infrastructure in the PKCA as well as revised procedures for operation of the facility while it remains under care and maintenance. Once Shear has an opportunity to thoroughly investigate the site and gather information in 2011, the PKMP will be revised. Subsequent revisions of the PKMP will also be prepared prior to resuming mining operations or commencing closure and reclamation activities.

1.2 Objective of Processed Kimberlite Management Plan

The primary objective of the Processed Kimberlite Management Plan (PKMP) is to provide Shear and its designated contractors with a working document to operate the PKCA including the discharge of compliant water to receiving environment.

At the time of the water licence renewal application, mining operations have been suspended and the site is under care and maintenance. This document will therefore address the specific requirements at the present time. The PKCA serves a dual purpose at Jericho:

- The storage of fine processed kimberlite from mining and processing operations; and
- The treatment and storage of site and supernatant process water.

While Jericho is under care and maintenance, processed kimberlite will not be discharged to the PKCA with the possible exception of a relatively small volume discharged during the evaluation of the processing plant. Site water management will therefore be the PKCA's prime function. In 2011, Shear will undertake a resource evaluation and a processing evaluation in order to make critical decisions regarding the future of the Jericho mine. The activities associated with these evaluations will be conducted while the project remains on care and maintenance and will help to determine when and if the project will go back into operations. Unfortunately, site water management while the project was suspended was limited to minimal handling and discharge from the PKCA. This has resulted in the accumulation of melt and storm water in the pit and the PKCA. Currently, the water elevation in the PKCA is such that real concern exists with regard to the ability to manage the inflow during freshet. Additionally, the water that has accumulated in the pit seriously impedes Shear's ability to conduct an evaluation of the resource. Shear will need to dewater the pit in 2011 to ensure success of the worked planned for the year (WRSI 2011).

In addition to being a management tool, the PKMP was developed to assist Shear and the regulatory agencies with mine closure planning and the development of Jericho's Interim Closure and Reclamation Plan (EBA 2011e).

1.3 Background Information

The Jericho Diamond Mine is located approximately 260 km southeast of Kugluktuk, NU and 20 km north of Lupin Mine. The Jericho Mine was constructed and operated by Tahera Diamond Corporation (TDC) from 2004 to 2008. In January of 2008, mining operations were suspended by TDC and the site was subsequently placed under care and maintenance. Shortly thereafter, Indian and Northern Affairs Canada (INAC) assumed control of the care and maintenance activities for the site. In August of 2010, Shear Diamonds Ltd. purchased the Jericho Mine and its assets and assumed responsibility for the site.

Presently the mine remains under care and maintenance as Shear evaluates the mineral resource in Jericho Pit. Once the evaluation is complete, a mine plan and operations schedule for the project will be established.

1.4 Linkage to Other Management Plans

Numerous interlinked site plans exist for mine and environmental management at the Jericho. The PKCA should be considered as part of the site wide management system. Other management plans that are related to or refer to the PKCA include:

- Aquatic Effects Monitoring Plan (AEMP);
- Site Water Management Plan (SWMP)
- Site Water Monitoring Plan (GMP);
- Waste Rock Management Plan (WRMP);
- Wastewater Treatment Management Plan (WTMP); and
- Interim Closure and Reclamation Plan (ICRP).

2.0 PROCESSED KIMBERLITE CONTAINMENT AREA

The PKCA is located within the existing Long Lake Basin that is at the south end of the project site. The site and mine infrastructure layout are shown in Figures 1 and 2. A plan of the PKCA facility is presented in Figure 3.

The original lake level of Long Lake was 515.4 m. The maximum operating storage water level of the PKCA is defined as 523 m. Four dams have been or will be constructed around the facility to allow the water level to potentially rise to this level and remain stored within the PKCA. Once the perimeter berms have been constructed, the maximum operating storage level of fine processed kimberlite (FPK) in Cell A will be increased to 527.5 m. Water inflow to the PKCA comes from numerous sources including precipitation, runoff from the surrounding catchment area, site water pumped to the facility from the pit and other containment facilities, wastewater from the camp, and supernatant water from processed kimberlite deposited in the facility.

The PKCA is divided into three cells: Cell A, Cell B, and Cell C. FPK will first be deposited into Cell A, between the East and Southeast Dams and Divider Dyke A. Once Cell A is full and Divider Dyke B has been constructed, FPK will be deposited in Cell B. Water will filter through the divider dykes into the western portion (Cell C) of the PKCA.

No FPK will be deposited in Cell C. It will remain as a 'polishing pond' to facilitate the settlement of any remaining suspended solids so that excess water can be discharged to Stream C3 during the summer and fall.

The water level in the facility is ultimately controlled by discharging of compliant water over the West Dam located at the west end of the PKCA. The stage storage volume for the combined Cell B and Cell C is shown in Figure 6.

3.0 FINE PROCESSED KIMBERLITE DISPOSAL MANAGEMENT

During care and maintenance activities, production of FPK will be limited to a small amount produced during the evaluation of the process plant. Presently, Cell A has sufficient capacity for commissioning; however, before full production resumes, a detailed deposition plan will be developed and included in a revised PKMP. The revised PKMP will be submitted to the NWB for review and approval a minimum of 60 days prior to resuming processing activities.

4.0 DAM AND DYKE DESIGN

The PKCA facility requires dams and dykes to control the water level and discharge and FPK. The existing and proposed structures are listed in Table 1 and are shown in Figures 3 and 4. Dams and dykes that have been partially constructed or completed were designed using the 1999 Canadian Dam Safety Guidelines. The designs for the North Dam and Divider Dyke B will be reviewed to ensure compliance with the 2007 Canadian Dam Safety Guidelines before construction begins. Detailed design and construction drawings will be submitted to the NWB at least 60 days prior to construction.

Table 1: Summary and Status of PKCA Dams and Dykes

Structure	Status	Design Crest (m)	As-Built Crest (approx) (m)	Function	Construction Period*	Design Reference
West Dam	Partially Complete	528 Crest 524 Core	525 (min) Crest 520 (min) Core	Water Control at outlet of PKCA	2005-2007, 2012	EBA 2005c
East Dam	Complete	524.5 Crest 523.5 Liner	524.5 Crest 523.5 Liner	Containment of FPK	2005-2006	EBA 2005a
Southeast Dam	Complete	524.5 Crest 523.5 Liner	524.5 Crest 523.5 Liner	Containment of FPK	2006-2007	EBA 2005a
Divider Dyke A	Partially Complete	524	Varies – low point 521.5	Containment of FPK – flow through structure	2005-2007, 2012	EBA 2005b
Divider Dyke B	Not in place	524	-	Containment of FPK – flow through structure	2012	To be prepared
North Dam	Not in place	528 Crest 524 Core	-	Water Control	2012	EBA 2007
Cell A Coarse PK Perimeter Dyke	Not in place	528.5	-	Containment of FPK	Stage 1 2012-2013 Stage 2 2014-2015	To be prepared
West Settling Pond Dam	Optional	-	-	Water Control	Optional	To be prepared
*Construction period is estimated and is based on processing resuming mid-2012.						

4.1 West Dam

The West Dam design is described in EBA (2005c). The design criteria for the West Dam are as follows:

- The dam should retain water within the PKCA.
- The dam will remain physically stable during the operational life of the mine.
- The dam will remain physically stable during the operational life of the mine and will not be required after mine closure

The main water retention element in the dam is a frozen core overlying a frozen foundation. An effective frozen core dam requires that the central core and foundation remain frozen year-round to act as an impervious barrier against seepage. The core and foundation must be nearly saturated with ice to produce a well-bonded and impermeable mass, and the permafrost must be sustained. A geosynthetic liner on the upstream face of the frozen core provides a secondary seepage barrier.

The upstream shell consists primarily of rockfill. A small till zone has been placed at lower elevations to reduce convective water movement through the open graded rockfill. The downstream shell of the dam is constructed of rockfill. The rockfill shells are designed to be constructed with 3H:1V outside slopes.

The dam includes piping for the installation of thermosyphons. The need for thermosyphons will be based on the ground temperatures of the dam and foundation at the end of construction and over the life of the dam.

The West Dam was inspected in late September 2010 during the Jericho Annual Geotechnical Inspection (EBA 2010) and was performing satisfactorily.

4.2 East and Southeast Dam Design

The design of the East and Southeast dams are described in EBA (2005a). The design criteria for the East and Southeast dams are as follows:

- The dams will retain FPK solids.
- The water in the PKCA is to be maintained at a low level; therefore, water will not be impounded against the East and Southeast dams for long periods of time. However, the dams have been designed as water retaining structures since water may pond against the dams for short periods of time.
- The dams will remain physically stable during the operational life of the mine and following mine closure.

The main water retention element in the dams is the geomembrane liner. The liner is keyed into the ground using frozen saturated fill. Additional water retention is provided by FPK and coarse processed kimberlite (CPK) and till placed upstream of the liner. The dam foundation is designed to remain in a frozen condition thereby minimizing or eliminating seepage through the foundation.

The East Dam was constructed during the winter of 2005 and 2006. The Southeast Dam was constructed during the winter of 2006 and 2007. Construction details for the dams can be found in the East and Southeast Dam As-built Construction Report (EBA 2007)

The East and Southeast Dams were inspected in late September 2010 during the Jericho Annual Geotechnical Inspection (EBA 2010) and were performing well.

4.3 Divider Dyke A and B Design

The design of Divider Dyke A is described in EBA (2005b). The design criteria for the divider dykes are as follows:

- The dykes should retain the FPK solids to the extent practical. It will not be possible, or necessary, to prevent the movement of all colloidal particles through the dyke. These particles will combine and settle in the deposition cell following flocculation.
- The dyke should allow the movement of water from upstream (east) to downstream (west), as seepage flows through the dyke. If seepage is impeded by the development of frozen zones or filter blinding, a surface overflow channel will be constructed in the dyke.
- The dyke will remain physically stable during the operational life of the mine and following mine closure.

- Divider Dyke A construction began in 2005 but has not yet been completed. A second dyke, Divider Dyke B, will be constructed during future mine operations as the area upstream of Divider Dyke A fills with FPK or as required for water quality.
- Divider Dyke A will be used a haul road for the construction of the West Dam.

Divider Dyke A was partially constructed between 2005 and 2007. The filter material zone has been constructed a minimum elevation of 521.5 m. Divider Dyke A will need to be constructed to the final elevation of 524 m shortly after resuming processing activities.

The Divider Dyke A was inspected in late September 2010 during the Jericho Annual Geotechnical Inspection (EBA 2010) and was performing well.

Divider Dyke B has not been constructed but will be required once Cell A is nearing capacity. The final design of Divider Dyke B will be similar to Divider Dyke A and will be submitted to the NWB a minimum of 60 days prior to construction.

4.4 Perimeter Berm

CPK stockpiles and berms will be placed around the perimeter of Cell A to increase the volume of the facility. The perimeter berms are required when the FPK level is above elevation 523 m. A detailed design, including a projection on when the perimeter berms will be required, will be added to the PKMP and submitted to the NWB a minimum of 60 days prior to prior to resuming processing activities.

4.5 North Dam

The proposed location of the North Dam is in a low area at the north side of Cell C. The dam is required to allow the water level to rise to the maximum design level of the PKCA (523 m) and prevent water from the PKCA area flowing into the drainage basin north of the PKCA. The natural ground at the saddle of the North Dam is approximately 518.2 m and will restrict pond elevations in the PKCA to 517.2 m until the North Dam has been completed.

Construction of the North Dam is planned for 2012, pending results of resource evaluation. It will be constructed as a frozen core dam keyed into the frozen ground and bedrock. The design and construction drawings for the North Dam will be submitted to the NWB for approval at least 60 days prior to construction.

4.6 Settling Pond Dam

Construction of an additional settling pond may be required downstream of the West Dam if additional settling time is needed to reduce the suspended solids level in the PK supernatant. The final design of the settling pond dam would be determined based on calculated settling requirements. If the dam is required, the final design will be submitted to the NWB a minimum of 60 days prior to construction.

5.0 OPERATIONAL WATER MANAGEMENT

5.1 Water Balance

5.1.1 Objectives

Water balance for the PKCA was carried out for the following objectives:

- Projecting water elevations in PKCA for Cell B and C; and
- Estimating the discharge volume and rate for the water released from Cell B and C to Stream C3;

5.1.2 Water Sources

The catchment areas of the mine are shown in Figure 3 and a flowsheet of the site water management plan is shown in Figures 4. The PKCA area is currently divided into Cell A and Cell B/C by Divider Dyke A. Site water inflows to the PKCA consist of the following:

- Direct precipitation onto the pond surface;
- Runoff from the catchment area of PKCA;
- Water released from deposited FPK as a result of settling and consolidation in Cell A; and
- Runoff water collected from Pit Sump, Collection Ponds, East Sump and treated wastewater effluent, and water from other water retention facilities.

Water outflows from the PKCA consist of the following sources:

- Evaporation from the pond surface;
- Reclaim water pumped from the PKCA to the process plant; and
- Water discharged from the PKCA to Stream C3.

5.1.3 Methodology

A water balance for the Jericho site and PKCA will be produced using current on-site quantity and quality information obtained from an investigation program in February 2011. The water balance will be modelled using monthly time steps and will evaluate inflows and outflows from the PKCA including fully dewatering the pit in the summer of 2011. The seepage volume through the Divider Dyke A as well as the downstream pond levels in Cells B and C will be estimated for the time period. The monthly PKCA discharge schedule for 2011 will be developed based on the findings of the water balance.

5.2 Water Balance Model Basis and Assumptions

5.2.1 Climatic and Hydrological Data

The climatic and hydrological data required for the water balance analyses includes precipitation, lake surface evaporation, and runoff for watershed areas near the mine site. A detailed study of the climate and hydrology for the Jericho Mine project has been carried out (SRK 2003b). Based on the findings in the study, the following parameters were adopted in the current water balance analyses:

- Annual precipitation of 330 mm for a mean (1-in-2 return period) year;
- Mean annual runoff of 225 mm corresponding to a mean runoff coefficient of 0.682;
- Annual lake surface evaporation of 270 mm; and
- Annual precipitation of 500 mm for a 1:100 event wet year.

The monthly distributions of the runoff and lake surface evaporation are listed in Table 2.

Table 2: Monthly Distributions of Runoff and Lake Surface Evaporation

Month	Monthly Percentage of Runoff (%)	Monthly Runoff (Mean) (mm)	Monthly Runoff (1:100 Wet) (mm)	Monthly Lake Surface Evaporation (mm)
May	3	7	10	14
June	57	128	194	78
July	16	36	55	97
August	10	23	34	57
September	13	29	44	24
October	1	2	3	0
November to April	0	0	0	0
Annual	100	225	340	270

5.2.2 Storage Curves and Initial Pond Elevations

The stage storage curves for the combined Cells B and C in the PKCA is shown in Figure 6. As of September 30, 2010, the staff gauge in the cells indicated that the pond elevation was 516.1 m.

5.2.3 Mine Site Runoff Water, Pit Seepage Water, and Sewage to PKCA

The catchment areas within the Jericho mine site are shown in Figure 3 and summarized in Table 3. Runoff from Catchment Areas A and B, the Plant Site and the Pit Area, will be collected and pumped to the PKCA as described in the Jericho Site Water Management Plan (EBA 2011i).

Table 3: Mine Site Catchment Areas

Catchment Area	Area (m^2)
PKCA (Cell A)	215,300
PKCA (Cell B)	127,500
PKCA (Cell C)	191,900
Catchment Area A	557,000
Catchment Area B	178,800
Plant Site Catchment Area	308,200
Pit Area Catchment	241,700

Based on the available records of the site water management infrastructure, Waste Rock Dumps 1 and 2 are constructed in Catchment Area A and B, respectively. Surface runoff and seepage from waste rock dumps are collected in the collector ditches and then flow into the Pit Sump. Surface runoff and seepage collected from Catchment Area B and the Pit Area Catchment will be pumped to the PKCA.

Runoff from Catchment Areas A and B and the Plant Site and Pit Area Catchment will be pumped to the PKCA. It is assumed that all water from the C1 Catchment is diverted through the C1 diversion. Permafrost is expected to exist throughout the Jericho pit with the exception of the active layer. Ground temperatures of approximately –5°C were measured from two thermistor strings installed in the Jericho kimberlite pipe at depths of 40 m and 223.5 m (SRK, 2003a). The seepage through the permafrost into the open pit is expected to be negligible.

Sewage effluent from the camp facility will be treated in the Wastewater Treatment plant and pumped to Cell A.

5.2.4 Seepage through Divider Dykes A

Water flow between Cell A and Cell B is controlled by seepage through the internal Divider Dyke A when the water elevation in Cell A is below the dyke's present elevation of 521.5 m. The filter material is much finer than the transition material, so run-of-mine waste rock in the dyke dictates the seepage rate through the dyke. When estimating the seepage volume through the dyke, both the transition zone and waste rock zone can be practically ignored without introducing significant errors. Therefore, the design geometry of the filter was used in estimating the seepage through Divider Dyke A. The standing water elevation in Cell A is assumed to be controlled such that it will be below the top of the filter zone.

As Cell A becomes full, a second divider dyke (Divider Dyke B) will be constructed between Cell B and Cell C. Water flow from Cell B to Cell C will be via seepage through the internal Divider Dyke B. It is assumed that Dyke B will have a design cross-section similar to that for Dyke A; however, operating experience from Divider Dyke A's performance, will be used to optimize the design of Dyke B. A vertical profile along the proposed axis of Dyke B was used to calculate the vertical filter area for seepage calculations.

The hydraulic conductivity of a dyke filter material sample tested in EBA's laboratory was 1.3×10^{-2} cm/s. This value will be used as the average hydraulic conductivity for the filter material for Dykes A and B in estimating seepage volume through the dykes.

It is assumed that the FPK will completely block the filter area below the FPK surface elevation; thus, no seepage water will pass through the blocked filter area.

Ice covers have been observed on the pond surfaces during previous winter seasons. Once discharge to the PKCA resumes, the thickness of the ice cover in Cell B and/or Cell C will be monitored on an annual basis. The model will assume that there will be no seepage through the ice covered filter area.

5.2.5 Discharge Water from Cell C to Stream C3

Previous years' care and maintenance activities have demonstrated that it is critical to discharge water from the PKCA to maximize the storage volume in preparation for freshet. In 2009 and 2010, before Shear acquired the project, only a limited amount of water was discharged from the PKCA, and no water was pumped from the pit. After the acquisition, Shear discharged water from the PKCA for approximately one month until weather conditions prohibited continuing. The final elevation was 516.08 m as measured during the annual formal geotechnical inspection on September 30, 2010 (EBA 2010).

The current situation is such that water must be discharged before June to avoid exceeding the maximum allowable freeboard when freshet waters enter the PKCA. If water is not discharged before June, the consequences could be dire given that the current capacity is equal to the predicted mean year monthly runoff for June. In addition, the Jericho pit will need to be dewatered during 2011 to allow Shear to conduct a resource evaluation. The quantity and quality of the pit water will be determined in February 2011, and the information will be used to produce a discharge schedule. This will be submitted as an addendum at least 30 days prior to commencing discharge. Discharge is expected to have to continue throughout the open water season to dewater the pit and to achieve the desired elevation of 514.0 m in the PKCA.

Water that meets licence discharge criteria will be annually discharged from the PKCA over the West Dam to Stream C3. The annual outflow from the PKCA will be maximized such that the water levels in Cells B and C are maintained at a lower level than the pre-existing natural level. The minimum operating pond surface elevation in Cell C will be 513.5 m to provide a sufficient water depth to avoid disturbing the lake bottom sediment.

A detailed study of receiving water quality for a series of discharge scenarios was conducted (SRK 2004a). The study indicated that the minimum dilution of approximately 10:1 could occur within 200 m of the mouth of Stream C3 in Lake C3 during the brief period immediately prior to break-up of the ice (assumed to be June 18 in the modelling) for the scenario with release of a total water volume of 959,500 m^3 within six months (25,000 m^3, 551,600 m^3, 153,100 m^3, 87,400 m^3, 121,300 m^3, and 21,000 m^3 from May to October respectively). Dilutions would then increase rapidly to approximately 20:1 by the beginning of July.

The discharge rate from the PKCA will be managed to achieve minimum 10:1 dilution at the edge of the mixing zone in Lake C3. The water balance analyses assume that a discharge schedule and monthly distribution objectives would be applied to achieve the dilution ratio. Monthly percentage of the total discharge to Stream C3 was assumed to be 40%, 25%, 15% and 20% from June to September.

The discharge to Stream C3 will assume during the period of June to September 2011 as presented in the Site Water Management Plan (EBA 2011i). The monthly percentage of the total discharge to Stream C3 in 2011 was assumed to be 50%, 35%, and 15% from July to September.

5.2.6 Reclaim Water from Cell C

During the mine production phase, water in Cell C will be reclaimed to the processing plant to reduce the freshwater intake from Carat Lake. It is anticipated that during the care and maintenance activities water will only be reclaimed from the PKCA for the evaluation and commissioning of the process plant.

6.0 CLOSURE

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2011 WATER LICENCE RENEWAL DOCUMENTS

Management Plans

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FIGURES

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Figure 3 Catchment Areas Plan
Figure 4 Existing PKCA Plan
Figure 5 Sitewater Management Flowsheet
Figure 6 Stage Storage Curve for Cells B and C

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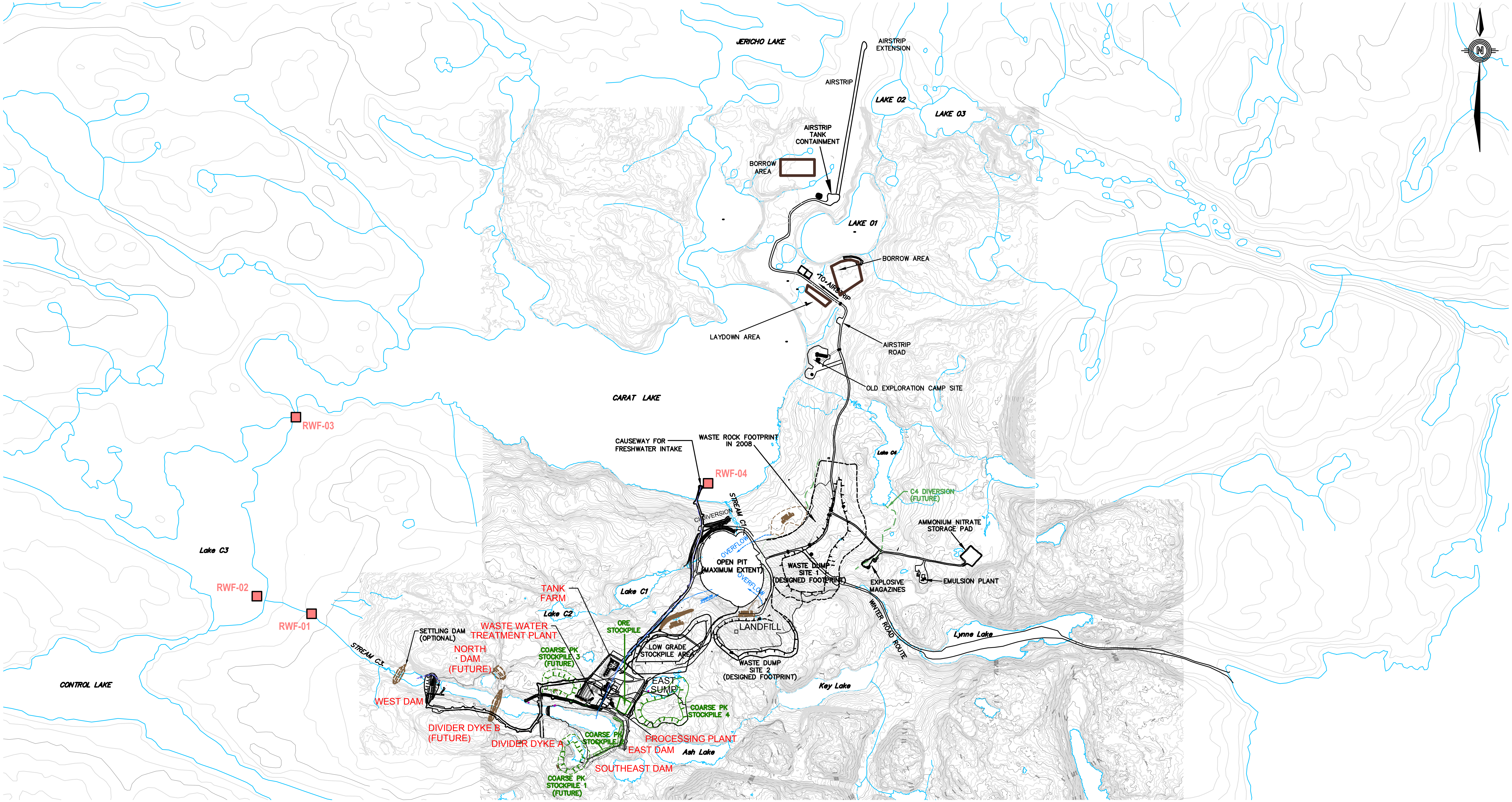
Q:\Edmonton\Drafting\CIVIL3D\E141\E14101118\acad\Task 11_PKCA Management Plan\E14101118_Figure 1_PKCA Management Plan.dwg [FIGURE 1] January 31, 2011 - 2:58:48 pm (BY: DAS, DEBASHIS)



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NOTES:

1. LAYOUTS ARE APPROXIMATE, AND MAY NOT REFLECT ACTUAL SIZE AND LOCATIONS
2. LOCATIONS OF MONITORING STATIONS ARE CONCEPTUAL, ACTUAL LOCATIONS MAY VARY
3. FOOTPRINTS OF WASTE ROCK PILES, COARSE PK STOCKPILES, AND ORE STOCKPILES ARE SHOWN IN MAXIMUM LIMITS, ACTUAL FOOTPRINTS MAY VARY

MONITORING LOCATIONS:

- RWF, RECEIVING WATERBODY FLOW MONITORING STATION

STATUS
ISSUED FOR USE

CLIENT
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PKCA MANAGEMENT PLAN JERICHO DIAMOND MINE, NUNAVUT

GENERAL SITE PLAN

PROJECT NO.	DWN	CKD	REV
E14101118	DBD	WL	0

OFFICE	DATE
EBA-EDM	January 31, 2011

Figure 1

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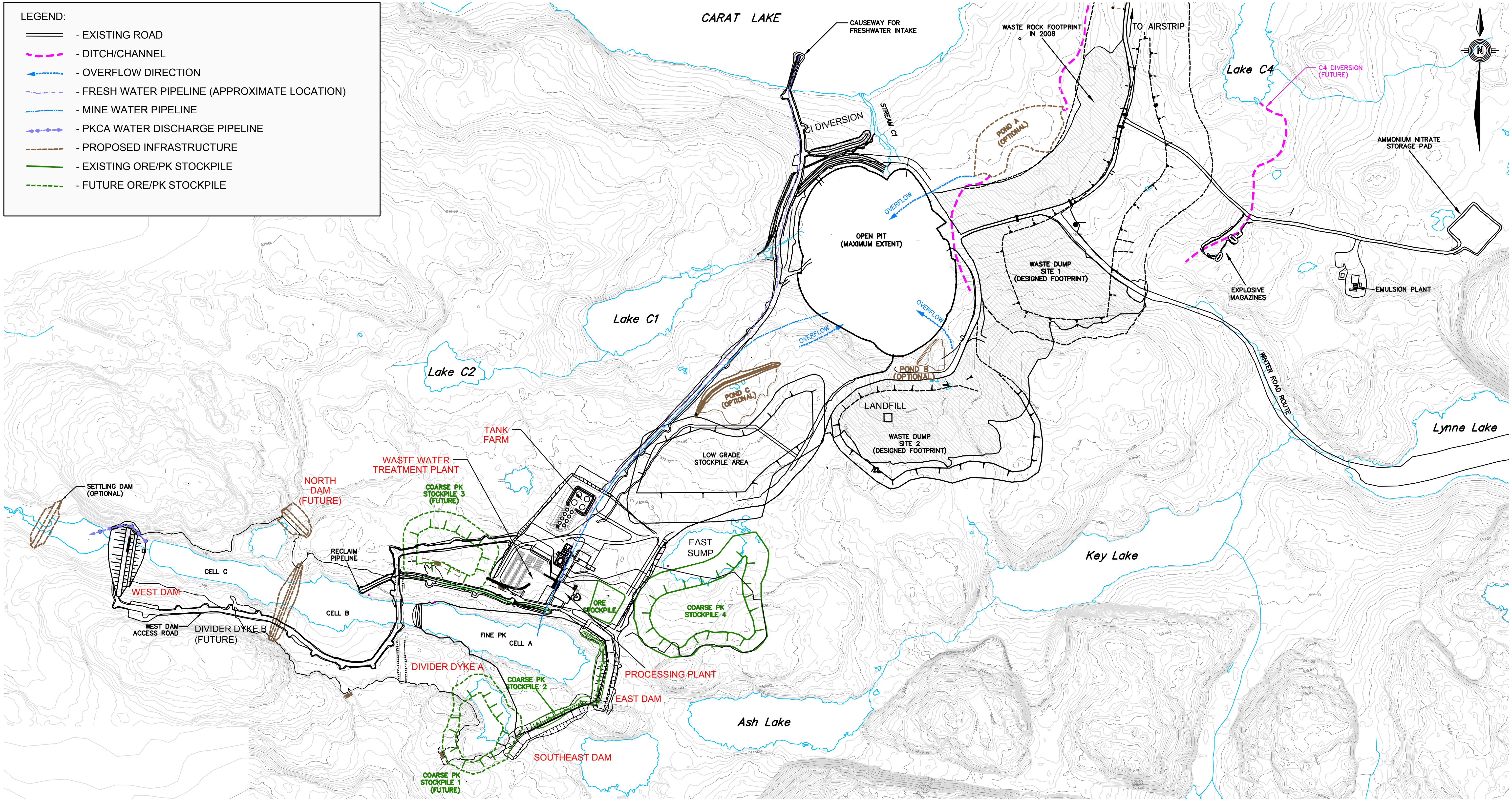

NOTES:

1. LAYOUTS ARE APPROXIMATE, AND MAY NOT REFLECT ACTUAL SIZE AND LOCATIONS
2. FOOTPRINTS OF WASTE ROCK PILES, COARSE PK STOCKPILES, AND ORE STOCKPILES ARE SHOWN IN MAXIMUM LIMITS, ACTUAL FOOTPRINTS MAY VARY

0 500

Scale: 1: 10 000 (metres)

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PKCA MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

SITE INFRASTRUCTURE PLAN

PROJECT NO.	DWN	CKD	REV
E14101118	DBD	WL	0
OFFICE	DATE		
EBA-EDM	January 31, 2011		

Figure 2

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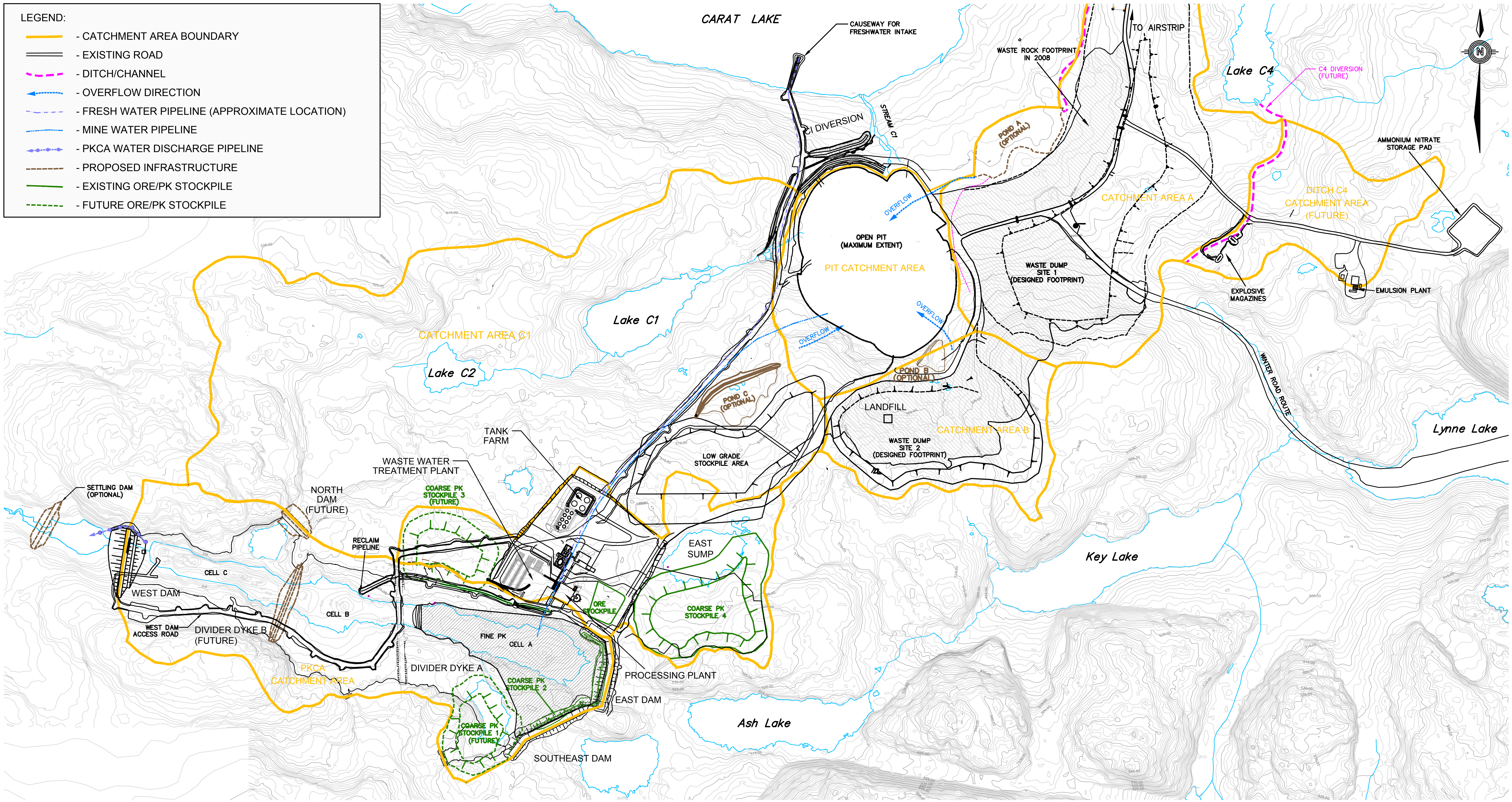

NOTES:

1. LAYOUTS ARE APPROXIMATE, AND MAY NOT REFLECT ACTUAL SIZE AND LOCATIONS
2. FOOTPRINTS OF WASTE ROCK PILES, COARSE PK STOCKPILES, AND ORE STOCKPILES ARE SHOWN IN MAXIMUM LIMITS, ACTUAL FOOTPRINTS MAY VARY

0 500

Scale: 1: 10 000 (metres)

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PKCA MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

CATCHMENT AREAS PLAN

PROJECT NO.	DWN	CKD	REV
E14101118	DBD	WL	0

OFFICE	DATE
EBA-EDM	January 31, 2011

Figure 3

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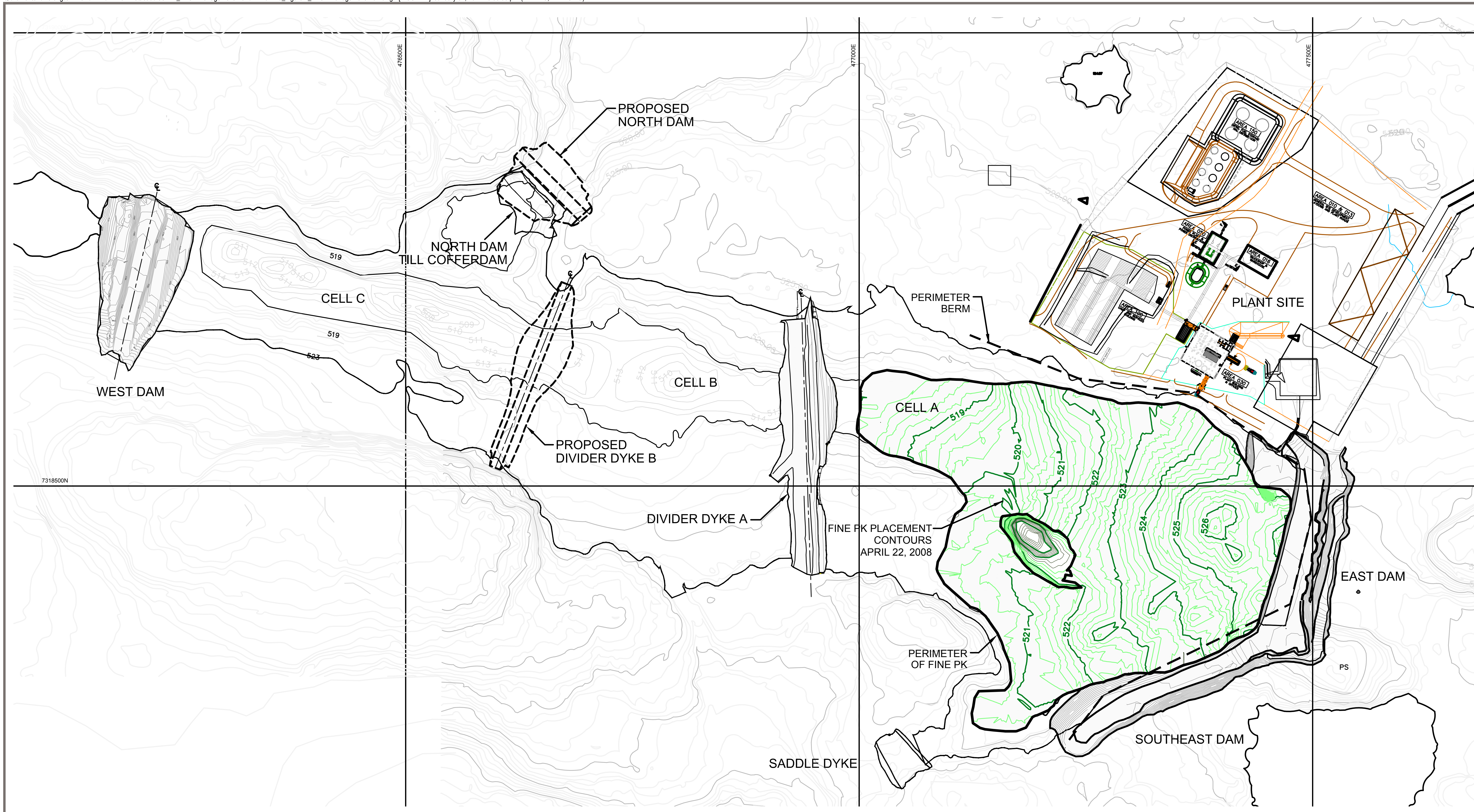

NOTE:

PROCESSED KIMBERLITE CONTOURS EXTRAPOLATED FROM APRIL 22, 2008 SURVEY.

