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May 29, 2025

Mason Mantla
Chair
Wek'èezhìi Land and Water Board
#1, 4905 – 48th Street
Yellowknife, NT
X1A 3S3

Dear Mr. Mantla:

RE: W2022L2-0001 – Waste Rock and Ore Management Plan (WROMP) Version 13.1

Burgundy Diamond Mines Limited (Burgundy) is pleased to submit Version 13.1 of the Ekati *Diamond Mine Waste Rock and Ore Storage Management Plan (WROMP)* to the Wek'èezhìı Land and Water Board (the Board), in accordance with the Boards's Decision #2 of the WROMP 13.0 Reasons for Decision (RFD)[1]:

> *Decision #2: To require Burgundy to submit Version 13.1 of the WROMP within 90 days of communication of its decision. Version 13.1 is to include Revisions #1 to 16, and is for Board approval.*

A summary of the revisions made to the WROMP is provided in Table 1: Revision History Table. The Conformity Table 2 detail how the decision and administrative revisions from the RFD above have been addressed in Version 13.1.

We trust that this Plan meets the Board's requirements to facilitate a timely approval. Should you have any questions or require further information, please contact the undersigned at Feyi.Adebayo@burgundydiamonds.com or 403.910.1933 ext. 2403, or Tania Robitaille - Environment Operations Advisor at Tania.Robitaille@burgundydiamonds.com

Sincerely,

Feyi Adebayo
Environment Advisor – Projects and Closure Planning
Burgundy Diamond Mines

[1] letterhead master

Table 1. Revision History Table

Date	Section	Revisions
March 2024	General	• Incorporates references to Water Licence W2022L2-0001 • Removes all mention of activities not in compliance with the Licence
September 2024	General	• Includes a revision history table • Includes an abbreviations table • Incorporates a consistent operating company name • Include updated terminology for Receiving Environment and Receiving Water, to align with the Renewed Water Licence.
	Sections 1.3, 2.4, 2.4.11, 5.2.1, 5.2.2, 5.2.6, 6.10 7.1.1, 7.1.2, 7.3, 7.7.1, 7.7.2 and 7.9.3	• Reflects the changes to the Sable WRSA • Incorporates the decisions and revisions requested in the Reasons for Decisions for: o 2022 Three-Year WRSA Seepage Survey Report o WROMP 12.0 o Overburden Stockpile Seepage and Runoff – Request o WROMP Seepage Response Framework V1.0.
May 2025	Tables 2.4-2, 2.4-3, 3.14-1, 3.14-2 Figures 3.11-3, 3.11-4, 5.2-1, 5.2-2, 5.2-3, 5.2-4, 5.2-5, 5.2-7 Sections 2.4, 2.4.5, 2.4.11, 3.1.1, 3.11, 3.14, 5.2.6, 6.10, 7.1.1, 7.1.2,7.1.3, 7.3	• Incorporates the decision #2 and revisions #1-16 of the WROMP 13.0 Reasons for Decision

Table 2. Conformity with the WROMP 13.0 Reasons for Decision (Board – February 28, 2025)

WLWB Revision Requirements for WROMP 13.1	Location in WROMP Version 13.1/Comment
Decision #2 To require Burgundy to submit Version 13.1 of the WROMP within 90 days of communication of its decision. Version 13.1 is to include Revisions #1 to 16, and is for Board approval.	WROMP V13.1
Revision #1 Version 13.1 of the WROMP is to include a monitoring schedule and the proposed updates to section 7.1.1, and confirm reporting of monthly WRSA Seepage Collection Channels monitoring in the Annual Report required as per Schedule 1, condition 1 (n).	Section 7.1.1
Revision #2 Burgundy to include details regarding how overburden sampling results will be used and analyzed to determine infiltration rates and assess cover effectiveness in section 7.1.2.	Section 7.1.2
Revision#3 Burgundy is to include a table in the main body of the next submission of the WROMP that includes the geometric characteristics of all WRSAs, including at minimum, maximum height, average height, overall slope angle, and footprint.	Section 2.4 Table 2.4-3
Revision #4 Burgundy is to revise the text in section 3.1.1 of the WROMP to clarify how the change in methodology between pre-2020 metals analysis and post-2020 metals analysis can be accounted for when comparing data from the different methods.	Section 3.1.1 was revised to clarify the change in methodology.
Revision #5 Burgundy to include the proposed revision in its response to GNWT-ECC comment 3, in the next WROMP submission.	Section 7.3
Revision #6 The general target height for WRSAs be reverted to the original 50 m in the next WROMP submission.	Table 2.4-2
Revision #7 Burgundy to address the sentence identified in GNWT-ECC comment 7 in the next WROMP submission.	Section 2.4 - the omitted phrase “soil berms” has been added to the sentence.
Revision #8 The data presented in Figure 3.10-2 be finalized and updated in the next WROMP submission.	The Pigeon HCT data was incorporated into the site-wide Effective Neutralization Potential Investigation Report (Golder, 2021), which does not provide standalone analyses or figures specific to

	Pigeon, for inclusion in the WROMP.
Revision #9 Seepage sampling location figures be updated in the next WROMP submission, and to include at minimum, seepage sampling locations, flow directions, and updated satellite imagery.	Figure 5.2-1 Figure 5.2-2 Figure 5.2-3 Figure 5.2-4 Figure 5.2-5
Revision #10 A summary of recent and historical Coarse Kimberlite Reject geochemistry data be included with Table 3.14-1 with the next WROMP submission, and with updated data to be included in future submissions of the WROMP.	Section 3.14 Table 3.14-1 Table 3.14-2
Revision #11 The description of the type of snow survey data that will be collected to support the final cover design of the Point Lake WRSA is to be included in section 7.1.3 in the next WROMP submission.	Section 7.1.3
Revision #12 Section 2.4.5 is to be updated pertaining to Misery Production History to reflect up to date history information, in the next WROMP submission.	Section 2.4.5 reflects up-to-date information
Revision #13 Text and figures in section 5 and 6 are to be updated to reflect current facilities at the Sable WRSA area in the next WROMP submission.	Sections 5.2.6 Figure 5.2-7 Section 6.10
Revision #14 Section 3.11 be updated to reflect up-to-date Lynx geochemical characterization data in the next WROMP submission.	Section 3.11 Figure 3.11-3 Figure 3.11-4
Revision #15 The text regarding the Sable development is to be revised to clarify what till and overburden at the Sable Development will be available for reclamation, in the next WROMP submission.	Section 2.4.11 has been revised to clarify that the remaining till and overburden are available for reclamation use.
Revision #16 Burgundy is to correct the appendix reference in Section 7.1.1 identified in WLWB staff comment 4 and GNWT-ECC comment 4 in the next WROMP submission.	Section 7.1.1

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Waste Rock and Ore Storage Management Plan Version 13.1

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Appendix B: Seepage Sampling Protocol

Appendix C: Pigeon WRSA Updated Design Report

Appendix D: Diabase Geochemical Evaluations

Appendix E: Sable WRSA Design Report Version 2

Appendix F: Point Lake WRSA Design Plan Version 1.1

Appendix G: Ekati Mine: Evaluation of geochemical classification criteria

Appendix H: Point Lake Project Metasediment Geochemical Assessment Update - August 2022 *(Appendix G to ERM, 2023)*

ABBREVIATIONS

Abbreviation	Definition
ABA	Acid-Base Accounting
ARD	Acid Rock Drainage
AP	Acid Potential
Burgundy	Burgundy Diamond Mines Limited
$CaCO_3$	Calcium carbonate
CKR	Corse Kimberlite Rejects
CKSA	Coarse Kimberlite Rejects Storage Area
CPK	Coarse Processed Kimberlite. "Coarse material, as defined in the approved Wastewater and Processed Kimberlite Management Plan, rejected from the process plan after the recoverable diamonds have been extracted" as defined in W2022L2-0001.
CPT	Cone Penetration Testing
EQC	Effluent Quality Criteria
Ekati mine	Ekati Diamond Mine
FPK	Fine processed kimberlite. "Fine material, as defined in the approved Wastewater and Processed Kimberlite Management Plan, rejected from the process plant after the recoverable diamonds have been extracted" as defined in W2022L2-0001
Ga	Bilion years of age
ICP-AES	Inductively coupled plasma mass spectrometry
ICRP	Interim Closure and Reclamation Plan
LLCF	Long Lake Containment Facility
Ma	Million years of age
ML	Metal leaching
MPA	Maximum Potential Acidity – refers to the amount of acid that could be generated from the total sulfur concentration
MUG	Misery Underground
NP	Neutralization potential
NNP	Net Neutralization Potential
Non-PAG	Acid consuming / non-potentially acid generating
NP/MPA	Neutralization potential ratio
OBSP	Overburden Stockpile
PAG	Potential acid generating

PL	Point Lake
QA/QC	Quality assurance and quality control
RE	Receiving Environment means “The natural aquatic environment that received any deposit or Discharge of Waste, Including Seepage or Minewater, from Project” as defined in the Class A Water Licence (W2022L2-0001)
RW	Receiving Water means “The water in the Receiving Environment that receives any direct or indirect deposit of Waste from the Project” as defined in Class A Water Licence (W2022L2-0001)
Seepage	“Includes water or Waste that drains through or escapes from any structure designed to contain, withhold, divert or retain water or Waste, including Waste Rock Storage Areas” as defined in the Class A Water Licence (W2022L2-0001)
SNP	Surveillance Network Program
SoPC	Seep of potential concern
SRK	SRK Consulting
SUG	Sable Underground
TRSP	Two Rock Sedimentation Pond
Waste Rock	“All unprocessed rock materials that are produced as a result of mining operations” as defined in the Class A Water Licence (W2022L2-0001)
WLWB	Wek'èezhìı Land and Water Board
WPKMP	Wastewater and Processed Kimberlite Management Plan
WROMP	Waste Rock and Ore Storage Management Plan
WRSA	Waste rock storage area

1. INTRODUCTION

1.1 Background

Part H.6 of Water Licence W2022L2-0001 for the Ekati Diamond Mine requires a Waste Rock and Ore Storage Management Plan (WROMP or Plan). Detailed requirements for the Plan are specified in Schedule 6 Item 2 of the Water Licence.

The various versions of the WROMP describe a series of operational updates to approved or existing Waste Rock Storage Areas (WRSAs), as follows and in Table 1.1-1:

- *WROMP V.6.0 July 2016* incorporated the Sable WRSA and addressed the Wek'èezhìi Land and Water Board's (WLWB, the Board) conditions for approval of V.5.1, and was approved by the WLWB, with conditions, in its August 31, 2016 Directives and Reasons for Decision.
- *WROMP V. 6.1 September 2016* addressed the WLWB's conditions for approval of V.6.0, and was approved by the WLWB in its November 8, 2016 letter. It was noted that a Sable WRSA Final Design Report was required for submission prior to the commencement of construction of the Sable WRSA.
- *WROMP V.6.2 December 2016* described changes to the Misery WRSA and was approved by the WLWB, with conditions, in its February 15, 2017 letter.
- The *Sable WRSA Final Design Report* prepared by Tetra Tech Canada was submitted in May 2017 for WLWB approval as per Condition H.3 of the Water Licence and as follow-up to WLWB approval of WROMP V.6.1.
- *WROMP V.7.0* describes changes to the Pigeon WRSA (with accompanying Updated Design Report), addresses the WLWB's conditions for approval of V.6.2, and updates language related to the Sable WRSA.
- *WROMP V.7.1* provides statements in the WROMP and the Pigeon WRSA design report to include WLWB decision on Pigeon WRSA Final Cover Design.
- *WROMP V.8.0* reflects the presence of diabase within the Lynx Pit and the use of non-potential acid generating waste rock materials for construction use.
- *WROMP V.9.0* provides the final Sable WRSA design version 2 with a 30 m setback from the Two Rock Sedimentation Pond (TRSP).
- *WROMP V.10.0* includes Misery Underground Project Development, revision to section 7.0; verification, monitoring and reporting, screening criteria and to the rock types and proposed monitoring of Lynx WRSA, and the Lynx diabase risk mitigation program

- *WROMP V10.1* provides revisions requested in WROMP V.10.0 Reasons for Decision including clarifying that there are some uncertainties in the characterization of diabase, and that only granite and Lynx diabase have been approved for use in construction and other requirements related to diabase.

- *WROMP V11.0* includes the Seepage response Framework and provides revisions requested in WROMP V.10.1 Reasons for Decision including to clearly state that only Lynx diabase can be used in the same manner as granite at the Ekati site and trigger for additional seepage sampling of placed construction material beyond the minimum two spring and two fall events.

- *WROMP V11.1* removes the Seepage Response Framework and proposes seepage management consistent with Water Licence W2020L2-0004 requirements. Revisions requested in WROMP V11.0 Reasons for Decision are provided.

- *WROMP V12.0* incorporates the Point Lake WRSA and Overburden Stockpile and addresses the Board's conditions for approval of WROMP V11.1.

- *WROMP V12.1* incorporates references to Water Licence W2022L2-0001 and removes all mention of activities not in compliance with the Licence.

- *WROMP V13.0* incorporates the decisions and revisions requested in the Reasons for Decisions for WROMP 12.0, the 2022 Three-Year WRSA Seepage Program, Overburden Stockpile Seepage and Runoff Request, and the Seepage Response Framework V1.0. Additionally, it includes an abbreviations table and reflects the changes to the Sable WRSA.

- *WROMP V13.1* provides revisions requested in WROMP V13.0 Reasons for Decision.

Table 1.1-1 Previous Versions of the Plan

Report Title	Year	Areas Covered
Waste Rock and Ore Storage Management Plan	2000 - Version 1 (revised 2001 - Version 2)	Panda, Koala, Koala North, Misery, Fox
Addendum #1 Waste Rock and Ore Storage Management Plan	2002	Fox pipe
Addendum #2 Beartooth Pipe Waste Rock and Ore Storage Management Plan	2003	Beartooth Pipe
Addendum #3 Expansion of the Panda/Koala WRSA	2007	Panda/Koala
Addendum #4 Misery Waste Rock Storage Area Modification	2010	Misery
Version 3.0	2011	Incorporate relevant aspects of the subsequently eliminated Geochemical Characterization and Metal Leaching (ML) Management Plan, 2007
Version 4.0	2014	Pigeon Amendment
Version 4.1	2014	Addresses other requests and directives provided in WLWB's approval of Version 4.0
Version 5.0	2015	Lynx Amendment
Version 5.1	2015	Addresses review comments received on V.5.0
Version 6.0	2016	Sable Amendment, and addresses directives provided in WLWB's approval of Version 5.1
Version 6.1	2016	Addresses directives provided in WLWB's approval of Version 6.0
Version 6.2	2016	Misery Amendment
Version 7.0	2017	Pigeon Amendment, addresses directives provided in WLWB's approval of Version 6.2
Version 7.1	2017	Updated WROMP and Pigeon WRSA design report to include WLWB decision on Pigeon WRSA Final Cover Design
Version 8.0	2018	Lynx diabase update and waste rock material construction use update
Version 9.0	2018	Sable WRSA design version 2.0 with a 30 m setback from the Two Rock Sedimentation Pond (TRSP)
Version 10.0	2018	Misery Underground Development; Revision to section 7.0; verification, monitoring and reporting, screening criteria; Lynx diabase risk mitigation program; Proposed monitoring for Lynx WRSA

Report Title	Year	Areas Covered
Version 10.1	2019	Revisions requested in WROMP V.10.0 Reasons for Decision including: clarifying that there is some uncertainties in the characterization of diabase, and that only granite and Lynx diabase has been approved for use in construction and other requirements related to diabase.
Version 11.0	2020	Seepage Response Framework and revisions requested in WROMP V.10.1 including to clearly state that only Lynx diabase can be used in the same manner as granite at the Ekati site and trigger for additional seepage sampling of placed construction material beyond the minimum two spring and two fall events.
Version 11.1	2022	Removal of the Seepage Response Framework and proposes seepage management consistent with Water Licence W2020L2-0004 requirements.
Version 12.0	2023	Incorporates Point Lake WRSA and Overburden Stockpile and appends the approved Point Lake WRSA Design Plan; addresses the Board's conditions for approval of WROMP V.11.1.
Version 12.1	2024	Incorporates the required updates of Water Licence W2022L2-0001. Removal of activities stated that are not in compliance with the licence as directed by WROMP Revision #1 by the WLWB in the Reason for Decision on March 1st 2024.
Version 13.0	2024	Incorporates the required updates of Reasons for Decision of WROMP V12.0 for The Point Lake Development, Seepage Response Framework, and other topics pertaining to waste rock and seepage management.
Version 13.1	2025	Revisions requested in WROMP 13.0 Reasons for Decision within 90days of communication of its decision including; Point Lake Development WRSA Seepage Collection Channels Monitoring, Waste Rock Pile Characteristic, Trace Metal Analyses Methods and basic revisions per the recommendations received during WROMP V12.0 public review.

1.2 Plan Alignment with Requirements

Table 1.2-1 correlates the Plan with the Water License requirements.

Table 1.2-1 Alignment with Water License Requirements

Water Licence Requirement Per Schedule 6 Item 2	Location in WROMP
ARD Characterization	
(a) characterization of the rock types (b) representative sampling and testing (c) assessment of potential for ARD/ML	S.3, Appendix A
(d) predicted loadings and/or impacts	S.5
(e) geochemical characterization for reclamation	see note
(f) Description of the process to be used to regularly assess and revise the plans based on ongoing data collection through this program or through the attached Surveillance Network Program, the Aquatic Effects Monitoring, Seepage Surveys, or other environmental monitoring programs	S.3
Waste Rock and Ore Storage Management	
(g) Schedule of ore stockpiling, and Coarse Processed Kimberlite and Waste Rock production by rock type, tonnage, and destination over the term of this Licence	S.2
(h) Complete description, including site maps to scale, of each proposed ore and Waste Rock Storage Area	S.2 and S.6
(i) Detailed descriptions of the different types of Solid Waste disposed of and the locations for the disposal of solid Waste and Sewage sludge within the Waste Rock Storage Area	S.6
(j) An identification of all potential sources of Seepage for each Waste Rock Storage Area and the distance to the downstream Receiving Water;	S.5 and S.6
(k) Detailed proposals for management of Seepage, including water quality monitoring, collection, treatment, re-routing, final disposal, and for incorporating the studies and plans developed under Part H, Condition 6 of this Licence;	S.7
(l) Detailed Construction Plans and drainage management for Waste Rock Storage Areas used for containment of the Misery schist, Point Lake metasediment, and other Waste Rock types that may be identified as problematic through Acid/Alkaline Rock Drainage testing, including contingency plans for controlling runoff and Seepage water chemistry;	S.6
(m) Temperature analysis of all Waste Rock Storage Areas having acid/alkaline potential to include the effect of oxidation reactions on predicted Acid/Alkaline Rock Drainage generation rates;	S.4
(n) Detailed descriptions of how Seepage surveys will be carried out to meet the requirements of Part H, Condition 9;	S.7, Appendix B
(o) For the Point Lake, Sable, Pigeon, and Misery pits, a description of the geochemical criteria for the management and placement of potentially ARD Waste Rock and hydrocarbon contaminated materials within the Waste Rock Storage Areas. This shall include a section describing the process for segregation of the various rock types;	S.3 and S.6
(p) A description of confirmatory process and field inspection program to verify pegmatite	S.7.3

Water Licence Requirement Per Schedule 6 Item 2	Location in WROMP
volumes in the Point Lake Waste Rock Pit and Storage Area;	
(q) A description for testing that will be conducted if pegmatite volumes are greater than 5% of the Point Lake Waste rock;	S.7.3
(r) A description of a procedure to be implemented during Point Lake open pit operations to identify, using operational monitoring data, a sample of Point Lake metasediment that contains 95th percentile concentrations of solid phase and leachate constituents, and a description of humidity cell test and other test and reporting procedures for that sample;	S.7.3
(s) Description of adaptive management processes that systematically link monitoring results to management activities and allow management activities to be developed adaptively, in response to changes in the environment;	S.7
(t) Characterization and rationale for validating or altering the approved overburden monitoring program approach with respect to the Point Lake Project; and	S.7.3
(u) a summary of rock, soil and granular materials that may be used for site Construction and reclamation based on geochemical characterization.	S.6.3, Appendix A
(v) A WRSA Seepage Response Framework that includes a description of the link between the results of WRSA Seepage surveys to those actions necessary to ensure that Project-related effects on the Receiving Environment remain within an acceptable range	See note

Note: As with previous versions of this Plan, a geochemical characterization of material to be used for reclamation (Schedule 6 Item 2(e) is provided separately through the Interim Closure and Reclamation Plan.
Item 2(v) will be addressed after the approval of the Seepage Response Framework.

1.3 Changes in Version 13.1

Table 1.3-1 Primary Changes for WROMP Version 13.1

Location	Change	Rationale
Section 7.1.1	Include a monitoring schedule of WRSA Seepage Collection Channels and reporting in the Annual Report	Revision #1 – WROMP V13.0
Section 7.1.2	Additional details regarding how the OVBSP sampling results will be used and analyzed to determine the infiltration rates	Revision #2 – WROMP V13.0
Section 2.4 Table 2.4-3	Addition of Table of Geometric characteristics	Revision #3 – WROMP V13.0
Section 3.1.1	Revision of paragraph to clarify how different methods between pre-2020 and post-2020 metals analyses can be compared	Revision #4 – WROMP V13.0
Section 7.3	Additional details on the purpose of waste rock placement chemistry monitoring program.	Revision #5 – WROMP V13.0
Table 2.4-2	Reversion to the original 50m target height for WRSAs	Revision #6 – WROMP V13.0
Section 2.4	Addition of “soil berms” to complete the sentence	Revision #7 – WROMP V13.0
Figure 5.2-1 Figure 5.2-2 Figure 5.2-3 Figure 5.2-4 Figure 5.2-5	Updated Seepage sampling locations	Revision #9 – WROMP V13.0
Section 3.14 Table 3.14-1 Table 3.14-2 Table 3.7-3 Table 3.7-4	Updated geochemistry data and tables for the Coarse Kimberlite Reject and Misery Underground	Revision #10 – WROMP V13.0
Section 7.1.3	Updated description of the type of snow survey data that will be collected to support the final cover design of the Point Lake WRSA added	Revision #11 – WROMP V13.0
Section 2.4.5	Updated to include proper dates for Misery development history	Revision #12 – WROMP V13.0
Sections 5.2.6 Figure 5.2-7 Section 6.10	Updated text and figures to reflect current facilities at the Sable WRSA	Revision #13 – WROMP V13.0
Section 3.11 Figure 3.11-3 Figure 3.11-4	Include data for Lynx geochemical characterization	Revision #14 – WROMP V13.0
Section 2.4.11	Revision of Sable development to clarify that till and overburden will be available for reclamation	Revision #15 – WROMP V13.0
Section 7.1.1	Correction of Appendix reference	Revision #16 – WROMP V13.0

Note: Incidental editorial or informational updates may also be incorporated into new versions of the Plan, but not warranting identification in Table 1.3-1.

2. SITE DESCRIPTION

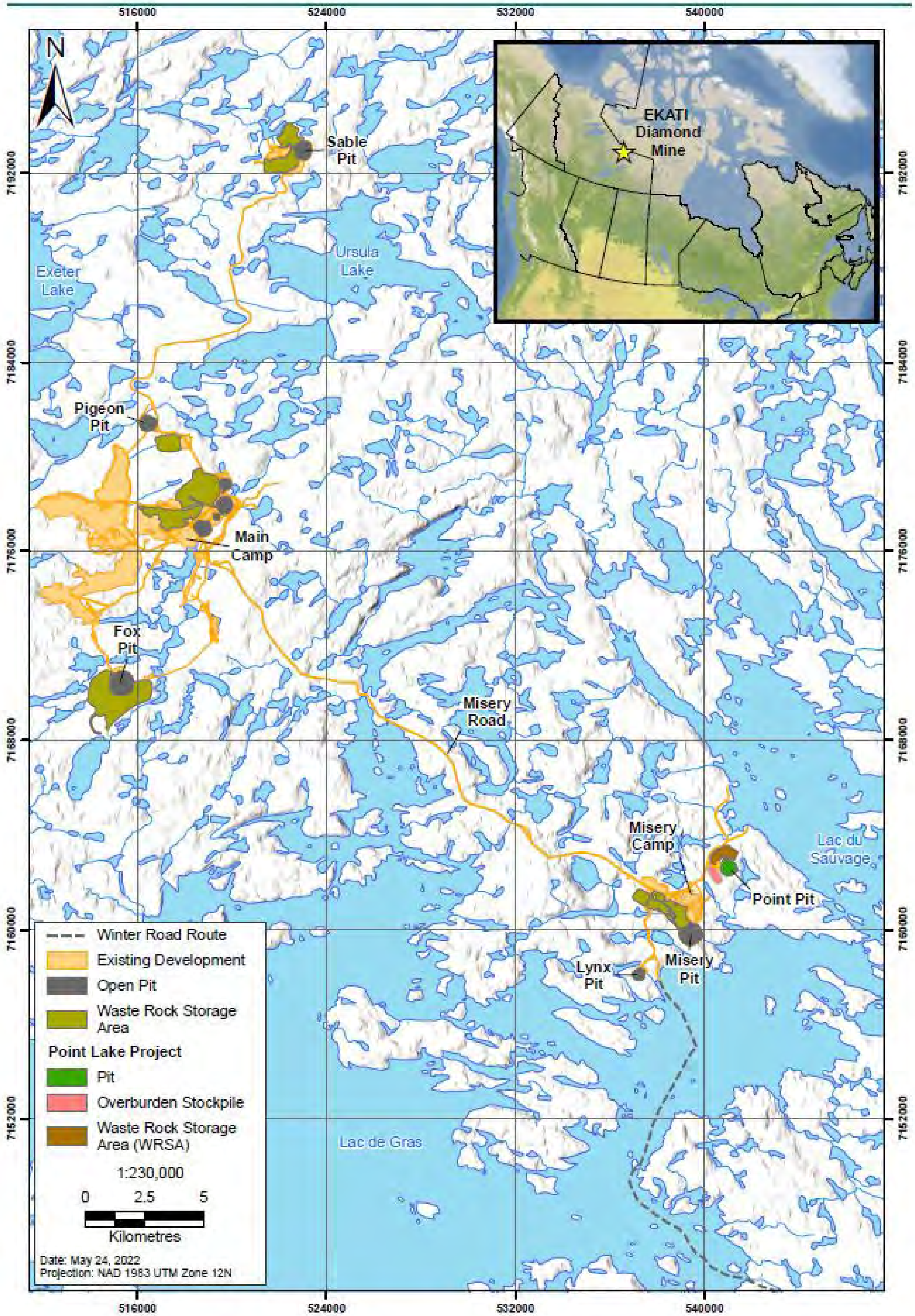
2.1 Introduction

The Ekati Diamond Mine is in the Northwest Territories approximately 300 km northeast of Yellowknife (Figure 2.1-1). The mine officially opened in October 1998. Mining activities are complete in eight development areas (Panda, Beartooth, Fox, Koala, Koala North, Misery open pit, Lynx, and Pigeon) and four remain as part of the planned mining activities to 2029 (Sable, Sable Underground, Misery underground, and Point Lake). This Plan will be amended to incorporate approved future developments. A list of the completed and planned mine components and the corresponding waste rock storage areas (WRSA) is provided in Table 2.1-1.

Table 2.1-1 Planned and Completed Mining Activities and WRSAs

Open Pits	Underground	Waste Rock Storage Areas
Panda (completed)	Panda (completed)	Panda/Koala/Beartooth
Koala (completed)	Koala (completed)	Panda/Koala/Beartooth
Koala North (completed)	Koala North (completed)	Panda/Koala/Beartooth
Beartooth (completed)	None Planned	Panda/Koala/Beartooth
Fox (completed)	None Planned	Fox
Misery (completed)	Misery (underway)	Misery
Pigeon (completed)	None Planned	Pigeon
Lynx (completed)	None Planned	Lynx
Sable (underway)	Planned	Sable
Point Lake (underway)	None Planned	Point Lake

Figure 2.1-1 Location of the Ekati Diamond Mine and Kimberlite Pipes



2.2 Topography and Geomorphology

The Ekati Diamond Mine is located north of the tree line within the sub-Arctic tundra of the Lac de Gras watershed. The mine lies within the zone of continuous permafrost with a seasonal shallow active layer. The original topography and geomorphology of each of the mined areas is described in previous WROMPs and addendums (BHP 2000, 2002, 2003). Prior to mining, each of the kimberlite pipes was covered by a lake which was subsequently drained to allow mining development. Where possible, lake sediments, glacial sediments and topsoil were removed and stored for possible use during reclamation. The current topography and geomorphology reflect a mined and natural landscape with waste rock storage areas, pit developments and infrastructure surrounded by tundra. The surrounding landscape has low to moderate relief with low-lying muskeg and swamp interspersed with moderately sloping rounded hills. This is intersected by numerous lakes and patchy rock outcrops. Rare rock escarpments and ravines are also present. Glacial deposits are common including tills, moraines, kames, eskers and significant boulder fields.

2.3 Site Geology

The Ekati Diamond Mine is located within the central portion of the Archean Slave Structural Province. The geology of the Ekati claim block is illustrated in Figure 2.3-1. The detailed kimberlite pipe geology is described in Appendix A while the site geology is summarized here.

The following rock types are present on the property, in order of decreasing age (based on geological time scales of millions (Ma) and billions (Ga) of years):

- Archean (>2.66 Ga) biotite schist/metasediment (occur primarily at Misery pipe) of the Burwash Formation (Yellowknife Supergroup) formed by the action of heat and pressure on muddy and sandy sediments deposited underwater;
- Archean (2.63-2.58 Ga) granitic to dioritic plutons (occur at all pipes) of various compositions (most commonly biotite granite) intruded as hot melts into the metasediments;
- Narrow (several metres thick) Proterozoic (2.23-1.27 Ga) diabase dykes (observed in Fox, Misery, Beartooth, Pigeon, Lynx, and Sable pipes) of the Mackenzie dyke swarm intruded as hot melts into cracks in the metasediments and plutons; and
- Phanerozoic (75-45 Ma) kimberlite pipes intruded into all of the above, but dominantly in the granitic intrusions.

Figure 2.3-2 provides a schematic diagram for a typical vertical cross section of an Ekati kimberlite pipe.

The composition of these rocks is predictable regionally and locally across the property. The rock units at the Ekati mine are visibly very distinctive and the contacts between the different rock types are well defined and easily observed in the field. The host rocks generally show no effects from contact with kimberlite, due to the nature of kimberlite emplacement. The kimberlite pipes were intruded rapidly and explosively as relatively cool molten rock from deeper in the crust, resulting in no significant mineralogical or chemical alteration of the surrounding host rocks. This contrasts sharply with the formation of metal and gold ore deposits which typically result from circulation of hot water through the rock and often results in alteration of the host rocks adjacent to the ore body and can later result in generation of acidic runoff when exposed to the atmosphere.

Very low concentrations of sulphide minerals are found in all rock types on the property. Granites and diabase contain rare, disseminated grains of pyrite and chalcopyrite at average concentrations of 0.02% for granite and 0.1% for diabase. Metasediments contain low concentrations (average 0.2%) of fine-grained disseminated pyrite, pyrrhotite, and chalcopyrite. These rock types also have low concentrations of carbonate minerals (typically calcite) which mostly occur as fracture fillings. Kimberlite also contains low concentrations (average 0.3%) of fine-grained disseminated pyrite, and has abundant associated carbonate (i.e., calcite).

Overall, the country rocks and subsequently the waste rock are geochemically non-reactive or have low reactivity.

Figure 2.3-1 Geology of the Ekati Claim Block

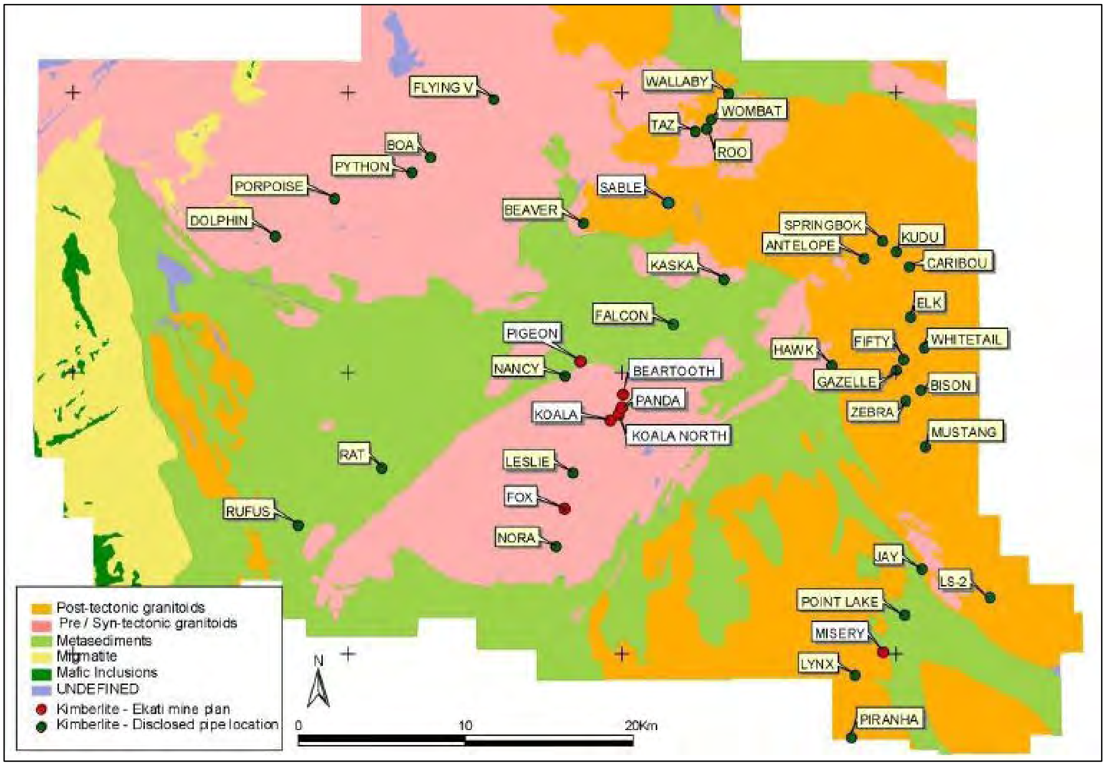
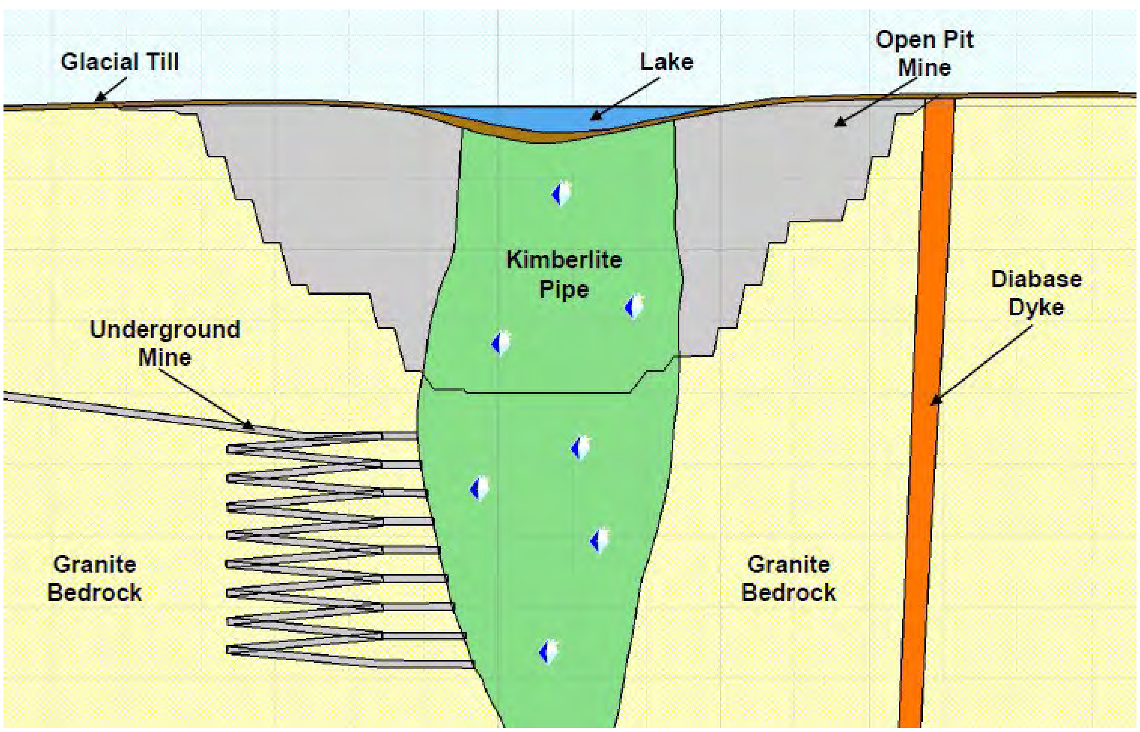


Figure 2.3-2 Typical Section of Kimberlite Pipe and Mine Workings



2.4 Approved Mining Activities and Storage Areas

Waste materials from open pit and underground mining are placed in WRSAs located adjacent to open pit operations. The WRSAs also contain and store other materials including coarse kimberlite rejects, kimberlite stockpiles, lake sediments, glacial tills, and landfill material. Salvage topsoil as well as co-mixed lake sediments/glacial till have also been stockpiled adjacent to WRSAs. There are currently seven separate WRSAs constructed at the Ekati mine (Panda/Koala/Beartooth, Pigeon, Fox, Misery, Lynx, Sable, Point Lake including the Point Lake Overburden Stockpile).

The WRSAs at the Ekati mine are all designed and constructed to meet the following primary objectives:

- To be inherently physically stable structures, both during mine operations and in the long term;
- Designed as permanent structures to remain after mining is completed;
- Constructed to promote permafrost aggradation; and
- Designed to achieve a reasonable balance between surface footprint and height.

Waste Rock Storage Areas at the Ekati mine are constructed to minimize the risk of runoff originating from them and to encourage permafrost formation. As the Ekati mine is located within the climate zone of continuous permafrost, water infiltrating the WRSAs becomes trapped in the waste rock as ice when it encounters sub-freezing internal temperatures. Leaching from waste rock is thus limited to the outer surface of the waste rock (i.e., active layer) where water produced by melting of seasonal surficial ice and snow runs over the trapped ice surface.

The following is a list of generic features that are incorporated into the design of WRSAs at the Ekati mine:

- Construction of a basal layer of approved construction materials over the tundra to encourage permafrost into the base of the waste rock and limit contact of potentially reactive waste rock (i.e., metasediment) with surface flow over tundra soils, which can be naturally acidic;
- WRSA geometry (i.e., lift height, setback and slope angles) that achieve long-term physical stability requirements;
- Encapsulation of potentially reactive materials (e.g., metasediment) within a cover of approved reclamation materials where beneficial to achieving closure water quality criteria;
- Consideration of the potential need for and nature of rock and/or soil berms in the toe area of a WRSA as means of achieving water quality objectives;
- Consideration of construction of soil berms in selected areas where appropriate (or drainage gullies) to limit runoff of water from the waste rock; and
- Setbacks from the receiving water bodies as a mitigation measure to allow for attenuation of drainage by tundra soils and to create opportunities for potential implementation of adaptive management contingencies that may be developed in future (as described in Section 7.5)

Application of the above features depends on the specific geochemical characteristics of the waste rock in combination with site-specific considerations such as topographical features and proximity to the Receiving Environment and Receiving Water.

The following sections describe the mining activities for each kimberlite pipe and the associated WRSAs. The quantity of waste rock removed from each pipe is summarized in Table 2.4-1. The general design criteria of the WRSAs are shown in Table 2.3. Note that site-specific variations to the general design criteria shown in Table 2.4-2 may be developed from time to time where appropriate. The geometric characteristics of the waste rock and coarse kimberlite reject storage areas are described in Table 2.4 3.

Table 2.4-1 Waste Rock Tonnages Mined

Geological Unit	Million Tonnes Mined – through September 2024									
	Panda	Koala	Koala N	Beartooth	Misery	Fox	Pigeon	Lynx	Sable	Point Lake
Surficial Material	8.6	9.8	0.1	2.0	3.0	7.2	4.4	0.2	1.68	0.783
Granite - pit	75.5	61.5	2.9	28.6	49.4	110.6	na	9.1	81.527	na
Granite - underground	4.9	1.0	0.7	na	0.6269	na	na	na	na	na
Waste Kimberlite	0	0	0	0	0.8	28.2	0.1	na	0.0041	0
Metasediments	0	0	0	0	40.8	0	na	na	0	0.839
Diabase	0	0	0	0	3.2	2.8	na	0.99	1.20	0
Mixed granite, metasediment & diabase[1]	na	na	na	na	na	na	41.9	na	na	na

1: The material mined from Pigeon pit is mixed metasediment, granite and diabase, which will be managed as PAG material.

Table 2.4-2 General Design Criteria of Waste Rock Storage Areas

Design Parameter	Unit	General Criteria*
Ramp Gradient	%	8 - 10
Road Width	m	30 - 32
Distance from high water marks	m	100
Angle of repose	degrees	35 – 37
Dump lift heights	m	Variable, typ 10-20
Maximum overall height above underlying tundra	m	Target 50
Overall slope angle	degrees	Variable, typ 18 - 28

Notes: m = metre; % = percent

** Design criteria are developed individually for each WRSA dependent on site-specific condition*

Table 2.4-3 Geometric Characteristics of Ekati WRSAs

WRSAs		Final Maximum Design Height (m)	Current Maximum Height (m)	Overall Slope Angle (%)*	Final Design Footprint (ha)
Misery		65	65	34	109
Point Lake	Rock Pile	48	15	37	69
	Overburden Stockpile	40	8	37	27
Sable	West WRSA	65	50	29	72
	South WRSA	60	50	34	93
	West WRSA	42	20	33	17
Pigeon		70	58	28	80
Fox		50	50	10	320
Lynx		35	32	30	32
Panda/Koala/Beartooth		50	40	37	341
Coarse Kimberlite Reject Storage Area		50	40	20	115

WRSA heights are calculated from the average tundra elevation adjacent to the respective WRSA

**Calculated from Ekati Mine Technical Services' Survey Data*

2.4.1 Panda/Koala/Beartooth Production History

Surface mining at Panda Pit spanned 1998 to 2004. Production from Panda underground began in 2005 and was completed in 2010. Full scale surface mining at Koala began in 2003 and was completed in 2005. A short period of mining in 2006 completed surface mining within Koala Pit. The first exploration drift at Koala underground was in 2005. Underground production from Koala began in 2007 and was completed in 2018.

Koala North open pit mining began in 2001 and was completed in 2003. Production from Koala North underground began in April 2010 and was completed in June 2015. The Beartooth kimberlite pipe was mined by open pit methods from 2004 until 2009, at which time mining operations at the pit ceased. The tonnages produced from each kimberlite pipe are summarized by rock type in Table 2.4-1.

2.4.2 Panda/Koala/Beartooth Waste Rock Storage Area

Waste materials from the Panda, Koala, Koala North, and Beartooth open pits, and the Panda and Koala underground developments are stored together in the waste rock storage area close to the main camp. This WRSA also contains several other waste management facilities including the Coarse Kimberlite Reject Storage Area and the Koala and Beartooth Topsoil Storage Areas. These facilities are discussed below. The total area covered by the Panda/Koala/ Beartooth WRSA (defined as the constructed perimeter berms and all enclosed land, including the uncovered tundra) is 4,281,000 m^2. The maximum elevation of the WRSA is 520 m above sea level (MASL), 40 m above the local average tundra elevation of 480 MASL. The footprint of the WRSA is shown in Figure 2.4-1.

Waste rock from the Panda, Koala, Koala North, and Beartooth developments consist primarily of biotite granite with minor quantities of kimberlite from rock near the waste/ore geological contact (estimated to be less than 3% of the total waste rock quantity). Beartooth waste rock also includes incidental minor quantities of metasediments (<0.1% of total Beartooth waste rock). Construction of the Panda/Koala/Beartooth WRSA is complete except for on-going placement of coarse kimberlite rejects.

Coarse Kimberlite Reject Storage Area

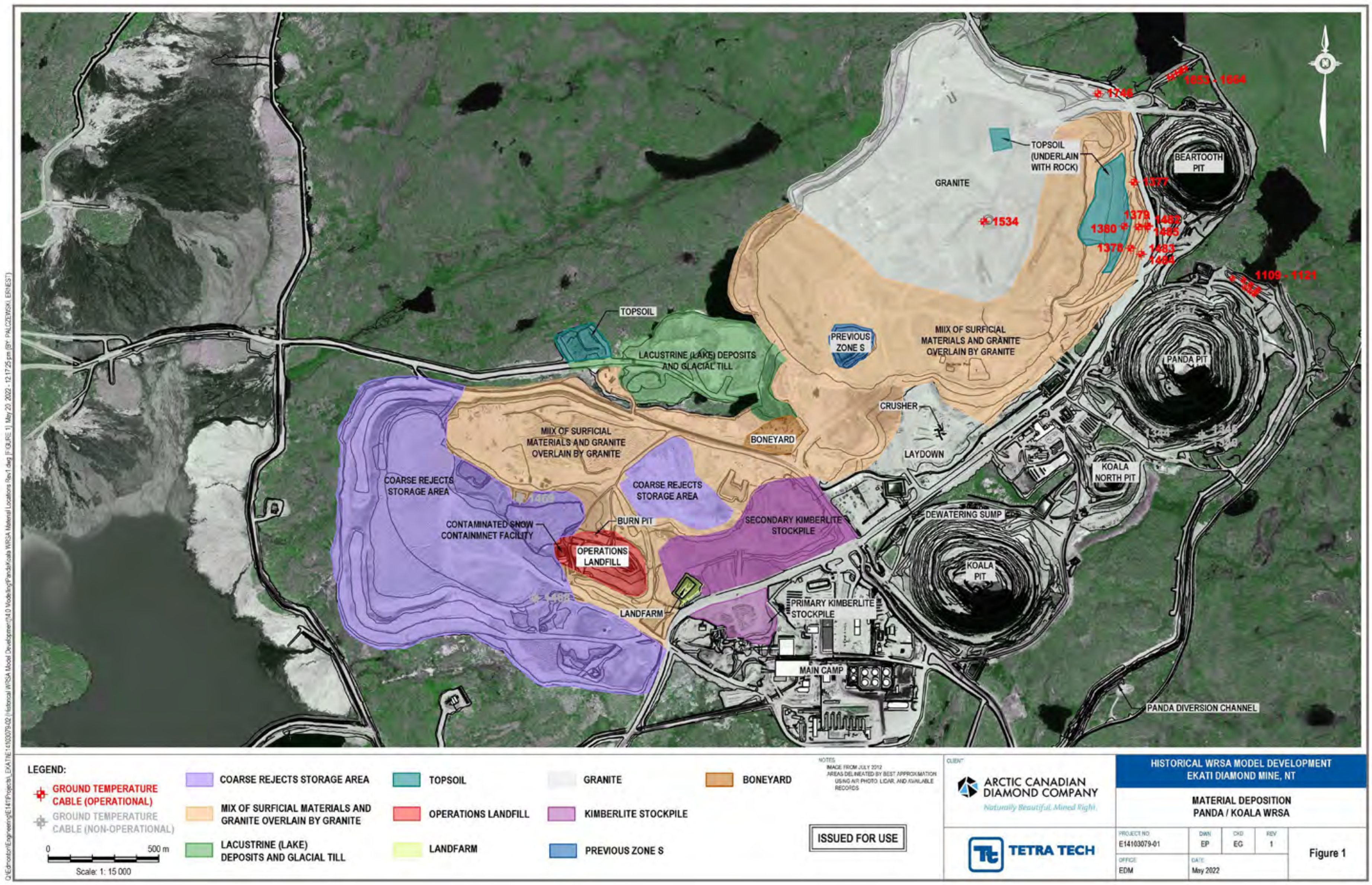
The Coarse Kimberlite Reject Storage Area (CKRSA) has received material from the Process Plant since 1998. The CKRSA contains processed kimberlite from all pipes mined to date at the Ekati mine. The Coarse Kimberlite Rejects (CKR), or Coarse Processed Kimberlite (CPK), are comprised of a mixture of sand to gravel-sized, light and dense minerals remaining after the diamonds have been recovered from the kimberlite. The grain size distribution is in the range of 0.5 to 25 mm diameter. Finer material (<0.5 mm) washed from the kimberlite ore during processing (Fine Processed Kimberlite - FPK) is discharged as a slurry to the Long Lake Containment Facility (LLCF).

The initial development of the CKRSA occurred prior to the identification, based on site-specific monitoring data, that interaction of kimberlite materials with the naturally acidic tundra soils can result in low pH waters resembling acid rock drainage with high solute concentrations, despite the high neutralization potential within the CKR (SRK 2001; Day *et al.* 2003). As such, early portions of the CKRSA were not built with an underlying granite pad. Subsequently, a granite shell was constructed around the outer edges of the CKRSA to ensure that the CKR remained in permanently frozen portions of the pile. Further expansions of the CKRSA were constructed with a pre-laid granite pad.

Lake Deposits and Glacial Tills

The Panda/Koala Lake Deposits and Glacial till Storage Area (Figure 2.4-1) contains lake-bottom sediments and overburden tills excavated during the development of the Panda and Koala North Pits (estimated volume of 20.5 million tonnes) for use during reclamation. This material is mixed to a limited degree with waste rock during transportation. Koala and Beartooth lake sediments were also mixed with waste rock in the western portions of the WRSA.

Figure 2.4-1 Panda/Koala/Beartooth WRSA Material Locations



Salvaged Topsoil

Topsoil, salvaged from the original Koala Lake perimeter has been stockpiled north of the Panda/Koala WRSA. Topsoil from the Beartooth Lake perimeter has been stockpiled on the east end of the WRSA.

Operations Landfill

The Main Camp solid waste landfill was commissioned in July 1998 and is located on the western side of the Panda/Koala/Beartooth WRSA (Figure 2.4-1). The landfill is an approved facility (under the 1995 Environmental Impact Statement [EIS]) and its operation is inspected regularly. The landfill is used for the disposal of inert non-hazardous wastes (metal, cement, etc.) generated as part of the operation of the mine.

Contaminated Snow Containment Facility

The Contaminated Snow/Ice Containment Facility (CSCF) was constructed in 2004 on the CKRSA on the western side of the WRSA (Figure 2.4-1). The CSCF is an approved facility (under the 1995 EIS) and its operation is inspected regularly. The

CSCF is a bermed and lined engineered facility designed for the containment of hydrocarbon-impacted snow and ice that are generated as a result of operational spills (diesel, glycol, gasoline, kerosene, jet fuels, hydraulic oil, transmission fluid and lube oil). Following the spring melt, the hydrocarbon contaminated sheen floating on the surface of the water is physically removed. The remaining water is sampled and tested for hydrocarbons prior to disposal into Cell B of the LLCF.

Landfarm

The landfarm was constructed in 1998 and is a lined engineered facility designed with a leachate collection system and side berms to control runoff. The landfarm is an approved facility (under the 1995 EIS) and its operation is inspected regularly. The landfarm is utilized for the management of hydrocarbon-impacted soil generated at the site as a result of operational spills (diesel, glycol, gasoline, kerosene, jet fuels, hydraulic oil, transmission fluid and lube oil). Hydrocarbon impacted soils with average particle sizes of less than 4 cm are bio-remediated at the landfarm facility. The landfarm may also be used as secure temporary storage for hydrocarbon-impacted material which is unsuitable for bio-remediation, prior to these materials being sent offsite for disposal.

Zone S

Zone S is a management facility designed to accept hydrocarbon impacted materials greater than 4cm in diameter. Zone S locations accept large diameter Run of Mine (ROM) material contaminated with hydrocarbons. This waste stream is usually generated through open pit mining process when equipment failures cause spills of hydrocarbons to contaminate blast rock as it is being excavated. Larger diameter hydrocarbon contaminated materials in Zone S are not treated and will become part of the waste rock pile capped at the end of the mine life as described in the Interim Closure and Reclamation Plan. Solid Waste sewage is also deposited in Zone S of the Panda/Koala Waste Rock Storage Area.

Sump Water Disposal Area

The Sump Water Disposal Area (SWDA; also known as the Racetrack) was closed in September 2006. It is located within the footprint of the CKRSA and was designated for the disposal of excess water that had been decanted from the landfarm, CSCF, truck shop sumps and collection ponds or other sources of mine water. Mine water includes runoff from facilities associated with the mine operation and all water or waste pumped or flowing out of any open pit or underground mine. Seepage flowed from the SWDA to the LLCF. All wastewater that formerly discharged to the SWDA now goes directly to Cell B of the LLCF.

2.4.3 Fox Production History

The Fox pipe is the largest of the mining development pipes (17 ha at surface; Figure 2.4-2) and is located approximately 15 km southwest of the main camp. The Fox pipe was developed by open pit mining methods. Development began in 2002 with mine production starting late in 2005 and was completed in spring 2014. The quantities of various rock units that have been removed from the Fox Pit are provided in Table 2.4-1. Kimberlite ore from Fox Pit was hauled to the main process plant. Coarse kimberlite rejects from Fox were placed within the existing Panda/Koala/Beartooth CKRSA.

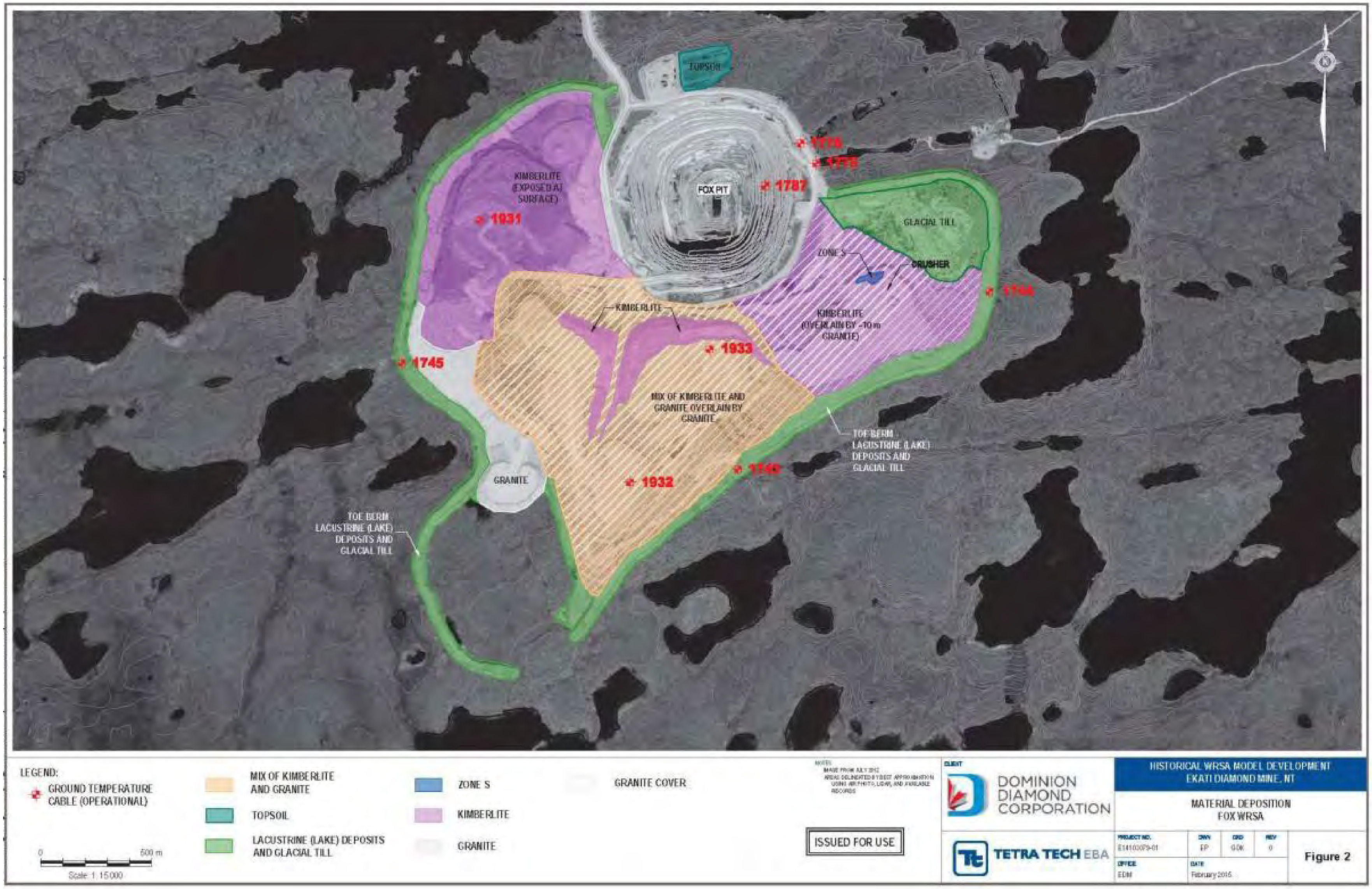
2.4.4 Fox Waste Rock Storage Area

The Fox WRSA covers the western, southern and eastern areas immediately adjacent to the pit. The Fox WRSA is the repository for all waste rock from the Fox Pit. The total area covered by the Fox WRSA (defined as the constructed perimeter berms and all enclosed land including the uncovered tundra) is 3,830,000 m^2. The maximum elevation of the WRSA is 510 MASL, 50 m above the local average tundra elevation of 460 MASL. The footprint of the Fox WRSA is shown on Figure 2.4-2.

The Fox WRSA consists of granite co-disposed with minor diabase, lake-bottom sediments and till. Waste kimberlite is segregated and located within the Fox WRSA in a south-central location and along the northwest side (Figure 2.4-2). Granite pads were pre-laid to avoid direct contact of waste kimberlite with tundra water and to promote freezing in the pile. All the waste kimberlite within the WRSA is surrounded by an extensive (approx.40 m thick) granite zone. Berms were constructed in select areas around and downgradient of the WRSA during the fall and winter of 2003/2004 to enhance the attenuation of WRSA seepage flow towards Receiving Environment. Limited topsoil from the perimeter of Fox Lake was salvaged for future reclamation efforts during pre-stripping in 2003. This material has been stored north of the Fox pit (Figure 2.4-2).

Similar to the Panda/Koala/Beartooth WRSA the Fox WRSA has a Zone S (Figure 2.4-2) where hydrocarbon impacted soils and rock with average particle sizes of greater than 4 cm are not treated and become part of the waste rock pile capped at the end of the mine life as described in the Interim Closure and Reclamation plan. Further details on Zone S design can be found in Section 2.4.2. Construction of the Fox WRSA is complete.

Figure 2.4-2 Fox WRSA Material Locations



2.4.5 Misery Production History

The Misery pipe is located approximately 30 km southeast of the main camp, close to Lac de Gras. Stripping of the Misery Pit and construction of the WRSA was initiated in 2000 with mine production occurring from 2001 to 2005 by open pit methods. Open pit mining resumed in 2012 as a push-back of the initial open pit and has been completed in 2018.

The Misery Underground (MUG) Project includes underground development started in April 2018, followed by kimberlite mining in early 2019. Additional development occurred until 2021, and kimberlite mining is ongoing. All waste generated from the underground will be hauled to surface (via the main access ramp) for disposal in the designated areas of the Misery WRSA or for utilization as a construction material.

Major facilities in the Misery area include the Misery Pit, the Misery WRSA, the Temporary Kimberlite Storage Area, and Misery Camp. Table 2.4-1 provides the quantities of various rock units that have been removed from the Misery Pit. The maximum WRSA elevation is 515 MASL, which is approximately 65 m above the local average tundra elevation of 450 MASL. The total area to be covered by the Misery WRSA is 1.4 Mm^2.

2.4.6 Misery Waste Rock Storage Area

Waste materials from the Misery Open Pit and the MUG development and operations are stored at the Misery WRSA. The Misery WRSA is constructed to encapsulate all potentially acid generating (PAG) metasediments within the permanently frozen portions of the pile. Methods used include alternating layers of potentially reactive metasediments (10 m thick) and non-reactive granite and diabase (5 m thick). A final 5 m thick granite and diabase cap was placed over the interim storage area in May and June of 2005 and will be placed over the final WRSA upon completion. A cover thickness of 5 m (granite and diabase) has been demonstrated as appropriate to maintain the active freeze/thaw zone within the upper granite and diabase layer to minimize potential oxidation within the metasediments. The current footprint of the completed Misery WRSA is shown in Figure 2.4-3. The final top surface of the Misery WRSA is planned to be at two elevations, 500 m and 515 m (Figure 2.4-4). The partial upper lift reflects the quantity of waste rock that is currently scheduled to be mined, with the ‘extra’ space available as contingency.

An estimated total of 530,000 wet metric tonnes of waste rock is expected to be generated from the Misery underground development. This includes 430,000 wet metric tonnes of granite waste rock from the lateral and vertical developments which includes an allowance for the additional cutouts required for safety bays and electrical rooms. During the Sublevel Retreat underground mining method, an additional 100,000 wet metric tonnes of waste rock from the contact zone between the host bedrock and the kimberlite pipe are expected to be mined out (dilution). Based on the geology of the area, it is estimated that 50% of this will be non-reactive granite and diabase materials and 50% could be metasedimentary waste rock. This material will be hauled up with the kimberlite ore and sorted at the Misery kimberlite ore transfer pad. The added schist tonnage of 50,000 tonnes from the MUG Project represents approximately 1% of the schist tonnage (5 million tonnes) allocated for the final 515 m lift at the Misery WRSA. Burgundy has confirmed with mine planning that this small amount of schist can be accommodated within the allocated contingency for the 515 m lift design and hence will not require any changes to approved final design footprint as shown in Figure 2.4-4. Processed kimberlite from Misery is managed according to the approved Wastewater and Processed Kimberlite Management Plan (WPKMP).

The north end of the Misery WRSA contains a till and lake sediment storage area (Figure 2.4-3), where approximately three million tonnes of material stripped from the Misery Pit and salvaged from the construction of the King Pond Dam are being stored for possible future reclamation use.

A landfill at the Misery site (Figure 2.4-3) was commissioned in August 2001 and is located north of the Misery Pit within the footprint of the Misery WRSA. When mining was suspended at Misery, the landfill was covered with a granite and diabase cap. The landfill is not currently in operation. Materials placed within this facility were the same as those disposed of within the Panda/Koala/Beartooth Landfill.

Similar to the Panda/Koala/Beartooth WRSA and Fox WRSA, Misery WRSA also has a Zone S where hydrocarbon impacted soils and rock with average particle sizes of greater than 4 cm are not treated and become part of the waste rock pile capped at the end of the mine life as described in the Interim Closure and Reclamation Plan. Further details on Zone S design can be found in Section 2.4.2.

Figure 2.4-3 Current Status of Misery Site

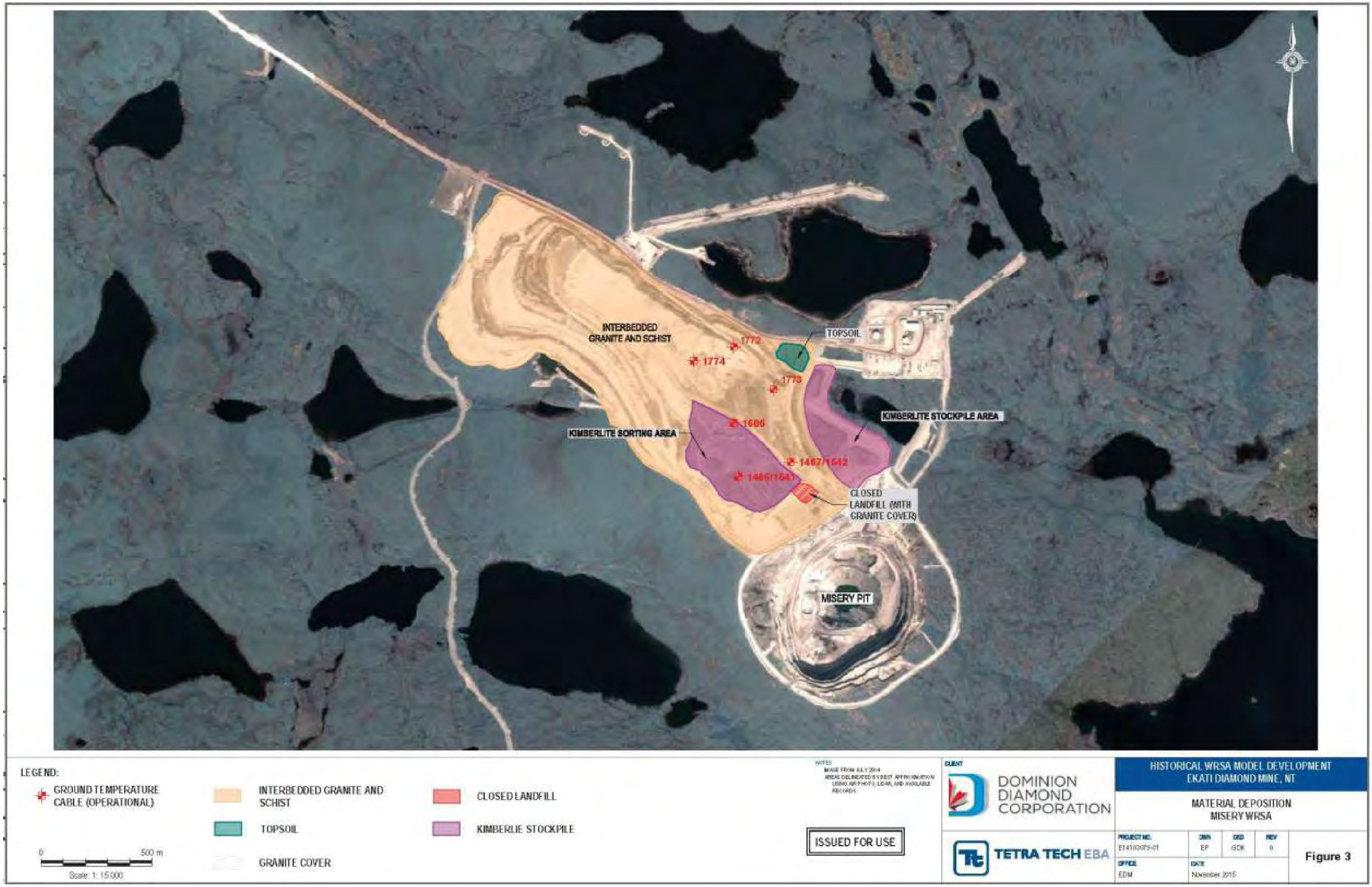
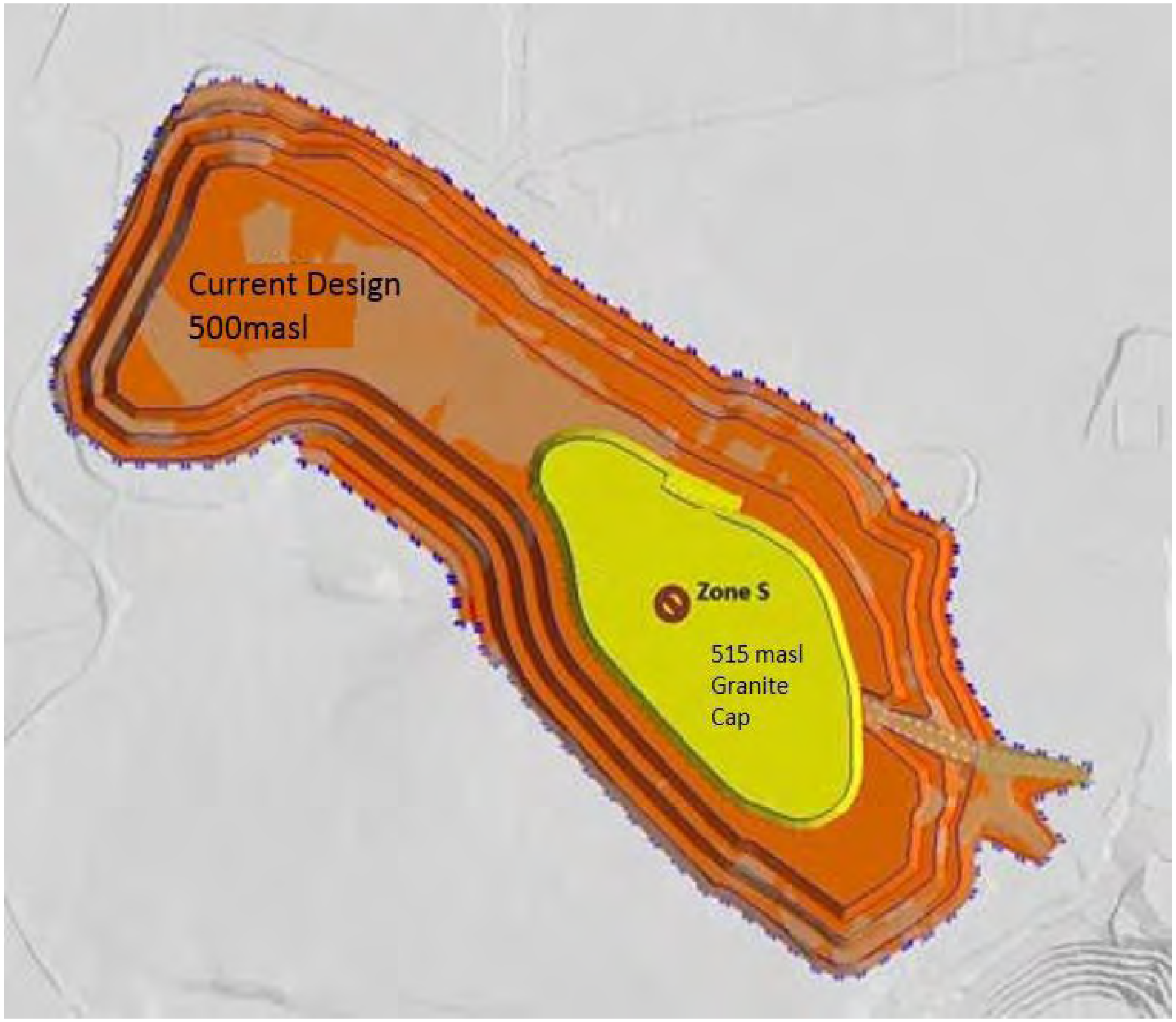


Figure 2.4-4 Final Misery WRSA Design Layout



2.4.7 Pigeon Production History

From January to April 2010, the Pigeon trial pit was excavated for bulk sampling of kimberlite and excess overburden placed in the Panda/Koala/Beartooth waste rock storage area (Figure 2.4-1). The kimberlite was processed in the process plant. Open pit construction at Pigeon began in 2014 with stripping of the open pit area completed during summer of 2015. Table 2.4-1 Waste Rock Tonnages Mined provides the quantities of various rock units that have been removed from the Pigeon Pit. Mining at Pigeon Open Pit was completed in 2022 with waste material removed and placed in the appropriate storage areas in accordance with the Design Plan described in Section 6.

2.4.8 Pigeon Waste Rock Storage Area

From January to April 2010, the Pigeon trial pit was excavated for bulk sampling of kimberlite. No waste rock was removed but overburden material was removed totaling 829,568 tonnes. The excavated overburden was stockpiled locally to the extent possible within the test pit catchment area and excess overburden placed in the Panda/Koala/Beartooth WRSA (Figure 2.4-1). The kimberlite was processed in the process plant.

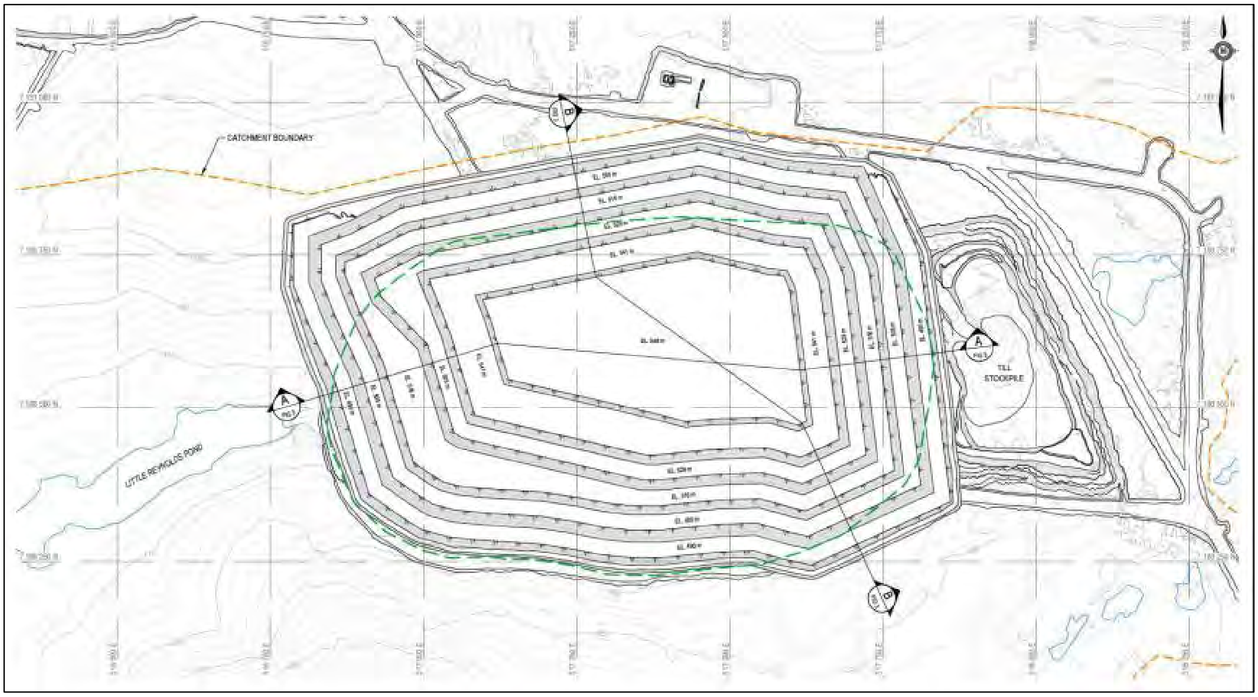
Stripping of the open pit area was completed during summer 2015. Mining at Pigeon Open Pit was completed in 2022 with waste material being removed and placed in appropriate storage areas in accordance with the Design Plan described in Section 6. The inter-banded occurrence of the geological contact between granite and metasediment in the Pigeon open pit precluded the mining of granite separately at an operational scale. Therefore, for waste rock management purposes, all the mixed granite and metasediment waste rock was managed as if it were PAG material. This approach provides a conservative element to the long-term performance of the Pigeon WRSA since the geochemical characterization shows that a granite/metasediment mixture in the range of 30-70% metasediment can be classified as NAG (i.e., non-acid generating). Additionally, the inclusion of granite within the mixed materials provides coarser and harder particles that can be expected to enhance permafrost aggradation into the WRSA by maintaining physical conditions that are more favorable to heat transfer.

The Pigeon WRSA Design Plan initially provided capacity for 13,445,000 m^3 of waste rock. The Design Plan was subsequently updated to incorporate an additional 11,500,000 m^3 of waste rock, for an aggregate containment volume of 24,945,000 m^3. The Updated Design Report as prepared by Tetra Tech Canada is provided as Appendix C of this document. The Design Report reports on the physical stability and thermal analyses of the WRSA as required by the Ekati Mine Water Licence. The Pigeon site plan showing the final design layout of the WRSA during operations is (Figure 2.4-5).

A design for a closure cover was provided in the WRSA Design Report; however, the final cover design for the Pigeon WRSA is not approved. The final cover design will be determined through the closure planning process or an update to the WROMP for Board approval. See Board's September 22, 2017 Reasons for Decisions on the Pigeon WRSA Design Report and WROMP Version 7.0 for more information.

Temporary Kimberlite Ore Storage Areas were used to stockpile kimberlite ore prior to hauling to the main camp for processing. A kimberlite ore storage area was developed on a granite pad in the area southeast of the open pit near the haul road. The pad will be reclaimed according to the established methods described in the Interim Closure and Reclamation Plan. All kimberlites will be removed for processing and the surface of the frozen granite pad will be ripped to encourage natural vegetation

Figure 2.4-5 Pigeon Site Plan Showing Design Pigeon WRSA Footprint for Operations



2.4.9 Lynx Waste Rock Storage Area

Waste rock excavated from the Lynx Pit is predominantly granite with limited amounts of diabase and negligible amount of gneiss. Waste rock not used for construction of pads or roads has been placed on the Lynx WRSA, a rectangular pile that is approximately 625 m long and 565 m wide. The final volume of rock in the WRSA is 4,780,876 m^3.

The waste rock pile is a benched pile design with a final design elevation of 485 m, and with bench elevations of 465 m and 480 m. The bench widths are typically 25 m with slopes of approximately 1.4H:1V. The overall pile slope is approximately 2.4H:1V to 2.7H:1V. Overburden was placed over a granite and diabase base that will have a depth up to 4.8m. The waste rock pile is located on a topographic high with a peak elevation of 470.0 m. The perimeter edge of the waste rock pile intersects the original ground at elevations from 453.0 to 468.0m.

2.4.10 Point Lake Waste Rock Storage Area and Overburden Stockpile

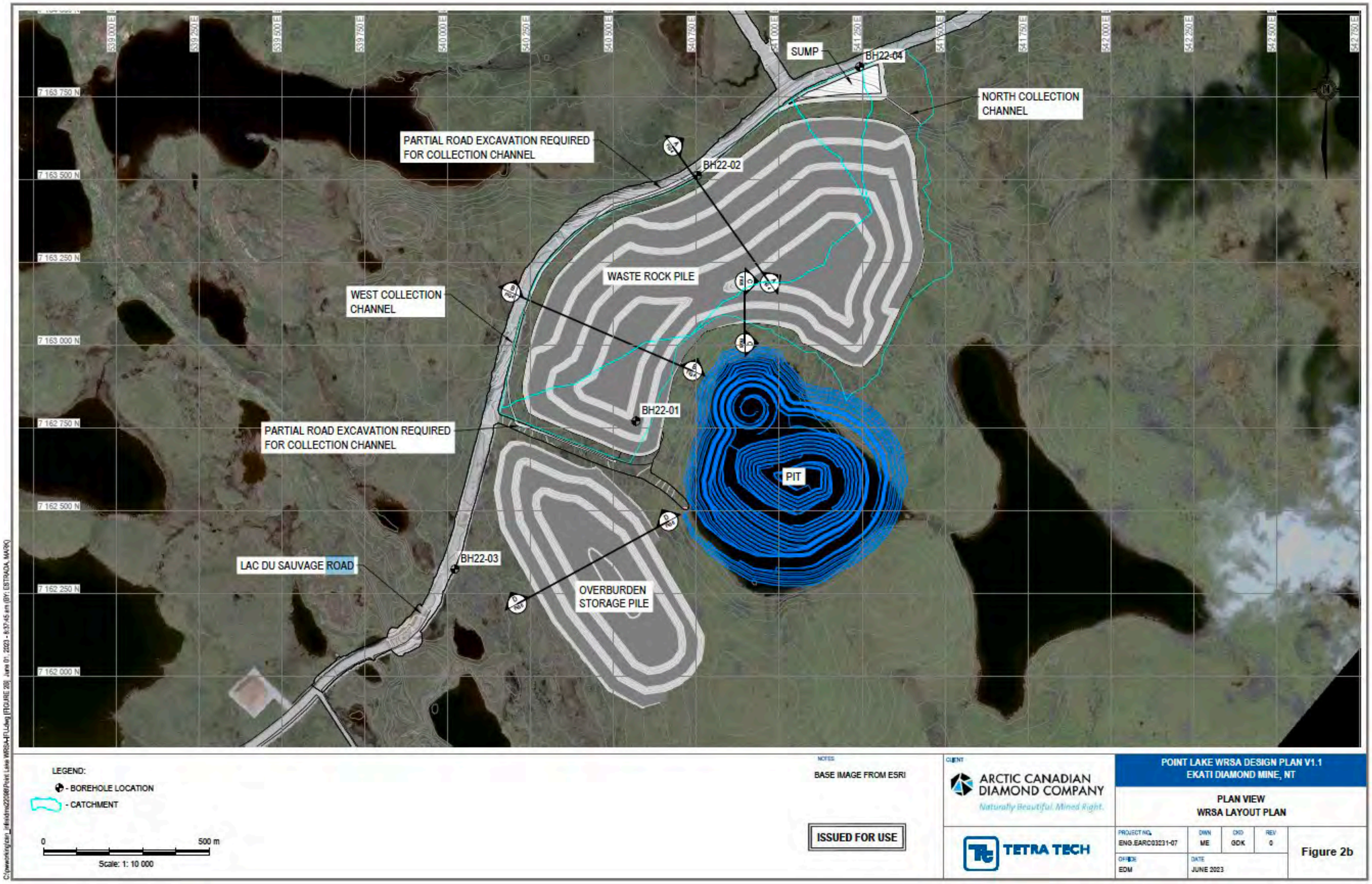
Waste materials from the Point Lake Open Pit will include lake bottom sediment, glacial till overburden, metasediment waste rock and minor (est. 1%) pegmatite waste rock. Lake bottom sediment and glacial till overburden will be placed in the Overburden Stockpile; and waste rock will be placed in the WRSA (Figure 2.4-10). A WRSA basal layer will be constructed using granite and Lynx diabase sourced from the Lynx WRSA and crusher stockpile. The approved Design Plan, including the WRSA and Overburden Stockpile, is provided as Appendix F. Construction of the WRSA basal layer has been separately approved and began in 2024. Placement of Point Lake waste rock and overburden has also commenced following the approval of WROMP Version 12.1.

The anticipated volume of waste rock in the WRSA is 12.9 Mm^3. The waste rock pile is a benched pile design with 15 m bench heights 15 m and setbacks of 35 to 55 m. Overall slopes are 4.2H:1V away from the open pit and 3.8H:1V towards the open pit. The waste rock pile is built out from a natural slope with a maximum height of 44.5 m and an average height of 23 m. A seepage collection system will be constructed that collects WRSA seepage through 2 ditches into a sump for transfer to King Pond Settling Facility. The design and QA/QC Plan for the seepage collection system is included in the WRSA Design Plan (Appendix F), which specifies that only approved construction materials (i.e., per Section 6.3) will be used as the specified Type A and Type B materials. The WRSA Design Plan includes a preliminary design of a closure cover consisting of a 3 m thick layer of Point Lake glacial till overburden surfaced with a 0.5 m thick layer of granite and Lynx diabase rock for erosion prevention.

A final design for a WRSA closure cover will be prepared shortly before completion of open pit mining for Board approval as required under Part K of the Water Licence. Burgundy is committed and required to achieve closure objective WR-1, which states “Seepage water quality from WRSAs is safe for people, terrestrial, and aquatic ecosystems”. The closure objective relates to safe seepage quality and not to freezing of 100% of the waste rock. The adaptive management approach established in the ICRP will evaluate and respond to circumstances where WRSA seepage quality is poorer than anticipated.

Kimberlite will be stored temporarily at the WRSA or at the Misery transfer pad prior to transport to the process plant. Processed kimberlite from Point Lake Open Pit will be managed according to the Wastewater and Processed Kimberlite Management Plan.

Figure 2.4-10 Point Lake WRSA and Overburden Stockpile Design



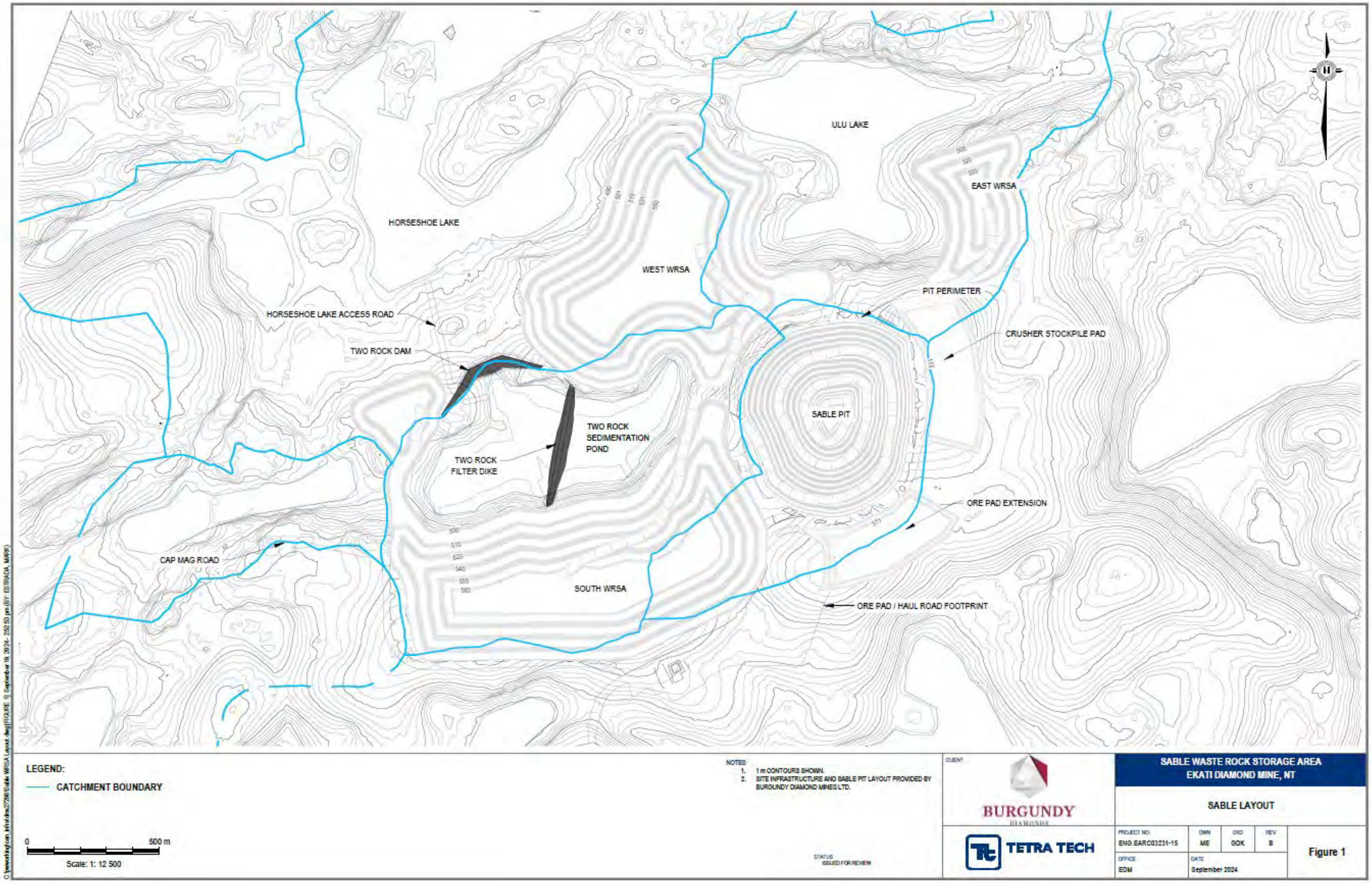
2.4.11 Sable Waste Rock Storage Area

Mining commenced in Sable Pit in August 2017 and is on-going. The waste rock excavated from the Sable pit is predominantly granite with small quantities of surficial materials and diabase. The till and overburden materials were stripped from the pit area, stockpiled adjacent to the pit, and allowed to freeze. The waste rock produced from the pit development is stored in three designated areas: South WRSA, East WRSA, and West WRSA (Figure 2.4-11). The South and West WRSAs are located on the west side of Sable Pit, while the East WRSA is located northwest of Sable Pit.

The South WRSA, located on the west side of Sable Pit, is roughly rectangular. In December 2017, a portion of the till and overburden was placed here and covered with waste rock to maintain frozen condition. The remaining till and overburden are available for reclamation use. The top bench of the South WRSA has been constructed to the design height of 563 masl. Construction of the South Extension WRSA commenced in 2024. The West WRSA, also situated on the west side of the pit and irregularly shaped, has reached the design height of 550 masl on its top bench. The East WRSA, located northwest of the pit and roughly rectangular in shape, has half of its top bench constructed to 535 masl. The slopes of the waste rock pile at the South, East, and West WRSAs vary from approximately 2.5H:1V to 8.25H:1V, 2.5H:1V to 6.5H:1V, and 2.5H:1V to 6.7H:1V, respectively, ranging from the steepest to the shallowest. These piles generally follow the design specifications outlined in the 2018 design report. The total volumes for the South, East, and West WRSAs are 25.38 Mm^3, 3.37 Mm^3, and 23.19 Mm^3, respectively, with a combined storage volume of 51.94 Mm^3.

The South and West WRSAs are separated by the Two Rock Sedimentation Pond. An Ore Pad/Laydown Area is located along the southeast side of the South WRSA. Additionally, a Kimberlite Ore Storage Area has been developed on a granite pad located south of the open pit and northeast of the Sable office complex, near the haul road. The Sable Ore Pad Extension covering 8.9 hectares (ha), and the Crusher Stockpile Pad covering 12.7 ha were approved in 2024. These pads are situated south and east of the Sable Pit.

Figure 2.4-11 Sable Site Plan Showing Design WRSA Footprint for Operations



3. GEOCHEMICAL CHARACTERIZATION

3.1 Introduction

The majority of the waste rock from mining at the combined Ekati operations is granite (or rocks of similar mineralogical composition), which is physically and chemically least reactive of the rock types at the Ekati mine. Granite comprises over 90% of the total waste rock volume stored at the Ekati mine. Other types of waste rock that occur in lesser quantities are metasediment and diabase, and at Fox pit, waste kimberlite. Granite and metasediments are largely composed of various amounts of the mineral plagioclase, feldspar, quartz, and mica. Diabase also contains feldspar and other dark minerals referred to as pyroxene. Minerals undergo chemical weathering by air and water when rock is placed in WRSAs. The weathering reactions (e.g., oxidation and reaction with dissolved carbon dioxide) release chemicals that are contained in the minerals. Water that infiltrates the WRSA mobilizes the chemicals that are released by weathering.

The minerals in granite and metasediment contain mainly the chemical elements aluminum and silicon, with potassium, sodium, calcium, magnesium and iron. Sulphide minerals, like pyrite, contain Sulphur mixed with metals like iron. Low concentrations of Sulphide minerals are present in metasediment. Sulphide minerals can produce acid when they oxidize, resulting in water with pH less than 5. It is important to note that some waters around the Ekati mine have naturally occurring pH levels of less than 5. The acidic water from this process is referred to as acid rock drainage (ARD) and has the ability to dissolve additional metals (referred to as metal leaching [ML]). This sometimes results in elevated dissolved metal concentrations in drainage. Metal leaching, however, can also occur at neutral and high pH as some metals dissolve under these conditions.

Carbonated minerals (or minerals that contain carbon) can prevent ARD from developing. These minerals react readily and produce water with pH greater than 6, which helps neutralize the acidic waters from Sulphide oxidation. Kimberlite generally contains large proportions of carbonate minerals. Silicate minerals are generally considered to be less effective than carbonates for neutralizing acid, but they have a role in neutralization when acid is produced at low levels.

The primary purpose of the ARD characterization of granite, diabase, metasediment, and kimberlite presented herein is to direct the development of appropriate waste rock management plans. ARD characterization and supporting information has been evaluated according to individual rock types such that appropriate management plans have been identified for each rock type. Where necessary, ARD characterization and supporting information have been further evaluated according to individual mining areas, and mining area-specific management plans have been identified where necessary. The geochemical dataset for each rock type includes some level of uncertainty inherent to working with natural materials. This nature of uncertainty is addressed through data analysis and reasonable professional judgement that considers the degree of numerical variability and geological variability. In some cases (such as granite and diabase) there is a clear preponderance of data to support an ARD classification, which results in a very high level of confidence in the rock type ARD classification and the associated management plan(s). In other cases (such as for metasediment), bi-modal data populations or other conflicting data occurrences result in greater uncertainty in the rock-type ARD classification, which is addressed through an appropriately conservative management plan. For example, the geochemical dataset for metasediment provides a bi-modal data population of potentially acid generating and non-potentially acid generating samples; however, the metasediment management plan is implemented with a high degree of confidence because it assumes the more conservative end member of the ARD characterization data.

