APPENDIX 9C

CONCEPTUAL AQUATIC EFFECTS MONITORING PROGRAM

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Abbreviations

Abbreviation	Definition
AEMP	Aquatic Effects Monitoring Program
DAR	Developer's Assessment Report
Dominion Diamond	Dominion Diamond Ekati Corporation
Ekati Mine	Ekati Diamond Mine
NWT	Northwest Territories
Project	Jay Project
UTM	Universal Transverse Mercator
WLWB	Wek'èezhìi Land and Water Board
WPKMP	Wastewater and Processed Kimberlite Management Plan
WROMP	Waste Rock and Ore Storage Management Plan
WRSA	waste rock storage area

Units of Measure

Unit	Definition
%	percent
km	kilometre
m	metres

9C1 INTRODUCTION

9C1.1 Background

Dominion Diamond Ekati Corporation (Dominion Diamond) is a Canadian-owned and Northwest Territories (NWT) based mining company that mines, processes, and markets Canadian diamonds from its Ekati Diamond Mine (Ekati Mine). The existing Ekati Mine is located approximately 200 kilometres (km) south of the Arctic Circle and 300 km northeast of Yellowknife, NWT (Section 9, Map 9.1-1).

Dominion Diamond is proposing to develop the Jay kimberlite pipe (Jay pipe) located beneath Lac du Sauvage. The proposed Jay Project (Project) will be an extension of the Ekati Mine, which is a large, stable, and successful mining operation that has been operating for 16 years. Most of the facilities required to support the development of the Jay pipe and to process the kimberlite currently exist at the Ekati Mine. The Project is located in the southeastern portion of the Ekati claim block, approximately 25 km from the main facilities and approximately 7 km to the east of the Misery Pit, in the Lac de Gras watershed. Open-pit mining of the Jay pipe represents 10 or more years of additional mine life (based on current ore processing rates).

Use of existing infrastructure at the Ekati Mine will be maximized. The project overview (Section 1.3) and detailed project description (Section 3) included in the Developer's Assessment Report [DAR]) provide information pertaining to new developments and activities associated with the Project.

Substantial monitoring of the Project site and receiving environment is anticipated. Because the Ekati Mine has been operating for 16 years, multiple environmental monitoring programs and management plans are in place, and have been effectively improved over time through adaptive management. The monitoring programs and management plans are outlined in Section 1.2.3.2 of the DAR and can be divided into two categories, which will be applicable during the development, operations, and closure of the Project:

- **Compliance monitoring** – monitoring activities, procedures, and programs undertaken to confirm the implementation of approved design standards, mitigation, and conditions of approval and company commitments. Examples of compliance monitoring include inspection of silt fences and other mitigation during construction, Surveillance Network Program.
- **Follow-up monitoring** – monitoring programs designed to assess the accuracy of the predictions in the DAR and the effectiveness of mitigation measures, evaluating the short-term and long-term effects on the physical, chemical and biological components of the aquatic ecosystems affected by the Project, estimating the spatial extent of effects, and providing the necessary input for implementation of adaptive management throughout the developmental lifespan of the Project. Examples of follow up monitoring include aquatic effects monitoring program (AEMP), wildlife effects monitoring program, and fisheries offsetting monitoring. Results from these programs can be used to increase the certainty of effect predictions in future environmental assessments.

An AEMP will be required of the Project through the Water Licence for the Project and will involve programs focused on the receiving environment. Given the Project is an extension of the existing Ekati Mine, it is anticipated that the AEMP for the Project will be an expansion of the existing AEMP under the current Water Licence #W2012L2-0001 (WLWB 2014). A conceptual overview of the scope of the expanded AEMP is outlined in this appendix.

9C1.2 Terms of Reference

The Terms of Reference for the Project (Appendix 1A) specifies requirements relevant to the AEMP Design Plan which are summarized below:

Section 2.3 – Public Engagement

Engagement with potentially affected communities (i.e., Ekati Mine Impact Benefit Agreement groups), governments, and the Independent Environmental Monitoring Agency should be considered and should include: a discussion of the implications for environmental monitoring and management of any relevant agreement between Dominion Diamond and other interested parties; and, how Dominion Diamond has engaged or intends to engage, traditional knowledge holders to collect relevant information for the design of monitoring programs.