0 200

Scale: 1: 4 000 (metres)

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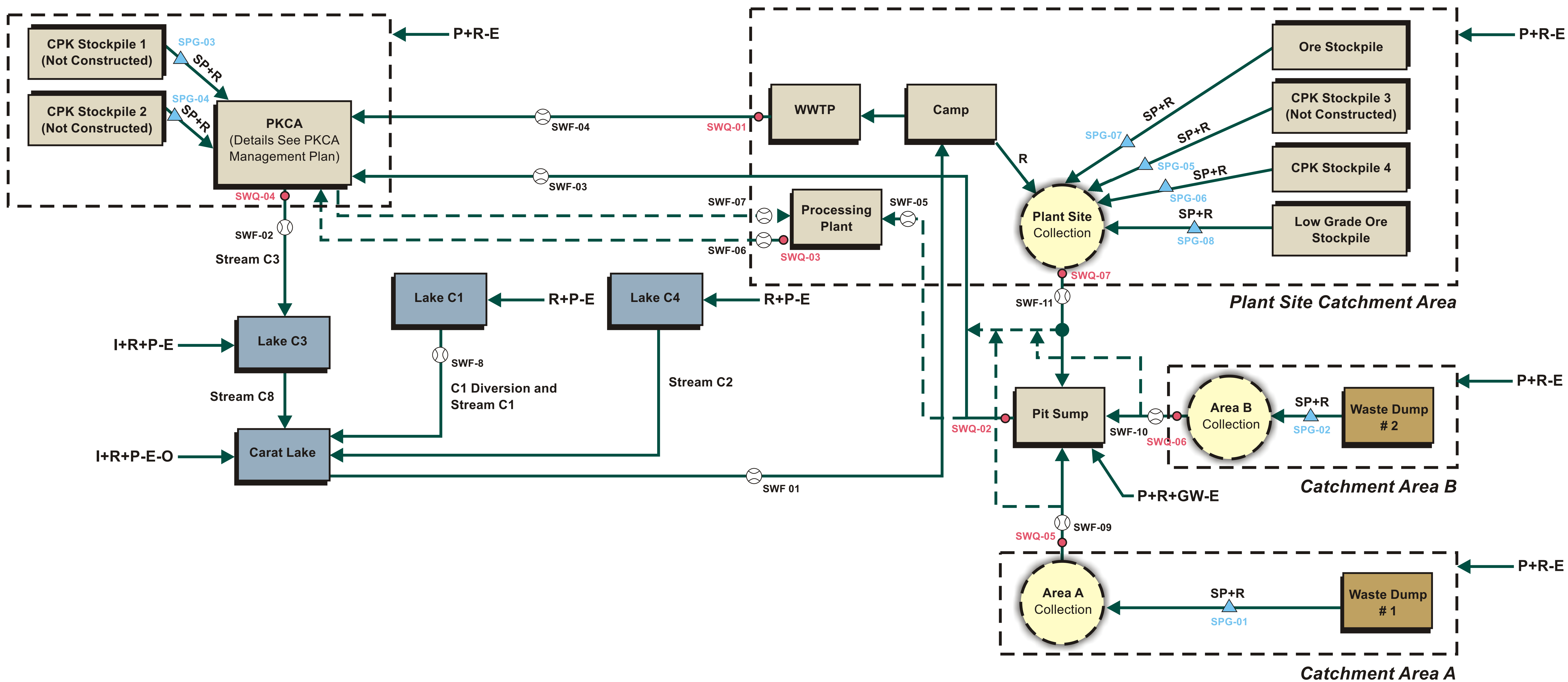
PKCA MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

EXISTING PKCA PLAN

PROJECT NO.	DWN	CKD	REV
E14101118	DBD	WL	0

OFFICE	DATE
EBA-EDM	January 31, 2011

Figure 4



LEGEND

- Sub-Watershed in Area of Impact
- Flow
- Potential Flow Path

P - Precipitation
R - Surface Runoff
E - Evaporation/Transpiration
I - Inflow
O - Outflow
Gw - Groundwater Inflow
Sp - Seepage
- Flow Meter
- SWQ Water Quality Monitoring Location
- Seepage Survey Location

Area A Collection : Collector Ditch or Potential Pond A
Area B Collection : Collector Ditch or Potential Pond B
Area C Collection : East Sump or Potential Pond C

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PKCA MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

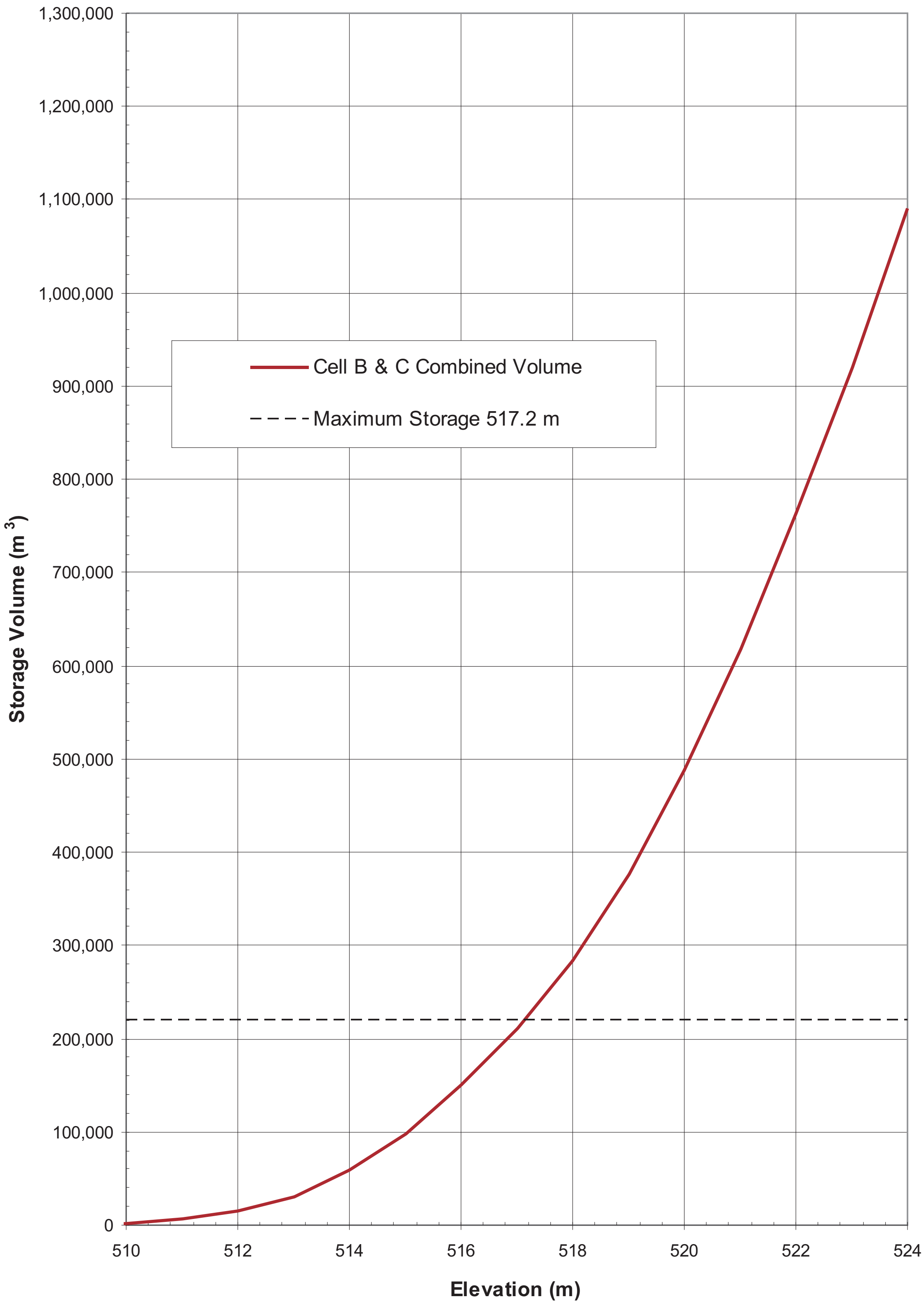
SITE WATER MANAGEMENT FLOWSHEET

PROJECT NO.	DWN	CKD	APVD	REV
E14101118	DBD	WL	WL	0

OFFICE	DATE
EBA-EDM	January 31, 2011

Figure 5

E14101118_Figure 5_PKCA Management Plan.cdr



LEGEND

NOTES

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PKCA MANGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

Stage Storage Curve for Cells B and C

PROJECT NO.	DWN	CKD	APVD	REV
E14101118	AF	WL	WL	0

OFFICE	DATE
EBA-EDM	January 31, 2011

Figure 6

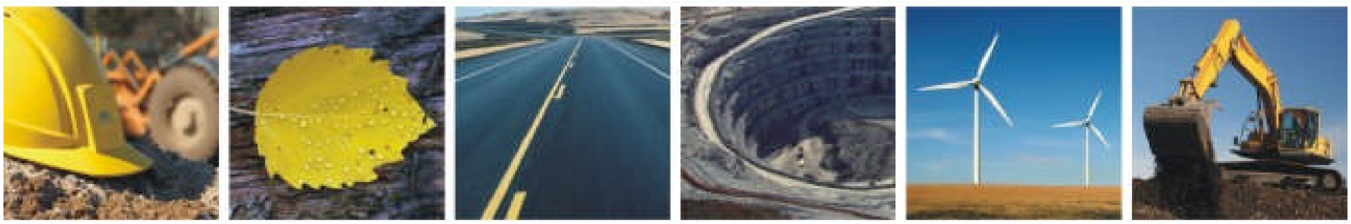
E14101118_Figure 6_PKCA Management Plan.cdr

APPENDIX C

APPENDIX C GENERAL MONITORING PLAN

SHEAR DIAMONDS LTD.

GENERAL MONITORING PLAN
CARE AND MAINTENANCE
JERICHO DIAMOND MINE, NUNAVUT



REPORT

JANUARY 2011
ISSUED FOR USE
EBA FILE: E14101118

SHEAR DIAMONDS LTD.

A TETRA TECH COMPANY

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APPENDICES

Appendix A Weekly Geotechnical Monitoring Form
Appendix B Laboratory Analytical Parameters

ACRONYMS & ABBREVIATIONS

AA	Atomic Absorption Spectrophotometry
AEMP	Aquatic Effects Monitoring Plan
AIA	Aquatic Impact Assessment
ANCOVA	Analysis of Covariance
ANOVA	Analysis of Variance
AQMP	Air Quality Management Plan
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
BACI	Before-after-control-impact
CAEAL	Canadian Association for Environmental Analytical Laboratories
CAMP	Care and Maintenance Plan
CMP	Contingency Management Plan
CPK	Coarse Processed Kimberlite
DO	Dissolved Oxygen
EC	Electric Conductivity
EIS	Environmental Impact Statement
FPK	Fine Processed Kimberlite
GC/FID	Gas Chromatograph - Flame Ionization Detector
GMP	General Monitoring Plan
ICP-MS	Inductively Coupled Plasma – Mass Spectrometry
ICRP	Interim Closure and Reclamation Plan
INAC	Indian and Northern Affairs Canada
LFMP	Landfarm Management Plan
LFP	Landfill Management Plan
KIA	Kitikmeot Inuit Association
MANOVA	Multivariate Analysis of Variance
NIRB	Nunavut Impact Review Board
NWB	Nunavut Water Board
PHC	Petroleum Hydrocarbons
PKCA	Processed Kimberlite Containment Area
PKMP	PKCA Management Plan
RPD	Relative Percent Difference
Shear	Shear Diamonds (Nunavut) Corp.
SWMP	Site Water Management Plan
TDC	Tahera Diamonds Corporation
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
WEMP	Wildlife Effects Management Plan
WMP	Waste Management Plan
WRMP	Waste Rock Management Plan
WTMP	Wastewater Treatment Management Plan
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

1.1 General

The Jericho Mine General Monitoring Plan (GMP) has been developed to provide a methodology for managing the environmental influences on the receiving environment associated with activities at the Jericho Site. The GMP is a comprehensive monitoring plan that is designed to:

- Assess the integrity and function of the site infrastructure;
- Record the variations in water flow at the site and in the receiving waterbodies;
- Observe and sample the seepage through the water retention structures and the rock piles; and
- Sample and analyze site water qualities.

The plan fulfills the requirements specified in Part L and Schedule L of the Jericho Mine Water Licence NWB1JER0410 (issued December 21, 2004) for General Monitoring. The aquatic effect monitoring requirements detailed within Part L and Schedule L are covered in the Jericho Aquatic Effects Monitoring Plan, presented as a separate document.

This plan is being submitted to the Nunavut Water Board (NWB) in the absence of complete historical information as Shear Diamonds (Nunavut) Corp. (Shear) only assumed control of the project in August 2010. Since that time Shear has discovered that detailed information on the present site water conditions is limited. Comprehensive historical general monitoring records were not well maintained under previous ownership and management, so the available information is incomplete or lacking detail.

During the course of preparing this plan, it came to Shear's attention that the current site structure layout may deviate from the mine design submitted by the previous owners. Upon a full review of current site conditions in 2011, the monitoring locations and frequencies in this section may need to be modified accordingly.

The GMP is based on these existing records including previous general monitoring plans, regulator comments, and external anecdotal information where available. This plan has been developed for the current regulatory requirements and to reflect Shear's commitment to the best practices in environmental stewardship.

The plan describes existing and planned monitoring stations in addition to revised procedures for the site during care and maintenance. Once Shear has had an opportunity to thoroughly investigate the site and gather information in 2011, the GMP will be revised. Annual reviews required under Part L, Item 4 will identify the need for any necessary revisions to the plan. Subsequent revisions of the GMP will be submitted to the NWB for approval.

1.2 Objective of General Monitoring Plan

The primary objective of the GMP is to identify potential impacts to the environment and assess the integrity of the site infrastructure. The information and data collected under the monitoring plans evaluates the effectiveness of the mitigation measures implemented at site and triggers the need for additional measures. At the time of the water licence renewal application, mining operations have been suspended and the site is under care and maintenance. This document will therefore address the monitoring requirements at the present time. In addition to being a management tool, the GMP was specifically developed to assist Shear and the regulatory agencies with mine closure planning and the development of Jericho's Interim Closure and Reclamation Plan (EBA 2011e).

1.3 Background Information

The Jericho Diamond Mine is located approximately 260 km southeast of Kugluktuk, NU, and 30 km north of Lupin Mine. The Jericho Mine was constructed and operated by Tahera Diamond Corporation (TDC) between 2004 and 2008. In January 2008, mining operations were suspended by TDC and the site was subsequently placed under care and maintenance. Shortly thereafter, Indian and Northern Affairs Canada (INAC) assumed control of the care and maintenance activities for the site. In August 2010, Shear purchased the Jericho Mine and its assets and assumed the responsibility for the site.

Presently, the mine remains under care and maintenance as Shear evaluates the mineral resource. Once this evaluation is complete, a mine plan and operations schedule for the project will be established.

1.4 Linkage to Other Management Plans

The GMP is a part of the site wide management system. Other management plans that are related to or refer to the GMP include:

- Aquatic Effects Monitoring Plan (AEMP);
- Site Water Monitoring Plan (SWMP);
- Processed Kimberlite Management Plan (PKMP);
- Waste Rock Management Plan (WRMP);
- Wastewater Treatment Management Plan (WTMP);
- Landfarm Management Plan (LFMP);
- Interim Closure and Reclamation Plan (ICRP); and
- Care and Maintenance Plan (CMP) during periods where mining and processing operations are suspended.

2.0 GENERAL MONITORING OVERVIEW

This GMP provides details of:

- Geotechnical performance monitoring of site infrastructure;
- Flow and water level variance monitoring on site and in the receiving environment;

- Seepage survey for water retention structures, waste rock piles, ore and coarse processed kimberlite (CPK) stockpiles; and
- A Site Water Quality Monitoring Program to monitor the water quality at various locations around the site.

3.0 QUALITY MANAGEMENT

While undertaking the requirements set forth the GMP, quality management of monitoring results will be achieved through two separate but interlinked programs: quality control (QC) and quality assurance (QA). For the purposes of the GMP, Shear defines QC and QA as the following:

- Quality Control is a system of maintaining standards for measurement through field and laboratory testing when following a defined or industry standard. Measures of QC success include including precision, accuracy and reproducibility of test results.
- Quality Assurance is a systematic method of monitoring, assessing and recording the care under which the QC testing was performed such that the measurement program is quantifiable and produces data of known quality.

If the developed QC and QA protocols are followed diligently, the GMP will provide monitoring results of acceptable and defensible quality. The QA protocols detailed below will be followed during the execution of the GMP.

Field Staff Qualification and Training

Field staff involved in the AEMP field program will be adequately trained such that they are competent in following the monitoring procedures including data recording and test equipment operation.

Before a field work program begins, a “kick-off” training session will be held with all field and senior staff in attendance. The purpose of the meeting will be to review the monitoring protocols and site-specific requirements. In addition, a close-out meeting will be held once the program is complete to review the results and identify any areas for future improvement.

Equipment Maintenance and Calibration

The devices used to collect field chemistry parameters will be calibrated daily or at a frequency determined by senior staff or designate contractor and will follow the equipment manufacturer recommendations. Testing equipment will be inspected thoroughly before each field season and, if required, will be sent for service and maintenance. Testing equipment will be calibrated based on the manufacturer’s recommended schedule. Maintenance records and calibration certificates will be kept in the GMP QA records.

An inspection of equipment used by field staff will be performed each day prior to use.

Laboratory Qualification

The Canadian Association for Environmental Analytical Laboratories (CAEAL) provides accreditation programs to review laboratories' procedures, methods, and quality control. Samples collected from the field will be sent to the CAEAL accredited laboratories.

Data Management

A data management program will be implemented to ensure proper recording and organization of the field and laboratory data.

Senior Staff Involvement

To ensure all procedures are adhered to, senior project staff will be closely involved throughout each stage of the project. Duties of the senior staff will include initiating the field kick-off training session, supervising the field program and staff, conducting a review of the laboratory data and data analysis, facilitating close out meetings, and reviewing the annual reporting.

4.0 GEOTECHNICAL MONITORING

4.1 General

Regular monitoring of site infrastructure is a critical component of care and maintenance activities at Jericho. Inspections are completed regularly to identify potential problems with these earth structures before they risk damaging human health and the environment.

Inspections are completed on most site earth structures which include, but are not limited to, the PKCA dams and dykes; the C1 Diversion; waste rock storage areas; landfill berms; and all containment berms used for fuel storage, hazardous waste, and other materials. Inspections are completed on both the structures and surrounding landforms to ensure the structures are not negatively impacting the surrounding terrain.

Inspections are broken into two categories: Operational Inspections and Formal Inspections.

4.2 Operational Geotechnical Inspections

Operational geotechnical inspections are performed by site personnel and are undertaken at least once a week. The purpose of the operational geotechnical inspection is to identify and document any hazards and damage to or deterioration of the structure. If a condition is deemed to be serious, a qualified geotechnical engineer will be brought to site to inspect the structure. More frequent geotechnical inspections may be required under certain conditions, as identified by the geotechnical engineer.

All site personnel tasked with the operational inspections will be trained in the identification of hazards and will be provided with documentation prepared by a qualified geotechnical engineer to assist with the identification of maintenance issues and hazardous conditions. An Operations, Maintenance, and Surveillance Manual is being prepared for the PKCA dams and dykes and will include detailed information and specific requirements for the inspection of these structures.

An example of an operational geotechnical inspection form is included in Appendix A. A copy of each operational geotechnical inspection will be preserved in Shear's document management system. Additionally, a hard copy will be maintained in a binder on site for review by the geotechnical engineer during the formal geotechnical inspection. Shear expects that the inspection process and form will evolve as more information about the structures and their condition become available during care and maintenance activities.

4.3 Formal Geotechnical Inspections

A site-wide formal geotechnical inspection will be completed annually, as required by the Jericho water licence. The inspection is performed by a qualified geotechnical engineer and includes a visual assessment of the structures and a review of ground temperature and deformation monitoring data where applicable. Where possible, formal geotechnical inspections will take place during freshet.

The following specific tasks should be completed during the formal inspections:

- Each structure and surrounding area is visually examined for signs of settlement, seepage, cracking, or any other signs of distress.
- Observations made during the inspection are photographed and recorded. Photographs of the general condition of each structure area taken to track year by year changes in each structure.
- Settlement surveys are completed where necessary for the dams to assess any movement in the structures.
- Ground temperature data is collected for several structures at various intervals throughout the year. This data is reviewed in conjunction with site observations from each structure to verify acceptable structure performance.

Following the inspection, a report will be prepared summarizing the assessment and monitoring data, a copy of which will be submitted to the NWB for review and approval.

4.4 Thermal Monitoring

Ground temperature cables (GTCs) have been installed in the West, East and Southeast dams to monitor the condition of the frozen zones within the structures. In addition to the dams, Shear plans to install a series of GTCs in the waste dumps to monitor the aggradation of permafrost into the piles.

Temperature readings will be collected monthly while personnel are on site. Monthly inspections will continue until a clear pattern has been established, at which point the geotechnical engineer may recommend reducing the reading frequency to quarterly. In addition, a full set of readings will be taken during the annual formal geotechnical inspection.

4.5 Survey

Settlement monitoring points have been installed in the dams or will be installed at the end of construction. The elevation and location of the monitoring points should be measured monthly while personnel are on site. The monitoring schedule will be reviewed by the geotechnical engineer if there are no signs of significant movement.

Settlement and topographic surveys of the dam crest will be carried out annually as part of the formal geotechnical inspection. The topographic survey will be carried out to identify any settlement areas or deterioration on the surface of the dams.

5.0 WATER FLOW MONITORING

5.1 General

Water flows are monitored at key locations within the water management system to detect significant deviations from the conditions predicted in the site water balance. Such deviations could indicate the need for changes to site water management procedures to ensure that discharge from the PKCA continues to meet the quality criteria specified in the water licence. The water flow monitoring program also records flow rates in the receiving environment, particularly within waterbodies downstream of the PKCA.

5.2 Monitoring Locations

Site water flow rates will be estimated by collecting volume measurements from site water management activities and by recording PKCA pond elevations and discharge volumes. Where possible, the water levels in ditches or channels will be estimated using weir calculations, whereas pumped water will be measured using flow meters with totalizers.

Table 5.1 in Section 5.3 presents the water flow and quantity monitoring locations, based on structures in the approved mine design. The monitoring locations for the receiving water flow monitoring network are presented in Figure 1 and 4. The key locations in the site water flow monitoring network are presented in Figures 3 and 5.

5.3 Methods and Frequency

The frequencies for estimating flow vary at different monitoring locations depending on the recording methods. Based on the available information, existing water pipelines were equipped with totalizer flow meters to record the total water throughput occurring between sampling events. Ditch and channel flows were monitored using v-notch weirs, which provide an estimate of flow rate but not total flow volume. Gravity-fed piped flows are measured using bucket-and-stopwatch methods. This method calculates the flow rate by measuring the time it takes for the pipe to discharge a known volume of water. As with the weir method, the bucket and stopwatch only provides a flow rate not a total volume. Frequent monitoring of the flow rate from gravity structures can be used to determine a weighted average flow rate, which allows a reasonable estimate of the total discharge volume to be calculated.

Previous versions of the Jericho GMP described a continuous pressure transducer in place at Transition Pool 2 of the C1 Diversion channel. However, the C1 Diversion design and construction report makes no mention of the transducer. During 2011. Shear will confirm the installation of the transducer and, if installed, the operating condition. In addition, a site-wide reconnaissance by a qualified geotechnical engineer will be conducted to ensure the aforementioned water flow and level monitoring devices are available and in working condition prior to any site water pumping.

The previous GMP also described an automated water level recorder, equipped with a radio link, which was installed prior to mine operations near the outlet of Lake C3. The signal from the radio link was received at the environment office where data was recorded continuously and in real time. The water level recorder was operated whenever discharge from the PKCA occurred.

While the site is under care and maintenance in 2011, the location and effectiveness of the water level recorder and the condition of Stream C3 will be assessed during PKCA discharge.

The following table summarizes the monitoring method and frequency for the water flows to be measured during care and maintenance. Upon the completion of the resource evaluation and prior to commencing mining operations, the sampling methods and frequency for water flow and level monitoring will be reviewed and if necessary updated.

Table 1: Water Flow and Level Monitoring

Category	Station	Location	Method	Frequency	Comment
Site Water Monitoring Stations	JER-SWF-01	Freshwater intake pump	Totalizer	Daily during pumping	Total water withdraw from Carat Lake
	JER-SWF-02	PKCA discharge pump	Totalizer	Daily during pumping	Total site water discharge
	JER-SWF-03	Pump for discharging pit water to PKCA	Totalizer	Daily during pumping	Amount of Water collected in Pit Sump
	JER-SWF-04	Pump for discharging Wastewater Treatment Plant effluent	Totalizer	Daily during pumping	Amount of waste water discharge
	JER-SWF-05	Pump for Processing Plant freshwater Intake	Totalizer	Daily during pumping	Freshwater intake for the Processing Plant
	JER-SWF-06	Pump for discharging Processing Plant Water to PKCA	Totalizer	TBD	Water discharge from the Processing Plant
	JER-SWF-07	Pump for reclaim PKCA water to Processing Plant	Totalizer	TBD	Amount of reclaimed water for the Processing Plant
	JER-SWF-08	C1 Diversion	Weir	Daily during freshet, and monthly thereafter	Amount of the water collected from C1 catchment area
	JER-SWF-09	Area A collection discharge	Totalizer or TBD	Daily during pumping	Surface runoff and seepage collected in ditch or potential Pond A to be drained to Pit Sump
	JER-SWF-10	Area B collection discharge	Totalizer or TBD	Daily during pumping	Surface runoff and seepage collected in ditch or potential Pond B to be drained to Pit Sump
	JER-SWF-11	Plant Site Area collection discharge	Totalizer or TBD	Daily during pumping	Surface runoff and seepage collected in East Sump or

Table 1: Water Flow and Level Monitoring

Category	Station	Location	Method	Frequency	Comment
					potential Pond C to be drained to Pit Sump or pumped to PKCA
Receiving Waterbody Monitoring Stations	JER-RWF-01	Stream C3 Near Mouth	Levelogger	Continuous	Stream C3 flow into Lake C3 due to PKCA discharge
	JER-RWF-02	Lake C3 (Exact monitoring location to be confirmed in 2011)	TBD	TBD	Variance of Lake C3 level due to PKCA discharge
	JER-RWF-03	Stream C8 at Lake C3 Outlet	TBD	TBD	Lake C3 discharge into Carat Lake
	JER-RWF-04	Freshwater Intake Station at Carat Lake	Levelogger	Continuous	Variance of Carat Lake level due to water intake

Note:

1. Monitoring frequency is for the Care and Maintenance Phase
2. Area A, Area B and Plant Site Area collections are collection ditches or future Pond A, B, or C
3. TBD – To be determined during the Care and Maintenance Phase in 2011

5.4 Data Analysis and Reporting

The records from the water flow monitoring program will be used to provide information on the mine water usage and discharge from various catchment areas and will also be interrelated with the Site Water Quality Monitoring Program (SWQM) and AEMP to estimate the constituent dilution and the chemical loadings in the PKCA and the receiving environment.

Monitoring data, including the volume of water used, volume of water pumped to and from collection facilities, the volume of reclaimed water and the volume of PKCA discharge, will be recorded and used to update the annual site water balance calculations as required by the water licence.

Discharge to Stream C3 from the PKCA will be measured and compared to the natural hydrograph developed as part of baseline studies (where available). PKCA discharge volumes will be compared to Lake C3 level and discharge to determine theoretical dilution factors for discharge water.

Seasonal variation in discharge through the C1 diversion will be compared to the background data collected during baseline studies (where available) and during early mine operations to determine whether a significant drop in water discharge has occurred.

The level of Carat Lake will be recorded and compared to the predicted drawdown of the lake. Since there is no background data regarding the seasonal variations of the Carat Lake water level, the lake level records will be compared to the lake bathymetry to determine the percentage of total lake water volume drawn off for mine use.

6.0 SEEPAGE SURVEY PROGRAM

6.1 General

As per Schedule A of the Jericho water licence, seepage is defined as the water that drains through or escapes from any structure designed to contain, withhold, divert, or retain water or waste. The definition also includes any flows that have emerged from the toe of a structure, or as a result of runoff from overburden storage areas, waste rock storage facilities, coarse kimberlite reject areas, and ore stockpile areas.

Any water collected from engineered ditches or sumps will be directed to and stored in the PKCA. Accumulated water in the PKCA can only be discharged once it meets the applicable criteria specified in the water licence.

Seepage from the water retentions structures, including the dams along the perimeter of the PKCA, will be collected and returned to the structure or transferred to another water management structure. Seepage observed from engineered structures will be evaluated by a qualified geotechnical engineer, and remedial actions will be taken if recommended.

Seepage originating from the waste rock dump, ore, and CPK stockpile may contain elevated concentrations of controlled constituents, which may reduce the quality of the PKCA pond water when pumped to the facility. A reduction in the PKCA water quality may affect the planned water discharge schedule. An annual seepage survey will be conducted to evaluate the integrity and effectiveness of the water retention structures, and to develop a better understanding of variations in source concentrations from different areas of site.

6.2 Monitoring Locations

To fulfill the requirements of Schedule L of the Jericho water licence, the Seepage Survey Program (SSP) is divided into two parts:

1. All engineered water retention structures and waste rock pads including all collector ditches; the potential Contingency Pond A, B, and C basins; all PKCA dams; the plant site foundation pad; explosive storage area; and emulsion plant areas.
2. Toes of all rock and ore piles including Waste Rock Pile 1, Waste Rock Pile 2, Ore Stockpile, the Low-grade Ore Stockpile, CPK Stockpiles 1, 2, 3, and 4. Table 6.1 in Section 6.3 summarizes the rock and ore pile seepage monitoring locations along with the monitoring method. The approximate locations in the seepage monitoring program are shown in Figure 3 and 5.

6.3 Methods and Frequency

6.3.1 Weekly Seepage Inspection

As discussed in Section 6.1, all site water collected will be transferred to the PKCA and will only be released to the receiving environment upon verification of compliance with the specified water licence criteria.

The purpose of Part 1 of the Seepage Survey program, which includes water retention structures and the graded site pads, is to prevent uncontrolled release of site water.

A weekly visual inspection of the toe of all water retention structures and waste rock pads as specified in Section 6.2 will be performed by site personnel with details of any observations recorded in a weekly inspection memorandum (Section 6.5). If visible water flow is observed through the structures, the maintenance personnel will immediately inform the mine manager. The released water will be collected and pumped back into the water retention structures or transferred to another structure if deemed necessary. Depending on the flow rate and location of the seepage, a qualified geotechnical engineer may be retained to investigate the integrity of the structure, and to design and monitor corrective measures. To avoid misidentifying the surface runoff as seepage, the weekly inspection will avoid the peak period of spring freshet and periods following precipitation events. The condition and performance of all engineered earthwork structures will be inspected annually by a qualified geotechnical engineer.

6.3.2 Annual Seepage Survey

The purpose of Part 2 the Seepage Survey program, which includes the toe of all waste rock dumps and ore stockpiles, is to ensure that the overall site water quality is not compromised by declining geochemical conditions of the stockpiles.

The seepage collected at the toe of rock piles will be used to predict the potential for metal leaching due to acid rock drainage or neutral drainage. The survey will take place in July or August to coincide with maximum seepage concentrations while avoiding dilution from surface runoff which would occur during the freshet period in June.

As part of the SWQM (discussed in Section 7.0), the monitoring stations at each collection ditch or potential collection ponds ensure that seepage and runoff from the waste rock is monitored on a seasonal basis. One annual seepage survey is, therefore, considered sufficient to characterize variability within the source concentrations from different areas of the dumps and stockpiles.

Seepage from the rock piles is expected to exfiltrate from a number of locations at the toe. Composite samples will therefore be collected based on the judgement of field staff and the senior representative overseeing the survey. In general, no more than three visible turbid streams, originating along a 30 m length of the rock pile, will be combined into a single composite sample.

All incidents of seepage, including each of the streams in a composite sample, will be documented including a written description and photographs of the stream, as well as UTM coordinates for the stream source.

The seepage samples will be submitted to a CAEAL accredited laboratory for the analysis of routine water chemistry, total metal, dissolved metal, and nutrients. Before shipping the samples, dissolved metal samples will be filtered through a 0.45 µm Millipore filter and preserved with AA grade nitric acid. Similarly, samples for total metals analysis will also be preserved with AA grade nitric acid. Nutrients samples will be preserved with AA grade sulphuric acid. The routine water sample will not be preserved. Water bottles containing samples from the same station will be placed in a clean plastic bag to avoid cross-contamination between samples, and stored in coolers to keep the samples below 4°C prior to shipment. Chain of custody forms will be used to track samples. The detailed parameters for each analytical package is presented in Appendix B. Field measurements including temperature, pH, dissolved oxygen, electric conductivity, and turbidity for each sample will be recorded.

Table 6.1 summarizes the location, method, and frequency for seepage monitoring:

Table 6.1: Annual Rock Pile Seepage Survey

Station	Location	Analysis (1)	Frequency	Comment
JER-SPG-01	Waste Rock Dump 1	R, ICP-T, ICP-D, N	July or August	Under development (2)
JER-SPG-02	Waste Rock Dump 2	R, ICP-T, ICP-D, N	July or August	Under development (2)
JER-SPG-03	CPK Stockpile 1	TBD	No monitoring	Not developed
JER-SPG-04	CPK Stockpile 2	TBD	No monitoring	Not developed
JER-SPG-05	CPK Stockpile 3	TBD	No monitoring	Not developed
JER-SPG-06	CPK Stockpile 4	R, ICP-T, ICP-D, N,	July or August	Under development (2)
JER-SPG-07	Ore Stockpile	R, ICP-T, ICP-D, N,	July or August	Under development (2)
JER-SPG-08	Low Grade Ore Stockpile	TBD	No monitoring	Not developed (2)

Note:
1. Detailed analytical parameters are presented in Appendix B.
2. Waste Rock Dump 1 and 2, CPK Stockpile 4, and Ore Stockpile have not reached to the designed footprints.

6.4 Quality Control

Quality control protocols for sampling seepage water sampling are detailed below.

Field Blank

Field blank samples reflect the ambient conditions during the sampling program and are used to measure potential sampling contamination. Field blank bottles are laboratory-supplied, pre-filled bottles of deionized water and are shipped to site with the other bottles. One field blank will be processed for each sampling location.

Trip Blank

Trip blank samples reflect the potential contamination that may occur during the transportation of the samples/bottles. The trip blank bottles are pre-filled with deionized water in the lab and shipped to site with the other bottles. The trip blank samples accompany other sample bottles to and from the sampling sites. One trip blank will be processed for each monitoring event.

Equipment Blank

Equipment blank samples reflect the adequacy of the equipment decontamination processes. Deionized water is poured over or through the decontaminated sampling equipment at the beginning of each day of the field program. One equipment blank will be processed for each day of sampling.

Duplicate Samples

To verify the precision of the samplers, duplicate water samples will be submitted for testing. A sequential duplicate sample requires that field personnel fill two sampling sets (a group of bottles from two different samples at the same depth). Sequential duplicate samples will be collected for 10% of the total number of samples, with a minimum of one duplicate taken per sampling event. The sampling program will submit blind duplicates for analysis (i.e., duplicate samples not labelled with the location).

Split Samples

To check on the laboratory's precision and accuracy, a split sample will be prepared in the field. A split sample is a discrete water sample separated into two identical tests and used to determine the reproducibility of the analysis. In theory, the individual test results from the split sample should be identical when analyzed by the laboratory. One split will be processed for each monitoring event.

6.5 Data Analysis and Reporting

A seepage inspection form will be prepared by the site personnel performing the inspection and will be maintained in Shear's document management system. The inspection form shall include a description of the condition of the structure being inspected and will note any visible flow at the toe of the structures. Photographs depicting the source and flow path of the seepage will also be included.

Annual seepage survey data will be incorporated into the waste rock geochemistry monitoring program to evaluate for potential metal leaching from the waste rock pile, the CPK stockpiles or ore stock piles. An Annual Seepage Survey report will be produced and submitted to the NWB for review no later than 60 days following completion of the survey.

7.0 SITE WATER QUALITY MONITORING PROGRAM

7.1 General

As described in the Jericho SWMP, any water collected from engineered water retention structures and processing facilities, such as the pit sump, collector ditches and berms, wastewater treatment plant (WWTP), and processing plant, will be directed to and stored in the PKCA. Impounded water in the PKCA will only be discharged to the receiving environment upon verification that its quality meets the criteria specified in the Jericho water licence and upon providing the required notification to the NWB and the Inspector. The Jericho SWQM has been designed to regularly monitor the variation in site water quality at the mine. The objective of the program is to ensure that the water quality in each area of the mine is maintained at an acceptable level, and that the quality of the water in the PKCA is not unduly impacted from inflows of poorer quality water from other mine areas. The SWQM comprises monitoring stations in the PKCA and all main water collection structures.

The SWQM location JER-SWQ-04 is used to determine if the water in the PKCA meets the specified quality criteria prior to discharge from the PKCA.

In contrast to the SWQM, the AEMP monitors the short- and long-term effects that site activities and operations have on the receiving environment. Figure 4 and Figure 5 present flowsheets for the AEMP and

SWQM, respectively. The SWQM flowsheet depicts the monitoring of water quality internal to the site such that water quality in the PKCA will satisfy the discharge criteria. The AEMP focuses on the water quality within the broader receiving environment and is designed to detect any negative impacts from PKCA discharge.

AEMP location JER-AEM-04 is used to determine if the water in the PKCA meets the specified quality criteria during discharge from the PKCA.

7.2 Monitoring Locations

To fulfill the requirements of Schedule K of the Jericho water licence, the SWQM will include routine monitoring of water quality at all main water retention facilities, effluent discharge points — including the discharge pump area in the PKCA, the WWTP, processing plant, pit sump, and collection structures responsible for Catchment Areas A and B and the Plant Site. As discussed in Section 2.7 of the SWMP, prior to construction of the contingency ponds, the collector ditches and the East Sump will be used for temporarily retaining runoff from the aforementioned catchment areas, and will be used as SWQM monitoring stations.

Table 3 in Section 7.3 summarizes the SWQM monitoring locations along with the monitoring method and frequency. Approximate locations for the SWQM stations are also shown on Figure 3.

7.3 Methods and Frequency

Water quality sampling from retention structures, with the exception of the pit sump and the PKCA, is on a monthly basis or until the ponds are ice covered. During the 2011 pit dewatering program, pit sump water quality testing will be performed weekly.

Process plant commissioning and trial operations will be conducted during care and maintenance activities in 2011. While the plant is being operated, even in reduced capacity to evaluate for commissions, supernatant samples will be collected and submitted for testing on a weekly basis.

The SWQM requires weekly monitoring of the effluent from the WWTP; however, to establish the effectiveness of the facility, water quality parameters of the influent, effluent, and some intermediate stages of the WWTP process will be analyzed. Effluent values will be reported in the SWQM while the results of the influent and other testing will be reported as part of the Wastewater Treatment Management Plan (WTMP, EBA 2011l).

The water impounded within the PKCA will be monitored weekly during the discharge period from June through September.

Samples will be submitted to an accredited laboratory for analysis of routine water chemistry, total metal, dissolved metal, and nutrients. Sample preparation procedures are detailed in Section 6.3.2. As required by the water licence, additional biological parameters including BOD_5 and fecal coliform will be included in the analysis of water samples from the PKCA (JER-SWQ-02). The detailed parameter in each of the analytical package is included in Appendix B of this document. Field measurements including temperature, pH, dissolved oxygen, electric conductivity, and turbidity for each sample will be recorded.

Table 3 summarizes the monitoring locations, analysis, and frequency for stations under the SWQM.

Table 3: Site Water Quality Monitoring Program

Station	Location	Analysis [1]	Frequency	Comment
JER-SWQ-01	Wastewater Treatment Effluent	R, ICP-T, ICP-D, N, B	Weekly	N/A
JER-SWQ-02	Pit Sump	R, ICP-T, ICP-D, N,	Weekly during initial pit dewatering, then Monthly until freeze-up	Currently contained approx. 500,000 m^3 water
JER-SWQ-03	Process Plant Supernatant	R, ICP-T, ICP-D, N,	Weekly	No production during Care and Maintenance Phase
JER-SWQ-04	PKCA Pond Water	R, ICP-T, ICP-D, N, B	Weekly during PKCA discharge, then monthly thereafter	Used to determine if water meets initial discharge criteria
JER-SWQ-05	Collector Ditch for Area A or Potential Pond A	R, ICP-T, ICP-D, N,	Monthly until freeze-up	Currently collected from ditch
JER-SWQ-06	Collector Ditch for Area B or Potential Pond B	R, ICP-T, ICP-D, N,	Monthly until freeze-up	Currently collected from ditch
JER-SWQ-07	East Sump or Potential Pond C	R, ICP-T, ICP-D, N,	Monthly until freeze-up	Currently collected from East Sump

Note:
1. Detailed analytical parameters are presented in Appendix A.

7.4 Quality Management

Quality control for the SWQM will follow the same protocols as the SSP described in Section 6.3. If the SWQM and SSP are performed concurrently and by the same field crew, the same field blank, trip blank, and equipment blank samples will be used.

7.5 Data Analysis and Reporting

The interpretation of the SWQM results will include sample variation at each monitoring location using measures of central tendency (range, mean or median, standard deviation). Qualitative and quantitative temporal trenches analysis will also be carried out to evaluate if there is increase of deleterious substance in the inflow water of the PKCA. An annual site water monitoring report will be prepared summarizing the observations, interpretation of the analytical results, and associated conclusions and recommendations. In the case of identifying declining quality of the inflow water to the PKCA, adaptive actions, including constructing additional settling ponds or providing pre-treatment of the inflow water, will be included in the recommendations.

8.0 CLOSURE

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2011 WATER LICENCE RENEWAL DOCUMENTS

Management Plans

EBA, A Tetra Tech Company (EBA), 2011a. Aquatic Effects Monitoring Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011b. Care and Maintenance Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011c. Contingency Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011d. General Monitoring Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011e. Interim Closure and Reclamation Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011f. Landfarm Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011g. Landfill Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011h. Processed Kimberlite Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011i. Site Water Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011j. Waste Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011k. Waste Rock Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011l. Wastewater Treatment Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

Design Reports

EBA, A Tetra Tech Company (EBA), 2011m. C1 Diversion Construction Summary, Jericho Diamond Mine, Nunavut. Prepared for Tahera Diamond Corporation, February 2011.