Acid-base accounting is the combined measurements of Sulphur species, neutralization potential (NP), and pH, and calculations of Maximum potential acidity (MPA) also, net neutralization potential (NNP) and neutralization potential ratio (NP/MPA). The term Acid Potential (AP) and MPA should be considered interchangeably. Moving forward Burgundy will employ the term MPA. Together, these measurements provide a useful indication of potential for ARD. Materials with ARD potential is referred to as potentially ARD generating or PAG. Additional testing such as mineralogical analyses, and laboratory kinetic testing (e.g. humidity cells, column tests) are generally done to refine and calibrate geochemical assessment.

3.1.1 Summary of Relevant Studies on Geochemistry

The geochemical characteristics of rock from each deposit are described with reference to solid phase characteristics (ABA and metals) and kinetic test results in the subsequent sections. This section provides a high-level summary of relevant investigations with respect to acid rock drainage potential, kinetic testing, and effective neutralization potential.

Acid Rock Drainage Potential

The Ekati mine has an extensive solid phase geochemical characterization dataset. The dataset includes greater than 4,000 results of pre-mining geochemical testing and routine geochemical testing of waste rock, used to evaluate their potential to generate acid and/or leach metals. Acid-base accounting (ABA) results from static geochemical tests are used to categorize waste rock acid generation potential according to industry standard procedures (i.e., MEND (2009) and DIAND (1992)). ARD characterization of waste rock at the Ekati Diamond Mine is based on the guidelines specified in DIAND 1992 excepting the Point Lake development which is based on MEND 2009. In both cases, NP/MPA ratios of less than 1 are considered to be potentially acid generating (PAG). Under DIAND 1992, samples with NP/MPA ratios greater than 3 are considered to be acid-consuming (non-PAG) and NP/MPA ratios between 1 and 3 are considered to have uncertain potential for acid rock drainage. Under MEND 2009, samples with NP/MPA ratios greater than 2 are considered to be acid-consuming (non-PAG) and NP/MPA ratios between 1 and 2 are considered to have uncertain potential for acid rock drainage. For the Point Lake Development (Section 3.13), the selected Guideline does not affect the waste rock management plan because the waste rock is >99% metasediment and is wholly managed as PAG.

Historically, there have been two key analytical methods to measure NP: 1) carbonate acid neutralization (calculates the carbon NP from carbon assays, assuming all carbon is CaCO3) (carbonate-NP); and 2) bulk acid neutralization, which measures the ability of a sample to neutralize a known volume and strength of acid over a short exposure period (bulk acid-NP) (CANMET 2009). Bulk NP was measured using the standard Sobek procedure but has been updated to the Modified Sobek method (Lawrence et al. 1989).

The Modified Sobek method is widely used and reduces over-estimation of bulk NP relative to the standard Sobek method (i.e., the standard Sobek method is known to overestimate the NP of samples as it uses total Sulphur instead of Sulphide Sulphur) (CANMET 2009; INAP 2014). The Modified Sobek procedure is also considered to provide practical NP values by accounting for only the most reactive of the silicate minerals in addition to the carbonate minerals (UBC 1996). Overall, by introducing the modified method to measure NP, the confirmatory sampling results are more conservative because the NP measurements are typically reduced.

The method for measuring trace metals has also been updated as part of confirmatory sampling. Multi-element analysis is conducted to identify trace elements that may be of potential concern in acid- and neutral mine drainage. Accepted methods for multi-element analysis have two stages: 1) digestion of the sample using a strong acid method, such as four acid or aqua regia digestions, to release the elements into a measurable form; and 2) analysis of the elemental concentrations in the resulting digestion; for four acid or aqua regia digestions, Inductively Coupled Plasma (ICP) or Atomic Absorption Spectroscopy (AAS) is often used (CANMET 2009).

In 2022, parallel analyses of select samples using both methodologies were carried out and confirmed that the change in methodology was consistent with differences in the elemental results from the digested waste rock samples; lower concentrations of dissolved metals are recovered with the aqua regia digestion. Aqua regia digestion is a less intensive acidic digestion (3:1 hydrochloric acid:nitric acid) compared to the 4-acid digestion (combination of nitric, perchloric, and hydrofluoric acids with a final dissolution stage using hydrochloric acid). Overall distribution trends of major and minor elements remained relatively consistent between the methodologies. Thus, comparisons can be made with the historical record as long as the changes in methodology are considered. The Modified Sobek method is now being used to determine the NP in all waste rock across Ekati Diamond Mine. Further details of the analyses results can be found in the 2022 WRSA 3-Year Seepage Program Report available on the WLWB registry.

Kinetic Testing

Ekati Mine has undertaken humidity cell testing of waste rock to evaluate the rate of mineral weathering reactions and the potential time to onset of acid generation (if ever). The kinetic testing dataset is discussed in detail in pre-mining geochemical characterization reports (e.g., Norecol, Dames and Moore (1997), Golder (2014) ERM (2023)). MEND (2009) states that for sulphidic geologic materials, the "well-flushed humidity cell is the recommended kinetic test for predicting primary reaction rates under aerobic weathering conditions". Humidity cell (kinetic) test results are reported in the WROMP to support new projects (such as the Point Lake Project, Section 3.13) and to support waste rock management plans.

The humidity cell testing dataset for the Ekati Mine were summarized in the context of acid generation potential and metal leaching potential in Dominion (2014), and recent results of HCT conducted for the Point Lake Project are summarized in ERM 2023. The results confirmed the following:

- Granite: HCT results confirmed that granite is non-PAG, owing to the low Sulphide mineral content of this rock type. Neutral pH was measured in HCT leachates, with low metal concentrations.
- Diabase: HCT results confirmed that diabase has a low potential for acid generation, owing to low Sulphide mineral content. Only one sample of 6 was predicted to generate acidity over time. All other samples had neutral pH with low metal concentrations.
- Metasediment: The solid phase composition of metasediment has a bi-modal distribution. HCT results confirmed that samples classified as PAG according to ABA results are capable of generating acidity in the long-term, whereas low Sulphide, non-PAG samples will not generate acidity.

Supplemental kinetic tests were conducted from 2018 to 2020 to evaluate effective neutralization potential of Ekati Mine waste rock. The results of the study are used to supplement the interpretation of long-term acid generation potential of each rock type according to the interpretation of ABA results. The WROMP relies on kinetic test results to inform the long-term reactivity of waste rock that will be placed in each WRSA.

Effective Neutralization Potential

Determination of acid generation potential from ABA results involves classification based on the ratio of the NP (represented by bulk carbonate and some silicate minerals) to the MPA (represented by total Sulphur) of a sample. Both NP and MPA measured in standard ABA static testing may differ from effective NP (ENP) and effective AP (EAP) under site-specific conditions, where factors such as temperature, mineral exposure, and particle size may differ from laboratory conditions; this may result in either overestimation or underestimation of ENP and/or EAP (MEND 2009). Laboratory-based research into the site-specific ENP at the Ekati mine is ongoing as part of the Interim Closure and Reclamation Plan. A study of ENP was conducted from 2018 to 2020 to identify variables that could affect the quantification of ENP on a lithology-specific basis. The ENP study comprised static, laboratory tests including ABA, metals analysis, particle size analysis and detailed mineralogical analysis.

The main factor influencing ENP is mineralogical composition. Mineralogical analyses identified the presence of silicate minerals that are capable of contributing to NP when weathered, including plagioclase, mica (specifically biotite and phlogopite), chlorite, pyroxene and clays. The interpretation of the results of the ENP investigation suggest that the standard method of modified Sobek NP is sufficiently conservative to quantify the bulk NP of granite and diabase samples. A fraction of the metasediment samples in the overall geochemical dataset for the Ekati Mine contain higher amounts of magnesium-bearing silicate minerals, which can result in measurements of NP that are biased higher. The review of the mineralogical data identified that it is appropriate to apply a correction factor to laboratory-measured bulk NP for metasediment samples based on solid phase magnesium content.

The methodology for the metasediment Mg-correction factor is preliminary based on the Interim ENP report, which was circulated on October 26, 2021. A final ENP Report is currently being developed for submission in 2025 and the findings of this report and the results of the ENP kinetic testing program will be used to make final recommendations as to the implementation of a calculation-based correction factor for metasediment samples. This factor will correct for analytical bias resulting from the presence of Mg-silicate minerals, which will allow for more accurate interpretation of the NP/MPA ratio. However, implementation of this factor will not change the waste management protocols for metasedimentary rock. The WROMP conservatively designates all metasedimentary waste rock as PAG, regardless of NP/MPA ratio.

3.1.2 Geochemical Classification Criteria

Until 2019, the results of waste rock characterization presented in the Annual and 3 Year Seepage Reports were screened with respect to acid generation potential according to the guidelines presented in DIAND (1992). Golder (2018) (Appendix G) discusses the difference between the geochemical classification criteria presented in DIAND (1992) and MEND (2009) and provides recommendations with respect to the geochemical classification criteria that should be used to screen the results of static geochemical testing at the Ekati mine. The Modified Sobek Method is used in the geochemical classification criteria calculation to define if waste rock is potentially acid generating at Ekati.

The size of the geochemical dataset has increased by one order of magnitude (more than 10 times) during operations at the Ekati mine, and the results of geochemical testing continue to be consistent with the initial static geochemical dataset. The MEND (2009) versus DIAND (1992) geochemical classification criteria were used to conduct an initial screening of ABA results; the long-term acid generation potential is confirmed by the results of humidity cell testing. Humidity cell test results were also used to confirm the appropriateness of using the MEND (2009) versus DIAND (1992) classification criteria for the initial screening of ABA results.

A comparison of the MEND (2009) and DIAND (1992) criteria for geochemical classification of waste rock confirmed that Ekati mine granite is classified as non-PAG regardless of classification criterion. Granite is a low-Sulphur waste rock type. The results of kinetic testing confirm that granite has a low potential for acid generation, owing to the lack of Sulphide minerals required to generate acidity. The WROMP for the Ekati mine designates granite as a suitable material for construction.

The majority of the diabase samples in the Ekati mine dataset are classified as non-PAG (95% according to MEND [2009] and 81% according to DIAND [1992]). Diabase also has a low total Sulphur content and owing to its competency and resistance to generation of fines, it is considered to have a low acid generation potential in site conditions.

Metasediment contains more Sulphide and, as such, has a higher potential for acid generation than diabase and granite. More samples are classified as uncertain and PAG according to the MEND (2009) criteria than the DIAND (1992) criteria. However, the results of kinetic testing have indicated that the MEND (2009) criteria are appropriate for predicting long-term acid generation potential. Despite the fact that a portion of the metasediment is classified as PAG using either set of criteria, the WROMP designates all metasedimentary waste rock as PAG, regardless of NP/MPA ratio. To date, metasediment has been mined from the Misery pit, the Pigeon pit, and in small amounts from the Beartooth pit. Metasediment will be mined from the Point Lake Open Pit. Metasediment is not used for construction at the Ekati mine.

The use of the MEND (2009) versus DIAND (1992) screening criteria will not influence waste rock placement and closure planning, as granite and diabase is predominantly non-PAG (regardless of screening criteria), and is suitable for construction. All metasedimentary rock is currently classified as PAG, and managed as such. A single classification criterion should be adopted for consistent use at the Ekati mine. An NP/MPA ratio of 2 is an accurate predictor of long-term acid generation according to the results of long-term laboratory testing and, therefore, the MEND (2009) criteria are suitable for use in initial data screening.

Based on the conclusions of Golder (2018) (Appendix G), it would be technically appropriate and recommended that Burgundy utilize the MEND 2009 Guidelines rather than DIAND 1992 for new projects and closure planning. Burgundy adheres to the requirement of the Water Licence (Schedule 6 Condition 2) to utilize DIAND 1992 except for named new projects (such as the Point Lake Development). Burgundy may suggest in future the use of MEND 2009 for other developments or for closure planning.

The criteria to classify potentially acid generating and non-potentially acid generating rock for the Ekati Diamond mine is as follows:

- NP/MPA < 1 is classified as PAG Rock
- NP/MPA <2 is considered as PAG Rock for operational management; and
- NP/MPA >2 is non-PAG Rock

3.2 Methods of Characterization

3.2.1 Acid Neutralization and Metal Leaching

The NP/MPA ratio is generally used to identify materials that may require special handling. Based on the MEND (2009) guidelines NP/MPA ratios of less than 1 are considered to be PAG. Samples with NP/MPA ratios greater than 2 are considered to be acid consuming (i.e., non-PAG), and samples with NP/MPA ratios between 1 and 2 are generally considered as having uncertain ARD potential under oxidizing conditions but is considered as PAG rock for operational management (DIAND 1993). However, at low sulphur concentrations, these ratios tend not to be meaningful due to the abundance of silicate minerals which are not fully quantified by the NP determination.

As summarized in the following sections, on-going waste rock geochemical characterization and seepage monitoring analyses have consistently shown that the Ekati Diamond Mine does not have ARD issues but does have minor issues associated with metal leaching. As such, the formerly called ARD and Geochemical Characterization Program was renamed the Geochemical Characterization and ML Management Plan (SRK 2007).

3.2.2 Waste Rock

Pre-mining characterization of waste rock was described by Norecol, Dames and Moore (1997) and compared to subsequent waste rock characterization during mining in SRK (2007). The results were very similar therefore this section summarizes the methods currently used and the results of waste rock characterization during mining.

Samples of waste rock are collected and submitted to a Standard Council of Canada accredited lab for geochemical analysis. Testing is completed to determine how much acid neutralizing and sulphur minerals, and metals, are present in the waste rock, and thus estimate if the waste rock will produce acid or non-acidic drainage and metal leaching during interaction with snow melt and rainwater.

Samples for waste rock characterization are generally collected from blasted muck (wet broken rock) during mining of a given pit. For each blast selected for sampling, two grab samples (approximately 2 kg each) are collected from two different locations within the blast area such that each sample represents approximately 50% of the blast. Prior to 2007, the frequency of sampling was based on the tonnage mined; typically, a minimum of approximately one sample per 100,000 tonnes of mined material. This was the confirmatory phase of waste rock characterization (phase of routine geochemical characterization during mining to confirm pre-mining results obtained from drill cores).

At that point, monitoring showed that rock characteristics were well documented and not expected to change as mining continued (SRK 2007). Since 2007, for active open pits, sampling consisted of three samples per rock type per bench every three years (for Fox while it was operating) and three samples per rock type per bench every year at Misery, Lynx, Pigeon and for the first two years of production at Sable. The waste rock sampling for Sable pit was limited at two years as the granite waste rock is already well characterized. For the Panda and Koala underground developments waste rock testing was discontinued as the volumes of rock removed were considered to be very minor compared to the large volumes of waste rock produced from open pits. Waste rock during the development of Misery Underground is sampled at a rate of three samples per 12 months. Waste rock sampling for acid-base accounting at the Point Lake open pit will proceed at a rate of 3 samples per rock type per bench per year. This is the sampling procedure applied at other open pits at the Ekati Diamond Mine.

The majority (>50%) of samples were analyzed using the standard Sobek et al. (1978) procedure for acid-base accounting (ABA), including total sulphur, neutralization potential and paste pH. All samples were analyzed for total sulfur. Metal scans were performed on a subset of samples by inductively coupled plasma emission spectrometry (ICP-ES) following an aqua regia digestion. Results of waste rock characterization are reported annually in Waste Rock and Waste Rock Storage Area Seepage Survey Reports. A summary of the results is presented in Section 3.5 to 3.14.

3.2.3 Coarse Kimberlite Rejects

Prior to 2007, CKR were sampled once per month from the surge pile formed at the outlet of a conveyor located at the southwest corner of the Process Plant. Since 2007, CKR has been sampled quarterly. Samples are analyzed as for waste rock characterization described above. Results of CKR testing are reported annually in Waste Rock and Waste Rock Storage Area Seepage Survey Reports. A summary of the results is presented in Section 3.15.

3.3 Panda Pipe Geochemical Characterization

Routine collection of blast muck samples from the Panda Pit began in 1999 and continued until 2003. Pre-mining samples were collected from the Panda Pit between 1997 and 1999. A total of 419 samples were collected from the Panda Pit, all granite. Surface mining at Panda Pit was completed in 2004 and no further sampling of Panda waste rock was carried out. Summaries of ABA and elemental results are provided in Table 3.3-1 and Table 3.3-2, respectively.

Table 3.3-1 Summary of Panda Waste Rock Acid-Base Accounting Data

Description		Summary Statistic	Paste pH	Total S	Sulphate	Sulphide	NP	AP	NNP	NP/AP
Year	Rock Type	Units	s.u. s %	%			kg CaCO3/t			
1997 - 2003	Granite	Average	9.4	0.02	0.008	0.02	15	0.65	15	24
		Max	12	0.39	0.07	0.18	153	12	150	272
		95th Percentile	9.0	0.06	0.01	0.07	20	1.9	20	102
		Median	9.5	0.01	0.005	0.010	14	0.31	14	42
		5th Percentile	9.9	0.005	0.005	0.005	10	0.16	11	8
		Min	8.4	0.001	0.005	0.005	1.8	0.031	4.4	2
		Count	419	419	62	389	388	417	371	388

Notes: All results reported as 'below detection' were replaced with detection limit values for the calculation of summary statistics.
NP: neutralization potential as determined by the standard Sobek method
*AP: acid potential, calculated as total sulphur * 31.25*
NNP: net neutralization potential.
CO_3-NP: carbonate neutralization potential
The NP/AP values are statistical calculations based on all sampled collected, and will not necessarily equal the value calculated from the NP and AP summary statistics presented in the table above.

In general, samples from the Panda Pit had very low sulphur contents (average of 0.02%) and average Sobek NP of 15 kg $CaCO_3$/t. Elevated sulphur outliers (maximum of 0.39%) were either located close to the kimberlite pipe contact and also tended to have higher neutralization potentials and/or nickel concentrations, indicating the possible presence of kimberlite in the samples; or thought to contain isolated enrichment of sulphide minerals in xenoliths or veinlets. Granite has a low acid generation potential (average NP/PA of 24). Blast samples had generally uniform metal concentrations. Elevated nickel, cobalt, and chromium concentrations (indicated by maximum concentrations) tended to occur in samples with elevated sulphur and neutralization potential, indicative of small amounts of kimberlite in some of the blasts (SRK 2002).

Table 3.3-2 Summary of Elemental Concentrations in Panda Waste Rock

Description		Summary Statistic	Al	As	Ba	Ca	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Zn
Year	Rock Type	Units	%	ppm	ppm	%	ppm	ppm	ppm	%	%	%	ppm	ppm	%	ppm	ppm
1999-2003	Granite	Average	9.3	3.7	631	3.3	18	146	28	2.9	1.8	1.9	381	1.5	3.0	53	65
		Max	13	15	890	5.9	24	229	142	3.6	4.3	5.3	535	5.0	4.4	149	88
		95th Percentile	11	10	746	4.0	22	201	58	3.4	2.1	2.3	498	4.0	4.0	83	80
		Median	9.3	3.0	630	3.3	19	144	25	2.9	1.8	1.9	375	1.0	3.0	48	64
		5th Percentile	7.6	1.0	520	2.1	13	86	6.4	2.3	1.4	1.4	286	1.0	2.3	40	52
		Min	7.2	1.0	430	0.4	4.0	38	1.0	1.2	1.2	0.6	140	1.0	0.5	21	34
		Count	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69

Note: Values below detection were replaced by detection limits for calculation of summary statistics.

3.4 Koala and Koala North Geochemical Characterization

Routine collection of Koala blast muck samples occurred from 1997 through 2004. The database contains analytical results of 347 samples from Koala. The majority of samples are granite and granite waste rock collected from the WRSA, but the database also includes till, black clay and waste kimberlite samples that were collected in 2002 and 2003.

Metasediment drill core samples were collected during pre-mining drilling; however, the amount of metasediment encountered in the Koala Pit during mining was too small to be represented by blast samples. Summaries of ABA and metal analyses results are provided in Table 3.4-1 and Table 3.4-2.

In general, Koala granite samples had low sulphur contents (average of 0.04%) and average Sobek NP of 16 kg $CaCO_3$/t. SRK (2005) distinguished two populations of Koala granite (<0.092% sulphur and >0.092% sulphur). It was concluded that the low-sulphur population consisted entirely of granite, while the high-sulphur population comprised granite with a minor kimberlite component, based on the observation that most of these samples were from blasts near the kimberlite pipe and were associated with elevated NP, and/or nickel concentrations. A very low potential for acid generation was determined.

Till samples had low total sulphur (0.008%). However, in comparison to granite, sulphur concentrations were elevated in Koala black clay (average of 0.4%) and Koala waste kimberlite samples (average of 0.26%). Sulphur concentrations as sulphate were small but detectable (0.06% average for Koala black clay and 0.04% average for kimberlite). Average Sobek NP was 293 kg $CaCO_3$/t for black clay and 192 kg $CaCO_3$/t for waste kimberlite. Sobek NP/AP ratios were correspondingly high for both Koala black clay and Koala waste kimberlite (average of 25 and 32, respectively). Results indicate that these materials have a low potential for acid generation.

Granite samples had generally uniform metal concentrations. As with Panda granite waste rock, elevated nickel, cobalt and chromium concentrations (indicated by maximum concentrations) tended to occur in samples with elevated sulphur and neutralization potential, indicative of small amounts of kimberlite in some of the blasts (SRK 2002).

Table 3.4-1 Summary of Koala Waste Rock Acid-Base Accounting Data

Description		Summary Statistic	Paste pH	Total S	Sulphate	Sulphide	NP	AP	NNP	NP/AP
Year	Rock Type	Units	s.u.	s	%	%	kg $CaCO_3$/t			
1997 – 2004	Till	Average	8.6	0.008	-	-	6.5	0	6.2	28
		Max	8.7	0.01	-	-	7	0	6.7	22
		95th Percentile	8.7	0.01	-	-	7	0	6.6	23
		Median	8.6	0.008	-	-	6.5	0	6.2	28
		5th Percentile	8.5	0.005	-	-	6.1	0	5.7	37
		Min	8.5	0.005	-	-	6	0	5.7	38
		Count	2	2	0	0	2	2	2	2
	Black Clay	Average	7.5	0.4	0.069	0.22	293	12	281	24
		Max	7.9	0.93	0.12	0.67	351	29	340	12
		95th Percentile	7.8	0.47	0.11	0.3	326	15	313	22
		Median	7.6	0.37	0.075	0.2	314	12	302	27
		5th Percentile	7.2	0.32	0.019	0.16	216	10	202	22
		Min	7.2	0.31	0.005	0.15	202	10	173	21
		Count	20	20	20	20	20	20	20	20
	Waste Rock	Average	8.7	0.034	-	-	13	1	14	12
		Max	10	0.31	-	-	248	10	238	26
		95th Percentile	9.8	0.11	-	-	19	3	19	5.5
		Median	9.2	0.02	-	-	13	1	12	21
		5th Percentile	8.1	0.005	-	-	0	0	6.3	0
		Min	7.2	0.005	-	-	0	0	3.4	0
		Count	192	192	0	0	192	192	170	192
	Granite	Average	8.7	0.052	0.0064	0.049	19	2	18	12
		Max	10	0.17	0.01	0.07	66	5	64	12
		95th Percentile	9.7	0.12	0.01	0.069	38	4	35	11
		Median	9.2	0.04	0.005	0.065	16	1	15	13
		5th Percentile	8	0.02	0.005	0.022	6.4	1	9.3	10
		Min	7.8	0.01	0.005	0.02	1.2	0	5	3.8
		Count	75	75	7	7	75	75	68	75
	Kimberlite	Average	7.9	0.27	0.037	0.22	241	8	185	29
		Max	8.4	0.96	0.13	0.52	424	30	358	14
		95th Percentile	8.4	0.57	0.11	0.46	370	18	289	21
		Median	8	0.22	0.024	0.19	267	7	239	40
		5th Percentile	7.6	0.11	0.0065	0.1	92	3	87	27
		Min	7.3	0.07	0.005	0.09	48	2	68	22
		Count	58	58	56	42	58	58	22	58

Notes: All results reported as 'below detection' were replaced with detection limit values for the calculation of summary statistics. NP: neutralization potential as determined by the standard Sobek method

*AP: acid potential, calculated as total sulphur * 31.25*

NNP: net neutralization potential.

CO_3-NP: carbonate neutralization potential Dash (-) indicates parameter not measured

The NP/AP values are statistical calculations based on all sampled collected and will not necessarily equal the value calculated from the NP and AP summary statistics presented in the table above.

Table 3.4-2 Summary of Elemental Concentrations in Koala Waste Rock

Description	Summary Statistic	Al	As	Ba	Ca	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Zn
Rock Type	Units	%	ppm	ppm	%	ppm	ppm	ppm	%	%	%	ppm	ppm	%	ppm	ppm
Black Clay	Average	4.0	6.8	1,989	5.5	37	779	47	3.9	1.3	8.7	1,001	2.6	0.24	486	76
	Max	4.6	30	2,910	7.7	48	1,265	58	4.3	1.8	11	1,785	9.0	0.67	681	90
	95th Percentile	4.6	29	2,904	7.7	48	1,256	58	4.3	1.8	11	1,759	8.9	0.66	680	90
	Median	4.0	5.0	2,010	6.0	37	746	49	3.9	1.3	9.0	990	2.0	0.22	484	79
	5th Percentile	3.5	2.5	1,274	3.5	20	409	28	3.1	0.79	4.9	637	0.50	0.10	242	45
	Min	3.5	2.5	1,270	3.5	19	406	27	3.0	0.78	4.8	630	0.50	0.10	236	44
	Count	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Granite	Average	9.1	3.6	518	2.4	15	107	17	2.8	1.8	2.2	350	2.3	3.6	67	55
	Max	11	7.0	760	3.5	25	192	41	3.5	2.2	4.4	446	6.0	6.8	235	72
	95th Percentile	11	6.4	760	3.3	22	180	38	3.5	2.1	3.8	438	5.4	5.6	189	69
	Median	9.0	2.5	560	2.4	15	113	18	3.0	1.9	1.9	380	1.5	3.2	52	61
	5th Percentile	8.0	2.5	136	0.80	8.8	55	4.4	1.7	1.2	1.3	180	0.80	2.8	22	28
	Min	7.8	2.5	100	0.60	7.0	40	2.0	1.4	1.2	1.1	128	0.50	2.7	16	19
	Count	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Waste Rock	Average	8.8	3.2	643	2.7	17	138	27	2.8	2.0	1.9	375	2.4	2.8	69	62
	Max	11	15	860	3.7	55	567	132	3.8	3.1	12	1,110	9.0	4.1	918	84
	95th Percentile	11	9.8	849	3.5	24	216	73	3.5	2.9	2.3	502	8.0	4.0	92	82
	Median	9.2	2.5	640	3.0	16	126	22	2.8	1.9	1.7	353	2.0	2.9	47	63
	5th Percentile	6.3	0.50	423	0.95	9.0	66	8.1	1.9	1.6	0.77	246	0.50	1.8	28	40
	Min	6.3	0.50	390	0.72	8.0	48	8.0	1.8	1.6	0.72	220	0.50	1.8	26	40
	Count	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Kimberlite	Average	1.8	7.0	599	1.5	70	714	15	4.0	0.44	14	678	2.0	0.095	1,301	46
	Max	4.5	11	1,370	2.3	95	1,120	31	5.0	1.5	15	935	5.0	0.45	1,765	68
	95th Percentile	2.3	10	791	2.0	91	1,030	22	4.9	1.0	15	892	4.1	0.18	1,670	57
	Median	1.6	7.5	570	1.4	65	658	14	3.8	0.36	14	632	2.0	0.065	1,223	42
	5th Percentile	1.4	2.5	436	1.1	58	592	11	3.6	0.32	12	562	0.50	0.049	1,069	38
	Min	1.4	2.5	350	1.1	42	441	10	3.6	0.31	11	520	0.50	0.030	668	38
	Count	20	20	20	20	20	20	20	20	20	13	20	20	20	20	20

Note: Values below detection were replaced by detection limits for calculation of summary statistics.

3.5 Beartooth Pipe Geochemical Characterization

Routine collection of blast muck samples from the Beartooth Pit occurred from 2004 to 2009. The database contains analytical results for 92 Beartooth Pit granite samples, 2 diabase samples and 4 kimberlite samples. Metasediment drill core samples were collected during pre-mining drilling; however, the amount of metasediment encountered in the Beartooth Pit during mining was too small to be represented by blast samples. ABA data and elemental results are summarized in Table 3.5-1 and Table 3.5-2.

In general, Beartooth granite samples had low total sulphur content (average of 0.05%) and average Modified Sobek NP of 16 kg $CaCO_3$/t. SRK (2003) distinguished two populations of Beartooth granite (68% had average sulphur = 0.026% and 30% had average sulphur = 0.11% with a threshold between the two groups of 0.07% sulphur). It was concluded that the low-sulphur population consisted entirely of granite, while the high-sulphur samples that were logged as granite but came from areas where metasediments were identified during pre-production drilling and therefore may have contained metasediment with higher sulphur content than the surrounding granite. Alternatively, elevated sulphur values may result from the presence of unidentified Sulphide veinlets. One sample had an anomalously high NP value (89 kg $CaCO_3$/t) suggesting it contained kimberlite.

No long-term issues are anticipated related to Beartooth waste rock with above-average sulphur content, provided that this material is placed in regions of the WRSA which will freeze and remain frozen as described in the WROMP for Beartooth (BHP 2003).

Beartooth granite samples had generally uniform metal concentrations that were similar to or lower than concentrations in Koala granite. The exception was for barium which had similar 95th percentile concentrations to Koala granite but a higher maximum concentration of barium than Koala granite. Given the high concentrations of barium in black clay from Koala, the high maximum concentration of barium in Beartooth granite may result from inclusion of some sediment during sampling.

Table 3.5-1 Summary of Beartooth Waste Rock Acid-Base Accounting Data

Description		Summary Statistic	Paste pH			Total S	Sulphate	Sulphide	NP	AP	NNP	NP/AP
Year	Rock Type	Units	s.u.	s	%	%			kg CaCO3 eq/tonne			
2004 - 2009	Granite	Average	9.2			0.052	0.0058	0.027	16	1.6	15	10.2
		Max	10			0.29	0.010	0.100	89	9.1	87	102.4
		95th Percentile	9.9			0.17	0.010	0.083	18	5.5	18	54.4
		Median	9.3			0.030	0.0050	0.010	15	0.94	13	17
		5th Percentile	8.0			0.010	0.0050	0.0050	7.9	0.31	7.0	3
		Min	7.8			0.0050	0.0050	0.0050	4	0.16	6.0	2
		Count	90			92	18	18.0	90	92	83	90
	Diabase	Average	9.6			0.0050	0.0050	0.0050	9.0	0.16	-	58
		Max	9.7			0.0050	0.0050	0.0050	9.4	0.16	-	60
		95th Percentile	9.7			0.0050	0.0050	0.0050	9.4	0.16	-	60
		Median	9.6			0.0050	0.0050	0.0050	9.0	0.16	-	58
		5th Percentile	9.6			0.0050	0.0050	0.0050	8.6	0.16	-	55
		Min	9.6			0.0050	0.0050	0.0050	8.6	0.16	-	55
		Count	2			2	2	2	2	2	0	2
	Kimberlite	Average	8.3			0.24	0.030	0.21	149	7.5	-	20
		Max	9			0.46	0.040	0.42	167	14	-	12
		95th Percentile	8.6			0.43	0.040	0.39	166	13	-	12
		Median	8.4			0.20	0.030	0.18	150	6.1	-	25
		5th Percentile	8.1			0.11	0.020	0.078	132	3.6	-	37
		Min	8.1			0.11	0.020	0.070	130	3.4	-	38
		Count	4			4	4	4	4	4	0	4

All results reported as 'below detection' were replaced with detection limit values for the calculation of summary statistics.

NP: neutralization potential as determined by the standard Sobek method

*AP: acid potential, calculated as total sulphur * 31.25*

NNP: net neutralization potential.

Dash (-) indicates parameter not measured

The NP/AP values are statistical calculations based on all sampled collected, and will not necessarily equal the value calculated from the NP and AP summary statistics presented in the table above.

Table 3.5-2 Summary of Elemental Concentrations in Beartooth Waste Rock

Description		Summary Statistic	Al	As	Ba	Ca	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Zn
Year	Rock Type	Units	%	ppm	ppm	%	ppm	ppm	ppm	%	%	%	ppm	ppm	%	ppm	ppm
2004 - 2009	Diabase	Average	1.5	3.8	280	1.0	16	222	18	2.4	1.2	1.9	390	1.5	0.065	87	54
		Max	1.7	5.0	360	1.1	18	239	31	2.7	1.6	2.1	400	2.0	0.070	94	57
		95th Percentile	1.7	4.9	352	1.1	18	237	30	2.6	1.5	2.1	399	2.0	0.070	93	57
		Median	1.5	3.8	280	1.0	16	222	18	2.4	1.2	1.9	390	1.5	0.065	87	54
		5th Percentile	1.3	2.6	208	0.87	14	206	5.4	2.1	0.90	1.7	381	1.1	0.061	80	50
		Min	1.3	2.5	200	0.86	14	204	4.0	2.1	0.86	1.7	380	1.0	0.060	79	50
		Count	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Granite	Average	7.6	3.6	594	2.8	20	172	39	3.5	2.0	2.2	465	1.1	2.2	76	73
		Max	10	11	1,060	12	38	644	153	5.8	3.2	7.4	3,330	5.0	3.0	479	114
		95th Percentile	9.3	7.0	735	3.6	33	288	85	4.4	2.6	4.0	664	3.5	2.8	173	92
		Median	8.2	2.5	605	3.0	18	161	31	3.3	2.0	1.9	410	0.50	2.5	50	72
		5th Percentile	2.2	2.5	428	0.54	15	65	5.6	3.0	1.5	1.6	301	0.50	0.11	43	59
		Min	2.0	2.5	250	0.33	8.0	59	0.50	2.7	1.1	1.5	275	0.50	0.080	20	28
		Count	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72
	Kimberlite	Average	0.97	3.0	700	1.5	64	404	12	4.5	0.50	15	720	2.0	0.028	1,272	51
		Max	1.5	5.0	930	2.3	74	458	24	4.8	0.76	15	780	2.0	0.040	1,568	63
		95th Percentile	1.4	4.5	908	2.1	74	453	21	4.8	0.71	15	779	2.0	0.038	1,562	61
		Median	0.86	2.5	660	1.5	66	389	9.0	4.6	0.51	15	740	2.0	0.030	1,332	52
		5th Percentile	0.79	2.5	542	1.0	49	359	8.2	4.1	0.35	15	612	2.0	0.020	826	44
		Min	0.78	2.5	540	1.0	46	353	8.0	4.1	0.35	15	585	2.0	0.020	736	44
		Count	5	5	5	5	5	5	5	5	5	1	5	5	5	5	5

Note: Values below detection were replaced by detection limits for calculation of summary statistics.

3.6 Fox Pipe Geochemical Characterization

Routine collection of blast muck samples from the Fox Pit has occurred every three years from 2003 to the completion of mining in 2009. The database contains analytical results for 661 samples from Fox Pit, including 475 granite samples, 168 kimberlite samples and 24 diabase samples. ABA data and elemental results are summarized in Table 3.6-1 and Table 3.6-2.

Table 3.6-1 Summary of Fox Waste Rock Acid-Base Accounting Data

Description		Summary Statistic	Paste pH	Total S	Sulphate	Sulphide	NP	AP	NNP	NP/AP
Year	Rock Type	Units	s.u.	s	%	%	kg $CaCO_3$ eq/tonne			
pre-1998 - 2009	Diabase	Average	8.5	0.25	0.019	-	20	7.7	12	2.6
		Max	9.3	1.3	0.06	-	68	42	12	16
		95th Percentile	9.0	1.0	0.043	-	61	31	12	13.4
		Median	8.6	0.05	0.01	-	14	1.6	12	4.74
		5th Percentile	8.1	0.032	0.005	-	1.38	0.98	12	0.1
		Min	8.1	0.03	0.005	-	0.5	0.94	12	0
		Count	18	24	18	0	17	24	1	17
	Granite	Average	8.7	0.035	0.011	0.037	20	1.1	18	15
		Max	10	0.29	0.04	0.15	154	9.1	213	102
		95th Percentile	9.8	0.095	0.03	0.13	41	3.0	32	53
		Median	9.3	0.03	0.01	0.025	17	0.94	15	18
		5th Percentile	8.2	0.01	0.005	0.005	14	0.31	11	6.2
		Min	8.0	0.003	0.005	0.005	6	0.094	5	1.5
		Count	475	570	65	31	150	570	417	150
	Kimberlite	Average	8.1	0.32	0.039	0.089	259	10	248	33
		Max	9.8	1.6	0.26	0.16	365	51	329	265.1
		95th Percentile	8.8	0.67	0.097	0.15	331	21	311	68
		Median	8.3	0.28	0.03	0.088	276	8.8	267	29
		5th Percentile	7.6	0.15	0.0093	0.044	147	4.7	162	12
		Min	7.1	0.005	0.005	0.035	17.0	0.16	14	4
		Count	168	168	168	10	163	168	146	163

Notes: All results reported as 'below detection' were replaced with detection limit values for the calculation of summary statistics.
NP: neutralization potential as determined by the standard Sobek method
*AP: acid potential, calculated as total sulphur * 31.25*
NNP: net neutralization potential
Dash (-) indicates parameter not measured
The NP/AP values are statistical calculations based on all sampled collected, and will not necessarily equal the value calculated from the NP and AP summary statistics presented in the table above.

Table 3.6-2 Summary of Elemental Concentrations in Fox Waste Rock

Description		Summary Statistic	Al	As	Ba	Ca	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Zn
Year	Rock Type	Units	%	ppm	ppm	%	ppm	ppm	ppm	%	%	%	ppm	ppm	%	ppm	ppm
pre-1998 - 2009	Diabase	Average	7	3	59	6.7	43	109	189	8.7	0.35	3.7	1,406	0.81	1.6	74	84
		Max	7.6	10	240	7.1	61	200	213	9.2	0.73	4	1,525	2	1.8	92	104
		95th Percentile	7.6	10	144	7	54	177	211	9.2	0.68	3.9	1,525	2	1.8	91	104
		Median	7.1	2.5	40	6.8	43	93	194	8.9	0.26	3.7	1,455	0.5	1.6	79	92
		5th Percentile	6.5	0.5	20	6.1	32	82	145	7.9	0.15	3.4	1,206	0.5	1.5	36	37
		Min	6.4	0.5	5	5.6	27	81	133	7.3	0.15	3.3	1,110	0.5	1.4	11	12
		Count	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
	Granite	Average	7.9	4.1	639	3.1	17	86	35	3.3	2	1.9	429	1.3	2.7	52	64
		Max	9.9	15	1,160	7.1	60	388	333	8.4	3.4	6.2	1,375	6	3.8	379	97
		95th Percentile	9.4	10	762	3.5	21	172	76	3.7	2.5	2.5	503	3	3	79	76
		Median	7.9	2.5	640	3.1	16	68	29	3.2	2	1.8	419	1	2.7	48	65
		5th Percentile	7	2.5	549	2.1	12	37	6	2.5	1.6	1.3	324	0.5	2.4	30	48
		Min	0.85	0.5	50	0.26	2	7	1	0.32	0.19	0.2	45	0.5	0.26	4	6
		Count	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218
	Kimberlite	Average	4	5.4	1,529	3.5	39	519	36	3.6	2.1	9.2	659	2.8	0.45	584	74
		Max	7.7	16	2,160	5.1	61	759	60	4.5	3.3	14	833	15	2.4	986	306
		95th Percentile	5	12	1,836	4.3	47	652	42	4.1	2.8	11	743	7	0.89	740	94
		Median	3.8	3.8	1,560	3.6	39	527	36	3.7	2.2	9.3	665	2	0.41	590	70
		5th Percentile	3.5	2.5	1,203	2.9	32	404	32	3.3	1.6	7.3	579	0.58	0.26	453	62
		Min	3.1	0.5	320	2.3	15	127	16	2.9	1.2	2	425	0.5	0.16	77	54
		Count	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150

Note: Values below detection were replaced by detection limits for calculation of summary statistics.

Fox granite samples generally had low sulphur contents that ranged from 0.003 to 0.29%, with an average of 0.04%. The average Sobek NP for Fox granite was 20 kg $CaCO_3$/t. These results were similar to Panda, Koala and Beartooth granite. As with the other data sets, analysis of the Fox data (SRK 2007) showed two populations of Fox granite (<0.085% sulphur and >0.085% sulphur). The higher sulphur group typically had higher NP suggesting that a component of kimberlite was included in the samples. It is known that Fox Pit naturally has regions where fragmented kimberlite is contained within the granite. A few samples with sulphur contents greater than 0.085% had typical NP values for Fox granite, so kimberlite was not suspected as a cause of the elevated sulphur values. Anomalous concentrations of Sulphide minerals in xenoliths or veinlets may account for the slightly elevated sulphur values in these samples, as documented in the WROMP for Fox (BHP 2002). The low-sulphur population were concluded to consist entirely of granite.

Fox waste kimberlite had similar ABA characteristics to Koala waste kimberlite, with an average total sulphur content of 0.32% (range of 0.005 to 1.6%). Sobek NP ranged from 17 to 365 kg $CaCO_3$/t, with an average of 259 kg $CaCO_3$/t. The average NP/AP ratio was 33, and Kimberlite has a low acid generation potential.

Diabase is a minor rock type at the Fox Pit. Fox Pit diabase has an average sulphur content of 0.25% (0.03 to 1.3%), and an average NP of 20 kg $CaCO_3$/t. Diabase has a low acid generation potential

Metal concentrations for Fox granite are similar to values reported for other areas at the Ekati mine. Compared to Koala waste kimberlite, Fox waste kimberlite has lower average concentrations of cobalt, chromium, magnesium and nickel, and higher average concentrations of aluminum, barium, calcium, copper, potassium, molybdenum, sodium and zinc.

3.7 Misery Pipe Geochemical Characterization

The Misery Main pipe host rock is primarily comprised of granite on the southern domain and biotite schist on the northern half. The amount of exposed biotite schist wall is reduced at depth and terminates on the 164 meters above sea level, as the granite-schist contact dips towards northeast. The proposed underground portion of the kimberlite pipe is mainly encompassed by granite host rock (Figure 3.7-1). A cross section of the Misery Pit and kimberlite pipes is shown in Figure 3.7-2.

Figure 3.7-1 Misery Complex Kimberlite Bodies – Plan View

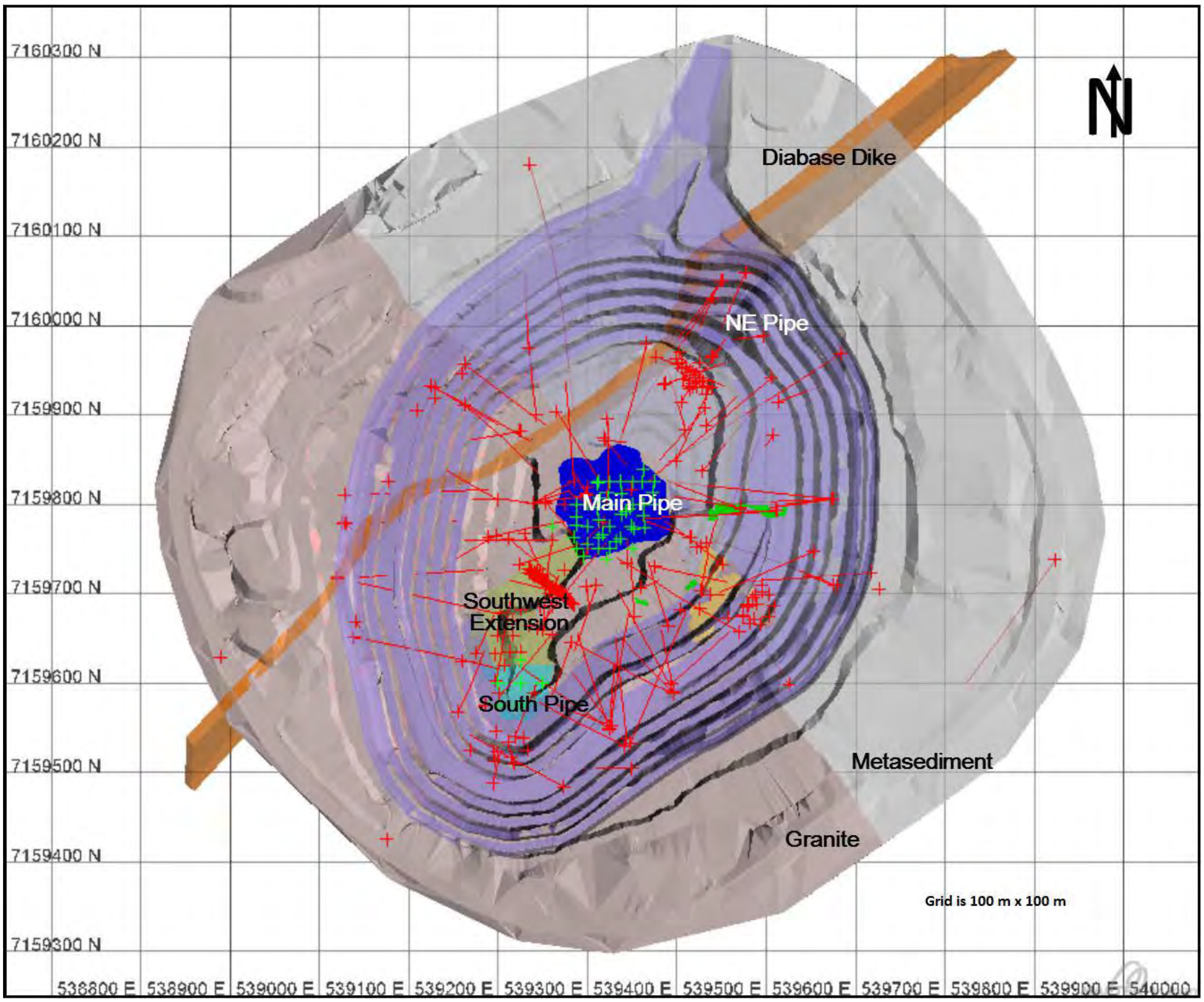
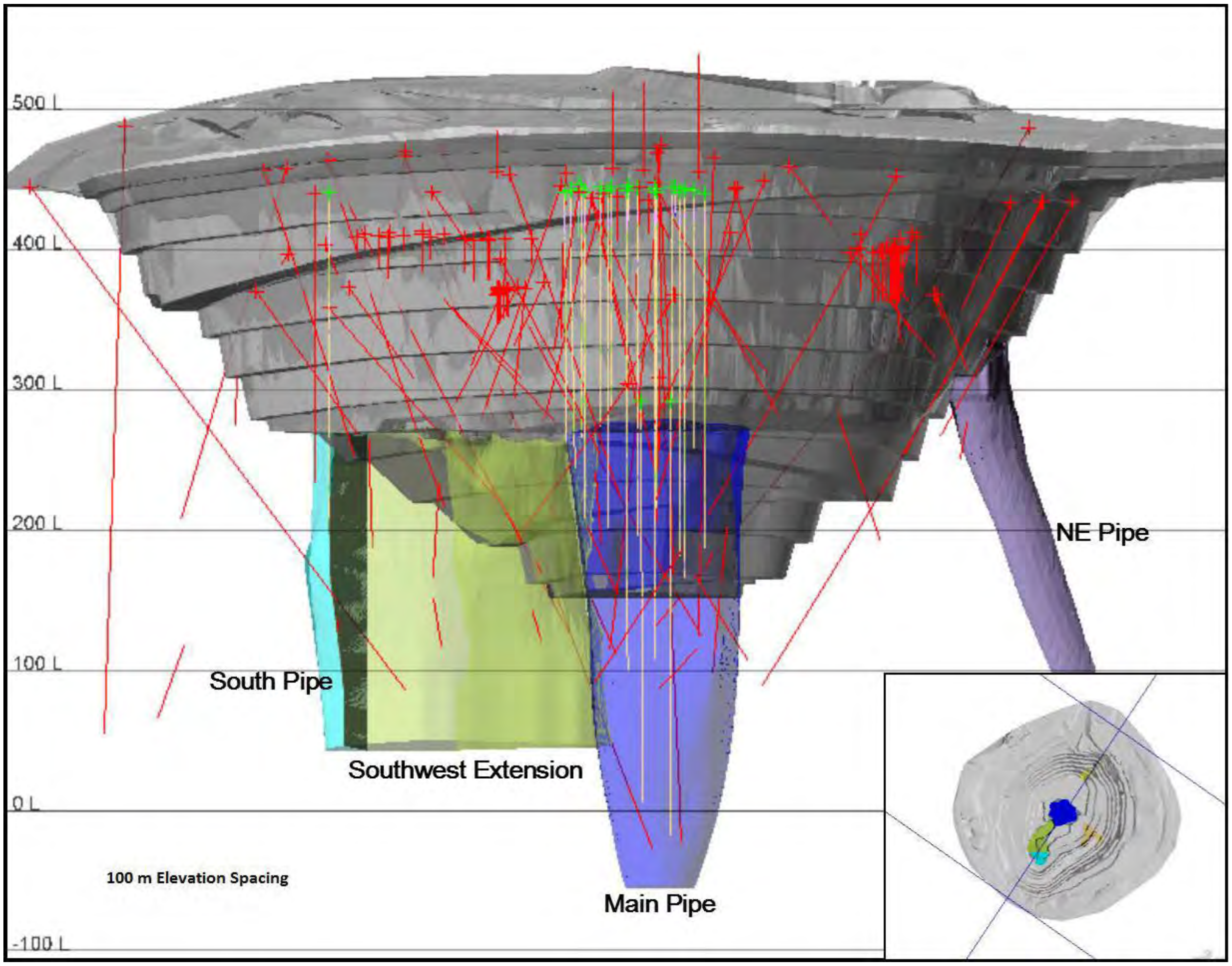


Figure 3.7-2 Misery Complex Kimberlite Bodies - Profile



Samples of drill core from the Misery pit were collected prior to mining. Routine collection of blast muck samples from the Misery Pit occurred from 2001 until 2005, when mining was suspended. This database contains analytical results from greater than 1000 Misery Pit samples, including granite, metasediments, diabase and waste kimberlite. Sampling was resumed in 2012 to 2017 for the Misery pit push back. In addition, samples were collected from Misery pit as part of special studies in 2017 and 2018. ABA data and metal analysis results for Misery samples are summarized in Tables 3.7-1 and 3.7-2.

The sulphur content of Misery granite samples ranged from 0.005 to 0.42% (average 0.025%). The average Sobek NP for Misery granite is 9.8 kg $CaCO_3$/t. These values are similar to granite at other areas at the Ekati Mine. Overall, granite from the Misery pit has low acid potential, with an average NP/AP of 13. Diabase also has a similar composition to other diabase at the Ekati Mine, with an average sulphur content of 0.11% (0.005% to 0.20%), and an average NP of 12 kg $CaCO_3$/t. Diabase acid generation potential is low (NP/AP average 3.6).

Misery waste kimberlite had similar ABA characteristics to other waste kimberlite from the Ekati mine, with an average total sulphur content of 0.35% (range of 0.005 to 1.9%). Sobek NP ranged from 9.8 to 417 kg $CaCO_3$/t, with an average of 313 kg $CaCO_3$/t. The average NP/AP ratio was 29, and Kimberlite has a low acid generation potential.

The average total sulphur content of the Misery metasediment was 0.17% (0.005 to 1.0%), and the average NP was 20 kg $CaCO_3$/t (0.1 to 416 kg $CaCO_3$/t). Metasediment has a mixed potential for acid generation; approximately 48% of the Misery metasediment samples were classified as uncertain or PAG (NP/AP <2) but the average NP/AP of the metasediment dataset was 3.8 (median 2.1). Major and trace element concentrations in the schist samples were similar to results previously recorded at other areas at the Ekati mine (Table 3.7-2).

The summary results of ABA and elemental analyses from the 2024 MUG samples are shown in Table 3.7-3 and Table 3.7-4 with a summary of previous monitoring results (2019 to 2023) provided for comparison. Total sulphur, sulphide sulphur, and MPA results for MUG granite were either at or below the detection limit in 2024 and were congruent with historical samples (Table 3.7-3).

The NP (Modified Sobek NP) from MUG granite Waste Rock samples collected in 2024 (3.0 kg CaCO3 eq/t) was smaller than the average of the historical dataset (4.9 kg CaCO3 eq/t), and the 2024 average MPA was the similar to the average for samples from 2019 – 2023. This resulted in a lower average NP/MPA ratio of 5.0 for the 2024 samples compared to an average value of 10.5 historically (Table 3.7-3). A wide range of NP/MPA ratios had been calculated from historical analyses of MUG granite (NP/MPA of 1.9 to 33.3), while in 2023 two of the three NP/MPA ratios calculated were 1.9 and would be categorized as “uncertain” PAG potential.

The sulphide sulphur content of the MUG granite is largely below detection limits (average 0.01 wt. % sulphide sulphur and other MUG granite samples (2019-2024, n = 13, not considering the two uncertain samples) are consistently categorized as non-PAG rock, due to their NP/MPA ratios greater than two (Price 2009). Therefore, acid production from the MUG granite waste rock is considered unlikely. Examination of the historical dataset of Misery granite (historical MUG granite samples and Misery pit granite samples) shows that the compositions of the current MUG granite samples are consistent with the historical Misery granite samples.

The three waste rock samples collected in 2024 are similar in elemental concentrations to historical samples (Table 3.7-4) with the following exceptions: the dissolved concentration of copper in one of the 2024 samples was approximately two times the maximum concentration of the historical samples, at an average of 75.8 ppm in comparison to the 2019 to 2023 dataset (maximum concentration of 34.2 ppm). Elevated chromium concentrations reported in 2023 are not present in the waste rock samples collected in 2024 (2019-2023 average concentration was 97.7 ppm and 2024 average concentration was 68.4 ppm). Low concentrations of sulphide-sulphur in MUG granite rock suggests an absence of metal sulphides; thus, metals and other elements are less likely to leach from the Misery granite.

Table 3.7-1 Summary of Misery Waste Rock Acid-Base Accounting Data

Year	Rock Type	Summary Statistic	Paste pH	Total S	Sulphate	Sulphide	NP	AP	NNP	NP/AP
			s.u.	(s)	(%)	(%)	(kg $CaCO_3$ eq/tonne)			
1997 - 2018	Diabase	Average	9.0	0.1	0.0083	0.097	12	3.2	9.4	3.8
		Max	9.8	0.2	0.03	0.2	31	6.3	28	64
		95th Percentile	9.5	0.16	0.02	0.16	21	5	17	16
		Median	9.1	0.11	0.005	0.1	12	3.4	9	3.7
		5th Percentile	8.6	0.02	0.005	0.01	6.6	0.61	3.7	2
		Min	8.3	0.005	0.005	0.005	2.5	0.16	1.2	1.2
		Count	100	100	97	97	100	100	86	100
	Granite	Average	9.1	0.025	0.0094	0.022	9.8	0.77	9	13
		Max	10.0	0.42	0.04	0.22	331	13	323	496
		95th Percentile	9.8	0.14	0.02	0.12	17	4.3	14	45
		Median	9.3	0.01	0.005	0.01	5.4	0.31	5	22
		5th Percentile	8.1	0.005	0.005	0.005	3	0.16	3	2.3
		Min	6.5	0.005	0.005	0	1.2	0.16	0.013	0.53
		Count	507	507	212	209	443	507	459	443
	Kimberlite	Average	8.4	0.39	0.065	0.35	304	12	292	25.2
		Max	10.3	1.94	0.38	1.36	417	61	416	1318
		95th Percentile	9.53	0.8865	0.14	0.72	406	28	403	1093
		Median	8.3	0.4	0.055	0.35	342	13	325	28
		5th Percentile	7.8	0.01	0.005	0.01	64	0.31	32	2.8
		Min	5.06	0.01	0.005	0.01	10	0.31	-51	0.2
		Count	108	108	108	88	108	108	108	108
	Metasediment	Average	8.8	0.16	0.012	0.15	20	5.1	15	4
		Max	10.0	1.0	0.1	0.78	416	31	407	117
		95th Percentile	9.6	0.29	0.03	0.27	57	9.1	52	26
		Median	8.9	0.16	0.01	0.14	10	5	4.9	2.1
		5th Percentile	7.9	0.04	0.005	0.03	5	1.3	-1	0.84
		Min	7.1	0.005	0.005	0.005	0.1	0	-14	0.023
		Count	553	553	546	547	553	554	553	553

Notes: All results reported as 'below detection' were replaced with detection limit values for the calculation of summary statistics. NP: neutralization potential as determined by the standard Sobek method

*AP: acid potential, calculated as total sulphur * 31.25*

NNP: net neutralization potential.

CO3-NP: carbonate neutralization potential Dash (-) indicates parameter not measured

Average NP/AP values are calculated using average NP and average AP values

Table 3.7-2 Summary of Elemental Concentrations in Misery Waste Rock

Description		Summary Statistic	Al	As	Ba	Ca	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Zn
Year	Rock Type	Units	%	ppm	ppm	%	ppm	ppm	ppm	%	%	%	ppm	ppm	%	ppm	ppm
1997 – 2018	Diabase	Average	5.3	5.6	209	3.8	37	83	237	8.3	0.85	2.2	1,260	0.76	1.5	53	122
		Max	8.1	82	670	6.6	56	163	331	13	2.9	3.7	2,050	2.3	3.0	80	226
		95th Percentile	7.7	12	492	6.4	54	149	314	12	2.4	3.4	1,962	1.7	2.5	76	180
		Median	6.4	2.7	210	5.1	46	82	270	10	0.78	2.8	1,650	0.64	1.8	58	129
		5th Percentile	1.5	0.80	46	0.71	14	40	20	2.5	0.27	0.69	302	0.40	0.072	25	55
		Min	0.42	0.50	21	0.16	1.0	36	0.90	0.67	0.14	0.26	139	0.20	0.031	3.5	22
		Count	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78
	Granite	Average	7.5	3.3	665	1.4	6.6	68	19	1.6	2.1	0.73	252	1.3	3.3	32	50
		Max	12	59	1,320	5.6	49	432	301	12	4.1	8.3	1,630	39	5.5	709	171
		95th Percentile	8.5	9.8	946	1.8	30	213	57	4.2	3.4	3.1	496	3.1	4.2	120	103
		Median	7.7	2.1	670	1.4	2.3	45	4.9	0.94	2.0	0.27	174	0.76	3.6	5.0	43
		5th Percentile	6.8	0.44	185	0.60	1.0	9.0	1.3	0.78	0.85	0.19	136	0.13	1.9	2.0	32
		Min	0.38	0.10	10	0.10	0.025	5.0	0.0050	0.52	0.10	0.14	100	0.090	0.031	1.0	22
		Count	229	229	229	229	229	229	229	229	229	229	229	229	229	229	229
	Kimberlite	Average	1.8	7.9	1,291	3.9	63	473	35	4.1	0.99	14	837	2.6	0.13	1,158	53
		Max	5.6	30	3,395	6.0	90	846	69	5.4	3.0	20	1,156	22	0.66	1,705	104
		95th Percentile	5.0	18	2,366	5.8	88	720	48	4.9	2.0	19	1,150	8.5	0.43	1,632	87
		Median	1.4	5.4	1,470	4.5	66	483	34	4.1	0.80	14	948	1.4	0.061	1,245	47
		5th Percentile	0.75	1.9	153	0.96	32	203	22	3.0	0.26	5.7	322	0.23	0.019	471	40
		Min	0.68	1.8	90	0.29	13	58	15	2.2	0.24	1.5	196	0.20	0.00050	132	38
		Count	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27
	Metasediment	Average	7.6	32	552	1.1	22	180	51	3.8	2.3	2.1	447	2.3	1.9	114	85
		Max	12	940	1,620	6.3	76	1,120	335	12	5.6	16	2,860	39	4.0	1,390	262
		95th Percentile	9.5	135	799	2.5	42	302	90	4.9	3.2	5.0	749	6.0	2.8	329	133
		Median	7.9	10	556	0.93	21	159	46	3.7	2.3	1.6	405	1.9	1.9	74	83
		5th Percentile	2.7	1.9	270	0.30	9.2	83	18	1.9	1.2	0.77	250	0.50	0.050	31	49
		Min	0.66	0.60	18	0.090	2.0	27	3.0	0.68	0.28	0.19	130	0.30	0.018	0.50	18
		Count	482	482	482	482	482	482	482	482	482	482	482	482	482	482	482

Table 3.7-3 Summary Statistics of ABA Results for Misery Underground Waste Rock

Rock Type	Summary Statistic[1]	Sampling Year	Count	Paste pH (pH units)	Total S[2] (s)	Sulphide S[3] (%)	NP[4] (kg $CaCO_3$ eq/t)	MPA[5] (kg $CaCO_3$ eq/t)	NNP[6] (kg $CaCO_3$ eq/t)	NP/MPA[7]
Granite	Mean	2024	3	9.7	0.01	0.01	3.0	0.4	2.8	5.0
		2019-2023	13	9.2	0.02	0.01	4.9	0.5	4.7	10.5
	Maximum	2024	3	10.0	0.05	0.02	3.0	0.6	3.0	5.0
		2019-2023	13	9.9	0.05	0.05	10.0	1.6	10.0	33.3
	95th Percentile	2024	3	9.9	0.02	0.02	3.0	0.6	3.0	5.0
		2019-2023	13	9.8	0.04	0.04	8.8	1.4	8.8	25.3
	Median	2024	3	9.6	0.01	0.01	3.0	0.3	3.0	5.0
		2019-2023	13	9.4	0.01	0.01	4.7	0.3	4.7	7.8
	5th Percentile	2024	3	9.5	0.01	0.01	3.0	0.3	2.5	5.0
		2019-2023	13	8.6	0.005	0.005	2.4	0.2	1.3	1.9
	Minimum	2024	3	9.5	0.01	0.01	3.0	0.3	2.4	5.0
		2019-2023	13	8.4	0.005	0.005	2.3	0.2	1.2	1.9

Notes:

DL = analytical detection limit; $CaCO_3$= calcium carbonate

[1] All results reported as < DL were replaced with DL value for the calculation of summary statistics.

[2] Total sulphur.

[3] Sulphur as sulphide; calculated by subtracting sulphate from total sulphur.

[4] Neutralization potential; 2019 samples determined using Sobek method, 2020 to 2023 samples determined using Modified Sobek method.

[5] Maximum potential acidity; 2019 samples calculated using total sulphur, 2020 to 2023 samples calculated using sulphide sulphur.

[6] Net neutralization potential.

[7] For samples where MPA < DL, DL values were used for NP/MPA calculation

Table 3.7-4 Summary of Elemental Concentrations in Misery Underground Waste Rock Granite

Rock Type	Summary Statistic[1]	Sampling Year	Count	Al (%)	As (ppm)	Ba (ppm)	Ca (%)	Cd (ppm)	Co (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	K (%)	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
Granite	Mean	2024	3	0.43	1.0	35.1	0.10	0.02	1.6	63.5	26.8	0.70	0.23	0.19	151	0.20	0.044	2.6	3.60	5	35.4
		2019-2023	13	2.23	0.6	225	0.43	0.04	2.2	97.8	6.4	0.88	0.86	0.25	167	0.53	0.849	5.4	11.1	8	45.5
	Maximum	2024	3	0.50	2.0	42.4	0.17	0.02	1.9	68.4	75.8	0.79	0.29	0.21	176	0.24	0.049	3.1	4.41	6	39.7
		2019-2023	13	8.0	1.5	1250	1.41	0.18	3.5	174	34.2	1.51	4.41	0.46	239	1.04	3.95	18	39.2	19	120
	95th Percentile	2024	3	0.49	0.5	32.7	0.12	0.02	1.6	63	2.4	0.72	0.22	0.19	161	0.19	0.043	2.5	3.23	6	36.4
		2019-2023	13	7.86	0.5	45.5	0.24	0.02	2.1	120	3.2	0.87	0.28	0.21	156	0.42	0.1	4	6.8	8	41
	Median	2024	3	0.42	0.5	32.7	0.12	0.02	1.6	63	2.4	0.72	0.22	0.19	161	0.19	0.043	2.5	3.23	6	36.4
		2019-2023	13	0.64	0.5	45.5	0.24	0.02	2.1	120	3.2	0.87	0.28	0.21	156	0.42	0.1	4	6.8	8	41
	5th Percentile	2024	3	0.38	0.5	32.7	0.12	0.02	1.6	63	2.4	0.72	0.22	0.19	161	0.19	0.043	2.5	3.23	6	36.4
		2019-2023	13	0.49	0.5	45.5	0.24	0.02	2.1	120	3.2	0.87	0.28	0.21	156	0.42	0.1	4	6.8	8	41
	Minimum	2024	3	0.37	0.4	30.1	0.005	0.005	1.4	59.2	2.11	0.60	0.19	0.17	115	0.18	0.041	2.3	3.16	4	30.2
		2019-2023	13	0.49	0.05	0.25	0.08	0.01	1.3	13	1.64	0.62	0.11	0.12	113	0.20	0.047	1.8	2.84	5	23.6

3.8 Kinetic Testing of Misery Metasediment

Kinetic testing of Misery metasediment was first conducted during pre-mining characterization (Norecol Dames and Moore 1997). The sample had a total sulphur concentration of 0.15% S. During the first 20 weeks of humidity cell testing, the pH of leachate declined from 7.5 to 4.8. The pH continued to fall reaching a low of around 3.6 between week 30 and week 40. The pH then remained around 4 for the duration of the test (120 weeks). Sulphate production followed a similar trend, with sulphate concentrations initially around 40 mg/L, increasing to around 140 mg/L once the pH dropped to 4.

This was supplemented by testing two additional Misery metasediment samples in humidity cells (SRK 2003, 2004). One of the samples had a total sulphur concentration (0.19% S) that was comparable to the average Misery metasediments composition and the other contained a much higher total sulphur concentration (0.34% S) above the 95th percentile.

These tests confirmed that Misery metasediment generates acid under laboratory conditions, though oxidation rates are low and related to sulphur concentration (SRK 2003). These materials have not resulted in ARD in the field. As discussed in Section 2.4, the WRSA was constructed to mitigate ARD potential by enhanced cooling. Current indications are that these measures have been effective.

3.9 Pigeon Pipe Geochemical Characterization

The Pigeon Pipe is a small steep-sided kimberlite pipe, approximately 3.5 ha in surface area. The kimberlite occurs near a regional lithological contact between granitoid and metasedimentary rocks. Two parallel diabase dykes intrude in a north- south direction adjacent to the Pigeon Pipe. The pipe is interpreted to intersect the eastern-most diabase dyke. The Pigeon kimberlite pipe is overlain by a substantive depth of glacial till (5 - 30 m), which is not common among the kimberlite pipes that have been developed at the Ekati mine where very little glacial till is typically encountered (generally <5 m till thickness).

An updated geological model was finalized in 2012 in which the Pigeon Pit waste rocks have been divided into the Northwest Domain and the Southeast Domain (Figure 3.9-1 and Figure 3.9-2) based on assessment of Pigeon drill logs, core photographs and petrographic analysis. The Northwest Domain is dominated by metasediment material (95%) and the Southeast Domain by a range of lithologies, including granitoid (16%), metasediment (34%), granitoid material with >30% intermixed metasediment (32%), and diabase (18%). The relative proportion of the units is based on the proportion of each lithology intercepted within all drill cores in each domain, not including the overburden (glacial till) unit.

Geochemical characterization of rock from the Pigeon deposit has been ongoing since 2000. ABA and geochemical characterization conducted prior to 2012 was based on an assumption that the geological contact between granite and metasediment would be visually distinct and obvious, as occurs in the Misery open pit. However, the final (2012) geological model identifies an inter-fingered contact zone that precludes the identification and isolation of all but a small amount of granite at a mining scale. Rock samples that were collected and analyzed for ABA prior to 2012 were re-logged according to the final geological model.

The Pigeon geochemical characterization dataset consists of 168 samples collected between 2000 and 2017. Waste rock sampling of Pigeon Pit began in 2015 and continued till end of mining operations in 2022. A summary of key geochemical test results are presented in Table 3.9-1 and Table 3.9-2

Figure 3.9-1 Pigeon Pit Geological Model

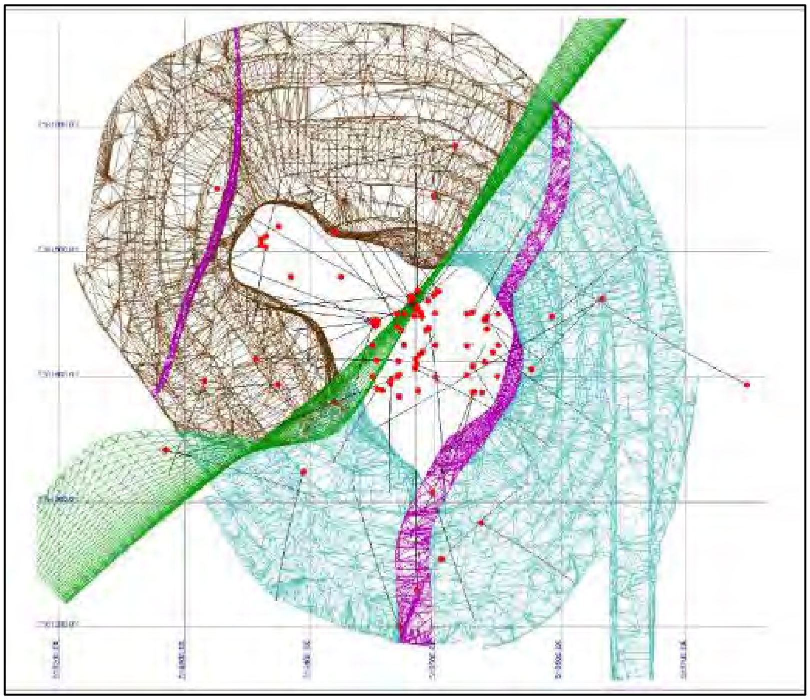


Figure 3.9-2 Pigeon Pit Geological Model 2

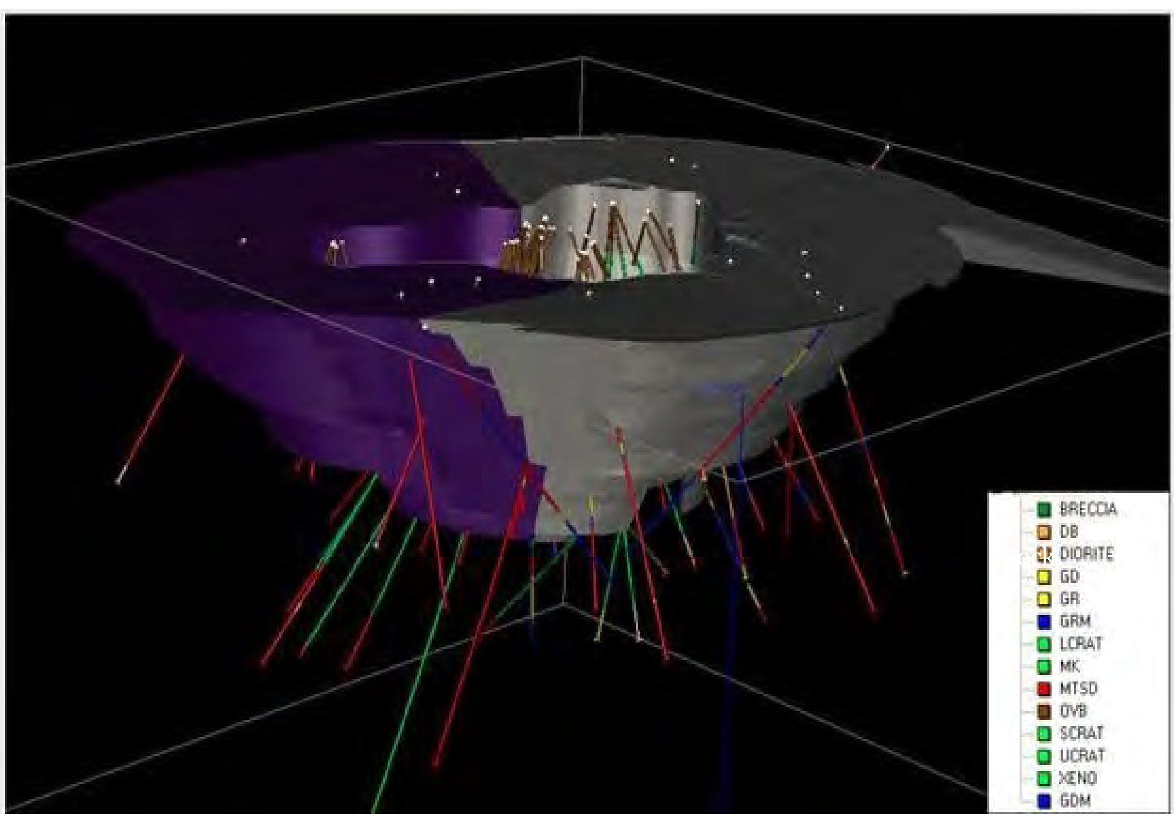


Table 3.9-1 Summary of Pigeon Waste Rock Acid-Base Accounting Data

Description		Summary Statistic	Paste pH	Total S	Sulphate	Sulphide	NP	AP	NNP	NP/AP
Year	Rock Type	Units	s.u.	%			kg CaCO3 eq/tonne			
	Diabase	Average	8.9	0.041	0.0057	0.023	10	1.3	9.1	8
		Max	9.5	0.06	0.01	0.04	15	1.9	13	34
		95th Percentile	9.5	0.057	0.0085	0.034	14	1.8	12	27
		Median	9.1	0.05	0.005	0.02	11	1.6	9.3	8.4
		5th Percentile	8.3	0.016	0.005	0.02	8.1	0.5	6.5	4.7
		Min	8.2	0.01	0.005	0.02	7.9	0.31	6.3	4.6
		Count	7	7	7	7	7	7	7	7
	Granite	Average	8.2	0.056	0.011	0.026	12	1.7	11	7
		Max	10	1.2	0.040	0.10	217	36	215	99
		95th Percentile	9.8	0.11	0.026	0.079	14	3.4	14	32
		Median	9.4	0.020	0.010	0.020	8.0	0.63	6.0	14.2
		5th Percentile	8.2	0.0050	0.0050	0.0050	3.9	0.16	2.5	1.7
		Min	6.6	0.0050	0.0050	0.0050	3.4	0.16	-26	0
		Count	50	50	50	15	50	50	46	50
	Kimberlite	Average	8.2	0.10	0.025	0.078	141	3.2	-	44
		Max	8.9	0.27	0.060	0.22	213	8.4	-	321
		95th Percentile	8.9	0.26	0.056	0.21	207	2.6	-	172
		Median	8.6	0.045	0.010	0.040	150	1.4	-	120
		5th Percentile	7.7	0.020	0.0050	0.0050	46	0.63	-	6.6
		Min	7.6	0.020	0.0050	0.0	9.0	0.63	-	2.9
		Count	11	12	10	11	11	12	0	11
2000 - 2017	Metasediment	Average	8.9	0.10	0.014	0.10	16	3.2	13	5
		Max	9.8	0.43	0.050	0.43	311	13	306	95
		95th Percentile	9.7	0.22	0.050	0.26	4	0.6	18	1
		Median	9.2	0.10	0.010	0.080	9.0	3.1	7.5	4.2
		5th Percentile	8.2	0.010	0.0050	0.010	3.4	0.31	-1.0	0.8
		Min	7.8	0.010	0.0050	0.010	2.9	0.31	-3.0	0.5
		Count	88	99	88	27	88	99	84	88

Notes: All results reported as 'below detection' were replaced with detection limit values for the calculation of summary statistics.

NP: neutralization potential as determined by the standard Sobek method

*AP: acid potential, calculated as total sulphur * 31.25 NNP: net neutralization potential.*

Dash (-) indicates parameter not measured

The NP/AP values are statistical calculations based on all sampled collected, and will not necessarily equal the value calculated from the NP and AP summary statistics presented in the table above.

Table 3.9-2 Summary of Elemental Concentrations in Pigeon Waste Rock

Description	Summary Statistic		Al	As	Ba	Ca	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Zn
Year	Rock Type		%	ppm	ppm	%	ppm	ppm	ppm	%	%	%	ppm	ppm	%	ppm	ppm
2000 - 2017	Diabase	Average	2.6	3.3	121	2.1	38	82	284	7.1	0.43	1.8	493	1.2	0.35	44	115
		Max	7.2	10	230	7.5	55	118	370	9.7	0.73	4.2	1440	2.0	1.5	97	143
		95th Percentile	5.8	7.7	215	5.6	54	110	358	9.3	0.7	3.8	1133	2.0	1.1	87	138
		Median	1.6	2.5	120	1.3	32	83	291	6.9	0.34	1.1	365	1.0	0.17	34	114
		5th Percentile	1.6	0.96	46	0.95	29	55	228	5.5	0.23	0.97	242	0.72	0.067	25	93
		Min	1.6	0.3	40	0.89	29	53	227	5.4	0.19	0.94	230	0.6	0.04	23	86
		Count	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
	Granite	Average	7.4	1.6	467	1.1	21	129	23	3.7	2.1	1.9	355	2.4	1.7	90	70
		Max	9.3	5.0	930	4.5	61	383	166	6.3	3.9	14	886	6.0	3.1	1,090	111
		95th Percentile	9.2	3.8	652	2.7	31	196	96	5.1	3.1	2.3	611	5.4	2.7	89	95
		Median	8.3	1.6	485	0.82	19	125	8.4	3.9	2.2	1.5	349	2.0	1.8	64	74
		5th Percentile	2.0	0.37	216	0.25	9.1	58	1.0	1.9	1.1	0.77	214	0.42	0.060	23	39
		Min	1.2	0.10	100	0.18	7.0	48	0.50	1.8	0.93	0.74	174	0.28	0.050	16	37
		Count	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34
	Kimberlite	Average	3.3	3.1	1,224	2.7	51	403	39	4.6	2.0	6.2	735	1.9	0.32	904	52
		Max	11.1	5.0	1,880	3.6	67	676	50	5.3	3.0	12	950	6.0	1.8	1,327	74
		95th Percentile	10.4	5.0	1,842	3.6	66	643	49	5.3	2.9	11	914	4.4	1.7	1,316	72
		Median	2.0	2.5	1,455	3.3	60	413	43	4.9	2.4	5.7	770	1.0	0.045	1,091	46
		5th Percentile	1.3	2.5	485	1.1	22	150	22	3.6	0.51	1.7	418	1.0	0.030	73	44
		Min	1.0	2.5	380	0.79	21	109	19	3.5	0.49	1.7	415	1.0	0.030	67	44
		Count	12	12	12	12	12	12	12	12	12	4	12	12	12	12	12
	Metasediment	Average	8.3	3	522.91	1	25	139	48.1	4.5	2.3	2	485.2	1.9	2	106	81
		Max	10.4	33	1,550.00	8	65	505	337.0	11.5	3.5	13	1,650.0	5.4	3	1,095	177
		95th Percentile	9.5	7	673.00	5	47	321	137.4	6.8	2.9	5	1,183.0	3.6	3	164	131
		Median	8.6	2	530.00	1	23	131	35.0	4.3	2.4	2	406.0	2.0	2	80	76
		5th Percentile	6.5	0	285.00	0	12	29	2.4	2.5	1.0	1	264.0	0.4	0	21	46.7
		Min	2.8	0	40.00	0	4	17	0.6	1.3	0.2	0	170.0	0.3	0	10	6.0
		Count	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79

The sulphur content of Pigeon granite samples ranged from 0.005 to 1.2% (average 0.06%). The average Sobek NP for Pigeon granite is 12kg $CaCO_3$/t. These values are similar to granite at other areas at the Ekati Mine. Overall, granite from the Pigeon pit has low acid potential, with an average NP/AP of 7.

A minimal amount of diabase was tested from the Pigeon pit during pre-mining geochemical characterization. Diabase has an average sulphur content of 0.04 (0.01 to 0.06%), and an average NP of 10 kg $CaCO_3$/t. Diabase also has a low acid potential (average NP/AP of 8).

Most samples collected during mining are classified as metasediment in hand sample, but some metasediment drill core samples were also collected prior to mining. The average sulphur content of metasediment samples was 0.10% (0.02 to 0.27%), and the average NP was 16 kg $CaCO_3$/t. On average, the metasediment from the Pigeon deposit has a low potential for acid generation (average NP/AP of 5), but approximately 33% of the metasediment samples are classified as PAG (NP/AP < 2).

Pigeon waste kimberlite had similar ABA characteristics to other waste kimberlite from the Ekati mine, with an average total sulphur content of 0.10% (range of 0.005 to 1.6%). Sobek NP ranged from 9.0 to 213 kg $CaCO_3$/t, with an average of 141kg $CaCO_3$/t. The average NP/AP ratio was 44, and Kimberlite has a low acid generation potential.

Major and trace element concentrations in the schist samples were similar to results previously recorded at other areas at the Ekati mine (Table 3.9-2).

3.10 Pigeon Humidity Cell Testing

Humidity cell tests were initiated on select drill core samples in 2012. Samples were selected based on the results of acid-base accounting results and to provide a representative range of Sulphide content. A total of eight core samples were selected for humidity cell analysis (Table 3.10-1). Six tests were initiated in October 2012 (HC-Pdef-1, 3, 4, 5, 10 and 16), and two tests were initiated in December 2012 (HC-Pdef-29 and 30). A total of 80 weeks of data are available for HC- Pdef-1, and 16; 111 weeks of data are available for HCPdef-3, 4, 5, and 10; 104 weeks of data are available for HC-Pdef- 29 and 73 weeks of data are available for HC-Pdef-30.

Trends in leachate pH and sulphate concentration over time are shown in Figure 3.10-1 and Figure 3.10-2. Four of the five metasediment tests (HC-PDef-3, HC-Pdef-5, HC-Pdef-10, HC-Pdef-16) produced acidic leachate with solution pH declining to approximately 3.5 to 5. Solution pH in the remaining tests has remained circumneutral. Chemical stability of a test is defined as less than a factor of two differences between a given week’s release rate and the running average of the previous five weeks data (Day 1994; MEND 1997).

Figure 3.10-1 Pigeon Humidity Cell Tests Leachate pH

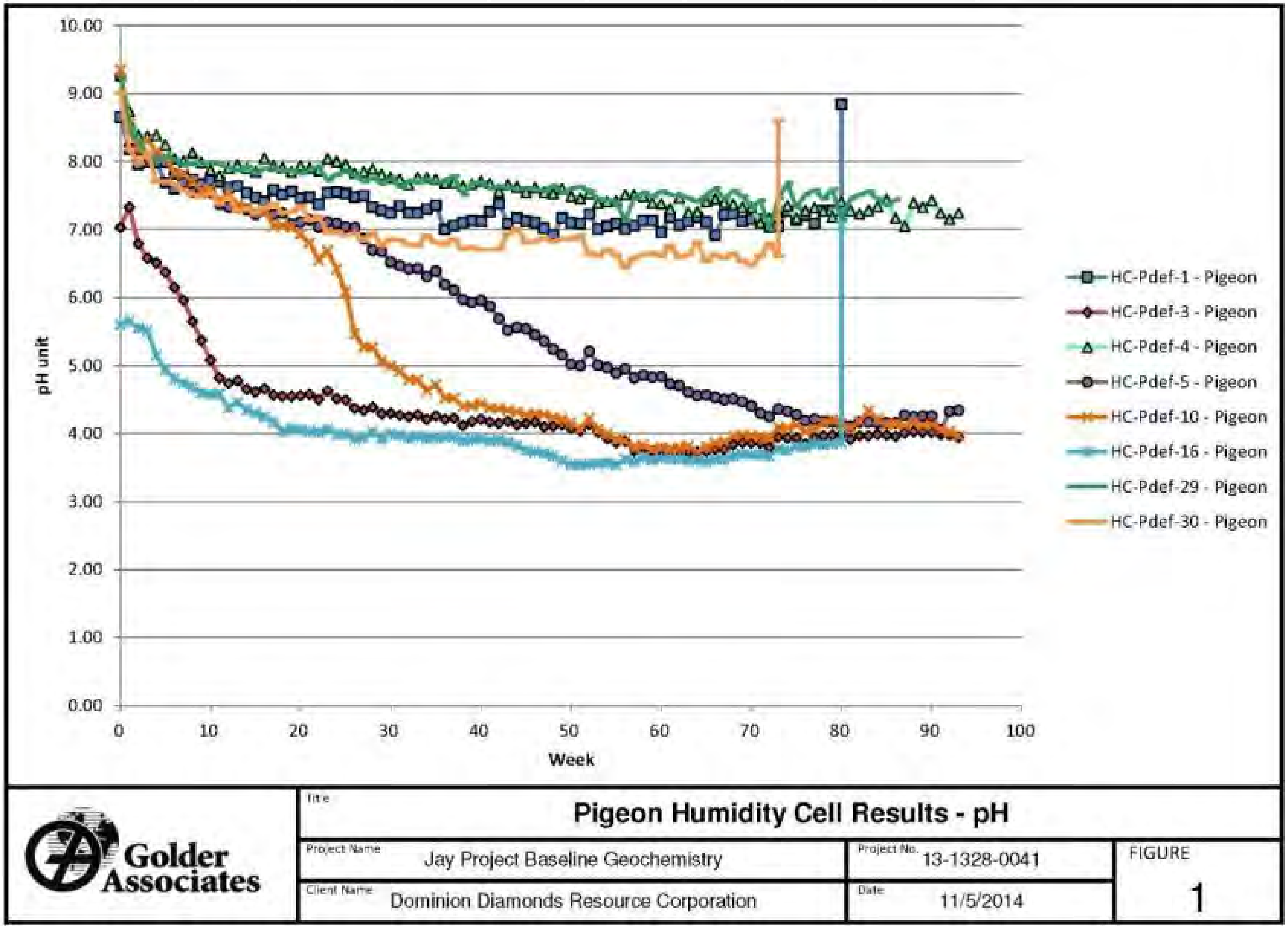
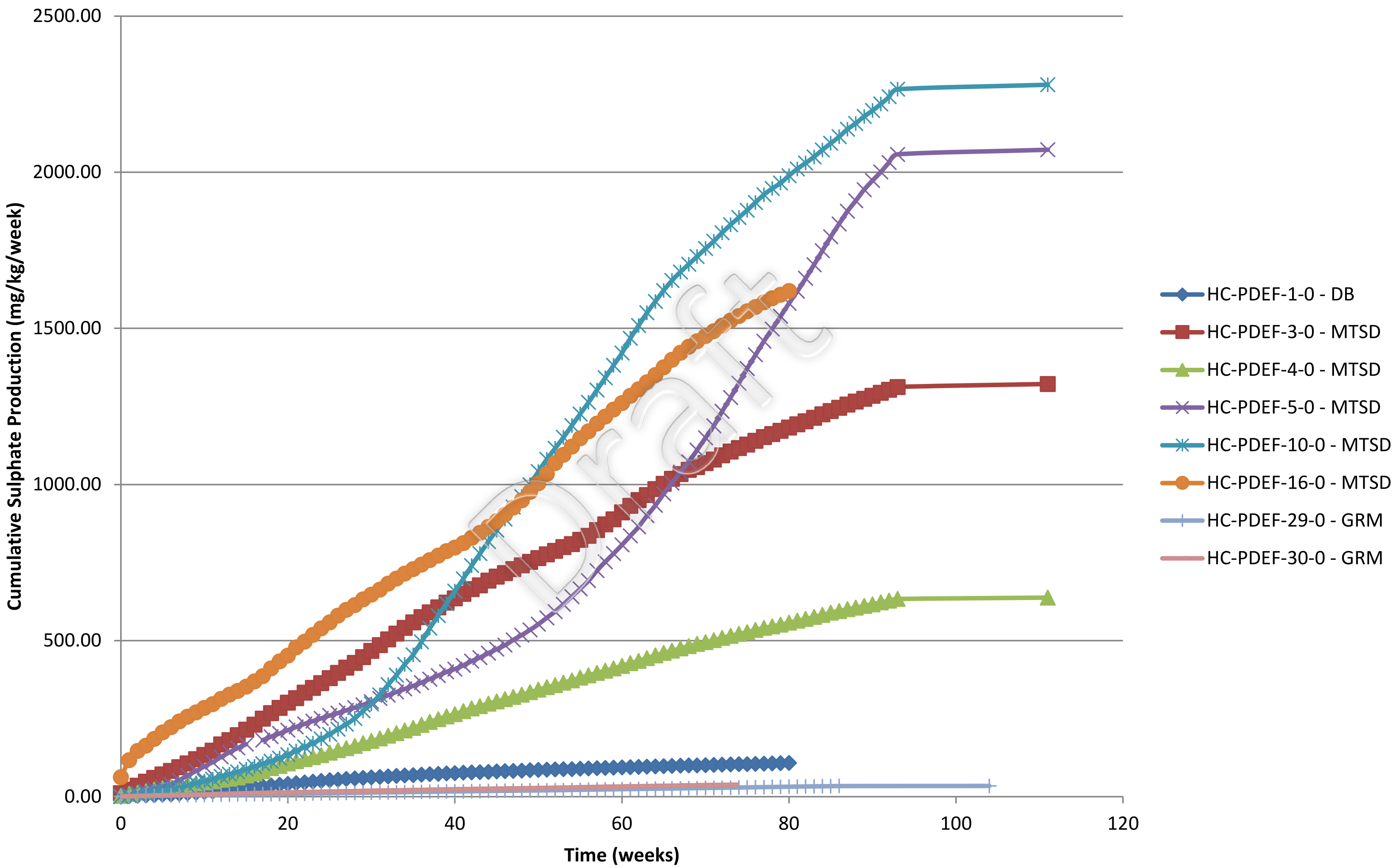


Figure 3.10-2 Pigeon Humidity Cell Tests Cumulative Sulphate Production



Note: Raw data subject to review. Not finalized - for discussion only.

Table 3.10-1 Pigeon Humidity Cell Samples

Sample ID	Domain	Lithology	Sulphide Content (%)
HC-Pdef-1	NW	Diabase	0.04
HC-Pdef-3	NW	Metasediment	0.2
HC-Pdef-4	NW	Metasediment	0.14
HC-Pdef-5	NW	Metasediment	0.43
HC-Pdef-10	SE	Metasediment	0.26
HC-Pdef-16	SE	Metasediment	0.15
HC-Pdef-29	SE	Mixed Granite/Metasediment (est. 70% metasediment)	0.02
HC-Pdef-30	SE	Mixed Granite/Metasediment (est. 30% metasediment)	0.03

After an initial pH of 8.65 in test HC-Pdef-1, the pH of the diabase decreased gradually over time to a value of 7.09 (week 51). The total alkalinity decreased from an initial concentration of 21.4 mg/L to a concentration of 3.9 mg/L. The sulfate concentration remained below 6.5 mg/L. Sulphide depletion outpaced NP depletion, indicating that the material will have sufficient neutralization capacity to mitigate any acid generation from sulphide oxidation. The dissolved metal concentrations in the diabase material maintained low concentrations. The test results are stable and confirm that diabase is non-PAG.

Initial pHs of the metasediment tests (HC-Pdef-3, -4, -5, -10, -16) ranged from 5.60 in HC-Pdef-16 to 9.35 in HC-Pdef-10, and all decreased over time to values ranging from 3.54 in HC-Pdef-16 to 7.46 in HC-Pdef-4 (week 51). Tests HC-Pdef- 10, HC-Pdef-16, HC-Pdef-05, and HC-Pdef-3 depleted all available alkalinity and became acid generating within the first 40 weeks. Only test HC-Pdef-04 remained circumneutral, with alkalinity of 10.7 mg/L at week 51. The sulfate concentration generally increased in all tests. Sulphide generation outpaced alkalinity production, indicating that the material will likely become acid generating in the field.