Section 7.5 – Biophysical Environmental Monitoring Programs and Management Plans

As part of the environmental assessment, Dominion Diamond will demonstrate that the monitoring and management plans have representative near-field and far-field baseline information, consider the natural range of variability, and will detect and mitigate any relevant changes – expected or unexpected – before they become significant adverse impacts.

Extensive monitoring programs are established for the Ekati Mine that should be used as the basis for monitoring of new project components. A response framework is required under the Ekati Mine Water Licence and should be used as the basis for new project components. Dominion Diamond will describe the framework for proposed monitoring programs and management plans or amendments to existing plans that will guide their evaluation of and adaptive management for impacts to water quality.

9C1.3 Regulatory Overview

Several federal and territorial acts are applicable to the Project and are related to effluent and environmental monitoring. There are also management plans relevant to water and waste disposal that are summarized in Sections 1.2.3.2, 3.4.3, and 8.8 of the DAR.

The federal laws include the *Canadian Environmental Protection Act* and the Toxic Substances Lists, as well as the *Fisheries Act*. At this time, the Metal Mining Effluent Regulations of the *Fisheries Act* are not applicable to diamond mines.

The territorial laws relevant to effluent and environmental monitoring include the following:

- The *Northwest Territories Water Act* and the Northwest Territories Water Regulations, which govern the use of water and the deposition of waste. Dominion Diamond will hold a Water Licence with criteria for discharge of deleterious substances and other water quality parameters, as well as a requirement for a Surveillance Network Program under these regulations. Under this regulation, the Ekati Mine Emergency Spill Response Plan, Wastewater and Processed Kimberlite Management Plan (WPKMP), Waste Rock and Ore Storage Management Plan (WROMP), and Spill Contingency Plan will be amended to incorporate the Project.
- *Mackenzie Valley Resource Management Act* and the Mackenzie Valley Land Use Regulations. Dominion Diamond will hold a land use permit with conditions related to waste disposal at the Project under these regulations.

9C1.4 Existing Aquatic Effects Monitoring Program

The Ekati Mine has an AEMP that is a comprehensive monitoring program designed to detect changes in the aquatic environment that may be mine-related. Tables 9C1.4-1 to 9C1.4-3 provide an overview of the existing AEMP, including waterbodies, components, and sampling frequencies. Additional details for the existing AEMP are available in the *Ekati Diamond Mine: Aquatic Effects Monitoring Program Plan for 2013 to 2015* (ERM Rescan 2013).

The existing AEMP for the Ekati Mine will be expanded to incorporate the Project area and this expanded AEMP will integrate concepts from the most recent designs for aquatic effects monitoring in NWT. Planning and implementation of the AEMP will consider the Aboriginal Affairs and Northern Development Canada document titled, "*Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the Northwest Territories (NWT), June 2009*" (AANDC 2009). The objective of the AEMP will be to meet the requirements and conditions of the water licence issued by the Wek'èezhìi Land and Water Board (WLWB).

9C1.5 Additional Monitoring Programs

The AEMP will be one program of many environmental monitoring programs (Section 1 of the DAR). Relevant data from the Surveillance Network Program, WPKMP, and WROMP as well as air quality monitoring will be incorporated into the interpretation of the AEMP. Specifically, effluent quality and loading, air quality, and waste rock storage area (WRSA) seepage monitoring will be considered in the AEMP in determining the potential effects of the Project on the aquatic receiving environment.

Table 9C1.4-1 Overview of Existing Ekati Mine Aquatic Effects Monitoring Program Components in Lakes