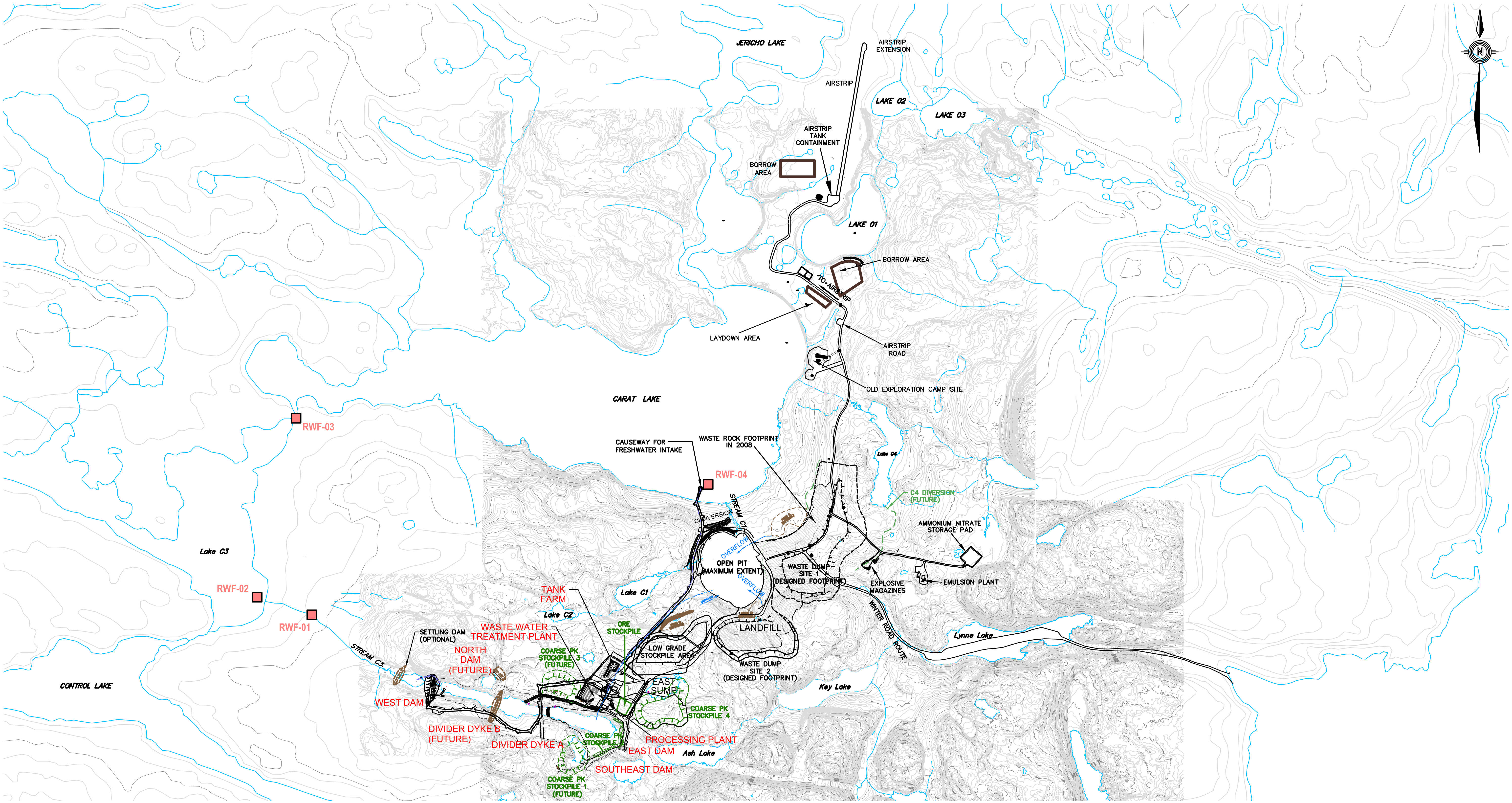
EBA, A Tetra Tech Company (EBA), 2011n. Geotechnical Design Report – Set 3 Tank Farm of Fuel Storage Facilities, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011o. Preliminary Landfarm Design Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

FIGURES

Figure 1 General Site Plan
Figure 2 Site Infrastructure Plan
Figure 3 Catchment Areas and Monitoring Stations Plan
Figure 4 Receiving Waterbodies Flowsheet
Figure 5 Site Water Management Flowsheet

SHEAR DIAMONDS LTD. A TETRA TECH COMPANY



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Scale: 1: 25 000 (metres)

NOTES:

1. LAYOUTS ARE APPROXIMATE, AND MAY NOT REFLECT ACTUAL SIZE AND LOCATIONS
2. LOCATIONS OF MONITORING STATIONS ARE CONCEPTUAL, ACTUAL LOCATIONS MAY VARY
3. FOOTPRINTS OF WASTE ROCK PILES, COARSE PK STOCKPILES, AND ORE STOCKPILES ARE SHOWN IN MAXIMUM LIMITS, ACTUAL FOOTPRINTS MAY VARY

MONITORING LOCATIONS:

■ - RWF, RECEIVING WATERBODY FLOW MONITORING STATION

STATUS
ISSUED FOR USE

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GENERAL MONITORING PLAN
JERICHO DIAMOND MINE, NUNAVUT

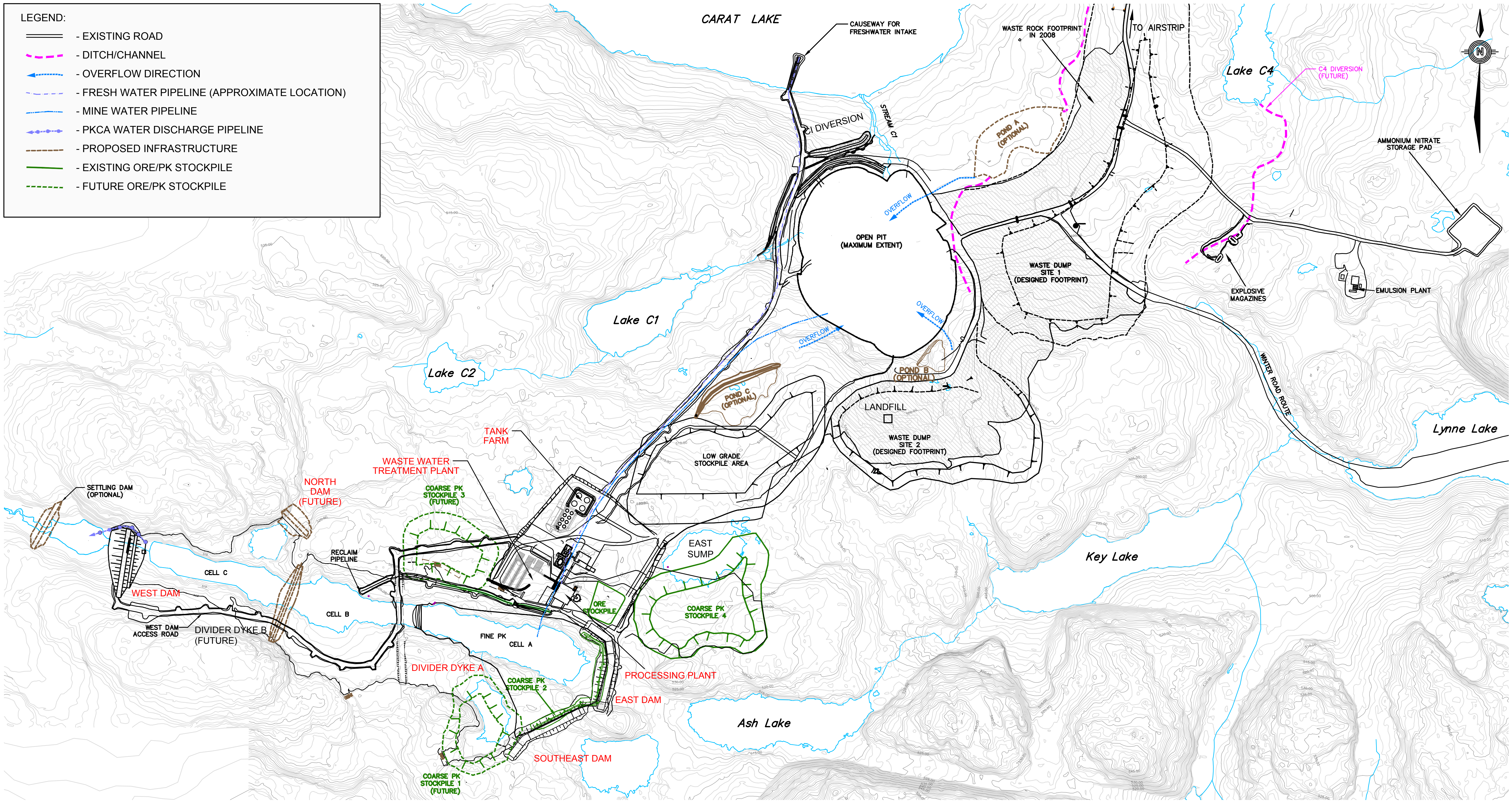
GENERAL SITE PLAN

PROJECT NO.	DWN	CKD	REV
E14101118	DBD	WL	0

OFFICE	DATE
EBA-EDM	January 31, 2011

Figure 1

Q:\Edmonton\Drafting\CIVIL3D\E141\E14101118\acad\Task 7_General Monitoring Plan\E14101118_Figure 2_General Monitoring Plan.dwg [FIGURE 2] January 31, 2011 - 2:13:49 pm (BY: DAS, DEBASHIS)



NOTES:

1. LAYOUTS ARE APPROXIMATE, AND MAY NOT REFLECT ACTUAL SIZE AND LOCATIONS
2. FOOTPRINTS OF WASTE ROCK PILES, COARSE PK STOCKPILES, AND ORE STOCKPILES ARE SHOWN IN MAXIMUM LIMITS, ACTUAL FOOTPRINTS MAY VARY

0 500

Scale: 1: 10 000 (metres)

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GENERAL MONITORING PLAN
JERICHO DIAMOND MINE, NUNAVUT

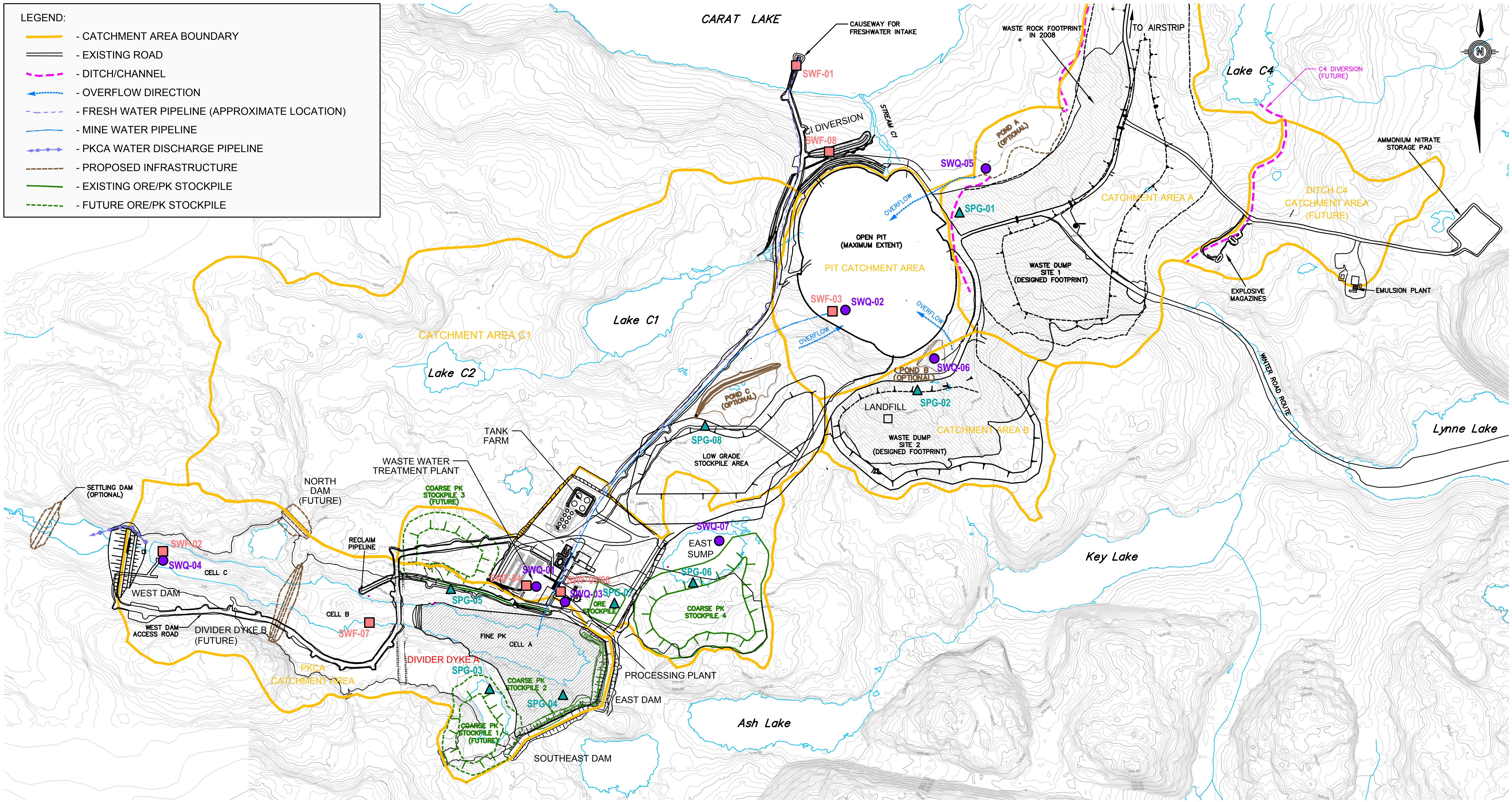
SITE INFRASTRUCTURE PLAN

PROJECT NO.	DWN	CKD	REV
E14101118	DBD	WL	0

OFFICE	DATE
EBA-EDM	January 31, 2011

Figure 2

Q:\Edmonton\Drafting\CIVIL3D\E141\E14101118\acad\Task 7_General Monitoring Plan\E14101118_Figure 3_General Monitoring Plan.dwg [FIGURE 3] January 31, 2011 - 2:17:43 pm (BY: DAS, DEBASHIS)



0 500

Scale: 1: 10 000 (metres)

NOTES:

1. LAYOUTS ARE APPROXIMATE, AND MAY NOT REFLECT ACTUAL SIZE AND LOCATIONS
2. LOCATIONS OF MONITORING STATIONS ARE CONCEPTUAL, ACTUAL LOCATIONS MAY VARY
3. FOOTPRINTS OF WASTE ROCK PILES, COARSE PK STOCKPILES, AND ORE STOCKPILES ARE SHOWN IN MAXIMUM LIMITS, ACTUAL FOOTPRINTS MAY VARY
4. LOCATIONS OF SWF-09, 10 AND 11 WILL BE DETERMINED ON-SITE IN 2011

MONITORING LOCATIONS:

- SWF, SITE WATER FLOW MONITORING LOCATION
- SWQ, SITE WATER QUALITY MONITORING LOCATION
- SPG, SEEPAGE SURVEY LOCATION

STATUS
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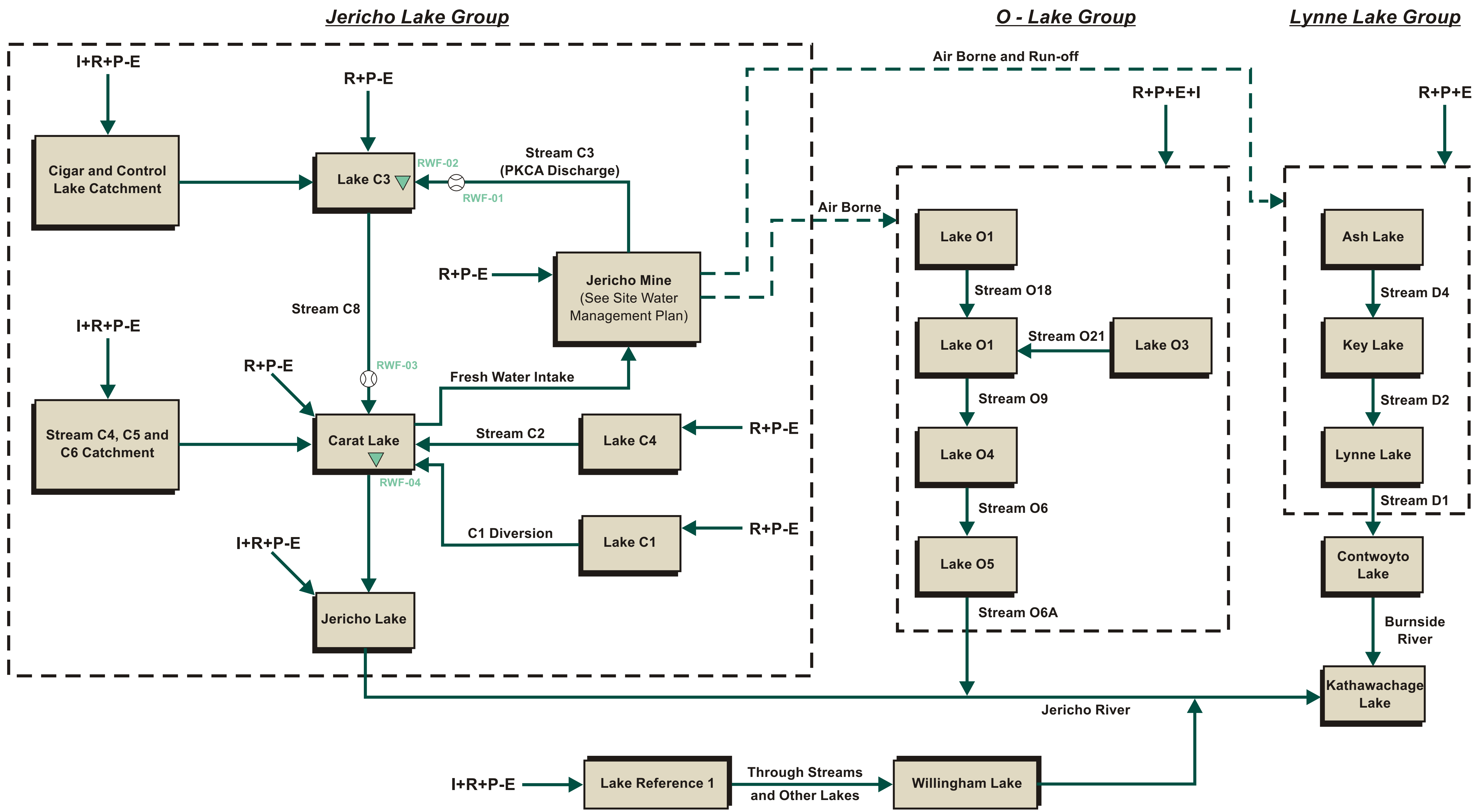
GENERAL MONITORING PLAN
JERICHO DIAMOND MINE, NUNAVUT

CATCHMENT AREAS AND MONITORING STATIONS PLAN

PROJECT NO.	DWN	CKD	REV
E14101118	DBD	WL	0

OFFICE	DATE
EBA-EDM	January 31, 2011

Figure 3



LEGEND

- Sub-Watershed in Area of Impact
- Flow
- Potential Contaminant Pathway

P - Precipitation
R - Surface Runoff
E - Evaporation/Transpiration
I - Inflow
O - Outflow
Gw - Groundwater Inflow
Sp - Seepage
- Stream Flow Monitoring Location
- Water Level Monitoring Location

STATUS: ISSUED FOR USE

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GENERAL MONITORING PLAN
JERICHO DIAMOND MINE, NUNAVUT

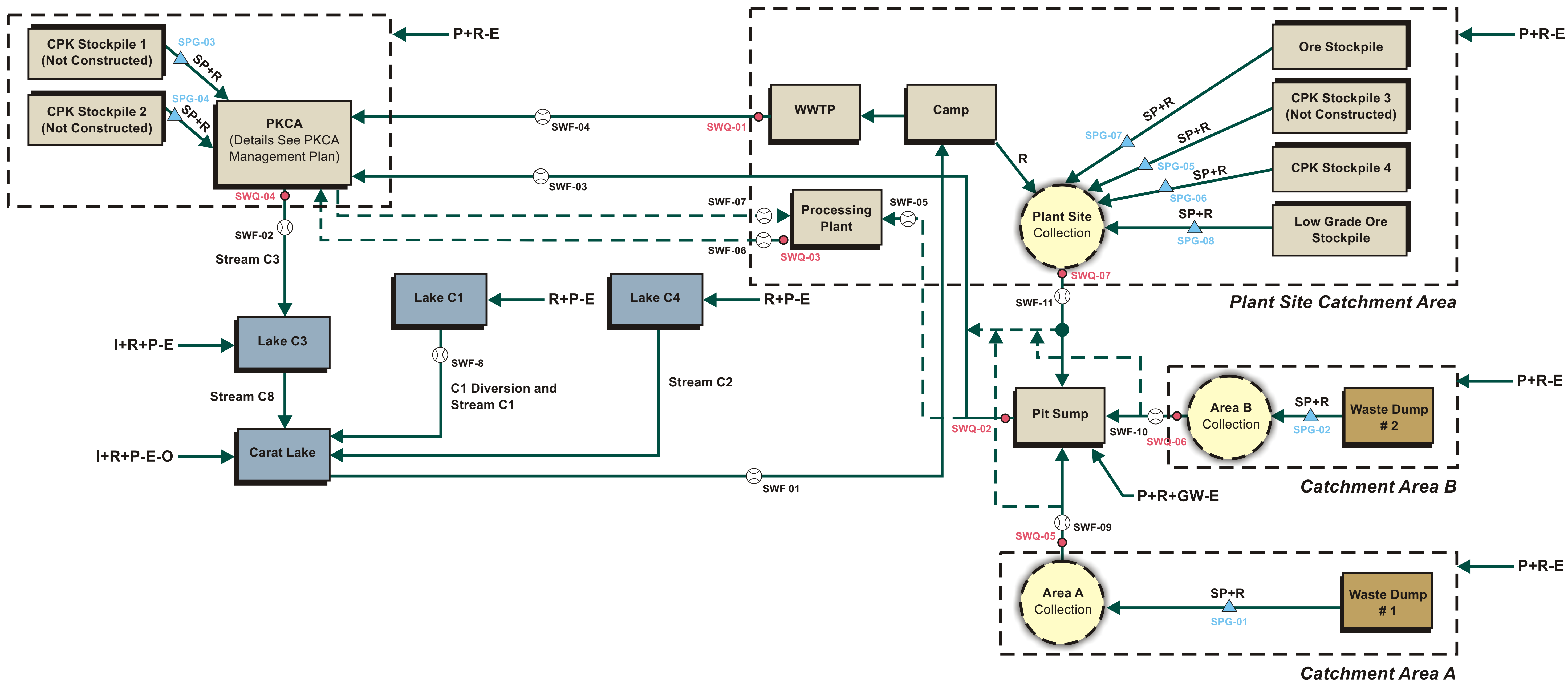
RECEIVING WATERBODIES FLOWSHEET

PROJECT NO.	DWN	CKD	APVD	REV
E14101118	DBD	WL	WL	0

OFFICE: EBA-EDM
DATE: January 31, 2011

Figure 4

E14101118_Figure 5_PKCA Management Plan.cdr



LEGEND

- Sub-Watershed in Area of Impact
- Flow
- Potential Flow Path

P - Precipitation
R - Surface Runoff
E - Evaporation/Transpiration
I - Inflow
O - Outflow
Gw - Groundwater Inflow
Sp - Seepage
- Flow Meter
- SWQ Water Quality Monitoring Location
- Seepage Survey Location

Area A Collection : Collector Ditch or Potential Pond A
Area B Collection : Collector Ditch or Potential Pond B
Area C Collection : East Sump or Potential Pond C

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GENERAL MONITORING PLAN
JERICHO DIAMOND MINE, NUNAVUT

SITE WATER MANAGEMENT FLOWSHEET

PROJECT NO.	DWN	CKD	APVD	REV
E14101118	DBD	WL	WL	0

OFFICE	DATE
EBA-EDM	January 31, 2011

Figure 5

E14101118_Figure 5_PKCA Management Plan.cdr

APPENDIX A

APPENDIX A WEEKLY GEOTECHNICAL MONITORING FORM

WEEKLY GEOTECHNICAL INSPECTION SUMMARY

Observation Date: ______________________ **Weather:** ______________________

Time (Start/Finish): ______________________ **Inspected by:** ______________________

West Dam

Y/N Seepage | Y/N Cracking | Y/N Erosion | Y/N Instruments Read

Y/N Settlement or Slumping | Y/N Ponded Water | Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

East Dam

Y/N Seepage | Y/N Cracking | Y/N Erosion | Y/N Instruments Read

Y/N Settlement or Slumping | Y/N Ponded Water | Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Southeast Dam

Y/N Seepage | Y/N Cracking | Y/N Erosion | Y/N Instruments Read

Y/N Settlement or Slumping | Y/N Ponded Water | Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Divider Dyke A

Y/N Downstream Turbidity | Y/N Cracking | Y/N Erosion | Cell B/C water level

Y/N Settlement or Slumping | Y/N Ponded Water | Y/N Damage by equipment | ______ m

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Fuel Tank Farm

Y/N Seepage | Y/N Cracking | Y/N Erosion | Y/N Evidence of Spillage

Y/N Settlement or Slumping | Y/N Ponded Water | Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Generator Containment Area

Y/N Seepage — Y/N Cracking — Y/N Erosion — Y/N Evidence of Spillage

Y/N Settlement or Slumping — Y/N Ponded Water — Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Airstrip Containment Area

Y/N Seepage — Y/N Cracking — Y/N Erosion — Y/N Evidence of Spillage

Y/N Settlement or Slumping — Y/N Ponded Water — Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Landfill

Y/N Seepage — Y/N Cracking — Y/N Erosion

Y/N Settlement or Slumping — Y/N Ponded Water — Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Waste Transfer Area

Y/N Seepage — Y/N Cracking — Y/N Erosion

Y/N Settlement or Slumping — Y/N Ponded Water — Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

C1 Diversion Channel

Y/N Water Flowing — Y/N Cracking — Y/N Erosion/Sloughing — Y/N Culverts Open

Y/N Settlement or Slumping — Y/N Ponded Water — Y/N Free of Snow

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

East Sump

Y/N Seepage/Over topping   Y/N Cracking   Y/N Damage by equipment   Pond water level

Y/N Settlement or Slumping   Y/N Erosion   ___ m

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Collector Ditches and Culverts

Y/N Water Flowing   Y/N Cracking   Y/N Erosion   Y/N Culverts Open

Y/N Settlement or Slumping   Y/N Ponded Water   Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Additional Notes:

Photo List:

SITE MAP
to be included

APPENDIX B

APPENDIX B LABORATORY ANALYTICAL PARAMETERS

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Appendix B - Analyzed Water Parameters and Detection Limits

Analytical Package	Parameters	Detection Limits	Unit
Total and Dissolved Metals (ICP-T, ICP-D)	Aluminum (Al)	0.0002	mg/L
	Antimony (Sb)	0.000005	mg/L
	Arsenic (As)	0.00002	mg/L
	Barium (Ba)	0.00002	mg/L
	Beryllium (Be)	0.000002	mg/L
	Bismuth (Bi)	0.000005	mg/L
	Boron (B)	0.005	mg/L
	Cadium (Cd)	0.000005	mg/L
	Calcium (Ca)	0.05	mg/L
	Chromium (Cr)	0.00005	mg/L
	Cobalt (Co)	0.00005	mg/L
	Copper (Cu)	0.00005	mg/L
	Iron (Fe)	0.01	mg/L
	Lead (Pb)	0.000005	mg/L
	Lithium (Li)	0.0002	mg/L
	Magnesium (Mg)	0.05	mg/L
	Manganese (Mn)	0.000005	mg/L
	Mercury (Hg)	0.00005	mg/L
	Molybdenum (Mo)	0.00005	mg/L
	Nickel (Ni)	0.00005	mg/L
	Phosphorus (P)	0.05	mg/L
	Potassium (K)	0.2	mg/L
	Selenium (Se)	0.00004	mg/L
	Silicon (Si)	0.05	mg/L
	Silver (Ag)	0.000005	mg/L
	Sodium (Na)	0.2	mg/L
	Strontium (Sr)	0.00001	mg/L
	Thallium (Tl)	0.000002	mg/L
	Tin (Sn)	0.00002	mg/L
	Titanium (Ti)	0.00005	mg/L
	Uranium (U)	0.000002	mg/L
	Vanadium (Va)	0.00001	mg/L
	Zinc (Zn)	0.0001	mg/L

Analytical Package	Parameters	Detection Limits	Unit
Routine Parameters (R)	Alkalinity ($CaCO_3$)	5	mg/L
	Acidity ($CaCO_3$)	5	mg/L
	Chloride	0.5	mg/L
	Carbonate (Co_3)	5	mg/L
	Bicarbonate (HCO_3)	5	mg/L
	Total Hardness ($CaC0_3$)	1	mg/L
	Hydroxide (OH)	5	mg/L
	Sulphate (SO_4)	0.05	mg/L
	Total Suspended Solids (TSS	3	mg/L
	Total Dissolved Solids (TDS)	5	mg/L
	Total Organic Carbon (TOC)	1	mg/L
	Total Inorganic (TIC)	1	mg/L
	pH	0.1	-
	Conductivity (uS/cm)	0.2	uS/cm
	Turbidity	0.1	NTU
Nutrients (N)	Nitrate (NO_3)	0.006	mg/L
	Nitrite (NO_2)	0.002	mg/L
	Ammonia (NH3)	0.005	mg/L
	Orthophosphate	0.001	mg/L
	Total Phosphorus	0.001	mg/L
Biological (B)	Biochem Oxygen Demand	5	mg/L
	Fecal Coliforms	1	CFU/100 mL
	Oil & Grease	1	mg/L
Petroleum Hydrocarbons (PHCs)	Benzene	0.0005	mg/L
	Ethylbenzene	0.0005	mg/L
	Toluene	0.0005	mg/L
	o-Xylene	0.0005	mg/L
	m+p-Xylene	0.0005	mg/L
	Xylenes	0.0005	mg/L
	F1(C6-C10)	0.1	mg/L
	F1-BTEX	0.1	mg/L
	F2 (>C10-C16)	0.25	mg/L
	F3 (C16-C34)	0.25	mg/L
	F4 (C34-C50)	0.25	mg/L

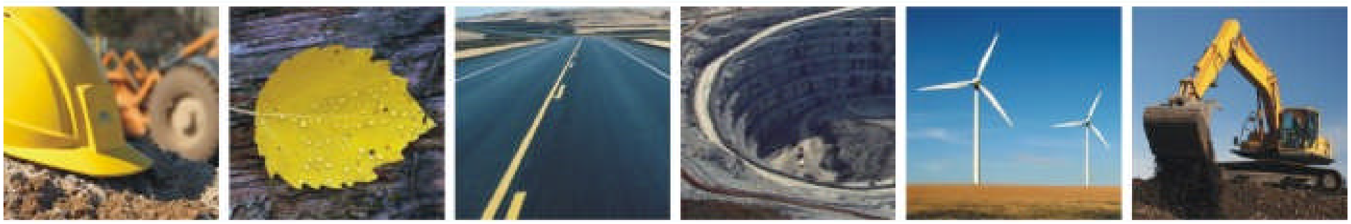
Note:
1. The detection limits are provided by ALS Laboratory Group.

APPENDIX D

APPENDIX D AQUATIC EFFECTS MONITORING PLAN

SHEAR DIAMONDS LTD.

AQUATIC EFFECTS MONITORING PLAN
CARE AND MAINTENANCE
JERICHO DIAMOND PROJECT, NUNAVUT



REPORT

JANUARY 2011
ISSUED FOR USE
EBA FILE: E14101118

SHEAR DIAMONDS LTD.

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EBA, A Tetra Tech Company
14940 - 123 Avenue
Edmonton, AB T5V 1B4 CANADA
p. 780.451.2121 f. 780.454.5688

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APPENDICES

Appendix A Analyzed Parameters and Detection Limits
Appendix B Water and Sediment Quality Analytical Methods
Appendix C General Laboratory QA/QC Controls
Appendix D Monitoring Schedule Master Table

ACRONYMS & ABBREVIATIONS

AA	Atomic Absorption Spectrophotometry
AEMP	Aquatic Effects Monitoring Plan
AIA	Aquatic Impact Assessment
ALS	ALS Laboratory Group
ANCOVA	Analysis of Covariance
ANOVA	Analysis of Variance
AQMP	Air Quality Management Plan
BACI	Before-after-control-impact
CAEAL	Canadian Association for Environmental Analytical Laboratories
CAMP	Jericho Mine Care and Maintenance Plan
DO	Dissolved Oxygen
EC	Electric Conductivity
GC/FID	Gas Chromatograph - Flame Ionization Detector
GMP	General Monitoring Plan
ICP-MS	Inductively Coupled Plasma – Mass Spectrometry
ICRP	Interim Closure and Reclamation Plan
INAC	Indian and Northern Affairs Canada
KIA	Kitikmeot Inuit Association
MANOVA	Multivariate Analysis of Variance
NIRB	Nunavut Impact Review Board
NWB	Nunavut Water Board
PKMP	Processed Kimberlite Management Plan
RPD	Relative Percent Difference
Shear	Shear Diamonds (Nunavut) Corp.
SWMP	Site Water Management Plan
TDC	Tahera Diamonds Corporation
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
WEMP	Wildlife Effects Management Plan
WMP	Waste Management Plan
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

1.1 General

The Jericho Aquatic Effects Monitoring Plan (AEMP) has been developed to provide a methodology for collecting and analyzing abiotic and biotic parameters in the receiving environment near the mine to ensure their quality or health is not influenced by site water discharge, surface runoff or the airborne emissions.

The current AEMP is prepared in support of the water licence renewal application, which conforms to conditions specified in Schedules K and L of Licence NWBJER0410 (issued December 21, 2004). However, this plan is being submitted to the Nunavut Water Board (NWB) in the absence of complete historical information as Shear Diamonds (Nunavut) Corp. (Shear) only assumed control of the project in August 2010. Since that time Shear has discovered that detailed information on the previous aquatic effect monitoring program is limited. Comprehensive historical aquatic effect monitoring records and baseline aquatic studies were not well maintained under previous ownership and management, so the available information incomplete or lacking detail.

The current AEMP is based on these existing records including the previous AEMP, annual aquatic effects monitoring reports, historical aquatic baseline studies, Environmental Impact Statement (EIS), and regulator comments. Where appropriate the Jericho AEMP follows guidelines described in the *Metal Mining Guidance Document for Aquatic Environmental Effects Monitoring* (MMEEM) by ENVCAN (2002). The plan has been developed for the current regulatory regime and reflects Shear's commitment to the best practices in environmental stewardship.

1.2 Objectives

The objectives of this AEMP are to monitor the potential effects of Jericho's effluent and emission sources on the aquatic environment. This will be achieved by using scientifically defensible, cost-effective methods and designs. The information gathered through the AEMP will be used to:

- Protect the health and integrity of the aquatic environment,
- Confirm impact predictions,
- Ascertain whether mitigation measures are effective, and
- Adjust mitigation where appropriate as part of the overall mine adaptive management.

1.3 Background

The Jericho Diamond Mine is located approximately 260 km southeast of Kugluktuk, NU, and 30 km north of Lupin Mine. The Jericho Mine was constructed and operated by Tahera Diamond Corporation (TDC) between 2004 and 2008. In January 2008, TDC suspended mining operations, and the site was placed under care and maintenance. Shortly thereafter, Indian and Northern Affairs Canada (INAC) assumed control of the care and maintenance activities for the site. In August 2010, Shear purchased the Jericho Mine and its assets and assumed responsibility for the site.

Presently, the mine remains under care and maintenance as Shear evaluates the mineral resources. Once evaluation of the mineral resources is complete, a mine plan and operations schedule for the project will be established.

The Nunavut Impact Review Board (NIRB) issued a Project Certificate on July 20, 2004, after receiving approval from Indian and Northern Affairs Canada (INAC). The conditions include development and implementation of a comprehensive environmental monitoring program. An integral part of the plan was the Aquatic Effects Monitoring Plan designed specifically to monitor potential effects of the development on the aquatic environment. The NWB issued Water Licence NWBJER0410 on December 22, 2004 (expired on December 31, 2010). In compliance with the water licence, an AEMP was prepared by AMEC and Mainstream Aquatics Ltd. (Mainstream) in March 2005. Comments from various stakeholders were also provided, as follows:

- Environment Canada (050513NWB1JER0410 EC Comments AEMP-ILAE), received on May 13, 2005
- INAC (050513NWB1JER0410 INAC Comments-AEMP-IMLE), received on May 13, 2005
- Kitikmeot Inuit Association (KIA) (050513NWB1JER0410 KIA Comments AEMP-IMLE), received on May 13, 2005
- Dillon Consulting Ltd. (Dillon) (050925NWB1JER0410 Dillon Review AEMP-ISTE), received on September 25, 2005
- NWB (060720 2AM-JER0410 AEMP Review-OTAE), received on July 20, 2006

1.4 Linkage to Other Management Plans

Numerous interlinked site plans exist for mine and environmental management at the Jericho mine site. As such, the AEMP should be considered as part of the overall environmental impact monitoring and management program. Other monitoring management plans, which are related to or refer to the AEMP, include:

- Air Quality Monitoring Plan (AQMP);
- General Monitoring Plan (GMP);
- Processed Kimberlite Management Plan (PKMP);
- Site Water Management Plan (SWMP);
- Care and Maintenance Plan (CAMP) during periods where mining and processing operations are suspended, and
- Interim Closure and Reclamation Plan (ICRP).

2.0 DESIGN

2.1 AEMP Approach

The protocols specific to each indicator and the selection of waterbodies for monitoring and analytical procedures of the AEMP adhere to the scientifically based approach recommended by Environment Canada for environmental effects monitoring programs (ENVCAN 2002). The AEMP adheres to these five general principles:

- The AEMP has been designed, and is of sufficient effort and duration, to detect changes in the receiving environment caused by the Jericho project
  - The proposed AEMP is devised to monitor indicators and parameters deemed to be sensitive to project effects in the environmental impact statement.
  - The primary risk to the receiving environment is the project's ability to affect water quality. Exceeding water quality criteria will indicate a project effect. Aquatic biota will be used to establish whether the effect is sufficient to cause a biological impact.
  - The AEMP will monitor with sufficient frequency, duration, and extent that the magnitude of any spatial and temporal impacts can be delineated. Delineation will establish whether the impacts are a result of local or regional effects. Baseline data has or will be collected to provide before and after comparison of changes (temporal). Data from control waterbodies is collected to compare these reference sites to the impacted site (spatial).
- The AEMP relies on statistical certainty as a basis for assessing change.
  - Specific statistical procedures are detailed under each respective assessment component, with a detailed explanation of general procedures and methods provided under the analytical methods, power analyses, and evaluation criteria sections that follow.
  - When logistical constraints or natural variability precludes the use of statistical certainty, two alternative approaches are to be employed. The first is weight of evidence, which involves integration of several disparate multiple variables to ascertain whether a change has occured. The second is data trend, which requires the existence of spatial or temporal patterns as an indication of change.
- The AEMP focuses effort on parameters that are ecologically relevant to each biological indicator, that provide a high probability for detection of change, and that are feasible for monitoring based on logistics and costs.
  - The AEMP allows detection of potential impacts before they result in long-term irreversible changes to the aquatic environment. The approach facilitates adjustments to mine operation and mitigation as part of the adaptive management strategy.
  - The trigger for site management change or adaptation will be an increase in water or sediment parameter concentration followed by a biologically significant effect detected by the AEMP. These effects will, in turn, be linked to mine discharges or mine emissions not mirrored in either of the

control lakes. Biological analysis will include an evaluation of the potential effects on the ecological integrity of the Jericho River basin aquatic ecosystem.