The dissolved metal concentrations maintained elevated concentrations of various metals including: aluminum, arsenic, cadmium, copper, iron, nickel, selenium, uranium, and zinc. In tests HC-Pdef-03, HC-Pdef-04, and HC-Pdef-16, metal concentrations stabilized or were decreasing at week 51. In test HC-Pdef-5, concentrations of cobalt, nickel, and iron rapidly increased beginning around week 30 from below detection limits at week 0 to 0.293 mg/L, 0.0204 mg/L and 1.86 mg/L, respectively, at week 51; more modest increases were also observed in zinc and copper. These increases correspond with the onset of mildly acidic conditions in the cell. Test HC-Pdef-10 showed a similar behavior with the onset of acidic conditions at week 25; however, only nickel concentrations have increased significantly to 2.63 mg/L at week 51. The results confirm that Metasediment is potentially acid generating and metal leaching.

After initial pH values of 9.23 and 9.01 in tests HC-Pdef-29 and HC-Pdef-30, respectively, the pH of the mixed granite/metasediment decreased gradually over time to values of 7.59 and 7.01 (week 44). The total alkalinity decreased from initial concentrations of 28.8 and 20.8 mg/L to concentrations of 13.6 and 3.1 mg/L. The sulfate concentration remained below 2.5 mg/L in both cells. Alkalinity production outpaced sulphate production, indicating that the material will have sufficient neutralization capacity to mitigate any acid generation from sulphide oxidation. The dissolved metal concentrations in the mixed material maintained low concentrations; although, in HC-Pdef-29, aluminum was slightly elevated at 0.01 mg/L. The test results are stable and indicate that the mixed granite/metasediment unit is non-PAG.

The Pigeon ABA and humidity cell test results indicate that:

- The diabase, diorite and granite rock units are classified as non-PAG, and are not a material risk of metal leaching, the same as the classification of these rock types at other open pits at the Ekati mine.
- Metasediment is PAG, and a risk of metal leaching, the same as the classification of this rock type at other open pits at the Ekati mine.
- The mixed granite/metasediment unit (30-70% metasediment) is classified as non-PAG.

Should the results of annual waste rock sampling deviate from the geochemical characteristics described above, supplemental geochemical testing will be initiated.

3.11 Lynx Geochemical Characterization

The Lynx kimberlite pipe occurs in the southeastern portion of the Ekati mine approximately 30 km from the Ekati main site facilities and approximately 2 km to the southwest of the Misery pipe (Figure 3.11-1).

The Lynx pipe is hosted by two-mica granite. The area immediately surrounding the Lynx kimberlite pipe is transected by numerous probable diabase dykes. One dike runs very close to the northwestern margin of the pipe and pit boundaries and one is inside the pit boundary adjacent to the pipe on its eastern side. The pipe lies within a small lake and is covered by approximately 18 to 30 m of water as well as boulder and gravel-dominated glacial till that is 10 to 20 m thick. The Lynx kimberlite pipe has elongated, steep-sided pipe morphology. In plan view, the pipe is roughly tear-shaped (approximately 0.7 ha surface area, 150 m by 65 m) with the narrow portion of the pipe extending towards the west. The available drilling data suggest that the more voluminous eastern portion of the pipe tapers inwards sharply. A plan view and an isometric view of the Lynx kimberlite pipe are provided in Figure 3.11-2 and Figure 3.11-3.

The Lynx kimberlite pipe is divided into an upper crater phase and lower volcaniclastic phase (volcaniclastic refers to clastic rock chiefly composed of volcanic material;). Drilling undertaken to date suggests that the volcaniclastic phase forms a steeply dipping wedge underlying the crater phase, and extends up into the eastern portion of the pipe. These phases have been defined as separate geological domains (DDEC 2013).

The crater phase is dominated by olivine-rich RVK (olivine is a mineral also known as magnesium iron silicate) with 15% to 50% partially altered to fresh medium to coarse grained olivine macrocrysts (i.e., relatively large crystals occurring in a mineral deposit) set in a dark mud-like matrix. Also present are: minor amounts of small (generally less than 2 to 3 cm) grey to black mudstone clasts (clasts are rock fragments resulting from the breakdown of larger rocks); between 1% and 3% rounded, fresh granite xenoliths (xenoliths are rock fragments that have become enveloped in a larger different type of rock as it formed) ranging from approximately 1 to 10 cm; and, occasional wood fragments. Lesser amounts of olivine-poor RVK (similar to above, but with less than 15% olivine) and minor interbedded epiclastic kimberlite are also present (DDEC 2013).

The volcaniclastic phase consists of very olivine-rich PVK, which contains between 40% and 70% coarse grained, fresh to altered, olivine macrocrysts set in a microcrystalline, serpentine-dominated matrix. Other components include relatively abundant rimmed magma clasts, RVK xenoliths (1% to 5%), and common granite xenoliths (5% to 15%; DDEC 2013).

Figure 3.11-1 Lynx WRSA Area Map

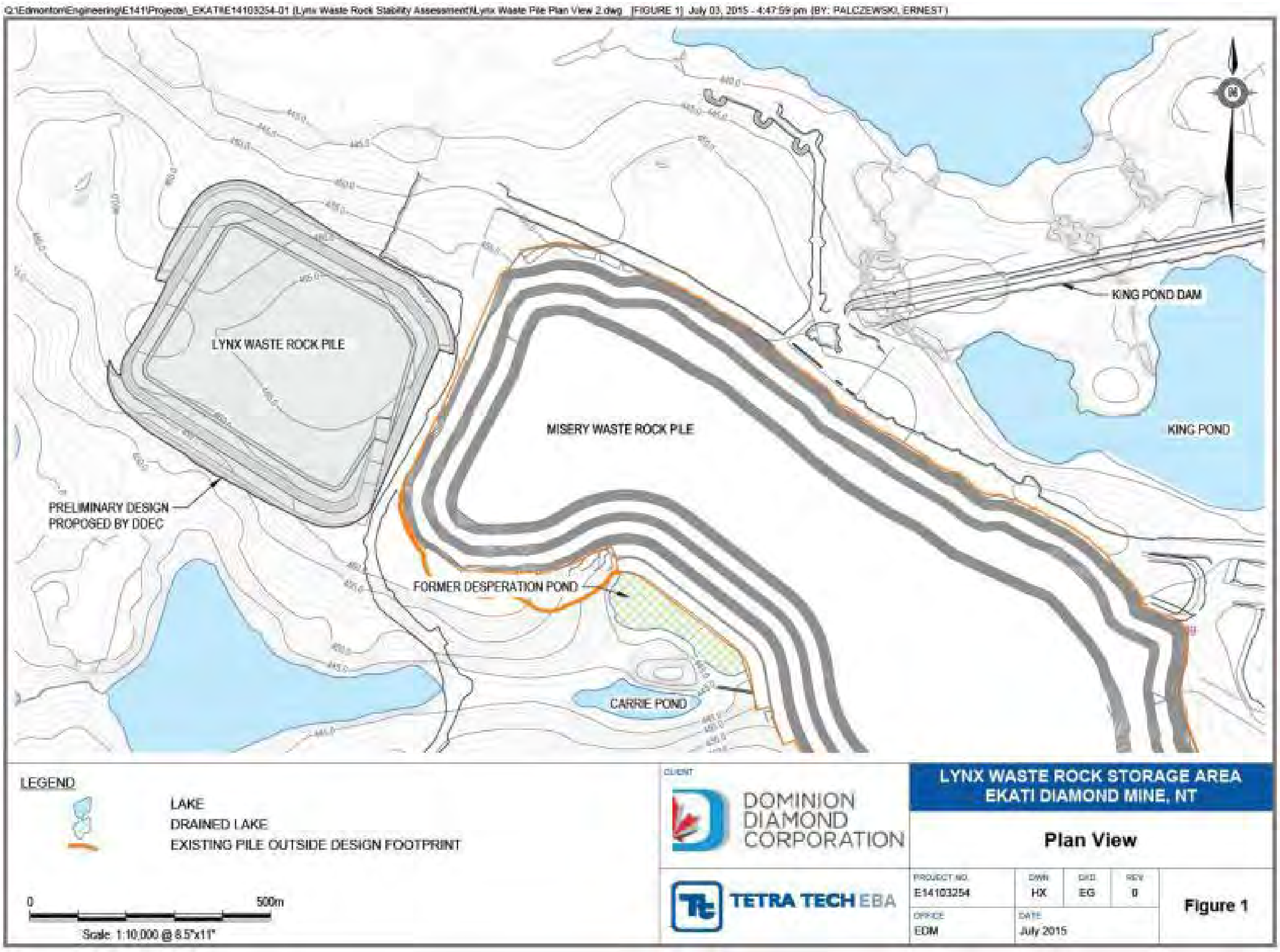


Figure 3.11-2 Lynx Kimberlite Plan View

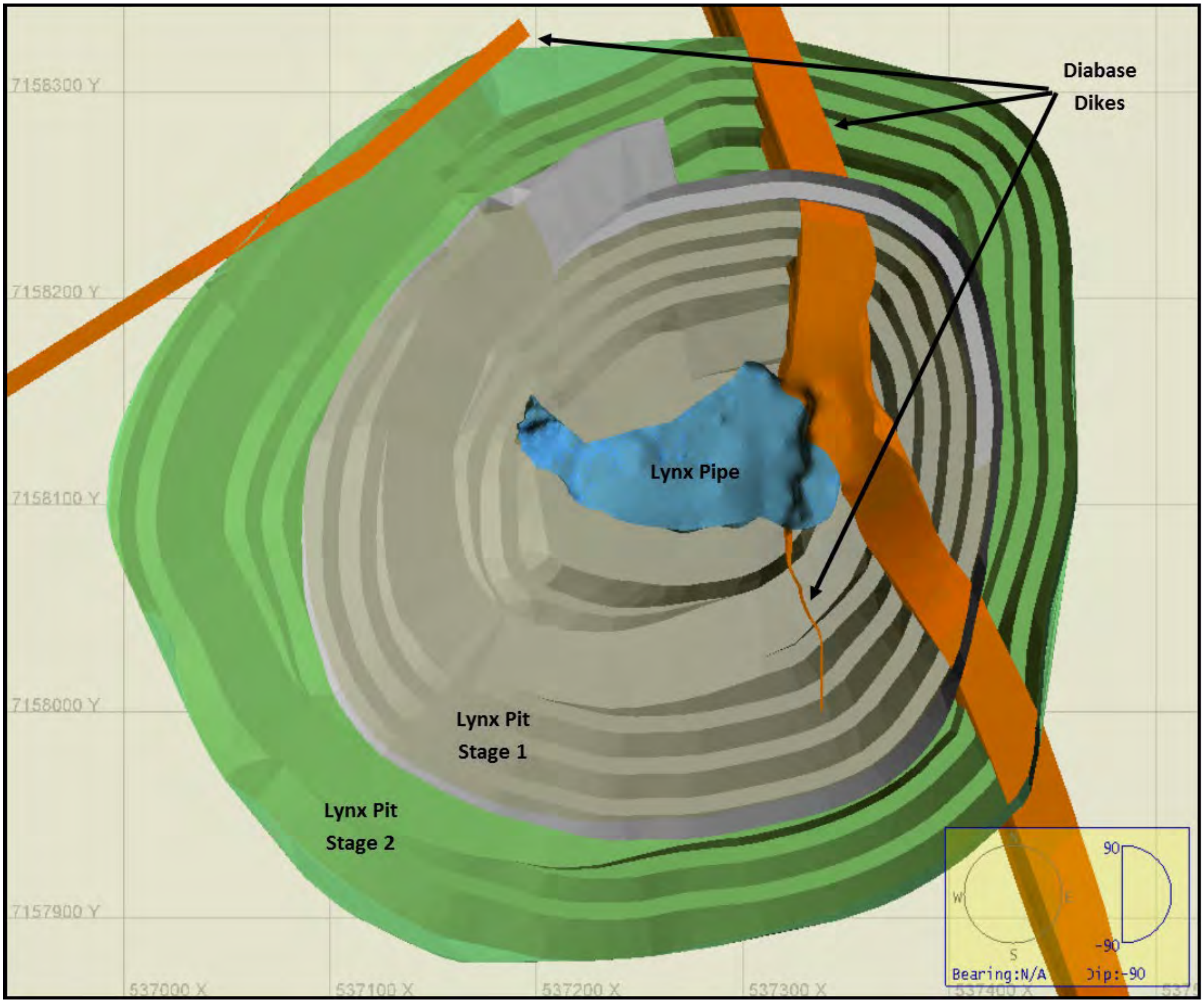
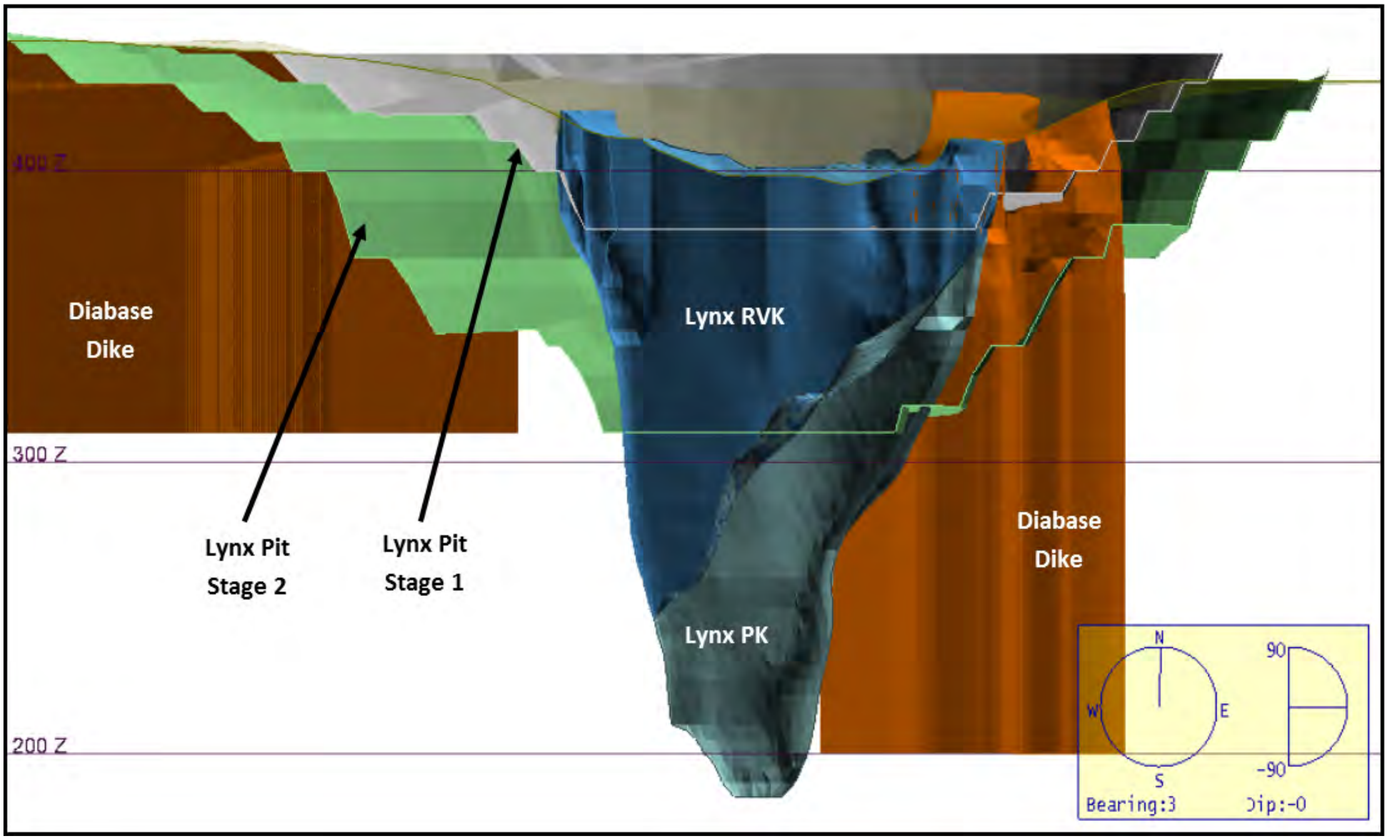


Figure 3.11-3 Lynx Kimberlite Isometric View



A limited geochemical testing program was conducted on rock collected from the Lynx pit and the Lynx WRSA in 2017. The objective of this program was to confirm the composition of diabase encountered at the Lynx pit during mining; therefore, the sample frequency is biased towards diabase. The Lynx geochemical dataset includes undiluted granite and diabase, respectively, as well as mixed diabase and granite from the Lynx crusher stockpiles and Lynx WRSA. The results of geochemical testing are presented in Tables 3.11-1 and 3.11-2, and are described below.

The sulphur content of Lynx granite samples ranged from 0.005 to 0.08% (average 0.049%). The average Sobek NP for Lynx granite is 8 kg $CaCO_3$/t. These values are similar to granite at other areas at the Ekati Mine. Overall, granite from the Lynx pit has a low acid potential, with an average NP/AP of 5.3. Major and trace element concentrations were similar to results previously recorded at other areas at the Ekati mine.

The sulphur content of diabase and mixed granite/diabase from the Lynx pit was low. Lynx WRSA samples contained 0.03 and 0.1% total sulphur, Lynx Pit samples contained from 0.02 to 0.03% (median 0.03%) total sulphur, Jay crusher stockpile samples (diabase mixed with granite) contained from 0.02 to 0.04% (median 0.03%) total sulphur, and the two Jay fine / coarse crusher samples (diabase mixed with granite) contained 0.01 and 0.03% total sulphur. Neutralization potential values were of a similar range in all samples. Lynx diabase NP values were 14 and 16 kg/t $CaCO_3$ in Lynx WRSA samples, 11 to 16 kg/t $CaCO_3$ (median 14 kg/t CaCO3) in Lynx pit samples, 11 to 30 kg/t $CaCO_3$ (median 13 kg/t $CaCO_3$) in Jay crusher stockpile mixed granite-diabase samples, and 5 and 6.5 kg/t $CaCO_3$ in the Jay coarse/fine crush mixed granite-diabase samples. All samples from the Lynx pit (diabase, and mixed diabase/granite) were classified as non-PAG.

Major and trace element concentrations in Lynx diabase samples were similar to results previously recorded at other areas at the Ekati Mine. In 2024, nine Lynx diabase waste rock samples collected during the move from the Lynx WRSA to Point Lake contained concentrations of barium, chromium, magnesium, and nickel above the range of Lynx diabase waste rock that were previously analyzed. Other elements were found in similar concentrations as historical Lynx diabase samples. The results are presented in Tables 3.11-3 and 3.11-4.

Table 3.11-1 Summary of Lynx Waste Rock Acid-Base Accounting Data

Description		Summary Statistic	Paste pH	Total S	Sulphate	Sulphide	NP	AP	NNP	NP/AP
Year	Rock Type	Units	s.u.	s	%	%	kg CaCO3 eq/tonne			
2017	Diabase and Mixed Diabase / Granite	Average	8.8	0.029	0.025	0.011	13	0.9	13.0	17
		Max	9.6	0.10	0.040	0.090	30	3.1	29.9	48
		95th Percentile	9.2	0.036	0.040	0.026	16	1.1	15.4	25
		Median	8.7	0.030	0.020	0.005	13	0.9	12.7	15
		5th Percentile	8.4	0.020	0.010	0.0050	9	0.6	8.2	8
		Min	8.4	0.010	0.0050	0.0050	5	0.3	5.0	4
		Count	30	30	30	30	30	30	30	30
	Granite	Average	9.4	0.049	0.006	0.049	8	1.5	6.5	16
		Max	10	0.08	0.010	0.080	9	2.5	8.0	51
		95th Percentile	9.6	0.077	0.009	0.077	9	2.4	7.9	44
		Median	9.3	0.055	0.005	0.055	8	1.7	6.5	5
		5th Percentile	9.2	0.012	0.005	0.0118	7	0.4	5.2	3
		Min	9.2	0.005	0.0050	0.0050	7	0.2	5.0	3
		Count	4	4	4	4	4	4	4	4

Notes: All results reported as 'below detection' were replaced with detection limit values for the calculation of summary statistics.
NP: neutralization potential as determined by the standard Sobek method
*AP: acid potential, calculated as total sulphur * 31.25*
NNP: net neutralization potential.
Dash (-) indicates parameter not MEASURAED
The NP/AP values are statistical calculations based on all sampled collected, and will not necessarily equal the value calculated from the NP and AP summary statistics presented in the table above.

Table 3.11-2 Summary of Elemental Concentrations in Lynx Waste Rock

Description		Summary Statistic	Al	As	Ba	Ca	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Zn
Year	Rock Type	Units	%	ppm	ppm	%	ppm	ppm	ppm	%	%	%	ppm	ppm	%	ppm	ppm
2017	Diabase and Mixed Diabase / Granite	Average	6.8	1.7	226	4.9	45	67	252	11	1.0	2.9	1,397	1.2	2.2	74	121
		Max	8.2	4.5	802	6.0	52	128	305	12	2.8	3.6	1,760	1.9	2.9	91	176
		95th Percentile	7.6	3.5	495	5.6	51	101	302	12	2.0	3.3	1,577	1.5	2.7	87	153
		Median	6.7	1.4	187	5.3	49	64	276	11	0.86	3.0	1,498	1.2	2.2	78	122
		5th Percentile	6.4	0.90	162	2.8	23	53	101	5.4	0.78	1.5	703	0.93	1.9	40	77
		Min	6.4	0.80	150	1.2	6.2	41	16	1.8	0.77	0.60	244	0.74	1.8	17	68
		Count	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	Granite	Average	8.0	4.5	548	1.1	11	76	58	3	2.9	0.9	348	3.5	2.8	39	107
		Max	8.6	5.6	800	1.2	15	107	96	4	3.6	1.1	439	5.9	3.0	52	120
		95th Percentile	8.5	5.6	775	1.2	14	104	90	4	3.6	1.1	429	5.8	3.0	51	119
		Median	7.9	5.0	580	1.1	13	78	49	3	2.91	0.9	343	3.9	2.8	44	108
		5th Percentile	7.6	2.79	275	0.9	7	44	37	2.4	2.16	0.6	273	0.74	2.4	18	95
		Min	7.6	2.50	230	0.9	5.8	39	36	2.3	2.13	0.61	266	0.46	2.4	14	93
		Count	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Table 3.11-3 Summary Statistics of ABA Results for Lynx Diabase Waste Rock

Summary Statistic[1]	Sampled Material (Year)	Count	Paste pH	Total S[2]	Sulphide S[3]	NP[4]	MPA[5]	NNP[6]	NP/MPA[7]
			pH units	%	%	kg $CaCO_3$ eq/t			
Mean	2017-2019 Lynx Diabase	46	8.9	0.02	0.02	14.6	1.0	15.6	16.9
	2024 Lynx Diabase	9	9.0	0.12	0.11	33.5	3.5	30.0	10.2
Maximum	2017-2019 Lynx Diabase	46	9.6	0.04	0.13	29.9	5.0	21.0	49.8
	2024 Lynx Diabase	9	9.2	0.60	0.51	169	15.9	153	14.3
95th Percentile	2017-2019 Lynx Diabase	46	9.2	0.04	0.04	21.0	1.6	20.2	32.7
	2024 Lynx Diabase	9	9.2	0.43	0.37	111	11.7	100	14.0
Median	2017-2019 Lynx Diabase	46	9.0	0.02	0.01	14.1	0.9	16.0	15.4
	2024 Lynx Diabase	9	9.1	0.05	0.05	16.0	1.6	14.7	10.6
5th Percentile	2017-2019 Lynx Diabase	46	8.4	0.01	0.01	8.8	0.6	10.3	5.6
	2024 Lynx Diabase	9	8.6	0.04	0.04	13.9	1.3	10.5	5.0
Minimum	2017-2019 Lynx Diabase	46	8.4	0.01	0.01	5.0	0.3	6.0	3.2
	2024 Lynx Diabase	9	8.3	0.04	0.04	13.3	1.3	9.7	2.8

Notes:

DL = analytical detection limit; CaCO3= calcium carbonate

1 All results reported as < DL were replaced with DL value for the calculation of summary statistics.

2 Total sulphur.

3 Sulphur as sulphide; calculated by subtracting sulphate from total sulphur.

4 Neutralization potential; 2019 samples determined using Sobek method, 2020 to 2024 samples determined using Modified Sobek method.

5 Maximum potential acidity; 2019 samples calculated using total sulphur, 2020 to 2024 samples calculated using sulphide sulphur.

6 Net neutralization potential.

7 For samples where MPA < DL, DL values were used for NP/MPA calculation.

Table 3.11-4 Summary Statistics of Elemental Results for Lynx Diabase Waste Rock

Summary Statistic[1]	Sampled Material (Year)	Count	Al	As	Ba	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Pb	Ti	V	Zn
			%	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm
Mean	2017-2019 Lynx Diabase	46	6.72	1.7	231	5.17	0.11	45.9	58.2	256	10.53	0.97	2.92	1466	1.17	2.14	73.4	3.62	1.77	374	119
	2024 Lynx Diabase	9	1.53	1.3	207	1.38	0.07	30.1	87.1	261	5.09	0.22	2.16	351	0.97	0.12	136.7	2.55	0.30	228	77
Maximum	2017-2019 Lynx Diabase	46	8.15	7.3	802	6.28	0.27	52.8	128.0	329	12.65	2.76	3.57	2460	1.93	2.89	90.7	18.60	2.66	444	176
	2024 Lynx Diabase	9	2.26	5.8	1530	2.57	0.33	56.3	288.0	317	6.70	0.47	11.70	628	1.86	0.17	901.0	11.70	0.54	264	113
95th Percentile	2017-2019 Lynx Diabase	46	7.06	1.4	200	5.48	0.10	48.7	60.5	279	11.08	0.86	3.06	1515	1.14	2.15	77.2	2.60	1.87	399	122
	2024 Lynx Diabase	9	2.02	0.7	40	1.27	0.04	27.0	63.6	297	5.10	0.19	0.96	314	0.75	0.13	39.2	1.44	0.29	237	73
Median	2017-2019 Lynx Diabase	46	6.63	1.4	200	5.48	0.10	48.7	60.5	279	11.08	0.86	3.06	1515	1.14	2.15	77.2	2.60	1.87	399	122
	2024 Lynx Diabase	9	1.45	0.7	40	1.27	0.04	27.0	63.6	297	5.10	0.19	0.96	314	0.75	0.13	39.2	1.44	0.29	237	73
5th Percentile	2017-2019 Lynx Diabase	46	6.40	1.4	200	5.48	0.10	48.7	60.5	279	11.08	0.86	3.06	1515	1.14	2.15	77.2	2.60	1.87	399	122
	2024 Lynx Diabase	9	1.28	0.7	40	1.27	0.04	27.0	63.6	297	5.10	0.19	0.96	314	0.75	0.13	39.2	1.44	0.29	237	73
Minimum	2017-2019 Lynx Diabase	46	6.26	0.8	120	0.83	0.06	6.2	29.0	16	1.83	0.74	0.60	228	0.74	1.78	17.4	1.40	0.21	36	52
	2024 Lynx Diabase	9	1.26	0.2	33	0.98	0.01	24.5	37.5	31	3.56	0.16	0.78	272	0.69	0.04	32.1	1.11	0.09	77	48

Notes:

The 2019 samples were analyzed following a four-acid digestion, while for the samples from 2020 to 2024, aqua regia digestion method was used.

DL = analytical detection limit; Al = aluminum; As = arsenic; Ba = barium; Ca =calcium; Na = sodium; Cd = cadmium; Co = cobalt; Cr = chromium; Cu = copper; Fe = iron; K = potassium; Mg = magnesium; Mo = molybdenum; Na = sodium; Ni = nickel; Pb = lead; Ti = titanium; V = vanadium; Zn = zinc

1 All results reported as < DL were replaced with half of the DL value for the calculation of summary statistics.

3.12 Sable Geochemical Characterization

The Sable Pipe is located beneath Sable Lake, approximately 15 km north of Panda Pit (Figure 2.1). The pipe forms an irregular heart-shaped outline in plan view (Figure 3.12-1) and is approximately 1.9 ha in area where it contacts glacial overburden. The pipe widens at depth, although the north wall dips inwards Figure 3.12-2). The overlying 7 to 15 meters of glacial till consists of boulders, and gravel (50-70%) with lesser sand (10-30%), silt (0-10%) and clay (0-10%) of undifferentiated glacial origin. The sand sized component is composed of angular to subrounded quartz, feldspar and flakes of micas locally-derived from two mica granite. The northwest quadrant of the pipe is overlain by abundant metre-sized boulders (BHP 2002b).

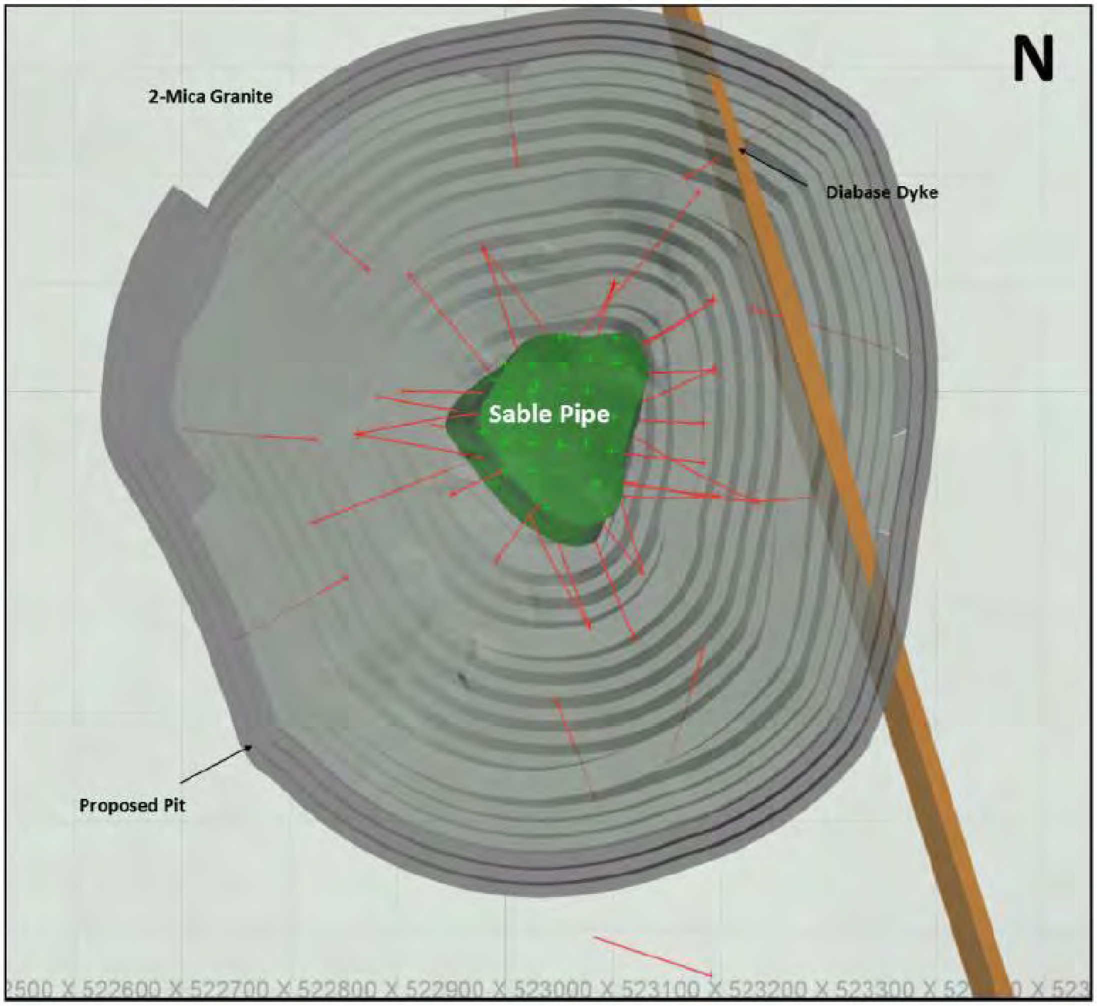
The Sable kimberlite contains two main lithologies:

- Olivine-rich Resedimented volcaniclastic kimberlite (ORVK): massive, matrix-supported, kimberlite with less than 30% fine- to medium- grained olivine, scattered mudstone clasts, rare small granite xenoliths and common wood fragments set in a dark, fine-grained matrix dominated by mud; and
- Very olivine-rich volcaniclastic kimberlite (vOVK): clast-supported, very olivine-rich VK with common mudstone clasts, scattered granite xenoliths and carbonized wood fragments. Olivine content commonly exceeds 50% and due to the significantly lower proportion of muddy matrix material, the kimberlite is generally pale to dark greenish- brown/grey in color (DDEC 2015b).

Kimberlite intersections have been assigned to two major domains based on drill core observations. An Upper Crater domain is characterized by a significant proportion of RVK. This kimberlite type generally dominates the upper portion of the kimberlite with increasing amounts of interbedded pale vOVK occurring with depth. The Lower Crater domain is dominated by vOVK, with the presence of scattered large (4 to 15 cm) granite xenoliths. The domain boundary is currently defined at the point below which matrix supported ORVK becomes an insignificant component (DDEC 2015b).

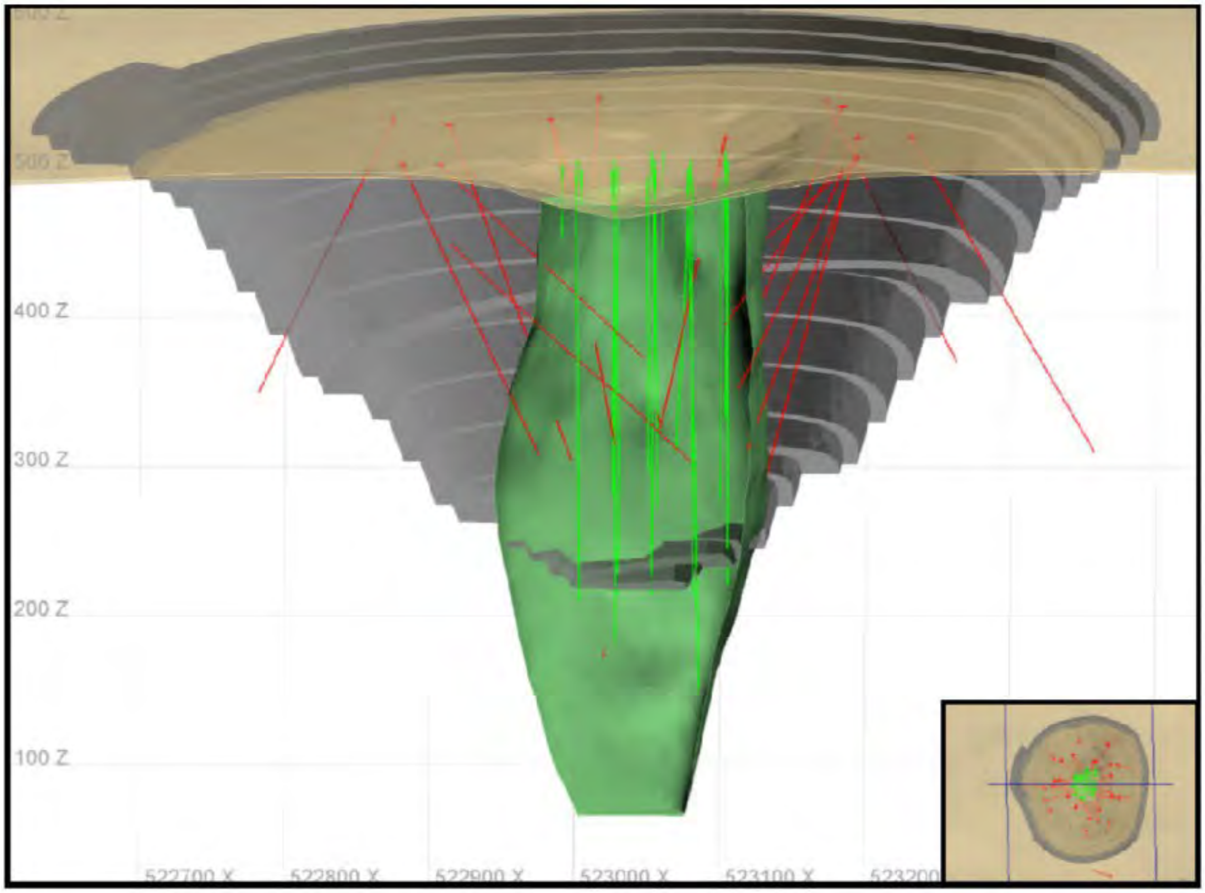
The two major waste rock types are two-mica granite (2MG) and diabase and mafic dykes. The 2MG showed gradational contacts with minor intervals of biotite granite, granodiorite, and pegmatite. The diabase dykes are near vertical and contacts with the granitic rocks are generally sharp, fractured, and of variable orientations. Most dykes are a few centimetres wide with the exception of a 30 m thick diabase dyke located 200 metres east of the kimberlite pipe. It is estimated that diabase represents less than 5% of the host rock in the proposed pit limits with 2% coming from the 30 m thick dyke (BHP 2002b).

Figure 3.12-1 Sable Pipe, Plan View



Note: Data used are current to end January 2015. Grid is as labelled (100 x 100 m). Wall rock is predominantly two-mica granite.

Figure 3.12-2 Sable Pipe, Isometric View



Note: Data used are as at end January 2015. Section is looking north (northing 7192970) with a slight incline (-11º). Brown = layer of overburden, grey = pit design, green = Sable Pipe. Drill hole traces are coded by drill hole type, green = RC, red = core. Elevation is as labelled (100 m spacing).

Geochemical testing of host rock types (granitic rock and diabase) indicates very low sulphur concentrations and consequently negligible reactivity. The results of geochemical testing of granite and kimberlite waste rock from the Sable pit are presented in Tables 3.12-1 and 3.12-2, respectively. No special management approaches are needed to address the geochemical properties of the host rock (BHP 2002b).

Table 3.12-1 Summary of Sable Waste Rock Acid-Base Accounting Data

Description		Summary Statistic	Paste pH	Total S	Sulphate	Sulphide	NP	AP	NNP	NP/AP
Year	Rock Type	Units	s.u.	s	%	%	kg $CaCO_3$ eq/tonne			
2003 - 2017	Granite	Average	9.0	0.030	0.0063	0.051	3.6	0.94	7.0	3.8
		Max	10	0.30	0.030	0.80	13	9.4	11	1.4
		95th Percentile	10	0.11	0.010	0.16	10	3.5	11	2.9
		Median	9.6	0.010	0.0050	0.0050	2.9	0.31	6.5	9.2
		5th Percentile	9.0	0.0050	0.0050	0.0050	0.93	0.16	3.7	6.0
		Min	7.5	0.0050	0.0050	0.0050	0.80	0.16	3.7	5.1
		Count	47	47	47	41	47	47	6	47.0
	Kimberlite	Average	8.2	0.11	0.022	0.085	170	3.3	-	51
		Max	10	0.32	0.050	0.27	204	10	-	20
		95th Percentile	9.1	0.22	0.038	0.19	199	6.8	-	29
		Median	8.2	0.090	0.020	0.060	176	2.8	-	63
		5th Percentile	7.8	0.040	0.0080	0.036	137	1.3	-	109
		Min	7.8	0.040	0.0050	0.030	128	1.3	-	102
		Count	13	13	13	13	13	13	0	1

Notes: All results reported as 'below detection' were replaced with detection limit values for the calculation of summary statistics.

NP: neutralization potential as determined by the standard Sobek method

*AP: acid potential, calculated as total sulphur * 31.25*

NNP: net neutralization potential.

Dash (-) indicates parameter not measured

The NP/AP values are statistical calculations based on all sampled collected, and will not necessarily equal the value calculated from the NP and AP summary statistics presented in the table above.

Table 3.12-2 Summary of Elemental Concentrations in Sable Waste Rock

Description		Summary Statistic	Al	As	Ba	Ca	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Zn
Year	Rock Type	Units	%	ppm	ppm	%	ppm	ppm	ppm	%	%	%	ppm	ppm	%	ppm	ppm
2003 - 2017	Granite	Average	1.8	2.2	195	0.30	6.2	174	4.6	1.7	1.0	0.73	196	3.4	0.41	14	70
		Max	7.9	2.5	780	1.5	38	343	60	6.9	5.6	5.9	820	14	4.1	113	424
		95th Percentile	7.3	2.5	704	0.90	21	297	18	4.1	4.4	2.9	470	6.8	2.8	62	205
		Median	0.65	2.5	30	0.19	3.0	187	0.50	1.1	0.34	0.27	145	4.0	0.060	5.0	47
		5th Percentile	0.23	0.40	10	0.050	0.50	17	0.50	0.28	0.095	0.036	35	0.87	0.033	2.1	5.6
		Min	0.060	0.20	5.0	0.030	0.50	9.0	0.50	0.20	0.050	0.030	20	0.28	0.010	1.5	0.50
		Count	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47
	Kimberlite	Average	1.3	2.5	1,504	2.7	58	278	23	4.4	0.78	13	817	1.4	0.12	1,174	50
		Max	1.7	2.5	3,800	4.8	66	321	32	4.8	1.8	13	1,810	2.0	0.43	1,383	59
		95th Percentile	1.6	2.5	2,578	4.7	66	320	30	4.7	1.7	13	1,219	2.0	0.36	1,366	58
		Median	1.3	2.5	1,415	2.2	59	286	22	4.4	0.58	13	740	1.0	0.050	1,198	50
		5th Percentile	0.92	2.5	839	1.6	48	231	15	4.0	0.37	13	640	1.0	0.040	950	45
		Min	0.89	2.5	410	1.4	41	228	14	3.6	0.36	13	630	1.0	0.040	752	44
		Count	14	14	14	14	14	14	14	14	14	1	14	14	14	14	14

3.13 Point Lake Geochemical Characterization

The Point Lake Open Pit located east of the Misery camp accesses three kimberlite pipes, Point Lake, Phoenix and Challenge, occurring beneath Point Lake (Figure 3.13-1), in the southeastern portion of the Ekati property approximately 2 km to the northeast of the Misery Camp (Figure 2.1-1). They form part of the Lac de Gras field, comprising more than 270 kimberlites emplaced between approximately 45 and 75 million years ago into Archean basement of the Slave Craton. All three kimberlites occur as volcanic pipes that were emplaced into foliated metasedimentary rocks. The kimberlites are steep-sided tapering volcanic pipes that vary considerably in size and in the nature of their infill.

The Point Lake pipe is the largest of the three kimberlites, covering an area of approximately 10.9 ha at the contact with overburden. Logging of drill core and reverse circulation (RC) drill chips identified two main kimberlite domains (internal zones with broadly equivalent geological characteristics):

- RVK – bedded, resedimented, olivine-poor to olivine-rich, volcaniclastic kimberlite with variable and significant amounts of mud dilution. This is the dominant material occupying the upper part of the pipe.
- PK – massive, olivine-rich pyroclastic kimberlite. This is the dominant kimberlite variety at depth and extends up to the overburden contact on the eastern and western portion of the pipe.

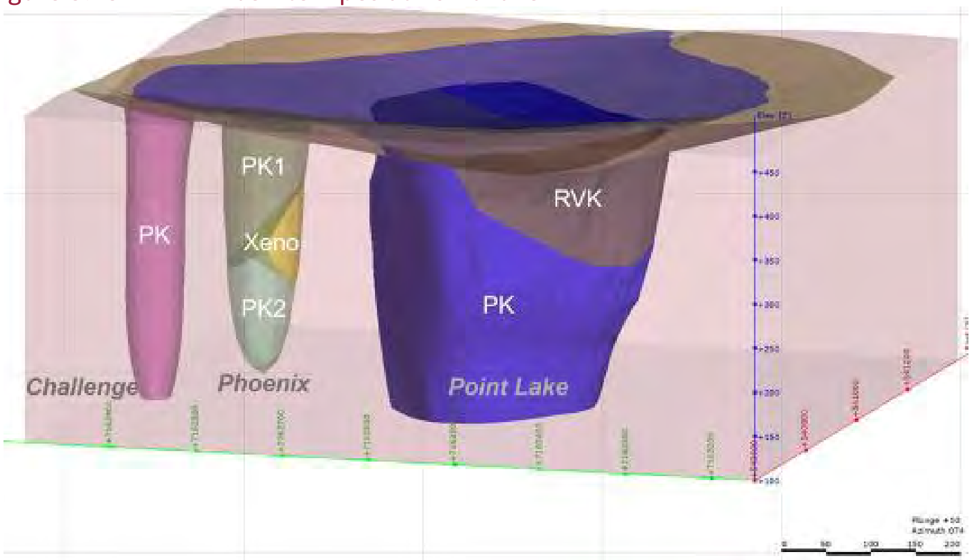
Other, volumetrically minor, domains include: VK1 – a zone of apparent mixing between RVK and PK; VK2 – probable contact material at the contacts between PK and wall-rock; and PK2 – distinctive pyroclastic kimberlite intersected only in one drill hole (PL-53) that is not considered to be part of the main Point Lake pipe.

The Phoenix kimberlite covers an area of approximately 0.8 ha at the contact with overburden and is infilled predominantly by massive, altered pyroclastic kimberlite (PK) with a high proportion of fine-grained (<1 cm) wall-rock fragments (metasediment xenoliths). Drilling indicates the presence of large metasediment blocks (xenoliths) occupying the south-east portion of the pipe at depths below surface of approximately 60 to 170 m. These are underlain by pyroclastic kimberlite similar to that occupying the upper portion of the pipe.

The Challenge kimberlite is the smallest of the three PLC bodies, covering an area of 0.6 ha at the contact with overburden. Based on drilling undertaken to date, this small pipe is entirely infilled with dark, very competent xenolith-poor and olivine-rich pyroclastic kimberlite.

Overburden and waste rock will be excavated from the Point Lake Open Pit and deposited separately (S.2.4.10). Overburden will comprise primarily glacial till with minor unconsolidated materials and lake bottom sediment. Sandy esker-like material is not anticipated. Overburden is planned to be re-used for reclamation, including the closure cover over the WRSA. Nearly all (estimate $99\%^{+}$) of the waste rock excavated from the Point Lake open pit will be metasediment, and all of the metasediment will be managed as PAG. There may be minor quantities of pegmatites that will not be separated and will be handled along with metasediment. A seepage collection system for the WRSA is included in the WRSA Design (Appendix F) that will protect receiving waters from poorer than anticipated seepage quality. A post-closure seepage quality prediction was prepared (ERM 2023) based on the preliminary closure design that will be updated as part of the final closure design.

Figure 3.13-1 Kimberlite Pipes at Point Lake



Three humidity cell tests (HCTs) were initiated in 2021 to better understand the geochemistry of the metasediment of the Point Lake open pit, as augmentation of the existing site-wide dataset. The HCT samples were selected from the 85-sample database that underwent static analyses. The samples were selected based on the static ABA and NAG and SFE (shake flask extraction) leachate results to represent average and conservative metal leaching potentials, to the extent practicable. Further, HCT 2 was selected with the specific intent of characterizing leaching in acidic drainage (pH<4.5) due to its low NP and classification as potentially acid forming (PAF) based on the NAG pH results.

The HCT samples were submitted for Xray Diffraction with Rietveld Refinement (XRD) analysis. The XRD results indicated that sulphides were present as pyrrhotite, which can be a faster reacting sulphide than pyrite (MEND 2009). However, when the Point Lake sulphate release rates were compared to the Ekati Diamond Mine site-wide HCT sulphate released rates, the actual rates of reactivity were determined to be similar. The primary mineral with NP in the samples selected for HCT analyses was identified as biotite by the XRD analyses. Approximately 10% of the Point Lake metasediment samples had measurable amounts of carbonate; however, these samples were not selected for HCT analyses.

The geochemical assessment of Point Lake metasediment waste rock is described in Appendix H. The HCT analyses were initially reported in August 2022 (Appendix H.1) with follow up reporting based on results to weekly sample cycle 61 in June 2023 (Appendix H.2). The geochemical analyses provided the basis for the metasediment source term used in the WRSA seepage quality prediction (ERM, 2023).

3.14 Coarse Kimberlite Reject Geochemical Characterization

ABA data and elemental results for CKR samples collected routinely from 2000 through 2024 are summarized in Table 3.14-1 and Table 3.14-2 and a summary is provided below, based on the Ekati Mine 2024 Waste Rock and Waste Rock Storage Area Seepage Report included in the 2024 EA and WL Annual Report. Monitoring results from the 2024 CKR samples were generally within the range of CKR ABA results from previous years.

CKR sampled during 2024 had total sulphur contents ranging from 0.16% to 0.25%, with a median sulphur content of 0.22%. This is lower than the median of 0.25% Sulphur from samples collected between 2000 and 2023. The 2024 samples had a lower median neutralization potential (NP) of 137 kg $CaCO_3$/t compared to a long-term median of 268 kg $CaCO_3$/t.

The ratio of NP to MPA provides a measure of the acid generating potential of the sample. Values of greater than two indicate that samples are non-PAG. The 2024 CKR samples had NP/MPA ratio that ranged from 18 to 28, with a median ratio of 23. This is lower than the long-term median NP/MPA value of 30. These results continue to indicate that there is sufficient NP within CKR to neutralize any acid produced as a result of oxidation of contained sulphides.

Major and trace element concentrations in the 2024 CKR were similar to the range of concentrations observed for Fox kimberlite or Koala kimberlite (summary data presented in DDEC 2014a). Kimberlite is enriched in magnesium, chromium and nickel compared to other rock types at the Ekati mine. Major and trace element concentrations remain within the range of CKR results recorded from 2000 to 2023, although the 2024 sample means are generally lower than the long-term mean. Overall, the concentrations now appear to be leveling off.

The CKR samples analyzed in 2024 were also categorized as non-PAG. To date, CKR samples consistently categorize as non-PAG rock due to their NP/MPA being greater than two (commonly found to be 20 to 50 times that threshold value; Price 2009). All results have agreed with historical datasets and therefore the WROMP remains relevant and appropriate for the current WRSA's.

Table 3.14-1 Summary of Coarse Kimberlite Reject Acid-Base Accounting Data

Summary Statistic[1]	Sampling Year	Count	Paste pH (pH units	Total S[2] (%)	Sulphide S[3] (%)	NP[4] (kg $CaCO_3$ eq/t)	MPA[5] (kg $CaCO_3$ eq/t)	NNP[6] (kg $CaCO_3$ eq/t)	NP/MPA[7]
Mean	2024	8	9.5	0.21	0.20	138	6.2	132	23
	2000 to 2023	228	8.6	0.27	0.24	248	8.6	239	42
Maximum	2024 CKR	8	9.6	0.25	0.24	172	7.5	165	28
	2000 to 2023	228	9.8	0.61	0.58	353	19.1	341	172
95th Percentile	2024	8	9.6	0.25	0.24	170	7.4	163	27
	2000 to 2023	228	9.5	0.51	0.47	325	16.0	318	125
Median	2024 CKR	8	9.4	0.22	0.21	137	6.6	130	23
	2000 to 2023	228	8.4	0.25	0.23	268	7.7	259	30
5th Percentile	2024 CKR	8	9.3	0.16	0.15	110	4.7	105	19
	2000 to 2023	228	7.8	0.07	0.04	90	2.2	78	10
Minimum	2024	8	9.3	0.16	0.15	108	4.7	103	18
	2000 to 2023	228	6.5	0.04	0.01	50	1.3	48	5

Notes:

DL = analytical detection limit; CKR = Coarse Kimberlite Reject; CaCO3= calcium carbonate

[1] *All results reported as < DL were replaced with DL value for the calculation of summary statistics.*

[2] *Total sulphur.*

[3] *Sulphur as sulphide; calculated by subtracting sulphate from total sulphur.*

[4] *Neutralization potential; 2000 to 2019 samples determined using Sobek method, 2020 to 2024 samples determined using Modified Sobek method.*

[5] *Maximum potential acidity; 2000 to 2019 samples calculated using total sulphur, 2020 to 2024 samples calculated using sulphide sulphur.*

[6] *Net neutralization potential.*

[7] *For samples where MPA < DL, DL values were used for NP/MPA calculation.*

Table 3.14-2 Summary of Elemental Concentrations in Coarse Kimberlite Reject (CKR)

Summary Statistic	Sampling Year	Count	Al %	As ppm	Ba ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	K %	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	Pb ppm	V ppm	Zn ppm
Mean	2024	8	1.	3.0	866	1.8	0.19	42	218	24	3.0	0.9	10	568	1.7	0.22	763	5.8	37	45
	2000 to 2023	228	3.9	5.6	920	2.5	0.54	52	573	30	4.0	1.2	12	678	2.1	0.77	864	15.2	71	58
Maximum	2024	8	1.4	4.6	1240	2.3	0.25	51	254	35	3.5	1.1	13	681	2.2	0.28	986	6.4	39	49
	2000 to 2023	228	7.3	19	1930	4.0	2.50	82	1510	60	5.1	2.1	16	880	11.0	2.25	1530	1150	116	117
95^{th} Percentile	2024	8	1.4	3.0	891	1.8	0.2	45	212	23	3.2	0.9	11	608	1.8	0.21	812	5.9	38	45
	2000 to 2023	228	5.5	5.0	900	2.4	0.5	50	554	29	4.0	1.2	13	670	1.9	0.70	834	8.0	70	57
Median	2024	8	1.3	3.0	891	1.8	0.2	45	212	23	3.2	0.9	11	608	1.8	0.21	812	5.6	38	45
	2000 to 2023	228	4.0	5.0	900	2.4	0.5	50	554	29	4.0	1.2	13	670	1.9	0.70	834	8.0	70	57
5^{th} Percentile	2024	8	1.2	3.0	891	1.8	0.2	45	212	23	3.3	0.9	11	608	1.8	0.21	812	5.9	38	45
	2000 to 2023	228	1.9	5.0	900	2.4	0.5	50	554	29	4.0	1.2	13	670	1.9	0.7	834	8.0	70	57
Minimum	2024	8	1.2	1.9	455	1.2	0.14	26	203	22	2.3	0.6	6.2	396	1.2	0.17	427	4.7	35	43
	2000 to 2023	228	1.2	2.0	60.5	1.2	0.14	29	168	15	3.0	0.5	6.4	500	1.0	0.04	410	2	35	38

Notes:

All results reported as < DL were replaced with half of the DL value for the calculation of summary statistics.

The samples from 2000 to 2019 were analyzed following a four-acid digestion, while the samples from 2020 to 2024 were analyzed following an aqua regia digestion.

DL = analytical detection limit; CKR = Coarse Kimberlite Rejects; Al = aluminum; As = arsenic; Ba = barium; Ca =calcium; Na = sodium; Cd = cadmium; Co = cobalt; Cr = chromium; Cu = copper; Fe = iron; K = potassium; Mg = magnesium; Mo = molybdenum; Na = sodium; Ni = nickel; Pb = lead; V = vanadium; Zn = zinc; ppm = parts per million

3.15 Granite Non-PAG Geochemical Characterization

An overall summary of the geochemical characteristics for granite is provided in the Geochemistry Baseline Report for the Jay Project (DDEC 2014b). In general, granite has low acid generation potential and is classified as non-PAG. Provided is an overall summary of the granite ABA data for granite.

- The dataset for granite materials includes a total 1,431 granite samples, collected from the Beartooth, Misery, Pigeon, Sable, Fox, Koala, and Panda areas, and the Jay pipe.
- Total sulphur concentrations ranged from 0.001% to 1.16 % by weight, with a median concentration of 0.03% sulphur. Generally, the highest total sulphur concentrations were observed in granite samples collected from the Sable Pit.
- The neutralization potential (NP) of the granite samples ranged from 1 to 331 kg $CaCO_3$/t (average 14 kg $CaCO_3$/t). Granite samples have a low carbonate content.
- A total of 1,206 granite samples were analyzed for NP and MPA. Of this dataset, 97% (1,174 samples) had NP/AP ratios greater than 2 and are classified as non-PAG. A total of 25 samples (2% of the dataset) had an uncertain acid generation potential: these samples could generate acidity if NP is insufficiently reactive, or depletes at a rate faster than sulphide minerals. Seven samples had NP/AP ratios less than 1, and were classified as PAG. Potentially acid generating samples were primarily from the Fox Pit, Koala Pit, and Sable Pit.
- The results of HCT confirmed that granite has a low long-term acid generation potential.

3.16 Diabase Non-PAG Geochemical Characterization

Diabase is a minor waste rock lithology at the Ekati mine, comprising less than 10% of all Ekati waste rock. Diabase is non-PAG with low metal leaching potential. As indicated in the May 22, 2018 Reasons for Decision on WROMP Version 8.0 stakeholders have indicated some uncertainty in the characterization of diabase.

Appendix D presents a discussion of the geochemical characteristics of diabase at the Ekati Mine:

- Diabase samples generally had a low total sulphur content, ranging from <0.01% to 1.3% with average 0.11% and median value of 0.10%.
- The bulk NP of diabase ranged from 0.5 to 68 kg/t $CaCO_3$, with an average value of 13 kg/t $CaCO_3$ and a median value of 12 kg/t $CaCO_3$.
- Information was available to calculate the NP/AP ratio for 155 samples. The NP/AP ratio of diabase samples collected from the Ekati mine ranged from 0.04 to 60, with an average of 8.0 and a median of 4.3. In total, 94% of the diabase dataset (147 of 155 samples) consisted of non-PAG samples (NP/AP ratios >2), 3% (4 of 155 samples) had an uncertain acid generation potential (NP/AP ratios between 1 and 2), and less than 3% (4 of 155 samples) was classified as PAG (NP/AP<1).
- Similar to granite samples in the geochemical baseline dataset, several metals can leach from diabase under neutral pH conditions; however, the risk and concentrations are low and are not greater than for granite. The long-term acid generation and metal leaching potential for diabase is also similar to that of granite.

3.17 General Summary of Geochemical Characterization

The following is a summary of the key results of geochemical characterization:

- The majority of rock types mined at the Ekati mine are not potentially acid generating or have low potential to generate acidity.
- Metasediment rock at the Misery, Pigeon and Point Lake pits is classified as PAG.
- Misery metasediment generated acid under laboratory conditions over a time frame of several tens of weeks. It is estimated that this would translate to periods of several years under site conditions (SRK 2010).
- The Misery WRSA is probably of sufficient age that the effects of acidification ought to be apparent if the schist were becoming acidic (SRK 2010).
- The Misery WRSA seepage is currently not acidic (see Section 5).
- The draft Pigeon humidity cell results indicate that the diabase, diorite, granite, and mixed granite/metasediments are non-PAG, and not a risk of metal leaching, while the metasediments are PAG and a risk of metal leaching.
- Granite and diabase are classified as non-PAG.

4. GROUND TEMPERATURE MONITORING

Ground temperatures in the WRSAs are measured four times annually, using ground temperature cables (GTCs) installed at various locations. The locations and current operating status of the GTCs are shown in Figures 2.4-1 to 2.4-3. Currently, no cables have been installed in the Pigeon waste rock pile, but cables will be installed at an appropriate time operationally. No cables will be installed in the Lynx or Sable WRSAs as they will comprise granite and diabase and will not contain any reactive materials that require encapsulation by permafrost to prevent metal leaching or acid rock drainage runoff.

Monitoring of the GTCs has been undertaken since 2000 and is reported to the Board annually as part of the annual closure and reclamation progress report. Preliminary thermal modelling for the Fox WRSA indicated that there were unique factors affecting freezing and that these factors require further development before predictive modeling can be completed. In order to address these factors, further investigation work was completed. This included the installation of five GTCs and piezometers within the Fox WRSA in 2015. Two new GTCs were installed at the Misery WRSA in 2018 as GTCs in active areas were buried or destroyed. One horizontal GTC was installed at Pigeon in 2019 as part of Research Plan 4 (RP4) on the Pigeon waste rock storage area closure cover.

5. WASTE ROCK SEEPAGE

5.1 Introduction

The main potential source of chemical loading from WRSAs is infiltration during late freshet as a result of seasonal melting of surface snow and ice. In addition, there is a small amount of melting within the active layer during the summer. Some seepage flows are small such that the water pools on the tundra and does not enter the aquatic Receiving Environment. Most other seepage water flows to mine water management facilities (i.e., LLCF, King Pond Settling Facility, Two Rock Sedimentation Pond, etc.). A portion of seepage water from some WRSA's flows to the Receiving Environment. The Pigeon WRSA was added to the seepage survey during freshet 2015; the Lynx and Sable WRSA were added in 2016 and 2018, respectively. Sampling at the Point Lake WRSA and Overburden Stockpile will commence with the placement of excavated materials (scheduled 2024). Seepage from the Point Lake WRSA is designed to be collected in a collection sump and transferred to the King Pond Settlement Facility. The Seepage Sampling Locations and Potential Seepage Destinations are shown in Figure 5.2-1 to Figure 5.2-5. The sampling locations vary according to where flow is present and may not always align with these figures and are reported on through the Annual and 3-Year Seepage Reports. Note that the Point Lake WRSA and Overburden Stockpile have not been constructed and, therefore, seepage sampling locations are not known; these will be provided in a future update of this Plan.

5.2 Physical Seepage Management

WRSAs are designed such that seepage water flows to mine water management areas where possible. Where this cannot occur, both active (collection and pumping) and passive (diversionary berm) collection methods can be used if required to re-route seepage into managed areas.

5.2.1 Panda/Koala/Beartooth Waste Rock Storage Area

The location of the Panda/Koala/Beartooth WRSA (Figure 5.2-1 and Figures 5.2-2) was selected and constructed such that the majority of the seepage flows either towards the LLCF or into surface and pit dewatering systems which are tied into the central dewatering system which ultimately discharges into the LLCF. The northeast corner of the WRSA (~3% of a ~24 km perimeter) flows to Bearclaw Lake via a small flow monitored during seepage surveys. A berm was constructed in this location early in the mine life to mitigate past seepage quality concerns that have since resolved.

5.2.2 Fox Waste Rock Storage Area

The Fox WRSA was located such that the majority of drainage flows into the Fox Pit drainage catchment. The WRSA perimeter includes berms that reduce seepage to the surrounding Receiving Environment (Figure 5.2-3).

Figure 5.2-1 Seepage Sampling Locations and Potential Seepage Destinations from the Panda/Koala/Beartooth NE/NW WRSA

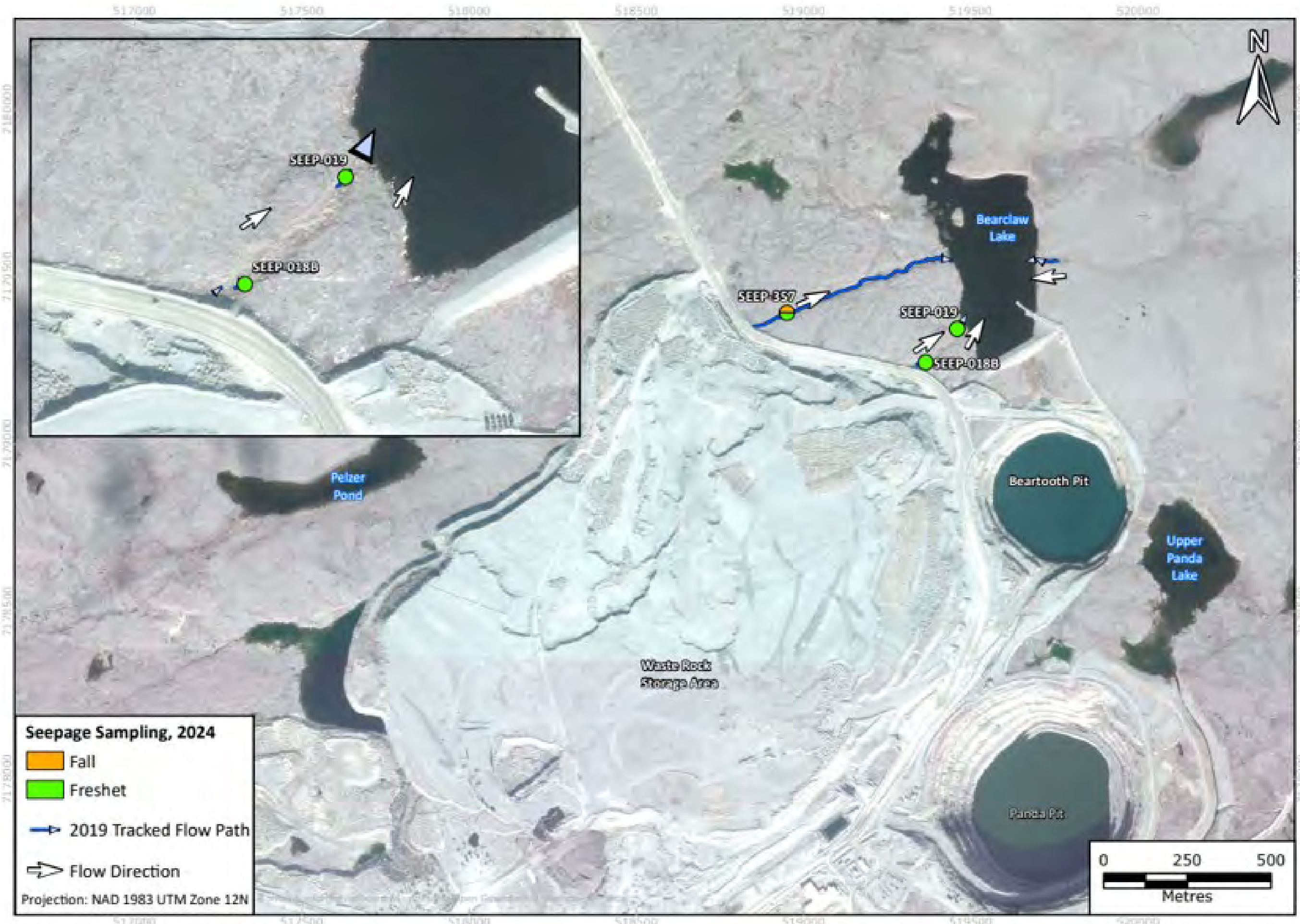


Figure 5.2-2 Seepage Sampling Locations and Potential Seepage Destination from the Panda/Koala/Beartooth WRSA

Figure 5.2-3 Seepage Sampling Locations and Potential Seepage Destinations from the Fox WRSA

5.2.3 Misery Waste Rock Storage Area

The location of the Misery WRSA was selected so that the majority of drainage flows into the pit, or mine water management facilities (i.e., Desperation Pond, Waste Rock Dam and King Pond Settling Facility). To manage the flow of runoff and seepage into Lac de Gras (the Receiving Environment), a runoff and seepage containment structure (Waste Rock Dam) was constructed down gradient and east of the Misery WRSA. This structure temporarily stores runoff and seepage that flows towards Lac de Gras. Two coffer dams were constructed south of Desperation Pond (Figure 5.2-4) to capture seepage and runoff down gradient and northwest of the Misery WRSA. During the operations of the MUG Project, the majority of seepage from the Misery WRSA will continue to flow into the pit, or minewater management facilities (i.e., Desperation Pond, Waste Rock Dam, and King Pond Settling Facility).

Drainage from the north side of the Temporary Kimberlite Ore Storage Area (Figure 5.2-4; approximately 2% of an approximately 6 km perimeter) flows to Cujo Lake via a small north-eastward flow monitored during seepage surveys. The Temporary Kimberlite Ore Storage Area is similarly monitored for seepage twice annually.

5.2.4 Pigeon Waste Rock Storage Area

There is a small residual catchment area to the east of the WRSA that would naturally flow to Big Reynolds Pond under the base of the WRSA. There will be no perceivable “flow” of water through the base of the WRSA because of the limited catchment area and, importantly, because of the aggradation of permafrost in the base of the WRSA. The presence of glacial till abutting (or nearly so) the east side of the WRSA is likely to encourage runoff to pass to the south of the WRSA. Additionally, the shape of the southeast ‘corner’ of the WRSA is designed to utilize the natural topography to encourage surface runoff to pass to the south of the WRSA (Figure 5.2-5). An assessment of the fish presence/absence of Little Reynolds Pond concluded that the pond is non-fish bearing (ERM, 2018)

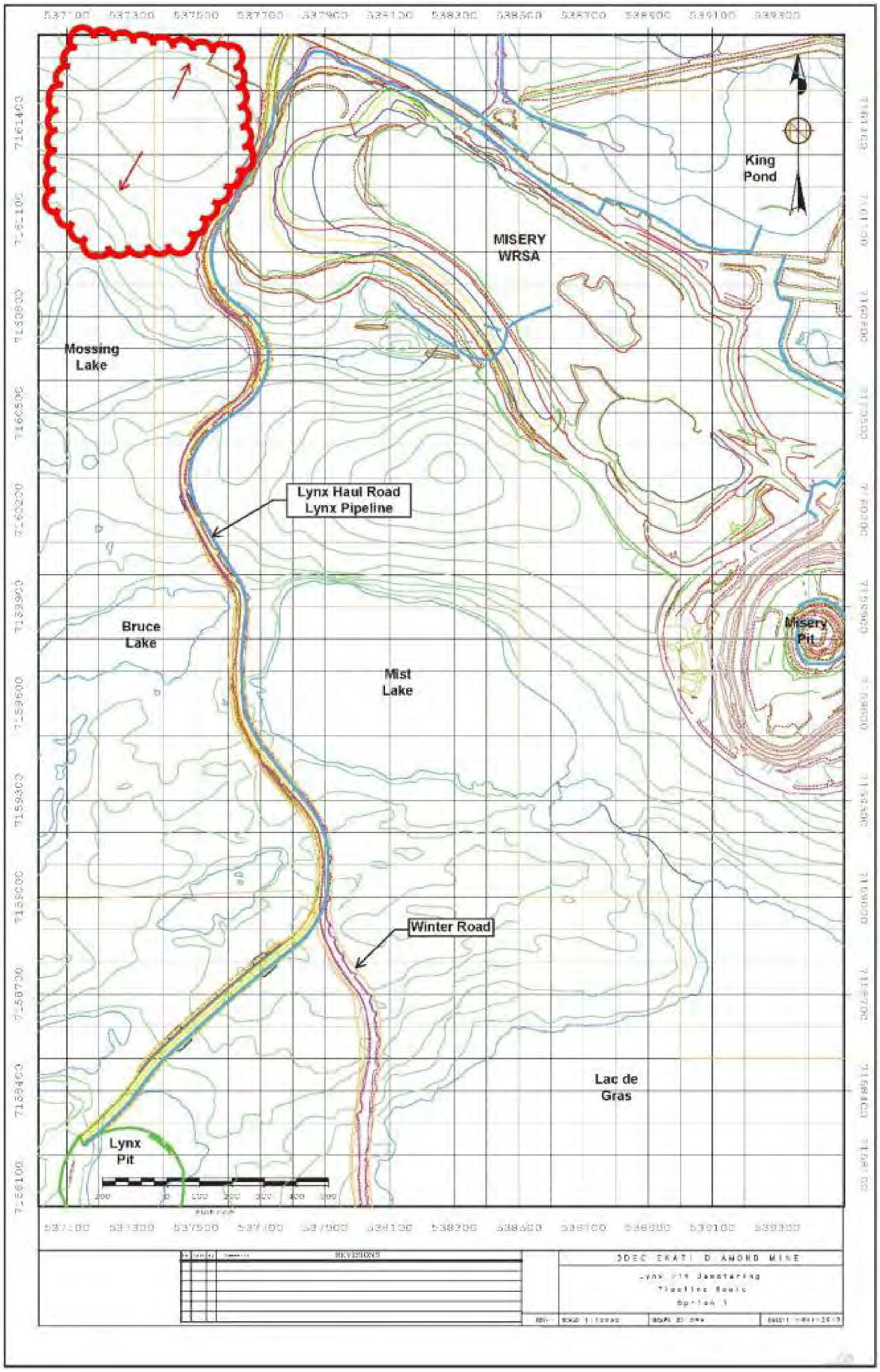
5.2.5 Lynx Waste Rock Storage Area

The Lynx Waste Rock Storage Area is monitored twice annually for seepage during the freshet and fall seepage surveys. All results are reported in the Waste Rock and Waste Rock Storage Area Seepage Survey included in the EA and WL Annual Report. Seepage from the northeast side of Lynx is expected to flow towards Cujo Lake, while seepage from the southwest side is expected to flow towards Mossing Lake (Figure 5.2-6).

Figure 5.2-4 Seepage Sampling Locations and Potential Seepage Destination from Misery and Lynx WRSAs

Figure 5.2-5 Seepage Sampling Locations and Potential Seepage Destination from Pigeon WRSA

Figure 5.2-6 Lynx WRSA Expected Seepage Flow Directions (shown in red)



5.2.6 Sable Waste Rock Storage Area

Sable Pit mining commenced in August 2017 and is on-going. The Sable WRSAs comprises of the South WRSA, East WRSA, and West WRSA as described in Section 2.4.11. Figure 5.2-7 presents the watershed boundaries and potential seepage flows directions from the South, West and East Sable WRSAs. Seepage from the toe of the South WRSA would flow towards either Sable Pit or to Two Rock Sedimentation Pond. A very small portion of the seepage from the toe of the South WRSA would flow to the south towards the road. Seepage from the West WRSA would be to Ulu Lake, Horseshoe Lake, or to the Two Rock Sedimentation Pond. The seepage from the East storage area would flow towards Ulu Lake. A kimberlite ore storage area was developed on a granite pad in the area south of the open pit and north east of the Sable office complex near the haul road. The Sable WRSA and Temporary Kimberlite Ore Storage Area will be monitored twice annually for seepage during freshet and fall seepage surveys. All results will be reported in the Waste Rock and Waste Rock Storage Area Seepage Survey submitted with the EA and WL Annual Report. As described further in Section 7.9, adaptive management will be used in the event that seepage with poor water quality is detected around the Sable WRSA.

5.2.7 Point Lake WRSA and Overburden Stockpile

A minor portion of seepage from the WRSA will flow southwards into the open pit (Figure 5.2-8). The remainder, and vast majority, of the seepage will flow northwards and will be collected through perimeter ditches to a collection sump. Water in the collection sump is to be transferred by pumping or trucking to King Pond Settlement Facility and Lynx Pit. The WRSA seepage collection system is intended to operate though operations and into post-closure until its removal is approved by the Board. WRSA seepage will be monitored monthly during the ice-free season.

Seepage will be monitored twice annually, during freshet and fall seepage surveys. During the construction and re-mining of the Overburden Stockpile, visual inspection for seepage at the toe will be conducted monthly. After construction, the seepage survey will continue per the seepage protocol. All seepage monitoring results will be reported in the Waste Rock and Waste Rock Storage Area Seepage Survey submitted with the EA and WL Annual Report. As described further in Section 7.9, adaptive management will be used in the event that seepage with poor water quality is detected.

Burgundy is committed and required to achieve closure objective WR-1, which states “Seepage water quality from WRSAs is safe for people, terrestrial, and aquatic ecosystems”. The current uncertainties in the long-term thermal model prepared by Tetra Tech (Appendix F) are documented along with recommendations that will reduce uncertainty in a model update to be prepared for the final cover design. Burgundy highlights that the closure objective to be achieved relates to safe seepage quality and not to freezing of 100% of the waste rock. The adaptive management approach established in the ICRP will evaluate and respond to circumstances where WRSA seepage quality is poorer than anticipated.

Figure 5.2-7 Sable WRSA Potential Seepage Flow Directions

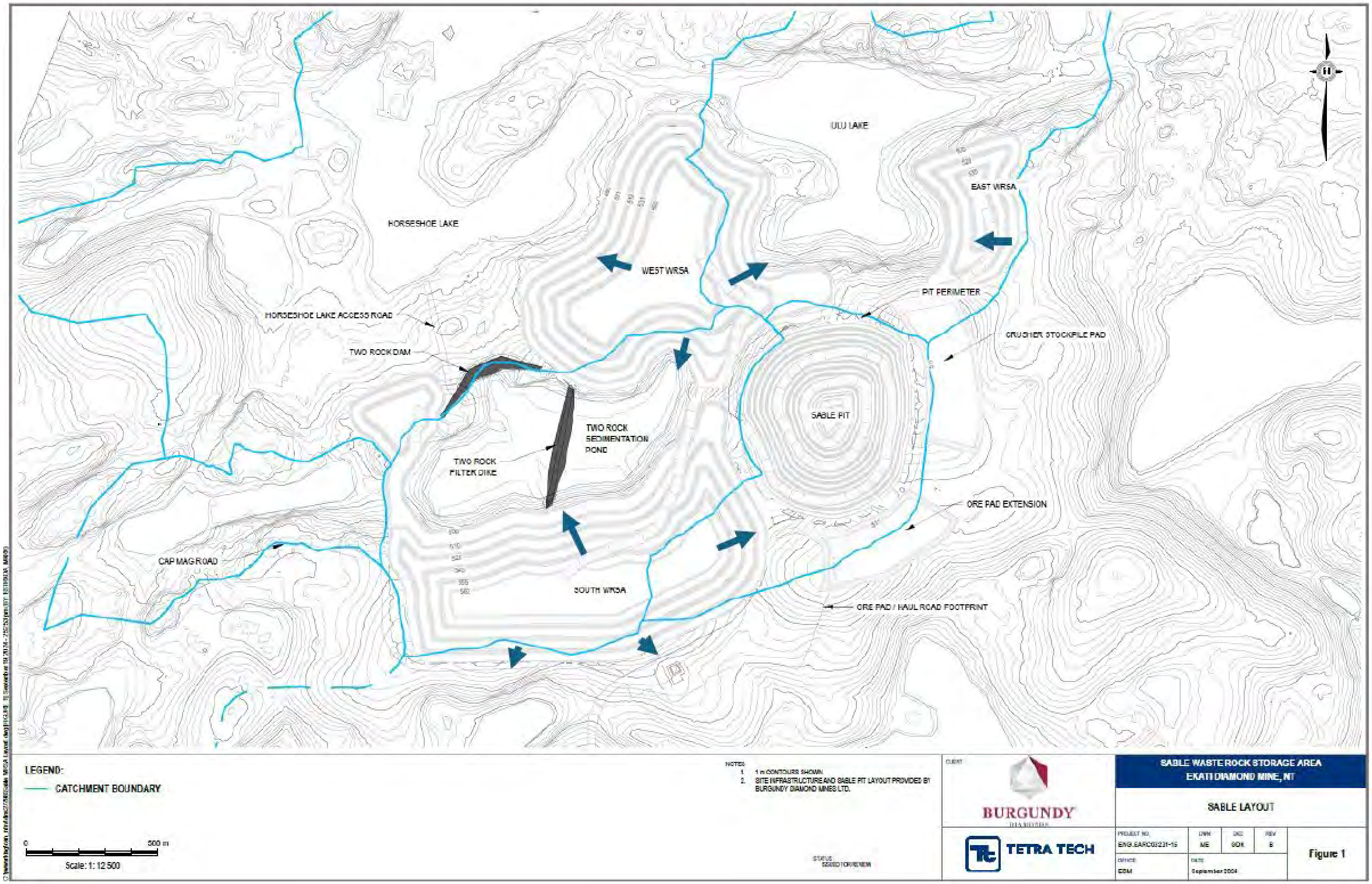
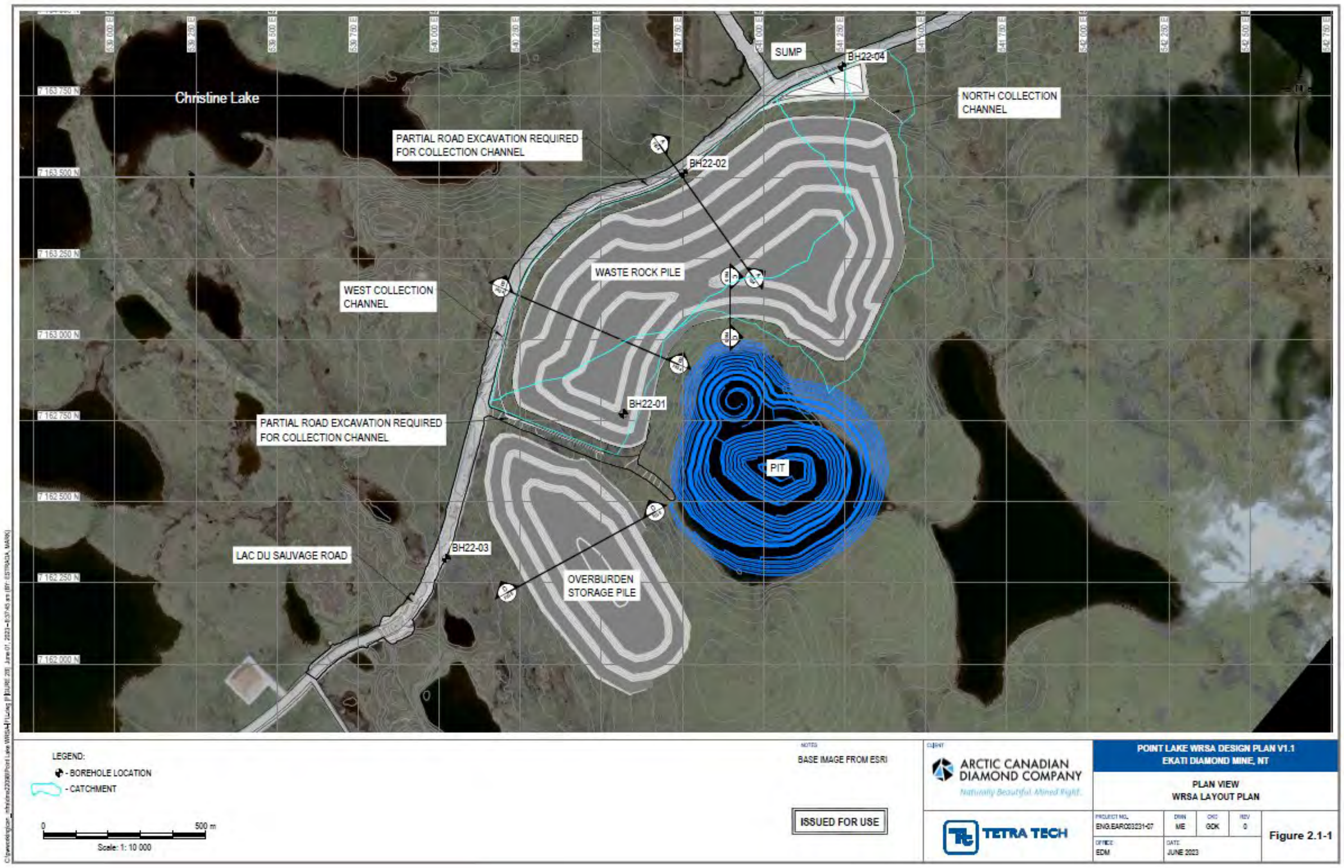


Figure 5.2-8 Point Lake WRSA Seepage Collection System Layout



5.3 Seepage Monitoring

Seepage surveys of all constructed WRSAs and ore stockpiles are conducted twice a year (during spring freshet, and again in late summer or fall before freeze up), in accordance with the requirement of the Water Licence. Additional sampling may occur at certain WRSA's. The testing of seepage chemistry is designed to detect changes that may affect the Receiving Environment and Receiving Water.

Samples are also collected from reference areas near the mine that are not affected by waste rock and other mining activities to determine the chemical composition of natural waters in the area. Reference stations were established to provide baseline characterization of natural runoff chemistry and evaluate possible causes of chemical differences between natural tundra water and WRSA seepage. On-going monitoring at REF-005 has also allowed differentiation between natural climate/hydrology driven changes in water quality around Ekati and WRSA-influenced trends.

Prior to mining, baseline reference areas were set up north of Sable, around Fox, and east of the Panda/Koala WRSA. Monitoring of tundra seepage water quality occurs in three potential reference areas outside of mining activities (east of Bearclaw Lake, and within the Sable and Misery areas; REF-005, REF-037, and REF-040 respectively). REF-005, located east of Bearclaw Lake, has been sampled historically since 1999. REF-037, historically sampled from 2002 to 2008, was sampled again in 2019 to evaluate the suitability of REF-005 as a reference station and was confirmed dry in 2021. REF--037 is located less than 2 km from the Sable Pit, and therefore it is not possible to rule out that it may be affected by dust from mining operations. In 2019, REF-037 showed no notable changes in chemistry to historical monitoring results and therefore was concluded to be a suitable reference station; however, when compared to REF-005, differences in water chemistry have been evident since the onset of monitoring and are likely a result of the different catchment areas of these two stations. Monitoring at a new reference site, REF-040 (near Lac de Gras in the Misery area), began in 2019.

Laboratory testing of seepage samples includes the set of parameters defined under Water Licence W2022L2-0001. Field testing includes measurement of volume and rate of flow, field pH, and conductivity. The detailed seepage sampling protocol is provided in Appendix B. The results of seepage monitoring are reported annually as required by the Water Licence (W2022L2-0001).

5.4 Chemical Weathering Mechanisms

Waste rock leachate quality is dependent on the actual minerals present and the mechanisms by which the minerals break down chemically (decompose) to release metal ions to solution. Understanding of these mechanisms is important to predicting the long-term chemical loadings from waste disposal areas. The following sections describe expected chemical weathering mechanisms for each of the main rock types.

5.4.1 Granite

The main mineralogical features of granite are the presence of abundant silicate minerals (mainly plagioclase, quartz, and biotite mica), low concentrations of sulphide minerals and negligible carbonate minerals.

The dominant chemical process for granite under site conditions is the reaction of carbonic acid (carbon dioxide dissolved in rainwater and snowmelt) with silicate minerals. This reaction produces clay from weathering of silicates, some dissolved metals (calcium, magnesium, potassium) and dissolved alkalinity.

The rate of the reaction is limited by the formation of thin clay layers on the fresh silicate surfaces; however, kinetic testing on granite samples has consistently shown that low levels of alkalinity are produced by this process (Norecol Dames and Moore, 1997).

Oxidation of the small amounts of sulphide minerals will release protons (i.e., acidity) to solution. However, since this occurs at a very low rate, the acidity produced is readily consumed by reaction with the dissolved alkalinity and carbonate minerals from silicate weathering.

Overall, granite will not produce ARD because the capacity to generate dissolved alkalinity by long term weathering of abundant silicates will offset the acid produced by short term weathering of small quantities of sulphides. In the long term, no major changes in drainage chemistry are expected except for slowly declining loadings of metals released by silicate weathering. Drainage pH is not expected to change. Therefore, the chemistry of drainage observed under current conditions is a conservative indication of long-term drainage chemistry and can be used to predict future loadings.

5.4.2 Metasediment

Metasedimentary rock at the Ekati mine contains higher concentrations of sulphide minerals than granite, and negligible carbonate mineralization.

As described in Section 3.8, acidity and sulphate were generated during kinetic testing of metasediment samples in laboratory conditions. The samples that generated acidity had NP/AP ratios less than 2, and had sulphur contents between 0.18 and 0.43%. To date, acid rock drainage has not been observed in seepage from the Misery WRSA.

5.4.3 Diabase

Diabase represents a volumetrically insignificant rock type at the Ekati mine relative to granite. Diabase is non-PAG with low metal leaching potential. As indicated in the May 22, 2018, Reasons for Decision on WROMP Version 8.0 stakeholders have indicated some uncertainty in the characterization of diabase. The long-term acid generation and metal leaching potential for diabase is similar to that of granite. Several metals can leach from diabase under neutral pH conditions; however, the risk and concentrations are low and are not greater than for granite.

Diabase from Lynx is classified as non-reactive rock. Diabase from Lynx can be used in the same manner as granite at the Ekati mine. This includes use as a clean general construction material, including roads, pads, dykes and berms, laydowns, and the basal layer and active layer (i.e., capping of reactive material) in the WRSAs.

5.4.4 Kimberlite Processing Products

Kimberlite is geologically different from the host rocks. While it contains similar or greater levels of sulphide minerals as metasediments, kimberlite mostly consists of magnesium silicates (serpentine and olivine) and also contains abundant carbonates. The carbonates are thought to be calcite but may also contain magnesium (magnesite and/or dolomite).

Interaction of carbonic acid with kimberlite and its processing products is expected to result in three chemical processes:

- Weathering of magnesium silicates – release of dissolved magnesium, bicarbonate and formation of clay weathering products (magnesium silicates and hydroxides);

- Weathering of other silicates (e.g., phlogopite mica) – release of dissolved magnesium, potassium, bicarbonate and formation of clay weathering products; and,
- Dissolution of carbonates – release of dissolved calcium, magnesium and bicarbonate.

Kimberlite will also experience oxidation of pyrite which will release acidity and sulphate, and result in precipitation of ferric hydroxide. The acidity will be readily neutralized by dissolved alkalinity produced by the above processes and interaction with carbonates. Weathering of kimberlite produces soluble magnesium rather than calcium. Under these conditions, sulphate concentrations in solution can become elevated because magnesium sulphate is more soluble than calcium sulphate.

Due to the excess of neutralizing minerals, decrease in pH will not occur and therefore the chemistry of seepage from kimberlite disposal areas under current conditions is a conservative indicator of long-term drainage chemistry.

6. WASTE ROCK AND ORE STORAGE MANAGEMENT

6.1 Approach

The WROMP is based on the most reasonable information available for design and natural conditions. This information is inherently variable over time and diligent management responds to changes in natural conditions (such as storm events or a sequence of wet years) or design factors (such as volumes of each rock type mined). The Board will be notified of changes in circumstances or conditions that represent new or greatly heightened environmental concerns (operational or closure) for the WRSA. This will include plans for responding to the change encountered.

Measures to optimize the design of a WRSA will be implemented during construction and the Board will be notified of such measures.

6.2 Material Generation and Disposal Schedule

Estimated tonnages of each type of material are shown in Table 6.2-1. The volume of granite and diabase in the Misery Pit is sufficient to layer and encapsulate the Misery metasediment.