Location	UTM Coordinates[a]		Water Quality	Limnology	Phytoplankton	Zooplankton	Benthos	Sediment Quality	Fish
	Easting (m)	Northing (m)							
Reference Lakes									
Nanuq	534200	7199287	X	X	X	X	X	X	X
Counts[b]	533825	7169850	X	X	X	X	X	X	X
Vulture	521183	7180882	X	X	X	X	X	X	X
Koala Watershed									
Grizzly	521303	7177743	X	X	-	-	-	-	-
Kodiak	518273	7175550	X	X	X	X	X	X	X
Leslie	515938	7173285	X	X	X	X	X	X	X
Moose	516630	7177852	X	X	X	X	X	X	X
Nema	513575	7171132	X	X	X	X	X	X	X
Slipper	507098	7165297	X	X	X	X	X	X	X
S2	507638	7164468	X	X	X	X	X	X	-
S3	505912	7164439	X	X	X	X	-	-	-
King-Cujo Watershed									
Cujo[c]	538721	7162007	X	X	X	X	X	X	X
LDS2	541240	7164235	X	X	-	-	-	-	-
LDS1	541616	7164530	X	X	X	X	X	X	-
Pigeon Watershed									
Fay Bay	515470	7181355	X	X	X	-	-	X	-
Upper Exeter Lake	513066	7180902	X	X	X	-	-	X	-

Source: ERM Rescan (2013).

a) UTM coordinates are in NAD 83 Zone 12N.

b) Lake D3.

c) Lake B4.

UTM = Universal Transverse Mercator; m = metres; X = indicates component is included; - = indicates component is not included.

Table 9C1.4-2 Overview of Existing Ekati Mine Aquatic Effects Monitoring Program Components in Streams

Streams	UTM Coordinates[a]		Water Quality	Benthos	Hydrology Station	Stream Flows
	Easting (m)	Northing (m)				
Reference						
Nanuq Outflow	532197	7199430	X	X	-	-
Counts Outflow	535488	7169709	X	X	X	X
Vulture-Polar	521503	7179655	X	X	X	X
Pigeon Stream - Reach 7	517224	7182256	X	-	-	-
Koala Watershed						
Lower PDC (Panda Diversion Channel)	518587	7175997	X	-	X	X
Kodiak-Little	517943	7174808	X	X	-	-
1616-30 (Long Lake Containment Facility)	514021	7173081	X	-	(pumps)	(pumps)
Leslie-Moose	516481	7172868	X	-	-	-
Moose-Nero	517460	7172818	X	X	-	-
Nema-Martine1	513921	7170646	X	X	X	X
Slipper-Lac de Gras	507643	7164878	X	X	X	X
King-Cujo Watershed						
1616-43 (King Pond Settlement Facility)	538785	7161359	X		(pumps)	(pumps)
Cujo Outflow	538942	7162432	X	X	X	X
Christine-Lac du Sauvage	540025	7163840	X	-	X	X
Mossing Outflow			X	-	-	-
Pigeon Watershed						
Pigeon Stream – Reach 1	514355	7180927	X	-	-	-

Source: ERM Rescan (2013).

a) UTM coordinates are in NAD 83 Zone 12N.

UTM = Universal Transverse Mercator; m = metre; X = indicates component is included; - = indicates component is not included.

Table 9C1.4-3 Overview of Sampling Frequencies for the Existing Ekati Mine Aquatic Effects Monitoring Program Components

Monitoring Component	Annual Frequency	Seasonal Frequency
Lakes		
Water quality	annual	April and early August[(c)]
Physical Limnology	annual	April and early August[(c)]
Sediment quality	every three years	early August
Phytoplankton[(b)]	annual	early August
Plankton[(b)]	annual	early August
Benthos[(b)]	annual	early August
Fish	every three years (Slimy Sculpin) / six years (large-bodied)	mid- to late August
Streams		
Water quality[(a)]	annual	freshet (June), July, early/mid-August, fall high flows (September)
Benthos[(b)]	annual	early August to early September
Hydrology manual flow measurements[(b)]	annual	seven or more times per open water season (late May to September)
Hydrology automated station installation[(b)]	annual	installation prior to freshet, maintenance during manual measurements
Hydrometric levelling surveys[(b)]	annual	four or more times, late May to August

Source: ERM Rescan (2013).

a) Biweekly monitoring during the open-water season was required in Pigeon Stream Reach 1 for the first year of monitoring only.

b) Component is not required as part of the Pigeon watershed monitoring program.

c) Sampling required in July and September in Pigeon watershed.

9C2 CONCEPTUAL AQUATIC EFFECTS MONITORING PROGRAM

The AEMP Design Plan for the Project is anticipated to include a conceptual site model, impact hypotheses of the possible effects of the mine on the receiving environment, methodology (including methods to address cumulative effects), and an adaptive management component.