- When a change is detected, the AEMP will determine whether the change is caused by the project and, if so, which aspect of the project is responsible. In addition, the AEMP has been designed to be flexible and adaptive in order to respond effectively to unforeseen issues.
  - First. water quality data collected at site monitoring stations will be examined for increasing trends in the concentration of parameters. If a trend is detected, monitoring protocols will be adjusted to identify the cause and source of the increase. Protocol adjustments may include increased monitoring frequency and the inclusion of additional monitoring sites and parameters in the AEMP. At the same time, Processed Kimberlite Containment Area (PKCA) discharge data will be examined for the existence of similar trends to ascertain whether the receiving waterbody (Lake C3) is affected. Finally, near-field monitoring sites in the receiving environment (i.e., mouth of Stream C3, at the edge of the mixing zone in Lake C3) will be evaluated for these trends. The objective of this approach will be to isolate the source of the increases and to determine whether the effect continues from the point source into the receiving environment. If at any point the link is broken, the cause of the biological change is unlikely to be mine discharges or emissions.
  - If the link is not broken and the source is isolated, mining practices will be examined for methods to reduce concentrations at the source. If that is not possible, the second step will be methods to reduce concentrations in the PKCA (e.g., controlled addition of phosphorus, reducing dust transport from blasting).
  - Concurrent to these steps, aquatic biota parameters in the receiving environment will be examined. If an effect is detected (i.e., statistical significant change in a specific parameter relative to reference sites), monitoring protocols will be adjusted to determine whether the statistical effect could result in a biologically significant effect on the population. Protocol adjustments could include increased monitoring frequency, the addition of monitoring sites and parameters, and evaluation of toxicity.
  - If mine site control measures are ineffective and monitoring data indicates a trend towards a significant effect on the biotic population, alternate discharge methods, such as extended storage in the PKCA or spray irrigation, will be examined.
- The Jericho AEMP will undertake measures to identify and address information deficiencies as follows:
  - Annual review of the AEMP results to evaluate:
    - Adherence to sample design and protocols, and
    - The ability to detect an effect if one exists.
  - Provide specific recommendations to address each deficiency.
  - Adjust the AEMP for the subsequent sampling iteration and re-evaluate in order to determine whether the deficiency was addressed.

2.2 AEMP Indicators

The results of the monitoring programs will be interpreted in association with the Aquatic Impact Assessment (AIA; RL&L, 2000b) predictions, the previous baseline studies, and the related parameters in the reference lakes. The monitoring program is designed to measure the change in water and sediment quality and the effect on aquatic receptors. Indicators monitored by the AEMP and discussed in this document are:

- Water quality;
- Sediment quality and deposition;
- Dissolved oxygen profile;
- Toxicity of PKCA discharge water;
- Phytoplankton community;
- Zooplankton community;
- Periphyton community;
- Benthic macroinvertebrates community;
- Fish habitat and population; and
- Metal contaminants in fish.

2.2.1 Potentially Affected Waterbodies

Jericho is located in a small watershed of the upper Burnside River drainage basin. A number of waterbodies immediately adjacent to and downstream of the project may be affected by mine activities (see Figure 1 and 2). The AEMP sampling program incorporates assessment of watercourses and waterbodies where the potential for direct or indirect effects are likely to occur, or where previous assessments have identified areas of concern (AIA; RL&L, 2000). A general overview of the main waterbody groupings is presented below. A detailed description of waterbody characteristics, including lake morphologies and stream reaches, can be found in RL&L 1996, 1999, and 2000.

2.2.2 Jericho Lake Group

The Jericho Lake group, which is part of the Jericho River drainage system, consists of Carat Lake, Jericho Lake, Lake C3, Lake C1, Lake C4, Control Lake, and Stream C1, Stream C2, Stream C3, and other well-defined streams. Water from the project area flows downstream into Jericho Lake and then to the Kathawachaga River situated approximately 15 km downstream and to the north. The Kathawachaga River then flows into the Burnside River.

Carat Lake is the largest waterbody in this sub-watershed with a surface area of 271 ha. It consists of three basins, a large central basin, and two smaller sub basins located to the east and west. The average depth of Carat Lake is 10.8 m; and the maximum recorded depth is 32 m (RL&L 2000). The major inlet enters from Lake C3 at the west end, and the major outlet is at the northeast end. Carat Lake may receive surface runoff from the mine site via Stream C1 and Stream C4. Stream C1 is located at the southeast corner and stream C4 is located on the east shore of Carat Lake.

Lake C3 has a surface area of 103 ha and is the second largest waterbody in this group. It has a central basin with an elongated bay that extends to the west. The bathymetric survey conducted in 1999 showed an average depth of 4.8 m with a maximum depth of 15 m. Lake C3 receives the majority of the inflow from inlet streams at the south and northwest sides. It will also receive licensed discharge via Stream C3 from the PKCA. Stream C3 enters Lake C3 in the southeast corner.

Jericho Lake covers a surface area of 69 ha. It has a single elongated basin with a maximum depth of 15 m. It receives water from two inter-basins from the south end and feeds into Jericho River through a narrow stream.

No detailed information is currently available regarding the specific character of Control Lake, Lake C4, Lake C1, and streams C1, C3, and C4. This information will be obtained during field investigations as a part of the current Care and Maintenance activities.

2.2.3 O-Lake Group

The O-Lake group is located along the east side of the airstrip within an esker system. The group consists of Lakes O1 through O5 and a series of well-defined streams that flow into Jericho River. Potential surface runoff and airborne dust from the site activities may reach this group of waterbodies.

Lake O1 is the largest waterbody and the headwater lake in this group, covering a surface area of 18.1 ha. It is composed of two basins: a larger and shallower northern basin with a smaller and deeper southwestern basin (RL&L 1997). The average depth of this lake is 4.1 m and the maximum depth is 14 m.

Lake O2 covers a surface area of 5.3 ha. It composed of one conical shaped basin with a maximum depth of 7.0 m. The only outlet stream to this waterbody flows north to Lake O4, but it receives surface water input from Lake O1 and O3.

Lake O3 covers a surface area of 8.3 ha. The maximum recorded depth in this lake is 11.0 m. It receives surface water input from intermittent streams, and its outlet stream flows into Lake O2.

Lake O4 covers a surface area of 16.7 ha. The maximum recorded depth is 8.0 m. It receives surface water flow from several small intermittent streams along its south shore and from the outlet stream of Lake O2. The only outlet stream of Lake O4 flows north to Lake O5.

Lake O5 is immediately adjacent to Jericho River and is connected to this watercourse by a short, well-defined channel. It covers a surface area of 17 ha. The bathymetric survey showed it is composed of a single basin with relatively shallow depth of 5.0 m. It receives surface water input from Lake O4 and a tributary from the southeast side.

2.2.4 Lynne Lake Group

The Lynne Lake group, situated to the east of Jericho, consists of Lynne Lake, Key Lake, Ash Lake and a series of ephemeral streams that drain into Contwoyto Lake. Potential surface runoff and airborne dust from mining activities may reach this group of waterbodies.

Key Lake covers a surface area of 8.6 ha. A bathymetric survey indicated it is composed of two basins: a larger, deeper western basin and a smaller, shallower eastern basin (RL&L 1997). The average depth of this lake is 2.7 m, and the maximum depth is 12 m. Key Lake receives surface water from Ash Lake along with a small number of intermittent tributaries, and one outlet stream flows eastwards into Lynn Lake.

Lynne Lake covers a surface area of 16 ha, is oriented in an east-west direction, and is entrenched between two steep rock outcrops. The bathymetric survey showed a single basin with three deep-water depressions. The average depth of this lake is 6.9 m, and the maximum depth is 20 m. Excess water exits at the eastern end of the lake towards Contwoyto Lake via a boulder based channel.

2.2.5 Controls

Baseline studies and previous operational monitoring included two control waterbodies, Control Lake and Reference Lake 1[1]. Control Lake is within the potential indirect impact zone for mine operations and will be classified as an indirect upstream control for the Jericho Lake group. Jericho Lake is also within the potential indirect impact zone and will be classified as an indirect downstream control for the Jericho Lake group. Following a review of historical monitoring under previous ownership and management, Shear now questions the legitimacy of the previous control lake selection and use. Before continuing baseline studies, a comprehensive review of this lake will be conducted. Correspondingly, a new control lake (Reference Lake 2) selection process will be undertaken to identify a candidate lake that can better serve future monitoring requirements. The detailed selection rationale and method are described in Section 2.3. Reference Lake 1 may be retained as an additional indirect control pending further evaluation of historical data and methodology.

2.2.6 Potential Effects to Receiving Waterbodies

Table 2.1 describes the discharge source, the mode of transport, and receiving waterbodies.

Table 2.1: Water Transport Pathways and Receiving Waterbodies

Phase	Source	Transport Pathways	Receiving Waterbodies
Care and Maintenance	▪ PKCA	▪ Discharge and airborne	▪ Stream C3, Lake C3
	▪ Mine site runoff	▪ Runoff	▪ Lake C1, Stream C1, Carat Lake
	▪ Drainage ditch to Lake C4	▪ Runoff	▪ Lake C4, Stream C2, Carat Lake
	▪ Site roads	▪ Runoff and airborne	▪ Lake C4, Stream C2 and Carat Lake
	▪ Airstrip	▪ Runoff and airborne	▪ Lake O1-O4, Jericho Lake
	▪ Waste rock dumps	▪ Airborne and runoff	▪ Lynne Lake, Key Lake, Ash Lake, Carat Lake, Lake C4

[1] Reference Lake 1 was referred as "Cigar Lake" during aquatic effect monitoring programs between 2004 and 2007. However, during the baseline studies between 1995 and 2000, the lake, 2.5 km to the northeast, was already named as "Cigar Lake". To avoid confusion, the "Cigar Lake" in the 2004 to 2007 studies is renamed as "Reference Lake 1" in this document.

Table 2.1: Water Transport Pathways and Receiving Waterbodies

Phase	Source	Transport Pathways	Receiving Waterbodies
Operation	▪ PKCA (1)	▪ Discharge and airborne	▪ Stream C3, Lake C3
	▪ Mine site runoff	▪ Runoff	▪ Lake C1, Stream C1, Carat Lake
	▪ Drainage ditch to Lake C4	▪ Runoff	▪ Lake C4, Stream C4, Carat Lake
	▪ Site roads	▪ Runoff and airborne	▪ Lake C4, Stream C4 and Carat Lake
	▪ Airstrip	▪ Runoff and airborne	▪ Lake O1-O4, Jericho Lake
	▪ Waste rock dumps	▪ Airborne and runoff	▪ Lynne Lake, Key Lake, Ash Lake, Carat Lake, Lake C4
Post-closure	▪ Discharge from PKCA	▪ Discharge	▪ Stream C3 and Lake C3
	▪ Mine site runoff	▪ Runoff	▪ Lake C1, Stream C1, Stream C2, Lake C4, Carat Lake, Lynne Lake, Key Lake, Ash Lake
	▪ Mine pit water discharge	▪ Runoff	▪ Stream C1, Lake C1 and Carat Lake

2.3 Site Selection

The AEMP is designed to provide a detailed biotic and abiotic assessment of direct and indirect project effects, along with comparative assessment to control systems within and beyond the project effects area. The program includes monitoring of these effects within the Jericho River, O-Lake and Lynne Lake groups, upstream and downstream far field controls within the Jericho lake group, and two additional control lakes located disparate distances from the mine site.

The sampling program was created to provide effective coverage of potentially affected areas while maximizing retention or utility of historic baseline and operational sampling data. Although this design is comprehensive, it is not designed to be static. Previous sampling programs do not provide enough information to set all aspects of the monitoring design. The program design may, therefore, be altered to ensure adequate scientific rigor pending further in situ evaluations. One design aspect that is currently being reviewed is the selection of an additional control lake outside previous monitoring boundaries. The rationale and selection process that will be used to further evaluate the existing site and to select this new monitoring control is explained below.

2.3.1 Reference Sites Evaluation

In general, desktop screening is used to identify and select a list of impact and reference sites that are applicable for ascertaining near-field and far-field potential effects and providing comparative control background values.

For near-field and far-field exposure sites, selection criteria are based on location to applicable process or production vectors. Reference or control sample site selection is based on comparative suitability stemming from similar abiotic and biotic parameters, in concert with isolation from any direct or indirect project effects. General physical selection criteria for control sites includes size and shape, watershed to lake area ratio, current level of development, shoreline development, geology, proximity and practicality, and availability of existing data. Specific selection criteria includes water quality, trophic status, bathymetry, fish community, benthic invertebrate community, phyto and zooplankton assemblages, sediment chemistry, sediment particle size, and hydrologic retention time. New control site selection and previous site evaluations will include desktop and field investigations.

2.3.2 Desktop and Field Verifications

Desktop assessment will review all existing information relative to the physical and biotic character of the selected monitoring sites. Although this monitoring program provides comprehensive coverage for all potential mine effects, specific characteristics of each site have not been adequately provided in past records. A detailed review and gap analysis will be performed to ensure all sites provide defensible and robust data for evaluating potential project effects. A general set of criteria will be used to evaluate a new control lake and, where applicable, review the efficacy of existing monitoring waterbodies.

Evaluation criteria will include:

- Size and Shape – basin morphology directly influences water, limnology, sedimentation, and food web structure.
- Watershed and Lake Area Ratio – the ratio of watershed to surface area directly correlates with hydrologic, chemical, and sediment influx into lake systems.
- Existing or Potential Development – development or watershed disturbances can greatly alter a lake system.
- Shoreline Development – the degree to which a shoreline is irregular, or departs from a circular shape. The higher the degree of development, the higher the degree of direct interface with terrestrial influences.
- Geology – watershed and benthic geology shapes the nature and amounts of dissolved solids, nutrients, metals, etc., that are naturally found within the system, along with influx potential from adjacent watershed areas.
- Proximity and Practicality – providing reliable data in an economical and logistically feasible manner is essential for insuring comparative data.
- Existing Data – previous baseline and monitoring data can prove useful for establishing the baseline criteria for future monitoring efforts.
- Abiotic Parameters – existing water chemistry, limnology, bathymetry, water retention period, substrate character, morpho-edaphic index, and seasonal temperature profile are important for establishing criteria for comparative evaluations of baselines and potential effects.
- Biotic Parameters – the precise nature of the existing biotic assemblages along with the seasonal fluctuations within the food web are important for defining existing baseline biotic variability and evaluating potential future effects.

In addition to desktop review and refinement of the AEMP, an extensive field assessment will be conducted prior to resuming mining operations. This assessment will verify existing parameters for several potential control lakes, several new monitoring sites added to the previous AEMP, and to provide spot check verifications for all past sites that are included in this AEMP.

2.4 Sample Locations General Principles

Rationale for site selection under the previous AEMP is incomplete and sparse. The sampling program for this AEMP provides substantial expansion and coverage with respect to biotic component assessment and number of sites. Each sampling site is chosen to provide assessment of identified direct and indirect projects effects or to provide a control for assessment of these effects. The specific rationale for site selection, location, sampling methodology and frequency used for the AEMP are described in detail within the specific description sections for each identified indicator. In general, sampling locations were based on the following general principles:

- All areas of potential direct impact will be sampled. For sites with a direct interaction of watercourses or waterbodies, near-field and far-field sites will be established to provide for future dispersion evaluations.
- Efforts will be made to incorporate as many previous sites as possible to maintain consistency with past studies and monitoring programs and to extend monitoring data for trends analysis.
- Where practical, a full suite of abiotic and biotic sampling will be employed at each site.
- Where practical, the sampling schedule will incorporate a seasonal element to enable assessment of seasonal variability.
- New sites will be incorporated to provide more extensive coverage of indirect project effects and enhance controls.

2.5 Analysis and Interpretation

Data analyses and interpretation procedures are specific to each indicator and parameter. In general, data analyses adhere to analytical protocols recommended by ENVCAN (2002). Interpretation of the results (effect versus no effect) is based primarily on statistical significance and the power of the test. The following provides an overview of the Jericho AEMP sample design and analytical methods.

2.5.1 Analytical Methods

The two general groups of analytical techniques are parametric statistical analyses and weight of evidence. Parametric statistical analysis of univariate statistics (i.e., measure of central tendency or sample mean or median) is the primary method.

The basic statistical design is before-after-control-impact (BACI), with year and station as factors. Other statistical designs used as appropriate include gradient analyses of spatial and temporal trends (regression), and pattern or grouping analyses (classification). Where appropriate, univariate and multivariate parametric statistical tests are employed as follows:

- Analysis of Variance (ANOVA)
- Analysis of Covariance (ANCOVA).
- Multivariate Analysis of Variance (MANOVA)
- Linear Regression
- Multiple Regression
- Cluster Analyses

For parametric statistical analyses, data are evaluated and adjusted using standard procedures as follows:

- Data are plotted and visually assessed to identify potential outliers.
- Assumptions for parametric statistical analyses are tested.
- Homogeneity of variance (Levene's test)
- Normal distribution (G-test; Shapiro-Wilks test)
- Independence (Runs Test)
- If assumptions for parametric tests are violated, the data are transformed to an appropriate nonlinear scale.
- If violations cannot be addressed by transformation, parametric tests will be employed using appropriate adjustments to the test statistic (e.g., use of the Welch statistic in place of the F statistic).
- If multiple and serious violations remain following transformation, nonparametric statistical tests are employed in lieu of parametric tests.

Statistical significance is accepted at P = 0.05. All tests follow descriptions presented in Sokal and Rolhf (1981).

If data characteristics preclude use of parametric statistical methods, if the power of the analyses is not sufficient to detect the required effect size, or if several univariate statistics approach but do not achieve statistical significance, weight-of-evidence will be employed as an analytical tool. This approach combines several disparate lines of evidence to make decisions on the existence and extent of project effects.

2.5.2 Power Analyses

Power analysis is used to calculate the number of replicates needed to detect a given effect for a specific parameter and to determine the level of power (1-ß) that is actually achieved. Information used for this purpose include effect size (ES), the variability of the sample or standard deviation (SD), the probability of making a Type I error (a) and the probability of making a Type II error (ß).

Power analyses calculations are specific to each type of experimental design. Based on ENVCAN (2002) guidelines the following values are used in the calculations:

ES = ±2 SD

SD = Variation of the control station

a = 0.1

ß = 0.1

2.6 Evaluation Criteria

AEMP evaluation criteria are specific to each indictor and parameter. The existence of an effect can be accepted at three levels as follows:

- There is a statistical difference between samples.
- The sample mean exceeds:
  - A specific threshold (e.g., constituent concentration), or
  - An effect size (effect size is ± 2SD of the reference site).
- The sample mean exceeds a critical biological effect.

The third criterion is not fixed. It will be established based on spatial and temporal trends in the parameter of interest and inherent variability in the biological population.

When a Level 1 or Level 2 effect is identified, the AEMP will be adjusted to focus efforts:

- To establish the linkage (if any) between project activities and the effect.
- Delineate the spatial and temporal magnitude of the effect.
- Test effectiveness of measures to mitigate the effect.

Adjustments to the AEMP may include:

- Increased sampling effort in terms of number and location of stations, number of replicates, and frequency.
- Evaluation of additional indicators/parameters that are very sensitive to the effect and to delineate the causal mechanism of the effect.

The objective of the AEMP is to identify and address project effects before a Level 3 effect is identified.

3.0 WATER QUALITY

3.1 General

Deleterious substances released from the mining activities and their associated effects may adversely affect the aquatic biological community and are monitored as part of this AEMP. The main objective of the water quality portion of the AEMP is to provide information on the nutrient and contaminant levels in the water. This information will be used to evaluate changes in water quality within the receiving environment at various stages of the project. Changes in water quality in the receiving waterbodies or watercourses provide early warning of the declining aquatic environment and trigger the site management change or adaption.

In contrast, the Site Water Quality Monitoring Program (SWQM) described in the General Monitoring Plan (GMP) is designed to monitor the water quality in the PKCA and all main water collection structures at the mine. The objective of the SWQM is to ensure that the water quality in each area of the mine is maintained at an acceptable level, and that the quality of the water in the PKCA is not unduly impacted by inflows of poorer quality water from other mine areas.

3.2 Rationale

Mining activities that can potentially negatively impact water quality include surface runoff contacting mine infrastructure, effluent discharge from the PKCA, and air emissions such as dust. Such activities can introduce contaminants into the aquatic environment in the form of metals, nutrients, and suspended sediments. As indicated in the AIA, these contaminants can reduce water quality to a level which may adversely affect aquatic biota. Potential effects to fish populations include increased contaminant loads, lowered reproductive capacity, non-adaptive behavioural changes, and loss of habitat.

As described in the AIA, elevated metal concentrations can have both lethal and sub-lethal affects on fish. The effects of increased suspended sediment concentrations on fish and fish habitat may involve reduced fish survival by direct mortality or by reducing growth, overall health, or resistance to disease. The increased concentrations may also modify the abundance and type of pelagic food organisms available to fish, and/or interfere with the natural movements of fish and their ability to detect and capture prey.

The AIA indicated that the waterbodies near the Jericho Site are oligotrophic, where phosphorus is the nutrient in the shortest supply. Adding more phosphorus could stimulate biomass production of algae, which in turn, may affect the food-chain by increasing the biomass of zooplankton, benthic invertebrates, and ultimately fish. This potential shift in trophic status and community structure could alter the natural state of the affected waterbodies. The phosphorus that occurs in site rock at Jericho is predominantly in an insoluble form; therefore, dust or sediment from project activities is unlikely to alter the phosphorus availability in affected waterbodies.

The presence of sedimentation could affect the egg and larval stages of fish species that require clean rock substrates for incubation. Egg mortality could be increased through smothering of the eggs and altering the porosity of the substrate. Sedimentation can also affect fish habitat by reducing the productivity of benthic communities.

3.2.1 Runoff from Mine Site

As concluded in the AIA, impacted runoff would mainly originate from the waste rock dumps, overburden stockpiles, coarse processed kimberlite (CPK) stockpiles, and exposed rock from mining activities. Surface runoff from permanent roads was considered minor due to the diversion by road-side ditches. The runoff water would potentially affect the water quality in Carat Lake, Lake C1 and Key Lake by introducing nutrients, contaminants, and sediments.

The AIA also indicates that copper and ammonia are the two constituents in the waste rock and ore leachate tests that may exceed the applicable surface water guidelines. The toxicity of copper depends on the alkalinity, water hardness, and availability of organic substances. The effects of the ammonia vary depending on the nutrient level and redox equilibrium with other nitrogen forms.

The AEMP is designed to monitor water quality in waterbodies that may be directly or indirectly affected by the mine runoff. Parameters to be included in the analysis are identified in Appendix A.

3.2.2 Discharge from PKCA

The PKCA is required to store the fine processed kimberlite and supernatant water from processing operations, wastewater, and collected site water runoff.

Upon verification that the ponded water in the PKCA meets the specified quality criteria, the water will be discharged into Stream C3 flowing into Lake C3 and further to Carat Lake. The release of PKCA discharge could affect the water quality in Stream C3 and the waterbodies by introducing nutrients, contaminants, and sediments.

The AIA indicates that ammonia, copper, and total suspended solids (TSS) from the PKCA water are the main constituents of concern. The AEMP is designed to monitor the water quality in those waterbodies that may be directly or indirectly affected by the PKCA discharge. As discussed in the GMP (EBA 2011d), water quantity monitoring will measure whether potential contaminants in the discharge are adequately diluted. The water flow and water level monitoring stations are shown in Figure 3.

3.2.3 Air Emission

Mining and associated activities can generate dust, which can then be transported by wind and deposited in waterbodies near the mine site. Sources of dust include vehicles and haul traffic traveling on the unsealed roads, aircraft landing on the unsealed airstrip, blasting in open-pits, deposition of waste rock, rock crushing and earthwork construction activities. The air dispersion model (AMEC 2007) indicated the area with a 2 to 3 km radius from the mine is within the zone of airborne dusts influence. A portion of the dust would eventually be deposited onto the surface of Carat Lake and other surrounding waterbodies, increasing levels of suspended sediment in the water column and sediment deposition on the lake bottom habitat.

The AIA predicts airborne contaminants generated from the mine will not cause adverse environmental effects on aquatic biota. The AEMP is designed to monitor the sediment deposition and TSS in the surrounding waterbodies to confirm the predictions in the AIA. A care and maintenance air quality monitoring program is being developed for implementation at site in 2011. Shear is working directly with Environment Canada to develop an appropriate monitoring program for air quality that reflects the status of the project.

3.3 Summary of Previous Studies

The water analytical results under the proposed AEMP will be interpreted in association with the baseline studies and the results from previous water quality monitoring results before mining activities resume. Locations sampled during the operational period diverged from those sampled during baseline data collection and are summarized in Table 3.1.

Table 3.1: Summary of Historical Water Chemistry Sampling

Sample Site	Location	Collection Year
Water Chemistry Sampling During Baseline Studies (1995-1999)		
CL-01	Cigar Lake	1995, 1996
CL-02		1995, 1996, 1997, 1998, 1999
CL-03	Carat Lake	1995, 1996, 1997, 1998
CL-04		1995, 1996, 1997, 1998
CL-05		1995, 1996, 1997, 1999
CL-06	Jericho Lake Outlet	1995, 1996, 1998, 1999
CL-07		1995, 1996
CL-08		1995, 1996
CL-09	Mouth of Jericho River into Kathawachaga Lake	1995, 1996
CL-10	Mouth of Burnside River into Kathawachaga Lake	1995, 1996
CL-14	Key Lake	1996
CL-16	Lynne Lake	1996
CL-17	Ash Lake	1996
CL-21	Lake O1	1996
CL-22	Lake O2	1996
CL-23	Lake O4	1996
CL-25	Long Lake (Current PKCA)	1999
CL-26	Key Lake outlet stream	1999
CL-27	Lynne Lake outlet stream	1999
CL-28	Lake C3	1999
Water Chemistry Sampling During Tahera Monitoring Programs (2004-2007)		
JER-WQ1	Carat Lake near water intake	2005, 2006, 2007
JER-WQ2	Stream C3 near PKCA Discharge	2005, 2006, 2007
JER-WQ3	Stream C3 above Mouth	2005, 2006, 2007
JER-WQ4	Lake C3 South Basin	2005, 2006, 2007
JER-WQ5	Lake C3 Outlet	2005, 2006, 2007
JER-WQ6	Carat Lake Centre Basin	2005, 2006, 2007
JER-WQ7	Carat Lake Outlet	2005, 2006, 2007
JER-WQ8	Jericho Lake North Basin	2005, 2006, 2007
JER-WQ9	Jericho River at downstream Jericho Lake	2005, 2006, 2007
JER-WQ10	Control Lake	2005, 2006, 2007
JER-WQ11	Reference Lake 1 (1)	2005, 2006, 2007
JER-WQ12	Stream C1 above Mouth	2005, 2006, 2007
JER-WQ13	Lake C1	2005, 2006, 2007
JER-WQ14	Lake C4	2005, 2006, 2007
JER-WQ15	Stream C2 above Mouth	2005, 2006, 2007
JER-WQ16	Lynne Lake	2005, 2006, 2007
JER-WQ17	Key Lake	2005, 2006, 2007
JER-WQ18	Ash Lake	2005, 2006, 2007
JER-WQ19	Stream C1 outlet in Carat Lake	2005, 2006
JER-WQ20	Lake C3 near Stream C3 outlet	2005, 2006
JER-WQ21	Stream 6	2007

Note:

1. "Reference Lake 1" is renamed from the "Cigar Lake" referred in aquatic effect monitoring programs between 2004 and 2007 (See Footnote 1 on Page 7 for details)

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3.4 Monitoring Stations

The rationale for selecting sampling locations is described in Section 2.5. Sampling station JER-AEM-01 and -02 are located at the control lakes outside of the Jericho catchment area. Stations JER-AEM-03 through -18 are located within the Jericho River group. Stations JER-AEM-19 through -21 are located at the O-Lake Group and stations JER-AEM-21 through -24 are located at the Lynne Lake Group.

Table 3.2 details the specific purpose and general location of the monitoring stations. Detailed locations for the monitoring stations can be found on Figure 3.

Table 3.2: Water Chemistry Monitoring Stations and Purpose

	Station	Previous Station Code	Location	Purpose
Control Lakes	JER-AEM-01	JER-WQ11	Reference Lake 1 (1)	Control sample location
	JER-AEM-02	N/A	Reference Lake 2 (2)	Control sample location
Jericho River Group	JER-AEM-03	JER-WQ10	Control Lake	Upstream Far field
	JER-AEM-04	JER-WQ02	PKCA Discharge in Stream C3	Water discharge location during PKCA discharge (3)
	JER-AEM-05	JER-WQ03	Stream C3 upstream of Mouth	Near field - PKCA discharge
	JER-AEM-06	JER-WQ20	Lake C3 near Stream C3 outlet	Near field – PKCA discharge
	JER-AEM-07	JER-WQ04	Lake C3 South Basin	Near field - PKCA discharge
	JER-AEM-08	JER-WQ05	Lake C3 Outlet	Far field - PKCA discharge
	JER-AEM-09	JER-WQ13	Lake C1	Near field – Surface runoff and dust
	JER-AEM-10	JER-WQ12	Stream C1 Upstream of Mouth	Near field – Surface runoff and dust
	JER-AEM-11	JER-WQ19	Stream C1 outlet in Carat Lake	Near field – PKCA discharge
	JER-AEM-12	JER-WQ01	Carat Lake Freshwater Intake	Water Intake location
	JER-AEM-13	JER-WQ14	Lake C4	Near field – Surface runoff and dust
	JER-AEM-14	JER-WQ15	Stream C2 Upstream of Mouth	Near field – Surface runoff and dust
	JER-AEM-15	JER-WQ06	Carat Lake Centre Basin	Near field – Runoff, Stream C1 and C2 outflow
	JER-AEM-16	JER-WQ07	Carat Lake Outlet	Far field – Carat Lake and Lake C3 outflows
	JER-AEM-17	JER-WQ08	Jericho Lake	Far field – Jericho Lake outflows, above cascade
	JER-AEM-18	JER-WQ09	Jericho River Downstream of Jericho Lake	Far field – Jericho Lake outflows, below cascade
O-Lake Group	JER-AEM-19	N/A	Lake O1	Near field – Runoff and dust
	JER-AEM-20	N/A	Lake O2	Far field – Lake O1 and O3 outflows
	JER-AEM-21	N/A	Lake O4	Far field – Lake O1, O2, and O3 outflows

Table 3.2: Water Chemistry Monitoring Stations and Purpose

	Station	Previous Station Code	Location	Purpose
Lynne Lake Group	JER-AEM-22	JER-WQ18	Ash Lake	Near field – Surface runoff from waste rock piles and dust
	JER-AEM-23	JER-WQ17	Key Lake	Near field – Surface runoff waste rock piles and dust
	JER-AEM-24	JER-WQ16	Lynne Lake	Near field – Surface runoff waste rock piles and dust
	JER-AEM-25	N/A	Contwoyto Lake near Stream D1 Mouth	Far field – Surface runoff and dust

Note:

1. "Reference Lake 1" is renamed from the "Cigar Lake" referred in aquatic effect monitoring programs between 2004 and 2007 (See Footnote 1 on Page 7 for details).
2. Reference Lake 2 will be identified and investigated during the baseline study in 2011.
3. The SWQ monitoring station in the PKCA (JER-SWQ-04) will be used prior to PKCA discharge to determine if the water quality meets the discharge criteria; in comparison, the AEMP station JER-AEM-04 will be used during the PKCA discharge.

3.5 Frequency and Replication

Analytical packages for surface water monitoring programs are designed to detect potential contaminants at the specific monitoring stations. Total and dissolved metals and nutrients, identified in Appendix A, will be analyzed at all monitoring stations. Additional biological analysis will be conducted at the freshwater intake and PKCA discharge stations (JER-AEM-12, -04, and -05). Additional toxicity analysis will be conducted at the water discharge monitoring station (JER-AEM-04) and effluent mixing zone monitoring station (JER-AEM-06).

Monthly monitoring will be conducted during the care and maintenance period and during mining operations, whereas annual monitoring will be conducted during the post-closure phase. Waterbodies downstream from the PKCA discharge will be monitored in both winter and summer seasons. Water bodies impacted only by surface runoff will be monitored only during the summer season. Baseline information indicates that Stream C3 freezes to the bottom in the winter, precluding winter water sampling at that location.

Table 3.3 provides the proposed monitoring frequency during the Care and Maintenance activities. One set of water samples will be collected at each of the sampling events.

Table 3.3: Water Chemistry Monitoring Frequency

Station	Location	Water Chemistry (1)	Frequency (2)
JER-AEM-01	Reference Lake 1 (3)	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-02	Reference Lake 2 (4)	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-03	Control Lake	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-04	Stream C3 near PKCA Discharge	R, ICP-T, ICP-D, N, B,	Weekly during discharge, monthly until freeze up (5)
		Tox1	Monthly during and after discharge until freeze up

Table 3.3: Water Chemistry Monitoring Frequency

Station	Location	Water Chemistry (1)	Frequency (2)
JER-AEM-05	Stream C3 upstream of Lake C3	R, ICP-T, ICP-D, N, B	A2
JER-AEM-06	Stream C3 outlet in Lake C3	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-07	Lake C3 South Basin	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-08	Lake C3 Outlet	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-09	Lake C1	R, ICP-T, ICP-D, N	A2
JER-AEM-10	Stream C1 Upstream of Carat Lake	R, ICP-T, ICP-D, N	A2
JER-AEM-11	Stream C1 outlet in Carat lake	R, ICP-T, ICP-D, N	A2
JER-AEM-12	Carat Lake Freshwater Intake	R, ICP-T, ICP-D, N, B	M1
JER-AEM-13	Lake C4	R, ICP-T, ICP-D, N	A2
JER-AEM-14	Stream C2 Upstream of Carat Lake	R, ICP-T, ICP-D, N	A2
JER-AEM-15	Carat Lake Centre Basin	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-16	Carat Lake Outlet	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-17	Jericho Lake North Basin	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-18	Jericho River Downstream of Jericho Lake	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-19	Lake O1	R, ICP-T, ICP-D, N	A2
JER-AEM-20	Lake O2	R, ICP-T, ICP-D, N	A2
JER-AEM-21	Lake O4	R, ICP-T, ICP-D, N	A2
JER-AEM-22	Ash Lake	R, ICP-T, ICP-D, N	A2
JER-AEM-23	Key Lake	R, ICP-T, ICP-D, N	A2
JER-AEM-24	Lynne Lake	R, ICP-T, ICP-D, N	A2
JER-AEM-25	Contwoyto Lake near Stream D1 Mouth	R, ICP-T, ICP-D, N	A2

Note:

1. Analytical Package:	**R**	Routine
	ICP-T	Total Metals
	ICP-D	Dissolved Metals
	N	Nutrients
	B	Biological
	N	Nutrients
	Tox1	Effluent toxicity (*Oncorhynchus mykiss and Daphnia magna*)
	Tox2	Mix zone toxicity (*Ceriodaphnia dubia)*
2. Monitoring frequency:	**A1**	Annual once in Winter (April);
	A2	Annual once in Summer (Jul);
	M1	Monthly (Mid-Apr, Jun, Jul, Aug, Sep, Mid-Dec);
	M2	Monthly (Jun, Jul, Aug, Sep);

3. “Reference Lake 1” is renamed from the “Cigar Lake” referred in aquatic effect monitoring programs between 2004 and 2007 (See Footnote 1 on Page 7 for details).

4. Reference Lake 2 will be identified and investigated during the baseline study in 2011.

5. JER-SWQ-04 is used to determine compliance of water licence discharge criteria prior to discharge, whereas, JER-AEM-04 in the Jericho AEMP is to determine the compliance during discharge.

3.6 Field Sampling

3.6.1 Sampling Methods

Field parameters including depth, dissolved oxygen (DO), pH, temperature, and conductivity will be measured at the time and at each depth of sample collection with a multi-parameter instrument. DO and temperature profiles will be measured at 1 m intervals at required stations.

For water sample collections, pre-cleaned water bottles will be obtained from a laboratory supplier. Samples will be collected using laboratory recommended protocols and preservatives will be added to the water bottles when required.

During periods of open water, near-surface water samples will be collected by submersing bottles 0.25 m below the surface in lakes and just below the surface in streams. While submerged, the bottles will be uncapped, allowed to fill, and recapped prior to resurfacing. All actions will be performed using latex gloves.

When sediment chemistry is required, additional near-bottom water samples will be collected at the same monitoring station using a Kemmerer or Van Dorn sampler at approximately 1 m above the lake bottom.

During periods of ice, holes will be augered through the ice cover so that surface grab water samples can be collected. Samples will be collected approximately 1 m below the bottom of the ice. Rinsing sample containers with in situ water can be impractical in cold weather; therefore, laboratory prepared sample bottles will be used. A minimum of 10 L of water will be bailed from the hole prior to collecting the samples. Sample water will be obtained with a capture tube pre-rinsed with site water.

Field laboratory work will include filtering of dissolved metal samples through a 0.45 µm Millipore filter and preservation with AA grade nitric acid. Similarly, samples for total metals analysis will also be preserved with AA grade nitric acid. Total organic carbon and nutrients samples will be preserved with AA grade sulphuric acid. The routine water sample will not be preserved.

In addition, water bottles containing samples from the same station will be placed in a clean plastic bag to avoid cross-contamination between samples, and stored in coolers to keep the samples below 4°C prior to shipment. Chain of custody forms will be used to track samples.

3.6.2 QA/QC Procedures

3.6.2.1 Quality Assurance

Quality Assurance (QA) refers to a set of coordinated actions such as plans, specifications, and policies that assure that a measurement program can be quantifiable and produce data of known quality. If the developed QA protocols are followed diligently, the monitoring program under the AEMP will produce results with acceptable and defensible quality.

The QA protocols included the field staff qualification, laboratory qualifications, data management, and senior staff involvement.

Field Staff Qualification and Training

Field staff involved in the AEMP field program will be adequately trained such that they are competent in following the monitoring procedures including data recording and test equipment operation.

Before a field work program begins, a “kick-off” training session will be held with all field and senior staff in attendance. The purpose of the meeting will be to review the monitoring protocols and site-specific requirements. In addition, a close-out meeting will be held once the program is complete to review the results and identify any areas for future improvement.

Equipment Maintenance and Calibration

The devices used to collect field chemistry parameters will be calibrated daily or at a frequency determined by senior staff or designate contractor, and will follow the equipment manufacturer recommendations. Testing equipment will be inspected thoroughly before each field season and, if required, will be sent for service and maintenance. Testing equipment will be calibrated based on the manufacturer’s recommended schedule. Maintenance records and calibration certificates will be kept in the GMP QA records.

An inspection of equipment used by field staff will be performed each day prior to use.

Laboratory Qualification

The Canadian Association for Environmental Analytical Laboratories (CAEAL) provides accreditation programs to review laboratories’ procedures, methods, and quality control. Samples collected from the field will be sent to the CAEAL accredited laboratories.

Data Management

A data management program will be implemented to ensure proper recording and organization of the field and laboratory data.

Senior Staff Involvement

To ensure all procedures are adhered to, senior project staff will be closely involved throughout each stage of the project. Duties of the senior staff will include initiating the field kick-off training session, supervising the field program and staff, conducting a review of the laboratory data and data analysis, facilitating close out meetings, and reviewing the annual reporting.

3.6.2.2 Quality Control

Quality Control is a system of maintaining standards for measurement through field and laboratory testing when following a defined or industry standard. Measures of QC success include precision, accuracy and reproducibility of test results. The following QC procedures will be implemented as follows

Field Blank

Field blank samples reflect the ambient conditions during the sampling program and are used to measure potential sampling contamination. Field blank bottles are laboratory supplied, pre-filled bottles of deionized water and are shipped to site with the other bottles. One field blank will be processed for each sampling location.

Trip Blank

Trip blank samples reflect the potential contamination that may occur during the transportation of the samples/bottles. The trip blank bottles are pre-filled with deionized water in the lab and shipped to site with the other bottles. The trip blank samples accompany other sample bottles to and from the sampling sites. One trip blank will be processed for each monitoring event.

Equipment Blank

Equipment blank samples reflect the adequacy of the equipment decontamination processes. Deionized water is poured over or through the decontaminated sampling equipment at the beginning of each day of the field program. One equipment blank will be processed for each day of sampling.

Duplicate Samples

To verify the precision of the samplers, duplicate water samples will be submitted for testing. A sequential duplicate sample requires that field personnel fill two sampling sets (a group of bottles from two different samples at the same depth). Sequential duplicate samples will be collected for 10% of the total number of samples, with a minimum of one duplicate taken per sampling event. The sampling program will submit blind duplicates for analysis (i.e., duplicate samples not labeled with the location).

Split Samples

To check on the laboratory's precision and accuracy, a split sample will be prepared in the field. A split sample is a discrete water sample separated into two identical tests and used to determine the reproducibility of the analysis. In theory, the individual test results from the split sample should be identical when analyzed by the laboratory. One split will be processed for each monitoring event.

3.7 Laboratory Analysis

3.7.1 Analytical Methods

General water parameters (pH, dissolved anions, nutrients) will be analyzed in accordance with procedures described in *Methods for Chemical Analysis of Water and Wastes* (United States Environmental Protection Agency), *Manual for the Chemical Analysis of Water, Wastewaters, Sediments and Biological Tissues* (British Columbia Ministry of the Environment), and/or *Standard Methods for the Examination of Water and Wastewater* (American Public Health Association).

Total and dissolved metals and organic parameter samples will be analyzed in accordance with procedures described in *Standard Methods for the Examination of Water and Wastewater* (American Public Health Association). Several methods will be employed for metals analysis, including Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) and Atomic Absorption Spectrophotometry (AA) to obtain the required detection limit for each element. Organic parameters will be analyzed using a gas chromatograph - flame ionization detector (GC/FID). Mercury will be analyzed by cold vapour AA.