Table 6.2-1 Estimated Waste Rock Tonnages for Planned Mining Activities

Geological Unit	Million Dry Metric Tonnes to be Mined – As of October 2023		
	Misery	Sable	Point Lake*
Surficial Material	0	0.1	8.4
Granite			
- pit	0	4.70	0
- underground	0.43	Na	
Waste Kimberlite	0	0	0
Metasediments	0	0	22.0
Diabase	0	0.09	0

** Point Lake waste rock may contain pegmatite.*

6.3 Non PAG Material Construction Use

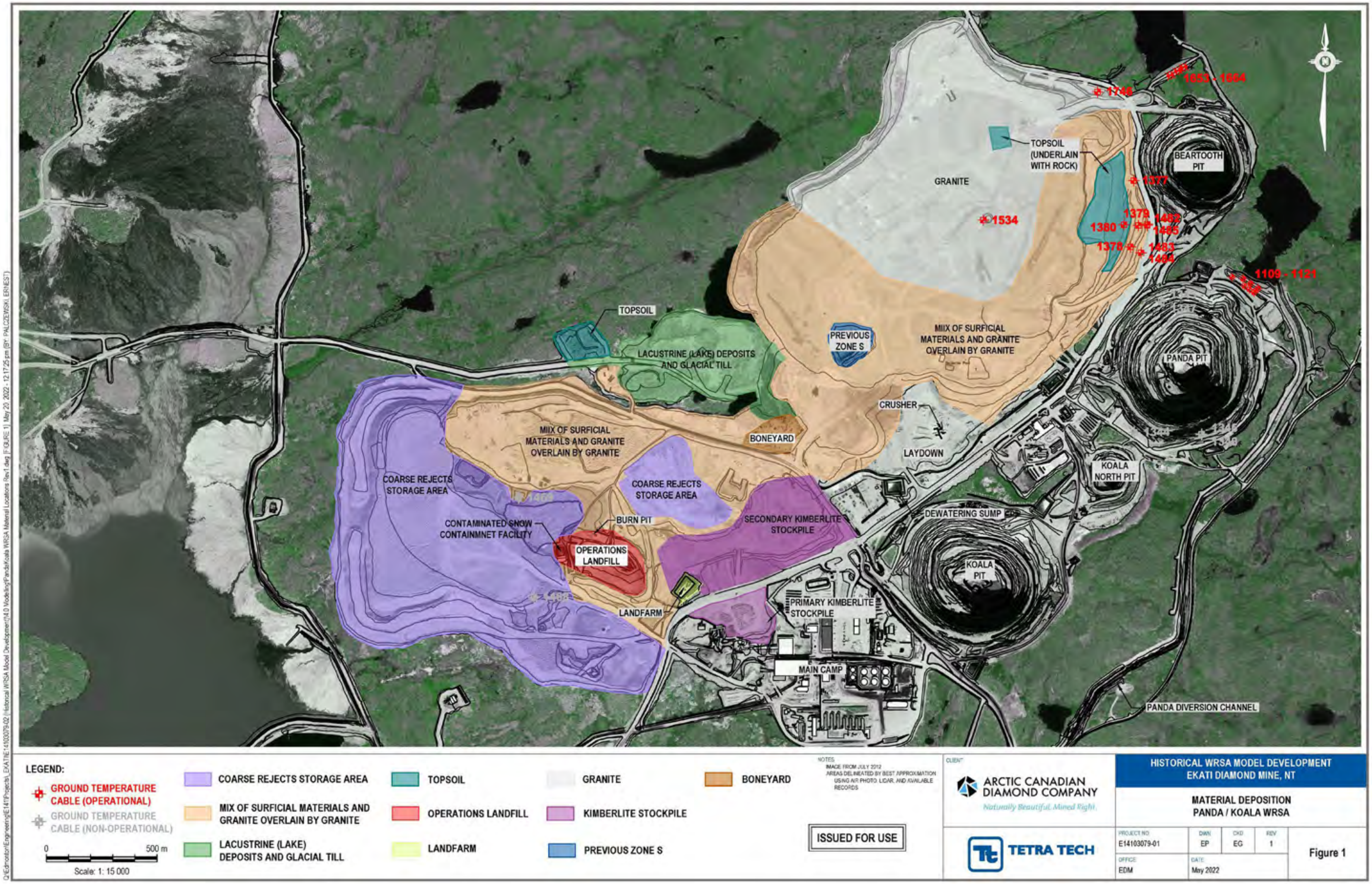
Based on its non-PAG geochemical characterization excavated granite (Section 3.15) and Lynx diabase (Section 3.16 and Appendix D) materials are designated as suitable for general construction and reclamation use at Ekati, which might include but is not limited to:

- Construction of the airstrip runway
- Construction of haul and access roads
- Construction of water diversion channels
- Construction of pads for buildings and equipment laydowns areas
- Construction of frozen core and water retention dams and dikes
- WRSA pad construction and final WRSA cover capping material
- Reclamation of the LLCF

6.4 Panda/Koala/Beartooth Waste Rock Storage Area

Underground mining of the Koala pipe was completed in 2018. Underground mining produces a considerably reduced volume of waste rock compared to open pit mining. Waste rock from these operations was granite and has been placed in the Panda/Koala/Beartooth WRSA or used as construction material for roads, dikes, pads, etc. The final footprint of the Panda/Koala/Beartooth WRSA is shown in Figure 6.4-1.

Figure 6.4-1 Final Footprint of Panda/Koala/Beartooth WRSA and CKRSA



6.5 Coarse Kimberlite Reject Storage Area

The CKRSA will continue to receive CKR from processing of kimberlite from all operations.

6.6 Fox Waste Rock Storage Area

Open pit mining in Fox pit was completed in spring 2014. There is no further construction planned for the Fox WRSA. The final footprint of the Fox WRSA is shown in Figure 6.7-1.

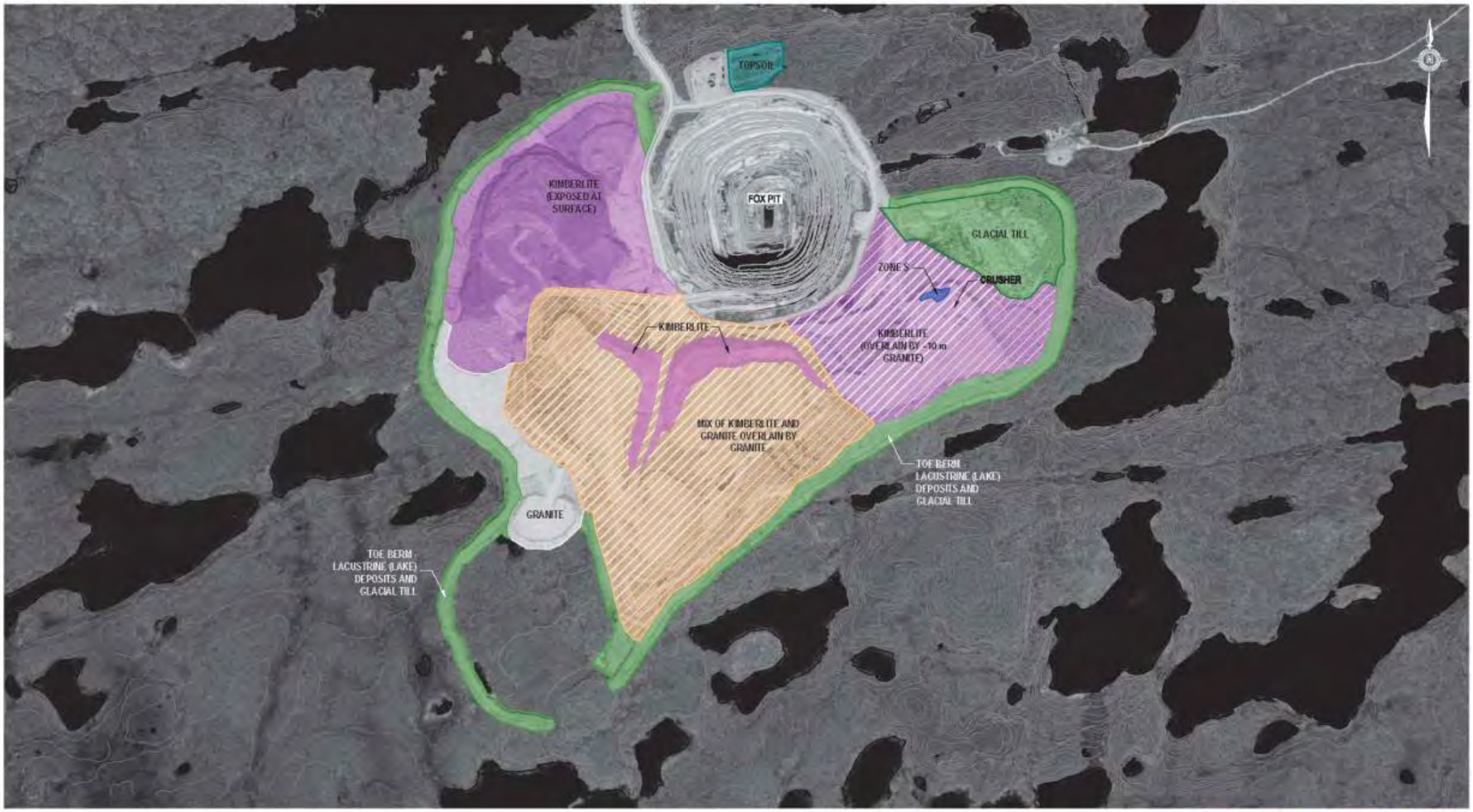
6.7 Misery Waste Rock Storage Area

Mining resumed at the Misery Pit in 2012, through a pushback to increase the size of the open pit. Open pit mining was completed in 2018. The Misery Underground (MUG) includes underground development starting in April 2018, followed by kimberlite mining by early 2019. Additional development will occur until 2021, and kimberlite mining through to about mid-2022.The final footprint of the WRSA is shown in Figure 2.4-4.

Because of the interest in managing and documenting the metasediment rock, geochemical characterization of waste rock during the Misery expansion is conducted annually (rather than every three years as occurred at Fox; Section 7.3). Potentially acid generating metasediment is layered within the WRSA and encapsulated within granite to promote freezing and to ensure that the seasonally active zone is within low reactive granite and diabase.

A Temporary Kimberlite Ore Storage Area is used to store kimberlite ore prior to haulage back to the processing plant at Main Camp. It may also be used for temporary storage of granite and diabase to facilitate the appropriate layering of rock types in the Misery WRSA. The base of the storage area is constructed out of granite and diabase waste rock. The material stored on the pad will be removed to the process plant or the WRSA and the pad will be reclaimed according to the measures described in the Interim Closure and Reclamation Plan. Also see Section 6.10 regarding Temporary Kimberlite Ore Storage.

Figure 6.7-1 Final Footprint of Fox WRSA



6.8 Pigeon Waste Rock Storage Area

Open pit construction at Pigeon began in 2014, and mining at Pigeon was completed in 2021. The Pigeon Site Plan is shown in Figure 2.4-5.

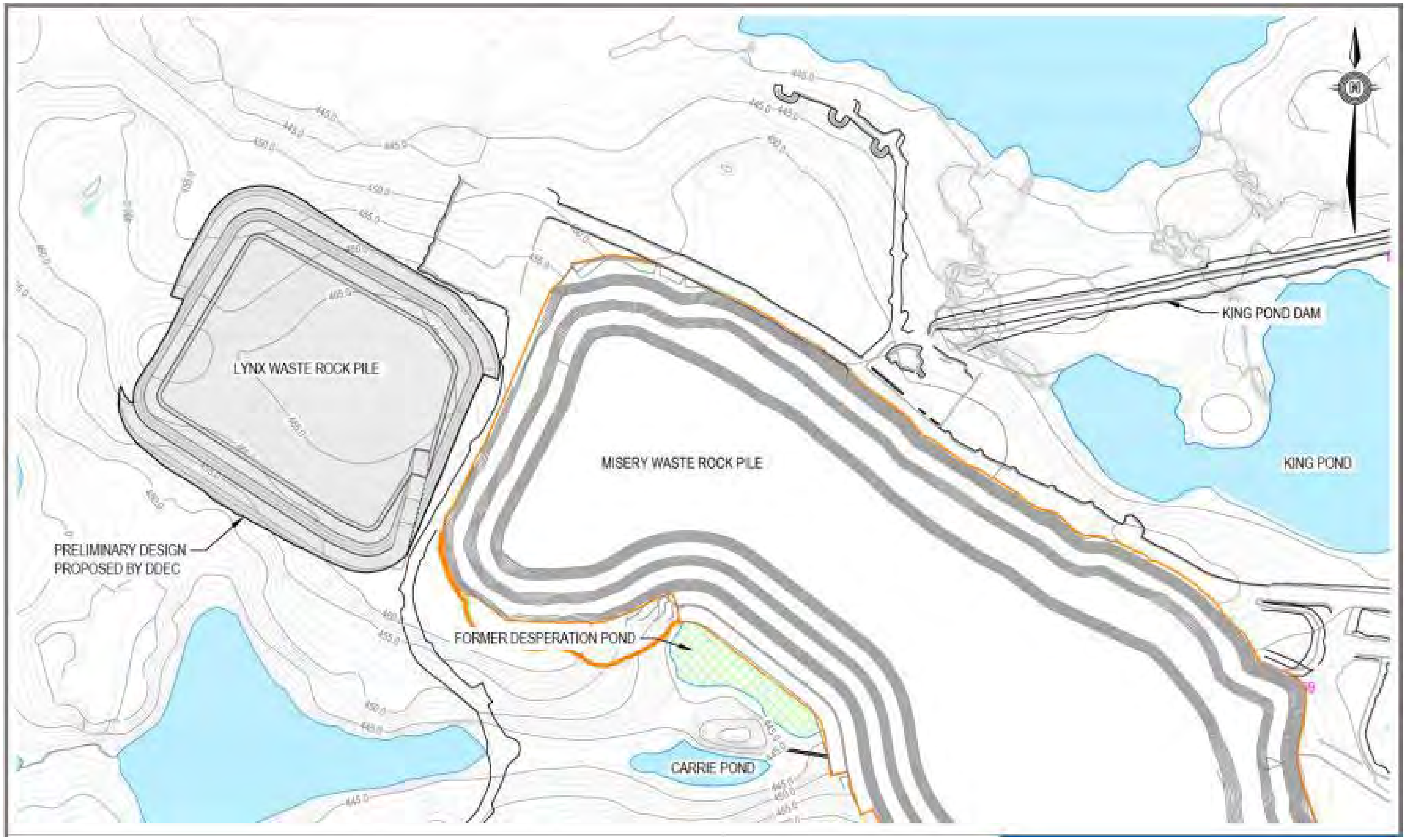
Details of the Pigeon WRSA are described in Section 2.4.8 and in the Updated Design Report (Appendix C). The footprint of the WRSA is approximately 66 ha entirely within the LLCF catchment area and the average height of the WRSA is approximately 66 m. Glacial till mined from the Pigeon pit is stockpiled adjacent to the WRSA and is available for reclamation. A closure cover has been designed but has not been approved by the Board. The final cover design will be determined through the closure planning process or an update to the WROMP for Board approval. See Board's Sept 22, 2017 Reasons for Decisions on the Pigeon WRSA Design Report and WROMP Version 7.0 for more information

6.9 Lynx Waste Rock Storage Area

Open pit mining of Lynx was completed in 2019. Waste rock excavated from the Lynx Pit was non-PAG, predominantly granite with approximately 10% diabase and minor amount of gneissic granite. The WRSA is a roughly rectangular shaped pile that is approximately 625 m long and 565 m wide (Tetra Tech EBA 2015; Figure 6.9-1. The final volume of rock in the WRSA is 4,780,876 m^3.

The waste rock pile is a benched pile design with a final design elevation of 485 m, and with bench elevations of 465 m and 480 m. The bench widths are typically 25 m with slopes of approximately 1.4H:1V. The overall pile slope is approximately 2.4H:1V to 2.7H:1V. Overburden was placed over a granite and diabase base that will have a depth up to 4.8 m. The waste rock pile is located on a topographic high with a peak elevation of 470.0 m. The perimeter edge of the waste rock pile intersects the original ground at elevations from 453.0 to 468.0 m.

Figure 6.9-1 Final Lynx WRSA



6.10 Sable Waste Rock Storage Area

As described in Section 3.12, the waste rock from Sable pit indicates very low sulfur concentrations and consequently negligible reactivity. 95 % of the waste rock excavated from Sable Pit will be granite. Granite rock has been demonstrated and accepted over the past 15 years of operations at the Ekati mine as non-acid generating and non-metal leaching. To verify the results of the samples collected during the geochemical characterization, waste rock sampling was conducted at Sable pit for two years at a rate of three samples per rock type per bench per year, and no additional sampling is required.

There are three parts to the Sable WRSA: The West WRSA is located northwest of the Sable Pit and the South WRSA is located southwest of the Sable Pit and wraps around the west side of the Two Rock Sedimentation Pond. The East WRSA is located northeast of Sable Pit. Directly south of the West WRSA and north of the South WRSA is Two Rock Sedimentation Pond (Figure 2.4-11). The South WRSA is a roughly rectangular shaped pile approximately 1,400 m long and 600 m wide. It will have a final volume of approximately 25.38 Mm^3 and a final design elevation of 563 MASL. The West WRSA is an irregularly shaped pile that is approximately 1,200 m at the greatest length and 1,100 m at the greatest width. It will have a final volume of approximately 23.19 Mm^3 and a final design elevation of 550 MASL. The East WRSA is a roughly rectangular shaped pile approximately 650 m in length and 500 m in width. It will have a final volume of approximately 3.37 Mm^3 and a final design elevation of 535 MASL. The pile will be constructed in bench lifts of 15 m height with steps every lift to meet the final wall angle that will vary depending on the storage area.

A Temporary Kimberlite Ore Storage Area is used to store kimberlite ore prior to haulage back to the processing plant at Main Camp. The base of the storage area is constructed out of granite waste rock. The material stored on the pad will be removed to the process plant or the WRSA and the pad will be reclaimed according to the measures described in the Interim Closure and Reclamation Plan. Also see Section 6.12 regarding Temporary Kimberlite Ore Storage.

6.11 Point Lake WRSA and Overburden Stockpile

As described in Section 3.13, the waste rock from Point Lake pit is virtually 100% metasediment. There may be in the order of 1% pegmatite present. There is no planned separation of metasediment according to geochemistry and all of the metasediment will be managed as PAG. Waste rock will be placed in the WRSA located on the north side of the open pit per the approved WRSA Design Plan (Appendix F). Seepage from the WRSA will be collected through two ditches into a collection sump, where water will be transferred by trucking or pumping to King Pond Settling Facility. The design of the seepage collection system is included in the WRSA Design Plan. The WRSA seepage collection system will be constructed using approved construction materials (S.6.3), which is planned to be Lynx granite/diabase. WRSA seepage will be monitored according to the seepage monitoring protocol (Appendix B) monthly during the ice-free season. Water quality monitoring will also include SNP sample 1616-52 in the collection sump. Waste rock will be placed on a basal layer constructed using granite and Lynx diabase sourced from the Lynx WRSA and crusher stockpile.

Overburden (primarily glacial till) will be placed into the Overburden Stockpile located on the west side of the open pit. The design of the Overburden Stockpile is included in the WRSA Design Plan (Appendix F). Per the WRSA Design Plan (S.4.1): "… some of the initially excavated materials may be saturated or wet. Sediment and erosion control will be implemented if erosion features develop in the OVBSP". Seepage from the Overburden Stockpile may also be monitored, if necessary, according to the *Metal and Diamond Mining Effluent Regulations* under the *Fisheries Act*.

The WRSA Design Plan (Appendix F) includes a QA/QC Plan for the WRSA, Overburden Stockpile, and WRSA seepage collection system. The QA/QC measures will be implemented in accordance with the approved plan. The WRSA Design Plan (Appendix F) provides six recommendations, which will be addressed as described in Table 6.11-1.

Table 6.11-1 Point Lake WRSA Design Plan Recommendations

Recommendation	Action
Generating site-specific data through lab testing of the Point Lake till once the OVBSP has been constructed, or during till excavation.	Testing described herein in Section 7.1.
Measurement of site-specific snow profiles, particularly as lower benches are constructed.	Testing described herein in Section 7.1.
Installation of monitoring instrumentation such as GTCs to verify predicted temperatures of the pile. Installation to be staged on completed portions of the waste rock pile.	Approach described herein in Section 7.2.
Updating the thermal analysis, depending on the till properties, measured ground temperatures, and snow cover profiles for the final cover design.	This work is to be conducted for final design of the WRSA closure cover.
Regular visual inspection of the waste rock pile and seepage collection system during and after the construction of the WRSA to identify signs of excess deformations, instability, or distress. Additionally, the piles could be surveyed and compared to design annually.	This work is to be conducted according to the approved QA/QC Plan (Appendix F). Approach described herein in Section 7.1.
The stability of the waste rock pile should be reviewed and reassessed if there are changes to the waste rock placement plan, especially the placement plan for the initial benches.	The waste rock placement plan has not changed to date and no further considerations of physical stability are necessary. This may apply in future if the placement plan changes substantively.

The locations of the WRSA and Overburden Stockpile are illustrated on Figure 2.4-10.

6.12 Temporary Kimberlite Ore Storage

Chemical interaction between seepage contacting both kimberlite and granite was discussed in recent (2011 and 2012) Annual Seepage Reports as a possible factor explaining the observed seepage quality. The seepage quality was well within Water Licence compliance but exhibited geochemical signatures of the source rocks. The case at hand was a kimberlite storage pad at the Misery site where kimberlite was exposed for an unusual extended period of time due to the suspension of operations at the Misery site from 2005 to 2011. That particular pad has since been reclaimed (2013) by relocation of unfrozen material to the active areas of the Misery WRSA and covering of the residual (i.e., frozen) pad materials by the advancing WRSA such that the residual frozen materials remain frozen as permafrost.

Temporary kimberlite storage areas are a necessary component of mine operations at some mining areas, such as Misery and Sable. At the Misery and Sable sites, for example, temporary storage is required to transfer diamond-bearing kimberlite from the open pit rock trucks to the 'long-haul' road trucks that transport the kimberlite to the process plant. The temporary kimberlite storage area that was previously and currently used for Misery was also previously used for the temporary storage of kimberlite ore from Lynx until 2019 when mining operations were completed.

The following guidelines will apply to operation of temporary kimberlite ore storage areas:

- The storage areas are constructed with a granite and diabase pad to create a safe operating surface for heavy equipment and to avoid the placement of kimberlite onto tundra soils which can generate naturally depressed pH.
- Where practical, storage areas will be located where seepage flows towards a managed mine water facility.
- Seepage from the kimberlite storage areas will be monitored and assessed as part of the Annual Seepage Monitoring Program.
- Remedial or adaptive management actions will be undertaken as appropriate based on seepage monitoring results.

No guideline for duration of exposure is provided as there is no laboratory or empirical information to define an appropriate timeframe based on environmental risk. Routine (minimum twice per year) monitoring of seepage from the storage areas provides the primary mechanism for assessing risks to the environment and prompting necessary response actions.

7. VERIFICATION, MONITORING AND REPORTING

As waste rock is stored as per the management plan, the physical and environmental performance of the WRSA will continue to be monitored.

7.1 Physical Monitoring

The physical stability of the active WRSAs will be monitored by on-site technical staff. WRSAs construction plans are developed by on-site technical staff based on approved engineering designs. As-built surveys are conducted monthly in summer and quarterly in winter, to compare against design and construction plans. Geotechnical engineers will be consulted if significant deviations from the construction plan or proposed changes to construction methodology arise. Ground temperature cables installed at several locations in the WRSAs are monitored quarterly. Physical monitoring reports for the WRSAs are included in the EA and WL Annual Report. The waste rock pile designs incorporate appropriate factors of safety against instability, and there have been no indications of significant pile instability to date.

Inspections will focus on the following:

- Changed or unusual conditions;
- Failures including slumps, slides and toppling;
- Indications of potential instabilities such as tension cracking, subsidence;
- Erosional features such as gullying or washouts; and
- Locations of seepage

In addition, WRSA will be surveyed as necessary to verify correct slopes, footprints, volumes, and heights.

7.1.1 Point Lake WRSA Seepage Collection System

The Point Lake WRSA seepage collection system is described in the WRSA Design Report (Appendix F) and consists of two perimeter ditches and a collection sump. The seepage channels are specifically designed for efficient transmission, minimizing the potential for seepage losses through optimized channel gradients and the hydraulic conductivity of the substrate. As stated in the Point Lake WRSA Design Plan (Appendix F, Section 6.1):

> *The channels will be unlined for the majority of their lengths, as significant seepage losses through the channel base are not expected based on channel gradients and hydraulic conductivity (in the order of 5x10-7 m/s) of the substrate soil (Tetra Tech 2019). Permafrost is generally considered to behave as an aquiclude or aquitard with groundwater being found in the thawed zones (Tetra Tech 2019). The highest volumes of snow melt and subsequent runoff occurs during freshet in June; however, the ground is largely frozen and impermeable, therefore the majority of water is transported by surface flow with negligible infiltration into the ground. Full active layer development is expected late summer and is typically 1.5 m at Ekati, although localized variances do occur. Late summer precipitation events are likely infiltrate the till, however, flow through the active*

layer is expected to be minimal based on the hydraulic conductivity of the till material (Tetra Tech 2019), and because there are no appreciable head pressures to facilitate infiltration (i.e., infiltration beneath a lake). Installation of downstream wells in select locations could be considered to monitor water quality if site observations indicate the seepage collection system is not performing as intended.

From freshet to late summer (June – October), the seepage collection channels and sump will be monitored monthly to assess their performance. As outlined in Section 3.4 of Point Lake Waste Rock Storage Area QA/QC Plan in Appendix F, physical performance monitoring will include:

- *Inspection of the channel slopes for any signs of distress;*
- *Inspection of the crests for transverse cracking;*
- *Inspection for signs of erosion or exposed composite liner system material; and*
- *Inspection for areas of thaw-settlement*

During the winter months, no monitoring will be conducted due to the absence of seepage flow. Regular inspections will be completed by the on-site Engineer during construction and post-construction monitoring will be conducted by Burgundy Staff.

The water level in the collection sump will be monitored to guide dewatering activities (i.e., water transfer to King Pond Settling Facility, Lynx Pit). This monitoring will ensure that the in-sump water level remains below the maximum design operating elevation specified in the WRSA Design Plan.

7.1.2 Point Lake Overburden

For the Point Lake WRSA and Overburden Stockpile, monitoring will be in accordance with QA/QC Plan in the Point Lake Design Plan V1.1 (Appendix F) and will include regular visual inspection of the waste rock pile during and after the construction of the WRSA to identify signs of excess deformations, instability, or distress.

Overburden excavated at the Point Lake open pit will be sampled for testing of physical properties to support the final design of a closure cover for the Point Lake WRSA, as follows:

- A minimum of five representative samples will be collected as mined or from the stockpile for infiltration testing and/or hydraulic conductivity testing
- Laboratory analysis will include moisture content, grain size and permeability

The analysis result will be used to assess the effectiveness of the overburden in the closure cover system by determining infiltration rates and evaluating overall cover performance. The analysis results will be reported in the Waste Rock and Waste Rock Storage Area Seepage Survey Report for the year in which the sampling is conducted.

7.1.3 WRSA Snow Drifting

Burgundy will conduct an annual late-winter survey of snow drifting at the WRSA to support the final design of the closure cover for the Point Lake WRSA. A summer survey may also be performed to provide comparative data. Collecting site-specific snow profile data (e.g., density and thickness), particularly during the construction of the lower benches as recommended in the design plan, will help refine thermal model predictions for closure.

7.2 Temperature Monitoring

Thermal monitoring of WRSA's will continue, with installed instrumentation typically monitored four times per year and reported in an annual WRSA ground temperature monitoring report which is included as an appendix the annual closure and reclamation progress report submitted to the WLWB.

Burgundy will work with qualified professionals to identify potentially feasible locations and techniques for the installation of thermistors during construction of the Point Lake WRSA. Feasible locations will have a high likelihood of success as compared to previous unsuccessful attempts at the Ekati Diamond Mine to install and monitor thermistors during WRSA construction. Locations for thermal monitoring of the Point Lake WRSA during construction will be provided within the Point Lake WRSA Design Plan V1.2. Data will be used to support the final design of a closure cover for the Point Lake WRSA.

7.3 Waste Rock and Overburden Geochemistry Monitoring

Verification programs are meant to monitor the chemistry of waste rock placed in the WRSA in a similar way to that described in Section 3.2 and reported annually in Waste rock Waste Rock Storage Area Seepage Survey Reports:

- Confirm that excavated material is geochemically similar to baseline data used for source term development in modelling to predict seepage quality during and after operations (upon which the project may have been approved).
- Provide an early indication of unexpected geochemistry.
- Waste rock mined in the Point Lake open pit will be sampled at a rate of three samples per rock type, per bench, every year with geological mapping of the benches sampled.
- Waste rock during the development and production of Misery Underground will be sampled at a rate of three samples per 12 months. The rock types and volumes will also be reported.
- Monitoring of tonnages mined will continue, with the figures reported in the annual Waste Rock and Waste Rock Seepage Survey Reports submitted to the WLWB.
- Waste rock volumes will be subdivided by rock type, by originating mine component and by destination WRSA and will include volumes of CKR.
- In circumstances where waste rock is mined that was not part of the initial mine plan for that area, the waste rock will be sampled according to the procedures and frequencies described above.
- Overburden excavated at the Point Lake open pit will be sampled for geochemical testing as follows:
    - A minimum 10 representative samples will be collected as mined or from the stockpile.
    - Laboratory analysis will include SFE tests, ICP-MS, and ABA.
- Additional sampling and/or testing of Point Lake overburden can be undertaken by Burgundy and the prescribed sampling program can be modified through an approved update of the WROMP.

Point Lake waste rock may contain a minor quantity of pegmatite included into the placement of metasediment. The quantity of pegmatites will be monitored against a threshold of 5%. If the cumulative quantity of pegmatite is found to exceed 5% of the total volume of the WRSA, SFE tests will be conducted on existing samples and a geochemical evaluation will be completed to evaluate implications for the post-closure seepage quality prediction. Monitoring the volume of pegmatite will be part of the routine sampling of blast holes and geological mapping of pit walls as described above. The proportional quantity of pegmatite observed will be recorded and reported in the annual Waste Rock and Waste Rock Seepage Survey Reports submitted to the WLWB. This method is sound because pegmatite is visually distinct from metasediment. If the cumulative estimate of pegmatite exceeds 5% of the cumulative volume of waste rock, three to five existing samples will undergo SFE testing and a geochemical evaluation will be carried out by a qualified professional to identify implications to the post-closure seepage quality predictions. If the geochemical evaluation determines that additional testing of pegmatite is necessary to maintain the rigor of the seepage prediction, a test program will be designed and initiated at that time. The outcomes of geochemical evaluations and follow up test work will be described in the annual Waste Rock and Waste Rock Seepage Survey Reports submitted to WLWB.

Humidity Cell Tests were conducted on Point Lake metasediment as described in Section 3.13. Samples were not available that provided 95th percentile concentrations of all solid phase and leachate constituents and this was identified as being of interest to reviewers. The ABA and solid-phase metal concentrations in Point Lake metasediment that are obtained through routine sampling of blast holes as described above will be screened against the Point Lake metasediment dataset to identify samples that may exceed the 95th percentile for all constituents. Samples that exceed the 95th percentile threshold will undergo SFE testing and a geochemical evaluation will be carried out by a qualified professional to identify implications to the post-closure seepage quality predictions. If the geochemical evaluation determines that additional testing of those or other samples of Point Lake metasediment is necessary to maintain the rigor of the seepage prediction, a test program will be designed and initiated at that time. The outcomes of geochemical evaluations and follow up test work will be described in the annual Waste Rock and Waste Rock Seepage Survey Reports submitted to WLWB.

7.3.1 Sable Geochemistry Sampling

The sampling at Sable pit was completed in 2019 after 2 years of sampling as required. Supporting evidence and rationale relating to the cessation of ABA sampling from the Sable Pit is as follows:

Annual monitoring has included the collection of waste rock at a rate of three samples per rock type per bench per year for two years. This requirement ended in 2019 given that monitoring commenced in 2017. In 2019, 20 samples of granite and 3 samples of diabase were collected. Two samples of granite (SG.470.38.01, SG.470.38.02) had high calcium, magnesium, iron, and nickel concentrations compared to the other granite samples, indicating that they were likely diabase or a mix of diabase and granite; these samples were reclassified as diabase and the update is reflected in the results below.

Summary statistics of ABA and elemental results from the 2019 samples are shown in Table 7-1 and Table 7-2 with a summary of previous monitoring results provided for comparison. A discussion of the results by waste rock type is included in this section.

Granite

Results of paste pH, total sulphur, NP, and CO_3 NP for the 18 granite samples collected in 2019 were all within the range observed in the 2017-2018 Sable samples (Table 10-1). The median values of paste pH (9.8), total sulphur (0.01%S), NP (9 kg $CaCO_3$ /t) and CO_3 NP (2.3 kg $CaCO_3$ /t, which represents half the detection limit) were similar to the historical results from 2017-2018. All samples were classified as non-PAG according to the NP/MPA whereas all but three samples were classified as non-PAG according to the CO_3 NP/MPA criteria established in Section 2.1.2 of the 2019 Seepage Report (Figure 7.3-1 and Figure 7.3-

2). This was mainly due to the very low sulphur content (range of <0.01 to 0.02%S), except for two samples that were classified as uncertain according to CO_3 NP/MPA criteria (range of 0.03 to 0.04%S).

The major and trace element median values were similar to the 2017-2018 Sable granite samples. Molybdenum and zinc concentrations were slightly higher in 2019 relative to the 2017-2018 samples, while copper concentrations were slightly lower.

In summary, the comparison of granite datasets yields the following conclusions:

- Results of paste pH, total sulphur, NP and CO3 NP, as well as NP/MPA and CO3 NP/MPA, for the Sable monitoring samples were all within the historical range of the Panda, Koala, and Fox granite monitoring results.
- Minimum values of various elements in the Sable dataset were below the historical minima of the Panda, Koala, and Fox monitoring results, however this is likely a result of lower detection limits achieved in recent years.
- Maximum values of a few elements in the Sable dataset were above the historical maxima of the Panda, Koala, and Fox monitoring results including:
    - Beryllium: maximum in Sable monitoring results of 5.2 ppm compared to 2.5 ppm in the historical datasets.
    - Potassium: maximum in Sable monitoring results of 5.6% compared to 4.3% in the historical datasets.
    - Phosphorus: maximum in Sable monitoring results of 2,200 ppm compared to 2,100 ppm in the historical datasets.
    - Zinc: maximum in Sable monitoring results of 110 ppm compared to 97 ppm in the historical datasets.

Sable granite is thus very similar to granite produced in other areas of Ekati that have been monitored extensively and deemed non-reactive.

Diabase

Results of paste pH, total sulphur, NP, and CO_3 NP for the five diabase samples (including the two samples collected as granite) were all within the range observed in the 2018 diabase samples (Table 7.3-1). Despite a similar total sulphur median value (0.02%S), the range in 2019 (0.01 to 0.03%S) was more limited than 2018 (0.01 to 0.18%S), which may simply reflect the limited sample size in 2019. The median Sobek NP was similar in 2019 (14 kg $CaCO_3$ /t) to 2018 (16 kg $CaCO_3$ /t). The CO_3 NP values were below detection for all 2018 and 2019 samples. All 2019 samples were classified as non-PAG according to the Sobek NP/MPA, whereas four of the five samples were classified as non-PAG according to the CO_3 NP/MPA criteria classification with one sample of uncertain ARD potential (Figure 7.3-1 and Figure 7.3-2).

The major and trace element concentrations were mostly within the range observed in 2018. Molybdenum and nickel concentrations were slightly lower in 2019, likely reflecting the potentially mixed granite/diabase composition of the two samples that were reclassified.

In summary, the comparison of diabase datasets yields the following conclusions:

Results of paste pH, total sulphur, NP, and CO3 NP, as well as of NP/MPA and CO3 NP/MPA, for the Sable monitoring samples were mostly within the historical range of the Beartooth, Fox, Jay, Lynx, and Misery monitoring results.

- The minimum paste pH value at Sable (8.0) was slightly below the minimum value of the historical dataset (8.1).
- The maximum NP/MPA value for the Sable monitoring samples (70) was higher than that of the historical dataset (60).

Median total sulphur for the Sable samples (0.02%) was below that of the median of the comparative historical dataset (0.095%), while median NP was slightly higher for the Sable samples (15 kg CaCO3 /t) compared to that of the historical dataset (12 kg $CaCO_3$ /t). Median CO3 NP values were below the detection limit in both datasets. This leads to higher median values for the Sable samples of NP/MPA (26) and CO_3 NP (3.6) compared to the historical datasets from the other pits (NP/MPA of 4.3 and CO_3 NP of 0.93).

Maximum concentrations of a few elements in the Sable dataset were above the maxima of the comparative historical dataset including:

- Aluminum: maximum in Sable monitoring results of 9.4% compared to 8.2% in the historical dataset.
- Barium: maximum in Sable monitoring results of 930 ppm compared to 800 ppm in the historical dataset.
- Potassium: maximum in Sable monitoring results of 2.9% compared to 2.8% in the historical dataset.
- Sodium: maximum in Sable monitoring results of 3.3% compared to 2.9% in the historical dataset.
- Nickel: maximum in Sable monitoring results of 100 ppm compared to 97 ppm in the historical dataset.
- Strontium: maximum in Sable monitoring results of 690 ppm compared to 470 ppm in the historical dataset.
- Titanium: maximum in Sable monitoring results of 2.5% compared to 2.0% in the historical dataset.
- Vanadium: maximum in Sable monitoring results of 530 ppm compared to 440 ppm in the historical dataset. Overall, Sable diabase samples have similar characteristics as previous samples collected from other areas at Ekati. Samples collected to date from Sable are on the lower end of the range present for risk of ARD potential, compared to the compiled historical dataset, mainly due to the low total sulphur content. Diabase is estimated to be less than 5% of the material within the proposed pit limit.

Only granite and Lynx diabase materials have been approved by the Board to be designated as suitable for general construction and reclamation at Ekati. Based on this, all Sable diabase will be contained within the WRSAs. Seepage surveys around the Sable WRSAs will continue to be conducted twice a year, in accordance with the requirement in the Water Licence. The analysis of Seepage chemistry from the Sable piles will be the best method of detecting any potential changes that may affect the Receiving Environment and Receiving Water.

Figure 7.3-1 Sobek NP vs MPA Sable Granite Sample

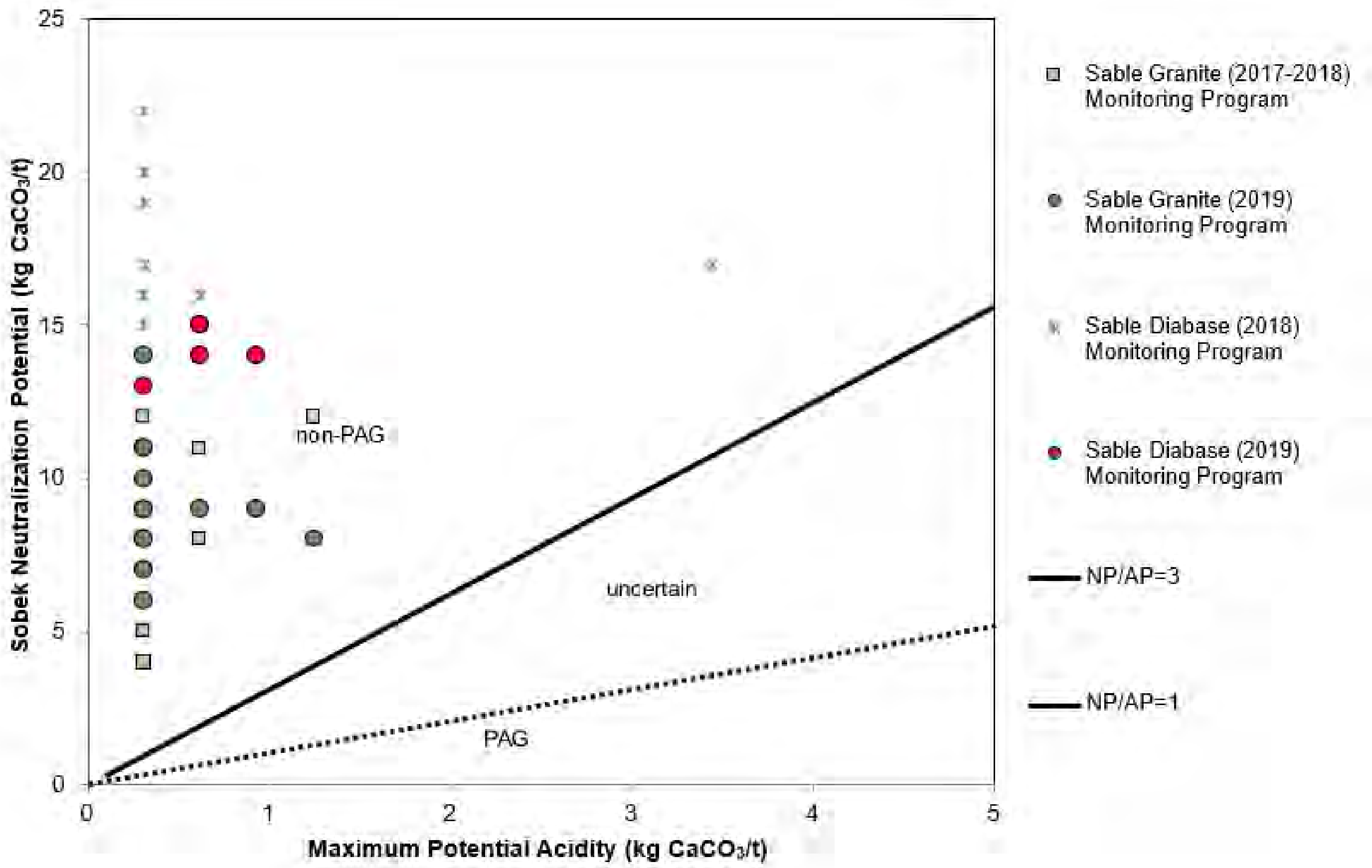


Figure 7.3-2 Sobek NP vs MPA Sable Diabase Samples

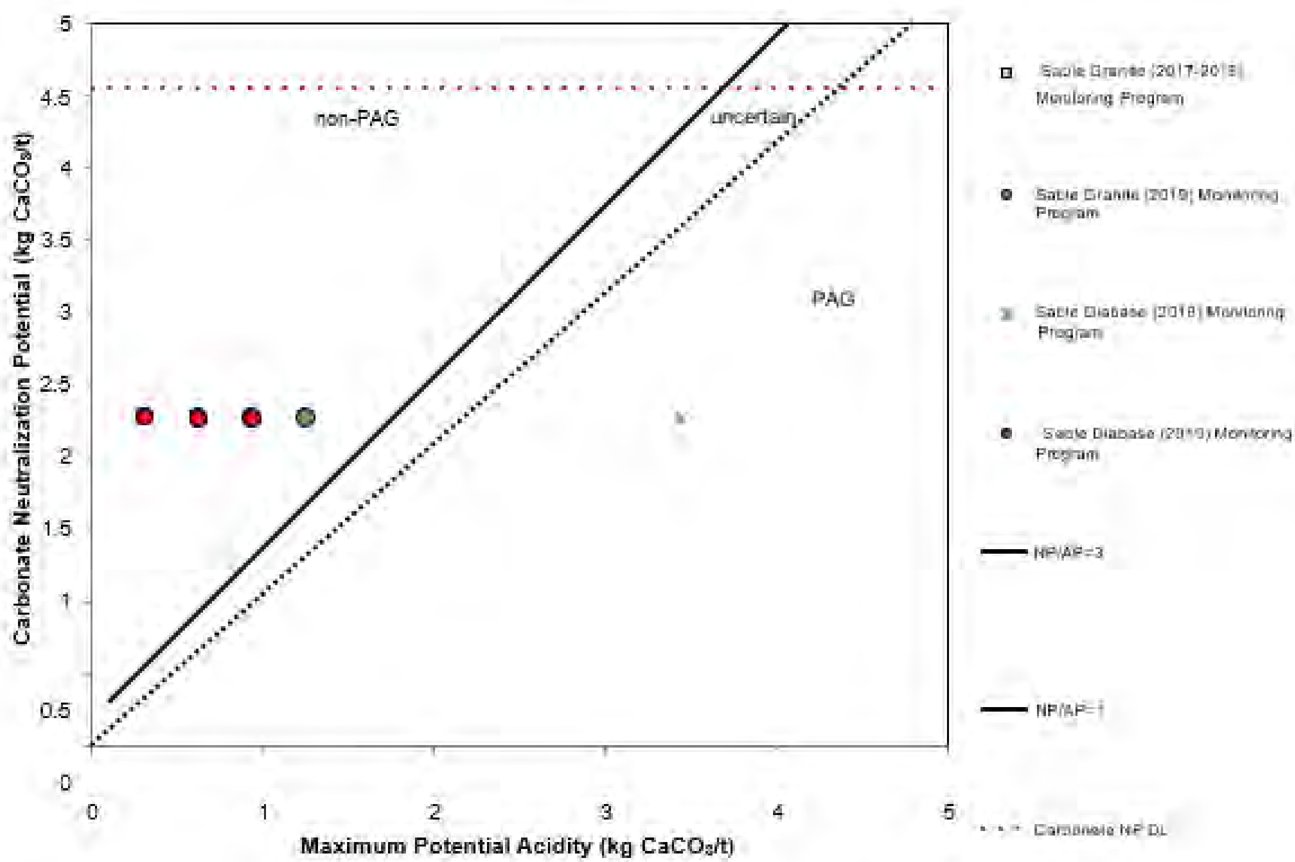


Table 7.3-1 Summary Statistics of ABA Results for Sable Waste Rock

Description	Summary Statistic	Paste pH	S (T)	S (SO_4)	CO_2	CO_3- NP	NP	MPA	NNP	NP/MPA	CO_3-NP/MPA
	Units	pH	%	%	%	kg $CaCO_3$ eq/tonne	kg $CaCO_3$ eq/tonne	kg $CaCO_3$ eq/tonne	kg $CaCO_3$ eq/tonne	-	-
Panda Granite (All Monitoring)	Average	9.5	0.022	0.012	0.21	2.7	16	0.7	15	34	11
	Max	12	0.39	0.07	0.8	18	150	12	150	64	15
	95th Percentile	9.9	0.06	0.01	0.2	4.3	20	1.9	19	54	15
	Median	9.5	0.01	0.01	0.2	2.3	14	0.31	14	42	15
	5th Percentile	9	0.01	0.01	0.2	2.3	11	0.31	11	8.2	2.5
	Min	8.4	0.01	0.01	0.2	2.3	7	0.31	4.4	1.8	0.81
	Count	397	397	43	43	43	379	397	379	379	43
Koala Granite (All Monitoring)	Average	9.1	0.036	-	-	-	15	1.1	14	21	-
	Max	10	0.26	-	-	-	86	8.1	81	77	-
	95th Percentile	9.8	0.1	-	-	-	25	3.2	24	46	-
	Median	9.2	0.03	-	-	-	14	0.9	13	17	-
	5th Percentile	8.1	0.01	-	-	-	7.7	0.31	6.3	4.8	-
	Min	7.2	0.01	-	-	-	5	0	3.4	1.5	-
	Count	297	297	-	-	-	275	298	275	275	-
Fox Granite (All Monitoring)	Average	9.1	0.037	-	-	-	19	1.2	18	24	-
	Max	10	0.29	-	-	-	220	9.1	210	100	-
	95th Percentile	9.8	0.11	-	-	-	33	3.4	31	51	-
	Median	9.2	0.03	-	-	-	16	0.9	15	20	-
	5th Percentile	8.1	0.01	-	-	-	13	0.3	11	6.4	-
	Min	7.5	0.01	-	-	-	5	0.3	5	1.5	-
	Count	417	417	12	12	12	417	417	417	417	12
Sable Granite (2017-2018)	Average	9.6	0.013	0.013	0.2	2.3	8.4	0.42	8.1	22	6.4
	Max	10	0.04	0.03	0.2	2.3	14	1.3	13	38	7.3
	95th Percentile	9.9	0.023	0.03	0.2	2.3	12	0.72	12	36	7.3
	Median	9.8	0.01	0.01	0.2	2.3	8.5	0.31	8.5	21	7.3
	5th Percentile	9.1	0.01	0.01	0.2	2.3	4	0.31	3.7	12	3.4
	Min	8.8	0.01	0.01	0.2	2.3	4	0.31	3.7	9.6	1.8
	Count	18	18	18	18	18	18	18	18	18	18
Sable Granite (2019)	Average	9.8	0.013	0.019	0.2	2.3	8.8	0.42	8.6	31	6.5
	Max	10	0.04	0.03	0.2	2.3	14	1.2	14	70	7.3
	95th Percentile	10	0.031	0.03	0.2	2.3	11	0.98	11	60	7.3
	Median	9.8	0.01	0.02	0.2	2.3	9	0.31	8	29	7.3
	5th Percentile	9.5	0.01	0.01	0.2	2.3	6	0.31	6	9.1	2.3
	Min	9.5	0.01	0.01	0.2	2.3	6	0.31	6	6.4	1.8
	Count	18	18	18	18	18	18	18	18	18	18
Beartooth, Fox, Jay, Lynx, Misery Diabase (Golder 2018)	Average	9	0.11	0.013	-	2.8	13	3.3	-	8	1.6
	Max	9.8	1.3	0.06	-	18	68	42	-	60	19
	95th Percentile	-	-	-	-	-	-	-	-	-	-
	Median	9	0.095	0.01	-	2.3	12	3	-	4.3	0.93
	5th Percentile	-	-	-	-	-	-	-	-	-	-
	Min	8.1	0.005	0.005	-	0.23	0.5	0.16	-	0.037	0.22
	Count	156	162	155	-	133	155	162	-	155	132

Description	Summary Statistic	Paste pH	S (T)	S (SO_4)	CO_2	CO3 NP	NP	MPA	NNP	NP/MPA	CO_3-NP/MPA
	Units	pH	%	%	%	Kg $CaCO_3$ eq/tonne	Kg $CaCO_3$ eq/tonne	Kg $CaCO_3$ eq/tonne	Kg $CaCO_3$ eq/tonne	-	-
Sable Diabase (2018)	Average	9.1	0.035	0.018	0.2	2.3	17	1.1	16	40	5.2
	Max	10	0.18	0.03	0.2	2.3	22	5.6	22	70	7.3
	95th Percentile	9.7	0.14	0.03	0.2	2.3	21	4.4	21	67	7.3
	Median	9.1	0.01	0.02	0.2	2.3	16	0.31	16	50	7.3
	5th Percentile	8.5	0.01	0.01	0.2	2.3	13	0.31	9.5	3.5	0.55
	Min	8.5	0.01	0.01	0.2	2.3	10	0.31	4	1.8	0.4
	Count	12	12	12	12	12	12	12	12	12	12
Sable Diabase (2019)	Average	8.8	0.02	0.018	0.2	2.3	14	0.62	13	25	4.1
	Max	9.2	0.03	0.02	0.2	2.3	15	0.94	14	42	7.3
	95th Percentile	9.2	0.028	0.02	0.2	2.3	15	0.87	14	38	6.5
	Median	8.9	0.02	0.02	0.2	2.3	14	0.62	13	24	3.6
	5th Percentile	8.1	0.012	0.012	0.2	2.3	13	0.37	13	16	2.7
	Min	8	0.01	0.01	0.2	2.3	13	0.31	13	15	2.4
	Count	5	5	5	5	5	5	5	5	5	5

Notes:

All results reported as 'below detection' were replaced with detection limit values for the calculation of summary statistics.

'S (T)': total sulphur.

'S (SO4)': sulphur as sulphate.

'CO_3-NP': carbonate neutralization potential. Units are kg $CaCO_3$ equivalent/tonne. Values below detection limit were converted to half the detection limit as required by the WROMP.

'NP': neutralization potential as determined by the standard Sobek method, except for 2009 Selection Phase diabase samples for which NP was determined by the Modified NP method. Units are kg $CaCO_3$ equivalent/tonne.

'MPA': maximum potential acidity calculated from total sulphur. Units are kg $CaCO_3$ equivalent/tonne.

'NNP': net neutralization potential. Units are kg $CaCO_3$ equivalent/tonne.

'-': indicates parameter not measured

Table 7.3-2 Summary Statistics of Elemental Results for Sable Waste Rock

Description	Summary Statistic	Al	As	Ba	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Pb	Sb	V	Zn	Hg	U
	Units	%	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Panda Granite (All Monitoring)	Average	9.3	3.7	630	3.3	0.51	18	150	28	2.9	1.8	1.9	380	1.5	3	53	9.7	2.6	78	65	-	-
	Max	13	15	890	5.9	1	24	230	140	3.6	4.3	5.3	540	5	4.4	150	70	10	100	88	-	-
	95th Percentile	11	10	750	4	0.5	22	200	58	3.4	2.1	2.3	500	4	4	83	14	5	91	80	-	-
	Median	9.3	3	630	3.3	0.5	19	140	25	2.9	1.8	1.9	380	1	3	48	10	0.2	80	64	-	-
	5th Percentile	7.6	1	520	2.1	0.5	13	86	6.4	2.3	1.4	1.4	290	1	2.3	40	2	0.2	54	52	-	-
	Min	7.2	1	430	0.35	0.5	4	38	1	1.2	1.2	0.63	140	1	0.45	21	2	0.2	21	34	-	-
	Count	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	-	-
Koala Granite (All Monitoring)	Average	9	4.7	610	2.6	0.5	15	110	24	2.7	1.9	1.7	350	2.3	3.1	51	8.3	4.3	69	61	8.5	-
	Max	11	15	850	3.7	0.5	25	220	130	3.5	3.1	4.4	510	9	6.8	240	16	15	91	84	30	-
	95th Percentile	11	6	770	3.5	0.5	20	190	53	3.4	2.6	2.3	450	6	4.1	88	16	5	89	78	10	-
	Median	9.2	5	620	2.9	0.5	16	110	21	2.9	1.9	1.8	370	1	3	46	8	5	71	62	10	-
	5th Percentile	7.5	1	380	0.94	0.5	9	61	8	1.9	1.6	0.98	220	1	2.3	26	2	0.2	43	40	0.01	-
	Min	6.3	1	100	0.6	0.5	7	40	2	1.4	1.2	0.72	130	1	1.8	16	2	0.2	29	19	0.01	-
	Count	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	-
Fox Granite (All Monitoring)	Average	8.2	6.2	640	3.2	0.5	17	110	42	3.3	2	2	440	1.3	2.7	58	11	5	86	64	2.4	-
	Max	9.9	15	1200	7.1	0.5	45	390	330	8.4	2.7	6.2	1400	6	3.8	380	230	6	320	97	10	-
	95th Percentile	9.8	12	790	3.7	0.5	26	200	95	3.8	2.4	3	610	3	3.2	110	13	5	100	73	10	-
	Median	8.1	5	630	3.2	0.5	16	100	30	3.1	2	1.8	410	1	2.7	48	8	5	78	65	0.01	-
	5th Percentile	7.3	5	540	2.3	0.5	13	59	15	2.8	1.5	1.6	350	1	2.2	42	3	5	72	57	0.01	-
	Min	6.7	5	170	0.5	0.5	3	22	3	0.93	0.66	0.49	100	1	1.6	4	2	5	13	12	0.01	-
	Count	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	-
Sable Granite (2017-2018)	Average	7.5	0.58	470	0.82	0.038	3	15	5.7	1.1	3.6	0.38	170	0.6	2.8	5.9	19	0.091	17	42	0.005	5.7
	Max	7.9	1.1	760	1.8	0.07	9	36	17	2.4	5.6	0.96	440	1.6	4.1	19	30	0.13	53	110	0.005	15
	95th Percentile	7.9	1	710	1.5	0.07	7.9	25	15	2	5.2	0.88	350	1.6	3.6	19	29	0.12	45	91	0.005	12
	Median	7.5	0.4	490	0.7	0.03	2.7	14	3.5	1.2	3.5	0.29	160	0.31	3	4.2	19	0.08	15	39	0.005	4.9
	5th Percentile	7.1	0.2	170	0.16	0.02	0.5	8.9	1	0.3	1.5	0.049	45	0.13	1.7	0.79	8.8	0.07	1.9	7.3	0.005	3.1
	Min	7	0.2	160	0.11	0.02	0.5	8	1	0.23	1.3	0.04	28	0.1	1.7	0.7	8	0.07	1	3	0.005	2.3
	Count	18	14	18	18	15	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18

Description	Summary Statistic	Al	A	Ba	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Mo		Ni	Pb	Sb	V	Zn	Hg	U
	Units	%	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	%	ppm	ppm		ppm	ppm	ppm	ppm	ppm	ppm	ppm
Sable Granite (2019)	Average	7.5	0.35	560	0.85	0.033	2.8	15	3.1	1.1	3.8	0.35	160	0.91		5	21	0.071	16	50	0.0051	5.5
	Max	8.2	0.7	1100	3	0.09	12	36	11	2.8	4.9	1.2	400	3		24	32	0.42	68	87	0.006	16
	95th Percentile	8	0.7	930	1.4	0.056	5.4	22	8.7	1.6	4.9	0.77	270	2		16	29	0.11	30	82	0.0051	9.1
	Median	7.5	0.25	530	0.72	0.03	2.1	15	1.4	1.1	3.9	0.27	150	0.96		3.4	21	0.05	14	53	0.005	5
	5th Percentile	7.1	0.2	130	0.51	0.02	1.2	8.9	0.47	0.59	1.8	0.15	99	0.16		1.5	13	0.05	3.9	20	0.005	2.2
	Min	7	0.2	120	0.47	0.02	1.1	8	0.3	0.58	1.6	0.13	90	0.15		1	9.2	0.05	3	18	0.005	1.6
	Count	18	18	18	18	18	18	18	18	18	18	18	18	18		18	18	18	18	18	18	18
Beartooth, Fox, Jay, Lynx, Misery Diabase (Golder 2018)	Average	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Max	8.2	82	800	7.5	2	61	240	370	13	2.8	4.2	2100	2.9	2.9	97	26	12	440	230	22	-
	95th Percentile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Median	6.5	2.5	190	5.3	0.18	46	80	270	10	0.78	3	1500	0.79	1.8	65	5.3	0.22	360	120	0.006	-
	5th Percentile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Min	0.42	0.3	5	0.16	0.05	1.4	36	0.9	0.67	0.14	0.26	140	0.2	0.031	3.5	0.7	0.025	4	12	0.0025	-
	Count	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	120	-
Sable Diabase (2018)	Average	7	0.73	210	5.8	0.088	48	64	240	10	0.88	3.4	1500	0.75	1.9	77	3	0.1	400	140	0.005	0.62
	Max	9.4	1.8	930	6.4	0.14	57	170	320	12	2.9	3.8	1800	1.6	3.3	100	8.4	0.17	450	170	0.005	1.7
	95th Percentile	8.1	1.6	610	6.3	0.14	54	130	310	12	1.8	3.8	1700	1.2	2.5	96	6.2	0.15	440	160	0.005	1.4
	Median	6.8	0.55	130	6.2	0.08	49	54	270	11	0.68	3.5	1500	0.72	1.7	76	2.4	0.11	420	130	0.005	0.4
	5th Percentile	6.5	0.3	110	4.1	0.048	38	39	86	7.9	0.58	2.6	1100	0.52	1.7	62	1.6	0.06	260	120	0.005	0.3
	Min	6.5	0.3	110	2	0.02	28	37	74	5	0.57	1.9	600	0.45	1.7	62	1.5	0.06	150	100	0.005	0.3
	Count	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Sable Diabase (2019)	Average	7.2	0.72	190	5	0.076	47	49	200	9.7	1.1	3.1	1400	0.6	2.1	69	3.5	0.08	420	93	0.005	2
	Max	8.3	1.2	340	6.2	0.11	59	76	260	11	2.4	3.7	1700	0.82	2.3	100	7.3	0.17	530	110	0.005	5.3
	95th Percentile	8.1	1.1	310	6.1	0.1	57	70	260	11	2.1	3.6	1700	0.8	2.3	95	6.5	0.15	520	100	0.005	4.6
	Median	6.8	0.6	160	4.8	0.07	49	44	220	11	0.81	3.4	1400	0.56	2.1	65	2.5	0.06	460	100	0.005	1.2
	5th Percentile	6.7	0.44	130	3.8	0.06	31	40	130	6.7	0.62	2.4	930	0.4	1.8	47	2	0.05	260	68	0.005	0.52
	Min	6.7	0.4	130	3.6	0.06	28	39	110	5.9	0.58	2.3	840	0.36	1.8	43	1.9	0.05	220	60	0.005	0.4
	Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

Notes:
All results reported as 'below detection' were replaced with detection limit values for the calculation of summary statistics.
Only samples analyzed following a four-acid digestion were included.

7.4 Coarse Kimberlite Reject Geochemistry Monitoring

- Monitoring of CKR will continue as described in the previous Geochemical Characterization and Metal Leaching Management Plan (SRK 2007) and Section 3.4 of this report.
- Coarse kimberlite reject will be sampled quarterly with an annual evaluation of the data.
- Results will be reported in the annual Waste Rock and Waste Rock Seepage Survey Reports

7.5 Lynx Diabase Risk Mitigation Program

As outlined in Section 6.3 excavated granite and Lynx diabase materials are designated as suitable for general construction and reclamation use at Ekati. Diabase generated from the Lynx Pit was sampled at a rate of three samples per rock type, per bench, every year during operations. The approximate tonnage of diabase material generated from Lynx Pit used for construction will be recorded and the following additional risk mitigation procedures will be implemented as part of the Lynx Diabase Risk Mitigation Program.

7.5.1 Additional ABA Sampling

Acid-base accounting sampling of placed construction rock containing diabase will be undertaken by the Environment Department or operations staff trained by the Environment Department. Three representative rock samples will be collected every 400,000 tonnes of waste rock material that contains diabase (run of mine and crushed waste rock if applicable) placed in construction. The ABA results will be reviewed when received according to standard analytical timeframes. If the ABA results for a sample are beyond the upper 95th percentile of the established dataset for Lynx diabase or if the geochemical classification of a sample is “potentially acid generating”, then Burgundy will promptly follow up with an increased number of verification samples of the placed rock. The need for further targeted rock sampling or other investigations would be determined based on the results obtained. Annual reporting of the rock sampling will be reported in Annual Seepage Survey Reports. The reports will include quantities and locations of placed construction materials containing Lynx diabase

Three initial representative samples will be collected at the start of construction (i.e < 400,000 tonnes placed) and then an additional three samples will be collected every 400,000 tonnes of waste rock that is placed. The selection of 400,000 tonnes was partially based on the Lynx geological model which indicates that approximately 10% of the waste rock out of the pit is diabase. Hence, for a total amount of 400,000 tonnes of waste generated from Lynx Pit to be used for construction 40,000 tonnes could be expected on average to be diabase and 360,000 tonnes to be granite. The designation of total amount of 400,000 tonnes of waste rock that contains diabase rather than a set tonnage amount for just diabase materials was designated since it would be operationally challenging and largely ineffective to track the sporadic and relative smaller tonnes of diabase that would be placed. Additionally, based on the accumulated geochemical dataset for Lynx diabase (see Section 3.13/3.17) and the low quantity of Lynx diabase used in construction relative to granite, the total 400,000 tonnes represents a reasonable balance between addressing the risk potential of Lynx diabase and the effort required for the sampling of placed construction material (i.e., in addition to the routine on-going ABA sampling of Lynx diabase as mined; see Section 7.3). For example, 400,000 tonnes of waste rock represents the following approximate footprints that would be generated for various potential constructions using waste containing diabase:

- haul road segment length of 2.5 km;
- a pad surface area of 80,000 m2 (assuming 2 m pad height); and,
- a waste rock covering area of 30,000 m2 (assuming 5 m cover thickness).

Notwithstanding that the guidelines are intended for a different waste rock sampling application, the Price (1997) sampling guidelines that are referenced in MEND 2009 may serve as a relevant reference. Price 1997 suggests characterization sampling at a minimum rate of 8 samples per 100,000 tonnes. Burgundy's rate described herein for additional sampling of placed Lynx diabase mixed with granite is on average 6 samples per 40,000 tonnes that is mixed within 360,000 tonnes of granite which is consistent in reference to Price 1997 particularly as this sampling is in addition to the routine on- going sampling of Lynx diabase as-mined.

A representative sample targeting diabase material will be collected according to sampling procedures developed with a Qualified Professional. That is, a sample will be collected if diabase is observed. Sampling will intend to be evenly spaced (i.e., sampling of each approximately 133,000 tonnes placed) with some variance anticipated for reasonable operating constraints. Environment personnel will visually inspect the placement area under consideration (i.e., placed since the previous inspection) for diabase. In normal circumstances, a sample will be collected compositing observed diabase within the placement area under consideration. Diabase is visually distinct from granite such that visual inspection is reasonable for this task. Burgundy will attempt to sample only diabase, however because diabase is expected to comprise only 10% of the placed materials on average and is well mixed with granite, it is possible that small amounts of granite may be present in some samples.

If no diabase is observed within the placement area under consideration, sampling will be deferred (i.e., samples will not be collected of placed granite). In that case, reasonable attempts will be made to make up the deferred sample(s) through increased sampling of the subsequent approximate 133,000 tonnes placement lot(s) such that the '3-sample per 400,000 tonnes placed' intent is achieved. This may involve an increased inspection/sampling frequency or sampling of individual diabase exposures rather than compositing.

Sampling described above is in addition to the routine sampling of Lynx diabase in the open pit as described in Section 7.3; specifically "*Waste rock mined in the Lynx open pit, Pigeon open pit and for the first two-years at the Sable pit will be sampled at a rate of three samples per rock type, per bench, every year with geological mapping of the benches sampled.*"

7.5.2 Seepage Sampling

As the sampling of placed materials will be targeted at diabase, seepage sampling in the area of placed construction material containing Lynx diabase will be conducted when triggered by the review of the 'verification' ABA sampling results described in Section 7.5.1. Seepage sampling will occur if verification ABA results for a placement area (i.e., 400,000 tonnes) are beyond the upper 95th percentile of the established geochemical dataset for Lynx diabase. Sample locations will be dependent on the area and circumstances at hand and, therefore, would be determined at that time.

Sampling procedures would follow the WRSA Seepage Sampling Protocol (Section 7.7) where the sampler would walk the areas of the placed construction material containing Lynx diabase and sample any observed seepage or flowing water that is interacting with the construction material.

Initial sampling would take place at the time that the need for sampling was triggered. The need for further sampling would be determined based on results obtained, and at a minimum would include the two subsequent general WRSA seepage surveys (i.e., spring/fall).

7.6 Non-PAG Material Construction Use

Based on its non-PAG geochemical characterization, excavated granite (Section 3.15) and Lynx diabase (Section 3.16 and Appendix D) materials are designated as suitable for general construction and reclamation use at Ekati, which might include but is not limited to:

- Construction of the airstrip runway
- Construction of haul and access roads
- Construction of water diversion channels
- Construction of pads for buildings and equipment laydowns areas
- Construction of frozen core and water retention dams and dikes
- WRSA pad construction and final WRSA cover capping material
- Reclamation of the LLCF

7.7 Seepage Monitoring

The WRSA seepage monitoring, screening and response program is designed to maintain compliance with Condition H.26 of the Water Licence W2022L2-0001 (i.e., compliance with EQC at point of entry of a WRSA seepage flow into a Receiving Environment and Receiving Water). This is accomplished through seepage quality monitoring that is linked to proactive adaptive management actions by utilizing screening criteria applied to seepage quality at the toe of the WRSA.

7.7.1 Monitoring and Reporting

The fundamental components and requirements of the seepage monitoring program are as follows:

- Seepage monitoring will address the requirements of Part H. 7, 8, 9, 10 and Schedule 6 Condition 2,3,4 of the Water Licence.

- Detected seepage at toe of WRSA's and the Point Lake Overburden Stockpile (OVBSP) will be sampled twice per year; once during spring freshet and again in late summer or fall, plus any additional sampling directed by the Board. In addition, the toe of Point Lake OVBSP will be monitored monthly for seepage during active construction and re-mining phases.

- Seepage from all WRSAs will also be monitored as required under the Metal and Diamond Mining Effluent Regulations of the Fisheries Act administered by Environment and Climate Change Canada.

- Seepage monitoring data will be reported, and an overview analysis of major trends provided annually per Part B 13. and Schedule 6 Condition 3(f) of the Water Licence, submitted as part of the EA and WL Annual Report.

- As part of the annual seepage report, seepage quality data at the toe of the WRSAs will be compared to screening criteria (see below) to identify seep of potential concerns.
- Adaptive management actions will be determined through collaboration between Burgundy and the Inspector to address seeps of potential concerns and any exceedances of EQC.
- Every three years beginning 2014 (i.e., report on 2013 surveys) a more extensive analysis of cumulative seepage monitoring data will be provided for WLWB approval per Schedule 6 Condition 3(g) of the Water Licence.
- Sampling following significant rainfall events was discontinued in 2019, as sufficient rationale to decrease monitoring was provided in the 2018 seepage survey report.

The detailed seepage sampling protocol is provided in Appendix B.

7.7.2 Reference Stations

Reference sites are intended to provide data on background Seepage quality that can help delineate the potential effects of mining activities on the Receiving Environment and Receiving Water. Reference sites should reflect the natural environment (including runoff, Seepage, and shallow groundwater), and not be affected by mining activities.

In recent years, monitoring of tundra Seepage water quality has occurred in three potential reference areas: east of Bearclaw Lake (REF-005), and within the Sable (REF-037) and Misery (REF-040) areas.

These seeps have variable monitoring records and intermittent flows, and previous Seepage reports questioned if they are truly representative of reference conditions or if they may be affected, to some degree, by the mine. While monitoring data for these seeps remains in the overall database and was included in the time series graphs throughout annual and three-year Seepage reports, these data are not used to support the interpretation and conclusions presented in these reports.

Instead, when relevant, utilization of pre-mining baseline Seepage chemistry serves as the best comparison point to examine potential mine-related changes. The characteristics of Seepage water that evolves in natural granite-tundra (i.e., Sable and Fox baseline sampling that occurred prior to mining in these areas) are utilized throughout this report as more robust points of comparison to elucidate potential mine-related water-rock interaction signatures in Seepage chemistries.

Biannual sampling at REF-005, REF-037, and REF-040 should be discontinued, as their data no longer contribute to the annual and three-year Seepage reports. Sampling at these reference stations will continue until sufficient rationale and supporting data are provided to evaluate this request.

7.8 Aquatic Effects Monitoring Program

The Aquatic Effects Monitoring Program (AEMP) was designed to detect downstream effects from the Ekati Diamond Mine. Sampling stations have been established in several lakes and streams downstream of all WRSA. Samples are collected annually during the open water season and analyzed for:

- Total metals (aluminum, nickel, calcium, iron, copper, mercury);

- Ammonia, nitrate, total- phosphorus, sulphate; and,
- pH, specific conductivity, total suspended solids, turbidity, hardness.

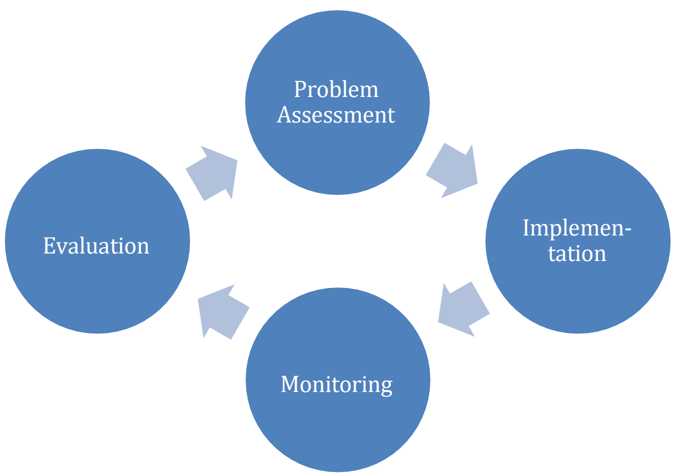
Sampling and analysis for the AEMP will continue as is currently practiced.

7.9 Adaptive Management

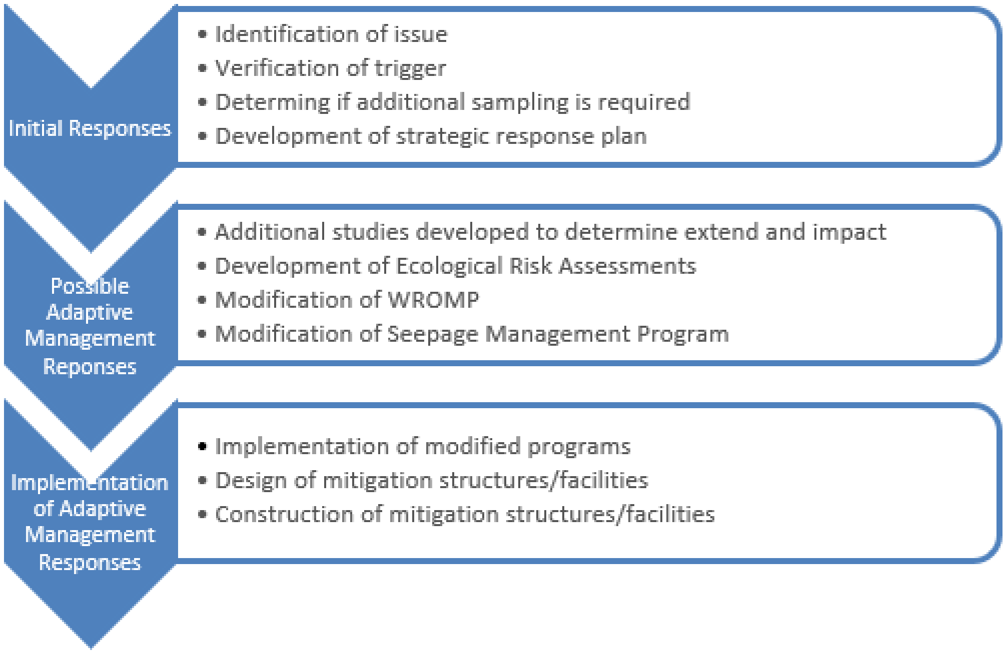
7.9.1 Approach to Adaptive Management

Monitoring programs currently in place and described above will detect potential undesirable physical and environmental changes caused by waste rock and ore storage. If this occurs, the likely causes will be determined, and management plans will be revisited. Operational and closure geochemical, thermal and environmental risk assessment frameworks have been developed for select WRSA as a means of further evaluating performance (DDEC 2015c, 2016), and these evaluations may be used in concert with monitoring data to identify and direct adaptive management activities.

Adaptive management steps include:



The following chart illustrates how such information would be used to develop adaptive management strategies.



Following implementation of appropriate adaptive management responses, Burgundy would continue with sampling, monitoring and evaluation of the program's trigger issues.

7.9.2 Response Timelines for Adaptive Management

On the completion of spring and fall surveys, data receipt, and data quality assurance and control, preliminary screening of results occurs, and seeps of potential concern (SoPC) are noted as part of Burgundy's internal management procedures. However, the annual report then facilitates the examination of whether SoPC are the result of a developing trend that may require adaptive management strategies or if there was a difference in the water quality at the time of sampling that does not appear to be part of a developing trend. In addition, notification and management of EQC exceedances occurs as per the Board Directive of the 2019 Seepage Survey Report and Version 11.0 of the Waste Rock and Ore Storage Management Plan (Decision #5) during which, Burgundy will work with the Inspector to determine appropriate adaptive management responses to identified seeps of potential concern and in the instance an exceedance of EQC should occur.

7.9.3 Seepage Quality Evaluation and Response

Screening and Response

Seepage quality screening is an annual comparison of analytical results with seepage screening criteria. Analytical results that are greater than the screening criteria will define a *seep of potential concern* for which further investigation and/or action may be required. Seepage screening criteria are designed to prompt preventive actions, where necessary, that intend to prevent an exceedance of EQC at point of entry of a seepage flow into a Receiving Environment and Receiving Water. This is achieved by basing screening criteria on EQC and applying those criteria 'at the toe' of the WRSA. This means that any dilution or attenuation of seepage along a flow path to a Receiving Environment would further protect the Receiving Water.

The Seepage screening criteria are applied to water quality variables that have effluent quality criteria (EQC) for the appropriate receiving watershed. A seep of potential concern will be identified where:

- For constituents with an EQC, with concentrations greater than the stated maximum allowable concentration of any grab sample; or
- A constituent concentration greater than the upper 95th percentile value of the associated WRSAs historical dataset on more than one occasion during the two-year period comprising the reporting year plus preceding year.

The EQC are specified in Water Licence W2022L2-0001, under Part H, Condition 26. EQC applicable to Surveillance Network Program (SNP) Station 1616-30 (Part H, Condition 26(a)) were used in the assessment for all seeps in the Panda/Koala, Fox, and Pigeon WRSA's. EQC applicable to SNP Station 1616-43 (Part H, Condition 26 (b)) were used in the assessment of the seeps in the Misery and Lynx WRSAs, and EQC applicable to SNP Station 0008-Sa3 (Part H, Condition 26 (c)) were used for the assessment of the seeps in the Sable WRSAs. For hardness dependent EQC the hardness obtained from sampling the sample or if appropriate relevant Receiving Environment was used in the calculations. Any WRSA that exceeds an applicable EQC is regarded as Unauthorized Discharge as per W2022L2-0001 Part I, Condition 4.

Only seeps with the potential to enter Receiving Water are considered of potential concern. For example, seeps flowing from the Coarse Kimberlite Rejects Storage Area (CKRSA) do not have the potential to enter Receiving Water. Seepage from the CKRSA flows towards the Long Lake Containment Facility (LLCF), which is a controlled mine water management facility.

Local catchment flows and WRSA destination waterbodies are identified on Figure 5.2-1 to 5.2-6 herein. Some WRSA seepage flows to a destination waterbody that is part of the operational mine water management system (such as the LLCF, for example). The designation of Receiving Environments may change in future as mine water management facilities are decommissioned for closure, and this is addressed through the ICRP. For the purposes of this operational management plan, the Receiving Environments for which WRSA seepage may directly enter are designated as follows:

- Sable WRSA: Ulu Lake, Horseshoe Lake
- Panda/Koala/Beartooth WRSA: Bearclaw Lake
- Fox WRSA: Three Hump Lake, Lake C, Pond D, Lake E, Nora Lake, South Fox Lake 2, Fox Two Lake, Martine Lake, Nema Lake
- Misery & Lynx WRSAs: Cujo Lake, Mossing Lake
- Point Lake: Thinner Lake, Christine Lake

In accordance with the Waste and Wastewater Management Policy (2023), Burgundy acknowledges that the receiving waters listed above do not consist of the entire Receiving Environment and that terrestrial components making up the natural environment are also included.

Each Annual Seepage Report will be accompanied by a table that lists past and current seeps of potential concern, new or updated response actions, and status.

Burgundy will work with the Inspector to determine appropriate adaptive management responses to identified seeps of potential concern and in the instance an exceedance of EQC should occur. During this process the Board will be notified of any EQC exceedance from a Seep. The following past examples of adaptive management responses provide examples of possible responses that may be considered in future:

- Silt curtain installation
- Construction of sumps in the toe area of a WRSA
- Construction of rock and/or soil berms in the toe area of a WRSA
- Increased monitoring of select seepage flow and chemistry
- Re-location of upslope rock material

In 2014, the terminus of Seep-377 was investigated, and sampled. Three Hump Lake adjacent to locations where Seep- 367 and Seep-377 were believed to have potentially been entering the lake, although seepage could not be confirmed to be flowing into the lake. These results were presented in the 2014 Annual Report and showed no water quality concerns in Three Hump Lake.

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Appendix A: Detailed Geology

A Detailed Geology

This appendix addresses the geological characterization requirements of Clause G.2.a (i) of Licence W2009L2-0001 in providing a detailed geological summary (rock types, geology, and mineralogy) of each mine component. The quantities of each material mined and the resulting exposed surface area of pit walls was discussed in Section 2 of the main report and summarized in Table 2.2.

This Appendix first occurred in SRK (2007b). The information presented is based on existing information from the following previously published reports:

- *Waste Rock and Ore Storage Management Plan* reports (BHP 2000, 2002, 2003);
- *Acid/Alkaline Rock Drainage (ARD) and Geochemical Characterization Plan* (Norecol Dames & Moore 1997); and
- *Beartooth Acid/Alkaline Rock Drainage (ARD) and Geochemical Characterization Plan* (SRK 2003b).

A.1 Panda Pipe

A.1.1 Host Rock Geology

Surficial Geology

The Panda pipe had a pre-mining surface area of 3.1 hectares and was overlain by varying thicknesses of pebbles and gravel with lesser silt and sand of glacial origin. This material has been removed and deposited on the north side of the Panda/Koala Waste Rock Storage Area.

Bedrock Geology

The host rock for the Panda kimberlite pipe is granitic to dioritic intrusive rock, known as the Koala Batholith (BHP 2000). The predominant rock type is a medium-grained, medium grey quartz diorite. The rock contains approximately 60% oligoclase feldspar, 15% green biotite, 15% quartz, and lesser mafic minerals. The mafic mineral component of the rock is composed primarily of biotite with lesser amounts of amphibole and chlorite. Accessory minerals include sphene, apatite and sulphides. The sulphides are associated with or included in the epidote and biotite/chlorite. A fine-grained biotite-muscovite quartz tonalite is present but less common than the coarser material. The modal mineralogy of the biotite-muscovite tonalite is approximately 60% oligoclase feldspar, 20% quartz, 10% biotite and 3% of each K-feldspar and muscovite. Pyrite is very rare (<0.5%) and occurs as minute subhedral grains up to 40 microns in size when present.

No mineralogical effects (ie. alteration zones) from emplacement of the kimberlite have been observed in any of the host lithologies at Panda.

A.1.2 Kimberlite Geology

The Panda pipe comprises a diatreme filled with volcaniclastic kimberlite, which contains minor epiclastic kimberlite mudstone, siltstone and sandstone intervals. The epiclastic material occurs as isolated discontinuous lenses or blocks. The main volcaniclastic constituents include fine and coarse ash tuff, fine and coarse lapilli tuff, and tuff breccia. A very fine-grained fissile dark brown mudstone is present in very minor discontinuous horizons.

A.2 Koala Pipe

A.2.1 Host Rock Geology

Surficial Geology

The Koala pipe was overlain by unconsolidated sediments of glacial origin characterized by a complex interfingering of sediment lenses ranging from mud to gravel. In general, the uppermost part of the overburden sequence was comprised of well-sorted silt and mud approximately 1 to 2 metres in thickness. This material has been removed and deposited on the north side of the Panda/Koala Waste Rock Storage Area.

Bedrock Geology

The predominant rock type around the Koala pipe is a medium-grained biotite granite. Other rock types include granodiorite, granite gneiss and small patches of diorite. The granite gneiss is located about 80 m southwest of the pipe and contains up to 1% almandine garnets measuring 1 to 2 mm that form circular pods up to 3.5 cm in diameter. Also within the gneiss are rare occurrences of tabular tourmaline crystals up to 2 cm in length. Small patches of diorite are scattered throughout the area to the east of the pipe. The diorite contains trace amounts of almandine garnet and disseminated sulphides. Granodiorite is also noted on the east side of the pipe. Small patches of a fine-grained magnetic mafic rock, possibly a fine-grained diabase, were found on the ridge just east-southeast of Koala.

A.2.2 Kimberlite Geology

The stratigraphy of the Koala kimberlite pipe was complex. Several different kimberlite lithologies were encountered in the pit and are outlined in Table A.1.

Table A.1: Koala Kimberlite Stratigraphy

Unit	Composition	Matrix	Alteration	Comments
Black clay	Montmorillonite, mica, quartz carbonate, serpentine		Serpentinized	Xenoliths of small serpentinized, black rounded mudstone, biotite, epidote, granite fragments
Upper Sandy Kimberlite (quartz-rich)	Quartz, mica, olivine, serpentine mudst., silt & tuffisitic fragments	Serpentine, lesser clay minor carbonate	Serpentinized	Sharp contact with the overlying black clay Coarsing downward sequence
Olivine-rich Tuffisitic Kimberlite	Olivine content increase while quartz content decreases	Smooth homogeneous texture	White coatings and veinlets of serpentine	Granitic xenoliths in this zone are strongly altered, transition zone
Fine Lapilli Tuff (FLT) Kimberlite	Blue & yellow serpentine, talc olivine, phlogopite, zircon	Brown, microlitic serpentine and hydromica	Talc, serpentine rims	
Coarse Olivine Lapilli (COLT)Kimberlite	Fresh yellow and green Olivine rims of blue talc, brown lapilli	Soft, waxy, brown microlitic serpentine-phlogopite-clay	Olivine with rims of blue talc	Multiple coursing downward layers
Coarse Grained Tuff Breccia	Frags; granite, mudst, sandst ash, tuff/silty kimberlite, dunite			Up to 20% rock fragments, pebble to cobble size, with size increasing with depth
Upper Red-Brown Kimberlite phase	Blue serpentine after olivine fresh olivine, phlogopite	Microlitic, phlogopite serpentine, carbonate	Serpentine, carbonate	Less than 5% xenoliths in the rock
Black Muddy Tuffs	White-orange carbonate-talc after olivine, olivine, indicators	Clay rich serpentine – carbonate	Carbonate – Talc	Xenoliths 5-25%, include granite, peridotite macrocrystic kimberlite, underlying is mudst – siltstone-sandstone sequence
Coarse Olivine Tuffisitic Kimberlite Breccia	Olivine crystals, serpentine after olivine, mica, indicator minerals	Brown matrix of soft phlogopite serpentine and carbonate	Minor carbonate	Wedge shaped Unit – interbedded with Silty Kimberlite, fine lapilli tuffs interbedded with Silty Kimberlite
Lower Sandy Kimberlite	Mudst., Sandst., Siltst.	Kimberlite sandstone		Extremely variable/contacts irregular & distorted
	Organic Rich Mudstone			Organic material make up 20% of the mudstone
	Mudstone and Silty Kimberlite	Clay minerals and waxy serpentine	Talc/serpentine rims on Olivines	Interbedded with intervals of brown clay rich sandy kimberlite
Lower Coarse Olivine Lapilli Tuffs Kimberlite	Light green lapilli Tuff Kimberlite	Soft, microlitic matrix of olivine serpentine	Moderate – strong serpentinization of olivine	Granite xenoliths make up 10-15% of the rock
Tuffisitic Kimberlite/Tuffisitic Kimberlite Breccia	Dark green olivine with microcryst of minor serpentine	Olivine rich matrix	Accretionary rims	Macrocrystic Kimberlite, 25% composed of 0.5 – 4mm Olivine. Very competent

Notes: Table is reproduced from BHP (2000)

A.3 Koala North Pipe

A.3.1 Host Rock Geology

Surficial Geology

The surficial geology is similar to that of the Panda and Koala pipes. Surficial material has been removed and deposited on the north side of the Panda/Koala Waste Rock Storage Area.

Bedrock Geology

The host rock for the Koala North kimberlite pipe is a quartz diorite/biotite granite, which is generally unaltered to weakly altered. Alteration consists of minor argillic alteration of feldspars and the development of epidote and chlorite within the rock mass and along discontinuities.

A.3.2 Kimberlite Geology

The Koala North kimberlite pipe has a very regular “carrot-shaped” body with steep walls (83-88°). In plan view, the pipe is semi-circular with irregularities.

The two major kimberlite lithologies mapped within the Koala North pipe are the crater facies kimberlite: consisting of mostly ash-rich tuff with minor amounts of olivine-rich-tuff and the volcanoclastic kimberlite. A brown to black serpentized mudstone was found occasionally as erratic sand blocks in the kimberlite, and at the contact zones around the pipe. The sand blocks are weakly cemented by calcite and have a maximum dimension of a few metres. The contact zones within the kimberlite can vary from 0.5 m to approximately 7 meters in width, and commonly contain greater proportions of xenolithic material such as granite boulders.

A.4 Beartooth Pipe

A.4.1 Host Rock Geology

Surficial Geology

The Beartooth pipe was overlain by 13 to 19 metres of glacial till which consisted of boulders and gravel (50-70%) with lesser sand (10-30%), silt (0-10%) and clay (0-10%) of undifferentiated glacial origin. The sand-sized component was composed of angular to sub-rounded quartz, feldspar and flakes of biotite derived from the massive surrounding biotite granite. This material has been removed and deposited on the east side of the Panda/Koala Waste Rock Storage Area.

Bedrock Geology

The major host rock types at the Beartooth kimberlite pipe are biotite granite and diabase, and are thought to be the same rock hosting the neighbouring Panda pipe. The host rock also contains a small amount of metasediments as rafts or lenses within the granite. A description of each of these rock types is provided below.

Biotite Granite

The biotite granite is medium- to coarse-grained, weakly foliated to massive, and ranges in colour from white to grey. It has an average composition of 40% quartz, 45% feldspar and 15% biotite. In weakly altered zones, 1% to 3% pervasive epidote alteration may be present, as well as minor plagioclase alteration and localized hematite staining near fault zones, as noted by minor infilling by clay gouge. Sulphide minerals are absent or occur at trace concentrations in the biotite granite.

A hornblende-enriched phase of the biotite granite (hornblende biotite granite) occurs in the northwest corner of the pit area. This light grey, medium-grained, massive to weakly foliated rock is composed of 10 to 15% hornblende, 5 to 10% biotite, 30% quartz and 50% alkali feldspar. Fine-grained zones of more mafic rock up to 30 cm by 50 cm in size are present in places. Epidote alteration was not observed in this rock. The contact between the two granite phases is marked by a 5 to 10 m wide steep-walled gully. The adjacent biotite granite has been altered to a red color. Two to five centimetre wide quartz veins, oriented sub-parallel to the contact are present in both rocks up to 50 m from the contact.

Diabase

Delineation drilling around the pipe intersected a single diabase dyke. The dyke was intersected in drill hole BGT-28 at the downhole interval from 58.0 - 61.4 m which equates to a vertical elevation of 398-396 masl. Based on the geological fabric on the southern side of the pipe, an east-west orientation is speculated for the dyke.

Metasediments

The biotite granite host rock contained blocks of metasediments on the eastern and western sides of the pipe, and small xenoliths of metasediments in the northeast and southwestern areas. These appear to be related to preferential segregation of the biotite micas in response to a metamorphic event, such as shearing and fault movement.

These metasediments generally contain trace concentrations of sulphide minerals, but occasionally have concentrations of up to 2% at centimetre scale. BHP Billiton estimates that approximately 93,000 tonnes of metasediments will be mined from the pit (BHP, 2003b). These tonnages are considered insignificant as they represent less than 0.1% of the total quantity of waste rock to be produced from the Beartooth Pit.

A.4.2 Kimberlite Geology

The Beartooth pipe is roughly circular in plan view, with an area of 0.5 ha. Overall, the pipe is shaped similar to an upright bowling pin with the lower bulge occurring at 60-150 metres below the surface and identifiable by a unique internal stratigraphy within the kimberlite.

The crater facies of the Beartooth pipe is dominantly comprised of an olivine-rich ash tuff, generally grey-brown in colour and contains 15% to 45% glassy, pale green, partially serpentinized olivine macrocrysts. Granite, autolithic kimberlite, and mudstones compose 2% to 10% of the ash tuffs.

The majority of the remaining crater material is an ash-rich tuff characterized by fewer xenoliths and more common sorting and bedding textures. Centimetre-scale bedding is frequently well developed. Locally, the tuff contains abundant wood fragments.

The diatreme facies is mostly composed of tuffisitic kimberlite and tuffisitic kimberlite breccia. The tuffisitic kimberlite is medium-grained and contains 15-35% pale yellowish-green, 1 to 6 mm broken to sub-rounded olivine macrocrysts. The matrix locally varies in color from dark grey-green to black and is moderately serpentinized. Xenoliths (less than 15%) include mudstones, well-rounded unaltered granite cobbles, autolithic boulders to blocks of crater facies kimberlite and rare carbonized black wood fragments. Tuffisitic kimberlite breccia is defined as containing more than 15% xenoliths.

A distinctly different tuffisitic kimberlite characterized by a very competent, well crystallized greenish-black matrix has been identified at the deepest levels of the proposed pit bottom. This material hosts a predominantly sub-rounded fresh dark olive-green olivine macrocrysts and is absent of kimberlite autoliths, ash and fossil material.

A hypabyssal kimberlite occurs within the tuffisitic kimberlite but is volumetrically insignificant. The material is noticeably absent from even the deepest elevations of crater material. It is the most competent of the kimberlite units within the pipe.

A non-kimberlitic friable siltstone and conglomerate occurs as at least two erratic blocks in the crater and diatreme. The units are 4.5 and 7 metres thick respectively. Also, a dark-brown to black serpentinized kimberlitic mudstone occurs as rare discontinuous boulders to metre-scale blocks. This material is poorly indurated, laminated and fissile, generally lacking olivine and other kimberlite components.

A.5 Misery Pipe

A.5.1 Host Rock Geology

Surficial Geology

The Misery pipe was overlain by 13 m of glacial overburden and 3 m of lake sediments. The glacial overburden was composed of poorly-sorted gravel (65% to 95%) and sand (5% to 35%) derived from metasediments and granitic rocks. The lake-bottom sediments consisted of grey to black mud. This material has been removed and co-deposited in the Misery Waste Rock Storage Area. Topsoil salvaged in the advancement of Misery Pit and King Pond Dam was stockpiled on the northeast corner of the Misery Waste Rock Storage Area.

Bedrock Geology

The Misery pipe is located at the contact between Archean metagreywacke and granite (also known as two-mica granite). The granite is younger than, and intrudes into, the metasediments. A description of each of these rock types is given below.