Results of the AEMP are expected to be reported annually. The design of the AEMP is expected to be reviewed every three years through the WLWB public review process.

The overall purpose of the AEMP is to:

- verify the predictions outlined in the DAR;
- evaluate the short-term and long-term effects on the physical, chemical, and biological components of the aquatic ecosystems of waterbodies in the Project area;
- estimate the spatial extent of effects; and,
- provide the necessary input to adaptive management.

9C2.1 Scope

The scope of the AEMP will change over the life of the Project in the construction, operation, and closure, phases of the project. Long-term monitoring will also be conducted during the post-closure period. It is anticipated that the following core components of the AEMP will be monitored during each phase of mine development:

- hydrology;
- water quality;
- sediment quality
- benthic invertebrate community;
- phytoplankton community;
- zooplankton community; and,
- fish (includes fish health and fish tissue chemistry).

Sites will be identified to be representative of near-field and far-field conditions. Water quality parameters to be sampled will be similar to those currently being sampled as part of the existing Ekati AEMP.

The AEMP will integrate Traditional Knowledge where appropriate. In addition, Special Studies, which are not core components of the AEMP, but rather studies proposed with the intent to supplement the AEMP components, may be conducted to address potential data gaps, and support future monitoring.

9C2.2 Conceptual Site Model

Conceptual site models illustrate potential interactions of stressors of potential concern, exposure pathways, and receptors of potential concern. The intention of the conceptual site model for the AEMP will be to assist in communicating potential effects of the mine to the structure and function of ecological components of the study area. The conceptual site model will be developed and the stressors of potential concern will be identified based on the following sources of information:

- Project description of the mine activities from the DAR and related commitments made by Dominion Diamond for the environmental assessment by the Mackenzie Valley Review Board;
- predictions from the DAR for the aquatic environment; and,
- measures and suggestions for reducing impacts provided for the Project by the Mackenzie Valley Review Board.

The AEMP will describe a method of differentiating the Ekati Mine versus Diavik Mine contributions to water quality and quantity changes or changes in aquatic life in Lac de Gras.

9C2.3 Response Framework

As required in Section 7.5 of the Terms of Reference (Appendix 1A), an adaptive management component will be included in or accompany the AEMP. It is termed the ‘Response Framework’, providing early warning thresholds that trigger further work that prevents adverse effects in the receiving environment. The Response Framework provides a systematic approach to responding to the results of the AEMP. An Aquatic Response Framework is a requirement of the Ekati Mine Water Licence and is currently under review by the WLWB. The framework has been developed with guidance from the *Draft Guidelines for Adaptive Response Framework for Aquatic Effects Monitoring* (WLWB 2010). The Response Framework will be amended to include the Project as part of the regulatory process following successful completion of Environmental Assessment.

9C2.4 Reporting

Monitoring will be summarized yearly as part of the Annual AEMP Report that is submitted to the WLWB by March 31 of each calendar year. Each annual report will follow the requirements identified in the Water Licence.

It is anticipated an Aquatic Effects Re-Evaluation Report will continue to be submitted every three years, and will present trends from baseline to current conditions. It is anticipated an updated AEMP Design Plan will be developed based on the 3-year Re-Evaluation, as a continuation of the current requirements of the Ekati Mine Water Licence. The content of the Re-evaluation Report will follow that defined in the Water Licence.

9C3 REFERENCES

AANDC (Aboriginal Affairs and Northern Development Canada). 2009. Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the Northwest Territories (NWT), June 2009.

ERM Rescan (ERM Rescan Environmental Services Ltd). 2013. Ekati Diamond Mine: Aquatic Effects Monitoring Program Plan for 2013 to 2015. Prepared for Dominion Diamond Ekati Corporation by Rescan Environmental Services Ltd: Yellowknife, NWT, Canada.

WLWB (Wek'èezhìi Land and Water Board). 2010. Guidelines for Adaptive Management – A Response Framework for Aquatic Effects Monitoring - Draft. Yellowknife, NWT, Canada.

WLWB. 2014. Wek'èezhìi Land and Water Board Water License #W2012L2-0001. Yellowknife, NWT, Canada.