The detailed analytical methods and detection limits have been provided by ALS Laboratory Group (ALS), and attached in Appendix B.

3.7.2 QA/QC Procedures

The samples collected from the field will be submitted to a CAEAL accredited laboratory. The QA program for an accredited laboratory includes document control, internal audits, quality control procedures, control charts, data validation, method validation, and detection limit management, staff training, sample tracking, and equipment calibration.

An example of laboratory QA/QC procedures has been provided by ALS, and attached in Appendix C.

3.8 Data Analyses

After laboratory analysis is complete, all chemistry data will be quality checked before formal statistical or trend analysis. Procedures to evaluate the integrity and quality of the chemistry data will be applied in two stages. The first stage will involve statistical evaluation of standard deviations across all data to identify any outliers or potential areas of analyses errors. The second stage, will involve evaluating expected water chemistry balances for measured versus calculated parameters such as cation/anion balance, conductivity, pH and, if possible, ANC.

Monitoring of water chemistry will occur at the same locations over time and should therefore be treated, statistically, as repeated measures ANOVA. However, no replicates are taken, so temporally pooled data will have to occur prior to rigorous parametric analysis. For example, the monthly data would be pooled quarterly, generating three replicates within each season. Variance will occur in space (among stations) and in time. In order to distinguish between these two potential sources of variance, the analysis of variance model, designed to test for spatial effects, will consider these two factors and the potential interaction between them.

The analysis of the temporal trend will proceed through a stepwise process initiated by simple charting over time of the parameter concentrations at each station. Regression analysis is the logical statistical tool used to investigate suspected temporal trends. Trend regression analysis will be conducted if a parameter of potential concern is indicated. To determine whether the trend differs from those at other stations, either up-gradient or down-gradient, a statistical test to investigate the differences in slopes will be performed (analysis of covariance).

Data analyses will include:

- Within-sample variation at each site using measures of central tendency (range, mean or median, standard deviation);
- Spatial variability in parameters controlled by the project water licence;
- Spatial trends quantitative analysis: To test whether there is any difference among stations, a repeated measures factorial ANOVA test will be performed with normalized data for parameters controlled by the project water licence for stations within the Jericho River (Control, C3, Carat, Jericho Lakes and Jericho River);

- Qualitative temporal trends will be evaluated using time series charts. Quantitative temporal trends, as required, will be investigated with regression analysis and determinations of differences among slopes (analysis of covariance); and
- Quantitative temporal trends among sites on the Jericho drainage using ANOVA.

4.0 SEDIMENT QUALITY

4.1 Objectives

The fine sediment on the bottom of the lake is an important component of the aquatic ecosystem, the quality of the sediment is monitored as part of this AEMP. The objective of the sediment monitoring program is to provide supporting environmental information regarding sediment quality when interpreting the results of the surface water and benthic invertebrate monitoring program.

4.2 Rationale

Surface runoff from the mine site, effluent discharge from the PKCA, and airborne contaminants that result from mining activities may adversely affect the quality of water and sediment in the waterbodies surrounding Jericho. Increasing levels of deleterious substances in the sediment could reduce the productivity of benthic communities and further impact the quality of the fish habitat.

As described in Section 3.2, runoff water from the mine may introduce sediments with contaminants into Carat Lake, Lake C1, and Key Lake. Discharge from PKCA may introduce suspended sediment into Stream C3 and Lake C3. Additionally, air emissions, which contain contaminants and are generated from the site activities, may fall in the surrounding waterbodies.

A prediction of the impact to the sediment quality in site waterbodies due to mining activities was not included in the AIA and potential constituents of concern were not identified. The 2006 Aquatic Effects Monitoring Program (Mainstream 2007) identified potential sediment constituents of concern including arsenic, chromium, copper, uranium, and zinc. The proposed AEMP is designed to focus on these constituents at the lakes within the zone of influence. As described in the Air Quality Monitoring Plan, potential dioxins and furans emission from the waste incineration have been identified as a possible source of sediment contamination and will be monitored at the site during care and maintenance. Incinerator stack emission testing will be completed before the project resumes mining activities.

4.3 Summary of Previous Studies

Sediment analytical results gathered under the proposed AEMP will be interpreted in association with the baseline studies and the water quality monitoring results obtained during mining activities under previous ownership. Table 4.1 summarizes the historical sediment quality sampling programs.

Table 4.1: Summary of Historical Sediment Quality Sampling

Station	Location	Collection Year
Sediment Quality Sampling During Baseline Studies (1995-2000)		
CL01	Cigar Lake	1995
N/A [1]	Lake C3	2000
CL-03	Carat Lake (West basin)	1995, 2000
CL-04	Carat Lake (Centre basin)	1995, 2000
CL-06	Jericho Lake	1995, 2000
N/A [1]	Lake C1	2000
CL-07	Jericho River (middle)	1995
CL-08	Jericho River (north)	1995
CL-14	Key Lake	1996, 2000
CL-16	Lynne Lake	1996, 2000
CL-17	Ash Lake	1996, 2000
N/A [1]	Control Lake	1999, 2000
N/A [1]	Lake C3	1999, 2000
N/A [1]	Stream C3	1999
N/A [1]	Carat Lake, potential outfall	2000
Water Quality Sampling During Tahera Monitoring Programs (2004-2007)		
JER-SQ4	Lake C3 South Basin	
JER-SQ6	Carat Lake Centre Basin	2004, 2006
JER-SQ8	Jericho Lake North Basin	2004, 2006
JER-SQ9	Jericho River Downstream of Jericho Lake	2004, 2006
JER-SQ10	Control Lake	2004, 2006
JER-SQ11	Reference Lake 1 [2]	2004, 2006
JER-SQ13	Lake C1	2004, 2006

Note:

1. The monitoring locations were indicated in the 2005 AEMP; however, reports containing the station codes were not available at the time of this document being prepared.

4.4 Monitoring Stations

Lakes near benthic macro invertebrates sampling locations have been selected as sediment monitoring stations to reflect the surrounding sedimentary environment. Table 4.2 details the specific purpose and general location of the monitoring stations. More detailed locations for the monitoring stations can be found in Figure 4.

Table 4.2: Sediment Quality Monitoring Stations and Purpose

Station	Previous Station Code	Location	Purpose
JER-AEM-01	JER-SQ11	Reference Lake 1 (1)	Reference Lake
JER-AEM-02	JER-SQ11	Reference Lake 2	Reference Lake
JER-AEM-03	JER-SQ10	Control Lake	Upstream Far field
JER-AEM-07	JER-SQ4	Lake C3 South Basin	Near field - PKCA discharge
JER-AEM-09	JER-SQ13	Lake C1	Near field – potential runoff and dust
JER-AEM-13	N/A	Lake C4	Near field - potential dust from incinerator
JER-AEM-15	JER-SQ6	Carat Lake Centre Basin	Near field - potential runoff and dust
JER-AEM-17	JER-SQ8	Jericho Lake	Far field of Jericho River group
JER-AEM-18	JER-SQ9	Jericho River Downstream of Jericho Lake	Far field of Jericho River group
JER-AEM-19	N/A	Lake O1	Near field – potential runoff and dust
JER-AEM-20	N/A	Lake O2	Near field – potential runoff and dust
JER-AEM-23	N/A	Key Lake	Near field – potential runoff and dust
JER-AEM-24	N/A	Lynne Lake	Near field – potential runoff and dust

Note:

1. “Reference Lake 1” is renamed from the “Cigar Lake” referred in aquatic effect monitoring programs between 2004 and 2007 (See Footnote 1 on Page 7 for details).
2. Reference Lake 2 will be identified and investigated during the baseline study in 2011.

4.5 Frequency and Replication

Sediment samples for metals analysis will be collected during the spring freshet period in conjunction with the macro invertebrate sampling schedule. Sediment samples for dioxins and furans analysis will be collected at the direct downwind location (JER-AEM-24) and close to the incinerator (JER-AEM13). Table 4.3 provides the monitoring frequency to be followed during care and maintenance activities. Each sample event consists of five replicates.

Table 4.3: Sediment Quality Monitoring Parameters and Frequency

Station	Location	Sediment Quality	Frequency
JER-AEM-01	Reference Lake 1 (1)	Total extractable metals, Dioxins and Furans	Annual (spring)
JER-AEM-02	Reference Lake 2 (2)	Total extractable metals	Annual (spring)
JER-AEM-03	Control Lake	Total extractable metals	Annual (spring)
JER-AEM-07	Lake C3 South Basin	Total extractable metals	Annual (spring)
JER-AEM-09	Lake C1	Total extractable metals	Annual (spring)
JER-AEM-13	Lake C4	Dioxins and Furans	Annual (spring)
JER-AEM-15	Carat Lake Centre Basin	Total extractable metals	Annual (spring)
JER-AEM-17	Jericho Lake	Total extractable metals	Annual (spring)
JER-AEM-19	Lake O1	Total extractable metals	Annual (spring)

Table 4.3: Sediment Quality Monitoring Parameters and Frequency

Station	Location	Sediment Quality	Frequency
JER-AEM-20	Lake O2	Total extractable metals	Annual (spring)
JER-AEM-23	Key Lake	Total extractable metals	Annual (spring)
JER-AEM-24	Lynne Lake	Total extractable metals, Dioxins and Furans	Annual (spring)

Note:

1. "Reference Lake 1" is renamed from the "Cigar Lake" referred in aquatic effect monitoring programs between 2004 and 2007 (See Footnote 1 on Page 7 for details).
2. Reference Lake 2 will be identified and investigated during the baseline study in 2011.

4.6 Field Sampling

4.6.1 Sampling Methods

Water column depth to 0.1 m resolution will be measured with a portable sonar unit. Prior to launching the sediment sampling device and as indicated in Section 3.6.1, additional water samples will be collected at approximately 1 m above the lake bed. Sediment samples will then be collected with a stainless steel 15 cm × 15 cm × 15 cm Ekman sediment grab sampler.

Samples will be taken from the top 5 cm and from the central part of the grab. Each sediment sample will be divided and placed in two 125 mL wide-mouth glass jars. The pre-labelled glass jars will be laboratory supplied. Glass jars containing samples from the same station will be placed in a clean plastic bag to avoid cross-contamination. Samples will be stored in coolers below 4°C prior to shipment, and chain of custody forms will be used to track samples.

4.6.2 QA/QC Procedures

4.6.2.1 Quality Assurance

The sediment quality monitoring will be undertaken in conjunction with the water quality monitoring program. The analytical results will be incorporated and evaluated concurrently with other monitoring programs. The quality assurance protocols implemented will be the same as those described in Section 3.6.2.1.

4.6.2.2 Quality Control

Decontamination

Deionized water will be poured over the Ekman dredge daily to ensure it is adequately decontaminated during the sediment sampling program. The deionized water will be collected and analyzed as the equipment blank. One equipment blank will be processed for each sampling day.

The Ekman grab sampler and sampling spoon will be thoroughly washed with lake water at each sampling station. Visual examination will be conducted to ensure no residual sediment particles remain on the sampler.

Duplicate Samples

Five replicate sediment samples will be collected at each sampling station. The analytical results will also be used as duplicate QC samples.

Split Samples

As verification of the laboratory's precision and accuracy, a split sample will be prepared in the field. A split sample is a discrete sediment sample from the same sediment grab, separated into two identical tests. However, due to the heterogeneity of the sediment sample, the relative percent difference (RPD) between the split samples may be higher. One split will be processed for each sample collection event.

4.7 Laboratory Analysis

4.7.1 Analytical Methods

Sediment samples will be analyzed for total extractable metals in accordance with the most current standardized methods detailed in Appendix B.

4.7.2 QA/QC Procedures

Sediment samples will be submitted to the same laboratory as the water samples. The laboratory QA/QC procedures are to be kept consistent and are described in Section 3.7.2.

4.8 Data Analysis

Sediment chemistry data analyses will include the following:

- Spatial variability in key parameters. Arsenic, copper, chromium, nickel, uranium, and zinc were chosen in 2004 based on concerns expressed during the project review. Any parameters that are near the water licence discharge limit or are found in sediment sampling to be significantly increasing will be added.
- Spatial trends qualitative analysis. This will include graphical analysis and calculation of 90% confidence intervals. The 90% confidence interval was chosen in 2004 to be compatible with the confidence interval used for aquatic biota. Qualitative analysis is necessary because of the high within-site variability of some metals, particularly arsenic.
- Spatial trends quantitative analysis. To test for differences among sites upstream of, near, and downstream of the mine discharge, a single factor ANOVA will be calculated for selected parameters with normalized data for sites within the Jericho River (Control, C3, Carat, Jericho lakes and Jericho River downstream of Jericho Lake). Previous analyses of baseline data indicated significant differences among sites.
- Temporal and among-station trends. Every three years, sediment monitoring will be conducted in the main waterbodies. To test for variance among time and space, a two factor ANOVA will be designed. If a statistical trend is found that is not mirrored in control stations, aquatic biota data will be reviewed

to determine whether there are any measurable and significant aquatic effects. A coincidence of parameter increases and significant biological effects will be a trigger for adaptive management.

- Temporal trends within sites including graphical analysis and ANOVA. If statistical differences are found, aquatic biota data will be reviewed to determine whether there are any measurable and significant aquatic effects. A coincidence of parameter increases and significant biological effects will be a trigger for adaptive management.
- Temporal trends among sites on the Jericho drainage including graphical analysis and ANOVA. The latter analysis will be used for metals whose variability within sites does not mask variability between sites. Again, an increase in metals coupled with biological effects will trigger adaptive management.

5.0 SEDIMENT DEPOSITION

5.1 Objectives

The objective of the sediment deposition monitoring program is to measure and assess sediment deposition rates within the targeted waterbodies. Results of the analysis will enable direct evaluation of any significant change in baseline sedimentation rates, potentially due to project activities. This information will be used to evaluate original impact assessments and provide an ongoing tool for identifying whether project controls require adaptation or change.

5.2 Summary of Previous Studies

Table 5.1 summarizes the historical sediment deposition monitoring programs. The results of the sediment deposition monitoring program under the current AEMP will be interpreted in association with the baseline studies before mining activities resume. Water quality monitoring results generated during mining activities under previous ownership will also be included.

Table 5.1: Summary of Historical Sediment Deposition Sampling

Station	Location	Collection Year[a]
JER-SD05	Lake C3 outlet	2006, 2007
JER-SD07	Carat Lake outlet	2005, 2006, 2007
JER-SD19 (same location as SD-1 in 1999)	Carat Lake at Stream C1	1999, 2005, 2006, 2007
JER-SD20 (same location as SD-3 in 1999)	Lake C3 at Stream C3	1999, 2005, 2007
JER-SD21	Carat Lake, west of causeway	2006, 2007
JER-SD22	Carat Lake, east of causeway	2006, 2007
JER-SD23 (as per 2005 and 2006 AEM reports, labelled as JER-SD10 in 2005 AEMP) (same location as SD-2 in 1999)	Control Lake	1999, 2005, 2006, 2007
JER-SD25 (as per 2005 and 2006 AEM reports, labelled as JER-SD11 in 2005 AEMP)	Reference Lake 1[(1)]	2005, 2006, 2007
JER-SD26 (as per 2005 and 2006 AEM reports, labelled as JER-SD08 in 2005 AEMP)	Jericho Lake	2005, 2006, 2007

Note:

1. “Reference Lake 1” is renamed from the “Cigar Lake” referred in aquatic effect monitoring programs between 2004 and 2007 (See Footnote 1 on Page 7 for details)

5.3 Rationale

Surface runoff from the mine site, effluent discharge from the PKCA, and airborne particulates from mining activities may increase sedimentation rates within ponded waters surrounding the site. As described in the AIA, the runoff water from the mine may introduce suspended sediments into Carat Lake, Lake C1, and Key Lake. The discharge from PKCA may introduce suspended sediment into Stream C3 followed by Lake C3. In addition, mining activities can to increase airborne particulates, which in turn can increase inputs to surrounding waterbodies.

Detrimental effects from increased sediment loading as indicated in the AIA include:

- Reduced primary production from decreased light penetration;
- Reduced benthic community production due to alterations in habitat and periphyton; and
- Detrimental effects to the fish assemblage resulting from reductions in benthic food resources, and loss of suitable spawning, incubation, and larval habitats.

The current AEMP is designed to monitor the quantity of sedimentation at the lakes within the zone of influence.

5.4 Monitoring Stations

The control sampling stations are selected at the littoral zone in Reference Lake 1 (JER-AEM-01). Monitoring stations include downstream near-field and far-field locations from the PKCA discharge, Stream C1, and Lynne Lake. Previous monitoring reports indicate that increased sediment deposition was found near the causeway in Carat Lake. Two monitoring stations (JER-AEM-12A and -12B) were chosen, one at either side of the causeway. In 2007, man-made shoals were constructed as per the Fisheries Authorization (EBA, 2007). The sediment deposition Table 5.2 provides the specific purposes of the monitoring stations. The locations of the monitoring stations are shown on Figure 5.

Table 5.2: Sediment Deposition Monitoring Stations

Station	Previous Station Code	Location	Purpose
JER-AEM-01A	JER-SD25	Reference Lake 1	Outside watershed control 1
JER-AEM-02	N/A	Reference Lake 2	Outside watershed control 2
JER-AEM-03A	JER-SD23	East side of Control Lake	Upstream control
JER-AEM-06	JER-SD20	Lake C3 at Stream C3	Near field; PKCA discharge
JER-AEM-08	JER-SD05	Lake C3 outlet	Far field; PKCA discharge
JER-AEM-11	JER-SD19	Carat Lake near Stream C1	Near field; Stream C1 discharge
JER-AEM-12A	JER-SD21	Carat Lake west of causeway	Near field; causeway effects
JER-AEM-12B	JER-SD22	Carat Lake east of causeway	Near field; causeway effects
JER-AEM-16	JER-SD07	Carat Lake outlet	Far field; Stream C1 discharge
JER-AEM-17	JER-SD26	Jericho Lake	Far field
JER-AEM-23	N/A	Key Lake	Near field – Runoff from waste rock pile

Note:

1. "Reference Lake 1" is renamed from the "Cigar Lake" referred in aquatic effect monitoring programs between 2004 and 2007 (See Footnote 1 on Page 7 for details)

5.5 Frequency and Replication

Sediment traps will be deployed at the sampling stations, and the trapped samples will be collected after one year. Table 5.3 lists sediment deposition samples collected for baseline characterization at Jericho. One sample will be collected from each monitoring station. Sediment traps will be mobilized in the summer of 2011 and collected in summer 2012 to characterize non-operational deposition rates. Once the project transitions into operations, the frequency illustrated in Table 5.3 will be implemented.

Table 5.3: Sediment Deposition Monitoring Frequency

Station	Location	Sediment Analysis	Frequency [1]
JER-AEM-01	Reference Lake 1 [2]	Total dry weight and organic content	A2
JER-AEM-02	Reference Lake 2 [2]	Total dry weight and organic content	A2
JER-AEM-03A	East side of Control Lake	Total dry weight and organic content	A2
JER-AEM-06	Lake C3 at Stream C3	Total dry weight and organic content	A2
JER-AEM-08	Lake C3 outlet	Total dry weight and organic content	A2
JER-AEM-11	Carat Lake near Stream C1	Total dry weight and organic content	A2
JER-AEM-12A	Carat Lake west of causeway	Total dry weight and organic content	A2
JER-AEM-12B	Carat Lake east of causeway	Total dry weight and organic content	A2
JER-AEM-16	Carat Lake outlet	Total dry weight and organic content	A2
JER-AEM-17	Jericho Lake	Total dry weight and organic content	A2
JER-AEM-24	Lynne Lake	Total dry weight and organic content	A2

Note:

1. Monitoring frequency: **A1** Annual once in Winter (April);
A2 Annual once in Summer (July);

2. "Reference Lake 1" is renamed from the "Cigar Lake" referred in aquatic effect monitoring programs between 2004 and 2007 (See Footnote 1 on Page 7 for details)

5.6 Field Sampling

5.6.1 Sampling Methods

Sediment deposition traps will consist of a flotation and retrieval apparatus, a Dacron rope, an anchor, and a 500 mL plastic sediment deposition collection bottle suspended in the water column (Figure 5.6.1 below). The bottle position and orientation is maintained by placing the bottle inside a PVC pipe (30.5 cm long and 10 cm diameter) secured to the rope.

Traps will be located at stations with an approximate depth of 6 m (range 6.0 m to 6.3 m). The sediment deposition collection bottle will be elevated 1.2 m above the lake bottom. The flotation and retrieval apparatus will be positioned 2.5 m below the water surface to prevent disturbance from ice.

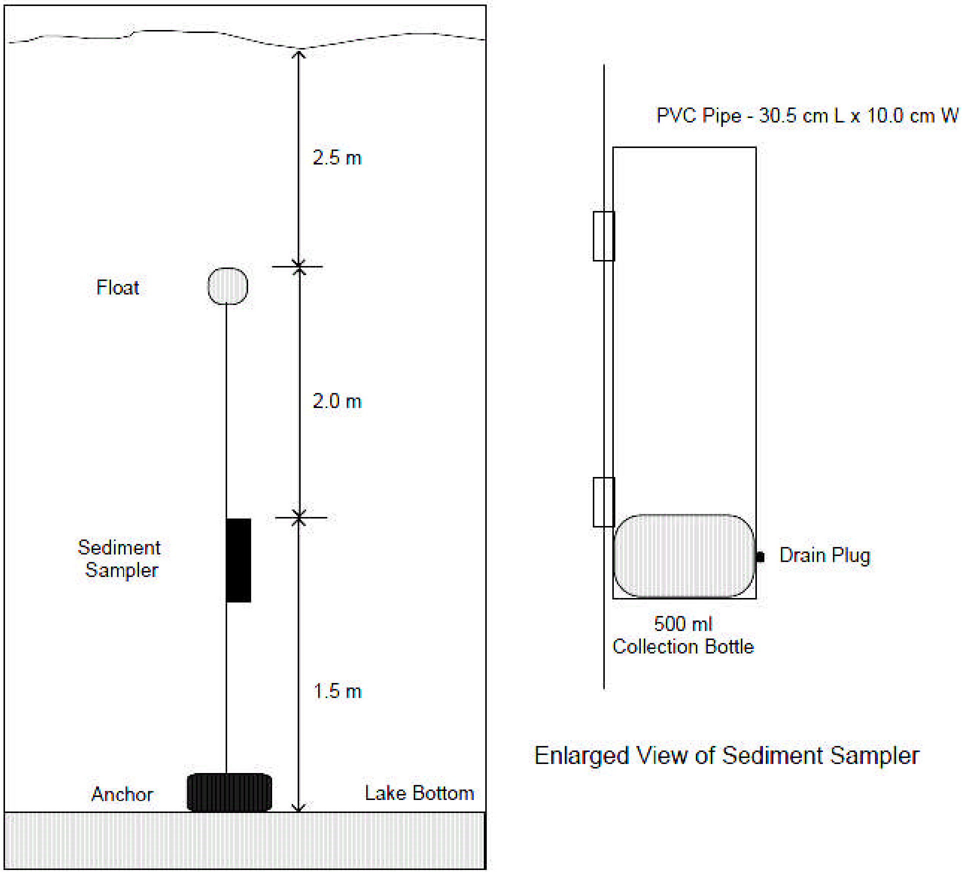

Figure 5.6.1 Conceptual Design of Sediment Trap (citied from Mainstream, 2006)

Retrieval of the trap entails:

- Gently lifting the unit until the PVC pipe reaches the surface;
- Releasing water within the pipe by removing the drain plug; and
- Securely capping the collection bottle before removal from the PVC pipe.

The samples from the sediment deposition collection bottle will be sent to the laboratory for processing.

5.6.2 QA/QC Procedures

One additional sediment trap will be deployed at Station JER-AEM-11. The sample will be used as the duplicate sample to check the field sampling precision.

5.7 Laboratory Analysis

5.7.1 Analytical Methods

The sediment deposition sample is to be thoroughly mixed and then filtered onto pre-weighed #47 Gelman GF/AE filters (nominal pore size 1 micron recommended for testing dissolved and suspended solids in water as described in Standard Methods for the Examination of Water and Wastewater) using a Millipore filter funnel and hand vacuum pump. The entire volume of each sample will be filtered using successive filters as required. Filters will be air dried, folded inward (in half), and individually stored in numbered foil packs.

Once all samples are processed, filters will be dried, weighed, and processed as follows:

- Oven dried for 24 hours at 105°C.
- Weighed using a Mettler M58A airlock/mechanical weight pan insertion balance (±5 μg).
- Placed in a muffle furnace for one hour at 550°C; the subsequent ash is cooled and reweighed.

5.7.2 QA/QC Procedures

The sediment samples will be submitted to the same laboratory as the water samples. The laboratory QA/QC procedures will be kept consistent, and are described in Section 3.7.2.

5.8 Data Analyses

Sediment deposition rate in mg/cm^2/day is calculated using the total dry weight of the collected sediment, divided by the cylinders' orifice area, divided by the number of days deployed.

One sample is collected at each station, which precludes statistical comparisons. Spatial and temporal trends in deposition rate and particle size distribution are visually assessed in comparison to control stations to identify the project's effect.

6.0 DISSOLVED OXYGEN

6.1 Objectives

The objective of the DO profile monitoring program is to document and track water column DO with respect to depth and temperature. This information will assist in determining potential changes in resident DO levels, which may indicate possible project effects. Significant changes in DO content can be linked to changes in lake trophic status, which can alter or restrict various components of a waterbody's food web. The monitoring program will track DO levels and compare results with previous work to identify any significant changes that may require changes in the current site management plan.

6.2 Summary of Previous Studies

Table 6.1 summarizes the historical DO monitoring programs. The proposed DO monitoring will be assessed in conjunction with baseline studies and results obtained during mining activities under the previous ownership.

Table 6.1: Summary of Historical Dissolved Oxygen Chemistry Sampling

Station	Location	Collection Year
Dissolved Oxygen Profile Monitoring During Baseline Studies (1995-2000)		
W1-1	West side of Carat Lake	1995, 1996
W1-2	East side of Carat Lake	1995, 1996
W2	Jericho Lake	1995, 1996
W3 (in 1995 and 1996) LM-3 (in 1999)	Lake C3	1995, 1996, 1999
W4 (in 1996) LM-4 (in 1999)	Lake C1	1996, 1999
W5	Interbasin One between Carat Lake and Jericho Lake	1996
W6	Interbasin Two between Carat Lake and Jericho Lake	1996
LM-7	Lake C2	1999
LM-9	East end of Long Lake (now PKCA)	1999
LM-10	West end of Long Lake (now PKCA)	1999
Dissolved Oxygen Profile Monitoring During Tahera AEM Programs (2004-2007)		
JER-DO04	Lake C3	2004, 2006
JER-DO06	Carat Lake	2004, 2006
JER-DO08	Jericho Lake	2004, 2006
JER-DO10	Control Lake	2004, 2006
JER-DO11	Reference Lake 1	2004, 2006

6.3 Rationale

Mining activities have the potential to release, and therefore increase, the levels of nutrients, ammonia, and other organic compounds in nearby waterbodies. Increased nutrient levels can stimulate changes in the overall productivity and character of the receptor waterbody. Direct changes can be exhibited by increased primary production and subsequent increased biomass of secondary consumers. An increase in biomass leads to an associated increase in biodegradable materials in the water column and on benthic substrates. This can lead to an increase in the level of aerobic bacterial decomposition, which directly reduces DO levels. Significant changes to, or reductions in, DO content can alter food web components. In extreme cases of prevalent anoxic conditions, species can be severely restricted or even eliminated from the food web. Baseline DO measurements in winter will also be useful in determining the likelihood of overwintering habitat for fish. Oxygen levels, particularly in shallow lakes, can fall to levels that preclude fish survival due to aerobic decomposition and lack of water circulation.

The AEMP is designed to monitor the DO and temperature profiles in the lakes that receive mine runoff and PKCA discharge.

6.4 Monitoring Stations

The sampling locations include the major lakes in each of the sub-watersheds described in Section 2.2. Table 6.2 outlines the specific purposes of the monitoring stations. The locations of the monitoring stations used during care and maintenance activities are shown on Figure 6.

Table 6.2: Dissolved Oxygen Profile Monitoring Stations

Station	Previous Station Code	Location	Purpose
JER-AEM-01	JER-DO11	Reference Lake 1 (1)	Reference lake
JER-AEM-03	JER-DO10	Control Lake	Far field – Upstream of Lake C3
JER-AEM-07	JER-DO04	Lake C3	Near field - PKCA discharge
JER-AEM-15	JER-DO06	Carat Lake	Near field - Surface runoff
JER-AEM-16	N/A	Carat Lake Outlet	Near field - Surface runoff
JER-AEM-17	JER-DO08	Jericho Lake	Far field – Inflow from Carat Lake
JER-AEM-20	N/A	Lake O2	Near field - Surface runoff from airstrip area
JER-AEM-23	N/A	Key Lake	Near field - Surface runoff from waste rock pile

Note:

1. “Reference Lake 1” is renamed from the “Cigar Lake” referred in aquatic effect monitoring programs between 2004 and 2007 (See Footnote 1 on Page 7 for details)

6.5 Frequency and Replication

The DO and temperature profile in the water will vary considerably between open water and under ice conditions. The water chemistry profile will be monitored twice annually during care and maintenance activities: once in summer and once in winter.

Table 6.3: Dissolved Oxygen Profile Monitoring Frequency

Station	Location	Parameters	Frequency
JER-AEM-01	Reference Lake 1 (1)	DO, Temp, pH, EC, Turbidity in 1 m interval	A1, A2
JER-AEM-03	Control Lake	DO, Temp, pH, EC, Turbidity in 1 m interval	A1, A2
JER-AEM-07	Lake C3	DO, Temp, pH, EC, Turbidity in 1 m interval	A1, A2
JER-AEM-15	Carat Lake	DO, Temp, pH, EC, Turbidity in 1 m interval	A1, A2
JER-AEM-16	Carat Lake Outlet	DO, Temp, pH, EC, Turbidity in 1 m interval	A1, A2
JER-AEM-17	Jericho Lake	DO, Temp, pH, EC, Turbidity in 1 m interval	A1, A2
JER-AEM-20	Lake O2	DO, Temp, pH, EC, Turbidity in 1 m interval	A1, A2
JER-AEM-23	Key Lake	DO, Temp, pH, EC, Turbidity in 1 m interval	A1, A2

Note:

1. Monitoring frequency: **A1** Annual once in Winter (April);
   A2 Annual once in Summer (Jul);
2. “Reference Lake 1” is renamed from the “Cigar Lake” referred in aquatic effect monitoring programs between 2004 and 2007 (See Footnote 1 on Page 7 for details)

6.6 Field Measurement

6.6.1 Measurement Methods

Exposure to atmospheric conditions can greatly alter a sample's DO, temperature, pH, and specific conductance. As such, in situ field measurement will be conducted for the DO profile monitoring program.

An in situ multi-parameter water quality meter will be used to measure the DO and temperature along with other water parameters including pH, EC, and turbidity. The parameters will be collected in 1.0 m intervals through the water column.

In situ DO and temperature measurements provide a high degree of accuracy given proper equipment calibration. The DO monitoring program will include daily verification of probe accuracy during sampling and documented weekly calibration to approved standards.

6.6.2 QA/QC Procedures

The procedures for the calibration of the water quality meter along with other field QA/QC procedures are described in Section 3.6.2 of this document.

6.7 Data Analyses

Analyses of the DO data will include data quality assurance, comparison to historic and previous data and trends, and assessment of significant change. Data quality assurance will include review of calibration records, and review of data with respect to potential outliers. Following data quality checks, all data will be plotted and assessed for potential trends, along with direct comparisons to historic and previous works. Any potentially significant trends or changes identified will be statistically evaluated.

7.0 AQUATIC BIOTA

Waterbodies within and near the Jericho Site area are representative of most typical subarctic systems. Nutrient levels are generally low for most constituents, ponded waters vary from small semi-permanent systems to large lakes, and streams can vary from ephemeral to permanent. Lakes are cold, nutrient poor, oxygen rich, and oligotrophic in nature (RL&L 2000c). Most streams are small with non-defined channels, coarse substrates, and low seasonal flows, except during and just after snowmelt (RL&L, 2000b).

Based on findings by RL&L (2000c), the biotic communities for the area surrounding the site can be characterized as follows:

- Aquatic macrophytes are severely limited in Jericho area lakes.
- The phytoplankton and periphyton communities have low densities and are dominated by relatively few taxa.
- Zooplankton densities are low and dominated by small bodied organisms.
- Benthic invertebrate communities exhibit low densities and diversity, but can show large variations in species composition between waterbodies.

- Fish communities are comprised of low density slow-growing species adapted to oligotrophic systems (Arctic char, Arctic grayling, lake trout, ninespine stickleback, round whitefish, and slimy sculpin).
- Fish migration is limited due to the presence fish barriers and a lack of connectivity corridors.
- Lake environments provide adequate feeding, spawning, and overwintering habitat; however, rearing habitat associated with streams is limited.

7.1 Parameters

Based on conditions specified in Schedule L of Licence NWBJER0410, the Jericho AEMP monitoring components are benthic macroinvertebrates, phytoplankton, periphyton, zooplankton, and fish (Table 7.1). The fish component consists of three target species: slimy sculpin, lake trout, and round whitefish. For the purposes of the AEMP, benthic macroinvertebrates and slimy sculpin are assumed to be sedentary indicators. Phytoplankton, zooplankton, lake trout, and round whitefish are assumed to be non-sedentary indicators.

Use of two groups of aquatic biota indicators (sedentary versus non-sedentary) requires use of two levels of effect evaluation: Station Effect and Waterbody Effect. Sedentary indicators, which do not have the potential to mix between stations within a waterbody, allow detection of an effect at the station level within a waterbody. Non-sedentary indicators require evaluation of effect at the waterbody level due to the potential for mixing of organisms within the entire waterbody. When assessing zooplankton and phytoplankton, replicates collected at stations are assumed to be representative of the entire waterbody. It is acknowledged that from a strictly statistical perspective this represents pseudo-replication.

Monitored parameters for each indicator are identified in Tables 7.1 and 7.2.

Table 7.1: Indicators and Parameters Measured as Part of the Jericho AEMP

Indicator	Parameter	
Phytoplankton, Zooplankton, Periphyton, and Benthic invertebrates	Taxa richness; taxa diversity; density; biovolume; biomass index (Chl. a) Taxa richness; taxa diversity; density; biomass	
Fish	Metal contaminants ▪ Lethal: Muscle and liver (lake trout and round whitefish) ▪ Lethal: Whole body (slimy sculpin) ▪ Non-lethal: Dorsal biopsy (lake trout and round whitefish)	
	Community Structure	Species diversity Relative abundance (catch rate)
	Population Structure	Age distribution Length distribution Sex ratio
	Population Health	Gonad Weight, fecundity estimates Age at sexual maturity Body condition Growth rate

7.2 Waterbody and General Monitoring Locations

A detailed list of monitored waterbodies and watercourses is provided in Table 7.2. A summary of the sampling frequencies for each biotic component is presented in Table 7.3. Specific sample site locations and frequencies are presented separately within each biota section.

The fish population and health studies will not be conducted during care and maintenance activities but will be conducted before mining activities resume.

Table 7.2 Aquatic Biota Monitoring Waterbodies

Type	Waterbody and Location	Phytoplankton	Zooplankton	Periphyton	Benthic Macroinvertebrates
Control	Reference Lake	✓	✓		✓
	Stream to Reference Lake			✓	✓
Direct	Lake C3	✓	✓		✓
	Carat Lake	✓	✓		✓
	Stream between Lake C3 and Carat Lake				
	Stream C3			✓	✓
	Stream C2				✓
	Stream C1			✓	✓
Indirect	Lynne Lake	✓	✓		✓
	Stream D2				✓
	Lake O2	✓	✓		✓
	Stream O18				✓

Note:

1. The sampling locations of the control biota parameters will be identified during the reference lake study in 2011.

Table 7.3 Sample Frequency and Replication at Aquatic Biota Monitoring Stations

Parameter	Timing	Frequency
Phytoplankton	Summer	Annual beginning with baseline
Zooplankton	Summer	Annual beginning with baseline
Periphyton	Spring/ Summer/ Fall	Annual with validation
Benthic Macroinvertebrates	Spring	Annual beginning with baseline

7.3 Phytoplankton and Zooplankton

7.3.1 Objectives and Scope

The principal objective of phytoplankton and zooplankton monitoring is to provide reference data for comparison with historic and previous monitoring efforts, establish current conditions, and provide a benchmark for assessing change in waterbodies or watercourses that may be affected by the Jericho mine site and activities. The phytoplankton and zooplankton component is designed to ascertain potential effects on community structure and production as a result of changes in overall water quality or nutrient enrichment. Materials presented here include rationale for site selection, sampling methods, a description of analytical and statistical procedures to be deployed, depiction of quality control measures, and a listing of data presentation and assessment criteria.

Northern lakes and waterbodies are typically classified as oligotrophic, meaning that they are naturally low in nutrients, productivity, and species diversity. Consequently, these lakes are vulnerable to the addition of foreign nutrients, such as those found in mining effluent. Potential changes that may occur include alterations to species composition, increases in primary production (Chlorophyll *a*), changes in assemblages structure (dominant species), and increases in cyanobacteria.

Plankton have short life cycles, which makes them useful indicators of environmental effects. Alterations to the plankton community can have profound effects throughout the entire aquatic ecosystem; therefore, obtaining adequate background data regarding these communities is a potentially important tool for understanding what, if any, changes are occurring as a result of mining operations.

The usefulness of plankton as a monitoring tool is limited by the inherent variability of species composition. Plankton species in a given waterbody vary both annually and seasonally. Species also have a tendency for significant variability of distribution, both vertically and horizontally, throughout the water column (Wetzel 1983; Paterson 2002; Findlay & Kling 2002).

7.3.2 Historical Information

7.3.2.1 Zooplankton

Review of previous zooplankton studies revealed that the watershed containing the Jericho project is best categorized as an oligotrophic system with low zooplankton species numbers and densities. Species number did not exceed 15 and total densities were low (72, 272 organisms/m^3) (RL&L 2000c). Dominant species in the system included rotifers and cyclopoid copepods. The general speciation and dominance by copepods and rotifers indicated similarity to subarctic systems such as Itchen Lake, Lac De Gras, and Lac du Sauvage (RL&L 2000c).

7.3.2.2 Phytoplankton

Phytoplankton assemblages also fit within expected parameters for oligotrophic systems — low species diversity and composition, coupled with low overall Chlorophyll *a* returns. Jericho Lake phytoplankton species did not exceed 66 species, total densities were low 18,103 cells/mL, and summer Chlorophyll *a* values ranged from 0.4 mg/L to 2.3 mg/L (RL&L 2000a). Dominant species for various Jericho Mine site waterbodies included cyanobacteria (Carat Lake and Lake C1), Chrysophytes (Lake C3), and Chlorophytes (Long Lake). The species compositions found (low overall cell numbers, low production, and reduced species diversity) were noted to be similar to other studies conducted in the area (RL&L 2000c).

7.3.3 Potential Project Effects

Potential sources of nutrients and contaminants at the Jericho mine site include site runoff, effluent discharge from the PKCA, and the airborne particles resulting from mining activities. Waterbodies potentially vulnerable to direct effects include Carat Lake and Lake C3. Potential indirect effects may occur within the O-Lake group, the Lynne Lake group, and additional Jericho group lakes including Control Lake and the southern portion of Jericho Lake.

7.3.4 Sampling Rationale

The AEMP zooplankton and phytoplankton monitoring program will focus primarily on the Jericho Lake group, with additional sample sites located within the Lynne Lake and O-Lake systems. The study sites for the Jericho mine project will include a total of six sampling sites (Figure 7). The sample areas chosen will enable assessment of direct and indirect effects. The direct effect areas will include Lake C3 and Carat Lake. Indirect effect sampling areas will include Lake O2, Key Lake, and a control lake yet to be determined (either Reference Lake 1 or 2). All samplings will be performed at the deepest basin of each waterbody, except for Carat Lake where sites will be located within the central and northern basins. The rationale for site selection is as follows:

1. Lake C3 – a mid-basin site was chosen to complement water, sediment, benthic, and fish sampling efforts and provide additional biologic data related to potential direct effects resulting from stream C3 discharges.
2. Carat Lake – mid-basin and northern basin sites were chosen to complement water, sediment, benthic, and fish sampling efforts and provide addition biologic data related to potential direct effects resulting from stream C1 and C4 discharges.
3. Key Lake – a mid-basin site was chosen to complement water, sediment, benthic, and fish sampling efforts and provide additional biologic data related to potential indirect effects resulting from mine operations.
4. Lake O2 – a mid-basin site was chosen to complement water, sediment, benthic, and fish sampling efforts and provide additional biologic data related to potential indirect effects resulting from mine operations.