Metasediments

The metasediments represents a metamorphosed Archean greywacke. It is weathered to a buff brown to rusty brown colour, and is commonly foliated. The metasediments contain about 40% biotite mica, 30% plagioclase feldspar, 15% quartz, and 19% sericitic mica, with the remainder made up of lesser mafic minerals. The metasediment has brown biotite and muscovite interlayered with feldspar and quartz. The micas form subhedral flakes up to 2 mm in diameter and are usually found in foliated masses that commonly contain less than 1% sulphides (pyrite, pyrrhotite, and minor chalcopyrite).

Granitic Rocks (Two-Mica Granite)

The granitic rocks generally weather white to light grey in colour and contain abundant primary muscovite. They consist mainly of intergrown plagioclase and quartz with scattered large muscovite and smaller biotite flakes. The mineralogy consists of 45-50% plagioclase feldspar (oligoclase), 25% quartz, 10-15% potassium feldspar, 10% muscovite and 3% biotite micas, with minor alteration minerals (chlorite, clay-sericite) making up the remainder. The plagioclase forms subhedral to occasionally ragged crystals up to 2.5 mm with minor clay-sericite alteration at the core and along fractures. The quartz forms subhedral to anhedral crystals up to 3 mm in diameter with textures suggestive of replacement of adjacent plagioclase at the margins. Textures vary from fine- to coarse-grained and pegmatitic, and equigranular to weakly porphyritic. There are essentially no sulphides present.

Diabase

The Misery diabase dyke trends approximately 45° and is located along the north-west edge, cross-cutting both the granite and the schist and is almost vertical with a slight dip southeast towards the kimberlite pipe.

The dyke is fine-grained with sub-ophitic textures and composed of mostly andesine, clinopyroxene and Fe/Ti oxides. The dyke consists of 45% plagioclase, 30% clinopyroxene, 10% amphibole, 5% chlorite, and 5% ilmeno-magnetite oxides. The remaining minerals are minor sericite, biotite micas, sphene and trace potassium feldspar and pyrrhotite. The plagioclase forms subhedral laths rarely over 1 mm in length and partly altered to sericite. The pyroxene forms sub- to anhedral crystals rarely over 0.75 mm and is partly altered to secondary amphibole, chlorite, and minor brown biotite. The Fe-Ti oxides form euhedral crystals less than 0.25 mm in diameter and are amassed in 0.5 mm aggregates that are partly oxidized. Minor sulphides (<0.5%) composed mostly of pyrrhotite and rare pyrite are associated with the oxides.

A.5.2 Kimberlite Geology

Misery kimberlites involve a complex, multiphase emplacement history and are comprised largely of pyroclastic fine-grained ash tuff to coarse-grained ash tuff.

The coarse-grained ash tuff has two different types of olivine; one type is subrounded to subangular, fresh to moderately serpentinized, and the other is a mass of white to cloudy-blue serpentized grains of olivines. The concentration of sulphides in the kimberlite is rarely as high as 0.5%. Thin pyritic rims commonly surround these serpentinized olivines, with more pervasive and complete pyritic replacement occurring in association with increasing degrees of olivine serpentinization. Pyrite grains up to approximately 2.5 mm to 3.0 mm are commonly observed, as is pyritic overprinting of granitic xenoliths within the pipe. Serpentinization is generally pervasive through the kimberlite groundmass and mineral grains. The kimberlite matrix is predominantly phlogopitic, with lesser disseminated wisps of sulphide and varying degrees of serpentine and clay alteration. Cr-diopside is conspicuously absent and ilmenite and chromite are rare.

Fine-grained ash tuff is mineralogically similar to the coarse ash tuff. Angular olivine exhibits varying degrees of serpentinization. Xenoliths and indicator minerals are usually rare. Garnet and chrome diopside are often angular and fragmented with less prevalent kelyphite rims.

Diatreme xenoliths include both host rock fragments (granite, biotite schist) and fragments derived from the pipe (kimberlitic mudstone and kimberlitic siltstone). The schist fragments are elongate and subparallel to schistosity. Rare potassium-rich granitic xenoliths are dissimilar to the host granite suggesting a deep source or foreign origin. The diatreme also hosts discontinuous horizons, lenses and blocks of epiclastic rocks. Crater facies sediments of Misery North consist of kimberlitic siltstone and kimberlitic mudstone. This unit consists of fine-grained silty-muds, rare serpentinized olivine and pyritic nodules. Indicator minerals are absent.

Kimberlitic dykes

Hypabyssal kimberlite dykes have been identified and are characterized by dark greenish-grey, aphanitic, phlogopite and clay matrix with pale glassy green, coarse-grained, sub-rounded to ellipsoidal olivine macrocrysts. Pyrope garnets are rare to common, and occur as broken to sub-rounded crystals. Chrome diopside is rare and occurs as broken grains and inclusions within the largest macrocrysts.

Contacts between dykes and host rocks vary in dip from vertical to 10°. Frequently, dyke margins are strongly iron stained with a serpentinized matrix. Similar alteration has moderately de-silicified, chloritized and saussuritised the host granite, and a bleached appearance is apparent over several metres adjacent to the contact with the dykes.

A.6 Fox Pipe

A.6.1 Host Rock Geology

Surficial Geology

Till veneer thickness in the Fox pipe area is generally less than 2 m and reflects the bedrock topography. The till is a compact diamicton with a silty, sandy matrix and contains pebbles, cobbles and boulders. An extensive boulder field lies to the south of Fox Lake.

Glacial sediments stripped from the bottom of Fox Lake consisted of silt and sand sized particles of quartz, feldspar, biotite, epidote, amphibole and traces of kimberlite indicator minerals. Gravel-sized rock fragments include biotite granite, hornblende granite, granodiorite and tonalite to quartz diorite, lesser amounts of biotite schist and diabase, and trace amounts of vein quartz and felsic to intermediate volcanic rocks. These materials were co-disposed with waste rock in the Fox Waste Rock Storage Area. Fine sandy and clay fraction materials were used to construct toe berms around the perimeter of the waste rock pile. Topsoil was stockpiled on the north side of the Fox Waste Rock Storage Area.

Bedrock Geology

Similar to the Koala, Koala North, Panda, and Beartooth pipes, the Fox kimberlite pipe was emplaced within the biotite granodiorite of the Koala Batholith. The main host rock types at the Fox kimberlite are a medium-grained biotite granite and diabase dykes. A description of each of these rock types is provided below.

Biotite Granite

The predominant rock type in the Fox area is a medium-grained biotite granite. The granite is generally unaltered, but weak to moderate potassic alteration occurs at the east end of the ravine near the Fox portal and also along the linear swamp subparallel to the ravine. Potassic alteration is identified by pink colouration to the rock. Green epidote also occurs in association with potassic alteration either as veinlets or pervasive alteration. Small (centimetre-scale) semi-circular black to greenish-black biotite- or chlorite-rich inclusions occur throughout the granite.

Sulphide minerals are rare in the granite occurring as small disseminated grains of pyrite, typically less than a millimetre in size. Disseminated pyrite and possibly chalcopyrite occur at higher concentrations (up to a few percent) in less than 50% of the centimetre-scale biotite-rich inclusions (on average, one inclusion is found for every 6 to 8 m of core). Carbonate minerals are rare in the granite and occur as fracture fillings of calcite.

Diabase

Three diabase dykes occur within the pit limits. The dykes are fine-grained with sub-ophitic textures and composed of mostly andesine, clinopyroxene, and Fe/Ti oxides. The dykes consist of 45% plagioclase, 30% clinopyroxene, 10% amphibole, 5% chlorite, and 5% ilmeno-magnetite oxides. The remaining minerals are minor sericite, biotite, sphene, and trace potassium feldspar and pyrrhotite. Rare pyrrhotite and very rare pyrite occur as small grains (less than millimetre-scale). Sulphide minerals are very rarely concentrated in centimetre wide segregated layers within the diabase. Carbonate minerals have not been observed in the diabase.

Like other diabase occurrences in the area, the rock does not break easily or form abundant fines when broken.

A.6.2 Kimberlite Geology

The Fox kimberlite pipe is roughly rectangular with dimensions of approximately 530 m (north-south) by 435 m (east-west). The pipe walls dip inwards with typical angles of about 75°, except the north wall which has a shallower dip.

The pipe contains distinctive crater and diatreme facies, which will be waste and ore, respectively. The crater facies is 100 to 150 m thick, defined by an assemblage of resedimented volcanoclastic kimberlites very similar to that observed in other EKATI kimberlites. The black to brown material is made up primarily of variable amounts of loosely packed, angular olivine grains set in a very fine-grained, mud-dominated matrix with lesser amounts of serpentine, phlogopite, and minor calcite. The small, altered olivine grains average 1 to 2 mm in size and comprise 25% to 35% of the kimberlite. Small mudstone clasts, granodiorite xenoliths and fresh to carbonised wood fragments are scattered throughout, but are most abundant at the top of the crater. Also, a small number (<1%) of shale lenses containing as much as 6% sulphides occur in the crater facies (Fox kimberlite typically contains <0.5% sulphides). An interval dominated by large granodiorite boulders (up to approximately 30 m) occurs in the lower part of the crater phase on the north side of the pipe. The contact between the crater facies material and the underlying diatreme phase is sub-horizontal and sharp with no evidence of intermixing.

The diatreme facies of the Fox pipe is a distinctive magmaclastic kimberlite, unique at EKATI in that it is the only phase identified to date that comprises consistently high (40% to 50%) proportions of xenolithic wall-rock materials, mostly as small fragments. The upper portion of the diatreme (upper 80 m) is a greyish-brown to brown tuffisitic kimberlite with a ground mass mineralogy similar to that of the crater facies kimberlite, but with 30% to 35% coarse olive grains (up to 5 mm). The rocks are described as highly fragmented and intensely clay-altered with a homogeneous distribution of olivine, very high concentrations (>40%) of altered, finely comminuted (<4 mm) granodiorite (mostly xenocrysts), larger (>4 mm) commonly angular granodiorite xenoliths (minimum 5% of the rock), an absence of matrix carbonate and pervasive olivine serpentinization. The intensely clay-altered Fox kimberlite contains high percentages of clay dominated by sodium and potassium enriched smectite/montmorillonite clays. Processing of this material requires addition of $CaCl_2$ to overcome issues of low slurry viscosity and clay entrainment (BHP 2005b).

Approximately 80 m below the base of the crater phase, the lower diatreme zone is a tuffisitic kimberlite breccia similar to the upper diatreme material, but with >15% xenolithic material and greenish-grey to light grey in colour due to a greater proportion of serpentine (up to 30%). Large granodiorite boulders (up to 30 m) occur sporadically throughout the diatreme facies to the limit of drilling (approximately 550 m depth). An interval dominated by the large boulders also occurs between the two diatreme zones.

Appendix B: Seepage Sampling Protocol

EKA WI 2113 08 SEEPAGE SAMPLING

Version:	3.0
Replaces:	2.0
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Scheduled Review Date:	2025-01-10
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Document Team Members:	Environment Team Leader – Environmental Management and Monitoring Environment Team Leader - Operations Environment Advisor – Operations Environment Advisor – Projects and Closure Planning
Document Owner:	Environment Advisor – Operations
Document Approver:	Team Leader – Environmental Management and Monitoring
Related Documents:	EKA WI.2107.02 ProPlus Calibration EKA WI.2113.40 Silt Fence Installation and Maintenance Seepage Sampling Protocol Version 2016 (SRK) 2017) EKA WI.2113.23 Surface Water Sampling EKA WI.2105.10 Environment Field Crew Check-ins EKA WI.2105.04 Working in Remote Areas EKA WI.2111.01 Crew Transport from Helicopter
Key Contacts:	Environment Team Leader – Environmental Management and Monitoring Environment Team Leader - Operations Environment Advisor – Operations Environment Advisor – Projects and Closure Planning
Change Requests:	Environment Advisor – Operations
Brief Description:	This work instruction describes sampling of surface water seeps at the Ekati Diamond Mine

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TASK DESCRIPTION:

This work instruction provides detailed instructions for seepage water sampling around the Waste Rock Storage Areas (WRSA) at the Ekati mine.

The protocol was originally prepared by SRK Consulting in August 2001 based on a previous BHP memorandum dated August 9, 2001. The latest approved version of the sampling protocol prepared by SRK Consulting was provided in the *2016 Waste Rock and Waste Rock Storage Area Seepage Survey Report* (SRK 2017, Appendix B1). In 2019, Dominion requested that SRK merge its version of the sampling protocol with its own work instruction. This version represents the updated protocol and supersedes SRK's (2017) sampling protocol and has also been updated following a review of the following guidance documents:

- Province of British Columbia, 2013. *B.C. Field Sampling Manual*. Part A and Part E.
- Northern Ecological Monitoring and Assessment Network (EMAN-North), 2005. Northern Water: A Guide to Designing and Conducting Water Quality Monitoring in Northern Canada. March 2005.
- Canadian Council of Ministers of the Environment (CCME), 2011. Protocols Manual for Water Quality Sampling in Canada. ISBN 978-1-896997- 7-0.

HSE INFORMATION / SAFETY RISKS:

- Wildlife encounters
- Remote work
- Poor communication
- Helicopter hazards
- Pedestrian/traffic interactions
- Adverse weather (hot, cold, or wet)
- Uneven terrain (slips, trips, and falls)
- Preservatives (chemical splash or spill)
- Water hazard
- Awkward and/ or heavy lifting

ADDITIONAL RESOURCES REQUIRED:

- Hard hat
- Safety glasses and Diphoterine emergency rinsing solution

- Steel-toed boots
- Appropriate clothing (including bug net/insect repellant)
- Reflective vest
- Safe touch vinyl gloves (free powder)
- Bear bangers and bear spray
- Handheld radios
- Environment safety kit
- In-Reach or satellite phone for work in areas with limited radio contact (e.g., Fox, Lynx)
- Ice cleats, snow gear (in the presence of ice or snow)
- Hand warmers
- Proper fitting backpack with carrying capacity for safety, personal, and sampling gear
- Additional personnel or equipment to act as wildlife spotter (full time) for certain areas and or conditions i.e., spotter and helicopter around Fox Pit
- Map with the past sampling locations
- GPS with station coordinates uploaded.
- Extra batteries
- Garmin In-Reach for field crew check-ins where radio reception is intermittent (i.e., Fox WRSA)

WORK PREPARATION:

	Task Description
1	**Related Documents for Review Prior to Sampling** a) EKA WI.2113.23 Surface Water Sampling – The surface Water Sampling work instruction covers various safety considerations around the use of acid preservatives and equipment requirements / handling. b) EKA WI.2105.10 Environment Field Crew Check-ins – The Field Crew Check-in work instruction outlines specific communication planning for field crews.
2	**Wildlife Deterrence and Monitoring Planning** a) Seepage samplers and associated monitors are required to complete the Wildlife Deterrence Operator Pathway including the two bear safety videos. Upon completion the field crews will be supplied with a wildlife deterrent kit. b) For Fox pit, an additional control to be implemented is to have a person (other than the pilot) monitor the field crews from the helicopter as it maneuvers around the pit. The monitor aids the pilot in suggesting possible locations to land to effectively observe the field crew and their surroundings with the intent to spot bears and other wildlife before they are encountered by the field crew. The monitor would

communicate any information regarding bear sighting to the field crew (and vice versa) enabling the crew to be picked up and avoid a potential bear encounter.

3

Equipment Checklist

a) Meters

i. Multi-meter complete with Oxidation-reduction potential (ORP) probe (calibrated as per EKA WI.2107.02 ProPlus Calibration) and (if ORP probe unavailable)
ii. Hand-held ORP meter (calibrated, check manufacturer's instructions)
iii. Back-up pH meter (calibrated, check manufacturer's instructions)
iv. Back-up electrical conductivity (EC) meter (calibrated, check manufacturer's instructions)

b) Sampling Equipment

i. Disposable plastic syringes
ii. Bottle labels with date, sample location, sample type and preservative, plus spare bottle sets
iii. Deionized water (DI water) from the lab (for field blanks)
iv. Sample bottles, preservatives, and BV Labs prepared travel blanks. Place each bottle set in a Ziploc bag. A bottle set typically consists of the following bottles:
   - One 1-L and one 500-mL plastic bottle for general parameters (unpreserved)
   - One 120-mL plastic bottle for total metals (pre-charged with nitric acid)
   - One 120-mL for dissolved metals (field filtered and pre-charged with nitric acid) One 40-mL glass vials for total mercury and one for dissolved mercury (pre-charged with hydrochloric acid).
   - One 250-mL plastic bottle for dissolved nutrients (field filtered and pre-charged with sulfuric acid)
   - One 250-mL plastic bottle (pre-charged with sulfuric acid) for total nutrients
   - One 40-mL glass vial for ammonia (unpreserved)
   - Two pairs of disposable Safe touch vinyl gloves (powder free)

   TPH and BTEX are collected at stations located on the south and west sides of the Coarse Kimberlite Rejects Storage Area (CKRSA). The following sampling bottles will be needed in addition to those listed above:

   - Two 100-mL amber glass bottles and two 40-mL vials with pre-charged sodium bisulfate preservative for TPH
   - Two 40-mL glass vials with pre-charged sodium bisulfate preservative for VOC (BTEX)
   - BV labs prepared travel blanks.

A radium sample must be collected at seep locations that are Final Discharge Points (FDPs) as part of the MDMER. The list of FDPs can be obtained from the Advisor. As of October 2021, May 2020, the seepage stations that are part of MDMER are Seep-019, Seep-081, Seep-373A, Seep-391* Seep-511 and 357. The following sampling bottle will be needed for the MDMER seepage stations in addition to those listed above:

- One 1-L bottle (unpreserved)
- *(* Seep-391 is only considered to be a Final Discharge Point if visible flow is coming from the Fox Waste Rock Storage Area to the Seep-391 location).*

c) Filtration Equipment

v. Disposable sterile Nalgene filtration units (kept in the laboratory at site, additional filters can be ordered through the warehouse – Ref: Filter Unit Nalgene Sterile Analytical 60184696/6200). Filters pore size of 0.45 µm.
vi. Vacuum hand pump (stored in the EFO area with the rest of seepage gear)
- Disposable syringe-type filters

4

Additional Equipment

a) Flow Measurement Equipment

i. Tape measure
ii. Stopwatch
iii. Bucket and 1-L beaker (marked with graduated volumes)
iv. Spare 60-mL or 125-mL sample bottle for poorly accessible flow (e.g., between boulders)

i. Other

i. Seepage field data sheets for recording observations
ii. Clipboard
iii. Waterproof field notebook
iv. Digital camera
v. Waterproof maps and GPS with coordinates of previous monitoring locations
vi. Extra batteries (AA for camera/GPS and 1.5V for back up meters)
vii. Cooler and ice packs if sampling with vehicle/helicopter support
viii. Pencils
ix. Rebar (for measuring permafrost depth)
x. Wooden stakes (for marking new seeps)
xi. Flagging tape (add to stakes if not easily visible)
xii. Aluminum station tags
xiii. Small white board or laminated piece of paper (to include seep number in photos)
xiv. Dry erase marker and permanent markers
xv. Ziploc bag of extra vinyl gloves
xvi. Ziploc bag with extra preservatives

Item	Task Description
	xvii. Watch xviii. Garbage bags
5	
WORK EXECUTION STEPS:	
Item	Task Description
1	**Job Hazard Analysis (JHA)** a) Complete a group JHA for initial sampling round (during freshet) and review with the Environment Operations Team Leader. Any new crew persons joining the sampling program after the initial session are required to review and sign off on the group JHA for the season as well. Questions regarding the group JHA should be directed to the Environment Team Leader or their designation. b) Each Sampler is required to complete their own personal JHA for each day for the duration of the sampling program. Personal JHAs should be completed separately for helicopter supported and truck-based sampling. Questions regarding the personal JHA should be directed to the Environment Team Leader or their designate.
2	**Wildlife Deterrence and Monitoring** Implement the controls discussed in section 4.2. If a bear is sighted in the field crews should notify the Team Leader as soon as possible and return to the nearest point of shelter (truck, or helicopter). No further work will be carried out without the approval of the Environment Team Leader or their designate
3	**Calibration** a) Calibrate multi-meter as per EKA WI.2107.02 ProPlus Calibration and back-up meters as per manufacturer's instructions. b) Record calibration information prior to sampling on a QA checklist form or in the Ekati SharePoint file. (Data XXXX<Sonde Calibration Records)
4	**Bottle Preparation** a) Take enough bottle sets for the day based on number of seeps sampled in the area in recent years, including spare bottle sets in case extra bottles are needed. b) Sample ID should also be marked at the sample station with permanent marking pen. Include the date in DD-MMM-YYYY format). c) Each station's bottle sets (in large Ziplock bags) should be clearly marked with permanent marker with station name (SEEP-###), and the date in DD-MM-YYYY format (e.g., 16-Jun-2022).

	d) At the end of the day or the next morning, labels should be created in MP5 based on the previous day's field sheets. Apply these labels to the collected bottle sets before making up new bottle sets for the current or next day.
5	**Identification of New Seeps** a) While walking the perimeter of the WRSAs check for new seeps. b) Double check using the GPS since seep Identifiers (Stakes, rebar. Flagging, etc.) may have been displaced by weather or wildlife. Note: If a new flowing seep is identified, use a wooden stake and flagging to identify the location and record the GPS co-ordinates. Write a new seep number (next seepage number to be used is determined based on the last new Seep from the previous year) on an aluminum label tag and attach to the base of the stake (e.g., SEEP-541). Record and sample as below. C) Emails Ops Advisor and Update New Seep Names and Duplicate Reference Sheet.xlsx and EkatiSeepageSamplingLocations.xlsx
6	**Selecting the Sampling Location of Existing Seeps** a) If the location has been monitored previously, identify the exact sampling location using the previous field notes, GPS coordinates and/or stakes marking the sites. b) **If water is flowing at the exact sampling location**, select this location for sampling and tie a new piece of flagging to the stake. Write the date on the stake in permanent marker. c) **If water is not flowing**, record the condition of the old sampling location, and determine a new sampling location using the following criteria: i) Monitor a 30-metre radius from the staked SEEP location (see Figure 1 below). Choose the nearest location that is along the same flow path (i.e., surface water can be seen to flow toward the new location). New locations at a sampling station along the flow path are to be labelled with a letter after the sample station ID (e.g., SEEP-002A). If the new station is not definitively along the same flow path, a new ID should be used (e.g., SEEP-098). New locations should be identified as for new seeps above (i.e., staked, flagged, tagged, and GPS coordinates recorded). ii) Any deviations from the previous sampling location should be recorded. iii) For all subsequent sampling rounds, return to the original sampling location. iv) In the example above, this would be location SEEP-002. If water is not flowing, sample the most frequently sampled secondary sampling location (e.g., SEEP-002A). Note in the above example, SEEP-002 and SEEP-098 are separate seeps.

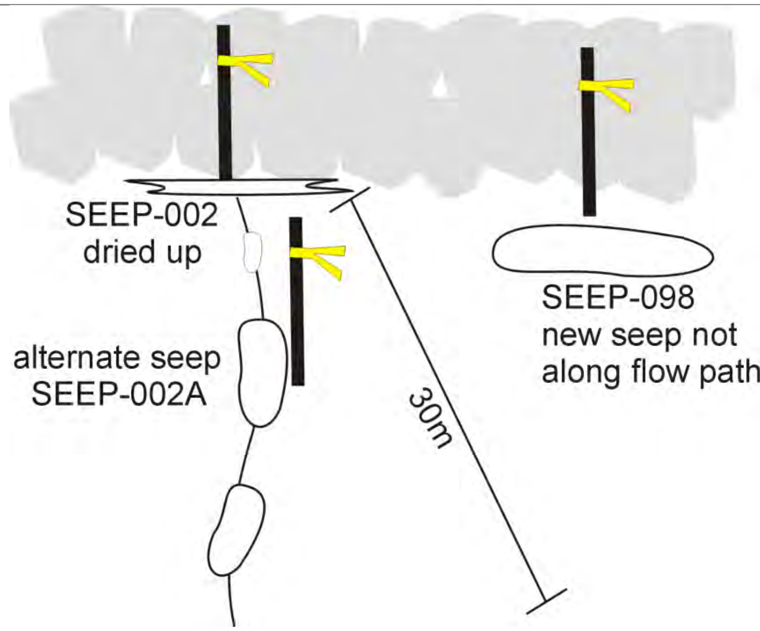

Figure 1: Selection of alternate sample locations for dried up seeps

d) **If there are multiple locations of water flowing from an established seep** (e.g., if a seep is much larger than when previously sampled), select the largest flow path for sampling. Record the GPS coordinates, or distance and compass direction from the original location in the field notes. For all subsequent sampling rounds, return to the original sampling location.

7 ## Seep Identification Numbers

a) **For locations covered by waste rock or other types of fill:** If the station was covered by waste rock give the new station an alternate ID (e.g., A or B etc.) if it can be determined that the new station is on the same well-defined flow path as the original station and is within 30 m from the original station. If not, the location should be given a new number (see Figure 2) regardless of the distance to the old location.

b) **For groups of seeps:** When several seeps are established in close proximity, they should each receive unique sample IDs. If the original seep has dried up, follow the procedures outlined in Section 6 (Figure 1).

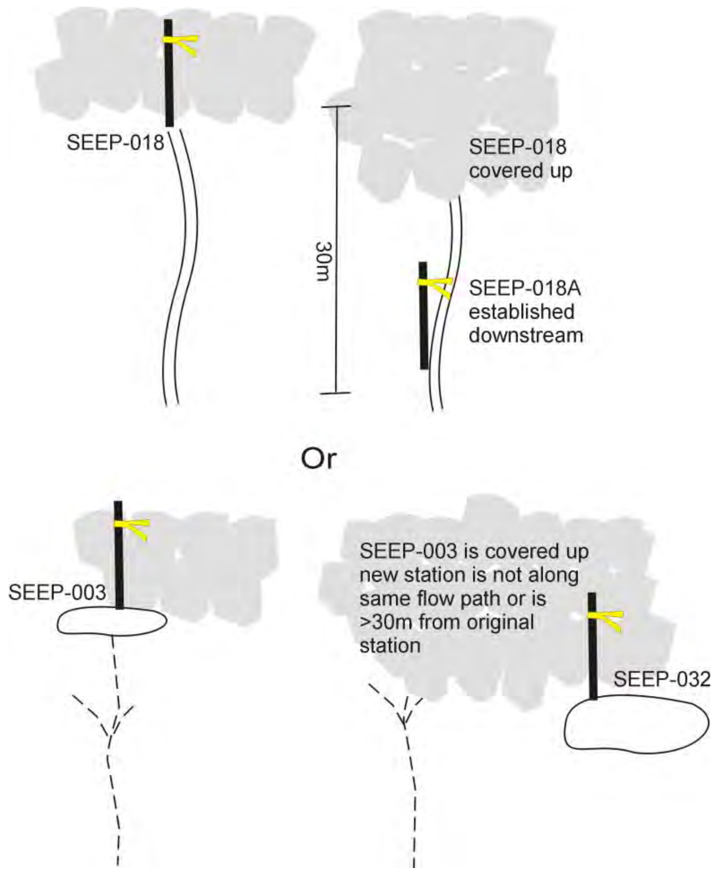

Figure 2. Naming seeps covered by waste rock

8 Seeps Entering the Aquatic Receiving Environment

a) Seeps that have the potential to flow into the aquatic receiving environment (lakes) should be followed downstream until the seep either reaches the aquatic receiving environment, or the seep can no longer be tracked visually or audibly (e.g., the seep has dried up or dispersed into the sub-surface).

b) If a seep is found to be flowing into the aquatic receiving environment, that seep is to be sampled immediately before it enters the aquatic receiving environment ('end of pipe'). This sample shall follow the same naming conventions as discussed above in Section 6.

c) If uncertainty exists as to where a seep enters the aquatic receiving environment (e.g., can be heard underground, but not sampled), the aquatic receiving environment should be sampled immediately adjacent to its suspected entrance into the aquatic receiving environment.

	d) Estimates of flow volume should be made as part of the investigation (see below).
9	**Record Field Observations** If flow is absent, record 'nv' (none visible), 'nm' (not measurable – i.e., flow is too slow or diffuse to measure), or 'du' (dried up.) It is not necessary to record any other observations. If flow is present continue as follows: a) Use the field data sheet to record observations (included in Appendix A). b) Record the proportion of ground covered by snow (if present). b) Record the general weather conditions (overcast, sunshine, rainfall, snowfall, windy/calm, general wind direction) and the air temperature. c) Note precipitation/snowmelt from the previous week. d) Record the depth to permafrost using established methods (rebar driven into ground in 3-4 spots around sampling location and maximum depth measured and recorded). e) Record the time. f) If a silt curtain (or other mitigation method) is installed, record general state (if sediments are trapped and if maintenance is required). g) Photograph the seep (ensure no glare/reflection and check photos are not too light/dark); use white board or laminated paper and dry erase marker to label seep for photo identification purposes: i. At the sample collection point ii. Upstream iii. Downstream h) Photograph the silt fence if there is one: i. Upstream ii. Downstream iii. Sediments trapped.
10	**Collect Water Sample (General Guidelines)** a) A water sample may not be able to be collected if there is no flow. b) Collect flow and field measurements (Sections 15 and 16) after water sample collection to avoid disturbing sediments. **c) Wear a new pair of vinyl gloves for each seep sampled (and for blanks or duplicates collected at the same seep). This is imperative when collecting multiple samples at one site, for each bottle set a new pair of vinyl gloves should be used. Care should be taken when donning and doffing gloves to not introduce contamination to other bottle sets.**

	d) Approach the sampling location from downstream and **stand downstream of the sampling location during sample collection to avoid disturbance.** Avoid collecting in stirred-up water. e) Mark dissolved and total metal bottles and caps with D or T with permanent marker to avoid confusion. Follow the instructions in Section 12 to collect and filter the dissolved parameters. f) Avoid touching the lip of the bottle and inside of the caps. If these are compromised, dispose of sample, and bottle and collect a new sample. g) For quality control purposes, note which person is collecting each sample. h) Note when and where field blanks were prepared and where duplicates were collected. **i)** Transfer samples to a cooler or refrigerate as soon as possible. Store the samples at 4°C until shipment.
11	**Collect Samples for General Parameters, Total Metals, Total Mercury, Total Nutrients and Radium (unfiltered samples)** a) Collect the general parameter, total metal samples by placing each bottle in the water without disturbing the sediments and point the mouth of the bottle upstream. If the seep is too shallow to fill the general parameters bottles, use a plastic syringe to fill it. Fill the general parameters bottles (1 x 1-L and 1 x 500-mL plastic bottles) and total metals bottle (1 x 120-mL plastic bottle). b) For the pre-charged bottles (total nutrients and total mercury), use a plastic syringe to fill the total nutrients bottles (1 x 250-mL plastic bottle and 1 x 40-mL glass vial) and the total mercury bottle (1 x 40-mL glass vial). c) Fill the radium bottle (1 x 1-L plastic bottle without preservative - if radium analysis is required as part of the MDMER, see section 4.1 iv), a syringe can be used if the water is not deep enough.
12	**Collect Filtered Samples for Dissolved Phosphorus, Dissolved Metals and Dissolved Mercury** a) For collecting the dissolved phosphorus, dissolved metals, and mercury samples, fill an extra 500-mL or 1-L plastic (unpreserved bottles), filter following the next steps and then add to the correspondent pre-charged bottles. b) Sample filtration: • If it is possible to filter in the field, follow steps below at the sample site. If impractical due to cold temperatures, excessive wind or insects, or samples that clog the filter easily, complete the filtration steps in the field laboratory on the same day as they are collected. If a sample has too much TSS/sediments, and the filters get clogged fast, the sample can be sent to be filtered by BV labs. Indicate this on the bottle and on the CoC.

	• Remove the plunger from a fresh syringe and attach a new filter to the discharge end. • Fill the syringe with fresh sample water from one of the unpreserved sample bottles. • Re-install the plunger and proceed to filter the required samples as per normal procedures, ensuring the syringe or filter do not contact the sample bottle. • As the filter becomes plugged, effort to push water through will increase. Do not struggle to get every drop out of each filter as this will lead to fatigue and potential blisters. Change filters and keep track of the number of filters used per sample site (not per bottle). • Record the color of the filtered sample and any sediment trapped on the filter.
13	**Collect Unfiltered Samples for BTEX and TPH** a) For TPH, the bottles contain preservative (sodium bisulfate). Care should be taken during sampling not to lose the preservative. Use a clean syringe (fresh out of package) or the general parameters to fill these bottles if required. If using the general parameters bottle, ensure not to touch the lip of the total metals bottle to the TPH bottle. b) For BTEX, the sample vials also contain sodium bisulfate preservative. Do not submerge the vials in the flowing stream, as this may cause the preservative to be lost. Use a syringe or the general parameters bottle to fill the vials. If using the general parameters bottle, ensure not to touch the lip of the bottle to the lip of the vial. Fill the vials completely and avoid air bubbles (i.e., leave no head space).
14	**Collect Field Blanks and Duplicates** Field blanks and duplicates samples collected should be recorded on the field data sheet. a) Field blanks are prepared in the field and are collected in exactly the same way as seepage samples except that the source of the water is not the seep, but instead metals-free DI water from bottles supplied by the laboratory and carried into the field. See Table 1 for sample IDs for labels. Collect 10% of field blanks per batch of samples shipped during each monitoring round. b) Travel blanks are prepared by the laboratory. Travel blanks should be taken to the field in the same way as the bottle sets. Travel blanks are not opened in the field. The travel blanks should be set aside while sampling and then labelled and shipped with the samples. Each shipment should have one travel blank set in it. c) Duplicates are collected in exactly the same way as regular seepage samples. The duplicate sample should be collected by the same person that collected the original sample and at stations with a reasonable amount of flow. Collect 10% of duplicate samples during each monitoring round. See Appendix B for Sample Labelling Key. As an example, if location SEEP-001 is being sampled the duplicate would be labelled SEEP-165.

Table 1. Quality Control Blanks

Notes:

Blank samples should be indistinguishable from conventional samples. The label should not contain the word "Blank". The date must also be recorded on the sample bottle.

Type of Blank	Label	Description and Purpose	Collection Frequency	Preparation
Travel blank	SEEP-2n1	Bottles of DI water are provided by the laboratory to monitor possible effects from the bottle materials and potential contamination whilst in transit	One per sample shipment	1. The bottles must not be opened 2. The bottles are taken into the field
Field blank	SEEP-2n2	Bottles of DI water are used to prepare field blank samples in the field. The purpose of the field blank is to monitor possible contamination from airborne particulate and contamination, which occurs during the filling of sample bottles and the preparation of the dissolved metals blank.	One set every batch of ten samples (or part thereof).	1. A TPH and BTEX blank should be included if these sample types are being collected
Site laboratory blank	SEEP-2n3	Bottles are filled DI water to monitor possible contamination from sampling equipment	One set per sampling round is required if	1. Repeat the same procedure as the "Field Blank"

		(filtering equipment) under site lab conditions.	any samples are filtered in the site lab.	

Each sampler should receive a unique identifier “n” which is to be inserted as shown into the sample label.

15 **Collect Field Measurements**

a) All field measurements of water should be conducted by placing the probe directly in the flow. Adjust the probe to ensure no bubbles are trapped as this will affect results. If the water is not deep enough to adequately submerge the probe do not push the probe into the sediment, instead, transfer sufficient water from the seep into a beaker (rinsed with water from the seep). If necessary, use a plastic syringe to fill the beaker.

b) Record the pH, EC, and ORP of the water. If the reading is unstable, wait and record after two minutes.

c) Record the water temperature.

d) Note the approximate color of the water in the sample bottles by placing a piece of white paper behind the water and describing the color (e.g. colorless, yellow, and brown).

e) Note the absence or presence of cloudiness (turbidity).

f) Record the color of any coatings or precipitates on rocks/vegetation in/adjacent to the seep.

g) Record any odors.

h) For a pool, measure the depth of the deepest part of the pool.

i) Measure the depth to permafrost (or rock bottom) by pushing a rebar into the pool bottom until hitting refusal.

j) Subtract the total depth to permafrost from the pool depth to get the depth to permafrost and record on the sheet. If rock bottom is encountered before permafrost, record this instead.

16 **Collect Flow Measurements**

a) Estimate the flow by the most appropriate method (described below). Flow should ideally be obtained by measuring flow velocity through a measured cross-section of the channel.

   i. For low flow volumes in irregular channels, identify the location where the flow is best defined. Measure the width and typical depth of the flow. Estimate the flow by taking three measurements of the time taken to travel a fixed distance by a floating object (such as a small stick).

	ii. If the flow (or a portion of it) can be directed into a container of known volume (i.e., 1-L plastic beaker or a bucket) record time it takes to fill beaker/bucket using a stopwatch and record volume filled. Repeat two more times. Estimate portion of flow captured (e.g., 50%, 90%), considering separate streams arising from one seep. b) Record method used to obtain flow. c) Calculation of flow is done as follows: i. For floating object method: a. Estimated flow (L/s) = ((l x w x d)/t) /1000 where l is length of channel transect (in cm), w is width of channel (in cm), d is depth of channel (in cm) and t is time for the object to float down the length of the transect (in seconds). ii. For bucket/beaker method: a. Average total flow (L/s) = average(v/t) / c\\ where average is the arithmetic mean calculated from three individual flow measurements, v is. volume filled (in liters), t is time for beaker to fill to specified volume (in seconds) and c is capture (in % as decimal).
17	**Completion of Sampling** a) Enclose each sample set in individual Ziplock plastic bags and label the bag with the name of seep and sample date. Wrap all glass sample bottles (mercury vials, ammonia vials BTEX, and TPH) in bubble wrap. b) Place samples in the cooler as soon as possible. c) On the field sheet, record list of samples collected at the station (this serves as a checklist). d) Retain all disposable items in a garbage bag. Upon returning to the field lab, plastic filtration units should be put in recycling bins; empty preservative bottles should be returned to the laboratory, and other garbage should be disposed of. e) At the end of the day, check pH meter against calibration standards and note any drift on the QA checklist form. Also note which meters were used that day.
18	**Sample Submission and Clean-up** a) Pack and label samples for shipping. Create cooler labels and COC forms for shipping. b) Log sample/station information and field measurements into the database c) Add any new seeps to the MP5 database including GPS co-ordinates. d) Complete vendor slip (in Shipping Order book) for shipping. e) Clean reusable field equipment using DI water as necessary and put it back in appropriate storage locations. f) Dismantle any bottle sets and place clean, unused bottles back in the Environment Field Office bottle room. g) Store probes back in appropriate locations.

	h) Order more bottles, ice packs, travel, and field blanks if necessary.

Table 2. Sample Container, Preservation and Hold Times for Water and Effluent Samples

Type of analysis	Container type	Preservation	Hold time (days)	Min. Sample	Comments
Total alkalinity (as $CaCO_3$), acidity (as $CaCO_3$), Total hardness (as CaCO3)	0.5 L plastic	none	14	300 mL	
Turbidity		none	3 (1)		
Chloride, Fluoride		none	28		
pH		none	0.25 h (1)		
Sulphate		none	28		
Conductivity		none	28		
Nitrate (as N)		none	3 (1)		
Nitrite (as N)		none	3 (1)		
Ortho-Phosphate		none	3		
Total Dissolved Solids (TDS), Total Suspended Solids (TSS)	1 L plastic	none	7	600 mL	
Total Organic Carbon	250 mL amber glass	Sulfuric Acid pre-charged	28	240 mL	
Total Kjeldahl Nitrogen (TKN)					
Total Phosphorus					
Phosphorus, Total Dissolved	250 mL amber glass – field filtered	Sulfuric Acid pre-charged	28 (2)	90 mL	
Metals (Total)	1 x 120 mL plastic bottle	Nitric acid	180 (after preserved)	30 mL	
Metals (Dissolved)	1 x 120 mL plastic bottle	Nitric acid	180 (after preserved) (2)	30 mL	
Total and Dissolved Mercury	2 x 40 mL glass vial (Dissolved Hg to be field filtered)	Hydrochloric Acid pre-charged	28 (2)	Full volume required	
Unionized Ammonia	40 mL glass vial	none	3	15 mL	Fill to rim – no headspace
BTEX	2 x 40 mL glass vial – no headspace	Sodium Bisulfate pre-charged	14	Full volume required	
TPH	2 x 100 mL amber glass	Sodium Bisulfate pre-charged	14	Full volume required	Fill to rim – no headspace

Notes:

(1) Holding time is 2 days except for British Columbia as per BC Ministry of Environment Laboratory Manual (2013) which is 3 days.
(2) Samples must be field filtered before preservation.

GENERAL REMARKS
Ensure that the correct bottles are used for the seep if they have been previously labelled.
Ensure that the correct bottle is used for the total/dissolved metals sample (if the bottles/samples are switched this will be reflected in the results).
This is equally important for the travel blanks and field blanks (i.e., label correctly and the travel blank is NOT opened or preserved).
If you are not sure about the procedure, contact the Team Leader before proceeding.
Access to many of the seep sites typically involves travel over rough terrain. Allow time to access the sites safely and be cautious when traversing uneven ground. Avoid climbing down steep sides of roadways if better access is gained either side and it only means walking over tundra. Utilize packs to carry gear vs. having both hands full of equipment.
For the Fox WSRA, follow the safety protocol and in collaboration with the Site Team Lead determine how to access the area.

Versioning and revision tracking

REVISION NUMBER	PAGE NUMBER	CHANGE EFFECTED	DATE OF CHANGE	WHO MADE THE CHANGE

BURGUNDY
DIAMOND MINES

Appendix

1.0 Approval signatures record

ROLE	NAME	SIGNATURE	DATE
REVIEWER	Feyi Adebayo		
DOCUMENT OWNER	Tania Robitalle/Landon Murphy		
DOCUMENT APPROVER	Kurtis Trefry		

Appendix C: Pigeon WRSA Updated Design Report

Pigeon Waste Rock Storage Area Updated Design Report Revision 1
Ekati Diamond Mine, NT



PRESENTED TO

Dominion Diamond Ekati Corporation

OCTOBER 19, 2017
ISSUED FOR USE
FILE: E14103068-03

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EXECUTIVE SUMMARY

Dominion Diamond Ekati Corporation is undertaking development of the Pigeon Pit at the Ekati Diamond Mine. Waste rock generated during pit development will be placed in a land-based waste rock storage area (WRSA), consistent with existing practice on site.

A site overlying Big Reynolds Pond was chosen as the preferred storage area for the original Pigeon waste rock. The WRSA is contained within a catchment area which drains to the north end of the Long Lake Containment Facility. The WRSA has been designed to minimize ponding adjacent to the pile, directing runoff around it.

A portion of the overburden soil generated during initial pit development has been stockpiled to the east of the WRSA for use in future capping of the WRSA as part of reclamation activities.

The waste rock from Pigeon Pit is expected to be composed primarily of potentially acid generating (PAG) material, including mixed granitoid and metasediment rock that cannot be easily differentiated from non-acid generating (NAG) granite. As a result, all waste rock from Pigeon Pit is planned to be treated as PAG material. The proposed cover for the original WRSA comprises till overburden soil overlain by clean granite. This will provide thermal cover while reducing the required quantity of clean NAG granite.

The Pigeon WRSA contains waste rock generated from Pigeon Pit development and was originally designed by Tetra Tech (Tetra Tech EBA 2014). The original WRSA design can accommodate 13,445,000 m^3 of waste rock; however, current mine planning requires additional storage capacity in the Pigeon WRSA. It is required that the WRSA to be expanded to incorporate an additional 11,500,000 m^3 of waste rock, for an aggregate containment volume of 24,945,000 m^3. The additional waste rock is planned to be stored in an extended area of the original WRSA.

For the original WRSA, thermal analyses were carried out to predict the behaviour of potential unfrozen zones within the WRSA pile and the proposed WRSA cover. Both 1D and 2D models were simulated through the WRSA pile. Global warming, potential internal heat generation due to sulphur oxidation, and progressive waste rock placement were considered in the modelling.

Thermal analyses indicate that two cover materials will provide sufficient cover to maintain the active layer within the cover material. The majority surface of the waste rock pile at closure will have a 3 m till cover overlain by 1 m of granite waste rock. The remaining surface around the toe of the slopes of the waste rock pile will be covered by 5 m of granite waste rock. Freeze back of the waste rock material is expected to occur within eight to twelve years depending on the degree of internal heat generation from the PAG material. It is assessed that the findings from the thermal analyses for the original WRSA remain valid for the WRSA expansion.

Stability analyses were conducted to evaluate the WRSA pile stability during stage-construction, long-term before closure cover placement, and after closure cover placement for the original design before the pile expansion. Additional stability analyses were carried out for the pile expansion. The analysis results suggest that the WRSA pile meets the required minimum factors of safety adopted for the design.

The design has been reviewed by the Wek’èezhìi Land and Water Board (the Board). In their Reasons for Decision dated September 22, 2017 the Board approved the pile expansion but not the proposed cover design. As of this time the final cover design for the Pigeon WRSA has not been approved.

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LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Dominion Diamond Ekati Corporation (DDEC) and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Dominion Diamond Ekati Corporation (DDEC), or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech's Services Agreement. Tetra Tech's General Conditions are provided in Appendix A of this report.

1.0 INTRODUCTION

1.1 General

Tetra Tech Canada Inc. (Tetra Tech) was retained by Dominion Diamond Ekati Corporation (DDEC) to complete an expansion design for the Pigeon waste rock storage area (WRSA), at the Ekati Diamond Mine. The Pigeon WRSA contains waste rock generated from Pigeon Pit development and was originally designed by Tetra Tech (Tetra Tech EBA 2014).

The original WRSA design can accommodate 13,445,000 m^3 of waste rock; however, current mine planning requires additional storage capacity in the Pigeon WRSA. Tetra Tech was asked to expand the pile to incorporate an additional 11,500,000 m^3 of waste rock, for an aggregate containment volume of 24,945,000 m^3.

The design presented herein has been reviewed by the Wek’èezhìi Land and Water Board (the Board). In their Reasons for Decision dated September 22, 2017 the Board approved the pile expansion but not the proposed cover design. At present time the final cover design for the Pigeon WRSA has not been approved.

1.2 Existing Design

Waste rock and overburden generated during pit development is being placed in a land-based storage facility overlying Big Reynolds Pond, as shown in Figure 1. A temporary till stockpile is located east of the WRSA for use in future reclamation work. The original WRSA design was documented in Tetra Tech EBA (2014). The Big Reynolds Pond was dewatered in the summer of 2014. The 3 m thick granite base pad placement was placed between May 2014 and November 2015. The waste rock deposition began in February of 2015.

The waste rock from Pigeon Pit comprises a combination of mixed metasediment, waste kimberlite, and xenolith. Some of the material is potentially acid generating (PAG) and cannot be easily differentiated from non-acid generating (NAG) granite. As a result, all waste rock from Pigeon Pit is treated as PAG material for waste rock management.

The original pile was designed with three benches to a maximum elevation of 513.0 m. Bench widths were widened from typical Ekati waste rock piles to provide long-term stability and a resultant closure slope of 3.2H:1V. The side slope was required to accommodate the proposed cover design. A granite base layer was provided to reduce direct contact of PAG rock with natural ground and to encourage permafrost development inside the pile.

Thermal analyses were completed as a part of the 2014 report to predict the thermal behaviour within the WRSA pile and develop a proposed closure cover system. The general cover design comprises 3 m thick till overburden covered by a 1 m thick granite waste rock cap. Thermal modelling predicted the aggradation of permafrost in the pile within eight to twelve years follow completion of construction.

2.0 WASTE MATERIAL AND CAPACITY REQUIREMENTS

Design waste rock volumes were provided by DDEC. Current pit planning shows a storage deficit in the original WRSA design. DDEC requested the pile capacity be expanded by 11,500,000 m^3 to accommodate the deficit and provide contingency for operations.

The waste rock in the expansion will be similar to the original rock composition anticipated from the 2014 design and includes mixed metasediment, some waste kimberlite, xenolith, and some overburden materials.

The existing temporary till stockpile has a volume of 1.97 million m^3 (based on December 2016 survey data).

3.0 PILE GEOMETRY AND LAYOUT

3.1 Design Criteria

The proposed waste rock pile expansion was designed using the following criteria:

- Pile footprint, cap material, and distance to Pigeon Pit should be minimized;
- The pile should be located in a single catchment or sub-catchment to route any potential seepage to a single location and to simplify discharge monitoring;
- Drainage from the pile should be directed towards the LLCF;
- The waste rock at placement is assumed to have an angle of repose of 37 degrees (or a bench side slope of approximately 1.33H:1V during placement before closure);
- Bench heights should not exceed 15 m; and
- Bench widths should be spaced to provide the pile long-term stability and allow grading to a closure slope of 3.2H:1V or flatter .

3.2 Expansion Layout and Configuration

The proposed pile expansion extends north and southeast of the original pile design, as shown in Figures 1 and 2. Two cross sections of the pile are shown in Figure 3. Typical design sections of the proposed WRSA expansion are shown in Figure 4.

The runoff of the proposed pile expansion will drain towards the north end of Cell B in the LLCF. The pile shape has been designed to promote runoff flow around the pile to the practical extent possible. However, some local pooling may occur on the east side of the pile, and at isolated locations along its south side toe. When required, minor earthwork (channelling or filling) can be conducted during operation to promote drainage around the pile perimeter.

The designed WRSA footprint before the closure cover placement is approximately 655,000 m^2 including the base pad. A 3 m thick layer of NAG rock (granite) is designed to be placed at the base to encourage permafrost aggradation and separate PAG material from the tundra. The pile has been designed with up to six benches with a maximum bench height of 15 m and a typical bench width of 25 m (with the third bench width of 25 m to 60 m and the fifth bench width of 40 m to 60 m for pile overall stability). The pile height reaches 58 m to 80 m above the original ground surface (including closure cover placement), as measured from the edge of the pile to the top of the pile. The average pile height is approximately 69.6 m in reference to the average original ground elevation of 482.4 m around the perimeter toe of the pile. The pile overall dimensions together with its surface area and storage volume are presented in Table 1.

Table 1: Pigeon WRSA Dimensions and Volumes

Pile	Height[2] (m)	Maximum Length (m)	Maximum Width (m)	Footprint Area (m^2)	Waste Rock Storage Volume (m^3)
Original Design	30 to 40	1,000	600	495,000	13,445,000
Pile Expansion1	54 to 76	1,060	710	655,000	24,956,000

[1]Surface area and volume includes original WRSA quantities; [2] Height before closure cover placement.

For ease of construction, the pile will be constructed with benches, which will then be smoothed out to give resultant slopes of 3.2H:1V or flatter at closure. The estimated quantity to smooth the slope is 550,000 m^3.

3.3 Till Storage Pile

Overburden till material is stockpiled at the east end of the waste rock pile, for use as closure cover. The existing pile volume is approximately 1.97 million m^3. It is assumed that the till material will be placed as a 3 m thick cap on the top and the majority of the side slopes of the waste rock pile at closure. Assuming a bulking factor of 1.2 before compaction and wasting, the estimated in-place volume of the till material after compaction is approximately 1.64 million m^3. This volume will cover an equivalent three-dimensional (3D) surface area of 547,000 m^2 for the WRSA.

3.4 Closure Cover

The existing cover design comprises a layer of 3 m thick till, overlain by 1 m of NAG granite waste rock. The total 3D surface area of the pile expansion after the benches being shaped for closure cover placement is 657,900 m^2, with a top surface area of 97,200 m^2. The existing till volume can cover an equivalent 3D surface area of 547,000 m^2 and therefore, is insufficient to cover the entire pile surface. The available till volume can cover approximately 83% of the pile 3D surface, including the entire pile crest and the majority of the side slopes.

In areas where there is insufficient till to cover the lower portion of the side slopes, a 5 m thick layer of clean, NAG rock will be used to cover the remaining pile surface. The thickness of rock was determined to be acceptable in the 2014 report during the original thermal modelling.

Figure 5 presents a preliminary plan layout of the Pigeon WRSA Expansion after proposed closure cover placement. Figure 6 shows the proposed typical sections for the closure cover design. It is recommended that the waste rock surfaces after the benches have been shaped for closure cover placement be graded and compacted to form smooth surfaces without open voids. If required, any open voids should be first backfilled with a transitional rockfill to avoid potential loss of the till cover materials into the waste rock voids. The till materials shall be placed and compacted in lifts with no more than a 0.5 m thick loose lift thickness.

The final cover design for the Pigeon WRSA is not approved. The final cover design will be determined through DDEC's closure planning process or an update to the WROMP for Board approval. Please see the Board's September 22, 2017 Reasons for Decisions on Pigeon WRSA Design Report and WROMP Version 7.0 for more information.

3.5 Site Access

Two access roads service the Pigeon WRSA: one from Sable Haul Road to the east and the other from Pigeon Pit to the northwest. The overburden till storage pile is serviced by one access road from Sable Haul Road to the north. Tie-ins to the piles will be developed by DDEC as part of pile construction.

4.0 THERMAL ANALYSES

4.1 Background and Previous Thermal Analyses

A series of thermal analyses were conducted by Tetra Tech (Tetra Tech EBA 2014) to evaluate the long-term thermal behavior of the Pigeon WRSA. These analyses were carried out to verify the adequacy of the proposed closure cover, the influence of the closure cover on pile freeze-back, and the ability of the closure cover to keep the waste rock in a permafrost state. Different cases were evaluated to investigate the effects of varying cover conditions and potential heat generation from PAG material contained in parts of the WRSA. These thermal analyses were also carried out under climate change conditions for a one hundred-year period.

With the expansion of the Pigeon WRSA, the validity of these past thermal analyses were assessed. The volume of the Pigeon WRSA has been significantly increased from its original design; however, the conclusions from the Tetra Tech EBA 2014 thermal analysis are still valid for the new larger capacity Pigeon WRSA. This is directly attributed to the geometry of pile expansion; the major design assumptions remain unchanged. As such, the thermal behaviour of the WRSA is expected to be similar to the original design.

The thermal predictions valid for the Pigeon WRSA expansion are summarized in the following sections. A detailed account of the analysis methodology, input parameters, and findings of the thermal analyses is available in Tetra Tech EBA (2014). The cover designs that were considered in the thermal analyses are presented in Table 2.

Table 2: Proposed Closure Cover Designs Analyzed

Case Name	Composition	
	Overburden Till Thickness	Clean Waste Rock Thickness
Base Case	0 m	5 m
Case 1	3 m	1 m

4.2 Maximum Depth of Active Layer

Table 3 presents the predicted maximum thicknesses of the active layer under mean air temperature conditions and A1B climate change conditions, with and without consideration of internal heat generation due to sulphur oxidation within the waste rock pile. The results indicate that internal heat generation does not have a significant influence on the predicted active layer thickness.

Table 3: Summary of Predicted Maximum Active Layer Thickness in the Closure Cover

	Maximum Thickness of Active Layer (m) (no internal heat)		Maximum Thickness of Active Layer (m) (with internal heat)	
Air Temperature Condition	Base Case	Case 1	Base Case	Case 1
Mean Air	3.2	2.4	3.3	2.4
Mean Air + Climate Change at 50 years	3.8	3.0	4.2	3.0
Mean Air + Climate Change at 100 years	4.6	3.6	5.0	3.6

4.3 Unfrozen Zones in Waste Rock

The thermal model predicts the creation of unfrozen zones within the Pigeon WRSA. These zones are created when the waste rock placement rate exceeds the rate of permafrost aggradation. Similar zones have been observed in practice at Ekati WRSAs (EBA 2006).

The thermal simulations of the Pigeon WRSA predict that the waste rock pile will freeze back under both scenarios with and without internal heat generation. The scenario without internal heat generation will take approximately eight years, while the scenario with internal heat will take approximately twelve years.

4.4 Long-term Ground Temperatures in Pile Foundation

The long-term ground temperatures in the Pigeon WRSA foundation soils are of interest for stability evaluations since the long-term strength (cohesion) of an ice-rich soil is associated with soil temperature. Based on the site conditions and past experience, it is expected that ice-rich soils may exist at depths of 2 m to 4 m below the original ground surface over the Pigeon WRSA footprint. The results of the thermal analyses indicate that the long-term ground temperatures in the assumed ice-rich zone after several years of ground freeze back following the dewatering of Big Reynolds Pond in 2014 and placement of the granite pad and waste rock are as follows:

- Colder than -1°C for the areas where shallow lake water was present before the dewatering of Big Reynolds Pond; and
- Colder than -2°C for the areas where the original ground was not thermally affected by the original Big Reynolds Pond.

The above predictions have considered the long-term climate change scenario for a 100-year period.

5.0 PIGEON WASTE ROCK PILE STABILITY EVALUATION

5.1 Analyses Methodology

The Pigeon WRSA stability analyses for the original design were summarized in Tetra Tech EBA (2014). Similar analysis methodology is applied to additional stability analyses for the expanded pile.

Limit equilibrium stability analyses were carried out to evaluate the stability of the Pigeon waste rock pile using a commercial computer program, SLOPE/W, GeoStudio 2012, Version 8.14 (Geo Slope International). The Morgenstern-Price method with a half-sine interslice force assumption was adopted in the analyses. The analyses were conducted to evaluate the waste rock slope stability during the staged construction, under post-construction conditions, and for long-term closure. Potential post-construction seismic loading was modelled as pseudo-static with a design horizontal peak surface acceleration in the analyses.

The principle underlying the method of limit equilibrium analyses of slope stability is as follows:

- A slip mechanism is postulated;
- The shear resistance required to equilibrate the assumed slip mechanism is calculated by means of statics;
- The calculated shear resistance required for equilibrium is compared with the available shear strength in terms of factor of safety; and
- The slip mechanism with the lowest factor of safety is determined through iteration.

A factor of safety is used to account for the uncertainty and variability in the input parameters and to limit deformation.

5.2 Cases Evaluated

Various cases were evaluated for the most critical sections (Section A and Section B) through the Pigeon waste rock pile expansion under the following stages:

- During staged construction;
- Under post-construction conditions (stepped slopes with benches; both static and seismic); and
- After pile closure and reclamation (shaped slopes with closure cover placement; both static and seismic).

The basic geometries that were evaluated in the stability analysis cases are as follows:

- Typical Section 1 in Figure 4 for Section A stability analyses for staged construction and post-construction stage before closure cover placement;
- Typical Section 2 in Figure 4 for Section B stability analyses for staged construction and post-construction stage before closure cover placement;
- Typical Section 3 in Figure 6 for Section A stability analyses for long-term closure after closure cover placement; and
- Typical Section 4 in Figure 6 for Section B stability analyses for long-term closure after closure cover placement.

As noted above the final cover design for the Pigeon WRSA is not approved. The final cover design will be determined through DDEC's closure planning process or an update to the WROMP for Board approval. Please see the Board's September 22, 2017 Reasons for Decisions on Pigeon WRSA Design Report and WROMP Version 7.0 for more information.

5.3 Soil Profile and Analysis Input Parameters

Geotechnical site investigations were not conducted in the Pigeon WRSA for the stability analyses in this study. The foundation soil profile for the stability analyses was developed based on preliminary air photo interpretation and ground conditions in nearby areas (Pigeon Pit and Long Lake area) at Ekati. The profile consisted of a layer of 2 m of unfrozen till or lakebed sediment (below the original Big Reynolds Pond), a layer of 2 m of ice-rich till over a layer of 6 m of ice-poor till overlying bedrock. This profile is generally conservative since a continuous layer of ice-rich till was assumed. No shear strength tests were conducted for any of the soils in this study; therefore, most of the soil input parameters for the analyses were estimated or assumed based on published data in the literature for similar soils and past experience. Table 4 presents the key soil parameters adopted in the stability analyses.

Table 4: Key Soil Parameters for Stability Analyses

Soil Type	Cohesion (kPa)	Internal Angle of Friction (°)	Excess Pore Pressure Parameter $\overline{B}$ Assumed during Construction or Thawing	Bulk Unit Weight (kN/m³)
Waste Rock and Granite Base	0	46 (0 to 15 m depth from surface) 41 (15 to 30 m depth from surface) 38 (30 to 45 m depth from surface) 35 (>45 m depth from surface)	0	20
Lakebed Sediment	0	26	0.2	18
Unfrozen Till Overburden	0	30	0.2	19
Frozen Ice-Rich Till	160 (long-term)	0	N/A	17

Table 4: Key Soil Parameters for Stability Analyses

Soil Type	Cohesion (kPa)	Internal Angle of Friction (°)	Excess Pore Pressure Parameter $\overline{B}$ Assumed during Construction or Thawing	Bulk Unit Weight (kN/m³)
Warm Frozen Ice-Rich Till	80 (long-term)	0	N/A	17
Thawing Ice-Rich Till	0	28	0.2	17
Ice-Poor Till	0	32	0	20
Compacted Till for Closure Cover	0	33	0	19

Potential post-construction seismic loading was modelled as pseudo-static with a design horizontal peak ground acceleration (PGA) of 0.036 g in the analyses. This is the value estimated from the 2010 National Building Code of Canada seismic hazard website (http://earthquakescanada.nrcan.gc.ca) for a 2% in 50 years probability of exceedance (0.000404 per annum or 1 in 2,475 year return) for the Ekati area.

5.4 Stability Analysis Results

Table 5 summarizes the stability analysis results for Section A. Selected figures for the stability analyses are illustrated in Appendix B.

Table 5: Summary of Selected Stability Analysis Results for Section A

Section	Conditions	Minimum Calculated Factor of Safety	Comments
A	Staged Construction	1.49 (Stage 1) to 1.19 (Stage 6)	Figure B1 (Stage 1); Figure B2 (Stage 6); considering potential excess pore water pressure generated in thawing ice rich till and lakebed sediment due to placement of waste rock.
A	Post Construction (Stepped Slopes); Static Loading	1.32	Figure B3; slip surface through warm frozen ice-rich till; higher factors of safety for slip through lakebed sediment or thawing ice-rich till.
		1.53	Figure B5; slip surface through thawing ice-rich till.
A	Post Construction (Stepped Slopes); Seismic Loading	1.05 [A)]	Figure B4; slip surface through warm frozen ice-rich till with a peak horizontal ground acceleration of 0.036 g; conservative values of frozen ice-rich till long-term cohesion assumed; see footnote A) for comments.
		1.38	Slip surface through thawing ice-rich till with a peak horizontal ground acceleration of 0.036 g.

Table 5: Summary of Selected Stability Analysis Results for Section A

Section	Conditions	Minimum Calculated Factor of Safety	Comments
A	After Closure Cover Placement; Static Loading	1.32	Figure B6; slip surface through warm frozen ice-rich till; higher factor of safety for slip through thawing ice-rich till.
		1.95	Figure B8; slip surface through thawing ice-rich till.
		1.28	Figure B9; slip through bottom of till cover; fully saturated till and hydrostatic water on top of the till cover assumed.
		1.74	Figure B11; slip through bottom of till cover; hydrostatic water at the half depth of the till cover assumed.
A	After Closure Cover Placement; Seismic Loading with Peak Horizontal Ground Acceleration of 0.036 g	1.03 [A)]	Figure B7; slip surface through warm frozen ice-rich till; conservative values of frozen ice-rich till long-term cohesion assumed; see footnote A) for comments.
		1.71	Slip surface through thawing ice-rich till.
		1.13	Figure B10; slip through bottom of till cover; fully saturated till and hydrostatic water on top of the till cover assumed.
		1.54	Slip through bottom of till cover; hydrostatic water at the half depth of the till cover assumed.

A) Long-term cohesion for frozen ice-rich till under static loading was used in this seismic stability analysis. This is conservative for short-term seismic loading. The actual ice-rich till cohesion under seismic loading would be higher because of a high loading rate. Therefore the actual factor of safety for seismic loading would be higher than calculated in this analysis.

Table 6 summarizes the stability analysis results for Section B. Selected figures for the stability analyses are illustrated in Appendix B.

Table 6: Summary of Selected Stability Analysis Results for Section B

Section	Conditions	Minimum Calculated Factor of Safety	Comments
B	Staged Construction	1.67 (Stage 1) to 1.36 (Stage 6)	Figure B12 (Stage 1); Figure B13 (Stage 6); considering potential excess pore water pressure generated in thawing ice rich till and lakebed sediment due to placement of waste rock.
B	Post Construction (Stepped Slopes); Static Loading	1.34	Figure B14; slip surface through warm frozen ice-rich till; higher factors of safety for slip through lakebed sediment or thawing ice-rich till.
		1.66	Figure B16; slip surface through thawing ice rich till.
B	Post Construction (Stepped Slopes); Seismic Loading	1.10 [B)]	Figure B15; slip surface through warm frozen ice rich till with a peak horizontal ground acceleration of 0.036 g; conservative values of frozen ice-rich till long-term cohesion assumed; see footnote B) for comments.
		1.50	Slip surface through thawing ice-rich till with a peak horizontal ground acceleration of 0.036 g.

Table 6: Summary of Selected Stability Analysis Results for Section B

Section	Conditions	Minimum Calculated Factor of Safety	Comments
B	After Closure Cover Placement; Static Loading	1.32	Figure B17; slip surface through warm frozen ice-rich till; higher factor of safety for slip through thawing ice-rich till.
		2.00	Figure B19; slip surface through thawing ice-rich till.
		1.28	Figure B20; slip through bottom of till cover; fully saturated till and hydrostatic water on top of the till cover assumed.
		1.74	Figure B22; slip through bottom of till cover; hydrostatic water at the half depth of the till cover assumed.
B	After Closure Cover Placement; Seismic Loading with Peak Horizontal Ground Acceleration of 0.036 g	1.03 [B)]	Figure B18; slip surface through warm frozen ice-rich till; conservative values of frozen ice-rich till long-term cohesion assumed; see footnote B) for comments.
		1.73	Slip surface through thawing ice-rich till.
		1.13	Figure B21; slip through bottom of till cover; fully saturated till and hydrostatic water on top of the till cover assumed.
		1.54	Slip through bottom of till cover; hydrostatic water at the half depth of the till cover assumed.

B) Long-term cohesion for frozen ice-rich till under static loading was used in this seismic stability analysis. This is conservative for short-term seismic loading. The actual ice-rich till cohesion under seismic loading would be higher because of a high loading rate. Therefore the actual factor of safety for seismic loading would be higher than calculated in this analysis.

5.5 Design Factor of Safety for Pigeon Waste Rock Pile

To ensure reasonable safety of earthworks, a safety factor is usually introduced in geotechnical stability analyses. The normal factor of safety for earthworks against shearing failure is from 1.3 to 1.5 under long-term static loading conditions (CGS 2006; PAE 1991). Generally, the selection of a design factor of safety for an earth structure depends on the importance of the structure, potential failure consequences, uncertainties involved in design loads, and soil parameters (especially shear strength parameters), the additional cost associated with a higher factor of safety, and the risk that the owner of the structure is willing to take.

The proposed Pigeon waste rock pile is situated in an isolated basin away from major infrastructures. Therefore, the consequence of potential slope stability failure is relatively low. In addition, relatively conservative assumptions were adopted in the stability analyses. The following minimum design factors of safety for the waste rock pile are adopted in this study:

- 1.3 for a potential deep-seated slip surface through the overburden soils under static, long-term, normal post-construction conditions;
- 1.2 for a potential failure during stage-construction stages with active monitoring or a shallower slumping failure; and
- 1.1 for a potential failure under a remote design seismic event.

The results in Tables 5 and 6 indicate that the majority of the calculated factors of safety meet or exceed the design criteria. The calculated factors of safety for the fully saturated till cover cases are 1.28 under static loading conditions. This value is slightly less than 1.30 and is acceptable in consideration of the conservative assumption of a fully saturated till cover on a waste rock slope. The calculated factors for safety under seismic loading for several cases with potential slip surfaces through the frozen ice-rich till are lower than 1.1. Conservative values of frozen ice-rich till long-term cohesion under static loading were adopted for these cases. The actual ice-rich till cohesion under seismic loading would be much higher because of the high loading rate. The actual factors of safety under seismic loading would be higher than calculated for these cases. Therefore, these relatively low calculated factors of safety under seismic loading are acceptable.

6.0 CONCLUSIONS AND DISCUSSION

The following conclusions are taken from the geometric and thermal models:

- The Pigeon WRSA expansion will accommodate the required storage volume of the Pigeon Pit waste rock;
- The proposed design of the Pigeon WRSA expansion meets the stability requirements during construction, post-construction stage before closure cover placement, and long-term closure after closure cover placement;
- A combination of 1 m thick NAG rock and 3 m thick overburden till may be used to encapsulate the pile top surface and the majority of the shaped side slopes of the WRSA; the rest of the waste rock pile close to the pile base can be covered with 5 m of NAG rock; and
- The WRSA is estimated to freeze back in eight years without internal heat generation due to sulphur oxidation. Adding internal heat generation extends the freeze-back process to twelve years.

As noted above, the final cover design for the Pigeon WRSA is not approved. The final cover design will be determined through DDEC's closure planning process or an update to the WROMP for Board approval.

7.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

REGISTERED PROFESSIONAL ENGINEER
G. ZHANG
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Oct. 19, 2017
NWT/NU

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PERMIT TO PRACTICE
TETRA TECH CANADA INC.

Signature ________________

Date Oct. 19, 2017

PERMIT NUMBER: P 018

NT/NU Association of Professional Engineers and Geoscientists

/jf

REFERENCES

CGS 2006. Canadian Foundation Engineering Manual, 4th Edition, Canadian Geotechnical Society, 2006.EBA Engineering Consultants Ltd., 1997a. Construction Drawings and Specifications, Panda Diversion Dam. Report submitted to BHP Diamonds Inc. EBA File: 0101-94-11580.007, January 1997.

EBA Engineering Consultants Ltd., 2006. Thermal Evaluation of Waste Rock Piles, Ekati Diamond Mine. Report submitted to BHP Billiton Diamonds Inc., Project No. 0101-94¬11580.033, September 2006.

PAE 1991. Investigation and Design of Mine Dumps, Interim Guidelines. Guidelines prepared for British Columbia Mine Dump Committee (with funding provided from the Provincial Sustainable Environment Fund) by Piteau Associates Engineering Ltd., North Vancouver, May 1991.

Tetra Tech EBA Inc., 2014, Pigeon Pit Waste Rock Storage Area Design, Ekati Diamond Mine, NT.

FIGURES

Figure 1 Plan View of Existing Condition

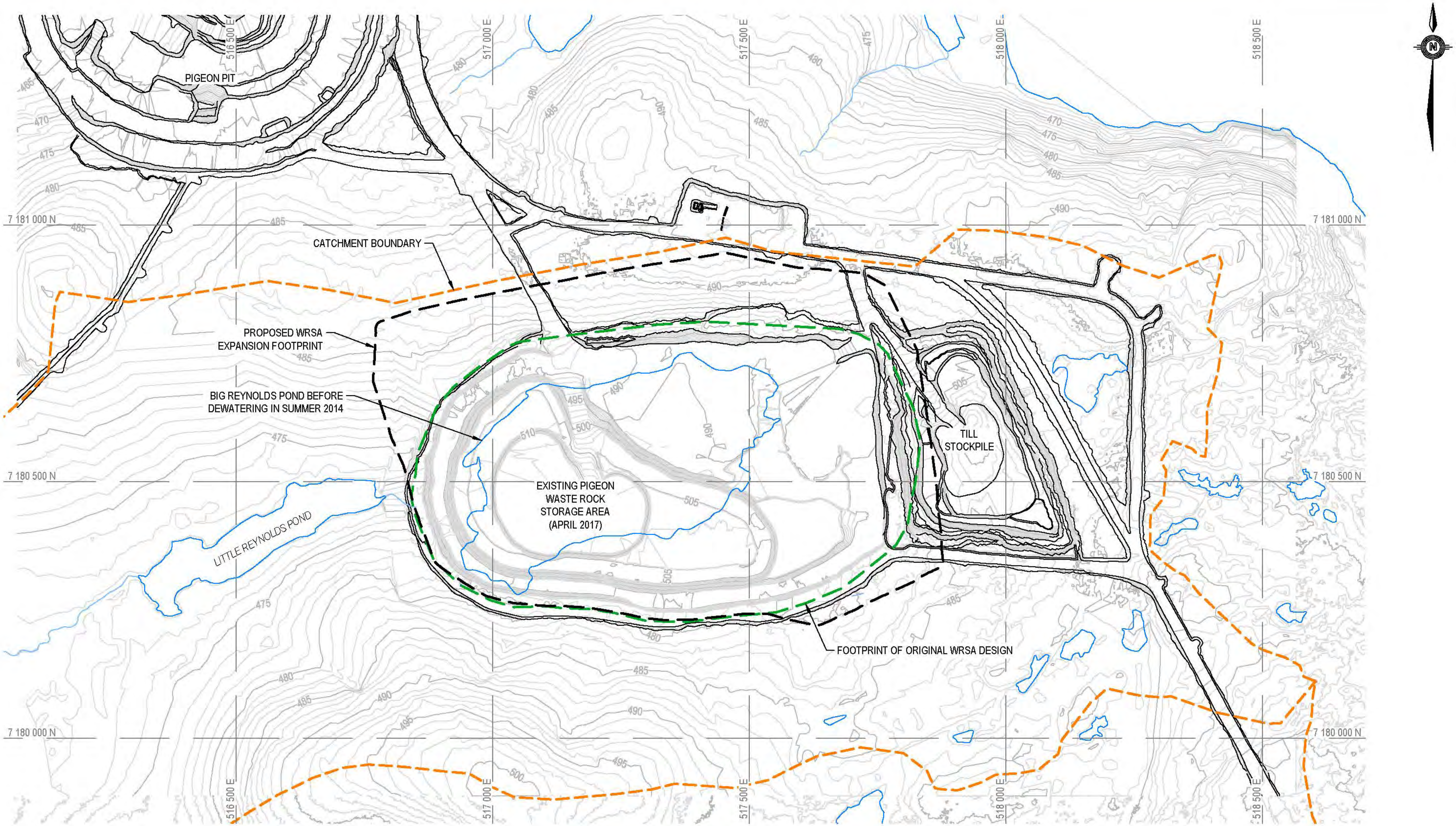
Figure 2 Proposed WRSA Expansion Plan

Figure 3 Proposed WRSA Expansion Cross-Sections

Figure 4 Typical Design Sections of Proposed WRSA Expansion

Figure 5 Preliminary Plan Layout of Proposed Pigeon WRSA Expansion after Closure Cover Placement

Figure 6 Conceptual Closure Cover Design Sections for Proposed WRSA Expansion



LEGEND

- CATCHMENT AREA BOUNDARY
- FOOTPRINT OF ORIGINAL WRSA DESIGN
- PROPOSED FOOTPRINT OF WRSA PILE EXPANSION

NOTES:

1. BASE TOPOGRAPHY FROM COMBINATION OF DECEMBER 2016 AND APRIL 2017 SURVEY.

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

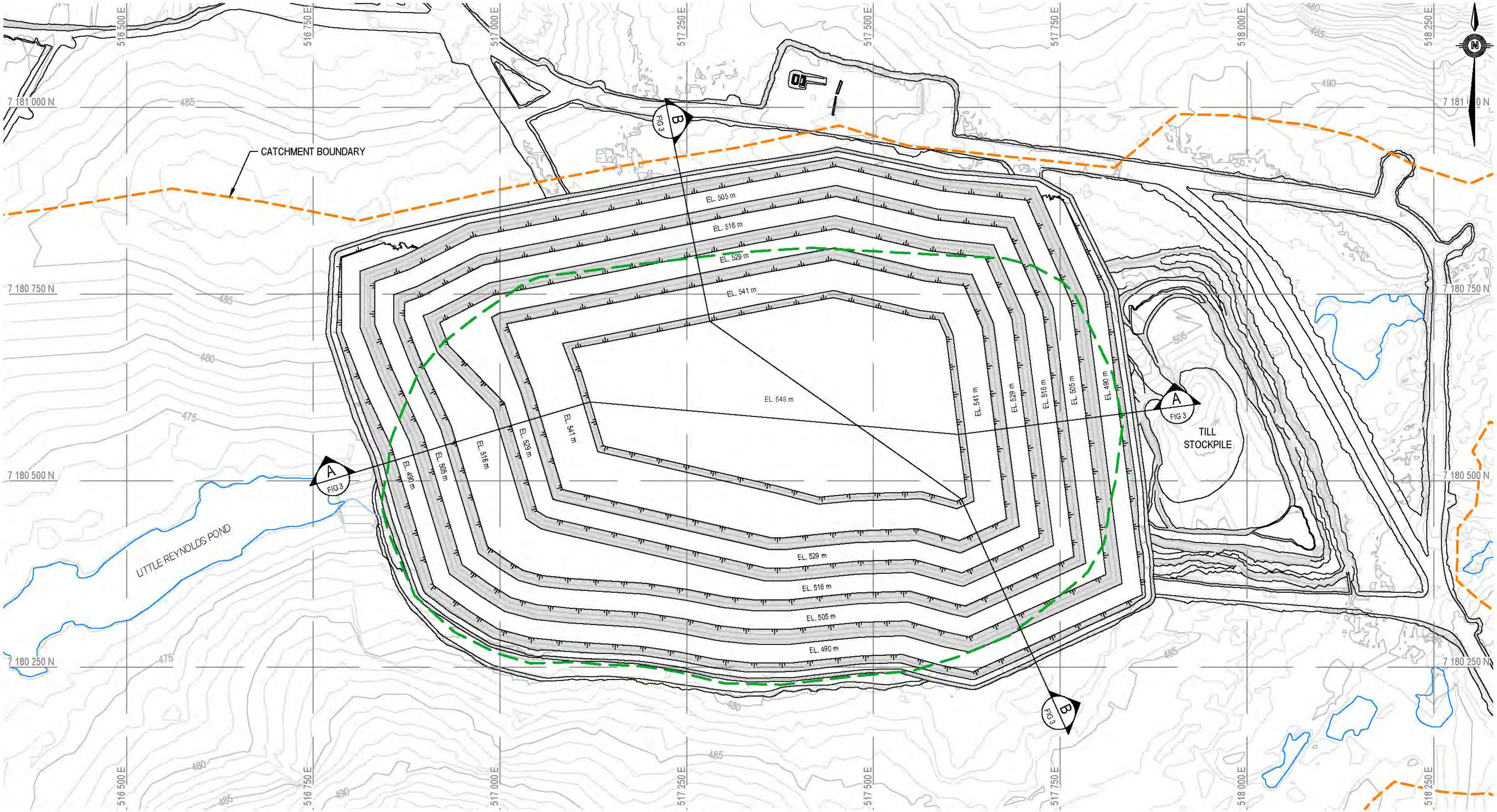
EKATI PIGEON WASTE ROCK AREA EXPANSION
EKATI, NT

PLAN VIEW OF EXISTING CONDITION

PROJECT NO.	DWN	CKD	REV
E14103068-03	EL	GZ	A

OFFICE	DATE
EDMONTON	MAY 11, 2017

FIGURE 1



LEGEND

CATCHMENT AREA BOUNDARY

FOOTPRINT OF ORIGINAL WRSA DESIGN

0 — 250m

Scale: 1:5,000 @ 11"x17"

CLIENT

DOMINION DIAMOND CORPORATION

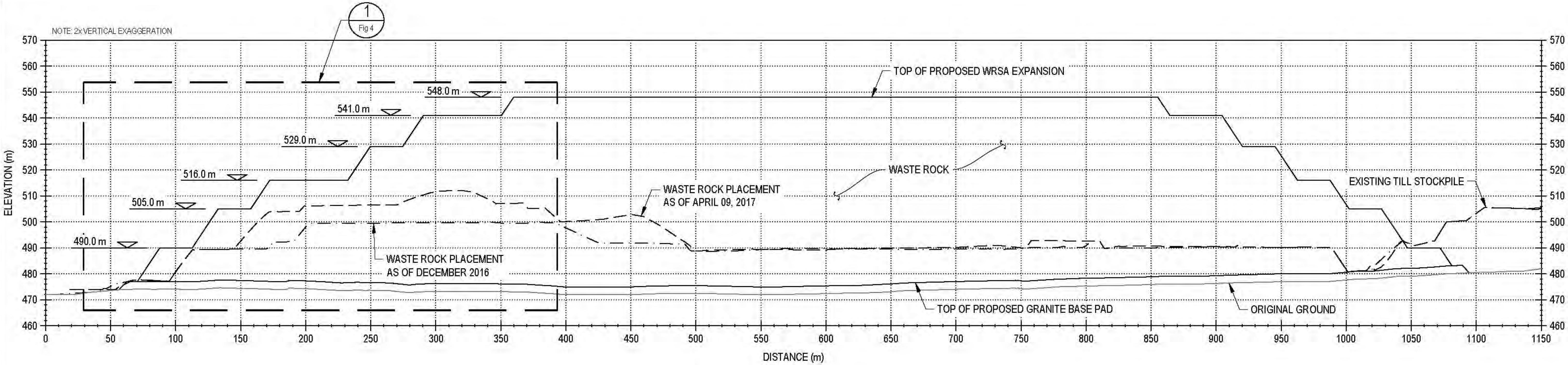
TETRA TECH

EKATI PIGEON WASTE ROCK AREA EXPANSION
EKATI, NT

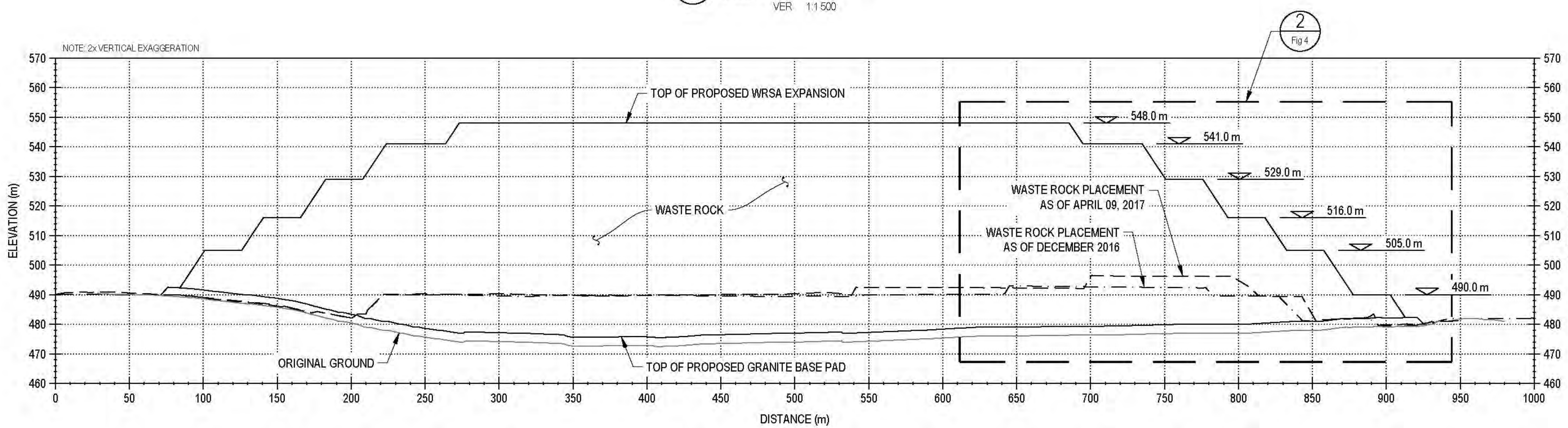
PROPOSED WRSA EXPANSION PLAN

PROJECT NO.	DWN	CKD	REV
E14103068-03	EL	GZ	A
OFFICE	DATE		
EDMONTON	MAY 11, 2017		

FIGURE 2



A
FIG 2
CROSS-SECTION
SCALE: HOR 1:3 000
VER 1:1 500



B
FIG 2
CROSS-SECTION
SCALE: HOR 1:3 000
VER 1:1 500

CLIENT
DOMINION DIAMOND CORPORATION

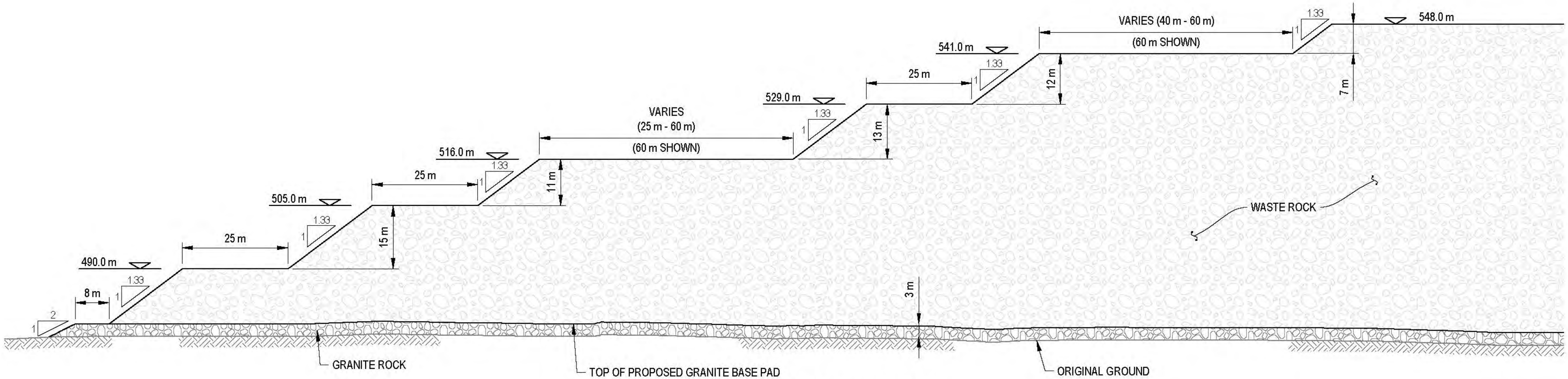
EKATI PIGEON WASTE ROCK AREA EXPANSION
EKATI, NT

PROPOSED WRSA EXPANSION CROSS-SECTIONS

TETRA TECH

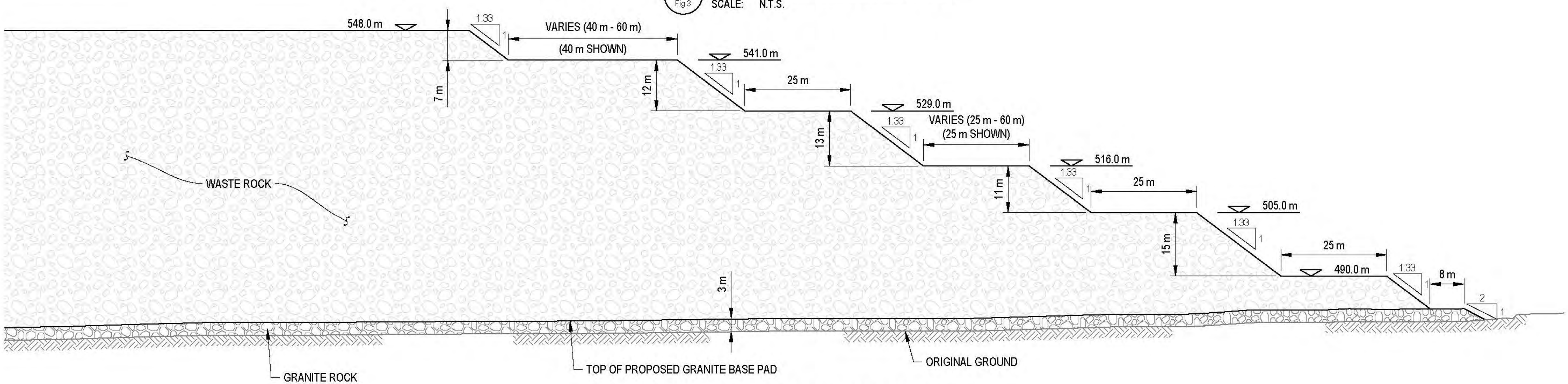
PROJECT NO.	DWN	CKD	REV
E14103068-03	EL	GZ	A
OFFICE	DATE		
EDMONTON	MAY 11, 2017		

FIGURE 3



1 Fig 3 TYPICAL DESIGN SECTION

SCALE: N.T.S.



2 Fig 3 TYPICAL DESIGN SECTION

SCALE: N.T.S.