5. Control – a mid-basin site will be sampled either within Reference Lake 1 or 2 to complement water, sediment, benthic, and fish sampling efforts and provide a comparative control for analysis and assessments.

Previous sampling sites within Control Lake and Jericho Lake have not been included in this sampling design. Control Lake was deemed an indicator of indirect effects, which are adequately covered by the additions of Key and Lynne lakes. Previous works on Jericho Lake did not include a full suite of biological samplings. It also served as a downstream indirect effects sampling site; the inclusion of Key and Lynne lakes serves this purpose, as does the inclusion of a second Carat Lake site within the northern basin.

7.3.5 Sample Frequency

Sampling will be conducted once during care and maintenance. Annual monitoring will begin once mining operations resume.

7.3.6 Sampling Methodologies

7.3.6.1 Phytoplankton

Field

Phytoplankton will be collected following procedures described in Findlay and Kling (2003). Samples will be collected from the water column within the euphotic zone, which is assumed to be a water depth equal to two times the Secchi depth. In lakes that are shallower than two times the Secchi depth, samples encompass the entire water column to 1 m above the benthic interface to avoid contamination with sediment.

Each sampling will consist of a composite of five discrete sub-samples from the euphotic zone, collected using an integrated sampler. The integrated sampler consists of a weighted 3 cm diameter polyethylene tube. The tube will be gently lowered vertically into the water column and the top capped off before being lifted out of the water and drained into a 10 L carboy. Following thorough mixing of the composite samples, sub-samples will be transferred into 500 mL opaque sample bottles and kept in a cooler until transferred to the field lab. All sampling devices and holding containers will be thoroughly rinsed prior to and following sampling at each site.

Field Lab

Once at the field lab, samples will be allocated for enumeration and Chlorophyll *a* analysis. Samples destined for Chlorophyll *a* analysis will be filtered (300 mL) onto Whatman GF/C filter paper, covered with anhydrous $MgCO_3$, and frozen. Samples destined for enumeration will be preserved with a combination acid-Lugol's solution (0.5% by volume) and a formaldehyde acetic acid solution (2% by volume). All samples will be kept cool and stored in the dark until processing. All samples will be labelled with the station and replicate identifier, time, date, depth, volume sampled, preservative amount, and name of the collector.

Laboratory

Phytoplankton samples will be processed by a qualified phytoplankton taxonomist. Although slight variations in techniques may exist between labs, procedures are expected to generally follow those outlined in Lund et al. (1958). These procedures include transfer of a 10 to 100 mL sub-sample into a settling chamber prior to analyses. Sub-sample volumes will depend on cell densities, with a minimum of a 200 cell or unit count required. Diatom identification will be accomplished through mounts and examination under a compound microscope. Taxonomic keys used for identification may include Prescott (1970), Taft and Taft (1971), and Webber (1971).

Cell density (cells/mL) will be calculated through enumeration of specified transects of known area within the sedimentation chamber counting base. Counting will continue until a minimum of 200 cells or units are identified, and cell density will be calculated as the number of cells within this area, extrapolated back to the sub-sample and then original sample volumes.

Cell biovolume ($\mu m^3/m^3$) will be calculated by first measuring the physical dimensions (length, width, and depth) of 10 to 30 cells of each species in the sample. Representative cell biovolume is then generated by calculating individual cell volumes for all cells measured (using the nearest geometric shape(s)) and averaging these to produce an estimated cell biovolume for each species. The cell biovolume estimate for the subsample will then be extrapolated back to the original sample volume.

Chlorophyll *a* analysis will be conducted using the spectrophotometric-acetone extraction method described by Moss (1967a, 1967b). This method corrects for the presence of phaeophytin *a*, which may be present in decaying algal cells. This is achieved by acidification of the sample after initial measurement and referencing results to predetermined calibration curves.

Quality Control and Data Analysis

Quality control procedures will include duplicates, verification of identifications, and secondary verification of all enumerations. A minimum of 5% of all field samples will be blind duplicates to assess the precision of laboratory identifications and calculations. In addition, 5% of lab samples will also be re-examined. To assess identification precision, 5% of all samples will be sent to a secondary laboratory for identifications. If taxonomic identifications are unusual or difficult, specimens will be sent to appropriate secondary experts.

Statistical assessment will include assessment of overall data quality and outliers, correlations between community variables and habitat variables (Spearman rank correlations), comparative assessment between sampling areas (ANOVA), or comparative assessments between sampling areas with significant correlations with habitat variables (ANCOVA). Statistical test will be considered at $\alpha=0.05$, and level of power and effect size evaluations will be conducted based on recommendations by Environment Canada (2002).

For each phytoplankton site, the total number of species, dominant species, species composition, biovolume, density, and Chlorophyll *a* concentration will be calculated. Following baseline assessments, within and between site variations will be determined through statistical analyses.

7.3.6.2 Zooplankton Methodologies

Field

Zooplankton will be collected following the general procedures described in Paterson (2003). Each zooplankton sample will consists of a composite of five vertical entire water column hauls. Each haul will be taken from 1 m above the benthic substrate to the waterbody surface. A Wisconsin plankton net (300 mm opening; 64 µm mesh) will be used. For each haul, the net is lowered to the desired depth and then retrieved at a constant rate of 1.0 m/s. If field investigations or taxonomic results reveal extremely low densities or a need to provide depth specific samples, the use of a hose and pump or Schindler trap will be explored. Following each vertical haul, the resulting sample and subsequent rinsing aliquots will be transferred to a 100 mL sample bottle. Once sampling is finished, the sample volume will be treated with $CaCO_3$, and then preserved with buffered formalin to 5% by volume. All sampling equipment will be thoroughly rinsed before and after sampling at each site to prevent contamination.

Laboratory

Depending on facility and sample densities, specific equipment and some procedures may vary for laboratory analysis. In general, it can be expected that the following procedures and methods will be employed. Exact methods and procedures will be documented upon final selection of a facility.

1. Cladocerans and copepods will be enumerated from three 1 mL to 15 mL sub-samples using an automatic pipette with a dissecting microscope at magnifications of 12x to 50x.

2. Rotifers and copepod nauplii will be enumerated by counting either six fields (one field = 0.02625 cm^2) or the entire counting chamber (4.907 cm^2) using an inverted microscope at magnifications of 200x to 400x. Counts will continue until 200 mature or identifiable organisms are processed.

3. The numbers of organisms within each sample will be converted to densities per cubic metre for each site.

4. Probable identification keys will include Brooks (1957), Edmondson (1959), Chengalath (1971), Grothe and Grothe (1977), Stemberger (1979), Clifford (1991), and Pennak (2001).

Biomass of major taxonomic groups will be calculated based on animal length, as determined by ocular micrometer under various magnifications of a compound microscope. Length will be measured for 30 specimens of each species or genus, and weights calculated from published length-weight equations (Table 7.4). General equations will be used for taxa where length-weight equations are not available. For each sample, mean individual weights for each species are calculated by averaging estimated weights. Total biomass for each group (species or developmental stage) will be calculated as the product of its density and estimated mean individual weight.

Table 7.4: Length-weight regressions used in calculating zooplankton weights

Organism	Equation (ug=microgram)	Reference
Copepods (N I-adults)	lnW(ug) = 1.9526 + 2.399 lnL(mm)	Bottrell et al. 1976
Daphnia spp.	lnW(ug) = 1.6 + 2.84' lnL(mm)	Bottrell et al. 1976
Ceriodaphnia spp.	lnW(ug) = 2.8713 + 3.079 lnL(mm)	Bottrell et al. 1976
Scapholeberis spp.	lnW(ug) = 2.5623 +3.338 lnL(mm)	Downing & Rigler 1984
Chydorus sphaericus	lnW(ug) = 4.543 + 3.6360 lnL(mm)	Downing & Rigler 1984
Other Cladocerans	lnW(ug) = 1.7512 + 2.653lnL(mm)	Bottrell et al. 1976
Rotifers	lnW(ug) = -10.3815 + 1.574llnL(mm)	Sternberger & Gilbert. 1987

Quality Control and Data Analysis

Quality control procedures will include duplicates, verification of identifications, and secondary verification of all enumerations. A minimum of 5% of all field samples will be blind duplicates to assess the precision of laboratory identifications and calculations. In addition, 5% of lab samples will also be re-examined. To assess identification precision 5% of all samples will be sent to a secondary laboratory for identifications. If taxonomic identifications are unusual or difficult, specimens will be sent to appropriate secondary experts.

Statistical assessment will include assessment of overall data quality and outliers, correlations between community variables and habitat variables (Spearman rank correlations), comparative assessment between sampling areas (ANOVA), or comparative assessments between sampling areas with significant correlations with habitat variables (ANCOVA). Statistical test will be considered at α=0.05, and level of power and effect size evaluations will be conducted based on recommendations by Environment Canada (2002).

For each zooplankton site, the total number of species, dominant species, species composition, biomass, and density will be calculated. Following baseline assessments, within and between site variations will be ascertained through statistical analyses.

7.4 Periphyton

7.4.1 Objectives and Scope

The principle objective of the proposed periphyton sampling is to obtain baseline information about the communities and to be able to identify potential temporal changes in these communities.

In order to serve as a viable effect assessment tool, a preliminary background study will be conducted to determine if seasonal variations (species composition, potential variations within and between sites, and Chlorophyll *a* concentrations) are small enough to allow comparative analysis. This is important for establishing whether periphyton can function as an appropriate monitoring tool with defined endpoints (critical effects sizes and species compositions). If background variations are greater than those expected as a result of project influences, then periphyton will not serve as an appropriate tool.

Sampling will be conducted on three watercourses: stream C1, stream C3 (Figure 8), and a reference stream to be selected. There will a total of six sample sites: two on each stream, 50 m and 100 m upstream of the outflow (or mixing zone). Samples will be analyzed according to protocols outlined in the following sections. Sampling will be conducted in the summer at each site.

7.4.2 Rationale and Historical information

Periphyton is a mixture of algae, fungi, bacteria, protozoa, and detritus attached to substrates and submerged surfaces in most aquatic ecosystems. They are a vital food source for many small aquatic organisms. Periphyton absorb pollutants and are good indicators of water quality because, just like plankton, they have rapid life cycles and, due to their stationary lifestyles, they are easily sampled. Some varieties of periphyton are more sensitive to change and others are more tolerant; therefore, assessing species composition in a periphyton community can give insight into changes in the ecosystem.

Sampling for periphyton is typically done in wadeable watercourses and is, therefore, easier and more cost effective than many other types of sampling. Application as a lake assessment tool is currently under investigation.

Periphyton sampling was not conducted, as part of the previous AEMP work, at the Jericho Mine site. We anticipate that, like many other aquatic biota communities in this region, periphyton communities will have relatively low densities and few taxa.

7.4.3 Periphyton Methodologies

7.4.3.1 Field

Field methods will follow those outlined in *Freshwater Biological Sampling Manual, BC Ministry of Environment,* a brief summary is provided below.

During the first field visit, field staff will locate appropriate sample locations and accurately record location descriptions (that identify key landmarks) for each sample location, so that the sites can be easily located during subsequent site visits. It is important that the same locations be sampled consistently so that temporal changes in the water quality can be interpreted with confidence. Pertinent sample site information will be recorded in a log-book. Sites will be carefully photographed and site positions will be recorded in a GPS.

Periphyton sample sites will be selected with a preference for uniform substrate over the wetted width of the creek. Working in an up-stream direction, five rocks will be randomly selected and brought back to shore. Algal scrapings will be obtained from each rock, using a scraping cup, deionized water, a toothbrush, and a modified turkey baster. Samples will be transferred into pre-labelled bottles, placed in a garbage bag, and immediately placed into coolers with ice (for biomass analysis). Samples to be analyzed for Chlorophyll *a* will be filtered, packaged, preserved, placed on ice and then shipped to the lab. Samples to be analyzed for taxonomy will be preserved with Lugol's solution.

These sampling procedures may be modified to suit the protocols of the lab selected for the analysis and to accommodate potential variables encountered during the baseline site evaluations.

7.4.3.2 Laboratory

Typically, laboratories provide explicit instructions, regarding their preferences for sample preservation and handling and they follow standard protocols for sample analysis. We will review the lab protocols to ensure that the analysis performed is suitable.

7.4.4 Sample Analysis and Quality Control

Analysis of periphyton samples will be conducted by two parties:

1. Quality Control and Data Analysis: An analytical laboratory that will be testing samples for ash-free dry weight (g) and Chlorophyll *a* and Pheophytin-*a* (µg). The results of this analysis will be provided in a concise report and forwarded to EBA, A Tetra Tech Company (EBA), for further analysis and incorporation of results into the AEMP.

2. A Periphyton Taxonomist that will identify and count species and provide metric calculations. The results will most likely be provided in a short report that EBA will incorporate into the AEMP.

Quality control measures will include a minimum of 5% field blind duplicates, and 5% of samples sent to a secondary laboratory source for identification. In addition, all data received will be checked for errors and outliers.

Quality control measures adopted by the selected laboratory will be included in the AEMP following acceptance of the baseline program.

Data analysis for the initial periphyton program will include comparison of total biomass, dominant taxa, and Chlorophyll *a*. Spatial and temporal variations will be ascertained by comparing within site samples. Variables will be first tested for correlations (Spearman). For sites without strong correlations, a two-way ANOVA will be used. For those sites with strong correlations, a series of ANCOVA's will be used.

7.4.5 Periphyton Validation

The suitability of periphyton as an effects assessment tool will be undertaken by examining seasonal biomass trends and spatial and temporal changes in community structure. Variability with respect to temporal spatial, community structure, dominant species, Chlorophyll *a*, and site characteristics will be determined statistically within and between sites to determine whether viable defined endpoints can be established to support monitoring needs. If analysis shows that periphyton is a viable effects assessment tool, an expanded program will be devised. If not, a recommendation and rationale to discontinue will be provided.

7.5 Benthic Macroinvertebrates

7.5.1 Objectives

The overriding objective of the benthic macroinvertebrate monitoring component of the AEMP is to provide biological corroboration of changes that may occur due to project activities, specifically, changes in water and sediment quality that can alter the existing character of the community. Assessment will include evaluation of significant changes relevant to existing baseline conditions, significant changes relevant to anticipated effects as outlined in the environmental assessment report, and spatial and trend analysis to determine potential, but not necessarily significant, deviations from baseline data. The overall goal is to provide a mechanism to identify potential effects, ascertain significance, and correlate potentially significant changes to project activities in order to enable proactive environmental management decisions.

7.5.2 Background

Benthic invertebrate communities occur in a wide variety of habitats and reflect the physical and chemical characteristics of their surroundings. General habitat requirements include the presence of substrate, DO, and a food source, as well as the absence of acute toxicity and extreme physical conditions (e.g., extremes of scouring, water level fluctuations, temperature). Two general habitat types determine the characteristics of the benthic invertebrate community that will be present: depositional habitats and erosional habitats. Depositional habitats consist of still or slow-moving water where the substrate, or bottom material, consists of fine sediments such as sand, silt, or clay. Organisms that live in depositional environments mostly live on top of the substrate or burrow into it. Depositional habitats are usually the dominant habitat in waterbodies and slow-flowing watercourses, but may also occur in specific habitats in swifter watercourses, such as backwaters and pools. Erosional habitats are characterized by swift-flowing water with substrates that consist of coarser material such as gravel, cobble, or boulder-sized particles. Organisms that live in erosional environments usually live on top of the substrate or in the spaces between the rocks.

7.5.3 Historic Benthic Invertebrate Community

The following benthic community history was summarized from previous monitoring works, several baseline studies, and reviews of data from the Jericho study site. Most of summary data presented here was summarized from the RL&L Environmental Impact Assessment (2000c).

Overall, the benthic invertebrate communities were noted to be similar to other subarctic systems with findings of low diversity and density, similar to what is expected within oligotrophic systems.

Within the Jericho mine area, lake benthic communities were noted to be dominated by few taxa with overall low densities. The dominant taxa found were Chironomids, and nematodes, oligochaetes, ostracods and pelecypods were also abundant. Species diversity and densities tended to be higher in the littoral zone (<5.0 m depth) than the deep waters (>5.0 m depth). Benthic invertebrate communities within streams were dominated by nematodes, oligochaetes, chironomids, and ostracods. However, large differences in species composition and diversity were noted between stream systems within the study site.

7.5.4 Sample Design and Site Selection

Timing is important when sampling benthic invertebrates as life cycle lengths can vary greatly between species. In general, the exact timing for the presence of mature larvae, pupae, or adults may be missed if community composition is highly variable or seasonal developments rates differ significantly. To minimize these impacts, benthic invertebrates will be sampled immediately following ice-out in the spring when late-stage larval forms are present but not yet mature. A spring sampling will provide highest species diversity; however, determination of seasonal variability is not possible with a single sampling. Benthic macroinvertebrates will be sampled annually each spring commencing with baseline studies.

At present, no benthic invertebrate sampling is scheduled to be conducted during ice cover. If it is ascertained that mine operations will lead to significant reductions in DO concentrations, which would be most prevalent during periods of ice cover, a winter sampling program will be implemented.

The designed benthic study does not incorporate provisions for collecting biomass for assessment of trace metal burdens. Although this condition has been implemented for other programs, results have shown insufficient amounts of biomass can be collected due to the prohibitively large amount of effort required (DeBeers Snap Lake Project, 2005).

The AEMP benthic invertebrate monitoring program will focus primarily on the Jericho Lake group, with specific attention paid to the direct effects on streams and associated waterbodies. The macroinvertebrate monitoring study sites for the Jericho mine project will include a total of 18 sampling sites (Figure 9). The chosen sample areas will enable assessment of direct and indirect effects. The direct effect areas will include streams C1, C2, and C3, and littoral and profundal zones located in Lake C3 and Carat Lake. Indirect effect sampling areas will include Stream O18 (between Lakes O1 and O2), Stream D2 (between Key and Lynne lakes), and the littoral and profundal zones of Lynne Lake and Lake O2. In addition, corresponding stream littoral, and profundal sites will be sampled for a chosen control system. Examination of the effects areas will include sampling within associated streams, within littoral areas adjacent to outflows of these streams, and within profundal zones corresponding to each outflow area. The 18 samplings sites will include:

1. Stream C3 Effects Area (3 sites) – a sampling site within stream C3 (300-500 m upstream of the outflow to Lake C3), a sampling site located within the littoral area of Lake C3 (<100 m from the outflow; < 5 m depth), and a site located within the profundal zone (< 300 m form the outlet; 5-10 m depth) in Lake C3.

2. Stream C1 Effects Area (3 sites) – a sampling site located within stream C1 (300-500 m upstream of the outflow to Carat Lake), a littoral zone sampling site (<300 m from the outflow), and a site located within the profundal zone (< 300 m form the outlet; 5-10 m depth) in Carat Lake.

3. Stream C2 Effects Area (3 sites) – a sampling site located within stream C2, a littoral zone sampling site (<300 m from the outflow), and a site located within the profundal zone (< 300 m form the outlet; 5-10 m depth) in Carat Lake. Due to the noted ephemeral nature of stream C2, selection of a within-stream site will depend on further field investigations.

4. O-Lakes Group (3 sites) – a sampling site will be located within Stream O18 (between lakes O1 and O2), a littoral zone sampling site within Lake O2 near the outflow of Stream O18, and a site located within the profundal zone (< 300 m form the outlet; 5-10 m depth) in Lake O2.

5. Lynne Lake Group (3 sites) – a sampling site located within Stream D2 (between Key and Lynne lakes), a littoral zone sampling site located in Lynne Lake (<300 m from the outflow), and a site located within the profundal zone (< 300 m form the outlet; 5-10 m depth) in Lynne Lake. Due to the noted ephemeral nature of the stream that connects Key and Lynne lakes, selection of a within-stream site will depend on further field investigations.

6. Control Area (3 sites) – as mentioned previously, the final decision of a control system will be undertaken before baseline studies begin. Regardless of whether the previous control (Reference Lake 1) or another is chosen, three corresponding stream, littoral, and profundal sites will be selected.

7.5.5 Field Surveys

Benthic invertebrate samples will be collected seasonally, shortly after ice off, commencing in the first year of baseline studies. If sample returns prove poor, as has been the case for previous works and several other mine baseline studies, the effectiveness of the program will be re-evaluated. Samples will be collected from streams, and lake littoral and pelagic zones.

7.5.5.1 Watercourses

For stream systems, five replicate samples will be collected at each site. Samples will be taken from a composite of habitats (riffle, run, and pool) and substrates (gravel, silt, sand, and cobble) types where feasible. Samples will be pooled. Given the relative small size, potentially seasonal nature, and predominantly coarse substrate found in the streams within the Jericho site, initial sampling efforts will focus on erosional habitat type. Sites will be sampled with a Surber sampler (bottom area of 0.093 m^2) equipped with a 210 μm mesh opening. If depositional habitats are encountered, they will be sampled with an Ekman grab (bottom area 0.023 m^2). Samples collected using the Ekman grab will be sieved through a 210 μm mesh sieve. All samples will be preserved in 10% neutral buffered formalin immediately after collection.

Additional supporting data collected at each stream sampling site will include UTM/GPS coordinates, water quality (pH, conductivity, DO, Temp), water velocity, water depth, visual inspection of substrate composition and aquatic plant cover, wetted and bankfull widths, and documentation of site characteristics by photography.

7.5.5.2 Waterbodies

Three replicate samples will be collected at each site using an Ekman grab (bottom area 0.023 m^2). If site substrate is found to be composed solely of coarse materials, a Petite Ponar grab will be used. Sample sites will be located using GPS reference points. Sampling for each replicate will consist of five random grabs depending on substrate encountered. If only coarse substrates are found, grab sampling will continue until 1 L of sediment has been obtained. Sediment volumes will be recorded for each sample replicate. Sediment samples will be transferred to clean five-gallon pails and transferred to shore for processing. All sediment samples will be sieved through a 210 μm or 500 μm mesh within 24 hours, transferred to appropriate containers, and preserved in 10% neutral buffered formalin. Samples will be shipped in sealed coolers to a qualified taxonomist for enumeration and identification.

Additional supporting data collected at each waterbody sampling site will include: UTM/GPS coordinates, water quality (pH, conductivity, DO, temperature), water depth, visual inspection of substrate composition and aquatic plant cover, and documentation of site characteristics by photography.

7.5.6 Laboratory Analysis

Benthic invertebrate samples will be shipped to an accredited laboratory or taxonomist for sorting and identification. Samples will be sorted and identified following standard methods based on Gibbons et al. (1993) and Environment Canada (2002). The following general process should be used:

- Samples will be elutriated to remove sand and gravel.
- Inorganic materials will be removed and discarded.
- All organisms will be removed from inorganic materials.
- Remaining organic materials will be separated into size fractions using nested 1 mm and 250 µm mesh sieves.
- Invertebrates will be removed from the detritus under a dissecting microscope at 6x to 10x magnification.
- Coarse fractions will be sorted and fine fractions will be sub-sampled as per Wrona et al. (1982).
- All remaining material will be preserved for random checks of sorting efficiency.

7.5.7 Quality Control

Quality control procedures will include verification of sorting efficiency and secondary verification of questionable identifications. A minimum of 10% of all samples will be re-sorted, with a removal target of less than 10% difference. If greater than 10% error is found, all samples within the group will be re-sorted. If taxonomic identifications are unusual or difficult, specimens will be sent to appropriate secondary experts.

Invertebrates will be identified to the lowest practical taxonomic level. Invertebrates will be identified to the levels recommended by Environment Canada (1998) and metal mining EEM standards — i.e., to the genus level for most species. Exceptions will be made for constituents that typically require extensive knowledge and time commitment to identify to the genus level. In general, target taxonomic levels will be as follows:

1. Oligochaeta and Hirundinea to species;
2. Nematoda to phylum;
3. Coelenterata, Pelecypoda, Gastropoda, and Insecta to genus;
4. Turbellaria to family;
5. Acarina to order;
6. Zooplankton will be identified to major taxon (Cladocera, Calanoida, Ostracoda, Harpacticoida, and Hydracarina).

Damaged organisms and early instars will be identified to family where feasible. Organisms that require detailed microscopy will be mounted on slide for identification. Specimen identifications will be made in reference to Brinkhurst (1986), Clifford (1991), Epler (2001), Merritt and Cummins (1996), Pennak (2001), Stewart and Stark (1988), and Wiederholm (1983).

Biomass will be measured as total dry weight per composite sample and as dry weight of each major group. A reference collection of samples will be prepared, and updated as necessary throughout the monitoring program. Samples will be stored for a minimum of six years for comparison.

7.5.8 Data Analysis

Before analysis, data entry checks will be conducted to ensure validity of the data. Data from terrestrial or non-benthic organisms will be sequestered, and all summary variables screened for potential outliers. All outliers will be identified and tested statistically. Any manipulation to the data or transformations prior to statistical analysis will be documented.

Statistical assessment will include correlations between benthic community variables and habitat variables (Spearman rank correlations), comparative assessment between sampling areas (ANOVA), or comparative assessments between sampling areas with significant correlations with habitat variables (ANCOVA). Statistical test will be considered at α=0.10 and level of power and effect size evaluations will be conducted based on recommendations by Environment Canada (2002).

In addition to statistical analysis, the following results will be presented for each site:

1. Total abundance of each major group;
2. Taxonomic richness (total and mean number of taxa per site) of each major group;
3. Community composition (relative density as a percent of total density) at the level of major taxon, and midge (Chironomidae) composition at the subfamily level; and
4. Overall density ranking for each site:
   - Low - less than 5,000 organisms/m^2 and richness less than 10 taxa/site;
   - Moderate - density ranging from 5,000 to 50,000 organisms/m^2 and richness ranging from 10 to 40 taxa/site; and
   - High - density greater than 50,000 organisms/m^2; and richness greater than 40 taxa/site.

8.0 REPORTING

A report summarizing the methods and results of the monitoring program will be prepared and submitted in accordance with the Jericho water licence. The report will make recommendations to improve the program design, where appropriate.

9.0 CLOSURE

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2011 WATER LICENCE RENEWAL DOCUMENTS

Management Plans

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FIGURES

Figure 1	General Site Plan
Figure 2	Receiving Waterbodies Flowsheet
Figure 3	Water Quality and Quantity Monitoring Location Plan
Figure 4	Sediment Quality Monitoring Location Plan
Figure 5	Sediment Deposition Monitoring Location Plan
Figure 6	DO/Temperature Profile Monitoring Location Plan
Figure 7	Phyto/Zooplankton Monitoring Location Plan
Figure 8	Periphyton Monitoring Location Plan
Figure 9	Benthic Macroinvertebrate Monitoring Location Plan

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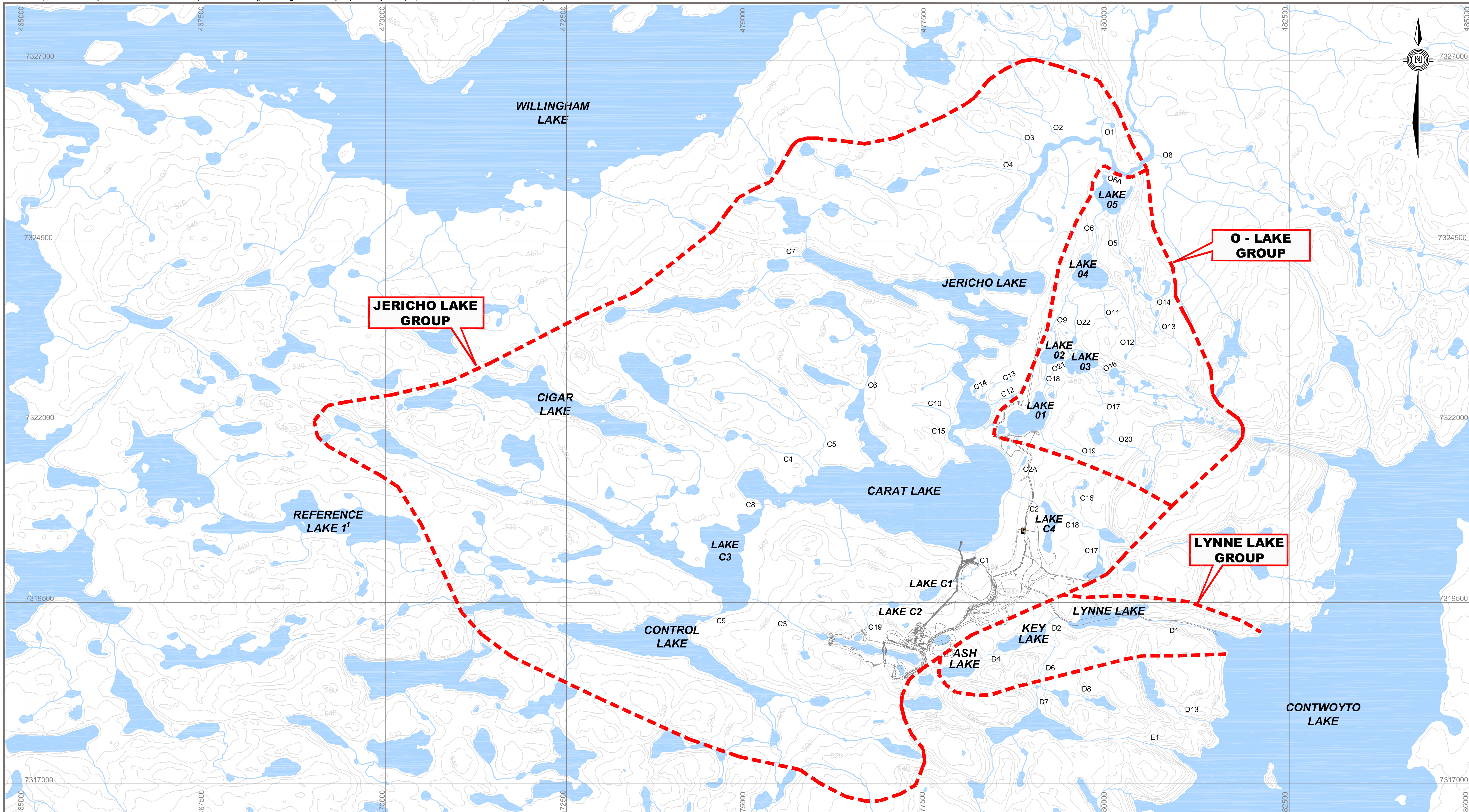

LEGEND

- SUB-WATERSHED

C19 - STREAM NAME

0 2 500

Scale: 1: 50 000 (metres)

NOTES

1. REFERENCE LAKE 1 WAS NAMED AS 'CIGAR LAKE' IN 2005 AEMP AND SUBSEQUENT AEM REPORTS. (MAINSTREAM, 2005-2008) . IT WAS IN CONFLICT WITH THE CIGAR LAKE IN AQUATIC BASELINE STUDIES (RL&L, 1995-1999)

2. CURRENT NAMING SYSTEM FOR THE LAKES AND STREAMS IS BASED ON THE AQUATIC BASELINE STUDIES (RL&L, 1995-1999)

3. DRAWING BASED ON NTS MAPS 76E13, 76E14, 76L03, 76L04

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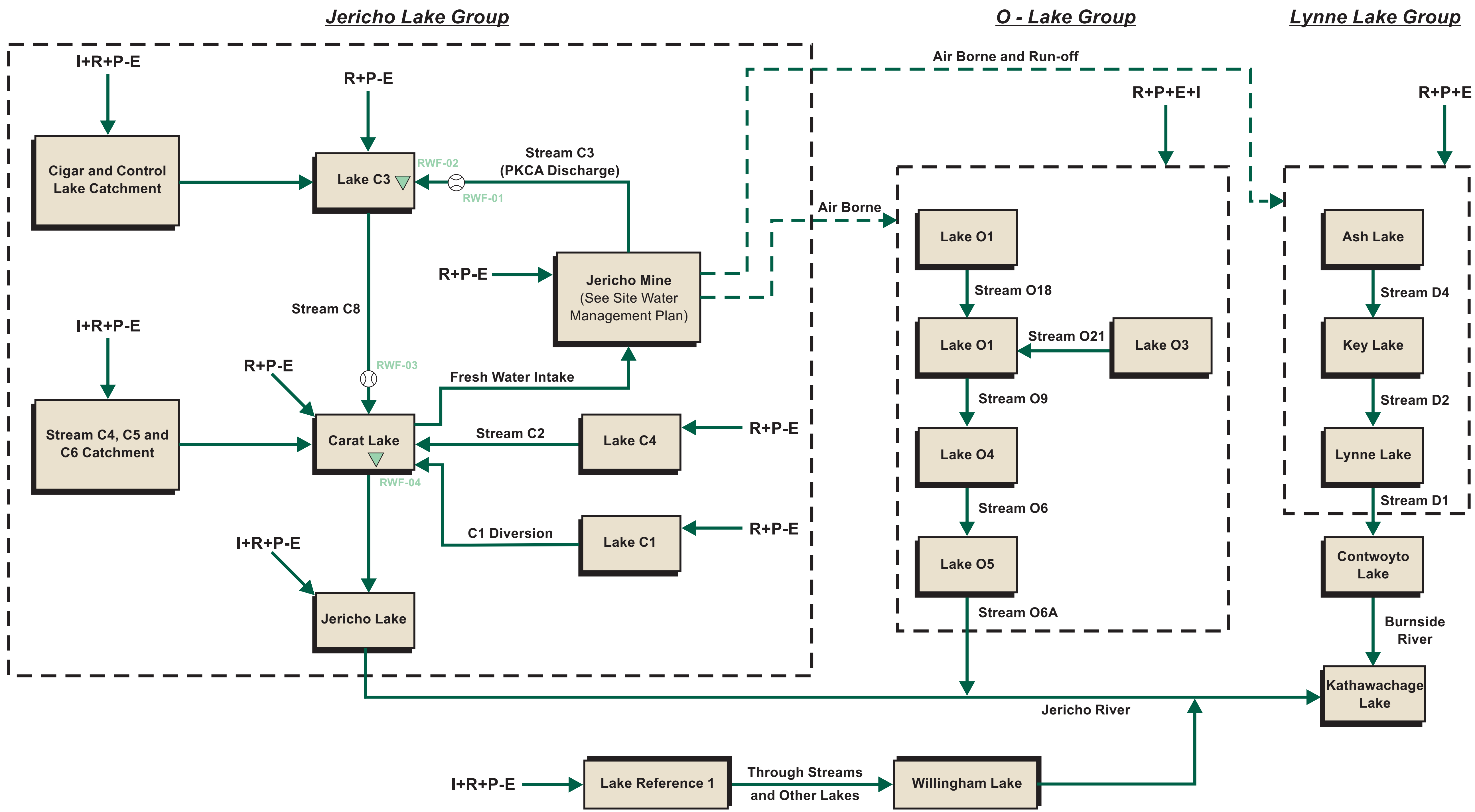
AQUATIC EFFECTS MONITORING PLAN
JERICHO DIAMOND MINE, NUNAVUT

GENERAL SITE PLAN

PROJECT NO.	DWN	CKD	REV
E14101118	MM	WL	0

OFFICE	DATE
EBA-EDM	January 31, 2011

Figure 1



LEGEND

- Sub-Watershed in Area of Impact
- Flow
- Potential Contaminant Pathway

P - Precipitation
R - Surface Runoff
E - Evaporation/Transpiration
I - Inflow
O - Outflow
Gw - Groundwater Inflow
Sp - Seepage
- Stream Flow Monitoring Location
- Water Level Monitoring Location

STATUS
ISSUED FOR USE

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AQUATIC EFFECTS MONITORING PLAN JERICHO DIAMOND MINE, NUNAVUT

RECEIVING WATERBODIES FLOWSHEET

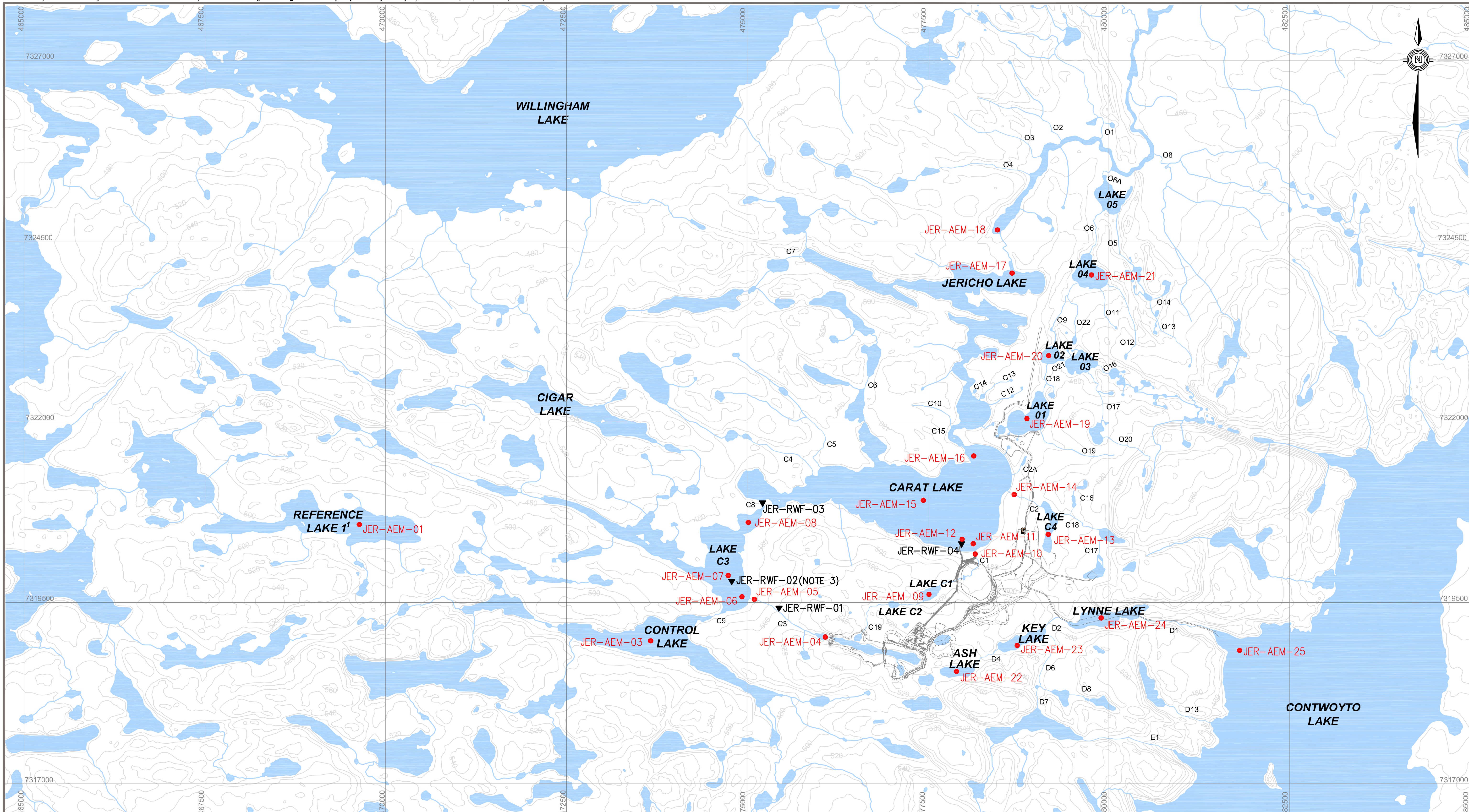
PROJECT NO.	DWN	CKD	APVD	REV
E14101118	DBD	WL	WL	0

OFFICE	DATE
EBA-EDM	January 31, 2011

Figure 2

E14101118_Figure 5_PKCA Management Plan.cdr

\\eba.local\corp\Edmonton\Drafting\CIVIL3D\E141\E14101118\acad\Aquatic Effects Monitoring\E14101118_FIG 3 AEMP.dwg [FIGURE 3] January 31, 2011 - 4:52:15 pm (BY: MARSH, MAUREEN)



LEGEND

- AEMP WATER QUALITY MONITORING STATION
- RECEIVING WATER FLOW MONITORING STATION

0 — 2 500

Scale: 1: 50 000 (metres)

NOTES

1. REFERENCE LAKE 2 WILL BE IDENTIFIED IN 2011. JER-AEM-02 WILL BE LOCATED AT REFERENCE LAKE 2.
2. DRAWING BASED ON NTS MAPS 76E13, 76E14, 76L03, 76L04
3. CONCEPTUAL LOCATION, EXACT LOCATION TO BE DETERMINED DURING CARE AND MAINTENANCE IN 2011.