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

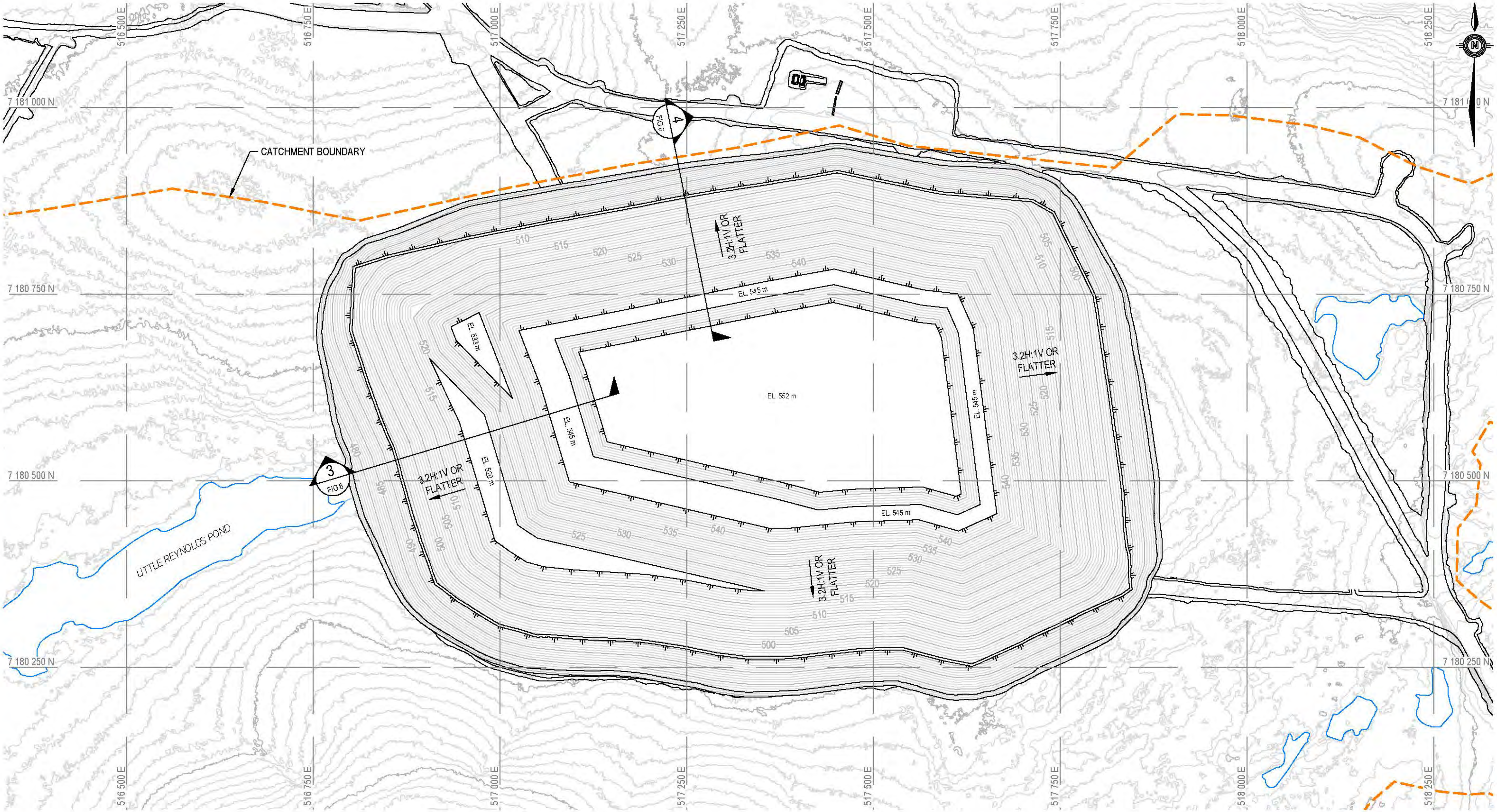
EKATI PIGEON WASTE ROCK AREA EXPANSION
EKATI, NT

TYPICAL DESIGN SECTIONS OF PROPOSED WRSA EXPANSION

PROJECT NO.	DWN	CKD	REV
E14103068-03	EL	GZ	A
OFFICE	DATE		
EDMONTON	MAY 11, 2017		

FIGURE 4

Q:\Edmonton\Engineering\E141\Projects_EKATI\E14103068-03\08_Acad\E14103068-03_WRSA_Figures 1-4.dwg [FIGURE 4] May 11, 2017 - 10:51:25 am (BY: LEE, ELVIN)



LEGEND

CATCHMENT AREA BOUNDARY

0 250m

Scale: 1:5,000 @ 11"x17"

Q:\Edmonton\Engineering\E141\Projects_EKATI\E14103068-03\08_Acad\E14103068-03_WRSA_Figures 5-6.dwg [FIGURE 5] May 11, 2017 - 10:57:23 am (BY: LEE, ELVIN)

CLIENT

DOMINION DIAMOND CORPORATION

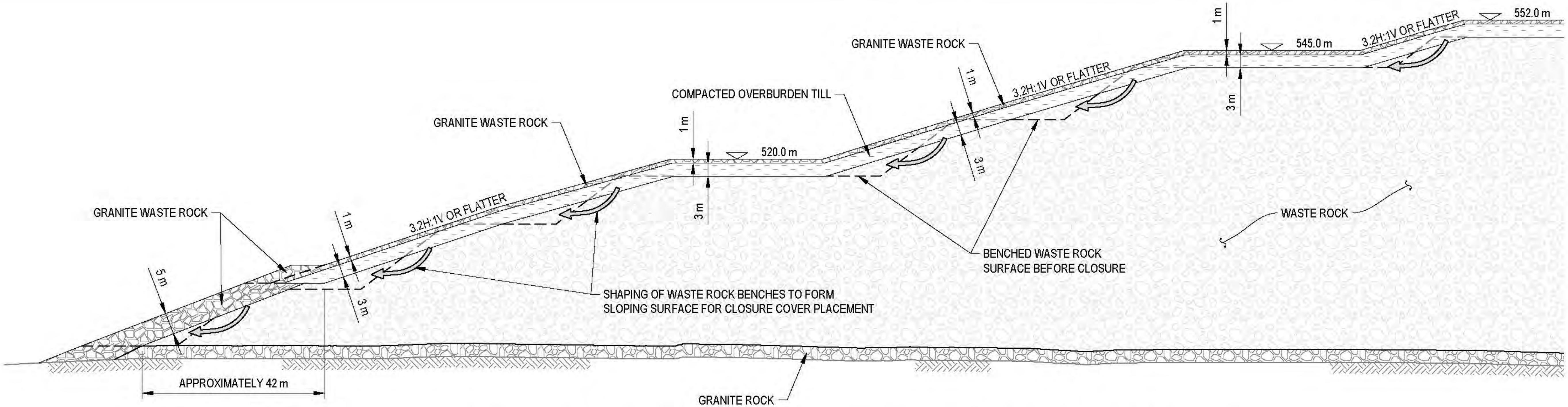
TETRA TECH

EKATI PIGEON WASTE ROCK AREA EXPANSION
EKATI, NT

PRELIMINARY PLAN LAYOUT OF PIGEON WRSA EXPANSION AFTER PROPOSED CLOSURE COVER PLACEMENT

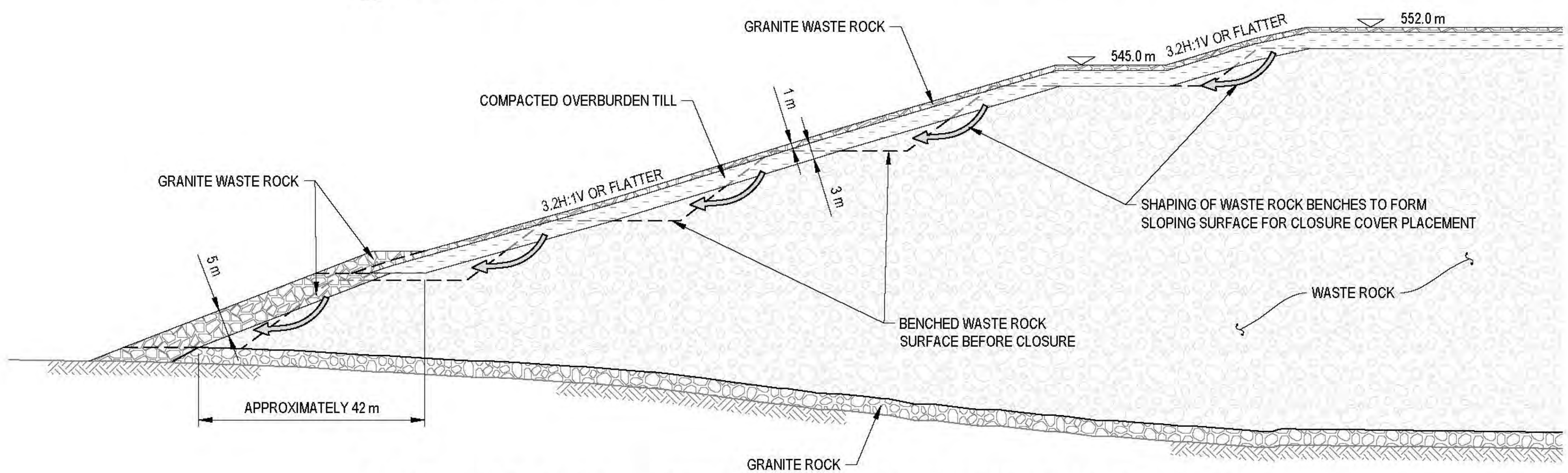
PROJECT NO.	DWN	CKD	REV
E14103068-03	EL	GZ	A
OFFICE	DATE		
EDMONTON	MAY 11, 2017		

FIGURE 5



3 (Fig 5) PROPOSED TYPICAL SECTION OF CONCEPTUAL-LEVEL CLOSURE COVER DESIGN

SCALE: N.T.S.



4 (Fig 5) PROPOSED TYPICAL SECTION OF CONCEPTUAL-LEVEL CLOSURE COVER DESIGN

SCALE: N.T.S.

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

EKATI PIGEON WASTE ROCK AREA EXPANSION
EKATI, NT

CONCEPTUAL CLOSURE COVER DESIGN SECTIONS FOR PROPOSED WRSA EXPANSION

PROJECT NO.	DWN	CKD	REV
E14103068-03	EL	GZ	A
OFFICE	DATE		
EDMONTON	MAY 11, 2017		

FIGURE 6

APPENDIX A
TETRA TECH'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOTECHNICAL REPORT

This report incorporates and is subject to these “General Conditions”.

1.1 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of TETRA TECH’s Client. TETRA TECH does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than TETRA TECH’s Client unless otherwise authorized in writing by TETRA TECH. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the report, if required, may be obtained upon request.

1.2 ALTERNATE REPORT FORMAT

Where TETRA TECH submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed TETRA TECH’s instruments of professional service); only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by TETRA TECH shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of TETRA TECH’s instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except TETRA TECH. TETRA TECH’s instruments of professional service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client’s current or future software and hardware systems.

1.3 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.4 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.5 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.6 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

1.7 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.8 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.9 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

1.10 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.11 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

1.12 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

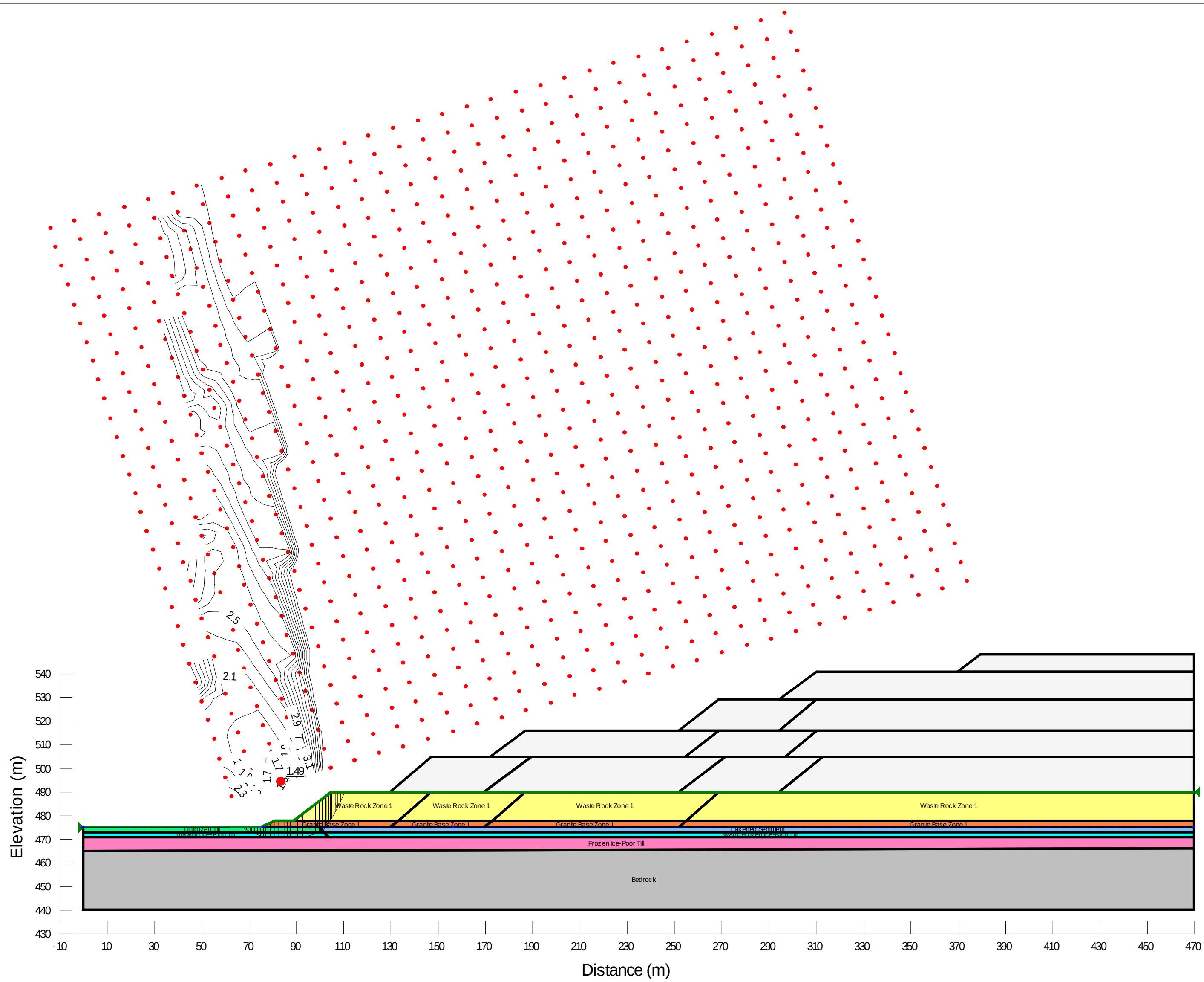
1.13 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

1.14 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of the report, TETRA TECH may rely on information provided by persons other than the Client. While TETRA TECH endeavours to verify the accuracy of such information when instructed to do so by the Client, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

APPENDIX B
SELECTED STABILITY ANALYSIS RESULTS



LEGEND

NOTES

1. Excess pore water pressure applied to thawing ice-rich till and lakebed sediment
2. Weight of newly placed material applied to Bbar parameter for excess pore water pressure

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

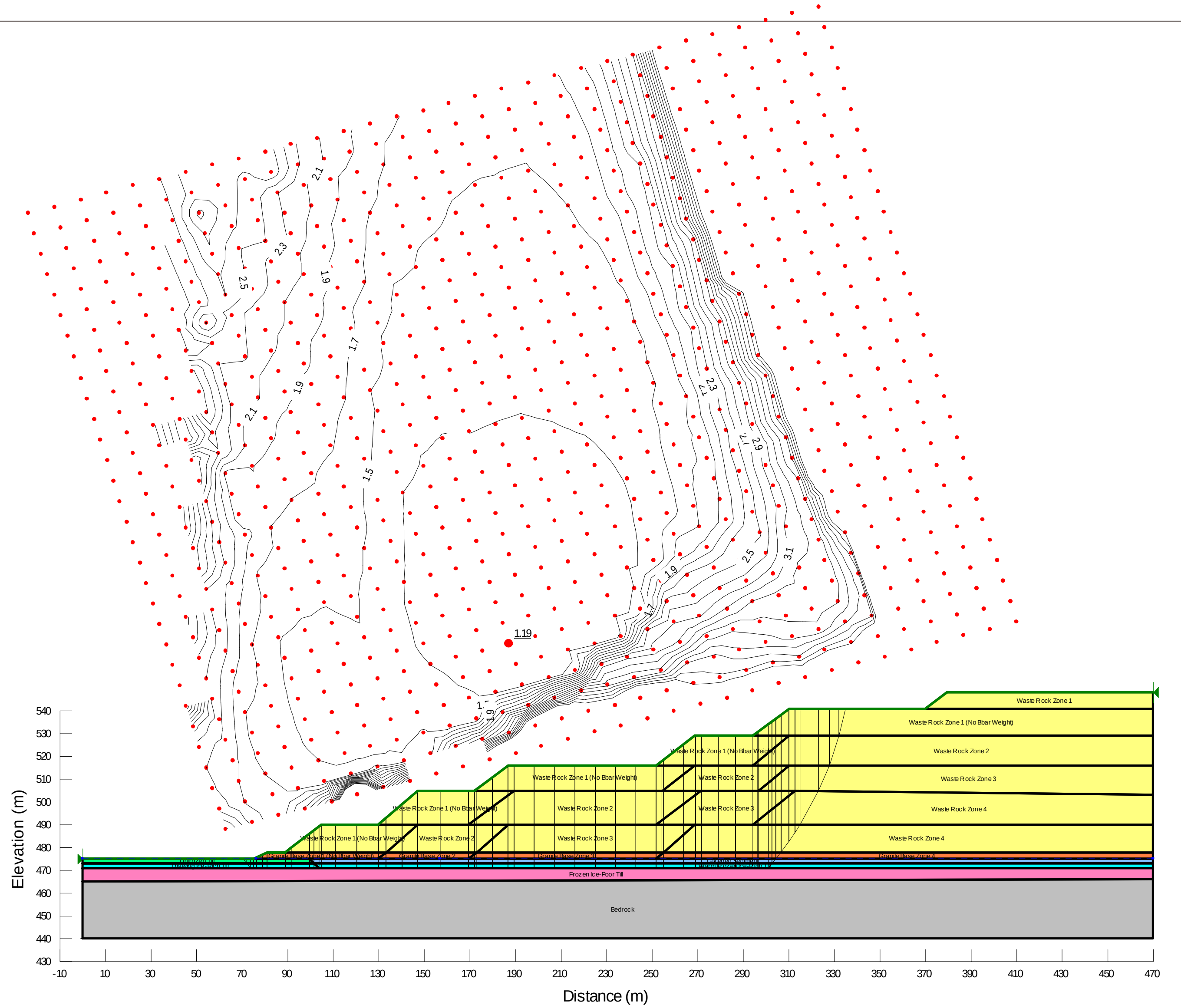
Slope Stability - Pigeon Pit WRSA Expansion

Section A - Construction Stage 1 – Short Term

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 5, 2017

Figure B1



LEGEND

NOTES

1. Excess pore water pressure applied to thawing ice-rich till and lakebed sediment
2. Weight of only newly placed material applied to Bbar parameter for excess pore water pressure

STATUS

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DOMINION DIAMOND CORPORATION

TETRA TECH

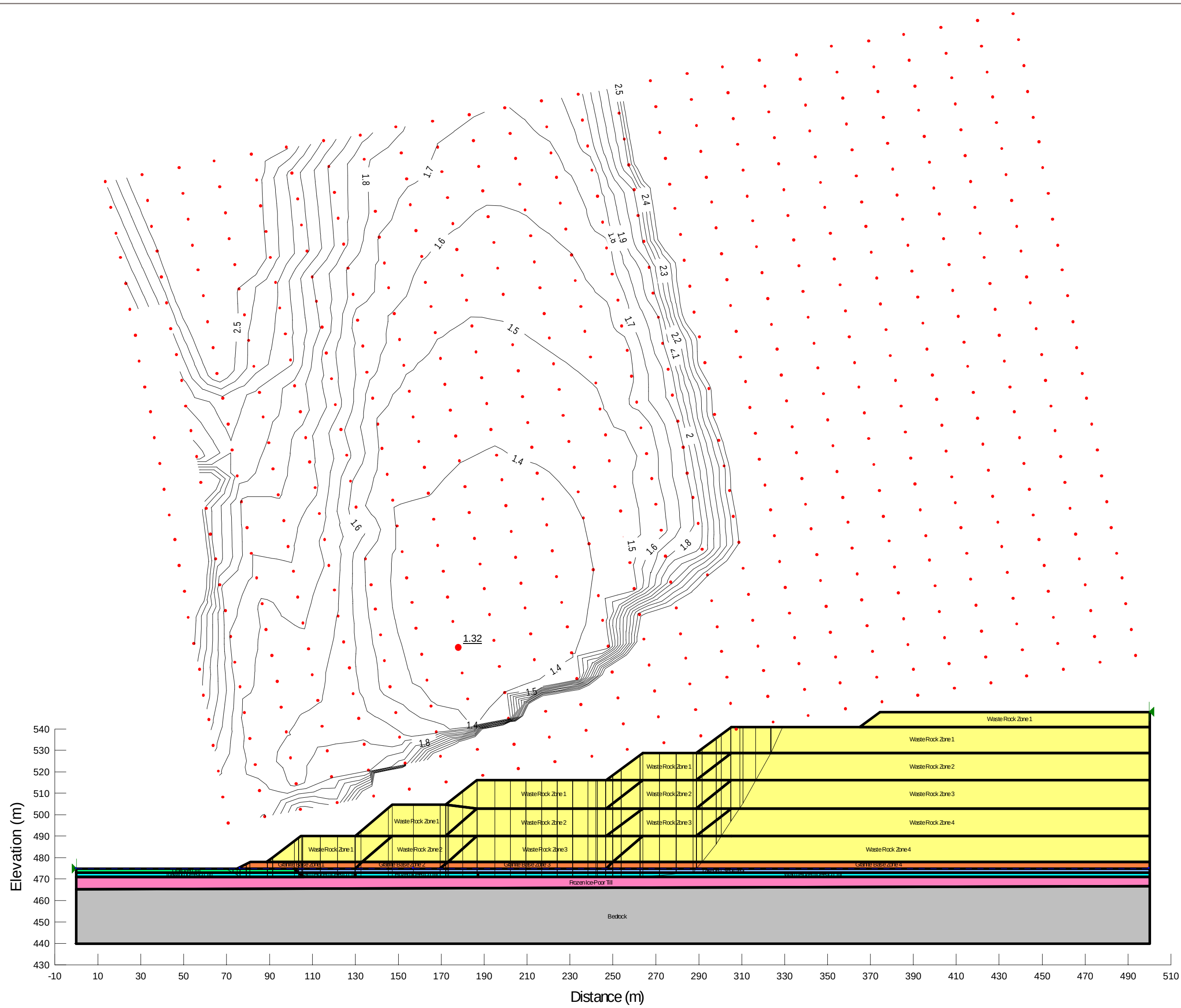
Slope Stability - Pigeon Pit WRSA Expansion

Section A - Construction Stage 6 – Short Term

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 5, 2017

Figure B2



LEGEND

NOTES

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

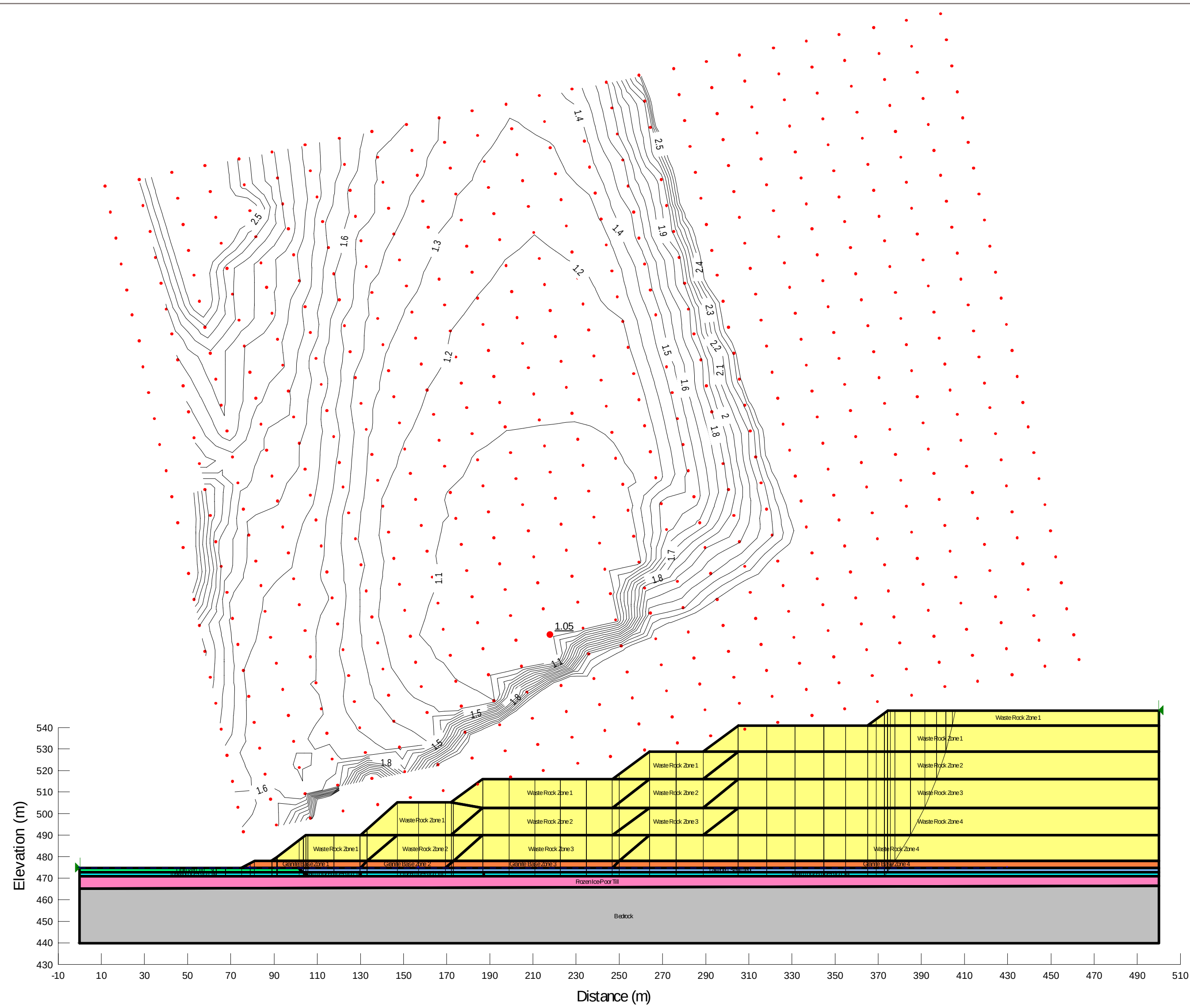
Slope Stability - Pigeon Pit WRSA Expansion

Section A - Post Construction - Long Term - Static
Slip through Warm Frozen Ice-Rich Till

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 4, 2017

Figure B3



LEGEND

NOTES

1. Long-term cohesion for frozen ice-rich till under static loading was used in this analysis. This is conservative for short-term seismic loading. The actual ice-rich till cohesion under seismic loading would be higher because of a high loading rate. Therefore the actual factor of safety for seismic loading would be higher than calculated in this analysis.

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

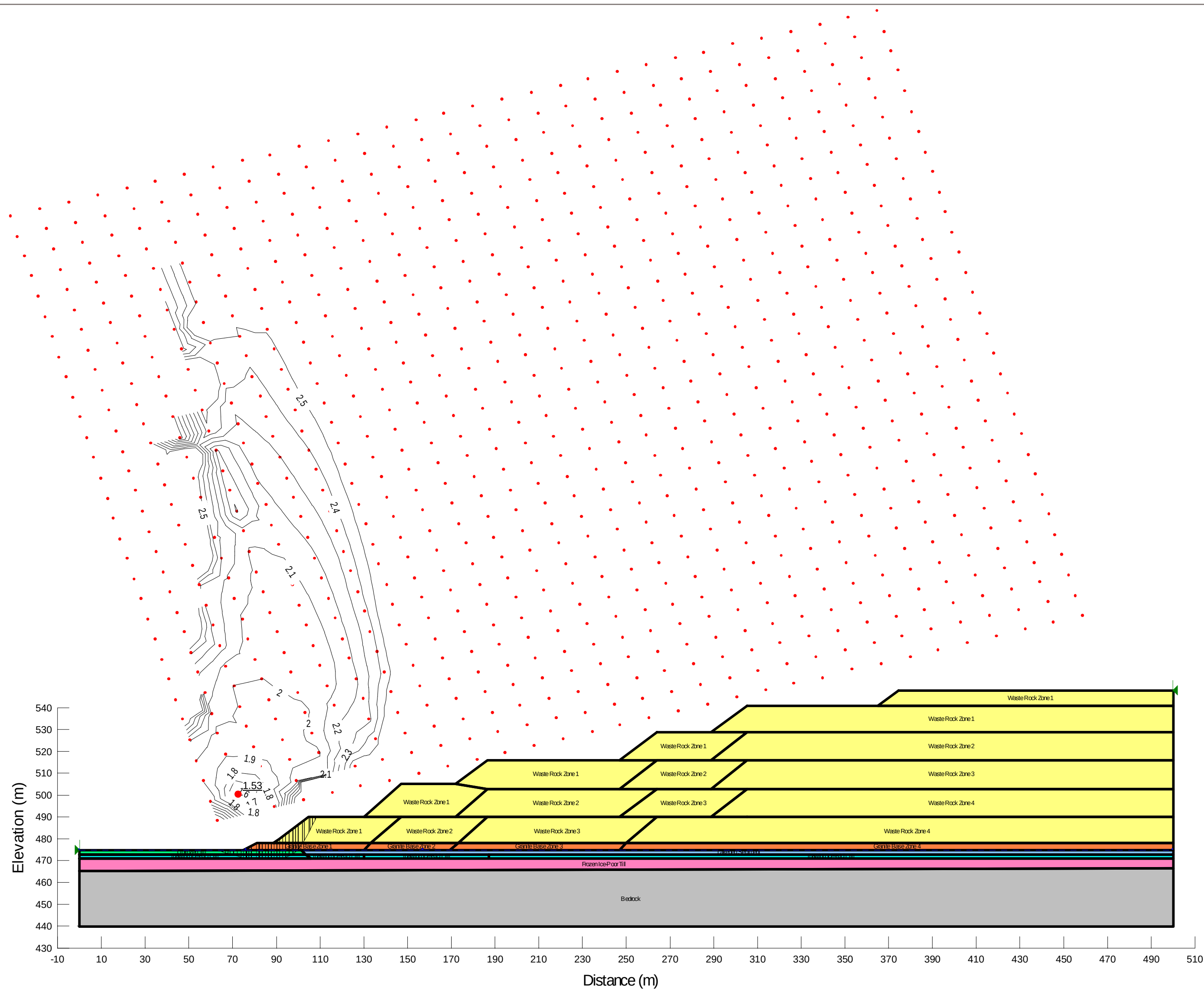
Slope Stability - Pigeon Pit WRSA Expansion

Section A - Post Construction - Long Term - Seismic
Slip through Warm Frozen Ice-Rich Till

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 4, 2017

Figure B4



LEGEND

NOTES

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

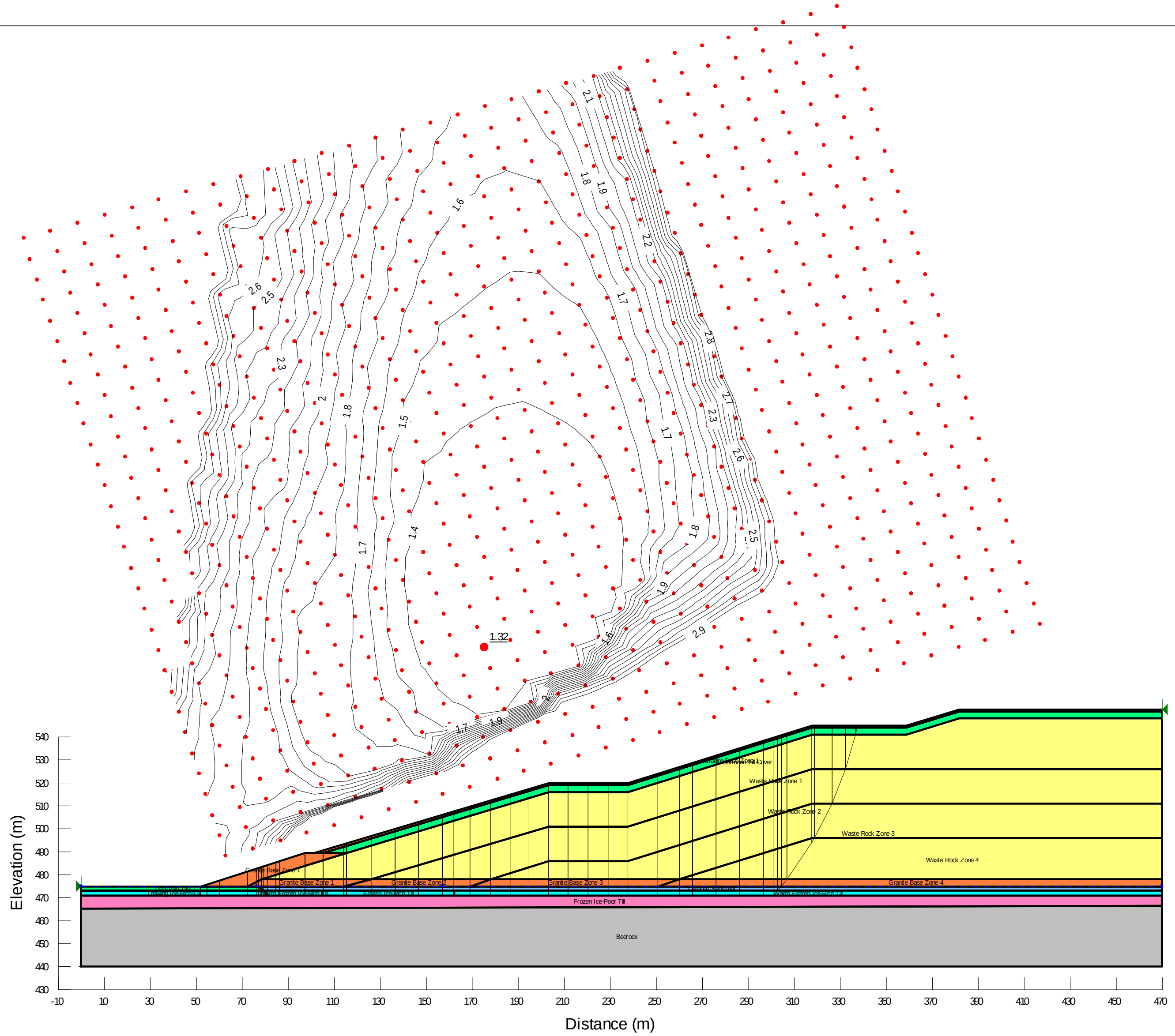
Slope Stability- Pigeon Pit WRSA Expansion

Section A - Post Construction - Long Term - Static Slip through Thawing Ice-Rich Till

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 4, 2017

Figure B5



LEGEND

NOTES

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

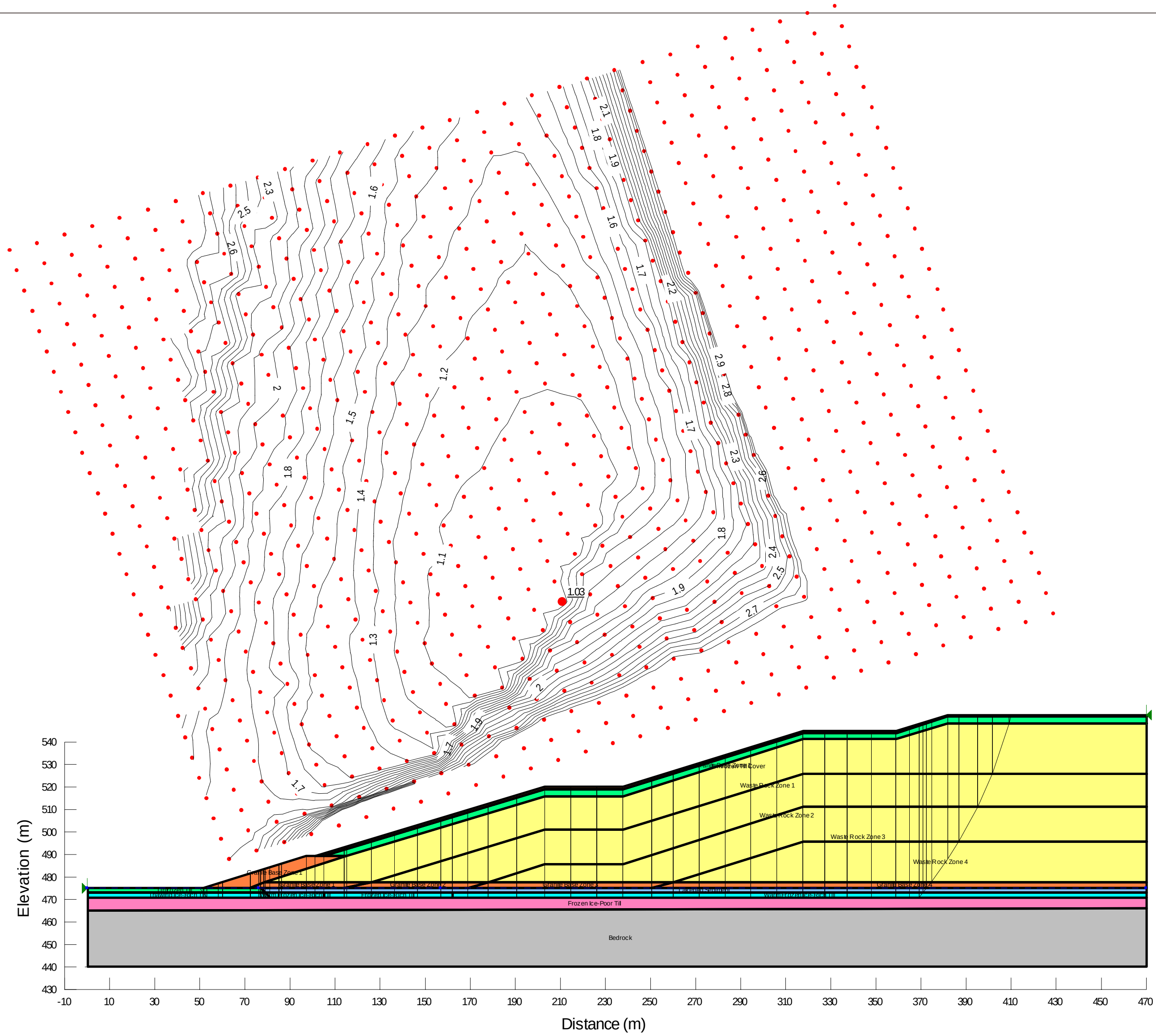
Slope Stability - Pigeon Pit WRSA Expansion

Section A - Closure - Long Term – Static Slip through Warm Frozen Ice-Rich Till

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 4, 2017

Figure B6



LEGEND

NOTES

1. Long-term cohesion for frozen ice-rich till under static loading was used in this analysis. This is conservative for short-term seismic loading. The actual ice-rich till cohesion under seismic loading would be higher because of a high loading rate. Therefore the actual factor of safety for seismic loading would be higher than calculated in this analysis.

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

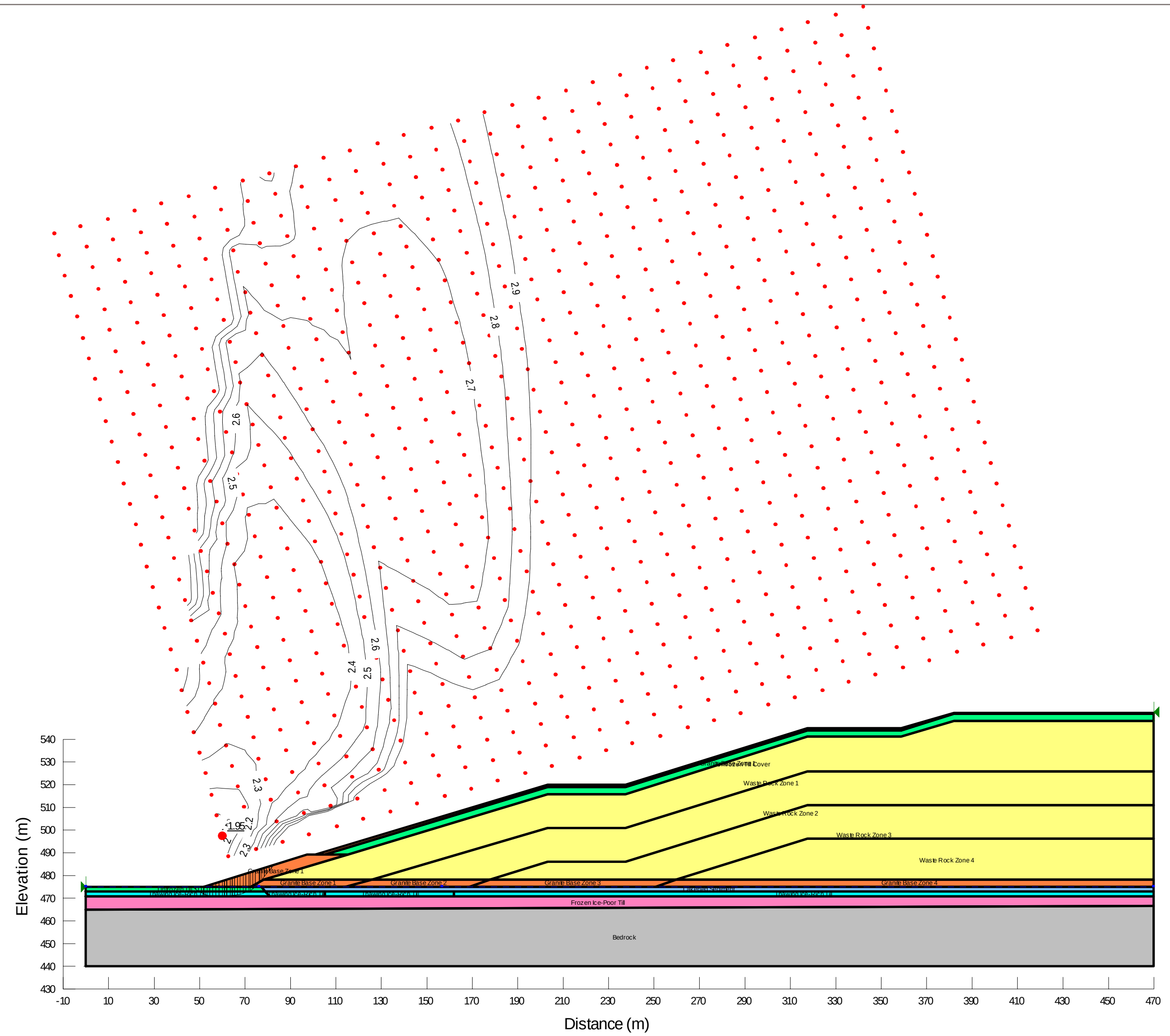
Slope Stability - Pigeon Pit WRSA Expansion

Section A - Closure - Long Term – Seismic Slip through Warm Frozen Ice-Rich Till

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 4, 2017

Figure B7



LEGEND

NOTES

STATUS

CLIENT

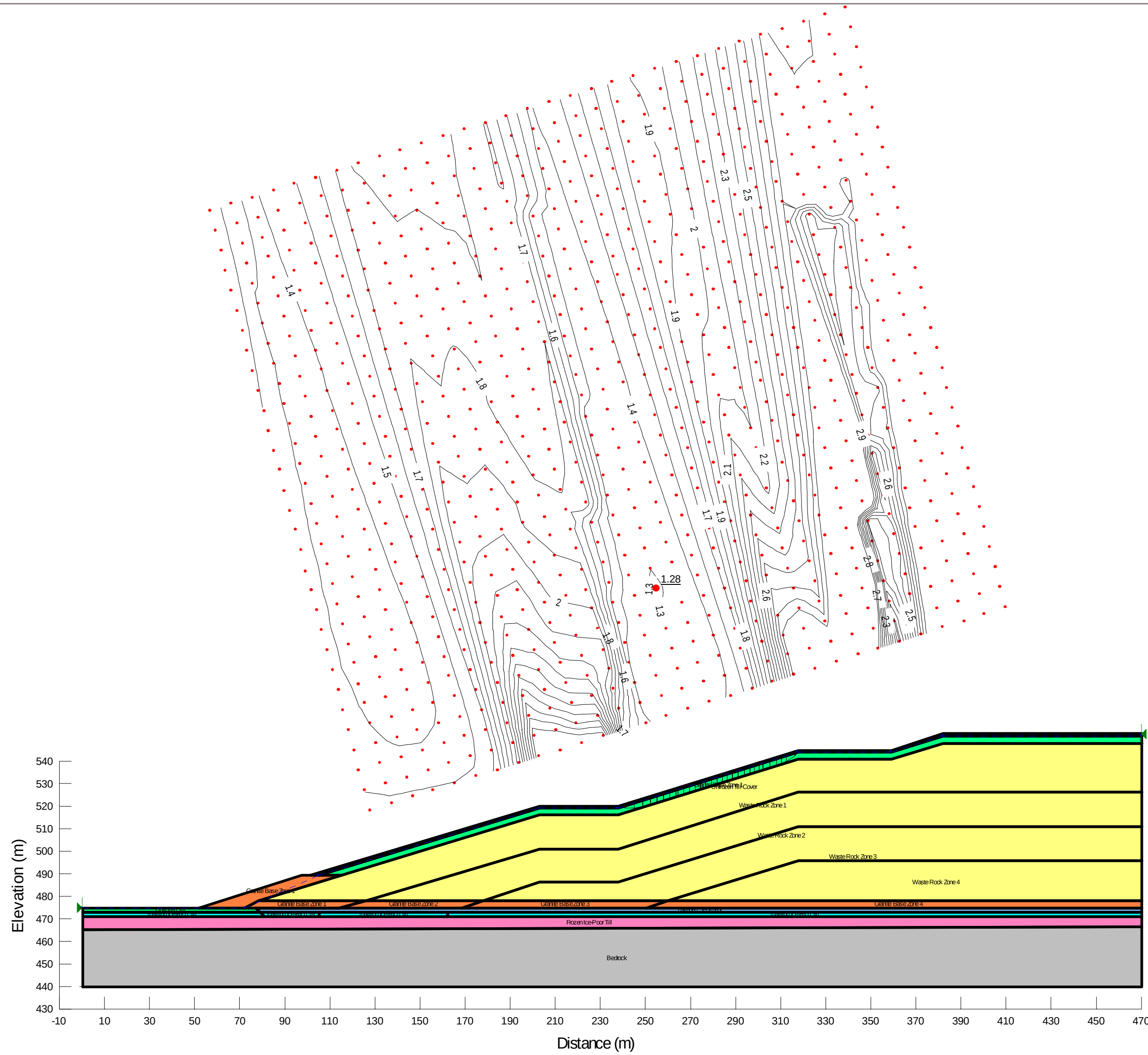
DOMINION DIAMOND CORPORATION

TETRA TECH

Slope Stability - Pigeon Pit WRSA Expansion

Section A - Closure - Long Term – Static Slip through Thawing Ice-Rich Till

PROJECT NO.	DWN	CKD	APVD	REV	
E14103068-03	JY	GZ	GZ	0	**Figure B8**
OFFICE EDM	**DATE** May 4, 2017				



LEGEND

NOTES

1. Forced failure through the till cover

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

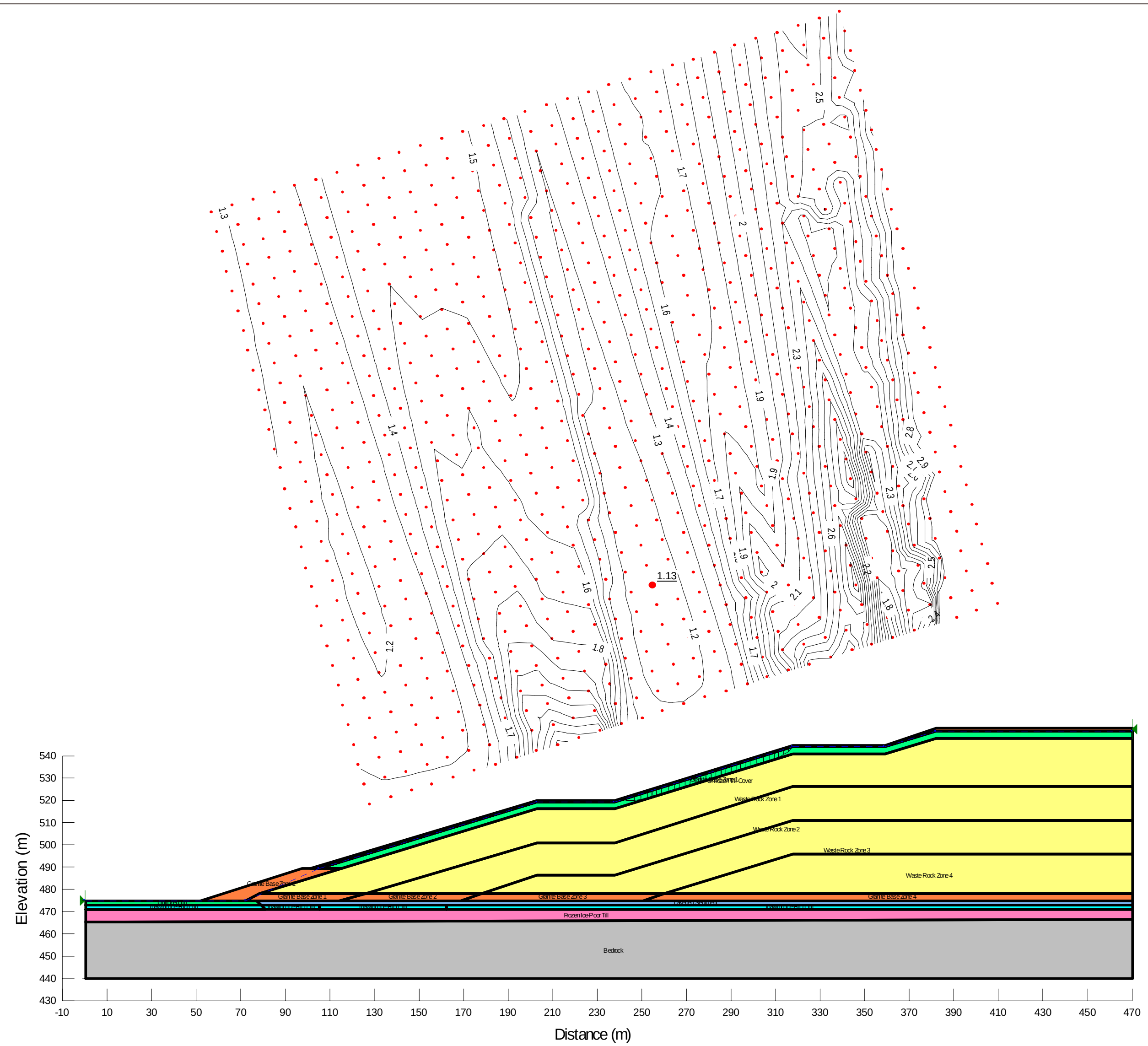
Slope Stability - Pigeon Pit WRSA Expansion

Section A - Closure - Long Term - Static Slip through Fully Saturated Till Cover

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 5, 2017

Figure B9



LEGEND

NOTES

1. Forced failure through the till cover

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

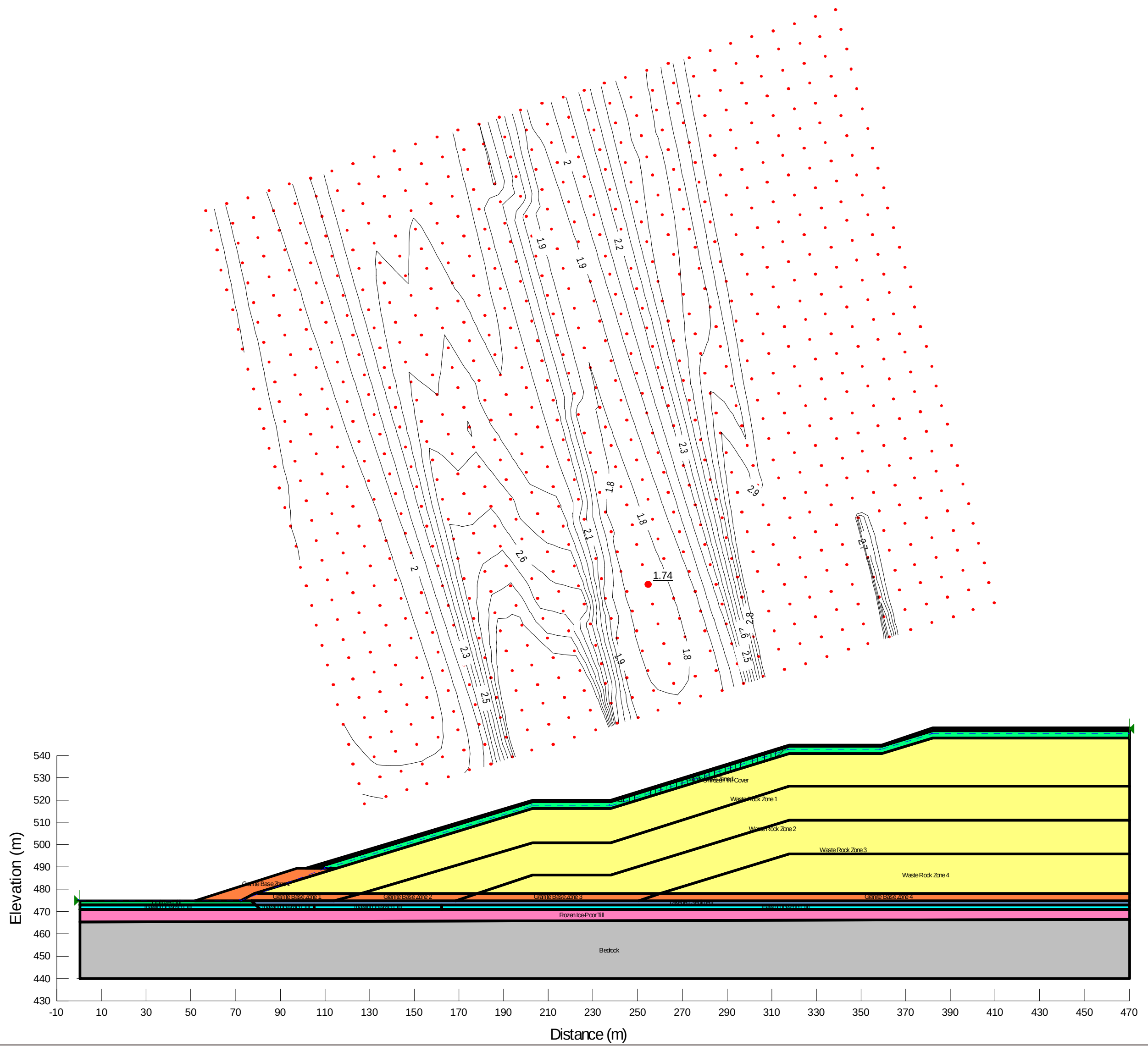
Slope Stability - Pigeon Pit WRSA Expansion

Section A - Closure - Long Term – Seismic Slip through Fully Saturated Till Cover

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 5, 2017

Figure B10



LEGEND

NOTES

1. Forced failure through the till cover

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

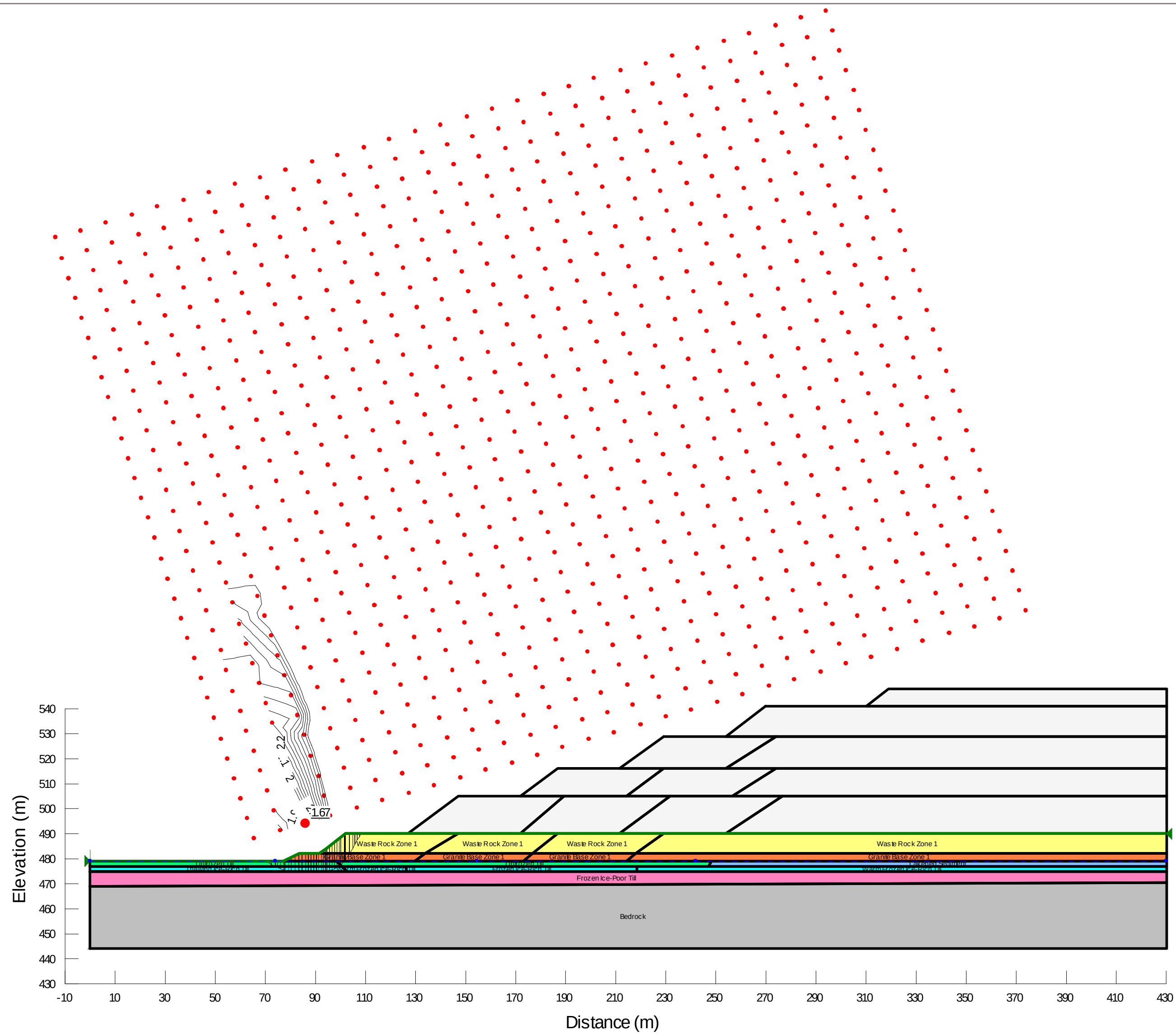
Slope Stability - Pigeon Pit WRSA Expansion

Section A - Closure - Long Term – Static Slip through Half Saturated Till Cover

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 5, 2017

Figure B11



LEGEND

NOTES

1. Excess pore water pressure applied to thawing ice-rich till and lakebed sediment.
2. Weight of only newly placed material applied to Bbar parameter for excess pore water pressure

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

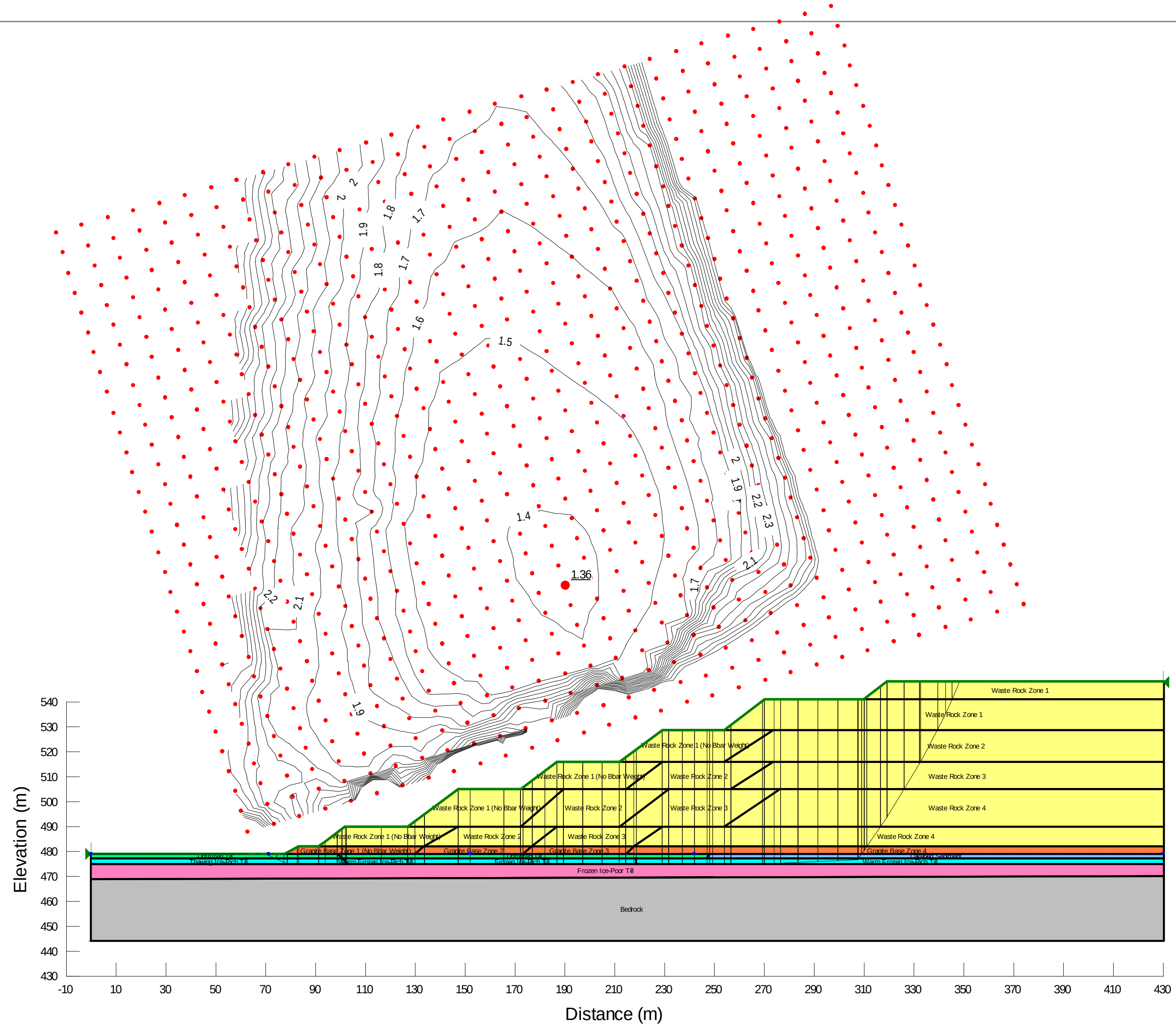
Slope Stability - Pigeon Pit WRSA Expansion

Section B - Construction Stage 1 – Short Term

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 5, 2017

Figure B12



LEGEND

NOTES

1. Excess pore water pressure applied to thawing ice-rich till and lakebed sediemnt
2. Weight of newly placed material applied to Bbar parameter for excess pore water pressure

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

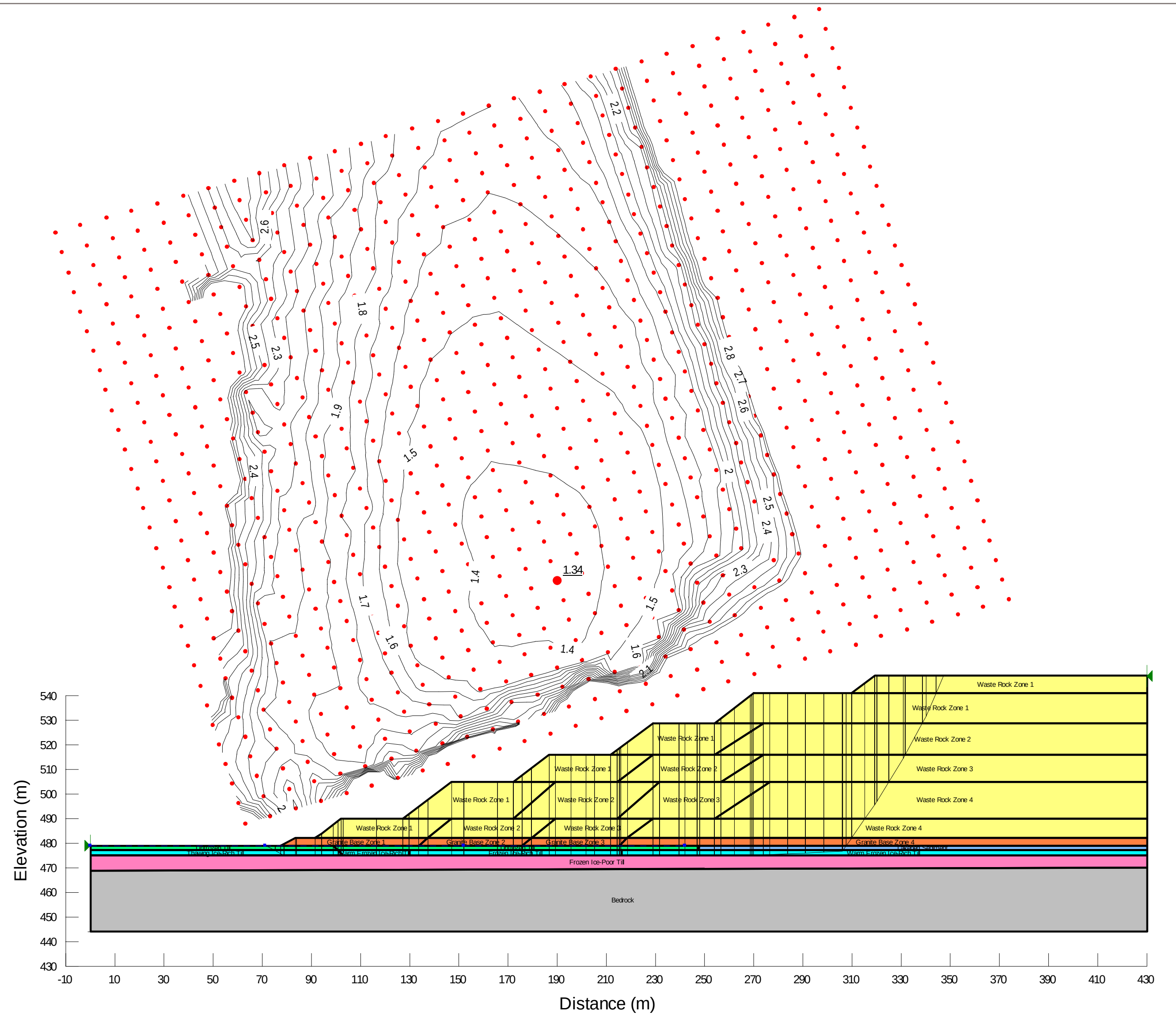
Slope Stability - Pigeon Pit WRSA Expansion

Section B - Construction Stage 6 – Short Term

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 5, 2017

Figure B13



LEGEND

NOTES

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

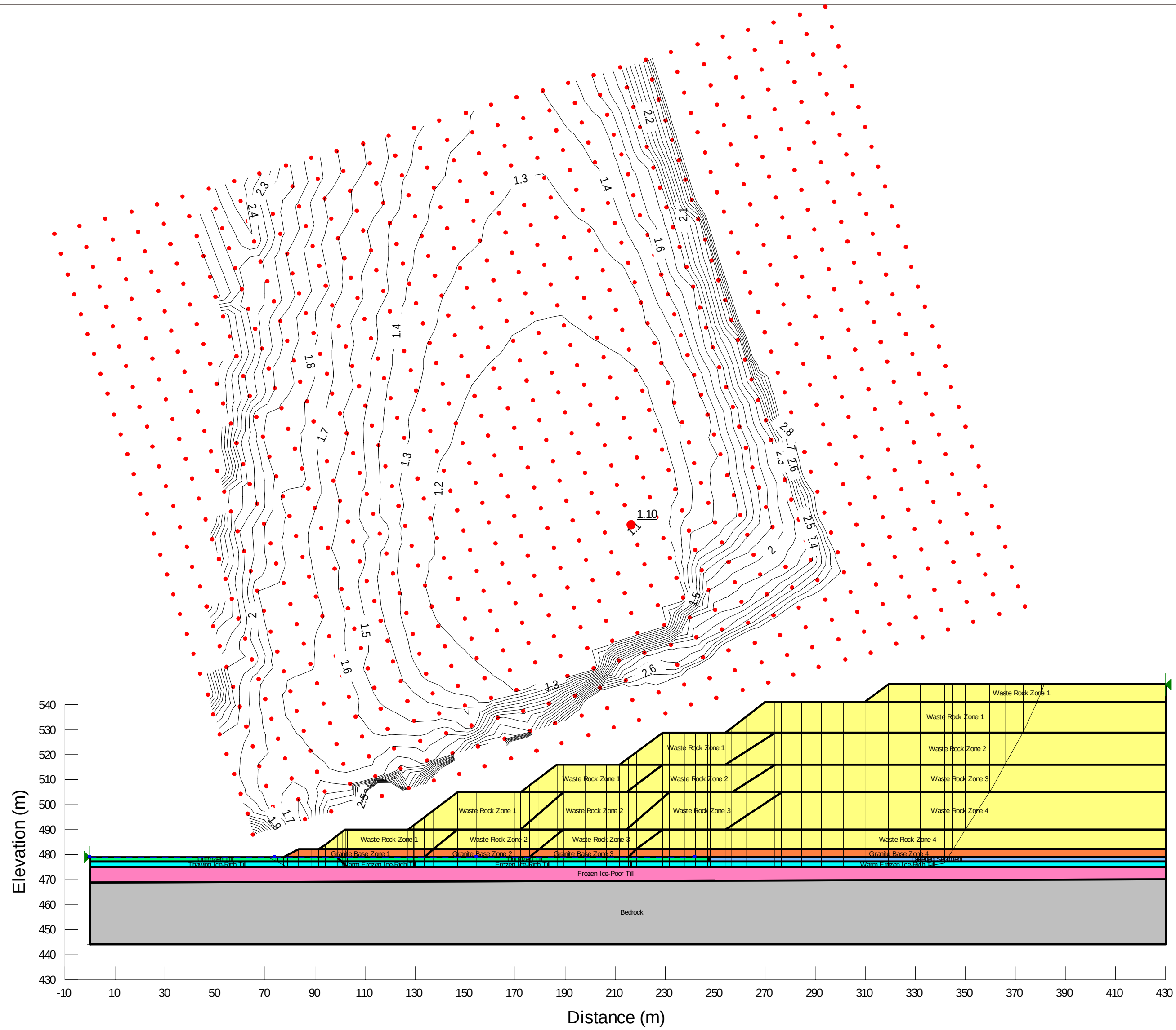
Slope Stability - Pigeon Pit WRSA Expansion

Section B - Post Construction - Long Term - Static Slip through Warm Frozen Ice-Rich Till

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 4, 2017

Figure B14



LEGEND

NOTES

1. Long-term cohesion for frozen ice-rich till under static loading was used in this analysis. This is conservative for short-term seismic loading. The actual ice-rich till cohesion under seismic loading would be higher because of a high loading rate. Therefore the actual factor of safety for seismic loading would be higher than calculated in this analysis.

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

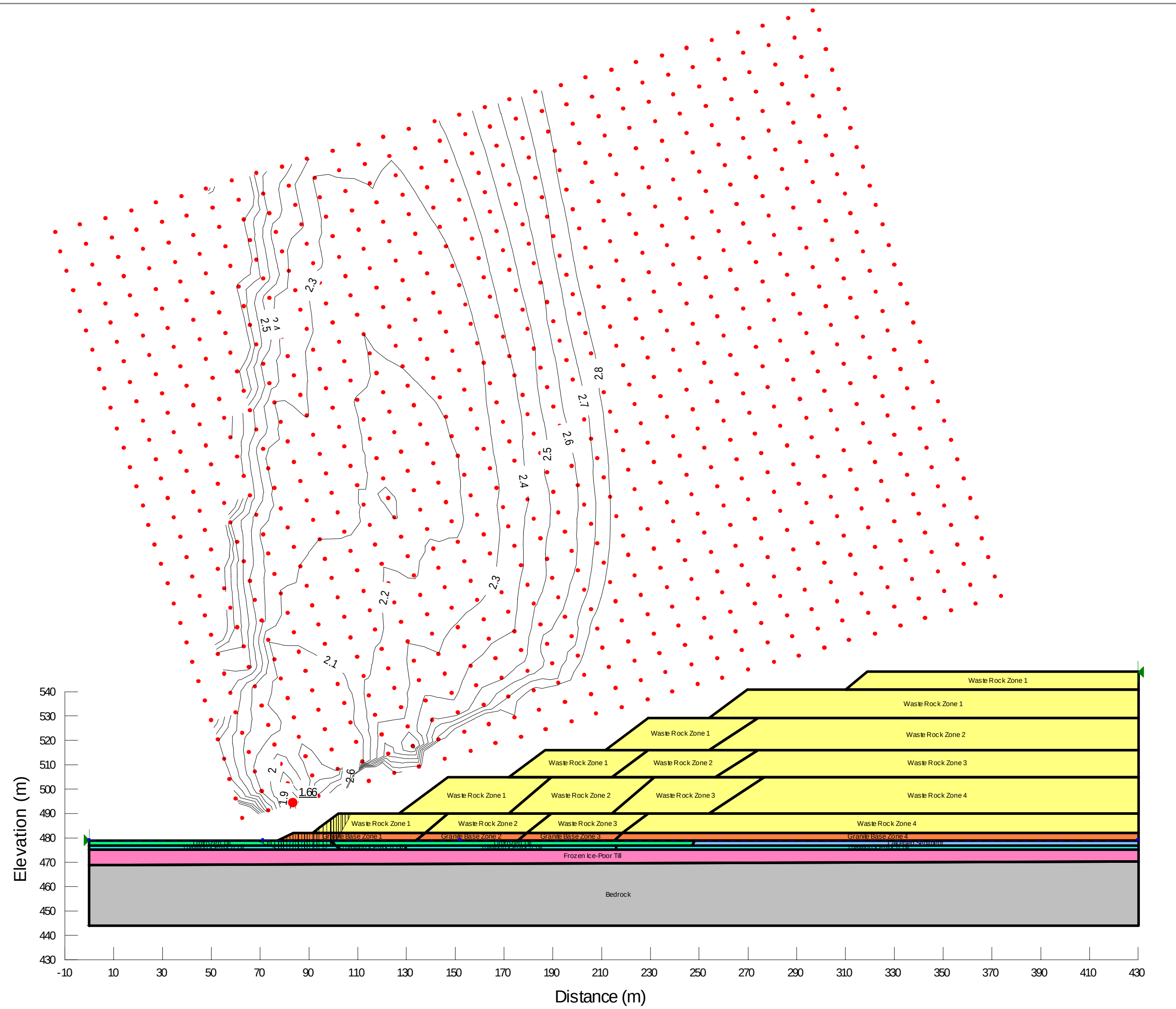
Slope Stability - Pigeon Pit WRSA Expansion

Section B - Post Construction - Long Term - Seismic Slip through Warm Frozen Ice-Rich Till

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 4, 2017

Figure B15



LEGEND

NOTES

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

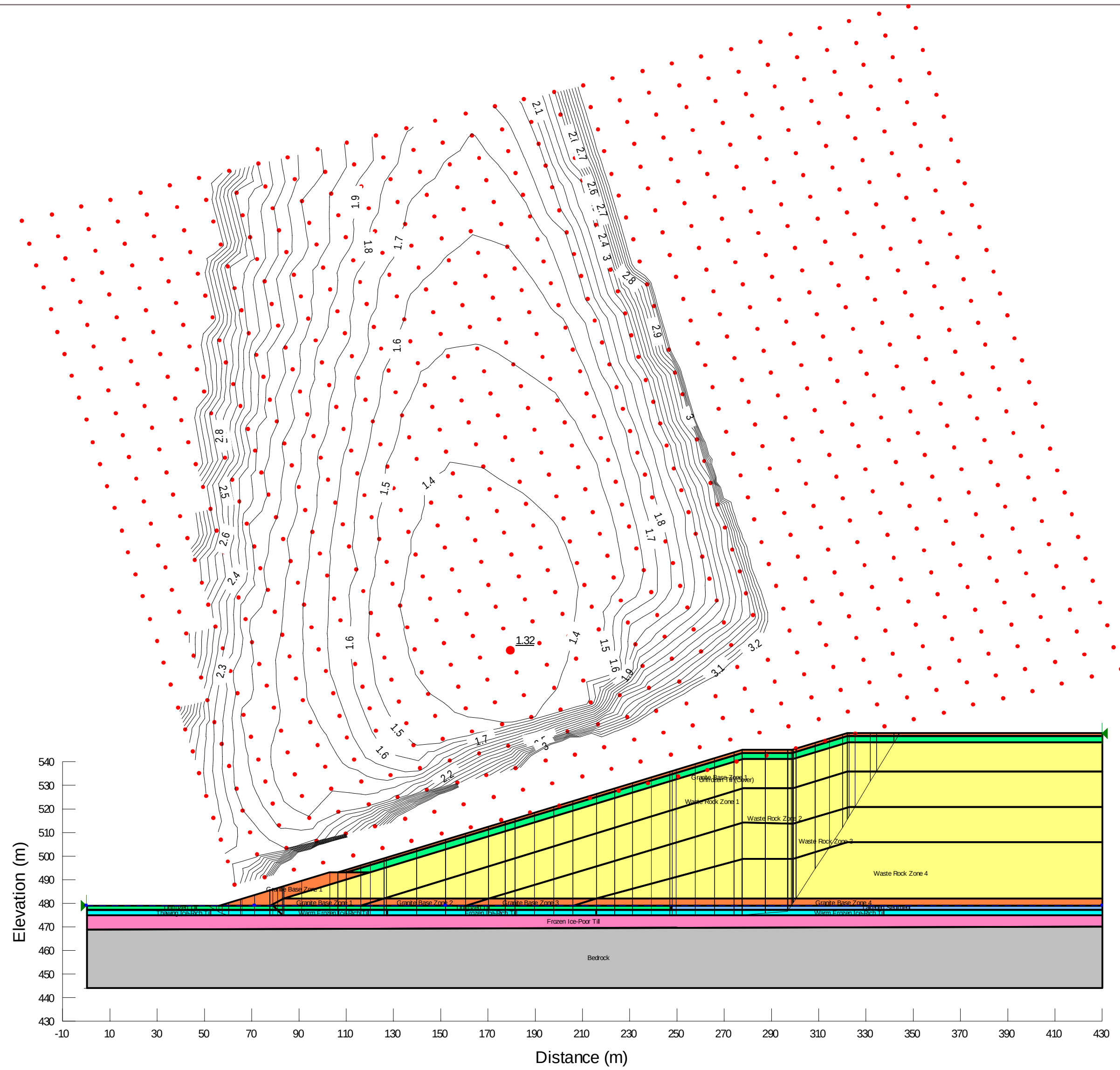
Slope Stability- Pigeon Pit WRSA Expansion

Section B - Post Construction - Long Term - Static Slip through Thawing Ice-Rich Till

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 4, 2017

Figure B16



LEGEND

NOTES

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

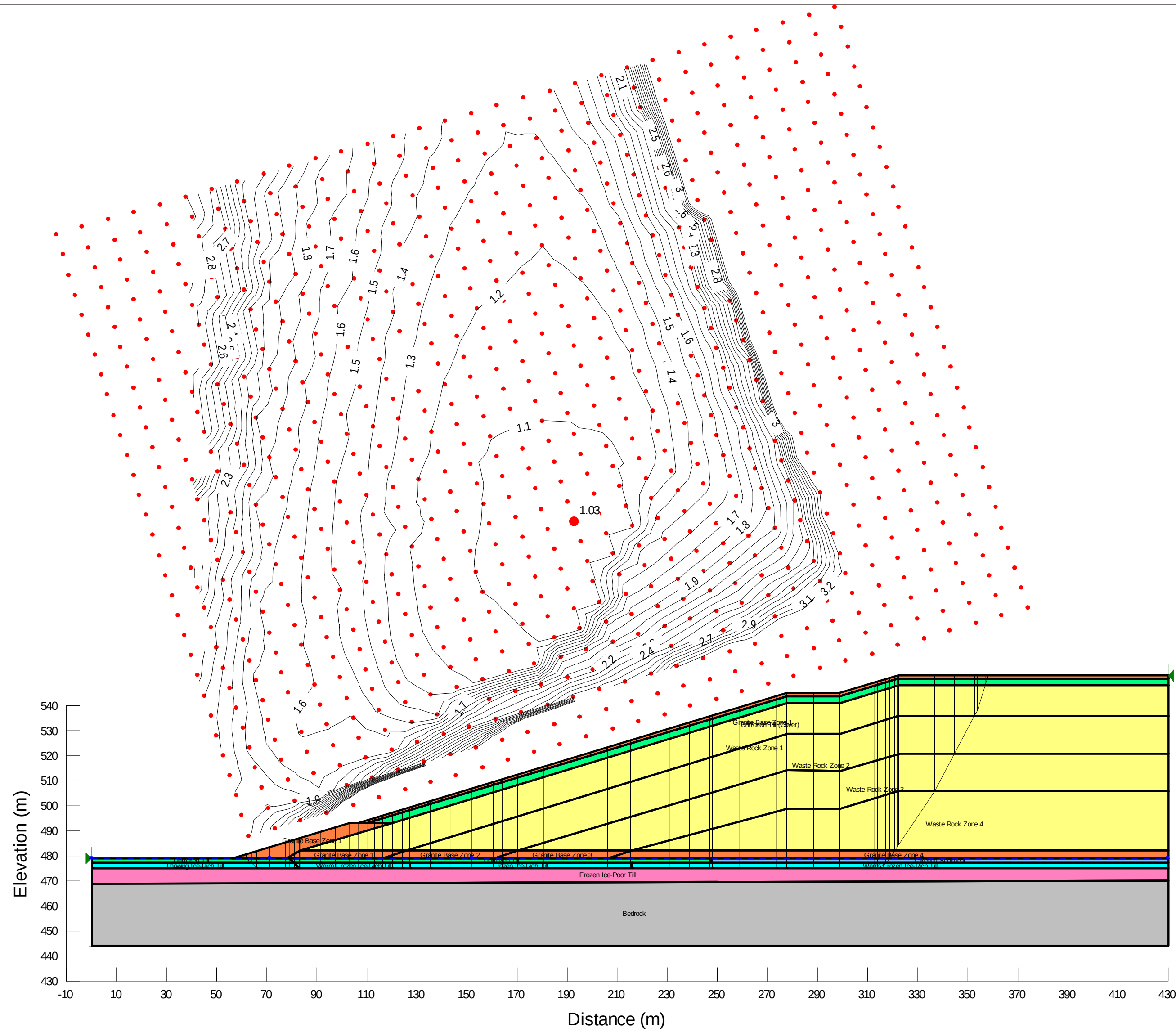
Slope Stability - Pigeon Pit WRSA Expansion

Section B - Closure - Long Term – Static Slip through Warm Frozen Ice-Rich Till

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 4, 2017

Figure B17



LEGEND

NOTES

1. Long-term cohesion for frozen ice-rich till under static loading was used in this analysis. This is conservative for short-term seismic loading. The actual ice-rich till cohesion under seismic loading would be higher because of a high loading rate. Therefore the actual factor of safety for seismic loading would be higher than calculated in this analysis.

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

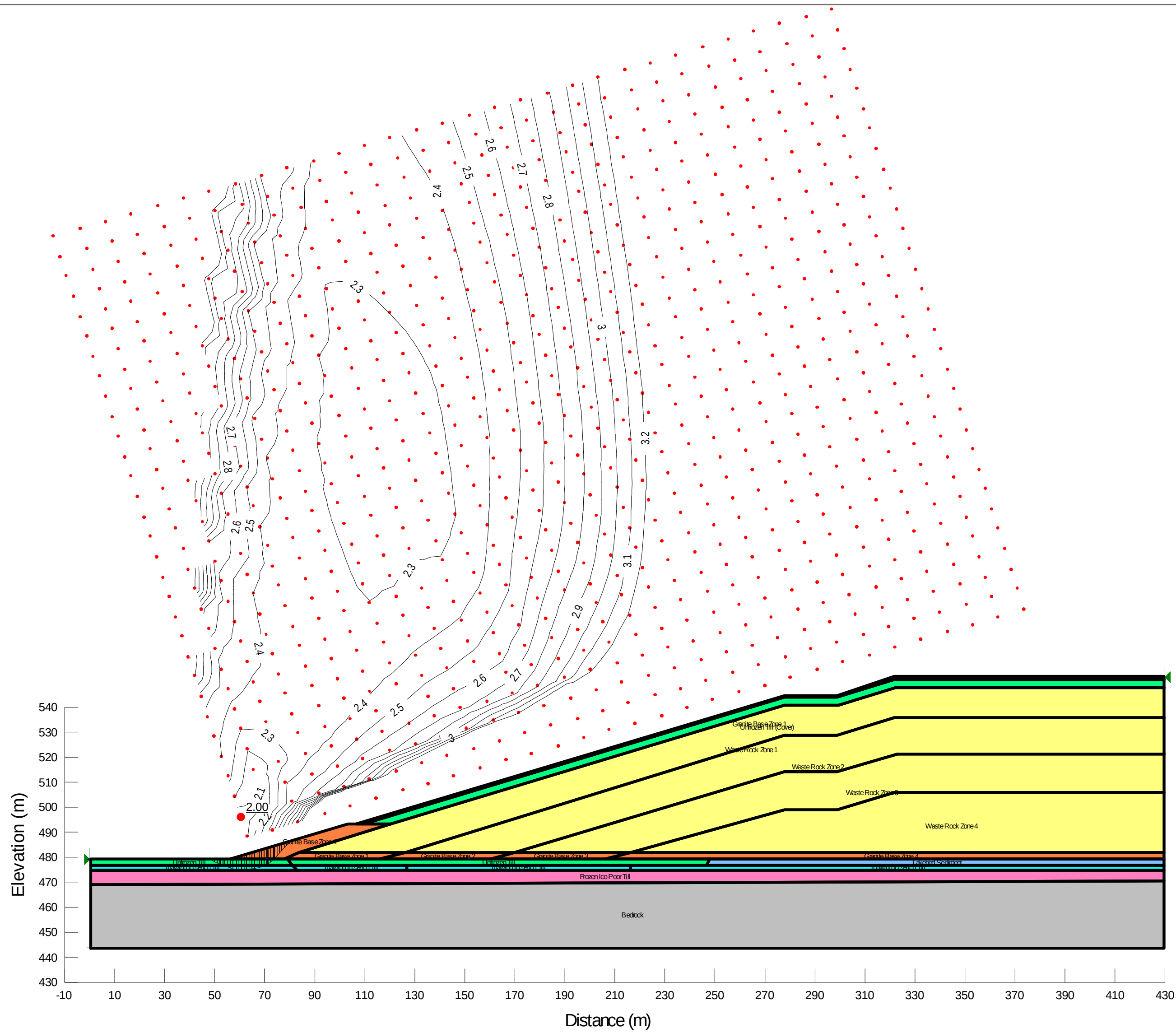
Slope Stability - Pigeon Pit WRSA Expansion

Section B - Closure - Long Term – Seismic Slip through Warm Frozen Ice-Rich Till

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May4, 2017

Figure B18



LEGEND

NOTES

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

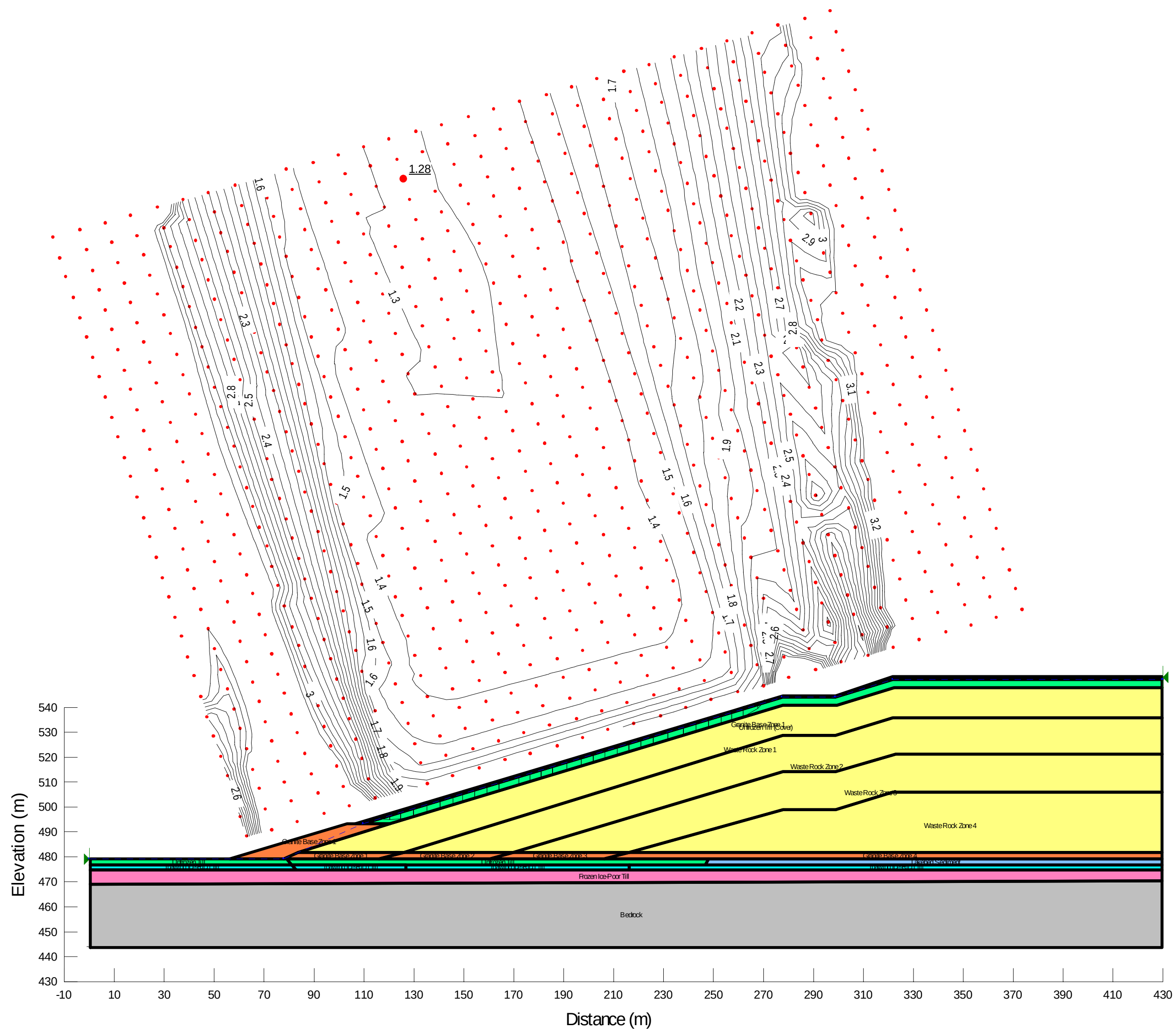
Slope Stability - Pigeon Pit WRSA Expansion

Section B - Closure - Long Term – Static Slip through Thawing Ice-Rich Till

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 4, 2017

Figure B19



LEGEND

NOTES

1. Forced failure through the till cover

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

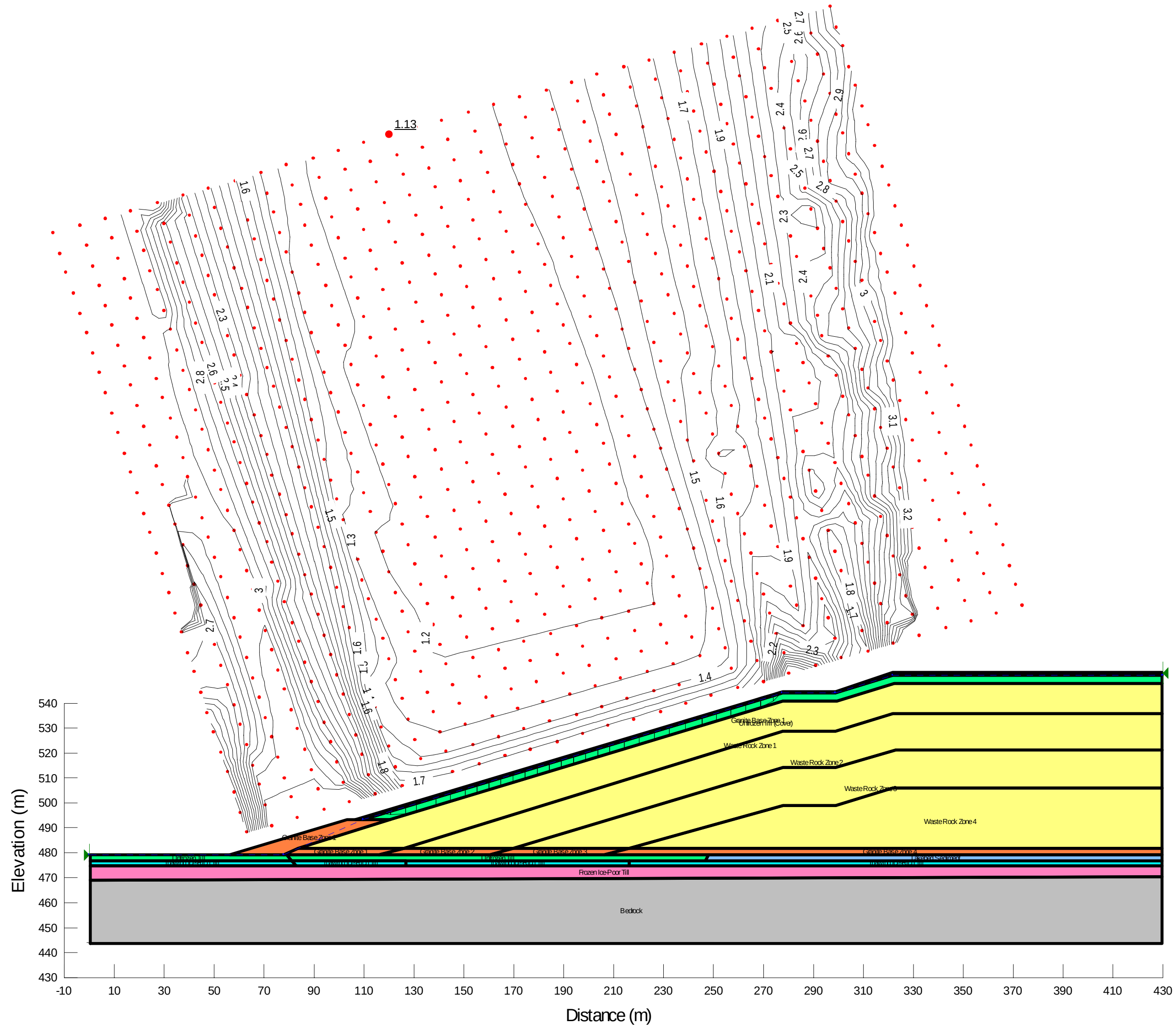
Slope Stability - Pigeon Pit WRSA Expansion

Section B - Closure - Long Term - Static
Slip through Fully Saturated Till Cover

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 5, 2017

Figure B20



LEGEND

NOTES

1. Forced failure through the till cover

STATUS

CLIENT

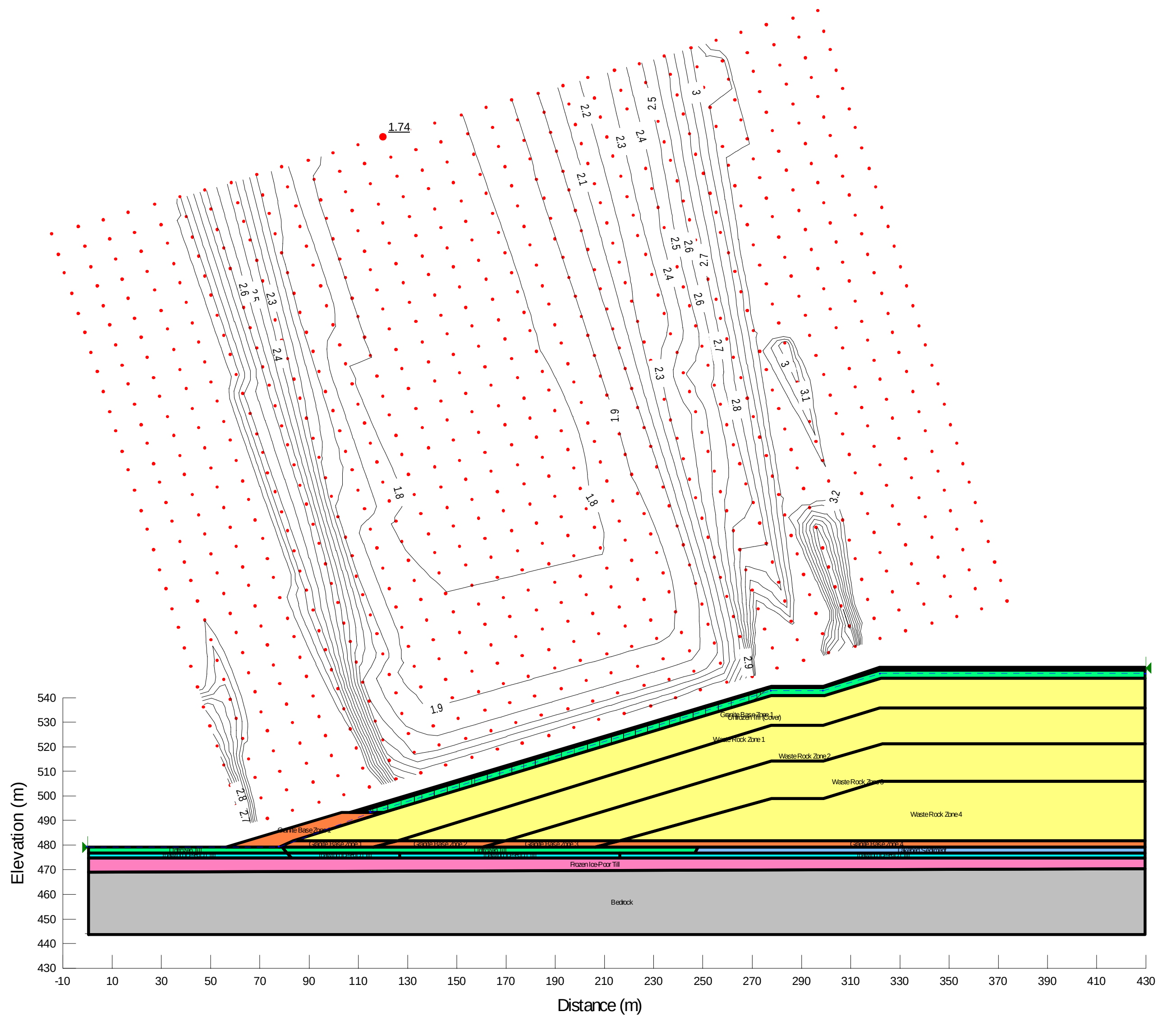
DOMINION DIAMOND CORPORATION

TETRA TECH

Slope Stability - Pigeon Pit WRSA Expansion

Section B - Closure - Long Term – Seismic Slip through Fully Saturated Till Cover

PROJECT NO.	DWN	CKD	APVD	REV	
E14103068-03	JY	GZ	GZ	0	Figure B21
OFFICE	DATE				
EDM	May 5, 2017				



LEGEND

NOTES

1. Forced failure through the till cover

STATUS

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH

Slope Stability - Pigeon Pit WRSA Expansion

Section B - Closure - Long Term – Static Slip through Half Saturated Till Cover

PROJECT NO.	DWN	CKD	APVD	REV
E14103068-03	JY	GZ	GZ	0

OFFICE	DATE
EDM	May 5, 2017

Figure B22

Appendix D: Diabase Geochemical Evaluations

TECHNICAL MEMORANDUM

DATE 23 July 2019 **REFERENCE No.** 1773267-E19039-TM-Rev0-8100

TO Kurtis Trefry
Dominion Diamond Ekati ULC

CC Lukas Novy and Cassandra Legacy

FROM Mackenzie Bromstad and Kristin Salzsauler **EMAIL** Mackenzie_Bromstad@golder.com; Kristin_Salzsauler@golder.com

EKATI MINE DIABASE GEOCHEMICAL EVALUATION

1.0 INTRODUCTION

The Waste Rock and Ore Storage Management Plan (WROMP) for the Ekati Diamond Mine (Ekati mine) describes the environmental characteristics of waste rock, and the design approach that is used at the Ekati mine to mitigate environmental risks. The WROMP also describes the geochemical characteristics (i.e., acid / alkaline rock drainage and metal leaching potential) of waste rock and coarse kimberlite rejects. The WROMP describes the management of granite and metasediment, which are the most volumetrically significant waste rock types at the Ekati mine. Diabase is a volumetrically minor waste rock lithology, and was not explicitly addressed in previous versions of the WROMP.