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AQUATIC EFFECTS MONITORING PLAN JERICHO DIAMOND MINE, NUNAVUT

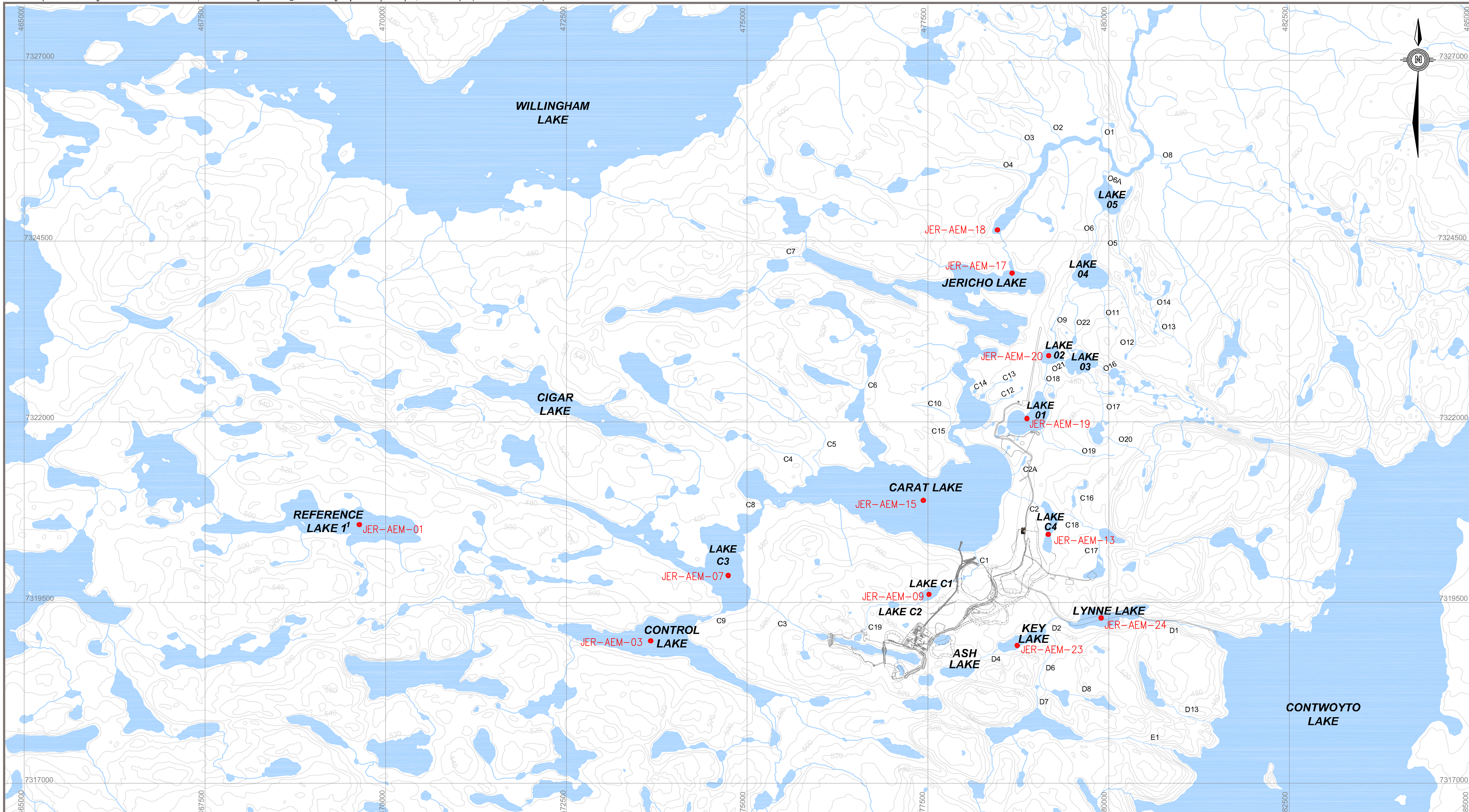
WATER QUALITY AND QUANTITY MONITORING LOCATION PLAN

PROJECT NO.	DWN	CKD	REV
E14101118	MM	WL	0

OFFICE	DATE
EBA-EDM	January 31, 2011

Figure 3

\\eba.local\corp\Edmonton\Drafting\CIVIL3D\E141\E14101118\acad\Aquatic Effects Monitoring\E14101118_FIG 4 AEMP.dwg [FIGURE 4] January 31, 2011 - 4:45:46 pm (BY: MARSH, MAUREEN)



LEGEND

- AEMP SEDIMENT QUALITY MONITORING STATION

0 2 500

Scale: 1: 50 000 (metres)

NOTES

1. REFERENCE LAKE 2 WILL BE IDENTIFIED IN 2011. JER-AEM-02 WILL BE LOCATED AT REFERENCE LAKE 2.
2. DRAWING BASED ON NTS MAPS 76E13, 76E14, 76L03, 76L04

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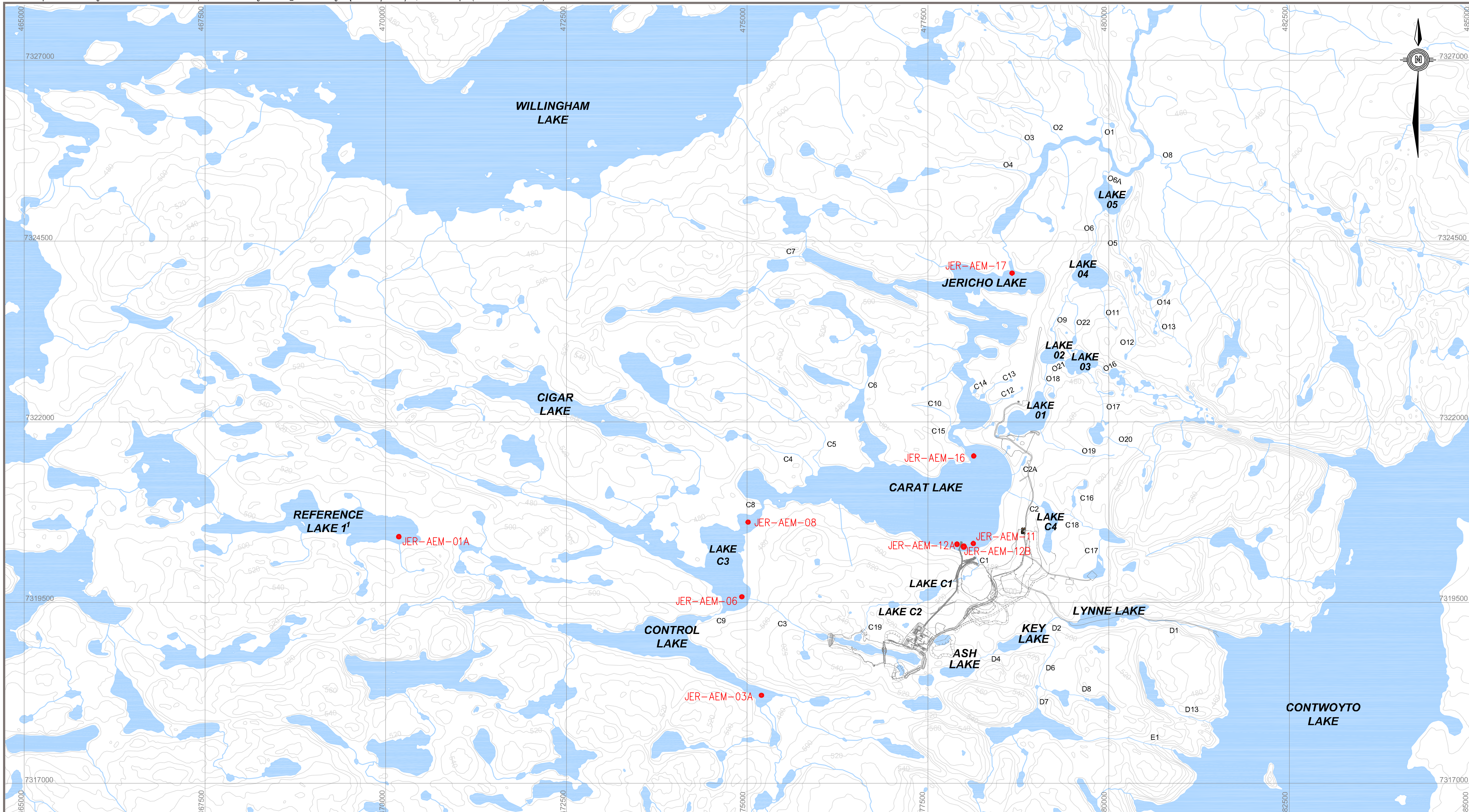
AQUATIC EFFECTS MONITORING PLAN JERICHO DIAMOND MINE, NUNAVUT

SEDIMENT QUALITY MONITORING LOCATION PLAN

PROJECT NO.	DWN	CKD	REV
E14101118	MM	WL	0
OFFICE	DATE		
EBA-EDM	January 31, 2011		

Figure 4



LEGEND

- AEMP SEDIMENT DEPOSITION MONITORING STATION

0 2 500

Scale: 1: 50 000 (metres)

NOTES

1. REFERENCE LAKE 2 WILL BE IDENTIFIED IN 2011. JER-AEM-02 WILL BE LOCATED AT REFERENCE LAKE 2.
2. DRAWING BASED ON NTS MAPS 76E13, 76E14, 76L03, 76L04

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AQUATIC EFFECTS MONITORING PLAN
JERICHO DIAMOND MINE, NUNAVUT

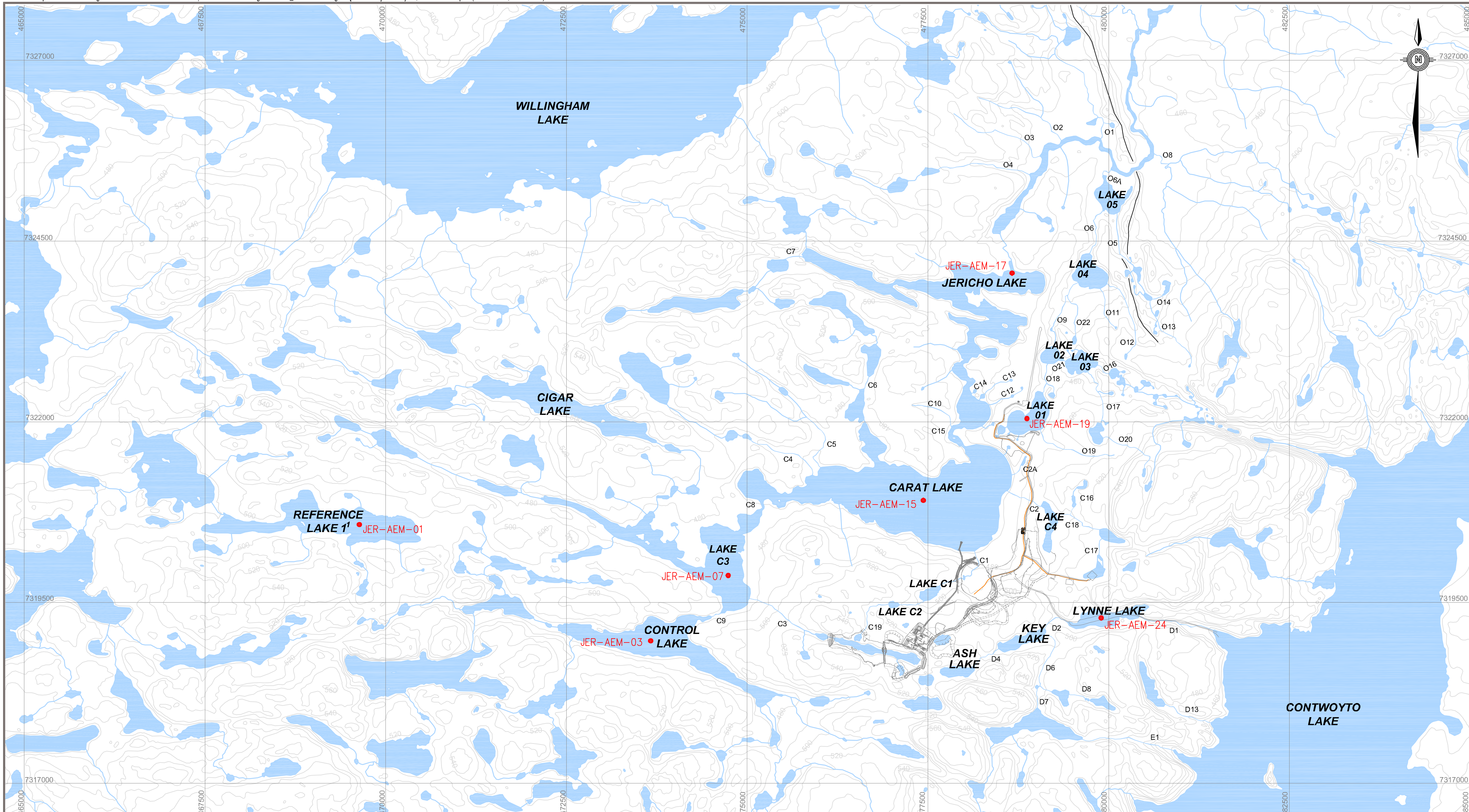
SEDIMENT DEPOSITION MONITORING LOCATION PLAN

PROJECT NO.	DWN	CKD	REV
E14101118	MM	WL	0

OFFICE	DATE
EBA-EDM	January 31, 2011

Figure 5

\\eba.local\corp\Edmonton\Drafting\CIVIL3D\E141\E14101118\acad\Aquatic Effects Monitoring\E14101118_FIG 6 AEMP.dwg [FIGURE 6] January 28, 2011 - 6:54:46 pm (BY: MARSH, MAUREEN)



LEGEND

• - DO / TEMPERATURE PROFILE MONITORING LOCATIONS

0 2 500

Scale: 1: 50 000 (metres)

NOTES

1. REFERENCE LAKE 2 WILL BE IDENTIFIED IN 2011. JER-AEM-02 WILL BE LOCATED AT REFERENCE LAKE 2.

3. DRAWING BASED ON NTS MAPS 76E13, 76E14, 76L03, 76L04

BASE DATA: NTS 1:50,000

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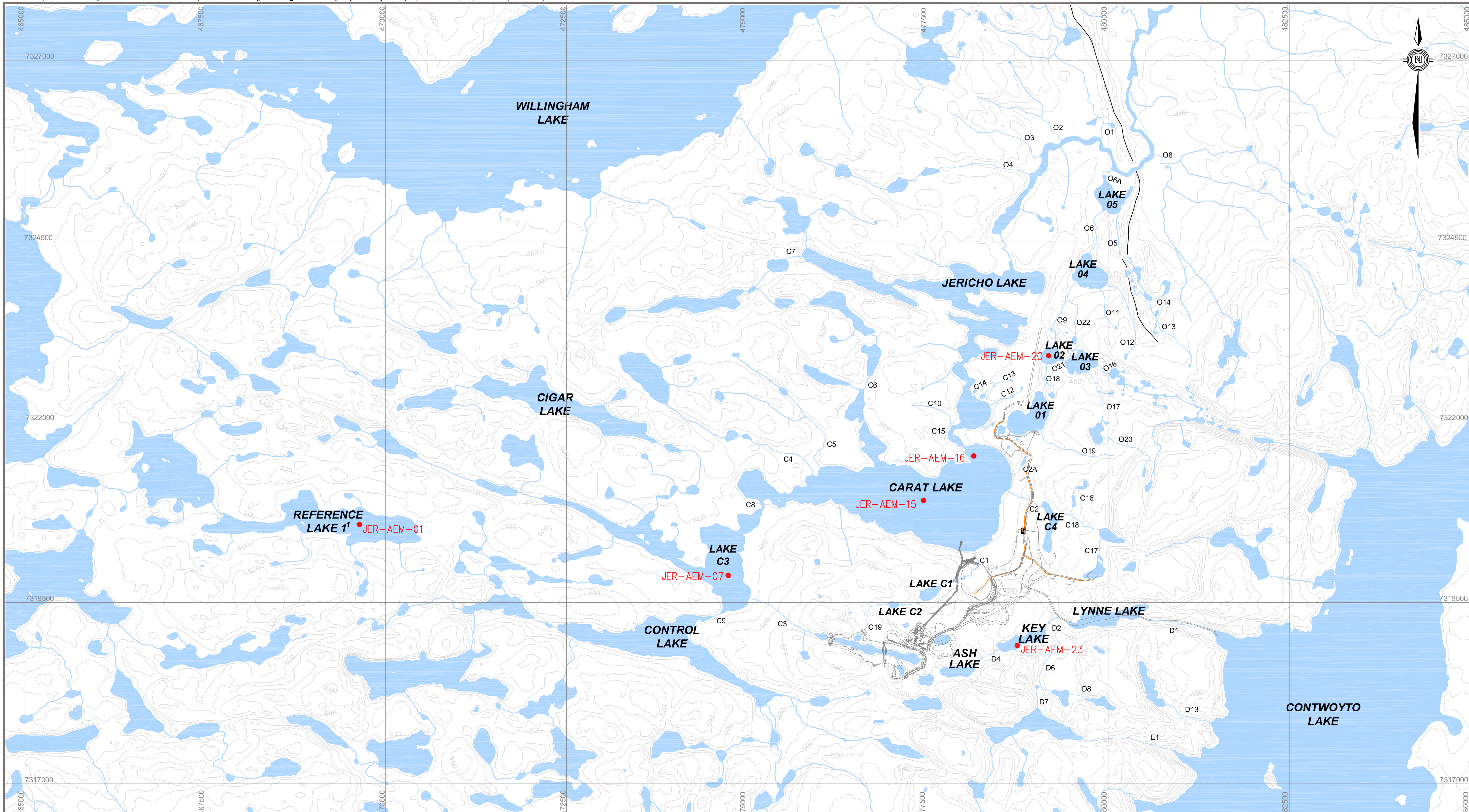
AQUATIC EFFECTS MONITORING PLAN JERICHO MINE

DO / TEMPERATURE PROFILE MONITORING LOCATION PLAN

PROJECT NO.	DWN	CKD	REV
E14101118	DBD / MM	WL	0
OFFICE	DATE		
EBA-EDM	January 28, 2011		

Figure 6

\\eba.local\corp\Edmonton\Drafting\CIVIL3D\E141\E14101118\acad\Aquatic Effects Monitoring\E14101118_FIG 7 AEMP.dwg [FIGURE 7] January 28, 2011 - 7:10:12 pm (BY: MARSH, MAUREEN)



LEGEND

● - PHYTO / ZOOPLANKTON MONITORING STATION

0 — 2 500

Scale: 1: 50 000 (metres)

NOTES

1. REFERENCE LAKE 2 WILL BE IDENTIFIED IN 2011. JER-AEM-02 WILL BE LOCATED AT REFERENCE LAKE 2.
2. DRAWING BASED ON NTS MAPS 76E13, 76E14, 76L03, 76L04

BASE DATA: NTS 1:50,000

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AQUATIC EFFECTS MONITORING PLAN JERICHO MINE

PHYTO / ZOOPLANKTON MONITORING LOCATION PLAN

PROJECT NO.	DWN	CKD	REV	
E14101118	DBD / MM	WL	0	Figure 7
OFFICE	DATE			
EBA-EDM	January 28, 2011			

LEGEND

- AEMP PERIPHYTON MONITORING STATION

0 2 500
Scale: 1: 50 000 (metres)

NOTES

1. TWO CONTROL LOCATIONS OF PERIPHYTON SAMPLING STATIONS (JER-AEM-1B and 1C) WILL BE IDENTIFIED DURING THE NEW REFERENCE LAKE STUDY IN 2011.
2. DRAWING BASED ON NTS MAPS 76E13, 76E14, 76L03, 76L04

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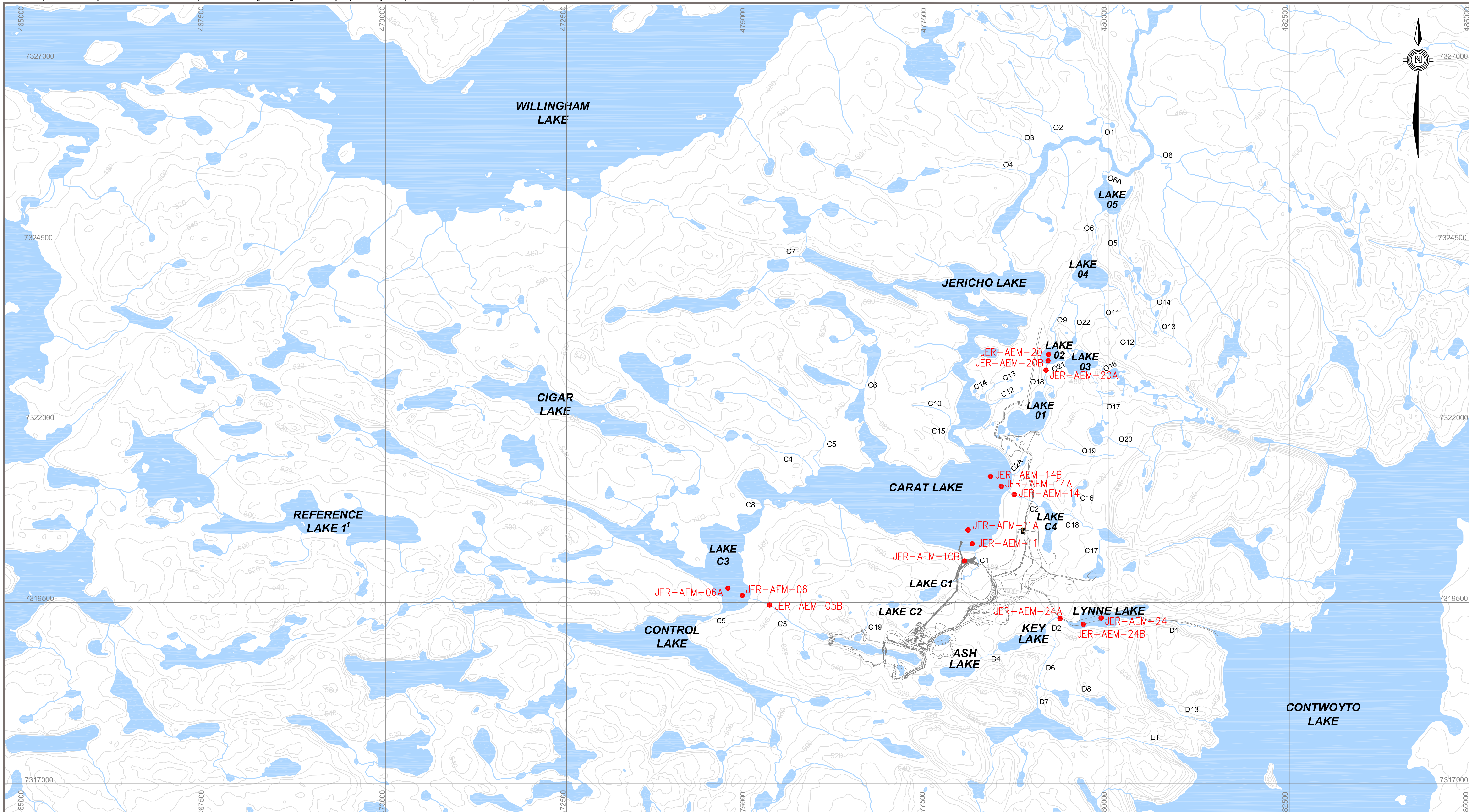
AQUATIC EFFECTS MONITORING PLAN
JERICHO DIAMOND MINE, NUNAVUT

PERIPHYTON MONITORING LOCATION PLAN

PROJECT NO.	DWN	CKD	REV
E14101118	MM	WL	0
OFFICE	DATE		
EBA-EDM	January 31, 2011		

Figure 8



LEGEND

● - AEMP BENTHIC MICROINVERTEBRATE MONITORING STATION

0 — 2 500

Scale: 1: 50 000 (metres)

NOTES

1. THREE CONTROL BENTHIC SAMPLING LOCATIONS (JER-AEM-01D,E AND F) WILL BE IDENTIFIED DURING REFERENCE LAKE STUDY IN 2011.
2. DRAWING BASED ON NTS MAPS 76E13, 76E14, 76L03, 76L04

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AQUATIC EFFECTS MONITORING PLAN
JERICHO DIAMOND MINE, NUNAVUT

BENTHIC MICROINVERTEBRATE MONITORING LOCATION PLAN

PROJECT NO.	DWN	CKD	REV
E14101118	MM	WL	0
OFFICE	DATE		
EBA-EDM	January 31, 2011		

Figure 9

APPENDIX A

APPENDIX A ANALYZED PARAMETERS AND DETECTION LIMITS

Appendix A1 - Analyzed Water Parameters and Detection Limits

Analytical Package	Parameters	Detection Limits	Unit
Total and Dissolved Metals (ICP-T, ICP-D)	Aluminum (Al)	0.0002	mg/L
	Antimony (Sb)	0.000005	mg/L
	Arsenic (As)	0.00002	mg/L
	Barium (Ba)	0.00002	mg/L
	Beryllium (Be)	0.000002	mg/L
	Bismuth (Bi)	0.000005	mg/L
	Boron (B)	0.005	mg/L
	Cadium (Cd)	0.000005	mg/L
	Calcium (Ca)	0.05	mg/L
	Chromium (Cr)	0.00005	mg/L
	Cobalt (Co)	0.00005	mg/L
	Copper (Cu)	0.00005	mg/L
	Iron (Fe)	0.01	mg/L
	Lead (Pb)	0.000005	mg/L
	Lithium (Li)	0.0002	mg/L
	Magnesium (Mg)	0.05	mg/L
	Manganese (Mn)	0.000005	mg/L
	Mercury (Hg)	0.00005	mg/L
	Molybdenum (Mo)	0.00005	mg/L
	Nickel (Ni)	0.00005	mg/L
	Phosphorus (P)	0.05	mg/L
	Potassium (K)	0.2	mg/L
	Selenium (Se)	0.00004	mg/L
	Silicon (Si)	0.05	mg/L
	Silver (Ag)	0.000005	mg/L
	Sodium (Na)	0.2	mg/L
	Strontium (Sr)	0.00001	mg/L
	Thallium (Tl)	0.000002	mg/L
	Tin (Sn)	0.00002	mg/L
	Titanium (Ti)	0.00005	mg/L
	Uranium (U)	0.000002	mg/L
	Vanadium (Va)	0.00001	mg/L
	Zinc (Zn)	0.0001	mg/L

Analytical Package	Parameters	Detection Limits	Unit
Routine Parameters (R)	Alkalinity ($CaCO_3$)	5	mg/L
	Acidity ($CaCO_3$)	5	mg/L
	Chloride	0.5	mg/L
	Carbonate (Co_3)	5	mg/L
	Bicarbonate (HCO_3)	5	mg/L
	Total Hardness ($CaC0_3$)	1	mg/L
	Hydroxide (OH)	5	mg/L
	Sulphate (SO_4)	0.05	mg/L
	Total Suspended Solids (TSS	3	mg/L
	Total Dissolved Solids (TDS)	5	mg/L
	Total Organic Carbon (TOC)	1	mg/L
	Total Inorganic (TIC)	1	mg/L
	pH	0.1	-
	Conductivity (uS/cm)	0.2	uS/cm
	Turbidity	0.1	NTU
Nutrients (N)	Nitrate (NO_3)	0.006	mg/L
	Nitrite (NO_2)	0.002	mg/L
	Ammonia (NH3)	0.005	mg/L
	Orthophosphate	0.001	mg/L
	Total Phosphorus	0.001	mg/L
Biological (B)	Biochem Oxygen Demand	5	mg/L
	Fecal Coliforms	1	CFU/100 mL
	Oil & Grease	1	mg/L
Petroleum Hydrocarbons (PHCs)	Benzene	0.0005	mg/L
	Ethylbenzene	0.0005	mg/L
	Toluene	0.0005	mg/L
	o-Xylene	0.0005	mg/L
	m+p-Xylene	0.0005	mg/L
	Xylenes	0.0005	mg/L
	F1(C6-C10)	0.1	mg/L
	F1-BTEX	0.1	mg/L
	F2 (>C10-C16)	0.25	mg/L
	F3 (C16-C34)	0.25	mg/L
	F4 (C34-C50)	0.25	mg/L

Note:
1. The detection limits are provided by ALS Laboratory Group.

Appendix A1 - Analyzed Sediment Parameters and Detection Limits

Analytical Package	Parameters	Detection Limits	Unit
Metals	Moisture (ug)	0.1	%
	Aluminum (ug)	50	mg/kg
	Antimony (ug)	0.1	mg/kg
	Arsenic (ug)	0.05	mg/kg
	Barium	0.5	mg/kg
	Beryllium	0.2	mg/kg
	Boron	0.1	mg/kg
	Cadmium	0.1	mg/kg
	Calcium	50	mg/kg
	Chromium	0.5	mg/kg
	Cobalt	0.1	mg/kg
	Copper	0.5	mg/kg
	Iron	50	mg/kg
	Lead	0.5	mg/kg
	Magnesium	20	mg/kg
	Manganese	1	mg/kg
	Mercury	0.005	mg/kg
	Molydenum	0.5	mg/kg
	Nickel	0.5	mg/kg
	Phosphorus	50	mg/kg
	Selenium	0.2	mg/kg
	Silver	0.1	mg/kg
	Sodium	100	mg/kg
	Strontium	0.5	mg/kg
	Tin	2	mg/kg
	Titanium	1	mg/kg
	Uranium	0.05	mg/kg
	Vanadium	0.2	mg/kg
	Zinc	1	mg/kg
Nutrients	Total Organic Carbon (%)	0.1	%
	Tatal Kjeldahl Nitrogen (%)	0.02	%
	Phosphorus (µg/g)	2	mg/kg
Particle Size	Particle Size Analysis	0.1	%

Note:
1. The detection limits are provided by ALS Laboratory Group.

APPENDIX B

APPENDIX B WATER AND SEDIMENT QUALITY ANALYTICAL METHODS

Quoted Parameters with Detection Limits

Parameter	Method Reference	Report D.L.	Units
Soil - Physical Tests			
% Moisture	Oven dry 105C-Gravimetric	0.10	%
Soil - Particle Size			
% Clay (<2um)	Forestry Canada (1991) p. 46-53	0.10	%
% Sand (2.0mm - 0.05mm)	Forestry Canada (1991) p. 46-53	0.10	%
% Silt (0.05mm - 2um)	Forestry Canada (1991) p. 46-53	0.10	%
Texture	Forestry Canada (1991) p. 46-53		
Soil - Leachable Anions & Nutrients			
Total Kjeldahl Nitrogen	FORESTRY CANADA (1991) P. 57-59	0.020	%
Soil - Organic / Inorganic Carbon			
CaCO3 Equivalent	SSSA (1996) P455-456	0.70	%
Inorganic Carbon	SSSA (1996) P455-456	0.10	%
Total Carbon by Combustion	SSSA (1996) P. 973-974	0.1	%
Total Carbon by Leco	SSSA (1996) P. 973-974	0.1	%
Total Organic Carbon	SSSA (1996) P455-456	0.10	%
Soil - Plant Available Nutrients			
Available Phosphate-P	Comm. Soil Sci. Plant Anal. 25 (5&6)	2.0	mg/kg
Soil - Metals			
Aluminum (Al)	EPA 200.2/6020A	50	mg/kg
Antimony (Sb)	EPA 200.2/6020A	0.10	mg/kg
Arsenic (As)	EPA 200.2/6020A	0.050	mg/kg
Barium (Ba)	EPA 200.2/6020A	0.50	mg/kg
Beryllium (Be)	EPA 200.2/6020A	0.20	mg/kg
Bismuth (Bi)	EPA 200.2/6020A	0.20	mg/kg
Cadmium (Cd)	EPA 200.2/6020A	0.10	mg/kg
Calcium (Ca)	EPA 200.2/6020A	50	mg/kg
Chromium (Cr)	EPA 200.2/6020A	0.50	mg/kg
Cobalt (Co)	EPA 200.2/6020A	0.10	mg/kg
Copper (Cu)	EPA 200.2/6020A	0.50	mg/kg
Iron (Fe)	EPA 200.2/6020A	50	mg/kg
Lead (Pb)	EPA 200.2/6020A	0.50	mg/kg
Lithium (Li)	EPA 200.2/6020A	1.0	mg/kg
Magnesium (Mg)	EPA 200.2/6020A	20	mg/kg
Manganese (Mn)	EPA 200.2/6020A	1.0	mg/kg
Mercury (Hg)	EPA 200.2/245.7	0.0050	mg/kg
Molybdenum (Mo)	EPA 200.2/6020A	0.50	mg/kg
Nickel (Ni)	EPA 200.2/6020A	0.50	mg/kg
Phosphorus (P)	EPA 200.2/6020A	50	mg/kg
Potassium (K)	EPA 200.2/6020A	100	mg/kg
Selenium (Se)	EPA 200.2/6020A	0.20	mg/kg

Quoted Parameters with Detection Limits

Parameter	Method Reference	Report D.L.	Units
Soil - Metals			
Silver (Ag)	EPA 200.2/6020A	0.10	mg/kg
Sodium (Na)	EPA 200.2/6020A	100	mg/kg
Strontium (Sr)	EPA 200.2/6020A	0.50	mg/kg
Thallium (Tl)	EPA 200.2/6020A	0.050	mg/kg
Tin (Sn)	EPA 200.2/6020A	2.0	mg/kg
Titanium (Ti)	EPA 200.2/6020A	1.0	mg/kg
Uranium (U)	EPA 200.2/6020A	0.050	mg/kg
Vanadium (V)	EPA 200.2/6020A	0.20	mg/kg
Zinc (Zn)	EPA 200.2/6020A	1.0	mg/kg
Soil - Leachable Metals			
Boron (B), Hot Water Ext.	Methods of Soil Analysis (1996) SSSA	0.10	mg/kg
Water - Physical Tests			
Hardness (as CaCO3)	APHA 2340B	0.50	mg/L
Temperature	APHA 2550-Thermometer	1.0	Degree C
Total Dissolved Solids	APHA 2540 C	5.0	mg/L
Total Suspended Solids	APHA 2540 D-Gravimetric	3.0	mg/L
Turbidity	APHA 2130 B-Nephelometer	0.10	NTU
Water - Anions and Nutrients			
Acidity (as CaCO3)	APHA 2310 B - Potentiometric Titration	5.0	mg/L
Alkalinity, Total (as CaCO3)	APHA 4500-H, 2510, 2320	5.0	mg/L
Ammonia-N	APHA 4500 NH3F-Colorimetry	0.0050	mg/L
Anion Sum	APHA 1030E	0.10	
Bicarbonate (HCO3)	APHA 4500-H, 2510, 2320	5.0	mg/L
Saturation pH	APHA 1030E	0.10	pH
Carbonate (CO3)	APHA 4500-H, 2510, 2320	5.0	mg/L
Cation - Anion Balance	APHA 1030E	-100	
Cation Sum	APHA 1030E	0.10	
Chloride (Cl)	APHA 4110 B-ION CHROMATOGRAPHY	0.50	mg/L
Computed Conductivity	APHA 1030E	0.20	uS/cm
Conductivity (EC)	APHA 4500-H, 2510, 2320	0.20	uS/cm
Conductivity % Difference	APHA 1030E	-100	%
Fluoride (F)	APHA 4110 B-ION CHROMATOGRAPHY	0.050	mg/L
Hardness (as CaCO3)	APHA 1030E	1.0	
Hydroxide (OH)	APHA 4500-H, 2510, 2320	5.0	mg/L
Ion Balance	APHA 1030E	-100	
Langelier Index	APHA 1030E	-14	
Nitrate+Nitrite-N	APHA 4500 NO3E-Colorimetry	0.0060	mg/L
Nitrate+Nitrite-N	APHA 4500 NO3H-Colorimetry	0.0060	mg/L
Nitrate-N	APHA 4500 NO3H-Colorimetry	0.0060	mg/L

Quoted Parameters with Detection Limits

Parameter	Method Reference	Report D.L.	Units
Water - Anions and Nutrients			
Nitrite-N	APHA 4500 NO2B-Colorimetry	0.0020	mg/L
Orthophosphate (PO4-P)	APHA 4500 P B,E-Auto-Colorimetry	0.0010	mg/L
pH	APHA 4500-H, 2510, 2320	0.10	pH
Phosphorus, Total	APHA 4500 P B,E-Auto-Colorimetry	0.0010	mg/L
Phosphorus, Total Dissolved	APHA 4500 P B,E - AUTO-COLORIMETRY	0.0010	mg/L
Sulfate (SO4)	APHA 4110 B-ION CHROMATOGRAPHY	0.050	mg/L
TDS (Calculated)	APHA 1030E	1.0	
Water - Organic / Inorganic Carbon			
Total Inorganic Carbon	APHA 5310 B-Instrumental	1.0	mg/L
Total Organic Carbon	APHA 5310 B-Instrumental	1.0	mg/L
Water - Bacteriological Tests			
Fecal Coliforms	APHA 9222D	1	CFU/100mL
Water - Bioassays			
Daphnia Magna - LC50	EPS/1/RM/11		
Trout Bioassay LC50	EPS/1/RM/13		
Water - Total Metals			
Calcium (Ca)-Total	EPA 3005A/6010B	0.05	mg/L
Iron (Fe)-Total	EPA 3005A/6010B	0.01	mg/L
Magnesium (Mg)-Total	EPA 3005A/6010B	0.05	mg/L
Mercury (Hg)-Total	EPA 245.7	0.000050	mg/L
Phosphorus (P)-Total	EPA 3005A/6010B	0.05	mg/L
Potassium (K)-Total	EPA 3005A/6010B	0.2	mg/L
Silicon (Si)-Total	EPA 3005A/6010B	0.05	mg/L
Sodium (Na)-Total	EPA 3005A/6010B	0.2	mg/L
Water - Total Metals (Undigested)			
Aluminum (Al)-Total	EPA 200.8	0.0002	mg/L
Antimony (Sb)-Total	EPA 200.8	0.000005	mg/L
Arsenic (As)-Total	EPA 200.8	0.00002	mg/L
Barium (Ba)-Total	EPA 200.8	0.00002	mg/L
Beryllium (Be)-Total	EPA 200.8	0.000002	mg/L
Bismuth (Bi)-Total	EPA 200.8	0.000005	mg/L
Boron (B)-Total	EPA 200.8	0.005	mg/L
Cadmium (Cd)-Total	EPA 200.8	0.000005	mg/L
Cesium (Cs)-Total	EPA 200.8	0.000005	mg/L
Chromium (Cr)-Total	EPA 200.8	0.00005	mg/L
Cobalt (Co)-Total	EPA 200.8	0.00005	mg/L
Copper (Cu)-Total	EPA 200.8	0.00005	mg/L
Gallium (Ga)-Total	EPA 200.8	0.00005	mg/L
Lead (Pb)-Total	EPA 200.8	0.000005	mg/L

Quoted Parameters with Detection Limits

Parameter	Method Reference	Report D.L.	Units
Water - Total Metals (Undigested)			
Lithium (Li)-Total	EPA 200.8	0.0002	mg/L
Manganese (Mn)-Total	EPA 200.8	0.000005	mg/L
Molybdenum (Mo)-Total	EPA 200.8	0.00005	mg/L
Nickel (Ni)-Total	EPA 200.8	0.00005	mg/L
Rhenium (Re)-Total	EPA 200.8	0.000005	mg/L
Rubidium (Rb)-Total	EPA 200.8	0.00001	mg/L
Selenium (Se)-Total	EPA 200.8	0.00004	mg/L
Silver (Ag)-Total	EPA 200.8	0.000005	mg/L
Strontium (Sr)-Total	EPA 200.8	0.00001	mg/L
Tellurium (Te)-Total	EPA 200.8	0.00001	mg/L
Thallium (Tl)-Total	EPA 200.8	0.000002	mg/L
Thorium (Th)-Total	EPA 200.8	0.000005	mg/L
Tin (Sn)-Total	EPA 200.8	0.00002	mg/L
Titanium (Ti)-Total	EPA 200.8	0.00005	mg/L
Tungsten (W)-Total	EPA 200.8	0.00001	mg/L
Uranium (U)-Total	EPA 200.8	0.000002	mg/L
Vanadium (V)-Total	EPA 200.8	0.00001	mg/L
Yttrium (Y)-Total	EPA 200.8	0.000005	mg/L
Zinc (Zn)-Total	EPA 200.8	0.0001	mg/L
Zirconium (Zr)-Total	EPA 200.8	0.00005	mg/L
Water - Dissolved Metals			
Aluminum (Al)-Dissolved	EPA 200.8	0.0002	mg/L
Antimony (Sb)-Dissolved	EPA 200.8	0.000005	mg/L
Arsenic (As)-Dissolved	EPA 200.8	0.00002	mg/L
Barium (Ba)-Dissolved	EPA 200.8	0.00002	mg/L
Beryllium (Be)-Dissolved	EPA 200.8	0.000002	mg/L
Bismuth (Bi)-Dissolved	EPA 200.8	0.000005	mg/L
Boron (B)-Dissolved	EPA 200.8	0.005	mg/L
Cadmium (Cd)-Dissolved	EPA 200.8	0.000005	mg/L
Calcium (Ca)-Dissolved	APHA 3120 B-ICP-OES	0.5	mg/L
Calcium (Ca)-Dissolved	EPA 3005A/6010B	0.05	mg/L
Cesium (Cs)-Dissolved	EPA 200.8	0.000005	mg/L
Chromium (Cr)-Dissolved	EPA 200.8	0.00005	mg/L
Cobalt (Co)-Dissolved	EPA 200.8	0.00005	mg/L
Copper (Cu)-Dissolved	EPA 200.8	0.00005	mg/L
Gallium (Ga)-Dissolved	EPA 200.8	0.00005	mg/L
Iron (Fe)-Dissolved	EPA 3005A/6010B	0.01	mg/L
Lead (Pb)-Dissolved	EPA 200.8	0.000005	mg/L
Lithium (Li)-Dissolved	EPA 200.8	0.0002	mg/L

Quoted Parameters with Detection Limits

Parameter	Method Reference	Report D.L.	Units
Water - Dissolved Metals			
Magnesium (Mg)-Dissolved	APHA 3120 B-ICP-OES	0.1	mg/L
Magnesium (Mg)-Dissolved	EPA 3005A/6010B	0.05	mg/L
Manganese (Mn)-Dissolved	EPA 200.8	0.000005	mg/L
Mercury (Hg)-Dissolved	EPA SW-846 3005A & EPA 245.7	0.000050	mg/L
Molybdenum (Mo)-Dissolved	EPA 200.8	0.00005	mg/L
Nickel (Ni)-Dissolved	EPA 200.8	0.00005	mg/L
Phosphorus (P)-Dissolved	EPA 3005A/6010B	0.05	mg/L
Potassium (K)-Dissolved	APHA 3120 B-ICP-OES	0.1	mg/L
Potassium (K)-Dissolved	EPA 3005A/6010B	0.2	mg/L
Rhenium (Re)-Dissolved	EPA 200.8	0.000005	mg/L
Rubidium (Rb)-Dissolved	EPA 200.8	0.00001	mg/L
Selenium (Se)-Dissolved	EPA 200.8	0.00004	mg/L
Silicon (Si)-Dissolved	EPA 3005A/6010B	0.05	mg/L
Silver (Ag)-Dissolved	EPA 200.8	0.000005	mg/L
Sodium (Na)-Dissolved	APHA 3120 B-ICP-OES	1	mg/L
Sodium (Na)-Dissolved	EPA 3005A/6010B	0.2	mg/L
Strontium (Sr)-Dissolved	EPA 200.8	0.00001	mg/L
Tellurium (Te)-Dissolved	EPA 200.8	0.00001	mg/L
Thallium (Tl)-Dissolved	EPA 200.8	0.000002	mg/L
Thorium (Th)-Dissolved	EPA 200.8	0.000005	mg/L
Tin (Sn)-Dissolved	EPA 200.8	0.00002	mg/L
Titanium (Ti)-Dissolved	EPA 200.8	0.00005	mg/L
Tungsten (W)-Dissolved	EPA 200.8	0.00001	mg/L
Uranium (U)-Dissolved	EPA 200.8	0.000002	mg/L
Vanadium (V)-Dissolved	EPA 200.8	0.00001	mg/L
Yttrium (Y)-Dissolved	EPA 200.8	0.000005	mg/L
Zinc (Zn)-Dissolved	EPA 200.8	0.0001	mg/L
Zirconium (Zr)-Dissolved	EPA 200.8	0.00005	mg/L
Water - Aggregate Organics			
Biochemical Oxygen Demand	APHA 5210 A& B	5.0	mg/L
Oil and Grease	APHA 5520 G HEXANE MTBE EXT. GRAVIME	1.0	mg/L
Water - Volatile Organic Compounds			
Benzene	EPA 5021/8015&8260 GC-MS & FID	0.00050	mg/L
Ethylbenzene	EPA 5021/8015&8260 GC-MS & FID	0.00050	mg/L
m+p-Xylene	EPA 5021/8015&8260 GC-MS & FID	0.00050	mg/L
o-Xylene	EPA 5021/8015&8260 GC-MS & FID	0.00050	mg/L
Toluene	EPA 5021/8015&8260 GC-MS & FID	0.00050	mg/L
F1(C6-C10)	EPA 5021/8015&8260 GC-MS & FID	0.10	mg/L
F1-BTEX	EPA 5021/8015&8260 GC-MS & FID	0.10	mg/L

Quoted Parameters with Detection Limits

Parameter	Method Reference	Report D.L.	Units
Water - Volatile Organic Compounds			
Xylenes	EPA 5021/8015&8260 GC-MS & FID	0.00050	mg/L
Water - Hydrocarbons			
F2 (>C10-C16)	EPA 3510/CCME PHC CWS-GC-FID	0.25	mg/L
F3 (C16-C34)	EPA 3510/CCME PHC CWS-GC-FID	0.25	mg/L
F4 (C34-C50)	EPA 3510/CCME PHC CWS-GC-FID	0.25	mg/L
Water - Miscellaneous			
Chronic Testing			

Methodology

Product	Matrix	Product Description	Analytical Method Reference
ACIDITY-ED	Water	Acidity (as CaCO3)	APHA 2310 B - Potentiometric Titration
B-HOTW-ED	Soil	Available Boron, Hot Water	Methods of Soil Analysis (1996) SSSA
BOD5-YL	Water	Biochemical Oxygen Demand (BOD)	APHA 5210 A& B

Samples are incubated at 20oC +1oC for 5 days. Comparison of DO content at the beginning and end of the incubation period provides a measure of the biochemical oxygen demand.

Product	Matrix	Product Description	Analytical Method Reference
BTX,F1-ED	Water	BTEX and F1 (C6-C10)	EPA 5021/8015&8260 GC-MS & FID
C-INORG-ORG-SK	Soil	Inorganic and Organic Carbon	SSSA (1996) P455-456

When carbonates are decomposed with acid in an open system, carbon dioxide is released to the atmosphere. The decrease in sample weight resulting from CO2 loss is proportional to the carbonate content of the soil.

Reference:
Loeppert, R.H. and Suarez, D.L. 1996. Gravimetric Method for Loss of Carbon Dioxide. P. 455-456 In: J.M. Bartels et al. (ed.) Methods of soil analysis: Part 3 Chemical methods. (3rd ed.) ASA and SSSA, Madison, WI. Book series no. 5

Product	Matrix	Product Description	Analytical Method Reference
C-TOT-LECO-SK	Soil	Total Carbon by combustion method	SSSA (1996) P. 973-974

The sample is introduced into a quartz tube where it undergoes combustion at 900 C in the presence of oxygen.
Combustion gases are first carried through a catalyst bed in the bottom of the combustion tube, where oxidation is completed and then carried through a reducing agent (copper), where the nitrogen oxides are reduced to elemental nitrogen.
This mixture of N2, CO2, and H2O is then passed through an absorber column containing magnesium perchlorate to remove water. N2 and CO2 gases are then separated in a gas chromatographic column and detected by thermal conductivity.

Methodology

Product	Matrix	Product Description	Analytical Method Reference

Reference:
Nelson, D.W. and Sommers, L.E. 1996. Total Carbon, organic carbon and organic matter. P. 973-974 In: J.M. Bartels et al. (ed.) Methods of soil analysis: Part 3 Chemical methods. (3rd ed.) ASA and SSSA, Madison, WI. Book series no. 5

C-TOT-ORG-ED	Water	Total Organic Carbon	APHA 5310 B-Instrumental
DAPHNIA-LC50-WP	Water	Daphnia Magna LC50	EPS/1/RM/11

Daphnia Magna, grown under controlled conditions, are introduced into various concentrations of a sample in order to obtain an LC50, a concentration where 50% of the organisms die.

Studies have shown the major contributor to measurement uncertainty (MU) for this test is the biological response. The best estimation of MU is therefore provided in the test report as the 95% CI of the reference toxicant.

F-IC-ED	Water	Fluoride by IC	APHA 4110 B-ION CHROMATOGRAPHY
FC-MF-YL	Water	Fecal Coliform	APHA 9222D
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Hardness is calculated from Calcium and Magnesium concentrations, and is expressed as calcium carbonate equivalents.

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/245.7

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, dried at 60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis is by atomic fluorescence spectrophotometry (EPA Method 245.7).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

HG-DIS-CVAFS-VA	Water	Dissolved Mercury in Water by CVAFS	EPA SW-846 3005A & EPA 245.7

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a

Methodology

Product	Matrix	Product Description	Analytical Method Reference

cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).

HG-TOT-CVAFS-VA	Water	Total Mercury in Water by CVAFS	EPA 245.7

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).

IONBALANCE-ED	Water	Ion Balance Calculation	APHA 1030E
MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, dried at 60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modifed from EPA Method 6020A).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

MET-D-L-ICP-ED	Water	Diss. Metals in Water by ICPOES (Low)	APHA 3120 B-ICP-OES
MET-D-NP-U-HRMS-VA	Water	Diss. Metals in Water by HR-ICPMS(Ultra)	EPA 200.8

Ultra trace metals in water are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS), based on US EPA Method 200.8, (Oct. 1999). This procedure is intended for pristine field-filtered acid-preserved water samples. ALS recommends that filtration blanks be submitted for this test to aid with interpretation of results.

MET-DIS-LOW-ICP-VA	Water	Dissolved Metals in Water by ICPOES	EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-T-NP-U-HRMS-VA	Water	Total Metals in Water by HR-ICPMS(Ultra)	EPA 200.8

Methodology

Product	Matrix	Product Description	Analytical Method Reference

Ultra trace metals in water are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS), modified from US EPA 200.8, (Revision 5.5). The detection limits provided can only be met for undigested samples. This procedure is intended for pristine, non-turbid, acid-preserved water samples, where sample turbidity is <1 NTU. Where turbidity exceeds 1 NTU, results may be biased low compared to true Total Metals concentrations. ALS recommends that turbidity analysis be requested on samples submitted for this test to aid with interpretation of results.

MET-TOT-LOW-ICP-VA	Water	Total Metals in Water by ICPOES	EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

N-TOTKJ-SK	Soil	Total Kjeldahl Nitrogen (Organic N)	FORESTRY CANADA (1991) P. 57-59

Organic Nitrogen in soil is converted to ammonia nitrogen using sulfuric acid with CuSO4 and K2SO4 as catalysts. The ammonia is determined by distillation into boric acid and titration with standard acid.

Reference:
Y.P. Kalra, and D.G. Maynard, 1991. Methods Manual For Forest Soil and Plant Analysis, Northwest Region. Forestry Canada p. 57-59

N2N3-LOW-ED	Water	Nitrate+Nitrite-N	APHA 4500 NO3E-Colorimetry
NH4-LOW-ED	Water	Ammonia-N Low Level	APHA 4500 NH3F-Colorimetry
NO3-LOW-ED	Water	Nitrate-N	APHA 4500 NO3H-Colorimetry
OGG-ED	Water	Oil and Grease-Gravimetric	APHA 5520 G HEXANE MTBE EXT. GRAVIME
P-TOTAL-LOW-ED	Water	Phosphorus, Total- Low Level	APHA 4500 P B,E-Auto-Colorimetry
P-TOTALDIS-LOW-ED	Water	Phosphorus, Dissolved- Low Level	APHA 4500 P B,E - AUTO-COLORIMETRY
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity	APHA 4500-H, 2510, 2320

Methodology

Product	Matrix	Product Description	Analytical Method Reference
PO4-AVAIL-SK	Soil	Available Phosphate-P	Comm. Soil Sci. Plant Anal. 25 (5&6)

Available orthophosphate P is extracted from the soil using Modified Kelowna extracting solution (0.025M HOAc, 0.25M NH4Oac, 0.015M NH4F at pH 4.5).
The orthophosphate ion reacts with ammonium molybdate and antimony potassium tartrate under acidic conditions to form a complex. This complex is reduced with ascorbic acid to form a blue complex which is measured colorimetrically by auto analysis at 880 nm.

Reference:
Communications in Soil Science and Plant Analysis, 25(5&6), 627-635 (1994).

Product	Matrix	Product Description	Analytical Method Reference
PO4-LOW-ED	Water	Orthophosphate (PO4-P)	APHA 4500 P B,E-Auto-Colorimetry
PREP-200.2-VA	Soil	Sediment/Soil Sample Preparation	
PREP-DRY/GRIND-ED	Soil	Dry and Grind	
PREP-MOISTURE-ED	Soil	% Moisture	Oven dry 105C-Gravimetric
PSA-3-SK	Soil	Particle size - Pipette removal OM & CO3	Forestry Canada (1991) p. 46-53

Kalra, Y.P., Maynard, D.G. 1991. Methods manual for forest soil and plant analysis. Forestry Canada. 46-53.

Product	Matrix	Product Description	Analytical Method Reference
SAMPLE-DISPOSAL	Misc.	Sample Handling and Disposal Fee	
SO4-L-IC-ED	Water	Sulfate by IC (Low Level)	APHA 4110 B-ION CHROMATOGRAPHY
SOLIDS-TDS-ED	Water	Total Dissolved Solids	APHA 2540 C
SOLIDS-TOTSUS-ED	Water	Total Suspended Solids	APHA 2540 D-Gravimetric
TEMP-ED	Water	Temperature	APHA 2550-Thermometer

Methodology

Product	Matrix	Product Description	Analytical Method Reference
TROUT-LC50-WP	Water	Trout Bioassay LC50	EPS/1/RM/13

Certified, disease-free Rainbow Trout (Oncorhynchus mykiss) have been used for two decades in Canada for testing effluents under a series of regulation and guidelines. This organism inhabits waters of all Canadian Provinces and is widely introduced around the world. It thrives in cool, fresh water, runs to sea on both Atlantic and Pacific coasts, and is commonly reared in hatcheries and commercial aquaculture. It has become the world's standard for freshwater toxicity tests.

Rainbow Trout are introduced into several concentrations of a sample, including full strength, in order to estimate the mean LC50, a concentration where 50% of the organisms die.

Studies have shown the major contributor to measurement uncertainty (MU) for this test is the biological response. The best estimation of MU is therefore provided in the test report as the 95% CI of the reference toxicant.

Product	Matrix	Product Description	Analytical Method Reference
TURBIDITY-ED	Water	Turbidity	APHA 2130 B-Nephelometer

APPENDIX C

APPENDIX C GENERAL LABORATORY QA/QC CONTROLS

ALS Quality Management System Summary

ALS is a global diversified testing services organization with a presence on every continent, offering a broad range of services to leading global companies.

The following report summarizes standard practices routinely employed by the ALS Environmental Division in Canada. Our practices exceed accreditation requirements and have been built to meet the needs of our customers and to give them confidence in the reliability of our test data.

Additional information is available on request from the Quality Department. Customers are invited to audit or tour ALS facilities at their convenience.

Documentation and Document Control

Test methods and support procedures are documented in detail to ensure consistency of application, repeatability of test results and traceability of analyses.

Test method requirements include but are not limited to sample handling, sample storage, minimizing interference, sample preparation, reagent and standard specifications, equipment, supplies, calibration requirements, instrumental measurement procedures, quality control requirements, data quality objectives and corrective actions, calculations, reporting requirements, reference information, hazards and their preventive measures.

Administrative support procedures are also documented where needed to ensure quality system procedures and customer services are provided in a controlled, approved manner consistent with ALS policies and client needs.

All procedures are authorized prior to use by the signing authority, ensuring adequate technical and quality oversight.

Distribution of documents is controlled to ensure only the most recent version is available for use. Authorized documents are reviewed periodically by the signing authority to ensure they continue to meet ALS requirements and customer needs.

Test methods and support procedures are available for client viewing on-site.

Internal Audits

Internal audits are scheduled and performed by qualified Quality and Technical staff for all routine analytical procedures and Quality System elements. Such audits ensure that procedures are implemented as intended, that test methods are scientifically defensible and technically sound, and that policies, procedures and records continue to meet the Quality System objectives.

Quality staff may periodically initiate unscheduled audits in response to proficiency testing program results, client feedback, requests from managers or any other circumstance that warrants investigation.

Quality Control (QC)

ALS has established QC procedures for monitoring the validity of tests performed by its laboratories. Individual test methods specify quality control requirements, frequency of use, and Data Quality Objectives (DQOs).

The type of quality control elements used for process monitoring is dependent on the test performed, but typically includes (as appropriate): Calibration Verification Standards, Continuing Calibration Verifications, Instrument Blanks, Method Blanks, Laboratory Control Samples, Reference Materials, Matrix Spikes, Surrogate Spikes, and Internal Standards.

DQOs are established for each QC sample, based on a combination of reference method objectives, customer requirements and historical test method performance. Where applicable, prescriptive elements of reference methods take precedence over internal DQOs.

Test results for selected QC samples are available on test reports. Please contact your Account Manager for more information.

Control Charts

Control charts are used to provide a graphical representation of QC results and test method performance over time. Control charts graphically display DQOs as well as the statistically derived mean and ± 2 and 3 standard deviations ("sigma") around the mean, calculated from recent historical QC results. ALS applies advanced trend monitoring algorithms to identify outliers and non-random data distributions (trends) that may indicate undesirable changes in test method performance. The trend monitoring process has been automated within our LIMS. Upon data entry, each QC result is checked against programmed limits and trends. If a trend is identified, a notification is e-mailed to the analyst and their supervisor, so that it can be investigated and corrected.

Data Validation

ALS analytical data proceeds through several reviews prior to the release of final reports. The ALS data validation process includes test result validation, inter-parameter validation and report validation. Test result validation involves an independent peer review of raw and calculated test results. Inter-parameter validation occurs when all department specific parameters for a sample are completed, and involves an overall review of test results within each sample for consistency among any related test parameters. Report validation occurs when all the requested test results for a work order are completed, and involves a review of the final report before it is sent to the customer.

ALS maintains laboratory records in a traceable manner for five years.

Method Validation

Customers rely on ALS to select test methods that are appropriate to meet their needs. Wherever possible, ALS references the latest versions of published standard methods developed by organizations such as American Public Health Association, United States Environmental Protection Agency, NIOSH, Environment Canada, and other international, regional or regulatory organizations, or equipment manufacturers.

Method validations are conducted to confirm that our test methods are fit for their intended use. The validations are as extensive as necessary to meet the needs of the given application. The extent depends on the source of the method. Test methods are revalidated periodically to ensure continued suitability and fitness for purpose.

Method Detection Limits and Limits of Reporting

ALS Limits of Reporting (LORs) are established using rigorous experimental and statistical procedures that begin with the determination of the Method Detection Limit (MDL) at 99% confidence. The MDL takes into account several factors, like long term Method Blanks, low level Sample Duplicates, and low level Spiked Samples. When detected at or above the MDL, ALS test results are considered to be qualitatively accurate, and a parameter can be reported with 99% confidence as being present in the sample.

$$MDL = (s_0 \times t_{n-1}) + |MBlk|$$

Where:
- s_0 = the standard deviation derived from the analysis of blank or low level samples, whichever gives a higher standard deviation,
- t_{n-1} = the Student's t-distribution with n-1 degrees of freedom for the one-sided 99% confidence interval.
- |MBlk|= the absolute value of the mean method blank.

ALS takes a conservative approach to detection limits. Our goal is to minimize false positives, because we recognize that any false positive results can be damaging for our clients. Where possible, we establish LORs at levels well-above the statistical MDL, and ideally at the LOQ_5. This improves the accuracy and precision of results near the detection limit, and reduces the chance of false positives due to sample-specific issues. At or above the LOQ_5, test results are considered to be quantitatively accurate. A reported parameter at the LOQ_5 is considered to be within 40% of the true value 95% of the time.

$$LOQ_5 = 5s_0 + |MBlk|$$

Where:
- s_0 = the standard deviation used in the MDL calculation,
- |MBlk| = the absolute value of the mean method blank.

The D. L. column on ALS analytical reports contains the LOR. The LOR may be the MDL as calculated above, or a higher value. ALS does not report LORs that are less then the calculated MDL.

Measurement Uncertainty (MU)

ALS procedures for calculating measurement uncertainty are based on accepted practices of identifying components contributing to uncertainty, compiling data that represents or includes these components, evaluating the data using appropriate statistical calculations, and reporting in a manner that prevents misunderstanding of the result. The Type A method of calculating measurement uncertainty is followed, however additional factors are considered to ensure the best and most complete information is derived from our evaluation of test method performance.

The ALS model describes the dependency of uncertainty on three factors. The first is a constant contribution to uncertainty attributable to s_0, the standard deviation of the method for concentrations that approach zero. The second is a constant relative uncertainty associated with higher parameter concentrations. The third is a constant contribution to uncertainty attributable to the mean long-term method blank value where it is significant. The following is the ALS equation for measurement uncertainty, using an expansion factor of k=2:

Expanded 95% Uncertainty as a Function of Concentration

$$U(c) = 2 * [\sqrt{ \{ s_0^2 + (\Theta c)^2 \} }] + |MBlk_{LT}|$$

Where:
- **U(c)** = The expanded uncertainty at concentration c. The range c ± U(c) represents approximately the 95% confidence interval (two standard deviations).
- **c** = Measured concentration of parameter in the sample.
- $\mathbf{s_0}$ = A constant contribution to standard uncertainty represented by the standard deviation at zero concentration, which is related to the method detection limit.
- **θ** = Combined relative standard uncertainty, excluding MDL and Method Blank contributions. Theta has no units.
- $|\mathbf{MBlk}_{LT}|$ = Absolute value of the mean long-term Method Blank value, where significant (i.e. if > 1/5 s_0). [Note that the Method Blank term is not expanded because it represents a constant bias, not a variance.]

Uncertainty values obtained from this procedure must be regarded as estimates. Primarily, this is because all environmental samples are different, especially with regard to matrix effects and heterogeneity. It is our intent with this procedure to arrive at an estimate of a 95% confidence level uncertainty value that can be assumed to apply to 95% (or more) of the samples that a laboratory receives for a given test. It follows that for samples where undetected matrix effects or interferences occur, or for samples that are atypically heterogeneous, uncertainty estimates may be low.

Another aspect of reporting MU is the reporting of test method bias. Bias occurs in a small number of test methods that cannot recover 100% of a parameter from a sample. In these cases ALS reports bias along with the MU to aid with the interpretation of the test result.

Participation in Interlaboratory Proficiency Testing (PT) Programs

ALS locations participate in an extensive variety of proficiency testing programs. Where available, formal programs operated by outside agencies are used. When not available, ALS utilizes less formal proficiency testing studies. Root cause analysis is initiated and corrective action plans are developed when PT program results indicate a decline in test method performance.

Staff Training

Formal training procedures are in place to ensure all staff are trained in ALS polices and analytical procedures prior to performing analyses. A staff orientation program communicates ALS polices to newly hired staff. Task specific training is performed, and analyst proficiency is demonstrated and documented before staff are authorized to work independently. On-going analyst proficiency is monitored using proficiency testing programs. Records are maintained in training logs issued to staff upon hiring.

As well, ALS Canada promotes continuing education and learning by offering advanced courses covering technical and quality functions.

Employee Agreements

ALS protects its customers' confidential information and proprietary rights. We require all employees to review and sign a Code of Conduct policy that communicates the ALS confidentiality policy. It is ALS practice to never disclose information about a client's analysis to a third party without prior consent of the client, or unless compelled to by law. If we are obligated by law to disclose such information, we will inform the client prior to doing so.

Our employees avoid involvement in activities that would diminish confidence in their competence, impartiality, judgment, or integrity by complying with the ALS Code of Conduct and Data Integrity Policy.

Sample Tracking

Procedures are in place to track samples from receipt at the lab through to final reporting. A data management system (LIMS – Laboratory Information Management System) is used to generate a work order number for each sample submission, and a unique identification number is generated for each sample within the work order. The system is then used to assign specific analyses for the samples, to identify methods to be used, and to assign due dates for the results. The system is used to manage analytical workloads and track the status of all samples in-house. LIMS is a secure system that can only be accessed using login passwords. Controlling the level of access according to staff needs provides additional security.

When requested by the client, legal sample protocols are implemented to ensure chain of custody defensibility in a court of law. Contact the lab for legal sampling and transportation instructions if this service is needed.

Equipment Calibration

Measuring and testing equipment used by ALS laboratories that can have a significant effect on the accuracy or validity of test results is calibrated using established procedures. The procedures ensure traceability through an unbroken chain of calibrations or comparisons to national measurement standards. Where traceability of measurements to SI units is not possible and/or not relevant, traceability is provided by the use of certified reference materials and/or consensus standards.

Management Reviews (MR)

Management conducts a review at least annually to ensure the management system is effective, and continues to be suitable for its operations, and to identify necessary changes or improvements. Senior management is included in the review process for all locations.

ALS Quality Control Protocols

Quality control samples are introduced into batches of samples at critical points of sample handling, preparation and analysis to demonstrate the processes are performing as expected. In general, quality control samples are considered either Instrument QC or Method QC.

Instrument QC:

Instrument QC samples demonstrate control for the instrumental portion of a method. Instrument QC requirements must be successfully met before the analysis of Method QC or samples may proceed.

- Verification of initial calibration - criteria varies with each test.
- 2nd source Calibration Verification Standard (CVS) – at minimum, with each initial calibration.
- Continuing Calibration Verification (CCV) – frequency varies by test.
- Instrument Blanks – usage and frequency varies by test.

Method QC:

Method QC samples encompass the entire method and are initiated at the earliest point of the method where appropriate. Refer to the QC Definitions below. One set of Method QC is included for each batch of up to 20 client samples. Each set includes:

- 1 Method Blank.
- 1 Sample Duplicate. *
- 1 Lab Control Sample.
- 1 Reference Material or Matrix Spike. **
- Surrogate Compounds.

* Duplicate analyses are not performed where sub-sampling is not possible – e.g. most tests for organics in water.
** Spikes and Reference Materials are unavailable for Microbiology tests.

Method QC must be successfully analyzed before sample results are approved. Method QC results are normally reported to ALS clients with data reports.

Data Quality Objectives (DQOs):

DQOs are established for each QC sample, based on a combination of reference method objectives, customer requirements and historical test method performance. Where applicable, prescriptive elements of reference methods take precedence over internal DQOs. Current DQOs are available upon request.

QC Definitions:

Method Blank (MB) - A blank sample prepared to represent the sample matrix as closely as possible and analyzed exactly like the calibration standards, samples, and quality control (QC) samples. Results of Method Blanks provide an estimate of the within batch variability of the blank response and an indication of bias introduced by the analytical procedure. The DQO is < Limit of Reporting (LOR).

Sample Duplicate (DUP) - A second portion of sample taken from the same container as the sub-sample used for the primary analysis, that is analyzed independently through all steps of the laboratory's sampling and analytical procedures. Duplicate samples are used to assess variance of the total method including sampling and analysis. Refer to ALS Precision DQOs.

Laboratory Control Sample (LCS) - A known matrix spiked with compound(s) representative of the target analytes. An LCS is used to verify the laboratory's performance of the test. Refer to ALS Accuracy DQOs.

Reference Material (RM) – A material or substance, one or more of whose property values are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. An RM is similar to an LCS, but encompasses a representative sample matrix. DQOs vary by test and analyte.

Matrix Spike (MS) - A sample prepared by adding a known amount of a target analyte to a specified amount of a sample for which an independent estimate of the target analyte concentration is available. Spiked samples are used, for example, to determine the effect of the sample matrix on a method's recovery efficiency. Refer to ALS Matrix Spike DQOs.

Surrogate Compounds (SURR) – Surrogate Compounds are added to every sample where applicable (organics tests only). They are substances with properties that mimic the analyte of interest, and which are unlikely to be found in environmental samples. They are added at known concentration to samples to establish that the analytical method has been properly performed. Refer to ALS Accuracy DQOs.

APPENDIX D

APPENDIX D MONITORING SCHEDULE MASTER TABLE

SHEAR DIAMONDS LTD. A TETRA TECH COMPANY

AEMP Monitoring Schedule - Care and Maintenance Phase

Monitoring Station	Historical Station Code (1)	Location	Coordinates (Datum: NAD 83	Monitoring Category	2011									2012		
					April	May	June	July	August	September	October	November	December	January	February	March
JER-AEM-01	JER-11	Reference Lake 1 (2)	-	Water Chemistry (3)	R, ICP-T, ICP-D, N (Surface) (4)	-	R, ICP-T, ICP-D, N (Bottom) (4)	R, ICP-T, ICP-D, N (Surface) (4)	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	Metals, Dioxin and Furans	-	-	-	-	-		-	-	-
				DO/Temp Profile	Yes	-	-	Yes	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	Yes	-	-	-	-		-	-	-
JER-AEM-01A	JER-25	East Side of Reference Lake 1 (2)	-	Sediment Deposition	-	-	-	Yes	-	-	-	-		-	-	-
JER-AEM-01B	N/A	50 m upstream of a reference stream (TBD)	-	Periphyton	-	-	-	Yes	-	-	-	-		-	-	-
JER-AEM-01C	N/A	100 m upstream of a reference stream (TBD)	-	Periphyton	-	-	-	Yes	-	-	-	-		-	-	-
JER-AEM-01D	N/A	300 m upstream of a reference stream (TBD)	-	Benthic	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-01E	N/A	In Reference Lake 1, <100 m from reference stream outlet, <5 m depth (Littoral Zone)	-	Benthic	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-01F	N/A	In Reference Lake 1, <300 m from reference stream outlet, 5-10 m depth (Profundal Zone)	-	Benthic	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-02	N/A	Reference Lake 2 (5)	-	Water Chemistry (3)	R, ICP-T, ICP-D, N (Surface) (4)	-	R, ICP-T, ICP-D, N (Bottom) (4)	R, ICP-T, ICP-D, N (Surface) (4)	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	Metals	Metals	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	-	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-
JER-AEM-03	JER-10	Control Lake	-	Water Chemistry (3)	R, ICP-T, ICP-D, N (Surface) (4)	-	R, ICP-T, ICP-D, N (Bottom) (4)	R, ICP-T, ICP-D, N (Surface) (4)	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	Metals	-	-	-	-	-		-	-	-
				DO/Temp Profile	Yes	-	-	Yes	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-
JER-AEM-03A	JER-23	East side of Control Lake	-	Sediment Deposition	-	-	-	Yes	-	-	-	-		-	-	-
JER-AEM-04	JER-02	Stream C3 near PKCA Discharge	-	Water Chemistry (3)	-	-	**Weekly during discharge:** R, ICP-T, ICP-D, N, B, **Monthly:** Tox 1 (6)	**Weekly during discharge:** R, ICP-T, ICP-D, N, B, **Monthly:** Tox 1 (6)	**Weekly during discharge:** R, ICP-T, ICP-D, N, B, **Monthly:** Tox 1 (6)	**Weekly during discharge:** R, ICP-T, ICP-D, N, B, **Monthly:** Tox 1 (6)	R, ICP-T, ICP-D, N, B, Tox 1	-		-	-	-
				Sediment Chemistry	-	-	-	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	-	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-

AEMP Monitoring Schedule - Care and Maintenance Phase

Monitoring Station	Historical Station Code [1]	Location	Coordinates (Datum: NAD 83	Monitoring Category	2011									2012		
					April	May	June	July	August	September	October	November	December	January	February	March
JER-AEM-05	JER-03	Stream C3, 50 m Upstream of Mouth	-	Water Chemistry [3]	-	-	-	R, ICP-T, ICP-D, N, B	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	-	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	-	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	Yes	-	-	-	-		-	-	-
JER-AEM-05A	N/A	Stream C3, 100 m Upstream of Mouth	-	Periphyton	-	-	-	Yes	-	-	-	-		-	-	-
JER-AEM-05B	N/A	Stream C3, 300-500 m Upstream of Mouth	-	Benthic	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-06	JER-20	Lake C3, <100 m from Stream C3 outlet, <5 m depth (Littoral Zone)	-	Water Chemistry [3]	R, ICP-T, ICP-D, N (Surface) [4]	-	-	R, ICP-T, ICP-D, N (Surface) [4]	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	-	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	Yes	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	-	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-06A	N/A	Lake C3, <300 m from Stream C3 outlet, 5-10 m depth (Profundal Zone)	-	Benthic	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-07	JER-04	Lake C3 South Basin	-	Water Chemistry [3]	R, ICP-T, ICP-D, N (Surface) [4]	-	R, ICP-T, ICP-D, N (Bottom) [4]	R, ICP-T, ICP-D, N (Surface) [4]	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	Metals	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	Yes	-	-	Yes	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	Yes	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-
JER-AEM-08	JER-05	Lake C3 Outlet	-	Water Chemistry [3]	R, ICP-T, ICP-D, N	-	-	R, ICP-T, ICP-D, N	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	-	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	Yes	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	-	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-
JER-AEM-09	JER-13	Lake C1	-	Water Chemistry [3]	-	-	R, ICP-T, ICP-D, N (Bottom) [4]	R, ICP-T, ICP-D, N (Surface) [4]	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	Metals	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	-	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-

AEMP Monitoring Schedule - Care and Maintenance Phase

Monitoring Station	Historical Station Code [1]	Location	Coordinates (Datum: NAD 83	Monitoring Category	2011									2012		
					April	May	June	July	August	September	October	November	December	January	February	March
JER-AEM-10	JER-12	Stream C1, 50 m Upstream of Mouth	-	**Water Chemistry [3]**	-	-	-	R, ICP-T, ICP-D, N	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	-	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	-	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	Yes	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-
JER-AEM-10A	N/A	Stream C1, 100 m Upstream of Mouth	-	**Periphyton**	-	-	-	Yes	-	-	-	-		-	-	-
JER-AEM-10B	N/A	Stream C1, 300-500 m Upstream of Mouth	-	**Benthic**	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-11	JER-19	Carat Lake, <100 m from Stream C1 outlet, <5 m depth (Littoral Zone)	-	**Water Chemistry [3]**	-	-	-	R, ICP-T, ICP-D, N (Surface) [4]	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	-	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	Yes	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	-	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-11A	N/A	Carat Lake, <300 m from Stream C1 outlet, 5-10 m depth (Profundal Zone)		**Benthic**	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-12	JER-01	Carat Lake Freshwater Intake	-	**Water Chemistry [3]**	R, ICP-T, ICP-D, N, B	R, ICP-T, ICP-D, N, B	R, ICP-T, ICP-D, N, B	R, ICP-T, ICP-D, N, B	R, ICP-T, ICP-D, N, B	R, ICP-T, ICP-D, N, B	R, ICP-T, ICP-D, N, B	R, ICP-T, ICP-D, N, B		R, ICP-T, ICP-D, N, B	R, ICP-T, ICP-D, N, B	R, ICP-T, ICP-D, N, B
				Sediment Chemistry	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	-	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-
JER-AEM-12A	JER-21	West side of Causeway		**Sediment Deposition**	-	-	-	Yes	-	-	-	-		-	-	-
JER-AEM-12B	JER-22	East side of Causeway		**Sediment Deposition**	-	-	-	Yes	-	-	-	-		-	-	-
JER-AEM-13	JER-14	Lake C4	-	**Water Chemistry [3]**	-	-	-	R, ICP-T, ICP-D, N (Surface) [4]	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	Dioxin and Furans	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	-	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-

AEMP Monitoring Schedule - Care and Maintenance Phase

Monitoring Station	Historical Station Code [1]	Location	Coordinates (Datum: NAD 83	Monitoring Category	2011 April	May	June	July	August	September	October	November	December	2012 January	February	March
JER-AEM-14	JER-15	Stream C2 Upstream of Mouth (Due to ephemeral natural, exact location to be determined in field)	-	Water Chemistry [3]	-	-	-	R, ICP-T, ICP-D, N (Surface) [4]	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	-	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	-	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-14A	N/A	Carat Lake, <100 m from Stream C1 outlet, <5 m depth (Littoral Zone)	-	Benthic	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-14B	N/A	Carat Lake, <300 m from Stream C1 outlet, 5-10 m depth (Profundal Zone)	-	Benthic	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-15	JER-06	Carat Lake Centre Basin	-	Water Chemistry [3]	R, ICP-T, ICP-D, N (Surface) [4]	-	R, ICP-T, ICP-D, N (Bottom) [4]	R, ICP-T, ICP-D, N (Surface) [4]	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	Metals	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	Yes	-	-	Yes	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	Yes	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-
JER-AEM-16	JER-07	Carat Lake Outlet	-	Water Chemistry [3]	R, ICP-T, ICP-D, N (Surface) [4]	-	-	R, ICP-T, ICP-D, N (Surface) [4]	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	-	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	Yes	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	Yes	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	Yes	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-
JER-AEM-17	JER-08	Jericho Lake	-	Water Chemistry [3]	R, ICP-T, ICP-D, N (Surface) [4]	-	R, ICP-T, ICP-D, N (Bottom) [4]	R, ICP-T, ICP-D, N (Surface) [4]	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	Metals	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	Yes	-	-	-	-		-	-	-
				DO/Temp Profile	Yes	-	-	Yes	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-

AEMP Monitoring Schedule - Care and Maintenance Phase

Monitoring Station	Historical Station Code [1]	Location	Coordinates (Datum: NAD 83	Monitoring Category	2011									2012		
					April	May	June	July	August	September	October	November	December	January	February	March
JER-AEM-18	JER-09	Jericho River Downstream of Jericho Lake	-	Water Chemistry [3]	R, ICP-T, ICP-D, N (Surface) [4]	-	-	R, ICP-T, ICP-D, N (Surface) [4]	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	-	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	-	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-
JER-AEM-19	N/A	Lake O1	-	Water Chemistry [3]	-	-	R, ICP-T, ICP-D, N (Bottom) [4]	R, ICP-T, ICP-D, N (Surface) [4]	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	Metals	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	Yes	-	-	Yes	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-
JER-AEM-20	N/A	Lake O2	-	Water Chemistry [3]	-	-	R, ICP-T, ICP-D, N (Bottom) [4]	R, ICP-T, ICP-D, N (Surface) [4]	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	Metals	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	Yes	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	Yes	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-20A	N/A	In Stream O18	-	Benthic	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-20B	N/A	Lake O2 (Littoral zone near Stream O18 outlet)	-	Benthic	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-21	N/A	Lake O4	-	Water Chemistry [3]	-	-	-	R, ICP-T, ICP-D, N (Surface) [4]	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	-	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	-	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-
JER-AEM-22	JER-18	Ash Lake	-	Water Chemistry [3]	-	-	-	R, ICP-T, ICP-D, N (Surface) [4]	-	-	-	-		-	-	-
				Sediment Chemistry	-	-		-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	-	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-

AEMP Monitoring Schedule - Care and Maintenance Phase

Monitoring Station	Historical Station Code (1)	Location	Coordinates (Datum: NAD 83	Monitoring Category	2011									2012		
					April	May	June	July	August	September	October	November	December	January	February	March
JER-AEM-23	JER-17	Key Lake	-	Water Chemistry (3)	-	-	R, ICP-T, ICP-D, N (Bottom) (4)	R, ICP-T, ICP-D, N (Surface) (4)	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	Metals	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	Yes	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	Yes	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	Yes	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-
JER-AEM-24	JER-16	Lynne Lake	-	Water Chemistry (3)	-	-	R, ICP-T, ICP-D, N (Bottom) (4)	R, ICP-T, ICP-D, N (Surface) (4)	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	Metals, Dioxins and Furans	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	Yes	-	Yes	-	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-24A	N/A	In Stream D2	-	Benthic	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-24B	N/A	Lynne Lake, <100 m from Stream D2 outlet, <5 m depth (Littoral Zone)		Benthic	-	-	Yes	-	-	-	-	-		-	-	-
JER-AEM-25	N/A	Contwoyto lake near Stream D1 Mouth	-	Water Chemistry (3)	-	-	-	R, ICP-T, ICP-D, N (Surface) (4)	-	-	-	-		-	-	-
				Sediment Chemistry	-	-	-	-	-	-	-	-		-	-	-
				Sediment Deposition	-	-	-	-	-	-	-	-		-	-	-
				DO/Temp Profile	-	-	-	-	-	-	-	-		-	-	-
				Phyto/Zooplankton	-	-	-	-	-	-	-	-		-	-	-
				Periphyton	-	-	-	-	-	-	-	-		-	-	-
				Benthic	-	-	-	-	-	-	-	-		-	-	-

Note:

1. Historical Monitoring Station Codes obtained from *Jericho Diamond Project Aquatic Effects Monitoring Plan* , Prepared by Mainstream and AMEC, March 2005
2. Reference Lake 1 was named as "Cigar Lake" in the 2005 AEMP, which is in conflict with the "Cigar Lake" approximately 2.5 km to the northeast in the baseline studies reports.
3. R=Routine, ICP-T=Total metals, ICP-D=Dissolved metals, N=Nutrients, B=Biological, Tox1=*Oncorhynchus mykiss* and *Daphnia magna* , Tox2=*Ceriodaphnia dubia*
4. When Sedimentiment chemistry sample is required, additional near-bottom water sample will be collected.
5. Location of Reference Lake 2 will be determined by January 2012.
6. Assuming PKCA Discharge occurs from June to September in 2011; and Stream 3 freezeup in November