This memorandum includes a summary of the geochemical characteristics of diabase materials at Ekati and recommendations for the environmentally-appropriate management of diabase, which has been or will be encountered at the Fox, Misery, Sable, Pigeon, Beartooth, Lynx, and Jay developments. This latest update of the memorandum includes the addition of a more detailed section comparing relevant diabase, granite, and metasediment geochemical characteristics at Ekati (Section 4.0).

2.0 DIABASE OCCURRENCE

Five major swarms of Proterozoic diabase dyke occur on the Ekati claim block. Most dykes belong to the Mackenzie Dyke Swarm or the 305 Dyke Swarm. Diabase dykes typically are several metres (m) thick; dykes in the Mackenzie Dyke Swarm may measure up to 50 m wide, and dykes in the 305 Dyke Swarm measure 10 m to 30 m wide (DDEC 2014). The diabase dykes occur as intrusions in the metasediments and granites. Dyke contacts with the country rock are well-defined and visually distinct (DDEC 2016). The diabase dykes appear dark grey to black in color, and are fine-grained (DDEC 2014). Diabase is a minor waste rock lithology at the Ekati mine, comprising less than 10% of all Ekati waste rock (DDEC 2016).

3.0 GEOCHEMICAL CHARACTERISTICS OF DIABASE

This section provides an overview of the geological and geochemical characteristics of diabase, based on the results of geochemical characterization of diabase samples collected from several areas at the Ekati mine, including Fox, Misery, Sable, Pigeon, Beartooth, Jay and Lynx.

3.1 Geochemical Dataset

The geochemical dataset includes the results of baseline geochemical testing and routine operation samples. Baseline geochemistry samples generally consist of exploration drill core samples, collected prior to the start of mining. Samples for routine waste rock characterization during mining are collected from blasted muck. Prior to 2007, samples were collected at a minimum frequency of one sample per 100,000 tonnes of mined material. Since 2007, samples are collected at a frequency of three samples per rock type per bench every three years for the Fox pit (until 2014 when open-pit mining was completed in Fox Pit), and three samples per rock type per bench at the Misery, Pigeon, Sable, and Lynx Pits.

In total, the geochemical dataset includes 162 diabase samples, of which the majority were collected from the Misery Pit (100 samples). The remaining samples were collected from the Fox Pit (24 samples), Pigeon Pit (7 samples), Jay core samples (4 samples), Sable Pit (1 sample), Beartooth core samples (2 samples), and the Lynx area (30 samples). All Lynx samples were collected in 2017 from the following areas: the Lynx Pit (9), the Lynx WRSA (2), the Jay crusher stockpile (17), and coarse and fine crush from the Jay crusher (2). Diabase samples from the Jay crusher stockpile consisted of diabase mixed with variable amounts of granite from the Lynx WRSA, slated to be used in future Jay construction. Lynx area samples from the Lynx WRSA, Jay crusher stockpile, and Jay crusher consist of mixed diabase and granite (21 of 30 Lynx area samples).

Appendix A presents the complete results of static testing of diabase samples in the Ekati mine geochemical dataset; the results of kinetic testing are presented in DDEC (2014).

3.2 Solid Phase Composition

Diabase contains variable percentages of magnetite, and traces of disseminated pyrite and chalcopyrite (DDEC 2013). It has low but variable overall concentrations of carbonate minerals (mostly calcite), mostly occurring as fracture fillings (DDEC 2016). The mineralogical composition of a single sample analyzed via x-ray diffraction consisted of plagioclase feldspar, augite, ilmenite, kaolinite, phlogopite, and quartz (DDEC 2014).

Diabase metal concentrations vary spatially between and within pit areas (DDEC 2014). Metals that occurred in concentrations above detection limits, greater than five times reference crustal levels (Price 1997), and in greater than 10% of the diabase dataset included bismuth (68% of Misery and 97% of Lynx), copper (13% of Lynx, 26% of Misery, and 29% of Pigeon), and selenium (14% of Pigeon, 7% of Lynx, and 71% of Misery). Five samples at Misery and two samples at Lynx contained elevated thorium; both elevated thorium Lynx samples were from the Jay crusher stockpile (mixed granite-diabase). Six Misery samples contained elevated mercury. Three samples at Fox and one at Misery contained elevated antimony, and five samples at Fox contained elevated silver. One sample each at Fox and Pigeon, and six samples at Misery reported elevated arsenic.

3.3 Acid Generation Potential

In the diabase dataset, 162 samples underwent acid base accounting (ABA). Within this dataset, 21 samples consisted of mixed diabase and granite, and 141 samples consisted of "pure" diabase. Sulphur data was available for all 162 samples (including all 141 pure diabase samples), and information was available to calculate the NP/AP ratio for 155 samples.

The average total sulphur content of the 162 samples in the diabase dataset was 0.11%, and the median value was 0.10% (<0.01% to 1.3%). Total sulphur concentration ranges by deposit are summarized as follows:

- Both Beartooth samples had total sulphur concentrations <0.01%.
- Fox diabase total sulphur concentrations ranged from 0.03% to 1.33%, with a median of 0.05%.
- Jay diabase total sulphur ranged from 0.04% to 0.05% (median 0.04%).
- Lynx WRSA samples contained 0.03 and 0.1% total sulphur, Lynx Pit samples contained from 0.02 to 0.03% (median 0.03%) total sulphur, Jay crusher stockpile samples (diabase mixed with granite) contained from 0.02 % to 0.04% (median 0.03%) total sulphur, and the two Jay fine / coarse crusher samples (diabase mixed with granite) contained 0.01 % and 0.03% total sulphur.
- Misery diabase total sulphur ranged from 0.01% to 0.20%, with a median of 0.11%.
- Pigeon diabase samples had total sulphur concentrations from 0.01% to 0.06%, median 0.05%.
- The Sable diabase sample had a total sulphur concentration of 0.01%.

The bulk neutralization potential (NP) of the 162 samples in the diabase dataset ranged from 0.5 to 68 kg/t $CaCO_3$ equivalents, with an average value of 13 kg/t $CaCO_3$ and a median value of 12 kg/t $CaCO_3$. Ranges of diabase NP values by deposit are summarized as follows, in units of kg/t $CaCO_3$ equivalents:

- Beartooth diabase NP values were 9.4 and 8.6 kg/t $CaCO_3$.
- Fox diabase NP values ranged from 0.5 to 68 kg/t $CaCO_3$ (median 14 kg/t $CaCO_3$).
- Jay diabase NP values ranged from 5.8 to 7.1 kg/t $CaCO_3$ (median 6.7 kg/t $CaCO_3$).
- Lynx diabase NP values were 14 and 16 kg/t $CaCO_3$ in Lynx WRSA samples, 11 to 16 kg/t $CaCO_3$ (median 14 kg/t CaCO3) in Lynx pit samples, 11 to 30 kg/t $CaCO_3$ (median 13 kg/t $CaCO_3$) in Jay crusher stockpile mixed granite-diabase samples, and 5 and 6.5 kg/t $CaCO_3$ in the Jay coarse / fine crush mixed granite-diabase samples.
- Misery diabase NP values ranged from 2.5 to 31 kg/t $CaCO_3$ (median 12 kg/t $CaCO_3$).
- Pigeon diabase NP values ranged from 7.9 to 15 kg/t $CaCO_3$ (median 11 kg/t $CaCO_3$).
- The Sable diabase sample had an NP value of 9.0 kg/t $CaCO_3$.

Carbonate NP varied between 0.23 and 18 kg/t $CaCO_3$, with an average value of 2.8 kg/t $CaCO_3$ and a median value of 2.3 kg/t $CaCO_3$. The higher values of bulk NP relative to carbonate NP indicate that silicate minerals may be a considerable source of NP in diabase in addition to carbonate minerals. Carbonate analyses for diabase at each deposit are summarized as follows:

- Beartooth diabase carbonate NP was 0.42 kg/t $CaCO_3$.
- Fox diabase carbonate NP ranged from 2.3 to 6.8 kg/t $CaCO_3$ (median 2.3 kg/t $CaCO_3$).
- Jay diabase carbonate NP ranged from 0.83 to 2.5 kg/t $CaCO_3$ (median 1.7 kg/t $CaCO_3$).
- Lynx diabase carbonate NP ranged as follows: 2.3 kg/t $CaCO_3$ in Lynx WRSA samples, 0.85 to 3.3 kg/t $CaCO_3$ (median 0.85 kg/t $CaCO_3$) in Lynx pit samples, 0.85 to 12 kg/t $CaCO_3$ (median 0.85 kg/t $CaCO_3$) in mixed granite-diabase Jay crusher stockpile samples, and 0.85 kg/t $CaCO_3$ in both mixed granite-diabase Jay crusher samples.
- Misery diabase carbonate NP ranged from 0.23 to 18 kg/t $CaCO_3$ (median 2.3 kg/t $CaCO_3$).
- Pigeon diabase carbonate NP values were 0.42, 0.83, and 2.1 kg/t $CaCO_3$.
- The Sable diabase sample had a carbonate NP value of 0.83 kg/t $CaCO_3$.

The acid generation potential of diabase was determined based on ABA classifications, determined with the ratio of NP to AP (NP/AP ratio). Figure 1 presents the NP/AP ratio of diabase samples by deposit type, updated from DDEC (2014) to include data collected between 2013 and 2017, which includes 155 samples. The NP/AP ratio of diabase samples collected from the Ekati mine ranged from 0.04 to 60, with an average of 8.0 and a median of 4.3.

In total, 94% of the diabase dataset (147 of 155 samples) consisted of NPAG samples (NP/AP ratios >2), 3% (4 of 155 samples) had an uncertain acid generation potential (NP/AP ratios between 1 and 2), and less than 3% (4 of 147 samples) was classified as potentially acid generating (PAG) (NP/AP<1). Acid generation potential of diabase by deposit is summarized as follows:

- All Beartooth (2), Jay (4), Lynx (9), Pigeon (7), and Sable (1) diabase samples were classified as NPAG.
- Four of 94 Misery diabase samples were classified as uncertain (4%); the remaining 96 samples were NPAG (96%).
- One of 17 Fox diabase samples was classified as PAG (6%), three of 17 as uncertain (18%), and the remaining 13 were classified as NPAG (76%).
- All of the 21 mixed diabase / granite Lynx WRSA and Jay crusher stockpile samples were classified as NPAG.

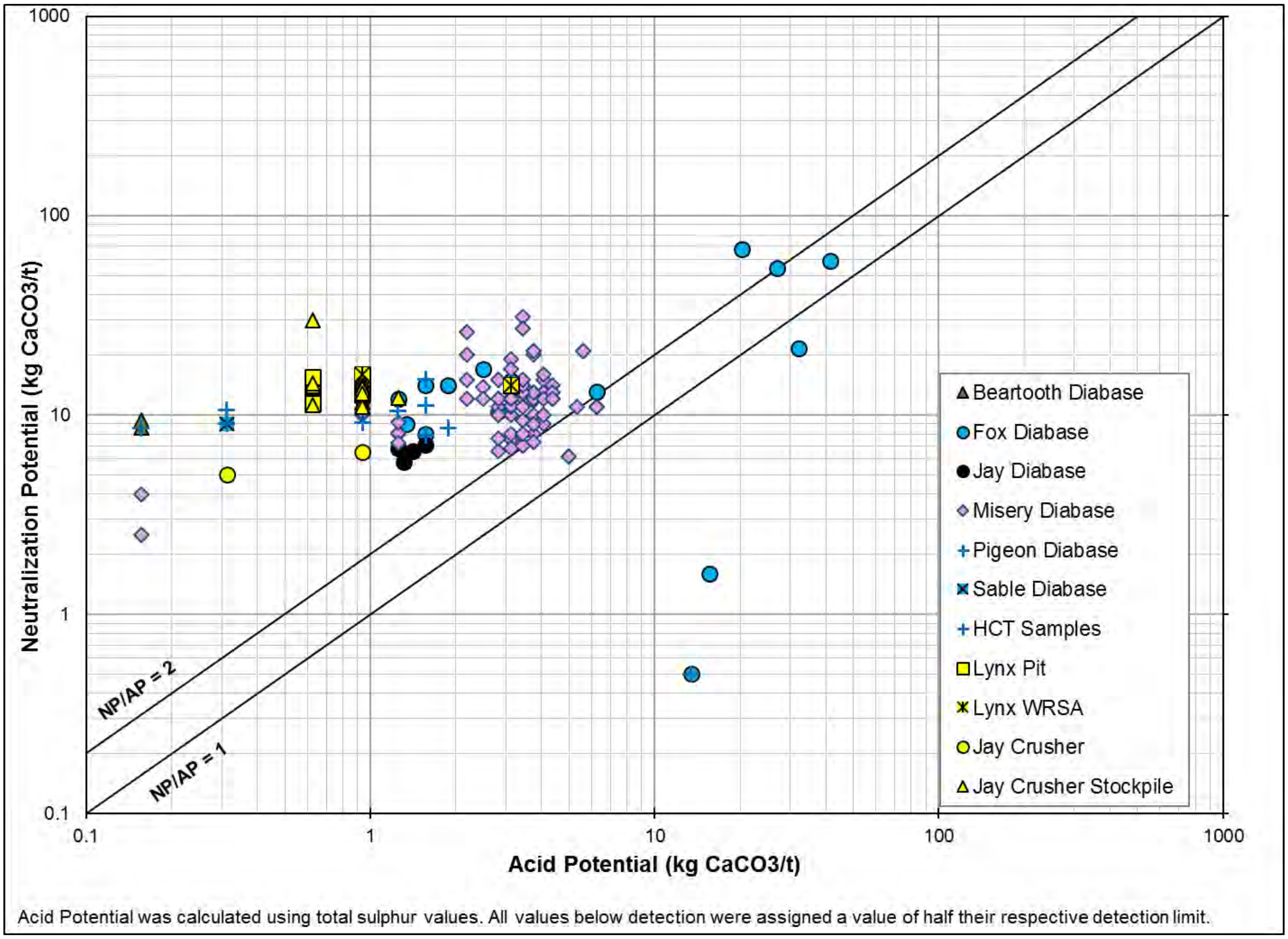


Figure 1: Acid Generation Potential (NP/AP ratio) of Diabase Samples

The results of humidity cell tests (HCT) were used to confirm the long-term acid generation potential of diabase. Humidity cell tests were conducted on seven diabase samples (one Fox, one Sable, four Pigeon, and one Beartooth). All samples used in the HCT program had NP/AP ratios greater than 2 (NPAG), except one sample from the Fox Pit that had an NP/AP ratio of 0.04 (Figure 1).

Apart from the PAG Fox Pit sample, the HCTs maintained a circumneutral to weakly alkaline pH (approximately 6 to 8.7) (Figure 3), while sulphate concentrations were generally stable at <10 mg/L after initial cell flushing (Figure 3). Acid potential and NP depletion calculations confirmed that these humidity cell tests would not generate acidity over time. Fox Pit sample FUC 3-3 70 developed weakly acidic leachate, with the pH decreasing from 8.7 to 5.6. In this sample, sulphate concentrations increased with decreasing pH. Depletion calculation results indicated that NP had been completely depleted from the Fox Pit sample by the end of the HCT duration (133 weeks), and that it would take approximately 35 years to deplete the remaining sulphur in the sample in laboratory conditions (DDEC 2014). It should be noted that the leachate of the Fox Pit sample was only mildly acidic over the last ten weeks of testing, with a pH ranging from approximately 5.5 to 6.1, while sulphate concentrations were generally less than 40 mg/kg after the first flush. As such, this PAG sample demonstrated only moderate reactivity.

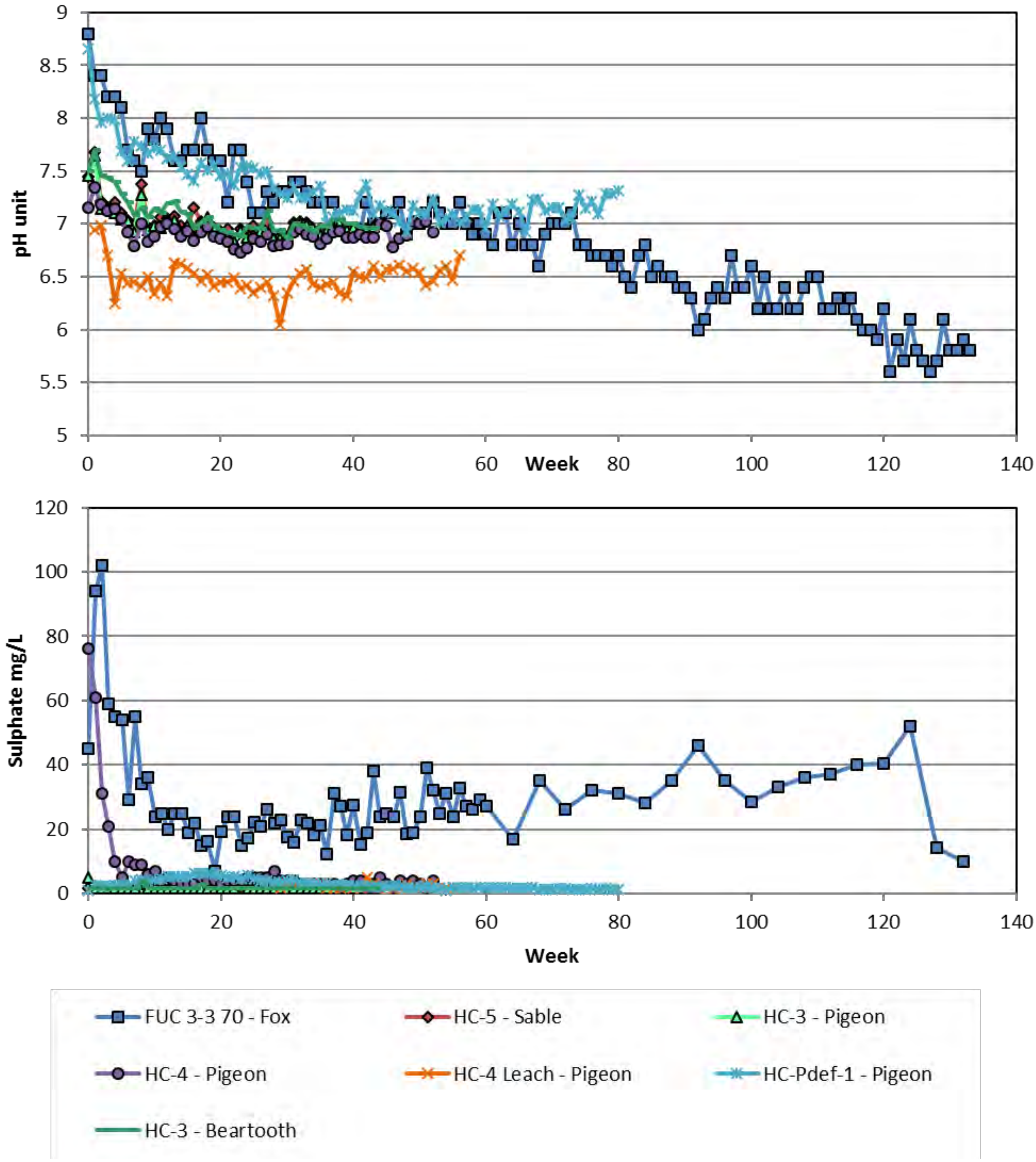


Figure 2: Diabase Humidity Cell Test Results for pH and Sulphate

Leachate from two Jay diabase net acid generation (NAG) tests had pH values of 6.4 and sulphate concentrations of 11 and 17 mg/L (DDEC 2014), respectively. NAG test leachate from 22 Lynx diabase samples had NAG pH values ranging from 6.7 to 7.8, and sulphate concentrations ranging from 3.8 to 11 mg/L. This confirms the generally NPAG nature of diabase.

3.4 Metal Leaching Potential

Diabase metal leaching potential was evaluated using the results of short-term leach testing, and HCT. Short-term leach testing was completed on a subset of samples of diabase from the Jay area (drill core) and Lynx Pit, and HCT was completed on samples from the Fox Pit, Sable Pit, Pigeon Pit and Beartooth Pit (DDEC 2014). Short and long-term leach test results were compared to the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 2014). The objective of this comparison was to utilize the CCME guidelines as a screening tool to identify parameters that may require further consideration in the context of the Project waste and water management plans.

Short-term leach tests, including Shake Flask Extraction (SFE) and NAG leachate analysis, were completed on two Jay diabase samples and 22 Lynx diabase and mixed diabase / granite samples. Shake flask extraction leachates are used to evaluate metal leaching potential associated with readily soluble minerals. Net acid generation leachates represent the composition of leachate after complete oxidation of any sulphide minerals present in a sample, and dissolution of soluble mineral phases. Short-term leach test results included:

- Aluminum concentrations exceeded the reference criterion in the two Jay diabase samples submitted for SFE and NAG short-term leach testing (DDEC 2014). At Lynx, 21 of 22 diabase and mixed diabase / granite samples submitted for SFE testing and 20 of 22 samples submitted for NAG testing exceeded the reference criterion.
- Arsenic concentrations exceeded the reference criterion for five of 22 Lynx samples in SFE testing, and eight of 22 Lynx samples for NAG testing.
- Chromium concentrations exceeded the reference criterion in all 22 Lynx NAG leachates, and in both Jay NAG leachates.
- Copper concentrations exceeded the reference criterion for 11 of 22 Lynx NAG samples.
- Twenty of 22 Lynx NAG samples exceeded the reference criterion for selenium. These results are similar to values returned for granite NAG leachates, and Jay diabase NAG leachates.
- Several other parameters exceeded reference criteria for one or more samples: one Lynx SFE sample exceeded the reference criterion for lead; both Jay NAG samples exceeded the criterion for cadmium; four of 22 Lynx NAG leachates exceeded the reference criterion for iron. Granite NAG leachates also exceeded criteria for cadmium and lead in some samples (DDEC 2014).

Seven diabase samples were submitted for kinetic testing, including one sample from the Fox Pit (FUC 3-370), one sample from the Sable Pit (HC-5), four samples from the Pigeon Pit (HC-3, HC-4, HC-4 Leach [carbonic leach sample], and HC-Pdef-1) and one sample from the Beartooth Pit (HC-3). Of the HCT samples, one sample was PAG (Fox Pit), and the remaining samples were NPAG. The HCT length ranged from 17 to 133 weeks. Humidity cell test results included:

- Aluminum concentrations exceeded the reference criterion in HCTs of diabase samples from Fox, Sable, Pigeon, and Beartooth. Granite also leached aluminum at concentrations greater than the reference criterion (DDEC 2014); aluminum concentrations in diabase HCTs were within the range of aluminum concentrations measured in granite HCT leachates.

- Arsenic concentrations in diabase HCT leachates were higher than the reference criterion during the first 20 weeks of testing. Arsenic also leached from granite HCTs from the Koala, Fox, and Pigeon Pits; arsenic leachate concentrations for the diabase HCTs were within the range of concentrations measured in granite HCT leachates.
- Copper concentrations were higher than the reference criterion for the duration of HCT testing in diabase samples from Pigeon, and zinc concentrations were higher than the reference criterion in the first flush of Pigeon and Sable samples (DDEC 2014). Copper and zinc concentrations were similar to those measured in granite HCT leachates.
- Humidity cell leachate for the PAG diabase sample from the Fox Pit had elevated concentrations above the reference criteria for several elements that increased over time, including nickel and cobalt. Nickel and cobalt concentrations in NPAG HCT leachates were similar to those in granite HCT leachates. Occasional elevated concentrations were noted for cadmium, lead, selenium, and vanadium in leachates from the Fox Pit sample (DDEC 2014).
- HCT leachates for Fox and Koala granites also exceeded reference criteria for selenium at several points throughout testing, and in several other locations during the first flush, as did mercury (DDEC 2014).

Jay and Lynx SFE leachate concentrations were generally lower than metal concentrations in NAG leachates and HCT leachates. Metal concentrations in the Lynx and Jay diabase NAG leachate were similar to those from the overall Ekati diabase HCT dataset. Parameters that exceeded reference criteria in short-term leach tests generally also exceeded criteria in some granite and/or diabase HCTs. The metal leaching potential of diabase in short-term and long-term leach tests is similar to that of granite (DDEC 2014).

4.0 COMPARISON OF GEOCHEMICAL CHARACTERISTICS OF GRANITE, DIABASE AND METASEDIMENT

The acid generation and metal leaching potential of diabase was compared to that of granite and metasediment in order to establish similarities and differences in geochemical behaviour of the three material types that could inform recommendations for diabase management in the WROMP.

Although all three rock types have a similar range of total sulphur content (Figure 3), granite has a negligible average sulphur content (0.03%); 84% of the granite dataset contains less than 0.05% total sulphur. Diabase has a higher average total sulphur content than granite (0.1%), with 33% of the dataset containing less than 0.05% total sulphur; however, the sulphur content of diabase varies by area at the Ekati Mine. Diabase samples from Beartooth, Jay, Pigeon and Sable contained less than 0.06% total sulphur while diabase samples from Fox and Misery had higher total sulphur contents (0.03% to 1.33% in the Fox diabase and 0.01% to 0.20% in the Misery diabase). As stated in BHP (2007), diabase is highly competent and, as such, does not generate an abundance of fines when blasted, which limits the surface area of diabase waste rock exposed to physical and chemical weathering. In comparison to granite and diabase, metasediment has a higher total sulphur content; the average total sulphur concentration of metasediment samples is 0.14%.

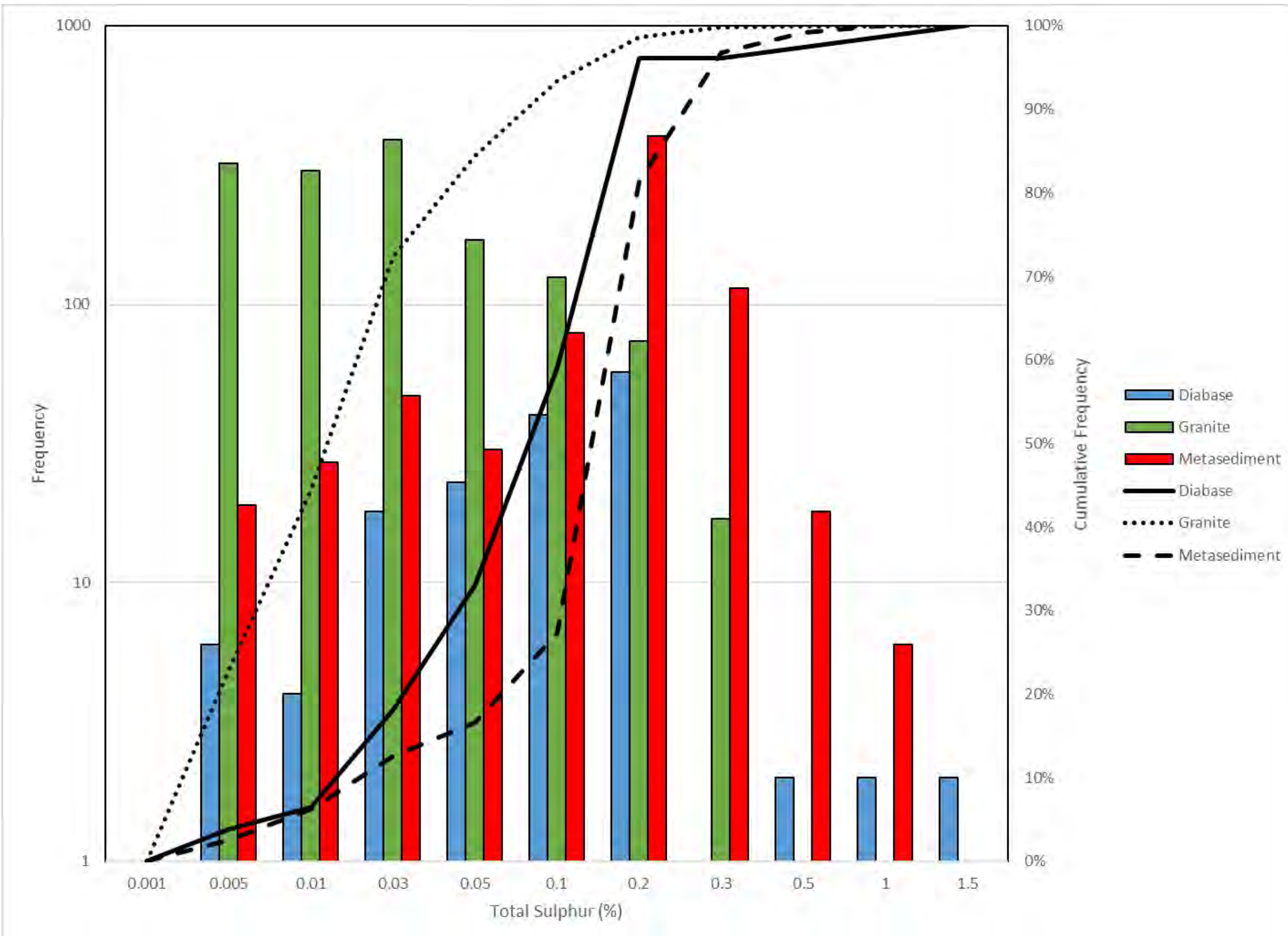
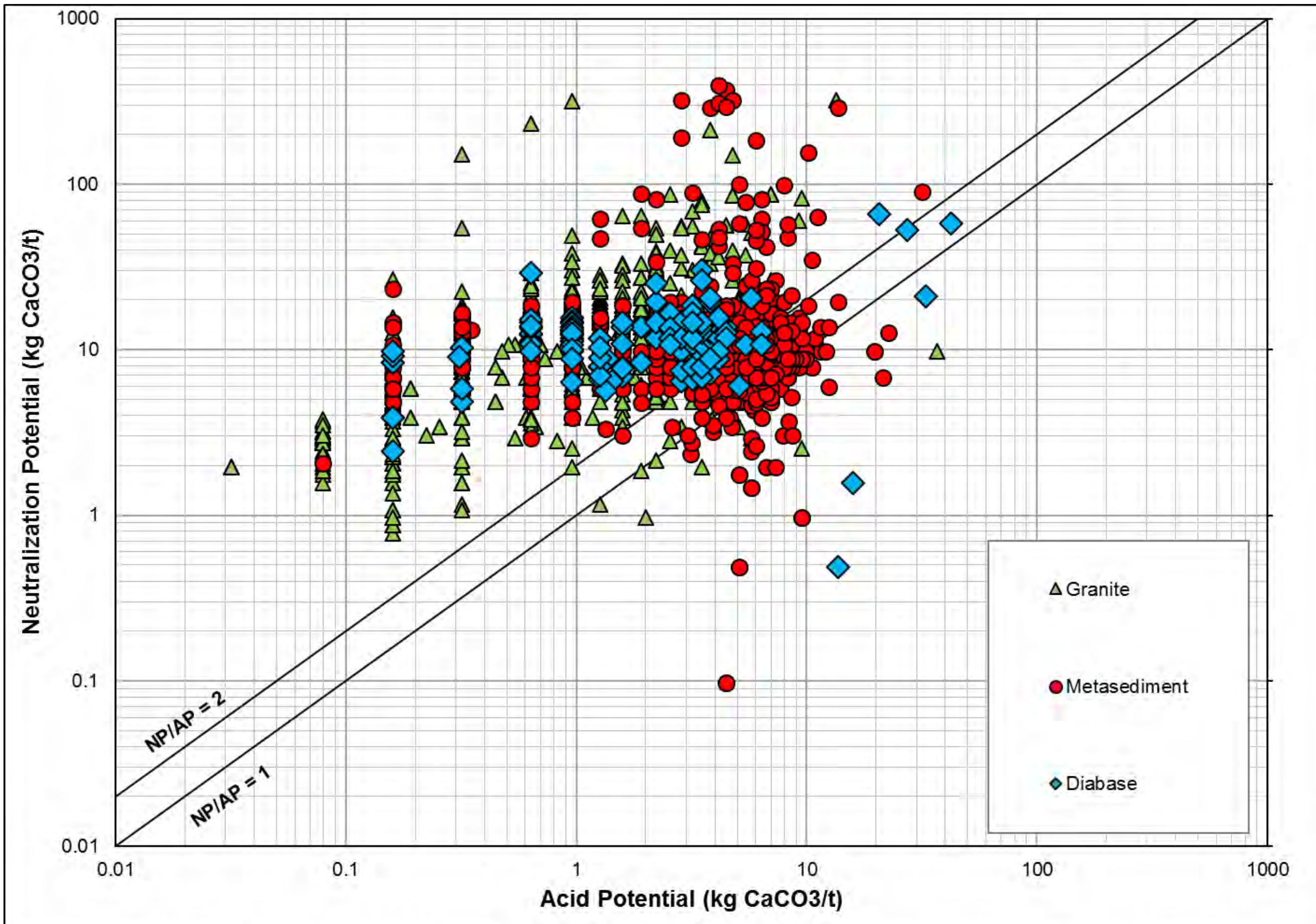


Figure 3: Frequency and Cumulative Distribution of Total Sulphur Concentrations in the Ekati Mine Geochemical Dataset

Figure 4 compares the acid generation potential of all three rock types in terms of NP/AP ratio. As discussed in Section 3.3, 95% of the diabase samples were NPAG (NP/AP>2). Similar to diabase, 97% of granite samples are classified as NPAG (NP/AP>2), 2% as having uncertain acid generation potential (1<NP/AP<2), and 0.6% as PAG (NP/AP<1). In contrast, only 55% of metasediment samples are classified as NPAG; 33% of metasediments are of uncertain acid generation potential, and 12% are PAG.



Acid Potential was calculated using total sulphur values. All values below detection were assigned a value of half their respective detection limit.

Figure 4: Acid Generation Potential (NP/AP ratio) of Diabase, Granite, and Metasediment Samples

Figures 5a and 5b compare the long-term acid generation potential of granite, diabase and metasediment samples, represented by the steady-state pH of humidity cell test leachates. Long-term HCT pH was calculated as the average of the final five to ten measurements (depending on data availability) after a HCT reached a steady-state condition. All but one diabase HCTs reported similar long-term pH values as the granite HCTs. The one outlying diabase sample had a lower NP/AP ratio and higher sulphur content than the granite and metasediment HCTs. As demonstrated by the ABA dataset for diabase samples, high-sulphur diabase is rare, as diabase has been demonstrated to have a low sulphur content (Figure 3) and high NP/AP ratio.

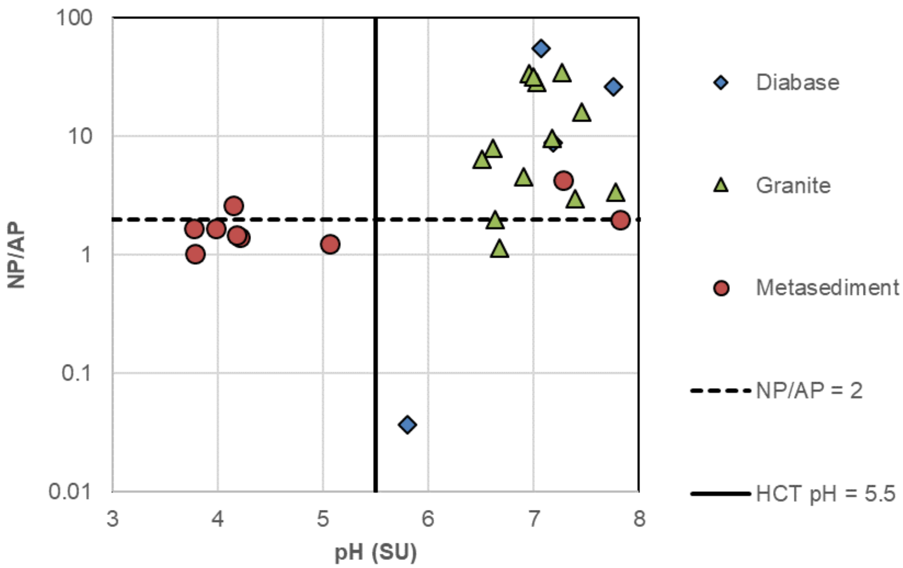


Figure 5a: Long-Term pH from Diabase, Granite and Metasediment HCTs vs. NP/AP Ratio

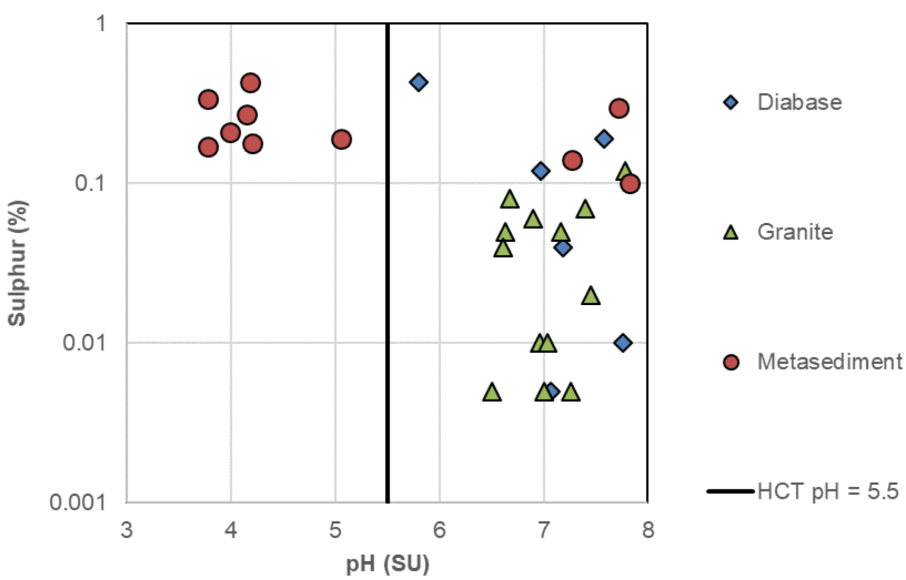


Figure 5b: Long-Term pH from Diabase, Granite and Metasediment HCTs vs. Total Sulphur Content

Figure 6 presents a comparison of long-term metal leaching characteristics of diabase, granite and metasediment. This comparison was performed by evaluating steady-state loading rates of sulphate versus pH and the loading rates of metals capable of leaching from diabase samples, as discussed in Section 3.4. Metal loading rates were compared to sulphate, as sulphate loading rates are an indicator of the occurrence of sulphide oxidation. In the context of this evaluation, long-term loading rates are defined as the average of the final five to ten measurements (depending on data availability) after a HCT reached a steady-state condition.

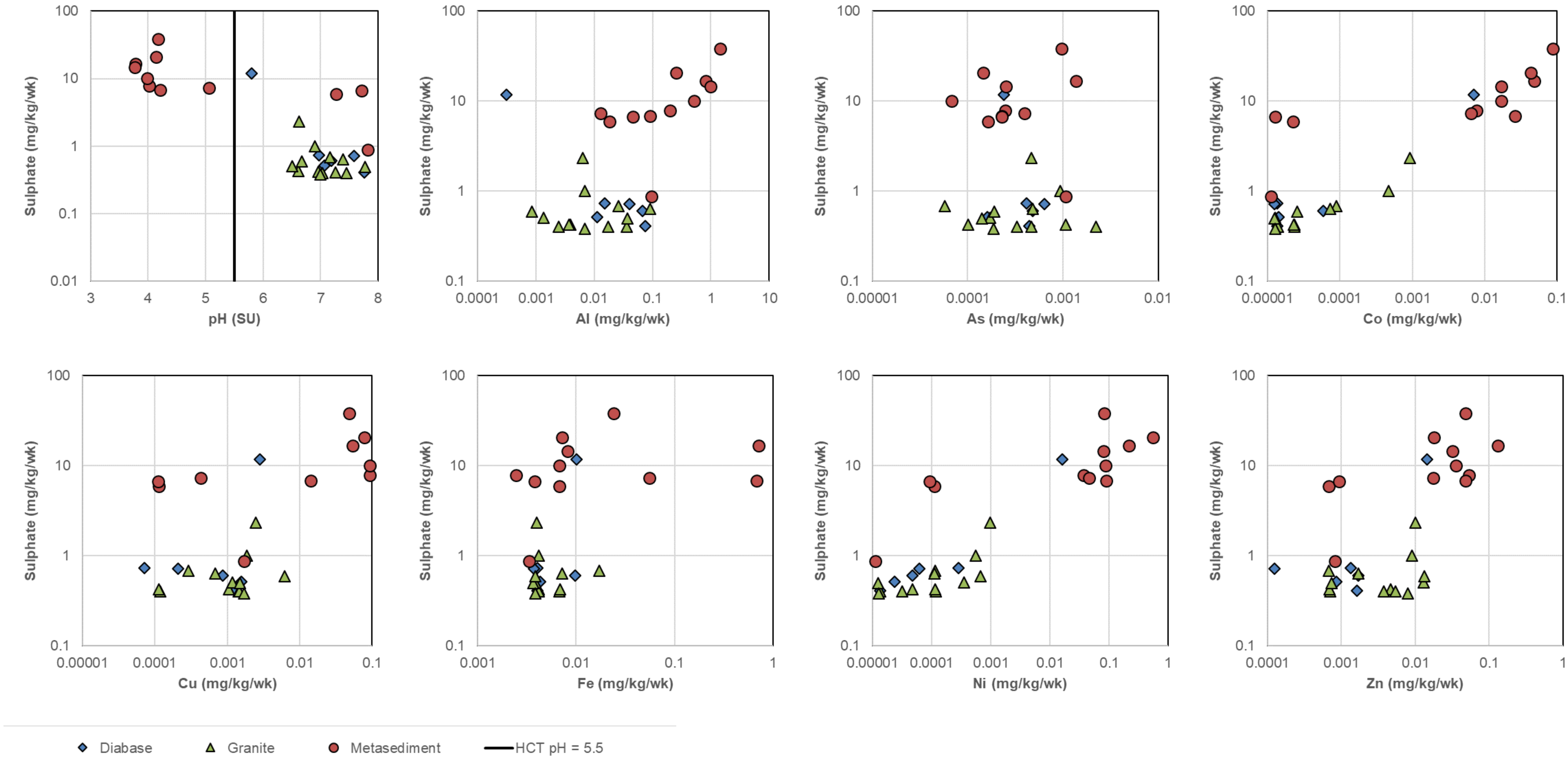


Figure 6: Comparison of Long-Term Sulphate and Metal Loading Rates in Diabase, Granite and Metasediment HCTs

As presented in Figure 6, there are distinct differences between the long-term metal loading rates of granite and diabase versus those of metasediment. Sulphate loading rates in metasediment are, in general, up to an order of magnitude higher than those realized in diabase and granite HCTs. Likewise, metal loading rates, on average, are lower in diabase and granite HCTs than in metasediment HCTs. In particular for metals associated with sulphide minerals (e.g., copper, cobalt, nickel, and zinc), long-term metal leaching characteristics are defined by both lower sulphate and metal loading rates in diabase and granite HCTs. Diabase and granite geochemical behavior is clearly distinct to that of metasediment. Three metasediment samples have low metal loading rates that are similar to those of diabase and granite, but these are distinguished from diabase and granite by higher sulphate loading rates.

Based on the evaluation of static test data (ABA) and HCT data, diabase has similar acid generation and metal leaching characteristics as granite. Diabase tends to be a low-sulphur lithology, with low sulphate and metal loading rates. Given the minor occurrence of diabase at the Ekati Mine relative to granite and metasediment, diabase does not require special waste rock management procedures.

5.0 WASTE ROCK MANAGEMENT

Generic features incorporated into WRSAs design at the Ekati mine are as follows:

- Non-reactive material is used for construction of the basal layer and final capping active layer of the WRSAs. At the Pigeon WRSA, the final capping layer can also include till. The basal rock layer promotes permafrost aggradation into the WRSA and limits contact of potentially reactive waste rock with acidic tundra soils. The active layer is subject to seasonal thawing, and the intentional use of non-reactive material as a final cap will limit the potential for acid generation during freeze / thaw events.
- Potentially reactive rock is encapsulated within a thermally-protective and geochemically non-reactive cover to maintain freezing conditions, which will limit the potential for sulphide mineral oxidation.
- Non-reactive rock is used for construction of site infrastructure (e.g., roads and rock pads). Excess non-reactive rock not required for construction, and reactive rock, are stored in the WRSAs.

5.1 Proposed Modifications to WROMP

5.1.1 Use of Diabase for Construction Purposes

The WROMP (DDEC 2016) manages metasediment as potentially reactive rock (although the geochemical dataset indicates a dual PAG/NPAG population), and granite as non-reactive rock. The WROMP also describes diabase as a non-reactive waste rock type. Similar to granite, diabase is classified as NPAG based on the predominance of NPAG diabase samples in the geochemical dataset. The metal leaching potential of diabase is comparable to that of granite. Diabase represents a volumetrically insignificant rock type at the Ekati mine relative to granite. Therefore, it is recommended that a future WROMP update formalize that diabase can be used for the same construction purposes as granite. Specifically, diabase can be used as a clean general construction material, including roads, pads, dykes and berms, laydowns, and the basal layer and active layer (i.e., capping of reactive material) in the WRSAs.

5.1.2 Geochemistry Sample Collection at the Lynx Pit

It is recommended that geochemical verification sampling of waste rock be carried out in the Lynx Pit similar to other operating pits as follows: waste rock mined from the Lynx development will be sampled at a rate of three samples per rock type per bench every year, with geological mapping of the benches sampled. Samples will be submitted for ABA and metals analysis. The objective of the Lynx Pit sampling is to expand the Lynx baseline geochemical dataset, and confirm the geochemical characteristics of granite and diabase waste rock that will be encountered during mining. The sample frequency and analysis is consistent the Misery and Pigeon Pit sample plan outlined in the WROMP (DDEC 2016). Data will be reported in the annual Waste Rock and Waste Seepage Survey Reports submitted to the Wek'èezhìı Land and Water Board (WLWB).

6.0 CONCLUSIONS AND RECOMMENDATIONS FOR DIABASE

Diabase has a non-existent to low potential for acid generation: 95% of the diabase dataset was classified as NPAG, 3% had an uncertain acid generation potential, and less than 2% was classified as potentially acid generating (PAG) (NP/AP<1). Similar to granite samples in the geochemical baseline dataset, several metals can leach from diabase under neutral pH conditions; however, the metal loading rates and associated risk are low and are not greater than for granite. The long-term acid generation and metal leaching potential for diabase is similar to that of granite.

Diabase represents a minor waste rock type at the Ekati mine; granite is and will continue to be the main waste rock lithology for the life of mine. Because of its non-existent to low acid generation potential, and its similarity in metal leaching potential relative to granite, diabase is classified as non-reactive rock. Diabase can be used in the same manner as granite at the Ekati mine. This includes use as a clean general construction material, including roads, pads, dykes and berms, laydowns, and the basal layer and active layer (i.e., capping of reactive material) in the WRSAs.

It is recommended that geochemical verification sampling be carried out at the Lynx Pit in a manner commensurate with the current operational geochemical verification programs for the Misery and Pigeon Pits. Waste rock mined from the Lynx development is recommended to be sampled at a rate of three samples per rock type per bench every year, with geological mapping of the benches sampled. Samples should be submitted for ABA and metals analysis. The objective of the geochemical verification testing program is to expand the Lynx Pit geochemical dataset, and confirm the geochemical characteristics of diabase and granite that will be encountered during mining.

7.0 CLOSURE

The reader is referred to the Study Limitations, which follows the text and forms an integral part of this memorandum.

We trust that the information provided in this technical memorandum meets your present needs. Should you have any questions or require additional information, please feel free to contact the undersigned.

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Attachments: Study Limitations
- Appendix A-1: Results of Acid Base Accounting and Net Acid Generation for Testing Diabase by Deposit, Ekati Mine
- Appendix A-2: Results of Trace Metal Analysis Testing for Diabase by Deposit, Ekati Mine
- Appendix A-3: Results of MEND Share-Flask Extraction Testing for Diabase by Deposit, Ekati Mine
- Appendix A-4: Results of Net Acid Generation Extract Analysis for Diabase by Deposit, Ekati Mine
- Appendix A-5: Results of Whole Rock XRF Testing for Lynx November 2017 Diabase Samples, Ekati Mine

https://golderassociates.sharepoint.com/sites/10514g/eng/8100 co-placement field study/30_lynx_diabase_memo/2019 07 23 rev 5/1773267-e19039-tm-rev0-8100-diabase geochem 23jul_19.docx

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Signature
Date 23 July 2019
PERMIT NUMBER: P 049
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STUDY LIMITATIONS

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APPENDIX A-1

Results of Acid Base Accounting and Net Acid Generation for Testing Diabase by Deposit, Ekati Mine

Appendix A-1, Results of Acid Base Accounting and Net Acid Generation Testing for Diabase by Deposit, Ekati Mine

Deposit	Sample	Paste pH	Total Sulfur (TS)	Sulphate (SO4)	Sulphide (S^{2-}, calc)	Sulphide (S2-, meas)	Acid Potential (AP)	Neutralization Potential (NP)	Carbonate Neutralization Potential (Ca-NP)	Neutralization Potential Ratio (NP/AP)	Carbon	Inorganic Carbon (CO_2)	NAG Acidity pH 4.5	NAG Acidity pH 7.0
		unit	%	%	%	%	kg $CaCO_3$/tonne equivalents				%	%	($kg H_2SO_4/tonne$)	($kg H_2SO_4/tonne$)
All Samples	**Median**	*9.00*	*0.10*	*0.01*	*0.09*	*0.05*	*2.97*	*12.00*	*2.27*	*4.27*	*0.01*	*0.10*		
	Minimum	*8.10*	*0.01*	*0.01*	*0.01*	*0.01*	*0.16*	*0.50*	*0.23*	**0.04**	*0.01*	*0.01*		
	Maximum	*9.80*	*1.33*	*0.06*	*0.20*	*0.20*	*41.56*	*67.80*	*18.19*	*60.16*	*0.14*	*0.80*		
	Average	*8.95*	*0.11*	*0.01*	*0.07*	*0.07*	*3.33*	*12.99*	*2.80*	*8.02*	*0.02*	*0.14*		
	N	*156*	*162*	*155*	*113*	*36*	*162*	*155*	*133*	*155*	*39*	*97*		
Beartooth	60	9.6	0.005	0.005		0.005	0.156	9.4		60.160				
Beartooth	61	9.7	0.005	0.005		0.005	0.156	8.6	0.417	55.040	0.005			
Fox	FUC 3-3 - 65	8.68	1.33	0.04			41.563	59.2		**1.424**				
Fox	FUC 3-3 - 66	8.76	1.03	0.01			32.188	21.6		**0.671**				
Fox	FUC 3-3 - 67	8.78	0.5	0.03			15.625	1.6		**0.102**				
Fox	FUC 3-3 - 70	8.52	0.43	0.03			13.438	0.5		**0.037**				
Fox	FUC 3-3 - 75	8.68	0.65	0.03			20.313	67.8		3.338				
Fox	FUC 3-3 - 80	8.71	0.1	0.005			3.125	14.8		4.736				
Fox	FUC 3-3 - 85	8.77	0.09	0.005			2.813	10.4		3.698				
Fox	FUC 3-3 - 90	8.58	0.2	0.01			6.250	13.1		2.096				
Fox	FUC 3-3 - 95	8.47	0.86	0.06			26.875	54.3		2.020				
Fox	Decline - 712	9.3	0.043	0.01			1.344	9.0	6.823	6.698		0.3		
Fox	Decline - 1202.2	8.6	0.05	0.005			1.563	8.0	2.274	5.120		0.1		
Fox	FUC 1-2 - 87.78	8.2	0.03	0.03			0.938	12.0	2.274	12.800		0.1		
Fox	FUC 1-2 - 93.72	8.1	0.04	0.03			1.250	12.0	2.274	9.600		0.1		
Fox	FUC 1-2 - 99.61	8.1	0.03	0.02			0.938	15.0	2.274	16.000		0.1		
Fox	FUC 1-2 - 108.66	8.3	0.08	0.01			2.500	17.0	4.549	6.800		0.2		
Fox	FGT-05 - 11.4		0.04				1.250		2.274			0.1		
Fox	FGT-05 - 134.9	8.5	0.06	0.01			1.875	14.0	2.274	7.467		0.1		
Fox	FGT-05 - 142		0.05				1.563		2.274			0.1		
Fox	FGT-05 - 149.5		0.05				1.563		2.274			0.1		
Fox	FGT-05 - 157		0.05				1.563		2.274			0.1		
Fox	FGT-05 - 164.5		0.05				1.563		2.274			0.1		
Fox	FGT-05 - 172		0.05				1.563		2.274			0.1		
Fox	- - -	9	0.05	0.005			1.563		4.549			0.2		
Fox	Fox-250-Diabase 8-Oct-09	9	0.05	0.005	0.05		1.563	14.0	4.545	8.960		0.2		
Fox Samples	**Median**	*8.6*	*0.05*	*0.01*	*0.05*		*1.6*	*14*	*2.3*	*4.7*		*0.10*		
	Minimum	*8.1*	*0.03*	*0.005*	*0.05*		*0.94*	*0.5*	*2.3*	***0.037***		*0.10*		
	Maximum	*9.3*	*1.3*	*0.06*	*0.05*		*42*	*68*	*6.8*	*16*		*0.30*		
	N	*18*	*24*	*18*	*1.0*		*24*	*17*	*15*	*17*		*15*		
Jay	2014-DD-040	9.10	0.05	0.005		0.02	1.563	7.1	1.667	4.544	0.02			
Jay	2014-DD-043	9.05	0.04	0.005		0.02	1.250	6.8	2.500	5.440	0.03			
Jay	2014-DD-044	9.05	0.045	0.005		0.02	1.406	6.6	1.667	4.693	0.02			
Jay	2014-DD-049	9.02	0.042	0.005		0.01	1.313	5.8	0.833	4.419	0.01			
Jay Samples	**Median**	*9.05*	*0.04*	*0.01*		*0.02*	*1.36*	*6.70*	*1.67*	*4.62*	*0.02*			
	Minimum	*9.02*	*0.04*	*0.01*		*0.01*	*1.25*	*5.80*	*0.83*	*4.42*	*0.01*			
	Maximum	*9.10*	*0.05*	*0.01*		*0.02*	*1.56*	*7.10*	*2.50*	*5.44*	*0.03*			
	N	*4*	*4*	*4*		*4*	*4*	*4.0*	*4*	*4*	*4*			
Deposit	**Sample**	**Paste pH**	**Total Sulfur (TS)**	**Sulphate (SO4)**	**Sulphide (S^{2-}, calc)**	**Sulphide (S2-, meas)**	**Acid Potential (AP)**	**Neutralization Potential (NP)**	**Carbonate Neutralization Potential (Ca-NP)**	**Neutralization Potential Ratio (NP/AP)**	**Carbon**	**Inorganic Carbon (CO_2)**	**NAG Acidity pH 4.5**	**NAG Acidity pH 7.0**
		unit	%	%	%	%	kg $CaCO_3$/tonne equivalents				%	%		
Lynx - Pit	2017Lynx01-01	8.46	0.03	0.04	0.005		0.938	15.2	0.850	16.213	0.01		0.00	0.00
Lynx - Pit	2017Lynx01-02	8.59	0.02	0.03	0.005		0.625	12.7	2.500	20.320	0.03		0.00	0.00
Lynx - Pit	2017Lynx01-03	8.39	0.03	0.04	0.005		0.938	13.5	0.850	14.400	0.01		0.00	0.00
Lynx - Pit	2017Lynx01-04	8.46	0.02	0.03	0.005		0.625	15.1	0.850	24.160	0.01		0.00	0.00
Lynx - Pit	2017Lynx01-05	8.5	0.02	0.02	0.005		0.625	12.8	0.850	20.480	0.01		0.00	0.00
Lynx - Pit	2017Lynx01-06	8.48	0.03	0.04	0.005		0.938	13.4	1.667	14.293	0.02		0.00	0.00
Lynx - Pit	2017Lynx03	8.56	0.02	0.02	0.005		0.625	11.5	0.850	18.400	0.01		0.00	0.00
Lynx - Pit	2017Lynx04	8.38	0.02	0.02	0.005		0.625	11.4	0.850	18.240	0.01		0.00	0.00
Lynx - Pit	2017Lynx05	8.78	0.02	0.02	0.005		0.625	15.5	3.333	24.800	0.04		0.00	0.00

Deposit	Sample	Paste pH	Total Sulfur (TS)	Sulphate (SO4)	Sulphide (S^{2-}, calc)	Sulphide (S2-, meas)	Acid Potential (AP)	Neutralization Potential (NP)	Carbonate Neutralization Potential (Ca-NP)	Neutralization Potential Ratio (NP/AP)	Carbon	Inorganic Carbon (CO_2)	NAG Acidity pH 4.5	NAG Acidity pH 7.0
		unit	%	%	%	%	kg $CaCO_3$/tonne equivalents				%	%		
Lynx Undiluted Samples	**Median**	*8.48*	*0.02*	*0.03*	*0.005*		*0.625*	*13.4*	*0.850*	*18.400*	*0.01*		*0.00*	*0.00*
	Minimum	*8.38*	*0.02*	*0.02*	*0.005*		*0.625*	*11.4*	*0.850*	*14.293*	*0.01*		*0.00*	*0.00*
	Maximum	*8.78*	*0.03*	*0.04*	*0.005*		*0.938*	*15.5*	*3.333*	*24.800*	*0.04*		*0.00*	*0.00*
	N	*9*	*9*	*9*	*9*		*9*	*9*	*9*	*9*	*9*		*9*	*9*
Lynx - WRSA	LYNX-DBS-01	8.9	0.03	0.005	0.03		0.938	16.0	2.273	17.067	0.025	0.1		
Lynx - WRSA	LYNX-DBS-02	9.2	0.1	0.01	0.09		3.125	14.0	2.273	4.480	0.025	0.1		
Lynx - Coarse crush stockpile	2017Lynx02	8.59	0.01	0.02	0.005		0.313	5.0	0.850	16.000	0.01		0.00	0.39
Lynx - Jay Crusher Stockpile	2017Lynx06	8.58	0.03	0.02	0.01		0.938	11.5	0.850	12.267	0.01		0.00	0.05
Lynx - Jay Crusher Stockpile	2017Lynx07	8.86	0.02	0.03	0.005		0.625	11.2	0.850	17.920	0.01		0.00	0.05
Lynx - Jay Crusher Stockpile	2017Lynx08	8.39	0.03	0.02	0.01		0.938	14.8	1.667	15.787	0.02		0.00	0.00
Lynx - Jay Crusher Stockpile	2017Lynx09	8.91	0.03	0.03	0.005		0.938	12.6	0.850	13.440	0.01		0.00	0.00
Lynx - Jay Crusher Stockpile	2017Lynx10	8.62	0.03	0.04	0.005		0.938	12.6	0.850	13.440	0.01		0.00	0.00
Lynx - Jay Crusher Stockpile	2017Lynx11	8.99	0.03	0.02	0.01		0.938	11.5	0.850	12.267	0.01		0.00	0.00
Lynx - Jay Crusher Stockpile	2017Lynx12	8.54	0.02	0.02	0.005		0.625	29.9	11.667	47.840	0.14		0.00	0.00
Lynx - Jay Crusher Stockpile	2017Lynx13	9.03	0.03	0.01	0.02		0.938	12.9	0.850	13.760	0.01		0.00	0.00
Lynx - Jay Crusher Stockpile	2017Lynx14	8.85	0.03	0.02	0.01		0.938	12.6	0.850	13.440	0.01		0.00	0.00
Lynx - Jay Crusher Stockpile	2017Lynx15	9.1	0.03	0.02	0.01		0.938	11.0	0.850	11.733	0.01		0.00	0.00
Lynx - Jay Crusher Stockpile	2017Lynx16	8.66	0.03	0.02	0.01		0.938	14.1	0.850	15.040	0.01		0.00	0.00
Lynx - Jay Crusher Stockpile	2017Lynx17	9.08	0.04	0.03	0.01		1.250	12.1	0.850	9.680	0.01		0.00	0.00
Lynx - Jay Crusher Stockpile	2017Lynx18	8.79	0.03	0.03	0.005		0.938	13.0	0.850	13.867	0.01		0.00	0.00
Lynx - Jay Crusher Stockpile	2017Lynx19	9	0.02	0.03	0.005		0.625	13.9	3.333	22.240	0.04		0.00	0.00
Lynx - Jay Crusher Stockpile	2017Lynx20	8.64	0.03	0.03	0.005		0.938	13.6	0.850	14.507	0.01		0.00	0.00
Lynx - Jay Crusher Stockpile	2017Lynx21	9.09	0.03	0.02	0.01		0.938	12.8	0.850	13.653	0.01		0.00	0.00
Lynx - Jay Crusher Stockpile	2017Lynx22	8.67	0.02	0.03	0.005		0.625	14.3	0.850	22.880	0.01		0.00	0.00
Lynx - Fine Crusher Stockpile	2017Lynx23	9.58	0.03	0.02	0.01		0.938	6.5	0.850	6.933	0.01		0.00	0.00
Lynx Diluted Samples	**Median**	*8.86*	*0.03*	*0.02*	*0.01*		*0.938*	*12.8*	*0.850*	*13.760*	*0.01*		*0.00*	*0.00*
	Minimum	*8.39*	*0.01*	*0.005*	*0.005*		*0.313*	*5.0*	*0.850*	*4.480*	*0.01*		*0.00*	*0.00*
	Maximum	*9.58*	*0.1*	*0.04*	*0.09*		*3.125*	*29.9*	*11.667*	*47.840*	*0.14*		*0.00*	*0.39*
	N	*21*	*21*	*21*	*21*		*21*	*21*	*21*	*21*	*21*		*19*	*19*
Misery	MDC-10 142.36	9.4	0.11	0.005	0.11	0.11	3.438	12.0	4.549	3.491		0.2		
Misery	MDC-10 159.49	9.3	0.1	0.005	0.1	0.11	3.125	11.0	2.274	3.520		0.1		
Misery	MDC-10 171.12	9.2	0.11	0.03	0.08	0.12	3.438	13.0	2.274	3.782		0.1		
Misery	MD 450-26 1A	8.8	0.1	0.01	0.09	0.12	3.125	10.0	2.274	3.200		0.1		
Misery	MD 430 21 1A	8.7	0.07	0.005	0.07	0.04	2.188	20.0	4.549	9.143		0.2		
Misery	MD 430 21 2A	8.9	0.07	0.005	0.07	0.04	2.188	26.0	13.646	11.886		0.6		
Misery	MD 430 25 1A	8.7	0.1	0.005	0.1	0.1	3.125	19.0	13.646	6.080		0.6		
Misery	MD 430 25 2A	8.6	0.11	0.005	0.11	0.1	3.438	31.0	18.194	9.018		0.8		
Misery	MD- 430-33-1A	8.7	0.09				2.813	11.0		3.911				
Misery	MD- 430-34-2A	8.8	0.1	0.005	0.1	0.01	3.125	12.0	2.274	3.840		0.1		
Misery	MD-430-91-01	8.7	0.12	0.01	0.11		3.750	13.0	2.274	3.467		0.1		
Misery	MD-430-91-02	9.5	0.07	0.02	0.05		2.188	12.0	2.274	5.486		0.1		
Misery	MD- 420-04-1A	8.3	0.09	0.005	0.09	0.08	2.813	15.0	2.274	5.333		0.1		
Misery	MD- 420-04-2A	8.3	0.09	0.005	0.09	0.05	2.813	15.0	2.274	5.333		0.1		
Misery	MD-420-12-01	9.1	0.12	0.01	0.11		3.750	8.0	2.274	2.133		0.1		
Misery	MD-410-08-01	8.8	0.1	0.005	0.1		3.125	13.0	4.549	4.160		0.2		
Misery	MD-410-08-02	8.9	0.1	0.005	0.1		3.125	12.0	2.274	3.840		0.1		
Misery	MD-410-07-01	9.4	0.1	0.005	0.1		3.125	11.0	2.274	3.520		0.1		
Misery	MD-410-07-02	9.1	0.11	0.005	0.11		3.438	12.0	2.274	3.491		0.1		
Misery	MD 400-42-1a	8.7	0.11	0.01	-	0.08	3.438	15.0	2.274	4.364		0.1		
Misery	MD-400-49-2a	8.7	0.07	0.01	-	0.05	2.188	15.0	2.274	6.857		0.1		
Misery	MD-390-38-2A	9.2	0.09	0.01	-	0.07	2.813	10.0	2.274	3.556		0.1		
Misery	MD-380-32-1A	8.8	0.11	0.01	-	0.1	3.438	13.0	2.274	3.782		0.1		
Misery	MD-370-22-1	8.6	0.12	0.01	0.11		3.750	9.0	2.274	2.400		0.1		
Misery	MD-370-22-2	8.8	0.12	0.01	0.11		3.750	10.0	2.274	2.667		0.1		
Misery	MDC-28 3.9-7	9.03	0.11	0.005	0.11		3.438	7.1	2.047	2.065		0.09		
Misery	MDC-28 7-10	9.16	0.1	0.005	0.1		3.125	7.5	1.592	2.400		0.07		
Misery	MDC-28 10-13	9.35	0.09	0.005	0.09		2.813	6.6	2.047	2.347		0.09		
Misery	MDC-28 13-16	9.34	0.04	0.005	0.04		1.250	8.0	1.592	6.400		0.07		
Misery	MDC-28 16-19	9.21	0.12	0.005	0.12		3.750	7.3	1.819	**1.947**		0.08		
Misery	MDC-28 19-22	9.1	0.1	0.005	0.1		3.125	6.8	2.502	2.176		0.11		
Misery	MDC-28 23-26.07	9.12	0.11	0.005	0.11		3.438	13.1	4.094	3.811		0.18		

Deposit	Sample	Paste pH	Total Sulfur (TS)	Sulphate (SO4)	Sulphide (S^{2-}, calc)	Sulphide (S2-, meas)	Acid Potential (AP)	Neutralization Potential (NP)	Carbonate Neutralization Potential (Ca-NP)	Neutralization Potential Ratio (NP/AP)	Carbon	Inorganic Carbon (CO_2)	NAG Acidity	NAG Acidity
		unit	%	%	%	%	kg $CaCO_3$/tonne equivalents				%	%	pH 4.5	pH 7.0
Misery	MGT-57 28.7-32	9.07	0.005	0.005	0.01		0.156	2.5	0.682	16.000		0.03		
Misery	MGT-57 40-43	9.22	0.04	0.005	0.04		1.250	8.1	1.592	6.480		0.07		
Misery	MGT-57 51-54	9.39	0.12	0.005	0.12		3.750	11.8	2.274	3.147		0.1		
Misery	MGT-57 62-65	9.35	0.04	0.005	0.04		1.250	7.2	0.682	5.760		0.03		
Misery	MGT-57 74-77	8.28	0.16	0.005	0.16		5.000	6.2	1.365	**1.240**		0.06		
Misery	MGT-66 16-19	9.8	0.005	0.005	0.01		0.156	4.0	1.365	25.600		0.06		
Misery	MGT-43 286-289	8.98	0.04	0.005	0.04		1.250	9.2	1.592	7.360		0.07		
Misery	MGT-43 289-292	8.89	0.03	0.005	0.03		0.938	10.0	1.365	10.667		0.06		
Misery	MGT-43 292-295	8.93	0.11	0.005	0.11		3.438	9.4	1.819	2.735		0.08		
Misery	MGT-43 300-303	8.89	0.1	0.005	0.1		3.125	11.1	2.047	3.552		0.09		
Misery	MGT-43 303-306	8.81	0.08	0.005	0.08		2.500	13.8	2.047	5.520		0.09		
Misery	MGT-43 306-309	9.09	0.09	0.005	0.09		2.813	7.6	0.910	2.702		0.04		
Misery	MGT-43 309-311.13	8.96	0.1	0.005	0.1		3.125	11.1	2.957	3.552		0.13		
Misery	MGT-54 211-213.47	9.2	0.03	0.005	0.03		0.938	10.3	0.227	10.987		0.01		
Misery	MGT-54 208-211	9.1	0.1	0.005	0.1		3.125	8.0	0.910	2.560		0.04		
Misery	MGT-05 - 120	9	0.11	0.01		0.11	3.438	7.0		2.036				
Misery	MGT-05 - 136	9.3	0.2	0.01		0.2	6.250	11.0		**1.760**				
Misery	MGT-08 - 89	9.2	0.1	0.01		0.1	3.125	12.0		3.840				
Misery	MGT-08 - 96	8.8	0.18	0.01		0.18	5.625	21.0		3.733				
Misery	MGT-08 - 101	9	0.13	0.01		0.13	4.063	10.0		2.462				
Misery	MGT-08 - 113	9.1	0.11	0.01		0.11	3.438	8.0		2.327				
Misery	MGT-08 - 125	9.2	0.12	0.01		0.11	3.750	9.0		2.400				
Misery	MD-210-03-01	9.2	0.13	0.02	0.11		4.063	13.0	2.500	3.200		0.1		
Misery	MD-220-01-01	9	0.11	0.005	0.11		3.438	14.0	2.500	4.073		0.1		
Misery	MD-220-15-01	9.2	0.12	0.01	0.11		3.750	13.0	2.500	3.467		0.1		
Misery	MD-220-21-01	9.2	0.11	0.02	0.09		3.438	12.0	2.500	3.491		0.1		
Misery	MD-230-03-01	9.3	0.1	0.03	0.07		3.125	12.0	2.500	3.840		0.1		
Misery	MD-230-03-02	9.2	0.11	0.02	0.09		3.438	14.0	2.500	4.073		0.1		
Misery	MD-240-20-01	9.3	0.14	0.02	0.12		4.375	14.0	4.545	3.200		0.2		
Misery	MD-240-40-01	9	0.12	0.005	0.12		3.750	12.0	2.500	3.200		0.1		
Misery	MD-280-44-01	9.2	0.11	0.02	0.09		3.438	13.0	4.545	3.782		0.2		
Misery	MD-290-29-01	9.2	0.13	0.005	0.13		4.063	15.0	4.545	3.692		0.2		
Misery	MD-290-29-02-7FEB2016	9.2	0.09	0.005	0.09		2.813	12.0	4.545	4.267		0.2		
Misery	MD-300-19-01	9.5	0.11	0.01	0.1		3.438	11.0	4.544	3.200		0.1		
Misery	MD-300-19-02	9.5	0.12	0.01	0.11		3.750	12.0	11.360	3.200		0.5		
Misery	MD-300-19-03	9.1	0.08	0.01	0.07		2.500	12.0	4.544	4.800		0.1		
Misery	MD-300-43-01	9.3	0.12	0.01	0.11		3.750	12.0	4.545	3.200		0.2		
Misery	MD-300-43-02	9.2	0.13	0.01	0.12		4.063	13.0	4.545	3.200		0.2		
Misery	MD-310	9.3	0.12	0.02	0.1		3.750	20.0	4.545	5.333		0.2		
Misery	MD-320-37-01	9.5	0.14	0.01	0.13		4.375	12.0	4.544	2.743		0.2		
Misery	MD-320-37-02	9.5	0.13	0.01	0.12		4.063	9.0	4.544	2.215		0.1		
Misery	MD-320-37-03	9.4	0.17	0.005	0.17		5.313	11.0	4.544	2.071		0.2		
Misery	MD-350-25-01	9.1	0.12	0.01	0.11		3.750	13.0	2.250	3.467		0.1		
Misery	MD-350-25-02	9	0.11	0.01	0.1		3.438	14.0	2.250	4.073		0.1		
Misery	MD-350-26-01	9	0.13	0.01	0.12		4.063	12.0	2.250	2.954		0.1		
Misery	MD-360-14-01 (1-Aug-2014)	9	0.14	0.01	0.13		4.375	13.0	2.250	2.971		0.1		
Misery	MD-360-20-01 (8-Aug-2014)	8.9	0.13	0.005	0.13		4.063	16.0	6.800	3.938		0.3		
Misery	MD-360-20-02 (8-Aug-2014)	8.9	0.11	0.01	0.1		3.438	27.0	13.500	7.855		0.6		
Misery	MD-380-29-01 (8-Mar-2014)	8.7	0.12	0.005	0.12		3.750	21.0	4.500	5.600		0.2		
Misery	MD-380-45-01 (3-May-2014)	8.7	0.14	0.005	0.14		4.375	12.0	2.250	2.743		0.1		
Misery	MD-380-45-02 (3-May-2014)	9	0.11	0.005	0.11		3.438	13.0	2.250	3.782		0.1		
Misery	MD-390-41-01 (13-JAN-2014)	9.2	0.11	0.02	0.09		3.438	14.0	2.250	4.073		0.1		
Misery	MD-390-41-02 (13-JAN-2014)	9.2	0.09	0.01	0.08		2.813	12.0	2.250	4.267		0.1		
Misery	MD-390-45-01 (8-Mar-2014)	8.9	0.1	0.005	0.005		3.125	17.0	2.250	5.440		0.1		
Misery	MD-400-21-01 (8 Mar-2014)	9.1	0.11	0.005	0.11		3.438	15.0	2.250	4.364		0.1		
Misery	MGT-05 120m -134m	9	0.11	0.005	0.11		3.438	7.0		2.036		-		
Misery	MGT-05 136m -144m	9.3	0.2	0.005	0.2		6.250	11.0		**1.760**		-		
Misery	MGT-08 101m -111m	9	0.13	0.005	0.13		4.063	10.0		2.462		-		
Misery	MGT-08 113m -123m	9.1	0.11	0.005	0.11		3.438	8.0		2.327		-		
Misery	MGT-08 125m -133m	9.2	0.12	0.005	0.11		3.750	9.0		2.400		-		
Misery	MGT-08 89m -96m	9.2	0.1	0.005	0.1		3.125	12.0		3.840		-		
Misery	MGT-08 96m -96.3m	8.8	0.18	0.005	0.18		5.625	21.0		3.733		-		

Deposit	Sample	Paste pH	Total Sulfur (TS)	Sulphate (SO4)	Sulphide (S^{2-}, calc)	Sulphide (S2-, meas)	Acid Potential (AP)	Neutralization Potential (NP)	Carbonate Neutralization Potential (Ca-NP)	Neutralization Potential Ratio (NP/AP)	Carbon	Inorganic Carbon (CO_2)	NAG Acidity pH 4.5	NAG Acidity pH 7.0
		unit	%	%	%	%	kg $CaCO_3$/tonne equivalents				%	%		
Misery Samples	**Median**	*9.10*	*0.11*	*0.01*	*0.10*	*0.10*	*3.4*	*12*	*2.3*	*3.6*		*0.1*		
	Average	*9.06*	*0.11*				*3.33*	*12.19*		*3.7*				
	Minimum	*8.28*	*0.01*	*0.01*	*0.01*	*0.01*	*0.16*	*2.5*	*0.23*	**1.2**		*0.01*		
	Maximum	*9.80*	*0.20*	*0.03*	*0.20*	*0.20*	*6.3*	*31*	*18*	*26*		*0.8*		
	N	*94*	*94*	*93*	*82*	*22*	*94*	*94*	*79*	*94*		*79*		
Pigeon	97-54	9.1	0.04	0.005		0.02	1.250	10.5		8.400				
Pigeon	97-54	9.1	0.05	0.005		0.02	1.563	11.1		7.104				
Pigeon	97-54	8.2	0.01	0.005		0.02	0.313	10.6	0.833	33.920	0.01			
Pigeon	97-54	8.6	0.06	0.005		0.02	1.875	8.6	0.417	4.587	0.005			
Pigeon	97-54	9.5	0.05	0.005		0.02	1.563	7.9		5.056				
Pigeon	97-54	9.4	0.03	0.005		0.02	0.938	9.1		9.707				
Pigeon	HC-Pdef-1	8.7	0.05	0.01		0.04	1.563	15.0	2.083	9.600	0.025	0.1		
Pigeon Samples	**Median**	*9.10*	*0.05*	*0.01*		*0.02*	*1.56*	*10.50*	*0.83*	*8.40*	*0.01*	*0.10*		
	Minimum	*8.20*	*0.01*	*0.01*		*0.02*	*0.31*	*7.90*	*0.42*	*4.59*	*0.01*	*0.10*		
	Maximum	*9.50*	*0.06*	*0.01*		*0.04*	*1.88*	*15.00*	*2.08*	*33.92*	*0.03*	*0.10*		
	N	*7*	*7*	*7*		*7*	*7*	*7*	*3*	*7*	*3*	*1*		
Sable	SDC-13	8.9	0.01	0.005		0.01	0.313	9.0	0.833	28.800	0.01			

Total sulphur by Leco; total inorganic carbon by HCl leach followed by Leco analysis and corrected for graphite carbon.
Acid Potential (AP) calculated with total sulphur (% total S * 31.25)
Red text indicates values below detection; <DL values have been replaced with half the detection limit.
Bolded grey values indicate 1<NP/AP<2 (Uncertain Acid Generation Potential)
Bolded yellow values indicate NP/AP < 1 (Potentially Acid Generating)

APPENDIX A-2

Results of Trace Metal Analysis Testing for Diabase by Deposit, Ekati Mine

Appendix A-2, Results of Trace Metal Analysis Testing for Diabase by Deposit, Ekati Mine

Deposit	Sample	Ag ppm	Al %	As ppm	Au ppm	B ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Cu ppm	Fe %	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	K %	La ppm	Li ppm	Mg %	Mn ppm	Mo ppm	Na %	Nb ppm
Crustal Abundances		0.08	8.23	1.80	0.004	10	425	3	0.01	4.15	3	-	25	102	-	60	5.63	19	-	-	0.08	-	2.085	39	20	2.33	950	1.3	2.355	-
All Samples	Median	0.13	6.5	2.5	4.15	10	190	0.85	0.1	5.27	0.18	56.06	46	80	0.92	268.8	10.12	20.5	0.09	5.9	0.006	0.107	0.78	19.4	29.1	2.98	1488	0.79	1.82	18.3
	Minimum	0.05	0.42	0.3	0.25	10	5	0.05	0.01	0.16	0.05	13.5	1.4	36	0.54	0.9	0.67	2	0.025	0.25	0.0025	0.01	0.14	5	14	0.26	139	0.2	0.031	0.26
	Maximum	1	8.15	81.6	13.3	20	802	7.59	14	7.52	2	66.61	61	239	8.24	370	12.85	25.92	0.15	6.6	22	0.118	2.76	34	52.4	4.24	2050	2.92	2.89	22
	N	130	130	130	22	26	130	108	130	130	130	35	130	130	35	130	130	99	35	35	120	35	130	99	35	130	130	130	130	35
Beartooth	60	0.1	1.31	5			200	0.25	2.5	1.13	0.5		14	204		4	2.1						0.86			1.71	380	1	0.07	
Beartooth	61	0.1	1.72	2.5			360	0.25	2.5	0.86	0.5		18	239		31	2.67						1.58			2.09	400	2	0.06	
Fox	FUC 1-2 - 87.78	0.6	7.38	0.5			5	0.25	1	6.8	0.25		61	161		184	8.46				5		0.3			3.75	1385	2	1.69	
Fox	FUC 1-2 - 93.72	0.4	7.23	0.5			30	0.25	1	6.82	0.25		50	200		189	8.47				5		0.26			3.96	1395	0.5	1.62	
Fox	FUC 1-2 - 99.61	0.2	6.94	0.5			80	0.25	1	6.43	0.25		43	149		153	8.23				5		0.45			3.72	1270	0.5	1.82	
Fox	FUC 1-2 - 108.66	0.2	7.33	0.5			40	0.25	1	6.59	0.25		27	107		196	8.4				5		0.39			3.93	1285	2	1.66	
Fox	FGT-05 - 11.4	0.25	6.7	2.5			240	0.5	1	5.6	0.25		36	94		133	7.33				5		0.73			3.33	1110	1	1.77	
Fox	FGT-05 - 134.9	1	6.82	2.5			50	0.25	1	6.7	0.25		44	81		213	9.11				5		0.2			3.66	1485	0.5	1.49	
Fox	FGT-05 - 142	0.5	7.2	2.5			30	0.25	1	7.1	0.25		43	93		174	8.65				5		0.15			3.91	1425	1	1.53	
Fox	FGT-05 - 149.5	0.25	7.13	2.5			40	0.25	1	6.5	0.25		42	82		207	9.11				5		0.26			3.47	1455	0.5	1.56	
Fox	FGT-05 - 157	0.25	6.84	2.5			30	0.25	1	6.9	0.25		45	96		192	9.08				5		0.18			3.9	1480	0.5	1.49	
Fox	FGT-05 - 164.5	0.5	6.4	2.5			30	0.25	1	6.7	0.25		44	88		199	8.9				5		0.15			3.57	1455	0.5	1.44	
Fox	FGT-05 - 172	0.5	6.5	2.5			50	0.25	1	6.8	0.25		44	89		194	9.08				5		0.21			3.74	1485	0.5	1.53	
Fox	- - -	0.25	7.57	10			70	0.25	1	7	0.25		43	91		210	9.16	20			5		0.65	5		3.58	1525	0.5	1.71	
Fox	Fox-250-Diabase 8-Oct-09	0.25	7.57	10			70	0.25	1	7	0.25		43	91		210	9.16	5			5		0.65	34		3.58	1525	0.5	1.71	
Fox Samples	Median	0.25	7.13	2.5			40	0.25	1	6.8	0.25		43	93		194	8.9				5		0.26			3.72	1455	0.5	1.62	
	Minimum	0.2	6.4	0.5			5	0.25	1	5.6	0.25		27	81		133	7.33	5			5		0.15	5		3.33	1110	0.5	1.44	
	Maximum	1	7.57	10			240	0.5	1	7.1	0.25		61	200		213	9.16	20			5		0.73	34		3.96	1525	2	1.82	
	N	13	13	13			13	13	13	13	13		13	13		13	13	2			13		13	2		13	13	13	13	
Jay	2014-DD-040	0.08	2.34	0.5		20	31	0.05	0.01	1.39	0.08	13.5	21.5	99	1.81	209	4.33	7.6	0.05	0.28	0.005	0.01	0.15	6.1	15	0.98	343	2.92	0.28	0.28
Jay	2014-DD-043	0.06	1.68	0.5		10	65	0.1	0.05	1.06	0.07	13.5	18.5	99	1.97	158	3.82	6.6	0.05	0.37	0.005	0.01	0.2	6.1	17	0.79	372	2.91	0.13	0.41
Jay	2014-DD-044	0.07	1.9	0.5		20	47	0.1	0.02	1.17	0.07	13.6	20	70	1.8	197	4.22	6.8	0.05	0.34	0.005	0.01	0.2	6.1	17	0.75	374	1.96	0.17	0.42
Jay	2014-DD-049	0.07	2.14	0.5		20	30	0.05	0.03	1.2	0.09	13.9	19.5	90	2.17	197	4.2	7	0.05	0.25	0.005	0.01	0.15	6.5	14	0.79	347	2.63	0.25	0.26
Lynx - Pit	2017Lynx01-01	0.27	6.89	2.1			186	1.63	0.09	5.57	0.27	57.31	48.7	72	0.89	301	11.78	23.61	0.025	6.5	0.0025	0.112	0.86	23.1	30	3.2	1565	1.14	2.21	19.8
Lynx - Pit	2017Lynx01-02	0.16	6.97	1.2			185	1.69	0.09	5.58	0.12	59.11	45.7	66	0.97	276.2	11.71	23.59	0.05	6.4	0.0025	0.116	0.82	23.7	31	3.25	1543	1.46	2.39	19.6
Lynx - Pit	2017Lynx01-03	0.14	6.8	3.1			167	1.68	0.1	5.4	0.12	59.31	48.9	64	0.88	278.1	11.61	24.18	0.06	6.6	0.0025	0.106	0.78	23.9	34.9	3.16	1562	1.1	2.32	20.4
Lynx - Pit	2017Lynx01-04	0.13	6.93	1.1			181	1.68	0.08	5.56	0.11	57.09	47.7	61	0.88	268.5	11.54	24.38	0.05	6.2	0.0025	0.115	0.85	23	32.8	3.19	1553	1.13	2.31	19.3
Lynx - Pit	2017Lynx01-05	0.11	6.82	1.1			166	1.69	0.07	5.49	0.09	60.26	48.2	61	0.8	268.6	11.33	25.92	0.05	6.5	0.0025	0.116	0.83	24.2	29.9	3.14	1491	1.17	2.28	20.3
Lynx - Pit	2017Lynx01-06	0.13	6.85	1.2			173	1.66	0.08	5.5	0.1	59.64	48.9	60	0.92	288.2	11.58	24.86	0.05	6.5	0.0025	0.108	0.85	24.1	29.1	3.12	1536	1.14	2.23	20.5
Lynx - Pit	2017Lynx03	0.13	6.94	1.5			174	1.66	0.08	5.55	0.11	58.05	47.4	92	0.67	301.7	11.44	24.9	0.1	6.2	0.0025	0.108	0.78	22.1	27.2	2.95	1541	1.26	2.27	19.2
Lynx - Pit	2017Lynx04	0.12	6.86	3			171	1.65	0.07	5.36	0.1	55.43	47.1	70	0.76	270.9	11.51	24.01	0.09	6	0.0025	0.115	0.78	21.1	30.1	3.12	1517	1.14	2.3	18.7
Lynx - Pit	2017Lynx05	0.1	6.85	1.6			162	1.67	0.08	5.37	0.09	59.63	47.7	65	0.78	279.6	11.62	24.59	0.1	6.3	0.0025	0.116	0.89	23	30.3	3.18	1505	1.11	2.27	19.1
Lynx Undiluted Samples	Median	0.13	6.86	1.5			173	1.67	0.08	5.5	0.11	59.11	47.7	65	0.88	278.1	11.58	24.38	0.05	6.4	0.0025	0.115	0.83	23.1	30.1	3.16	1541	1.1	2.3	20
	Minimum	0.1	6.80	1.1			162	1.63	0.1	5.36	0.09	55.4	45.7	60.0	0.67	268.5	11.33	23.59	0.025	6.0	0.0025	0.106	0.78	21.1	27.2	2.95	1491	1.1	2.21	18.7
	Maximum	0.27	6.97	3.1			186	1.69	0.1	5.58	0.27	60.3	48.9	92.0	0.97	301.7	11.78	25.92	0.1	6.6	0.0025	0.116	0.89	24.2	34.9	3.25	1565	1.46	2.39	20.5
	N	9	9	9			9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Lynx - WRSA	LYNX-DBS-01	0.08	6.55	2			200	1.54	0.08	5.7	0.09	58.4	50.4	41	1.07	283	10.7	25.3	0.15	5.9	0.005	0.115	0.88	24.1	27	3.13	1580	1.2	2.05	19.7
Lynx - WRSA	LYNX-DBS-02	0.1	6.5	2.4			190	0.84	0.05	6.01	0.13	43.3	51.3	62	8.24	296	11.8	20.5	0.12	4.5	0.006	0.105	0.81	19.5	35.3	2.78	1760	0.74	1.82	9.3
Lynx - Coarse crush stockpile	2017Lynx02	0.09	8.07	4.5			802	1.86	0.43	1.2	0.1	56.79	6.2	128	5.06	16.1	1.83	19.71	0.06	3.8	0.0025	0.035	2.59	25.7	50.1	0.6	244	1.24	2.87	5.7
Lynx - Jay Crusher Stockpile	2017Lynx06	0.12	6.84	1.3			206	1.6	0.07	5.32	0.15	54	48.3	74	0.82	297.4	12.07	23.65	0.1	5.9	0.01	0.106	0.82	20.8	25.2	3.16	1574	1.2	2.02	17.9
Lynx - Jay Crusher Stockpile	2017Lynx07	0.12	7.01	1.6			252	1.9	0.09	4.99	0.09	66.61	47.4	60	1.43	221.1	11.45	25.22	0.11	6.3	0.006	0.101	1.18	25.8	32.5	3.04	1498	1.19	2.17	22
Lynx - Jay Crusher Stockpile	2017Lynx08	0.1	6.6	1.8			162	1.57	0.1	4.65	0.07	54.93	41.7	62	0.76	179.8	10.46	23.26	0.09	5.5	0.0025	0.097	0.83	21	38.4	3.37	1474	0.91	2.55	16.9
Lynx - Jay Crusher Stockpile	2017Lynx09	0.13	6.55	1.1			187	1.51	0.06	5.29	0.1	54.57	49.6	66	1.11	275.9	11.19	24.21	0.1	5.7	0.008	0.109	0.84	20.7	23.9	2.98	1388	1.24	1.92	18.1
Lynx - Jay Crusher Stockpile	2017Lynx10	0.11	6.54	1.4			172	1.47	0.06	5.29	0.11	55.61	51.4	68	1.01	271.6	11	24.96	0.1	5.8	0.0025	0.104	0.86	21.3	23.3	3.03	1396	1.17	1.92	18.3
Lynx - Jay Crusher Stockpile	2017Lynx11	0.11	6.63	1.9			180	1.6	0.06	4.97	0.09	58.41	50.5	55	0.83	302.6	11.39	25.84	0.1	6.2	0.0025	0.118	0.9	22.3	32.4	2.95	1497	1.3	2.06	19.3
Lynx - Jay Crusher Stockpile	2017Lynx12	0.1	6.45	2			150	1.52	0.13	4.27	0.07	54.94	43.6	58	1.57	195.5	10.3	24.92	0.09	5.6	0.0025	0.108	0.79	21.4	47.7	3.57	1312	1.48	2.25	17.7
Lynx - Jay Crusher Stockpile	2017Lynx13	0.14	6.66	0.8			225	1.56	0.08	5.46	0.21	55	49.3	66	0.9	298.7	11.37	24.34	0.09	5.8	0.0025	0.113	0.85	20.9	21.3	3	1394	1.23	1.91	18.5
Lynx - Jay Crusher Stockpile	2017Lynx14	0.1	6.5	1.3			168	1.57	0.1	5	0.08	57.05	49.2	52	0.83	271.3	11.04	24.77	0.09	6.1	0.0025	0.107	0.86	22	26.2	3	1533	1.14	2.13	19.2
Lynx - Jay Crusher Stockpile	2017Lynx15	0.15	6.52	0.9			211	1.54	0.07	5.24	0.17	60.2	50.6	60	0.91	305.2	11.19	25.25	0.1	6.3	0.0025	0.111	0.85	23	23.8	2.88	1354	1.3	1.91	19.9
Lynx - Jay Crusher Stockpile	2017Lynx16	0.14	6.5	1.1			208	1.49	0.06	5.5	0.14	55.34	51.8	65	0.87	291.4	11.25	24.68	0.09	5.7	0.0025	0.111	0.77	21.4	24.7	3.06	1457	1.17	1.88	18
Lynx - Jay Crusher Stockpile	2017Lynx17	0.12	6.54	1			201	1.58	0.07	4.99	0.09	58.5	48.7	57	0.8	296.1	11.1	24.31	0.09	6.1	0.0025	0.106	0.95	22.5	28.7	2.88	1502	1.23	1.99	19.2
Lynx - Jay Crusher Stockpile	2017Lynx18	0.15	6.44	0.9			214	1.51	0.07	4.9	0.15	56.06	49.6	63	1.15	269.4	10.65	24.69	0.09	6	0.0025	0.108	0.88	21.5	28.1	2.9	1339	1.19	1.93	18.3
Lynx - Jay Crusher Stockpile	2017Lynx19	0.1	6.51	1.3			188	1.53	0.09	4.53	0.12	54.19	46.1	66	2.42	219.8	10.56	24.07	0.07	5.6	0.0025	0.103	0.87	20.9	36.2	3.21	1389	1.04	2.2	17.2
Lynx - Jay Crusher Stockpile	2017Lynx20	0.09	6.44	1			202	1.54	0.09	5.1	0.08	58.29	50.2	61	0.88	280.3	10.89	23.98	0.1	6.2	0.0025	0.107	0.95	21.9	30.2	3	1513	1.11	1.96	19.2
Lynx - Jay Crusher Stockpile	2017Lynx21	0.09	7.07	1.4			235	1.68	0.08	4.36	0.09	51.55	39.4	65	1.19	219.6	8.89	22.94	0.09	5.4	0.0025	0.091	1.25	20.2	26	2.46	1165	0.96	2.37	15.8
Lynx - Jay Crusher Stockpile	2017Lynx22	0.1	6.66	1.6			174	1.57	0.13	4.46	0.08	55.49	45	61	0.94	213.5	10.16	23.65	0.09	5.9	0.0025	0.102	0.95	21.3	33.5	3.02	1397	1.06	2.34	17.9
Lynx - Fine Crusher Stockpile	2017Lynx23	0.08	8.15	3.8			694	1.8	0.47	1.52	0.06	61.24	9.9	108	5.48	37.3	2.56	21.32	0.09	3.2	0.0025	0.042	2.76	27.2	52.4	0.8	325	1.93	2.89	6.9
Lynx Diluted Samples	Median	0.1	6.6	1.4			201	1.6	0.08	5.0	0.09	56	49	62	1.0	272	11	24	0.09	5.8	0.0025	0.11	0.87	21	29	3.0	1397	1.2	2.1	18
	Minimum	0.08	6.4	0.8			150	0.84	0.05	1.2	0.06	43.3	6.2	41	0.76	16	1.83	19.71	0.06	3.2	0.0025	0.035	0.77	19.5	21.3	0.6	244	0.74	1.82	5.7
	Maximum	0.15	8.2	4.5			802	1.9	0.47	6.01	0.21	66.6	51.8	128	8.24	305	12.07	25.84	0.15	6.3	0.01	0.118	2.76	27.2	52.4	3.57	1760	1.93	2.89	22
	N	21	21	21			21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
Misery	MDC-10 142.36	0.25	6.35	5			210	0.25	2	5.1	0.25		42	104		291	9.92				5		0.84			2.43	1830	1	1.84	
Misery	MDC-10 159.49	0.25	6.32	5			180	0.25	2	5.1	0.25		41	137		223	8.89				5		0.74			2.43	1630	1	1.84	
Misery	MDC-10 171.12	0.25	6.46	10			190	0.25	1	4.9	0.25		42	94		301	10.08				5		0.78			2.43	1910	1	2.01	
Misery	MD 450-26 1A	0.1	6.32	0.5			180	0.5	1	5.33	0.5		52	128		227	9.12				5		0.84			2.86	1540	0.5	1.91	
Misery	MD- 430-34-2A	0.25	6.04	5			200	0.25	14	5	0.25		47	113		254	9.82				5		0.73			2.67	1745	0.5	2.19	
Misery	MD-430-91-01	0.11	7.17	3.3			240	0.83	0.05	5.18	0.09		45.9	87		261	10.6	20.6			0.005		0.82	20.3		3.05	1600	0.76	1.98	
Misery	MD-430-91-02	0.05	8.12	10.8			360	1.2	0.3	1.05	0.08		19.3	148		22.2	4.45	22.9			0.005		2.74	25.4		1.56	512	1.96	2.34	
Misery	MD- 420-04-1A	0.25	6.33	5			210	0.25	12	4.4	0.25		47	154		290	9.89				5		0.94			3.21	1595	0.5	2.14	
Misery	MD- 420-04-2A	0.25	6.29	5			190	0.25	8	4.5	0.25		48	157		282	9.58				5		0.94			3.08	1605	0.5	2.38	
Misery	MD-420-12-01	0.15	6.99	3			250	0.78	0.04	6.43	0.15		51.9	84		309	11.8	20.5			0.005		0.84	19		3.29	1970	0.75	1.89	
Misery	MD-410-08-01	0.12	6.66	3.8			240	1.13	0.09	5.29	0.11		45.5	82		232	10.2	21			0.005		0.9	17.7		2.89	1760	0.66	2.26	
Misery	MD-410-08-02	0.11	6.55	2.6			290	0.99	0.1	5.14	0.08		43.8	70		234	9.9	20.3			0.005		1	16.9		2.67	1660	0.62	2.22	
Misery	MD-410-07-01	0.23	6.36	1.2			300	0.59	0.05	5.94	0.18		46.5	91		284	11.05	18.95			0.005		0.95	20.2		3.13	1940	0.65	1.81	
Misery	MD-410-07-02	0.18	6.54	2.5			220	0.62	0.06	5.99	0.12		46.1	77		289	11.35	19.2			0.005		0.77	20.4		3.1	1930	0.59	1.93	
Misery	MD 400-42-1a	0.25	6.78	2.5			220	2	1	5.4	0.5		47	90		327	11.1				5		0.78			3.12	1840	0.5	2.04	
Misery	MD-400-49-2a	0.25	6.73	2.5			190	2	6	5.2	2		48	106		269	10.96				5		0.83			3.57	2030	0.5	2.21	
Misery	MD-390-38-2A	0.25	6.8	5			230	0.5	2	6.1	1.5		52	113		331	10.59				5		1.06			3.45	1940	0.5	1.86	
Misery	MD-380-32-1A	0.25	6.57	2.5			210	0.5	2	5.7	1.5		50	159		285	10.81				5		0.93			3.14	1830	0.5	1.85	
Misery	MDC-28 3.9-7	0.05	1.8	0.8	5.4	10	50		0.05	1	0.05		21.7	53		212.7	4.82	9			0.005		0.26	12		0.89	412	0.5	0.139	
Misery	MDC-28 7-10	0.05	1.64	0.8	2.9	10	62		0.05	0.93	0.05		22.8	40		223.8	4.74	8			0.005		0.33	10		0.78	393	0.5	0.135	
Misery	MDC-28 10-13	0.05	1.55	1.1	7.7	10	43		0.05	0.76	0.05		20.4	41		232.1	4.53	7			0.005		0.27	8		0.75	323	0.5	0.13	
Misery	MDC-28 13-16	0.05	1.62	1.4	4.5	10	55		0.05	0.78	0.05		20.4	42		201	4.32	7			0.005		0.33	8		0.81	388	0.4	0.12	
Misery	MDC-28 16-19	0.05	1.65	1.6	3.6	10	63		0.05	0.84	0.05		23.7	64		214.2	4.63	8			0.005		0.37	9		0.86	432	0.6	0.089	
Misery	MDC-28 19-22	0.05	1.51	2.7	4.6	10	67		0.05	0.72	0.05		21	41		201	4.36	7			0.005		0.4	9		0.88	462	0.5	0.08	
Misery	MDC-28 23-26.07	0.1	1.55	1.1	4.1	10	74		0.1	0.87	0.1		21.2	66		233.4	4.23	7			0.005		0.29	11		1.06	448	0.5	0.096	
Misery	MGT-57 28.7-32	0.05	0.42	0.8	0.25	10	21		0.2	0.16	0.05		1.4	78		0.9	0.67	2			0.005		0.14	10		0.26	139	0.2	0.051	
Misery	MGT-57 40-43	0.05	1.56	1.7	2.2	10	48		0.05	0.75	0.05		21.6	38		203.8	4.61	7			0.005		0.33	10		0.84	404	0.5	0.09	
Misery	MGT-57 51-54	0.05	1.55	1.8	1.7	10	52		0.05	0.76	0.05		23.1	40		199.6	4.48	6			0.005		0.33	9		1.04	474	0.4	0.072	
Misery	MGT-57 62-65	0.05	1.52	1.8	1.7	10	41		0.05	0.73	0.1		22.9	56		197.6	4.64	7			0.005		0.3	8		0.9	452	0.4	0.084	
Misery	MGT-57 74-77	0.05	1.54	2.2	2.1	10	66		0.05	0.82	0.1		20.1	50		210.1	4.36	7			0.005		0.36	10		0.83	374	1.2	0.109	

Deposit	Sample	Ni ppm	P ppm	Pb ppm	Rb ppm	Re ppm	S %	Sb ppm	Sc ppm	Se ppm	Sn ppm	Sr ppm	Ta ppm	Te ppm	Th ppm	Ti %	Tl ppm	J (ICP ppm	V ppm	W ppm	Y ppm	Zn ppm	Zr ppm
Crustal Abundances		84	1050	19	-	-	0.04	0.2	22	0.05	2.3	100	-	-	1.2	5.65	2.3	3	120	1.3	40	70	-
All Samples	Median	64.7	1030	5.3	26	0.003	0.09	0.22	27.3	0.5	2.1	196.8	1.22	0.025	2.3	1.02	0.1	0.6	356	0.4	29.75	116	211.3
	Minimum	3.5	60	0.7	6.8	0.001	0.03	0.03	0.3	0.25	0.15	7	0.03	0.025	0.5	0.03	0.1	0.16	4	0.1	7.4	12	8.6
	Maximum	97.2	2550	26.2	104	0.004	0.17	12	48.2	3	5	470.8	2.49	0.1	25.1	2.02	5	5.4	437	5	44.1	226	238
	N	130	130	130	35	31	108	130	108	97	44	130	35	97	99	130	98	98	130	130	44	130	35
Beartooth	60	79	2550	6				2.5	3		5	41				0.14			38	5	19	50	
Beartooth	61	94	2350	8				2.5	2		5	31				0.21			54	5	8	57	
Fox	FUC 1-2 - 87.78	11	60	6				0.2				178				0.87			342	5		12	
Fox	FUC 1-2 - 93.72	89	430	6				0.2				166				0.83			325	5		86	
Fox	FUC 1-2 - 99.61	72	460	6				0.1				199				0.91			338	5		74	
Fox	FUC 1-2 - 108.66	53	310	6				0.1				181				0.91			352	5		54	
Fox	FGT-05 - 11.4	79	660	2				2.5				314				0.68			279	5		84	
Fox	FGT-05 - 134.9	82	520	6				2.5				175				0.9			364	5		98	
Fox	FGT-05 - 142	91	420	4				2.5				172				0.81			337	5		88	
Fox	FGT-05 - 149.5	79	690	8				2.5				193				0.93			342	5		96	
Fox	FGT-05 - 157	92	470	8				2.5				174				0.86			347	5		92	
Fox	FGT-05 - 164.5	83	560	2				5				160				0.86			353	5		98	
Fox	FGT-05 - 172	86	510	1				2.5				177				0.88			359	5		96	
Fox	- - -	75	590	1				12	34			267			10	0.92	5	5	327	5		104	
Fox	Fox-250-Diabase 8-Oct-09	75	590	1			0.06	12	10			267			5	0.92			327	5		104	
Fox Samples	Median	79	510	6			0.06	2.5				178				0.88	5	5	342	5		92	
	Minimum	11	60	1				0.1	10			160			5	0.68			279	5		12	
	Maximum	92	690	8				12	34			314			10	0.93			364	5		104	
	N	13	13	13			1	13	2			13			2	13	1	1	13	13		13	
Jay	2014-DD-040	21.6	520	2	12.2		0.05	0.03	4.8	0.5	0.3	29.1	0.03	0.025	0.8	0.28	0.2	0.16	159	0.1	12	65	10.9
Jay	2014-DD-043	20.2	580	1.7	23.5		0.04	0.03	3.4	0.5	0.4	18.4	0.03	0.025	1	0.31	0.2	0.52	112	0.1	10.6	65	11.3
Jay	2014-DD-044	20.2	510	0.7	23.6		0.05	0.03	2.9	0.5	0.3	21.1	0.03	0.025	0.5	0.36	0.3	0.17	129	0.1	12.1	64	9.7
Jay	2014-DD-049	20.3	550	2.9	11		0.05	0.03	2.9	0.5	0.15	25.3	0.03	0.025	0.9	0.25	0.1	0.24	149	0.1	10.3	57	8.6
Lynx - Pit	2017Lynx01-01	78.7	1386	11.2	27.6	0.004	0.04	0.6	29.2	0.5	2.2	380.6	1.3	0.025	2.8	1.97	0.1	0.8	387	2	32.7	149	218.3
Lynx - Pit	2017Lynx01-02	74.4	1418	3.3	24.7	0.004	0.04	0.25	28.6	0.5	2.2	340.2	1.28	0.025	2.7	1.93	0.1	0.8	379	0.8	32.8	126	214.8
Lynx - Pit	2017Lynx01-03	77.1	1367	3.1	23.7	0.004	0.04	0.25	28.9	0.5	2.2	337.5	1.35	0.025	2.8	1.98	0.1	0.8	373	0.7	33.4	124	221.7
Lynx - Pit	2017Lynx01-04	79.5	1360	2.7	26	0.003	0.04	0.25	28.5	0.5	2.1	361.8	1.27	0.025	2.6	1.91	0.1	0.8	369	0.5	32.9	118	214.7
Lynx - Pit	2017Lynx01-05	79	1462	2.3	27.8	0.004	0.04	0.25	28.7	0.5	2.1	372.3	1.33	0.025	2.7	1.87	0.1	0.9	348	0.5	34.1	114	238
Lynx - Pit	2017Lynx01-06	78.1	1432	2.5	27.6	0.003	0.04	0.25	28.5	0.5	2.2	375.4	1.32	0.025	2.7	1.92	0.1	0.9	363	0.5	33.5	121	224.4
Lynx - Pit	2017Lynx03	76.5	1455	3.8	23.2	0.004	0.04	0.25	27	0.5	2	403.5	1.37	0.025	2.6	1.92	0.1	0.7	394	0.5	30.9	130	217.1
Lynx - Pit	2017Lynx04	76.4	1412	2.3	21.8	0.003	0.03	0.25	27.4	0.5	2	363.5	1.31	0.025	2.5	1.94	0.1	0.8	398	0.4	30.2	125	215.6
Lynx - Pit	2017Lynx05	76.5	1434	2.3	26.3	0.004	0.04	0.25	28.3	0.5	2	346.1	1.33	0.025	2.6	1.94	0.1	0.8	413	0.4	31.7	115	214
Lynx Undiluted Samples	Median	77	1418	2.7	26	0.004	0.04	0.25	28.5	0.5	2.1	363.5	1.32	0.025	2.7	1.93	0.1	0.8	379	0.5	32.8	124	217.1
	Minimum	74.4	1360	2.3	21.8	0.003	0.03	0.25	27	0.5	2	337.5	1.27	0.025	2.5	1.87	0.1	0.7	348	0.4	30.2	114	214
	Maximum	79.5	1462	11.2	27.8	0.004	0.04	0.6	29.2	0.5	2.2	403.5	1.37	0.025	2.8	1.98	0.1	0.9	413	2	34.1	149	238
	N	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Lynx - WRSA	LYNX-DBS-01	87.2	1380	1.9	26.7	0.001	0.03	0.14	29.1	2	2.1	437	1.17	0.025	2.31	1.86	0.1	0.8	424	0.3	33.6	133	233
Lynx - WRSA	LYNX-DBS-02	57.1	1130	2.7	48.3	0.002	0.11	0.09	43.3	2	1.2	189.5	0.58	0.025	2.1	1.21	0.3	0.5	401	0.2	44.1	145	176.5
Lynx - Coarse crush stockpile	2017Lynx02	17.4	960	18.6	66.4	0.001	0.03	0.25	5.8	0.5	1.8	378.2	2.49	0.025	8.9	0.21	0.6	2.6	36	0.9	7.4	68	99.3
Lynx - Jay Crusher Stockpile	2017Lynx06	79.2	1348	3	22.1	0.003	0.05	0.25	27.2	0.5	2	426.3	1.2	0.025	2.3	1.96	0.1	0.6	437	0.4	29.5	150	203.7
Lynx - Jay Crusher Stockpile	2017Lynx07	76.3	1657	2.9	39.1	0.003	0.04	0.25	28.5	0.5	2.1	383.2	1.48	0.025	3.4	2.02	0.1	0.8	405	0.4	31.6	111	217.1
Lynx - Jay Crusher Stockpile	2017Lynx08	74.7	1235	2.7	24.3	0.003	0.04	0.25	26.1	0.5	1.9	227.5	1.17	0.025	3.6	1.75	0.1	1	392	0.3	27.8	82	191.1
Lynx - Jay Crusher Stockpile	2017Lynx09	82.6	1381	2.4	24.4	0.003	0.03	0.25	27.4	0.5	1.9	446.1	1.21	0.025	2.3	1.86	0.1	0.6	412	0.4	29.7	133	204.9
Lynx - Jay Crusher Stockpile	2017Lynx10	90.7	1278	2.3	25.9	0.004	0.03	0.25	29	0.5	2.1	452.9	1.23	0.025	2.3	1.79	0.1	0.6	395	0.3	30.6	138	206
Lynx - Jay Crusher Stockpile	2017Lynx11	78.1	1376	3.4	26.7	0.003	0.04	0.25	28	0.5	2.1	426.3	1.3	0.025	2.6	1.87	0.1	0.7	405	0.3	32.2	109	225.6
Lynx - Jay Crusher Stockpile	2017Lynx12	71.9	1220	2.9	24.6	0.004	0.03	0.25	25.5	0.5	2	251.1	1.16	0.025	2.8	1.67	0.1	1.1	360	0.4	29.5	88	196.1
Lynx - Jay Crusher Stockpile	2017Lynx13	81.7	1326	2.7	23.9	0.003	0.04	0.25	27.3	0.5	2.1	469.4	1.22	0.025	2.4	1.84	0.1	0.6	400	0.3	30.1	176	212.7
Lynx - Jay Crusher Stockpile	2017Lynx14	80.7	1332	2.1	26.4	0.004	0.04	0.25	27.6	0.5	2.1	391.5	1.26	0.025	2.5	1.85	0.1	0.7	407	0.4	31.6	113	223.4
Lynx - Jay Crusher Stockpile	2017Lynx15	80.6	1314	2.9	26.6	0.003	0.04	0.25	29.1	0.5	2.2	470.8	1.29	0.025	2.5	1.84	0.1	0.6	403	0.4	33	150	221.7
Lynx - Jay Crusher Stockpile	2017Lynx16	86.9	1241	2.2	23.4	0.003	0.03	0.25	29	0.5	2	463	1.19	0.025	2.3	1.85	0.1	0.6	408	0.3	30.7	155	205.3
Lynx - Jay Crusher Stockpile	2017Lynx17	76.2	1346	2.4	28.1	0.003	0.04	0.25	27	0.5	2.1	419.3	1.27	0.025	2.5	1.86	0.1	0.6	402	0.3	31.5	115	215.9
Lynx - Jay Crusher Stockpile	2017Lynx18	80.3	1208	2.6	26.5	0.003	0.03	0.25	27.6	0.5	2	423.9	1.22	0.025	2.5	1.73	0.1	0.7	385	0.3	30.2	124	207
Lynx - Jay Crusher Stockpile	2017Lynx19	79.2	1222	2.9	25.9	0.003	0.03	0.25	25.8	0.5	1.9	330.3	1.16	0.025	2.6	1.69	0.1	1	373	0.4	28.6	115	201.4
Lynx - Jay Crusher Stockpile	2017Lynx20	87.3	1243	2.2	26.7	0.003	0.04	0.25	28.9	0.5	2.1	425.9	1.3	0.025	2.5	1.82	0.1	0.9	406	0.3	31.7	122	215.2
Lynx - Jay Crusher Stockpile	2017Lynx21	65.2	1118	5.5	32.6	0.003	0.03	0.25	23	0.5	1.9	421.7	1.08	0.025	2.4	1.5	0.1	0.8	318	0.3	25.6	104	183.1
Lynx - Jay Crusher Stockpile	2017Lynx22	77.9	1282	2.8	30.5	0.003	0.03	0.25	26.6	0.5	2	355.2	1.19	0.025	2.5	1.74	0.1	0.8	383	0.3	29.8	102	211.3
Lynx - Fine Crusher Stockpile	2017Lynx23	25.7	825	16.9	104	0.001	0.03	0.25	8.3	0.5	2	405.9	0.58	0.025	7.9	0.33	0.6	2.3	67	0.6	8.5	72	105
Lynx Diluted Samples	Median	79.2	1278	2.7	26.6	0.003	0.03	0.25	27.4	0.5	2	421.7	1.21	0.025	2.5	1.82	0.1	0.7	401	0.3	30.2	115	206
	Minimum	17.4	825	1.9	22.1	0.001	0.03	0.09	5.8	0.5	1.2	189.5	0.58	0.025	2.1	0.21	0.1	0.5	36	0.2	7.4	68	99.3
	Maximum	90.7	1657	18.6	104	0.004	0.11	0.25	43.3	2	2.2	470.8	2.49	0.025	8.9	2.02	0.6	2.6	437	0.9	44.1	176	233
	N	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
Misery	MDC-10 142.36	56	900	16			0.09	2.5				200				1.09			363	5		142	
Misery	MDC-10 159.49	57	840	16			0.08	2.5				203				0.95			285	5		126	
Misery	MDC-10 171.12	51	950	22			0.09	2.5				200				1.17			381	5		158	
Misery	MD 450-26 1A	57	850	12				0.1				206				0.99			365	5		110	
Misery	MD- 430-34-2A	55	1010	8			0.1	2.5				217				1.05			368	5		118	
Misery	MD-430-91-01	64.6	1030	5.3			0.11	0.08	41.5	2		203		0.025	2.6	1.08	0.2	0.7	366	0.3		116	
Misery	MD-430-91-02	76.9	780	11.8			0.07	0.03	15.2	1		229		0.025	5.7	0.4	1.1	3	121	1.1		132	
Misery	MD- 420-04-1A	64	970	6			0.09	2.5				184				1.02			347	5		116	
Misery	MD- 420-04-2A	65	930	8			0.08	2.5				194				0.95			347	5		128	
Misery	MD-420-12-01	68.1	1090	10.8			0.12	0.05	44.5	2		248		0.025	2.1	1.21	0.3	0.5	420	0.2		158	
Misery	MD-410-08-01	59.2	1010	13.3			0.09	0.08	38.2	3		251		0.07	2.3	1.03	0.3	1	323	0.3		132	
Misery	MD-410-08-02	54	980	9.3			0.09	0.06	35.5	3		262		0.025	2.3	1.02	0.3	0.9	328	0.3		124	
Misery	MD-410-07-01	60.3	1050	5.4			0.1	0.07	39.6	3		234		0.07	2.5	1.12	0.4	0.6	381	0.3		162	
Misery	MD-410-07-02	54	1130	5.9			0.11	0.05	38.1	3		213		0.025	2.5	1.19	0.2	0.6	384	0.3		143	
Misery	MD 400-42-1a	63	1010	14			0.12	2.5				177				1.05			366	5		138	
Misery	MD-400-49-2a	72	990	10			0.08	2.5				168				0.93			322	5		142	
Misery	MD-390-38-2A	79	730	6			0.1	5				209				0.96			435	5		134	
Misery	MD-380-32-1A	65	950	8			0.11	2.5				206				0.92			336	5		164	
Misery	MDC-28 3.9-7	31.5	1030	2.6			0.09	0.05	2	0.25		20		0.1	1.5	0.3	0.1	0.4	168	0.1		78	
Misery	MDC-28 7-10	29.9	980	1.4			0.08	0.05	1.9	0.6		21		0.1	1.4	0.27	0.1	0.3	180	0.1		78	
Misery	MDC-28 10-13	33.3	840	1.9			0.09	0.05	1.6	0.8		19		0.1	1.2	0.21	0.1	0.2	244	0.1		70	
Misery	MDC-28 13-16	33.5	890	2.4			0.08	0.05	1.7	0.8		18		0.1	1.3	0.22	0.1	0.2	171	0.1		75	
Misery	MDC-28 16-19	34.8	980	1.5			0.09	0.05	1.8	0.6		19		0.1	1.5	0.27	0.1	0.2	168	0.1		77	
Misery	MDC-28 19-22	30.8	960	1.7			0.09	0.05	1.9	0.6		16		0.1	1.4	0.23	0.1	0.2	117	0.1		57	
Misery	MDC-28 23-26.07	48.4	1080	2.8			0.09	0.05	2.9	0.25		32		0.1	1.5	0.23	0.1	0.8	130	0.1		81	
Misery	MGT-57 28.7-32	3.5	580	2.3			0.03	0.05	0.3	0.25		12		0.1	4.2	0.03	0.1	2.4	4	0.1		22	
Misery	MGT-57 40-43	29	1050	2.2			0.09	0.05	1.7	0.25		15		0.1	1.4	0.21	0.1	0.2	151	0.1		72	
Misery	MGT-57 51-54	40.1	1040	2.8			0.1	0.05	1.9	0.7		24		0.1	1.3	0.24	0.1	0.2	131	0.1		63	
Misery	MGT-57 62-65	32.8	960	7.8			0.09	0.05	2	1		16		0.1	1.2	0.23	0.1	0.2	167	0.1		78	
Misery	MGT-57 74-77	31.2	1010	2			0.14	0.05	2	0.8		18		0.1	1.4	0.23	0.1	0.5	149	0.1		66	

Appendix A-2, Results of Trace Metal Analysis Testing for Diabase by Deposit, Ekati Mine

Deposit	Sample	Ag ppm	Al %	As ppm	Au ppm	B ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Cu ppm
Crustal Abundances		0.08	8.23	1.80	0.004	10	425	3	0.01	4.15	3	-	25	102	-	60
All Samples	Median	0.13	6.5	2.5	4.15	10	190	0.85	0.1	5.27	0.18	56.06	46	80	0.92	268.8
	Minimum	0.05	0.42	0.3	0.25	10	5	0.05	0.01	0.16	0.05	13.5	1.4	36	0.54	0.9
	Maximum	1	8.15	81.6	13.3	20	802	7.59	14	7.52	2	66.61	61	239	8.24	370
	N	130	130	130	22	26	130	108	130	130	130	35	130	130	35	130
Misery	MGT-66 16-19	0.1	0.71	2.5	0.5	10	36		0.5	0.16	0.05		3.8	85		3.6
Misery	MGT-43 286-289	0.2	1.55	0.8	13.3	10	73		0.1	0.8	0.2		22.4	49		276.1
Misery	MGT-43 289-292	0.2	1.61	2.1	8.7	10	76		0.2	0.81	0.4		25.5	36		307
Misery	MGT-43 292-295	0.2	1.6	2.9	7.3	10	74		0.05	0.69	0.2		25.7	38		303.4
Misery	MGT-43 300-303	0.2	1.9	1.4	5.7	10	46		0.1	0.71	0.5		27.2	61		289.7
Misery	MGT-43 303-306	0.1	1.59	1.6	3.8	10	59		0.05	0.72	0.2		22.9	61		193.7
Misery	MGT-43 306-309	0.1	1.66	1.2	4.2	10	78		0.05	0.83	0.2		22.4	42		245.5
Misery	MGT-43 309-311.13	0.2	1.77	1	4.8	10	60		0.05	0.85	0.2		24.6	49		279.5
Misery	MGT-54 211-213.47	0.1	1.68	2.4	4.3	10	81		0.05	0.8	0.3		24.4	44		249.7
Misery	MGT-54 208-211	0.1	1.62	3.1	3.1	10	92		0.05	0.82	0.2		25.5	57		246.6
Misery	MD-210-03-01	0.17	6.69	2.6			240	0.85	0.04	6.35	0.29		50.2	70		309
Misery	MD-220-01-01	0.16	6.73	1			240	0.83	0.04	6.59	0.29		49.3	81		289
Misery	MD-220-15-01	0.16	6.89	4.1			250	0.71	0.08	6.23	0.21		50.1	91		306
Misery	MD-220-21-01	0.15	6.86	2.7			240	0.79	0.04	6.55	0.24		48.1	91		311
Misery	MD-230-03-01	0.19	7.03	1.3			280	0.86	0.11	6.46	0.3		53.6	101		306
Misery	MD-230-03-02	0.19	6.88	1.4			260	1.04	0.1	6.41	0.37		51.8	78		313
Misery	MD-240-20-01	0.36	7.76	17.7			340	2.56	0.32	2.54	0.11		27.7	111		114
Misery	MD-240-40-01	0.18	6.5	5.2			230	0.86	0.13	6.23	0.26		52	86		291
Misery	MD-280-44-01	0.15	6.59	4.1			230	0.9	0.06	5.98	0.21		49.9	82		315
Misery	MD-290-29-01	0.15	7.04	6.3			310	0.95	0.12	5.03	0.2		46.3	97		245
Misery	MD-290-29-02-7FEB2016	0.17	6.88	5.7			240	0.77	0.06	6.33	0.22		52.7	101		310
Misery	MD-300-19-01	0.17	6.47	1.7			240	0.78	0.07	6.16	0.37		49.2	86		289
Misery	MD-300-19-02	0.17	6.27	3			260	0.67	0.08	5.75	0.19		44.3	77		306
Misery	MD-300-19-03	0.19	6.34	4.5			210	0.83	0.12	5.52	0.22		52.8	88		278
Misery	MD-300-43-01	0.13	6.51	2.7			230	0.93	0.16	5.75	0.21		49.8	67		291
Misery	MD-300-43-02	0.2	6.69	3.3			210	0.92	0.15	6.01	0.28		50	62		310
Misery	MD-310	0.15	6.76	5			240	0.87	0.07	6.17	0.22		51.2	82		315
Misery	MD-320-37-01	0.1	7.37	78.2			530	7.59	0.36	0.89	0.11		17.7	103		41.9
Misery	MD-320-37-02	0.09	7.72	24.1			500	1.82	0.27	0.7	0.13		16.1	98		35.3
Misery	MD-320-37-03	0.09	7.38	81.6			570	1.55	0.23	0.71	0.1		15.5	92		35.4
Misery	MD-350-25-01	0.14	6.38	3.3			230	0.79	0.17	6.28	0.2		55.6	99		308
Misery	MD-350-25-02	0.19	6.5	5.1			290	0.81	0.16	6.05	0.18		54.8	99		289
Misery	MD-350-26-01	0.2	6.38	7.8			210	0.83	0.09	6.17	0.53		54.4	80		290
Misery	MD-360-14-01 (1-Aug-2014	0.13	6.38	2.7			200	0.91	0.16	5.68	0.15		50.3	60		314
Misery	MD-360-20-01 (8-Aug-2014	0.09	6.41	5.1			190	0.87	0.08	5.84	0.17		48.9	63		287
Misery	MD-360-20-02 (8-Aug-2014	0.1	6.49	4.5			210	0.75	0.08	5.76	0.17		48.7	80		270
Misery	MD-380-29-01 (8-Mar-2014)	0.16	6.32	4.5			220	0.86	0.12	5.1	0.09		50.9	69		288
Misery	MD-380-45-01 (3-May-2014	0.14	6.32	1.9			210	0.85	0.27	5.85	0.13		49	110		249
Misery	MD-380-45-02 (3-May-2014	0.1	6.44	1.9			240	0.82	0.19	5.91	0.14		49.3	115		241
Misery	MD-390-41-01 (13-JAN-201	0.13	6.46	2			200	1.08	0.11	5.88	0.15		54.1	69		310
Misery	MD-390-41-02 (13-JAN-201	0.13	6.45	3.3			210	0.76	0.1	6.05	0.14		54.9	88		291
Misery	MD-390-45-01 (8-Mar-2014)	0.09	6.29	0.9			220	0.87	0.12	5.34	0.11		44.5	106		124.5
Misery	MD-400-21-01 (8 Mar-2014)	0.13	6.37	1.8			220	0.85	0.05	5.84	0.22		48.9	85		262
Misery Samples	Median	0.15	6.38	2.7	4.15	10	210	0.83	0.1	5.18	0.2		46.3	82		278
	Minimum	0.05	0.42	0.5	0.25	10	21	0.25	0.04	0.16	0.05		1.4	36		0.9
	Maximum	0.36	8.12	81.6	13.3	10	570	7.59	14	6.59	2		55.6	159		331
	N	73	73	73	22	22	73	51	73	73	73		73	73		73
Pigeon	97-54	0.1	1.79	2.5			120	0.25	2.5	1.26	0.5		30	92		329
Pigeon	97-54	0.1	1.55	2.5			60	0.25	2.5	1.28	0.5		32	77		294
Pigeon	97-54	0.1	2.79	10			180	0.25	2.5	1.27	0.5		55	61		370
Pigeon	97-54	0.1	1.56	2.5			230	0.25	2.5	0.89	0.5		36	53		248
Pigeon	97-54	0.1	1.64	2.5			150	0.25	2.5	1.1	1		29	83		227
Pigeon	97-54	0.1	1.63	2.5			70	0.25	2.5	1.19	0.5		30	89		291
Pigeon	HC-Pdef-1	0.1	7.15	0.3			40	0.51	0.01	7.52	0.15	16.35	50.7	118	0.54	229
Pigeon Samples	Median	0.1	1.64	2.5			120	0.25	2.5	1.26	0.5	16.35	32	83	0.54	291
	Minimum	0.1	1.55	0.3			40	0.25	0.01	0.89	0.15	16.35	29	53	0.54	227
	Maximum	0.1	7.15	10			230	0.51	2.5	7.52	1	16.35	55	118	0.54	370
	N	7	7	7			7	7	7	7	7	1	7	7	1	7
Sable	SDC-13	0.1	1.68	2.5			50	0.25	2.5	1.26	0.5		33	80		290

Deposit	Sample	Fe %	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	K %	La ppm	Li ppm	Mg %	Mn ppm	Mo ppm	Na %	Nb ppm
Crustal Abundances		5.63	19	-	-	0.08	-	2.085	39	20	2.33	950	1.3	2.355	-
All Samples	Median	10.12	20.5	0.09	5.9	0.006	0.107	0.78	19.4	29.1	2.98	1488	0.79	1.82	18.3
	Minimum	0.67	2	0.025	0.25	0.0025	0.01	0.14	5	14	0.26	139	0.2	0.031	0.26
	Maximum	12.85	25.92	0.15	6.6	22	0.118	2.76	34	52.4	4.24	2050	2.92	2.89	22
	N	130	99	35	35	120	35	130	99	35	130	130	130	130	35
Misery	MGT-66 16-19	1.07	3			0.005		0.47	31		0.35	171	1.3	0.031	
Misery	MGT-43 286-289	4.58	7			0.01		0.34	11		0.74	382	0.5	0.108	
Misery	MGT-43 289-292	4.85	7			0.005		0.38	10		0.9	396	0.6	0.101	
Misery	MGT-43 292-295	4.59	7			0.005		0.39	9		0.95	414	0.7	0.071	
Misery	MGT-43 300-303	4.85	9			0.005		0.22	9		1.29	553	0.5	0.069	
Misery	MGT-43 303-306	4.05	8			0.005		0.27	9		1.26	461	0.5	0.093	
Misery	MGT-43 306-309	4.36	7			0.005		0.4	10		0.72	362	0.5	0.138	
Misery	MGT-43 309-311.13	4.68	9			0.005		0.3	11		1.03	458	0.5	0.092	
Misery	MGT-54 211-213.47	4.58	7			0.005		0.38	9		0.9	415	0.5	0.091	
Misery	MGT-54 208-211	4.62	7			0.005		0.41	11		0.91	444	0.6	0.076	
Misery	MD-210-03-01	12.75	20.9			2.5		0.76	19.6		2.98	1960	0.64	1.69	
Misery	MD-220-01-01	12.3	19.5			22		0.7	20.1		3.14	1900	0.81	1.7	
Misery	MD-220-15-01	12.85	21.1			6		0.93	20.2		3.28	2050	0.67	1.82	
Misery	MD-220-21-01	12.6	20.6			8		0.87	19.5		3.23	1940	0.64	1.79	
Misery	MD-230-03-01	12.4	22			5		1.07	18.5		3.44	1900	0.74	1.79	
Misery	MD-230-03-02	12.5	22.3			8		0.91	19.6		3.08	1900	0.75	1.69	
Misery	MD-240-20-01	5.97	21.4			2.5		1.64	26.4		1.91	820	1.36	2.6	
Misery	MD-240-40-01	11.7	19.6			15		0.72	18.9		3.06	1940	0.76	1.9	
Misery	MD-280-44-01	11.9	20.3			2.5		0.85	17.3		3.15	1880	0.61	1.95	
Misery	MD-290-29-01	10.45	20.2			2.5		1.12	20		2.86	1540	0.75	1.83	
Misery	MD-290-29-02-7FEB2016	11.95	21.1			2.5		0.91	18.3		3.22	1800	0.68	1.87	
Misery	MD-300-19-01	11.4	21			2.5		0.82	20.2		2.96	1770	0.78	1.64	
Misery	MD-300-19-02	11.65	17.9			2.5		0.92	17.5		2.92	1780	0.78	1.76	
Misery	MD-300-19-03	11.2	21.3			2.5		0.75	19.2		3.16	1780	0.93	2.1	
Misery	MD-300-43-01	12.05	20.1			2.5		0.84	18.7		2.82	1800	0.46	1.8	
Misery	MD-300-43-02	12.35	20.6			2.5		0.71	19.4		2.83	2010	0.74	1.77	
Misery	MD-310	11.7	20.7			3.5		0.81	18.7		3.01	1720	0.93	1.98	
Misery	MD-320-37-01	3.15	21			2.5		2.35	23.6		1.37	393	2.3	2.22	
Misery	MD-320-37-02	2.94	23.6			2.5		2.38	25.2		1.24	329	1.7	2.52	
Misery	MD-320-37-03	2.79	21.5			2.5		2.68	28.8		1.1	329	2.27	2.25	
Misery	MD-350-25-01	11.35	19.85			0.006		0.82	18.4		3.18	1730	1.01	1.72	
Misery	MD-350-25-02	11	19.9			0.008		0.88	18.6		3.28	1860	0.61	1.94	
Misery	MD-350-26-01	11.05	20.4			0.011		0.68	18.9		2.86	1730	1.15	1.7	
Misery	MD-360-14-01 (1-Aug-2014	11.9	20.7			2.5		0.78	20		2.81	1920	0.86	1.79	
Misery	MD-360-20-01 (8-Aug-2014	11.5	20			2.5		0.62	18.6		2.94	1740	0.62	1.77	
Misery	MD-360-20-02 (8-Aug-2014	11.1	19.65			2.5		0.71	17.2		3.13	1640	0.63	1.71	
Misery	MD-380-29-01 (8-Mar-2014)	11.4	20.8			2.5		0.7	19		3.43	1700	0.79	1.81	
Misery	MD-380-45-01 (3-May-2014	10.55	18.8			2.5		0.76	16.3		3.15	1880	0.8	2.12	
Misery	MD-380-45-02 (3-May-2014	10.95	19.2			2.5		0.92	16.7		3.16	1900	0.79	1.96	
Misery	MD-390-41-01 (13-JAN-201	12	21.5			0.005		0.75	21.3		2.99	1880	0.91	2	
Misery	MD-390-41-02 (13-JAN-201	11	20.2			2.5		0.81	15.4		3.32	1720	0.7	1.86	
Misery	MD-390-45-01 (8-Mar-2014)	10.25	17.05			2.5		0.64	11.8		3.69	1920	0.36	2.33	
Misery	MD-400-21-01 (8 Mar-2014)	11.2	19.6			2.5		0.74	16.2		3.15	1770	0.56	1.9	
Misery Samples	Median	10.25	19.63			2.5		0.76	18		2.86	1720	0.64	1.81	
	Minimum	0.67	2			0.005		0.14	8		0.26	139	0.2	0.031	
	Maximum	12.85	23.6			22		2.74	31		3.69	2050	2.3	2.6	
	N	73	62			73		73	62		73	73	73	73	
Pigeon	97-54	6.94						0.43			1.14	380	2	0.18	
Pigeon	97-54	6.91						0.32			1.03	415	1	0.15	
Pigeon	97-54	8.42						0.33			2.76	350	1	0.04	
Pigeon	97-54	5.63						0.73			1.11	230	1	0.17	
Pigeon	97-54	5.44						0.64			0.94	270	2	0.24	
Pigeon	97-54	6.82						0.34			1.03	365	1	0.13	
Pigeon	HC-Pdef-1	9.7	21.9	0.15	2.7		0.084	0.19	5.9	16.2	4.24	1440	0.6	1.52	4.8
Pigeon Samples	Median	6.91	21.9	0.15	2.7		0.084	0.34	5.9	16.2	1.11	365	1	0.17	4.8
	Minimum	5.44	21.9	0.15	2.7		0.084	0.19	5.9	16.2	0.94	230	0.6	0.04	4.8
	Maximum	9.7	21.9	0.15	2.7		0.084	0.73	5.9	16.2	4.24	1440	2	1.52	4.8
	N	7	1	1	1		1	7	1	1	7	7	7	7	1
Sable	SDC-13	7.22						0.15			1.03	590	1	0.15	

Deposit	Sample	Ni ppm	P ppm	Pb ppm	Rb ppm	Re ppm	S %	Sb ppm	Sc ppm	Se ppm	Sn ppm	Sr ppm	Ta ppm	Te ppm	Th ppm	Ti %	Tl ppm	U (ICP ppm	V ppm	W ppm	Y ppm	Zn ppm	Zr ppm
Crustal Abundances		84	1050	19	-	-	0.04	0.2	22	0.05	2.3	100	-	-	1.2	5.65	2.3	3	120	1.3	40	70	-
All Samples	Median	64.7	1030	5.3	26	0.003	0.09	0.22	27.3	0.5	2.1	196.8	1.22	0.025	2.3	1.02	0.1	0.6	356	0.4	29.75	116	211.3
	Minimum	3.5	60	0.7	6.8	0.001	0.03	0.03	0.3	0.25	0.15	7	0.03	0.025	0.5	0.03	0.1	0.16	4	0.1	7.4	12	8.6
	Maximum	97.2	2550	26.2	104	0.004	0.17	12	48.2	3	5	470.8	2.49	0.1	25.1	2.02	5	5.4	437	5	44.1	226	238
	N	130	130	130	35	31	108	130	108	97	44	130	35	97	99	130	98	98	130	130	44	130	35
Misery	MGT-66 16-19	5.9	570	10			0.03	0.05	0.6	0.25		7		0.1	25.1	0.09	0.2	5.4	8	0.1		46	
Misery	MGT-43 286-289	27.1	910	5.4			0.12	0.05	2.4	0.25		18		0.1	1.6	0.23	0.1	0.3	157	0.1		95	
Misery	MGT-43 289-292	29.3	960	4.9			0.1	0.05	3.6	0.25		20		0.1	1.8	0.25	0.2	0.2	164	0.2		106	
Misery	MGT-43 292-295	31.4	900	6.8			0.09	0.05	3.1	0.25		16		0.1	1.6	0.27	0.1	0.2	153	0.1		87	
Misery	MGT-43 300-303	46.1	870	24.2			0.09	0.05	2.8	0.25		20		0.1	1.4	0.26	0.1	0.2	151	0.1		146	
Misery	MGT-43 303-306	55.4	810	14.6			0.08	0.05	3.5	0.25		21		0.1	1.9	0.25	0.1	0.5	107	0.1		88	
Misery	MGT-43 306-309	27.4	930	5.2			0.09	0.05	2.2	0.25		20		0.1	1.6	0.23	0.1	0.2	143	0.1		93	
Misery	MGT-43 309-311.13	33.5	920	7.7			0.1	0.05	2.8	0.25		15		0.1	1.5	0.25	0.1	0.2	138	0.1		99	
Misery	MGT-54 211-213.47	32.4	910	4.5			0.08	0.05	2.6	0.25		19		0.1	1.5	0.27	0.1	0.2	167	0.1		92	
Misery	MGT-54 208-211	35.9	1090	3.6			0.1	0.05	2.5	0.25		22		0.1	1.6	0.24	0.1	0.2	127	0.1		98	
Misery	MD-210-03-01	60.3	1180	4.7			0.13	0.1	43.1	2		182.5		0.025	2.22	1.26	0.3	0.6	412	0.4		170	
Misery	MD-220-01-01	62.2	1090	6.2			0.11	0.14	40.4	2		158.5		0.025	2.34	1.2	0.2	0.5	390	0.3		167	
Misery	MD-220-15-01	66.1	1170	5.2			0.13	0.12	43.5	2		199		0.025	2.3	1.26	0.3	0.5	411	0.4		161	
Misery	MD-220-21-01	65.3	1100	4.2			0.12	0.15	42.3	2		208		0.025	2.16	1.23	0.3	0.5	407	0.4		163	
Misery	MD-230-03-01	80.3	1100	7			0.11	0.25	44.3	2		217		0.025	2.35	1.16	0.3	0.5	408	0.8		192	
Misery	MD-230-03-02	68	1170	8.3			0.12	0.21	43.4	2		194		0.025	2.5	1.19	0.3	0.5	407	0.7		209	
Misery	MD-240-20-01	62.6	800	10			0.15	0.07	21	1		224		0.025	7.45	0.55	0.7	2.6	180	0.9		95	
Misery	MD-240-40-01	67	1030	6.7			0.11	0.14	42.5	2		191		0.025	2.19	1.13	0.2	0.5	372	0.4		170	
Misery	MD-280-44-01	65.9	1110	6.4			0.11	0.16	42.1	3		174.5		0.025	1.98	1.19	0.2	0.5	395	0.3		167	
Misery	MD-290-29-01	69.2	950	7			0.13	0.16	39.2	2		208		0.025	2.87	1	0.3	0.8	332	0.4		143	
Misery	MD-290-29-02-7FEB2016	76.9	1070	5.9			0.11	0.14	44.6	3		206		0.025	2.14	1.14	0.3	0.5	384	0.4		160	
Misery	MD-300-19-01	75.3	1030	5			0.11	0.23	44.6	3		192		0.025	2.4	1.14	0.3	0.5	372	0.5		189	
Misery	MD-300-19-02	62.7	1020	4.7			0.11	0.16	39.2	2		219		0.025	2.06	1.21	0.3	0.5	390	0.4		156	
Misery	MD-300-19-03	76	950	8			0.08	0.32	47.7	2		201		0.025	2.23	1.15	0.2	0.5	385	0.5		162	
Misery	MD-300-43-01	57.5	1090	5.3			0.12	0.14	42.2	2		174.5		0.025	2.23	1.18	0.2	0.5	379	0.3		152	
Misery	MD-300-43-02	54.8	1120	5.4			0.13	0.22	42.8	2		158		0.025	2.36	1.2	0.2	0.6	386	0.5		172	
Misery	MD-310	63	1060	4			0.12	0.22	42.5	2		195.5		0.025	2.11	1.16	0.3	0.5	385	0.4		163	
Misery	MD-320-37-01	61.1	690	15.6			0.16	0.09	12.5	0.5		211		0.06	6.5	0.3	0.6	2.3	92	0.7		76	
Misery	MD-320-37-02	56.3	750	16.3			0.15	0.1	11.5	1		190.5		0.025	7.36	0.28	0.6	3.5	80	1.2		76	
Misery	MD-320-37-03	51.6	740	19.6			0.17	0.09	10.4	1		187.5		0.025	11.3	0.26	0.7	4.1	72	0.9		70	
Misery	MD-350-25-01	72	1020	7			0.11	0.24	1.6	0.5		202		0.025	2	1.17	0.5	1.6	387	0.3		155	
Misery	MD-350-25-02	72.8	1000	26.2			0.11	0.41	1.5	0.5		230		0.025	1.6	1.12	0.5	2.7	377	0.3		156	
Misery	MD-350-26-01	59.4	1040	13.5			0.13	0.76	1.6	0.5		166.5		0.025	2.1	1.14	0.5	2.4	375	0.3		226	
Misery	MD-360-14-01 (1-Aug-2014	55	1210	4.3			0.12	0.29	42.3	2		179.5		0.025	2.8	1.3	0.2	0.6	406	0.3		145	
Misery	MD-360-20-01 (8-Aug-2014	56.7	1140	4.2			0.12	0.07	41.1	2		188		0.025	2.6	1.23	0.2	0.6	397	0.2		153	
Misery	MD-360-20-02 (8-Aug-2014	64.7	1040	4.6			0.1	0.07	41.3	2		198		0.025	2.3	1.15	0.2	0.5	386	0.2		136	
Misery	MD-380-29-01 (8-Mar-2014)	63.8	1100	18.9			0.11	0.19	44.6	3		181		0.025	2	1.15	0.2	0.8	378	0.3		110	
Misery	MD-380-45-01 (3-May-2014	70.3	970	9.9			0.12	0.15	41.1	2		236		0.025	2.2	1.05	0.2	0.5	338	0.2		126	
Misery	MD-380-45-02 (3-May-2014	70.5	1000	4.3			0.1	0.62	41.5	2		237		0.025	2.3	1.09	0.3	0.5	353	0.2		131	
Misery	MD-390-41-01 (13-JAN-201	61.6	1140	5			0.12	0.08	45.9	2		210		0.025	2.3	1.22	0.2	0.6	406	0.3		152	
Misery	MD-390-41-02 (13-JAN-201	76.3	890	4.2			0.1	0.13	48.2	1		222		0.025	1.7	1.05	0.3	0.4	404	0.2		129	
Misery	MD-390-45-01 (8-Mar-2014)	71.2	830	12.5			0.09	0.11	40.9	1		223		0.025	1.5	0.99	0.1	0.4	361	0.2		142	
Misery	MD-400-21-01 (8 Mar-2014)	67.1	1030	16.9			0.1	0.09	43.9	2		228		0.025	1.8	1.1	0.3	0.6	375	0.2		178	
Misery Samples	Median	59.4	1000	6.2			0.1	0.1	36.8	1		191		0.025	2.13	1.02	0.2	0.5	353	0.3		132	
	Minimum	3.5	570	1.4			0.03	0.03	0.3	0.25		7		0.025	1.2	0.03	0.1	0.2	4	0.1		22	
	Maximum	80.3	1210	26.2			0.17	5	48.2	3		262		0.1	25.1	1.3	1.1	5.4	435	5		226	
	N	73	73	73			72	73	62	62		73		62	62	73	62	62	73	73		73	
Pigeon	97-54	34	1470	18				2.5	4		5	57				0.4			284	5	16	143	
Pigeon	97-54	30	1500	16				2.5	3		5	51				0.43			293	5	17	127	
Pigeon	97-54	62	1820	10				2.5	18		5	36				0.57			337	5	21	114	
Pigeon	97-54	30	1510	6				2.5	9		5	51				0.37			333	5	17	115	
Pigeon	97-54	23	1390	8				2.5	3		5	70				0.42			284	5	11	86	
Pigeon	97-54	35	1360	6				2.5	3		5	44				0.42			314	5	15	111	
Pigeon	HC-Pdef-1	97.2	550	2	6.8	0.002	0.05	0.07	43.6	2	1.2	167.5	0.32	0.025	0.6	0.94	0.1	0.2	369	0.2	25.5	108	82.4
Pigeon Samples	Median	34	1470	8	6.8	0.002	0.05	2.5	4	2	5	51	0.32	0.025	0.6	0.42	0.1	0.2	314	5	17	114	82.4
	Minimum	23	550	2	6.8	0.002	0.05	0.07	3	2	1.2	36	0.32	0.025	0.6	0.37	0.1	0.2	284	0.2	11	86	82.4
	Maximum	97.2	1820	18	6.8	0.002	0.05	2.5	43.6	2	5	167.5	0.32	0.025	0.6	0.94	0.1	0.2	369	5	25.5	143	82.4
	N	7	7	7	1	1	1	7	7	1	7	7	1	1	1	7	1	1	7	7	7	7	1
Sable	SDC-13	36	1100	10				2.5	3		5	37				0.55			291	5	16	136	

Red text indicates values below detection; <DL values have been replaced with half the detection limit.
Bolded grey values indicate values are greater than five times average crustal abundances (Price 1997)

APPENDIX A-3

Results of MEND Share-Flask Extraction Testing for Diabase by Deposit, Ekati Mine

Appendix A-3, Results of MEND Shake-Flask Extraction Testing for Diabase by Deposit, Ekati Mine

Sample		pH	EC	Acidity (to pH 8.3)	Alkalinity (to pH 4.5)	Sulphate (SO4)	Hardness (CaCO3)	Al	Sb	As	Ba	Be	Bi	B	Cd	Cr
		unit	µS/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
CCME Guidelines (mg/L)[a]		6.5 - 9.0						0.1		0.005				1.5	0.00009	0.001
Lynx Median		*8.68*	*46*	*0.25*	*15.5*	*0.25*	*10.105*	**0.254**	*0.00025*	*0.00343*	*0.00135*	*0.00005*	*0.0005*	*0.025*	*0.000005*	*0.0005*
Lynx Minimum		*6.29*	*29*	*0.25*	*5*	*0.25*	*4.57*	*0.0454*	*0.00025*	*0.00144*	*0.0005*	*0.00005*	*0.0005*	*0.025*	*0.000005*	*0.0005*
Lynx Maximum		*8.99*	*74*	*4.5*	*21.5*	*5*	*18.8*	**0.356**	*0.00025*	**0.0108**	*0.0151*	*0.00005*	*0.0005*	*0.086*	*0.000031*	*0.0005*
Lynx N		*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*
Lynx - Coarse crush stockpile	2017Lynx02	6.29	74	4.5	5	5	18.8	**0.045**[b]	0.00025	0.00144	0.0151	0.00005	0.0005	0.025	0.000031	0.0005
Lynx - Pit	2017Lynx03	8.77	57	0.25	16	0.25	11.2	**0.289**	0.00025	**0.00635**	0.0005	0.00005	0.0005	0.025	0.000005	0.0005
Lynx - Pit	2017Lynx04	8.68	54	0.25	17.65	0.25	12.1	**0.231**	0.00025	0.00272	0.0005	0.00005	0.0005	0.025	0.000005	0.0005
Lynx - Pit	2017Lynx05	8.99	63	0.25	21	3	14.4	**0.239**	0.00025	0.0026	0.0005	0.00005	0.0005	0.025	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx06	7.77	31	3	10	3	6.27	**0.175**	0.00025	**0.0055**	0.0005	0.00005	0.0005	0.025	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx07	7.24	29	3.5	10	0.25	6.43	**0.117**	0.00025	0.00323	0.0019	0.00005	0.0005	0.025	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx08	8.72	57	0.25	21	0.25	15.4	**0.143**	0.00025	0.00333	0.0005	0.00005	0.0005	0.054	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx09	8.87	34	0.25	12.5	0.25	7.38	**0.267**	0.00025	0.0045	0.0005	0.00005	0.0005	0.063	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx10	8.93	37	0.25	12	0.25	7.81	**0.267**	0.00025	**0.00538**	0.0005	0.00005	0.0005	0.069	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx11	8.71	33	0.25	11.5	3.6	8.11	**0.253**	0.00025	**0.00551**	0.0013	0.00005	0.0005	0.025	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx12	8.55	56	0.25	21.5	2.8	17.9	0.0925	0.00025	0.00223	0.0017	0.00005	0.0005	0.025	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx13	8.74	51	0.25	16	0.25	9.22	**0.282**	0.00025	0.00458	0.0018	0.00005	0.0005	0.083	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx14	8.7	53	0.25	19.5	0.25	13.4	**0.255**	0.00025	0.00448	0.0022	0.00005	0.0005	0.055	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx15	8.68	41	0.25	13.75	0.25	8.27	**0.296**	0.00025	0.00275	0.0015	0.00005	0.0005	0.025	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx16	8.67	53	0.25	16	0.25	10.3	**0.282**	0.00025	0.00351	0.0005	0.00005	0.0005	0.086	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx17	8.49	41	0.25	14	0.25	9.91	**0.294**	0.00025	0.00455	0.0028	0.00005	0.0005	0.058	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx18	8.33	35	0.25	11	0.25	7.94	**0.183**	0.00025	0.00334	0.0014	0.00005	0.0005	0.025	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx19	8.73	51	0.25	20	0.25	13.3	**0.155**	0.00025	0.00234	0.0018	0.00005	0.0005	0.025	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx20	8.71	46	0.25	15	0.25	9.56	**0.356**	0.00025	0.00279	0.0005	0.00005	0.0005	0.073	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx21	8.61	46	0.25	17	0.25	11.1	**0.287**	0.00025	0.0021	0.0016	0.00005	0.0005	0.025	0.000005	0.0005
Lynx - Jay Crusher Stockpile	2017Lynx22	8.47	45	0.25	16.18	0.25	11.8	**0.179**	0.00025	**0.0108**	0.0011	0.00005	0.0005	0.025	0.000005	0.0005
Lynx - Fine Crusher Stockpile	2017Lynx23	7.96	29	4.25	10.34	0.25	4.57	**0.352**	0.00025	0.00362	0.0017	0.00005	0.0005	0.025	0.000005	0.0005
Jay - core	2014-DD-040	7.81				4	10.7	**0.187**	0.0002	0.0003	0.00046	0.000007	0.000007	0.0292	0.000003	0.00003
Jay - core	2014-DD-049	7.63				5	15.2	**0.178**	0.0002	0.0002	0.00111	0.000007	0.000007	0.0312	0.000003	0.00003

Sample		Co	Cu	Fe	Pb	Li	Mn	Hg	Mo	Ni	P	Se	Si	Ag	Sr	Tl	Sn	Ti	U	V	Zn	Zr	Ca	Mg	K	Na	S
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
CCME Guidelines (mg/L)[a]			0.02	0.3	0.001			0.000026	0.073	0.025		0.001		0.00025					0.015		0.03						
Lynx Median		*0.0001*	*0.00048*	*0.01855*	*0.0001*	*0.003*	*0.0005*	*0.000025*	*0.0005*	*0.0005*	*0.024*	*0.000165*	*1.83*	*0.00001*	*0.0141*	*1.7E-05*	*0.0025*	*0.0025*	*5E-05*	*0.0094*	*0*	*0*	*2.92*	*0.65*	*1.82*	*2.495*	*1.5*
Lynx Minimum		*0.0001*	*0.00026*	*0.0104*	*0.0001*	*0.002*	*0.0005*	*0.000025*	*0.0005*	*0.0005*	*0.005*	*0.00005*	*0.65*	*0.00001*	*0.0068*	*5E-06*	*0.0025*	*0.0025*	*5E-05*	*0.0025*	*0*	*0*	*1.26*	*0.35*	*1.25*	*1.77*	*1.5*
Lynx Maximum		*0.00025*	*0.00252*	*0.0452*	**0.00256**	*0.0068*	*0.0223*	*0.000025*	*0.0307*	*0.0017*	*0.038*	*0.00047*	*2.44*	*0.00001*	*0.0341*	*0.00016*	*0.0025*	*0.0025*	*0.0011*	*0.0179*	*0.02*	*0*	*4.84*	*2.3*	*3.93*	*4.18*	*1.5*
Lynx N		*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*
Lynx - Coarse crush stockpile	2017Lynx02	0.00025	0.0011	0.0212	**0.00256**	0.0061	0.0223	0.000025	0.002	0.0017	0.012	0.00011	0.65	0.00001	0.0341	0.000055	0.0025	0.0025	0.00015	0.0025	0	0	3.74	2.3	3.38	2.64	1.5
Lynx - Pit	2017Lynx03	0.0001	0.00029	0.0178	0.0001	0.0022	0.0005	0.000025	0.0005	0.0005	0.015	0.00019	1.45	0.00001	0.0151	0.000157	0.0025	0.0025	0.00005	0.0065	0	0	3.81	0.41	2.13	4.18	1.5
Lynx - Pit	2017Lynx04	0.0001	0.0004	0.0194	0.0001	0.0021	0.0005	0.000025	0.0005	0.0005	0.013	0.0002	1.36	0.00001	0.0161	0.000011	0.0025	0.0025	0.00005	0.0095	0	0	4.13	0.43	1.33	3.48	1.5
Lynx - Pit	2017Lynx05	0.0001	0.00047	0.023	0.0001	0.0025	0.0005	0.000025	0.0005	0.0005	0.005	0.00019	1.4	0.00001	0.0194	0.000129	0.0025	0.0025	0.00012	0.0092	0	0	4.7	0.64	1.49	3.6	1.5
Lynx - Jay Crusher Stockpile	2017Lynx06	0.0001	0.00045	0.0302	0.0001	0.0041	0.0005	0.000025	0.0005	0.0005	0.035	0.00005	1.93	0.00001	0.0071	0.000005	0.0025	0.0025	0.00005	0.0065	0.02	0	1.41	0.67	1.61	2.04	1.5
Lynx - Jay Crusher Stockpile	2017Lynx07	0.0001	0.00057	0.0296	0.0001	0.0046	0.0014	0.000025	0.0005	0.0005	0.032	0.00014	2.07	0.00001	0.0085	0.000064	0.0025	0.0025	0.00005	0.0075	0	0	1.52	0.64	1.66	1.77	1.5
Lynx - Jay Crusher Stockpile	2017Lynx08	0.0001	0.00084	0.0211	0.0001	0.0021	0.0005	0.000025	0.0005	0.0005	0.018	0.00015	2.2	0.00001	0.0199	0.00001	0.0025	0.0025	0.00005	0.0143	0	0	4.34	1.1	1.37	3.33	1.5
Lynx - Jay Crusher Stockpile	2017Lynx09	0.0001	0.0005	0.0178	0.0001	0.0025	0.0005	0.000025	0.0005	0.0005	0.028	0.00012	1.42	0.00001	0.0091	0.000051	0.0025	0.0025	0.00005	0.0069	0	0	1.99	0.58	1.81	2.07	1.5
Lynx - Jay Crusher Stockpile	2017Lynx10	0.0001	0.00034	0.0105	0.0001	0.002	0.0005	0.000025	0.0005	0.0005	0.016	0.00016	1.36	0.00001	0.0117	0.000005	0.0025	0.0025	0.00005	0.0055	0	0	2.36	0.47	1.65	2.29	1.5
Lynx - Jay Crusher Stockpile	2017Lynx11	0.0001	0.0003	0.0154	0.0001	0.0025	0.0005	0.000025	0.0005	0.0005	0.032	0.00012	1.29	0.00001	0.0096	0.00002	0.0025	0.0025	0.00005	0.006	0	0	2.2	0.64	1.32	1.89	1.5
Lynx - Jay Crusher Stockpile	2017Lynx12	0.0001	0.00252	0.0452	0.00022	0.0021	0.0011	0.000025	0.0005	0.0005	0.027	0.00022	2.44	0.00001	0.022	0.000005	0.0025	0.0025	0.0011	0.0131	0	0	4.84	1.41	1.25	2.35	1.5
Lynx - Jay Crusher Stockpile	2017Lynx13	0.0001	0.00028	0.0163	0.0001	0.0043	0.0005	0.000025	0.0005	0.0005	0.034	0.00025	2.06	0.00001	0.0122	0.000011	0.0025	0.0025	0.00005	0.0099	0	0	2.52	0.71	3.93	2.98	1.5
Lynx - Jay Crusher Stockpile	2017Lynx14	0.0001	0.00026	0.0166	0.0001	0.0027	0.0005	0.000025	0.0005	0.0005	0.029	0.00012	1.9	0.00001	0.014	0.000071	0.0025	0.0025	0.00005	0.0102	0	0	3.7	1.01	2.25	2.79	1.5
Lynx - Jay Crusher Stockpile	2017Lynx15	0.0001	0.00045	0.0193	0.0001	0.004	0.0005	0.000025	0.0005	0.0005	0.038	0.00019	1.72	0.00001	0.0098	0.000005	0.0025	0.0025	0.00005	0.0101	0	0	2.29	0.62	2.95	2.11	1.5
Lynx - Jay Crusher Stockpile	2017Lynx16	0.0001	0.00065	0.0143	0.0001	0.0039	0.0005	0.000025	0.0005	0.0005	0.024	0.00018	1.8	0.00001	0.0149	0.00005	0.0025	0.0025	0.00005	0.0095	0	0	3.21	0.54	3.06	3.43	1.5
Lynx - Jay Crusher Stockpile	2017Lynx17	0.0001	0.0005	0.0104	0.0001	0.003	0.0005	0.000025	0.0005	0.0005	0.026	0.00017	1.75	0.00001	0.0136	0.000005	0.0025	0.0025	0.00005	0.0097	0	0	2.62	0.82	1.82	2.11	1.5
Lynx - Jay Crusher Stockpile	2017Lynx18	0.0001	0.00048	0.0172	0.0001	0.004	0.0005	0.000025	0.0005	0.0005	0.02	0.00005	2.13	0.00001	0.0096	0.000027	0.0025	0.0025	0.00005	0.0084	0	0	2.06	0.68	2	1.87	1.5
Lynx - Jay Crusher Stockpile	2017Lynx19	0.0001	0.00117	0.0229	0.0001	0.003	0.0005	0.000025	0.0005	0.0005	0.018	0.00027	2.31	0.00001	0.0178	0.000005	0.0025	0.0025	0.00016	0.0141	0	0	3.53	1.09	1.8	2.16	1.5
Lynx - Jay Crusher Stockpile	2017Lynx20	0.0001	0.00048	0.0166	0.0001	0.003	0.0005	0.000025	0.0005	0.0005	0.017	0.00024	1.86	0.00001	0.0141	0.000033	0.0025	0.0025	0.00005	0.0078	0	0	2.79	0.63	2.04	3.12	1.5
Lynx - Jay Crusher Stockpile	2017Lynx21	0.0001	0.0007	0.02	0.0001	0.0035	0.0005	0.000025	0.0005	0.0005	0.024	0.00015	2.16	0.00001	0.0142	0.000005	0.0025	0.0025	0.00005	0.0096	0	0	3.05	0.84	2.02	2.82	1.5
Lynx - Jay Crusher Stockpile	2017Lynx22	0.0001	0.00057	0.0208	0.0001	0.0028	0.0005	0.000025	0.0005	0.0005	0.018	0.00047	2.16	0.00001	0.0147	0.000014	0.0025	0.0025	0.00005	0.0179	0	0	3.22	0.91	1.56	2.66	1.5
Lynx - Fine Crusher Stockpile	2017Lynx23	0.0001	0.00046	0.0133	0.0001	0.0068	0.0005	0.000025	0.0307	0.0005	0.024	0.00005	1.26	0.00001	0.0068	0.000019	0.0025	0.0025	0.00013	0.0025	0	0	1.26	0.35	2.53	1.87	1.5
Jay - core	2014-DD-040	0.000036	0.00022	0.011	0.00001	0.00172	0.0019	0.00001	0.00007	0.0001	0.009	0.00010	1.96	0.000002	0.0213	0.000005	0.00003	0.00013	0.000113	0.00634	0.001	0.002	2.95	0.813	1.80	4.61	0.14
Jay - core	2014-DD-049	0.000039	0.00028	0.004	0.00001	0.00243	0.0037	0.00001	0.00026	0.0001	0.015	0.00015	1.73	0.000006	0.0203	0.000013	0.00005	0.00006	0.000049	0.00295	0.001	0.002	5.05	0.639	2.44	2.52	0.28

Red text indicates values below detection; <DL values have been replaced with half the detection limit.
Bolded text and grey fill indicates a value exceeds CCME Guideline value.
a) CCME Guideline (2017).
b) Aluminum guideline = 0.005 mg/L for pH <6.5 and 0.01 mg/L for pH ≥ 6.5.
c) Boron guideline = 29 mg/L short term and 1.5 mg/L long term.
d) Cadmium guideline = 0.001 mg/L short term and 0.00009 mg/L long term.
e) Copper guideline = 0.002 mg/L for hardness <82 mg/L.
f) Nickel guideline = 0.025 mg/L for hardness <60 mg/L.
g) Phosphorus guideline is dependent on nature of receiving environment and is 0.004 mg/L at its lowest for ultra-oligotrophic water bodies.
h) Lead guideline = 0.001 mg/L for hardness <60 mg/L.
i) Uranium guideline = 0.033 mg/L short term and 0.015 mg/L long term.

APPENDIX A-4

Results of Net Acid Generation Extract Analysis for Diabase by Deposit, Ekati Mine

Appendix A-4, Results of Net Acid Generation Extract Analysis for Diabase by Deposit, Ekati Mine

		pH unit	EC µS/cm	Acidity (to pH 8.3) mg CaCO3/L	Alkalinity (to pH 4.5) mg CaCO3/L	Sulphate (SO4) mg/L	Hardness (CaCO3) mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mn mg/L
CCME Guidelines (mg/L)[a]		6.5 - 9.0						0.1		0.005				1.5	0.00009	0.001		0.002	0.3	0.001		
Lynx Median		7.08	59	4.0625	12.8125	7.85	7.845	**0.2685**	0.00025	0.004295	0.00075	0.00005	0.0005	0.328	0.000005	**0.00985**	0.0001	**0.00228**	0.08415	0.0001	0.00815	0.0012
Lynx Minimum		6.72	51	2.5	9.6875	3.8	4.59	0.0282	0.00025	0.0019	0.0005	0.00005	0.0005	0.15	0.000005	**0.002**	0.0001	0.00106	0.0114	0.0001	0.001	0.0005
Lynx Maximum		7.78	126	11.25	50	10.8	48.4	**0.79**	0.00025	**0.041**	0.0038	0.00005	0.0005	0.614	0.000005	**0.0365**	0.00061	**0.0109**	**0.528**	0.00039	0.0119	0.012
Lynx N		22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Lynx - Coarse crush stockpile	2017Lynx02	6.72	51	11.25	12.5	6.4	4.59	**0.321**	0.00025	**0.01310**	0.00380	0.00005	0.00050	0.37600	0.00001	**0.03650**	0.00010	0.00147	0.13300	0.00039	0.00100	0.00310
Lynx - Pit	2017Lynx03	7.04	64	6.25	13.75	9.5	8.35	**0.335**	0.00025	0.00273	0.00050	0.00005	0.00050	0.18900	0.00001	**0.01960**	0.00010	**0.00548**	0.14700	0.00010	0.00950	0.00170
Lynx - Pit	2017Lynx04	7.08	53	5.625	14.375	5	8.79	**0.384**	0.00025	0.00459	0.00050	0.00005	0.00050	0.36700	0.00001	**0.00770**	0.00010	0.00184	0.05770	0.00010	0.00780	0.00050
Lynx - Pit	2017Lynx05	7.57	94	3.125	18.125	7.8	27.9	**0.282**	0.00025	**0.00780**	0.00050	0.00005	0.00050	0.61400	0.00001	**0.01210**	0.00010	0.00109	0.01480	0.00010	0.00580	0.00050
Lynx - Jay Crusher Stockpile	2017Lynx06	6.94	62	3.4375	10.625	10.8	9.99	**0.263**	0.00025	0.00290	0.00160	0.00005	0.00050	0.34900	0.00001	**0.00200**	0.00045	**0.00702**	**0.36300**	0.00010	0.01190	0.01200
Lynx - Jay Crusher Stockpile	2017Lynx07	6.92	53	3.75	9.6875	7.5	7.44	**0.120**	0.00025	0.00413	0.00190	0.00005	0.00050	0.30900	0.00001	**0.01140**	0.00010	**0.00260**	0.13900	0.00010	0.01100	0.00210
Lynx - Jay Crusher Stockpile	2017Lynx08	7.27	70	5	18.75	7.7	16.8	**0.161**	0.00025	**0.00589**	0.00050	0.00005	0.00050	0.57800	0.00001	**0.01250**	0.00010	0.00179	0.02400	0.00010	0.00710	0.00050
Lynx - Jay Crusher Stockpile	2017Lynx09	7.08	59	3.125	12.5	7.9	6.76	**0.302**	0.00025	0.00326	0.00050	0.00005	0.00050	0.32200	0.00001	**0.00770**	0.00010	**0.00301**	0.11500	0.00010	0.00880	0.00130
Lynx - Jay Crusher Stockpile	2017Lynx10	7.06	56	3.125	12.5	6.8	7.73	**0.186**	0.00025	**0.00653**	0.00050	0.00005	0.00050	0.30000	0.00001	**0.00850**	0.00010	0.00196	0.05970	0.00010	0.00750	0.00050
Lynx - Jay Crusher Stockpile	2017Lynx11	7.06	54	2.5	11.875	6.6	10	0.100	0.00025	0.00311	0.00120	0.00005	0.00050	0.15000	0.00001	**0.00950**	0.00010	0.00181	0.05290	0.00010	0.00680	0.00100
Lynx - Jay Crusher Stockpile	2017Lynx12	7.78	126	2.5	50	3.8	48.4	0.028	0.00025	0.00211	0.00190	0.00005	0.00050	0.49100	0.00001	**0.01540**	0.00010	0.00137	0.01140	0.00010	0.00360	0.00050
Lynx - Jay Crusher Stockpile	2017Lynx13	7.15	62	2.8125	12.5	10	6.48	**0.530**	0.00025	**0.00912**	0.00200	0.00005	0.00050	0.28200	0.00001	**0.01100**	0.00061	**0.01090**	**0.52800**	0.00010	0.00950	0.00500
Lynx - Jay Crusher Stockpile	2017Lynx14	7.1	68	2.5	12.5	8.4	11.2	**0.208**	0.00025	0.00467	0.00130	0.00005	0.00050	0.33400	0.00001	**0.01020**	0.00010	0.00162	0.04270	0.00010	0.00900	0.00050
Lynx - Jay Crusher Stockpile	2017Lynx15	7.18	60	2.8125	13.75	8.8	6.49	**0.790**	0.00025	0.00281	0.00200	0.00005	0.00050	0.24700	0.00001	**0.00950**	0.00048	**0.00874**	**0.38600**	0.00010	0.00960	0.00390
Lynx - Jay Crusher Stockpile	2017Lynx16	7.1	58	2.8125	13.75	6.2	7.09	**0.430**	0.00025	0.00190	0.00100	0.00005	0.00050	0.22500	0.00001	**0.00680**	0.00040	**0.00535**	**0.31800**	0.00010	0.01100	0.00310
Lynx - Jay Crusher Stockpile	2017Lynx17	7.01	59	6.25	12.5	9.5	7.17	**0**	0.00025	**0.01490**	0.00130	0.00005	0.00050	0.46600	0.00001	**0.00250**	0.00010	**0.00268**	0.07360	0.00010	0.00850	0.00110
Lynx - Jay Crusher Stockpile	2017Lynx18	6.96	58	7.5	13.125	8.7	6.53	**0.274**	0.00025	0.00265	0.00050	0.00005	0.00050	0.28900	0.00001	**0.00620**	0.00021	**0.00296**	0.17100	0.00010	0.01110	0.00180
Lynx - Jay Crusher Stockpile	2017Lynx19	7.42	87	6.25	27.5	4.6	19.4	**0.171**	0.00025	0.00402	0.00050	0.00005	0.00050	0.37300	0.00001	**0.01290**	0.00010	0.00106	0.02600	0.00010	0.00730	0.00050
Lynx - Jay Crusher Stockpile	2017Lynx20	6.95	58	4.375	11.25	9.3	8.7	**0.141**	0.00025	0.00325	0.00050	0.00005	0.00050	0.32200	0.00001	**0.00280**	0.00010	**0.00266**	0.08100	0.00010	0.00720	0.00150
Lynx - Jay Crusher Stockpile	2017Lynx21	7.11	62	5	15	8.4	7.96	**0.233**	0.00025	0.00446	0.00050	0.00005	0.00050	0.36400	0.00001	**0.00840**	0.00010	**0.00265**	0.06990	0.00010	0.00680	0.00110
Lynx - Jay Crusher Stockpile	2017Lynx22	7.02	56	6.875	11.875	6	7.01	**0.157**	0.00025	**0.04100**	0.00050	0.00005	0.00050	0.40100	0.00001	**0.01230**	0.00010	0.00191	0.08730	0.00010	0.00950	0.00050
Lynx - Fine Crusher Stockpile	2017Lynx23	7.11	59	5	13.75	9.7	4.61	**0.571**	0.00025	**0.01780**	0.00320	0.00005	0.00050	0.28100	0.00001	**0.02990**	0.00010	0.00166	0.17700	0.00010	0.00300	0.00230
Jay - core	2014-DD-040	**6.37**				17	36.6	**0.0817**[b]	0.0011	0.0019	0.00056	0.000007	0.000007	0.0327	**0.000279**	**0.0585**	0.00130	0.00950	0.144	0.00006	0.00941	0.0271
Jay - core	2014-DD-049	**6.35**				11	30.2	**0.0216**[b]	0.0011	0.0041	0.00043	0.000007	0.000007	0.0293	**0.000333**	**0.0537**	0.00147	0.0148	0.009	0.00004	0.00810	0.0236

		Hg mg/L	Mo mg/L	Ni mg/L	P mg/L	Se mg/L	Si mg/L	Ag mg/L	Sr mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L	Ca mg/L	Mg mg/L	K mg/L	Na mg/L	S mg/L
CCME Guidelines (mg/L)[a]		0.00026	0.073	0.025		0.001		0.00025					0.015		0.03						
Lynx Median		0.000025	0.0029	0.0005	0.018	**0.00278**	13.35	0.00001	0.0097	0.0000135	0.0025	0.007	0.00005	0.0617	0.0025	0.00005	2.585	0.2705	4.125	5.735	3.05
Lynx Minimum		0.000025	0.002	0.0005	0.005	0.00028	10.3	0.00001	0.0069	0.000005	0.0025	0.0025	0.00005	0.0117	0.0025	0.00005	1.17	0.025	2.77	4.76	1.5
Lynx Maximum		0.000025	0.0167	0.0005	0.075	**0.00357**	16.3	0.000031	0.0305	0.000064	0.0025	0.0661	0.0017	0.0842	0.0025	0.00109	19.2	0.818	7.01	6.73	4.2
Lynx N		22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Lynx - Coarse crush stockpile	2017Lynx02	0.00003	0.00600	0.00050	0.07500	0.00028	11.10000	0.00003	0.00960	0.00006	0.00250	0.02700	0.00170	0.01170	0.00250	0.00109	1.17	0.405	4.96	5.57	1.5
Lynx - Pit	2017Lynx03	0.00003	0.00360	0.00050	0.01500	**0.00325**	13.30000	0.00001	0.00980	0.00002	0.00250	0.01030	0.00005	0.06180	0.00250	0.00005	3.01	0.205	5.14	6.52	3.8
Lynx - Pit	2017Lynx04	0.00003	0.00300	0.00050	0.01100	**0.00229**	11.40000	0.00001	0.00800	0.00006	0.00250	0.00250	0.00005	0.05290	0.00250	0.00005	3.42	0.063	3.46	4.96	1.5
Lynx - Pit	2017Lynx05	0.00003	0.00350	0.00050	0.00500	**0.00281**	12.10000	0.00001	0.01610	0.00001	0.00250	0.00250	0.00005	0.06180	0.00250	0.00005	11.2	0.025	3.26	5.83	3.3
Lynx - Jay Crusher Stockpile	2017Lynx06	0.00003	0.00260	0.00050	0.02300	**0.00304**	16.30000	0.00001	0.01030	0.00004	0.00250	0.02210	0.00005	0.06150	0.00250	0.00014	2.65	0.818	4.18	5.71	4.2
Lynx - Jay Crusher Stockpile	2017Lynx07	0.00003	0.00280	0.00050	0.03600	**0.00202**	13.90000	0.00001	0.00900	0.00003	0.00250	0.01230	0.00005	0.06630	0.00250	0.00005	1.92	0.641	3.69	5.22	1.5
Lynx - Jay Crusher Stockpile	2017Lynx08	0.00003	0.00220	0.00050	0.00500	**0.00174**	13.80000	0.00001	0.01400	0.00001	0.00250	0.00250	0.00005	0.06740	0.00250	0.00005	6.59	0.09	2.77	5.54	3
Lynx - Jay Crusher Stockpile	2017Lynx09	0.00003	0.00320	0.00050	0.01600	**0.00324**	14.10000	0.00001	0.00910	0.00002	0.00250	0.00870	0.00005	0.06230	0.00250	0.00017	2.26	0.269	4.71	6.05	1.5
Lynx - Jay Crusher Stockpile	2017Lynx10	0.00003	0.00270	0.00050	0.01300	**0.00270**	11.60000	0.00001	0.01130	0.00001	0.00250	0.00250	0.00005	0.04600	0.00250	0.00005	2.52	0.352	3.84	5.47	1.5
Lynx - Jay Crusher Stockpile	2017Lynx11	0.00003	0.00270	0.00050	0.01900	**0.00282**	10.30000	0.00001	0.01150	0.00002	0.00250	0.00560	0.00005	0.05100	0.00250	0.00005	2.76	0.762	2.97	4.76	1.5
Lynx - Jay Crusher Stockpile	2017Lynx12	0.00003	0.00200	0.00050	0.02300	**0.00163**	14.50000	0.00001	0.03050	0.00001	0.00250	0.00250	0.00033	0.07570	0.00250	0.00005	19.2	0.109	3.37	5.48	1.5
Lynx - Jay Crusher Stockpile	2017Lynx13	0.00003	0.00300	0.00050	0.02500	**0.00299**	12.40000	0.00002	0.00780	0.00001	0.00250	0.03630	0.00005	0.06160	0.00250	0.00021	2.14	0.272	7.01	5.69	3.8
Lynx - Jay Crusher Stockpile	2017Lynx14	0.00003	0.00250	0.00050	0.01300	**0.00275**	12.60000	0.00001	0.01220	0.00002	0.00250	0.00250	0.00005	0.05660	0.00250	0.00005	3.97	0.302	4.55	5.92	3.5
Lynx - Jay Crusher Stockpile	2017Lynx15	0.00003	0.00240	0.00050	0.02500	**0.00290**	13.20000	0.00001	0.00820	0.00001	0.00250	0.03550	0.00005	0.07070	0.00250	0.00035	2.14	0.278	6.02	5.76	3.7
Lynx - Jay Crusher Stockpile	2017Lynx16	0.00003	0.00300	0.00050	0.01800	**0.00306**	12.60000	0.00001	0.00880	0.00001	0.00250	0.02170	0.00005	0.06100	0.00250	0.00012	2.51	0.2	5.55	5.43	1.5
Lynx - Jay Crusher Stockpile	2017Lynx17	0.00003	0.00360	0.00050	0.01500	**0.00322**	13.00000	0.00001	0.00950	0.00001	0.00250	0.00650	0.00005	0.07610	0.00250	0.00005	2.46	0.25	3.97	6.37	4
Lynx - Jay Crusher Stockpile	2017Lynx18	0.00003	0.00280	0.00050	0.03000	**0.00274**	15.20000	0.00001	0.00690	0.00002	0.00250	0.01330	0.00005	0.08330	0.00250	0.00005	1.91	0.429	5.33	5.56	3.6
Lynx - Jay Crusher Stockpile	2017Lynx19	0.00003	0.00320	0.00050	0.01100	**0.00246**	14.70000	0.00001	0.01520	0.00001	0.00250	0.00250	0.00005	0.08420	0.00250	0.00005	7.69	0.06	5.59	6.48	1.5
Lynx - Jay Crusher Stockpile	2017Lynx20	0.00003	0.00300	0.00050	0.01400	**0.00332**	13.90000	0.00001	0.01140	0.00002	0.00250	0.00620	0.00005	0.05570	0.00250	0.00005	2.84	0.394	4.02	6.12	4.1
Lynx - Jay Crusher Stockpile	2017Lynx21	0.00003	0.00240	0.00050	0.01800	**0.00247**	15.70000	0.00001	0.01050	0.00001	0.00250	0.00590	0.00005	0.05920	0.00250	0.00005	2.74	0.268	4.07	6.73	3.6
Lynx - Jay Crusher Stockpile	2017Lynx22	0.00003	0.00250	0.00050	0.02000	**0.00357**	14.00000	0.00001	0.00840	0.00001	0.00250	0.00750	0.00005	0.08370	0.00250	0.00005	2.28	0.318	3.75	6.1	1.5
Lynx - Fine Crusher Stockpile	2017Lynx23	0.00003	0.01670	0.00050	0.05900	0.00041	13.40000	0.00001	0.00710	0.00001	0.00250	0.06610	0.00084	0.02500	0.00250	0.00059	1.42	0.255	6.85	6.18	3.1
Jay - core	2014-DD-040	0.00001	0.00805	0.0054	32.9	**0.00269**	7.99	0.000058	0.0105	0.000087	0.0140	0.132	0.00110	0.0424	0.002	0.002	5.84	5.34	2.74	40.9	6.81
Jay - core	2014-DD-049	0.00001	0.00834	0.0073	35.0	**0.00238**	6.31	0.000052	0.0097	0.000083	0.00768	0.112	0.000739	0.0231	0.002	0.002	5.97	3.71	2.72	44.1	6.05

Red text indicates values below detection; <DL values have been replaced with half the detection limit.
Bolded text and grey fill indicates a value is above the CCME Guideline value.
a) CCME Guideline (2014).
b) Aluminum guideline = 0.005 mg/L for pH <6.5 and 0.01 mg/L for pH≥6.5.
c) Boron guideline = 29 mg/L short term and 1.5 mg/L long term.
d) Cadmium guideline = 0.001 mg/L short term and 0.00009 mg/L long term.
e) Copper guideline = 0.002 mg/L for hardness <82 mg/L.
f) Nickel guideline = 0.025 mg/L for hardness <60 mg/L.
g) Phosphorus guideline is dependent on nature of receiving environment and is 0.004 mg/L at its lowest for ultra-oligotrophic water bodies.
h) Lead guideline = 0.001 mg/L for hardness <60 mg/L.
i) Uranium guideline = 0.033 mg/L short term and 0.015 mg/L long term.

APPENDIX A-5

Results of Whole Rock XRF Testing for Lynx November 2017 Diabase Samples, Ekati Mine

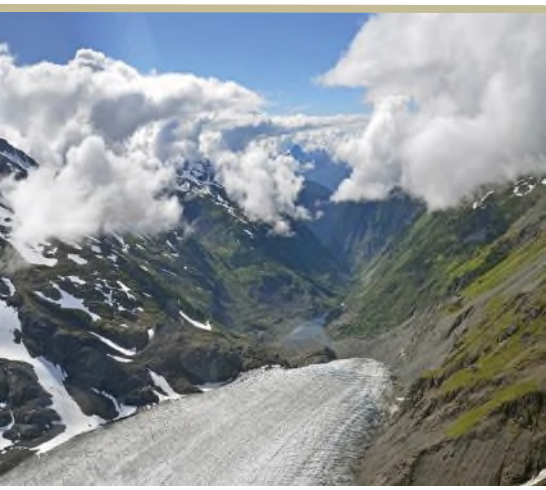
Appendix A-5, Results of Whole Rock XRF Testing for Lynx November 2017 Diabase samples, Ekati Mine

Sample	Al2O3	BaO	CaO	Cr2O3	Fe2O3	K2O	MgO	MnO	Na2O	P2O5	SO3	SiO2	SrO	TiO2	LOI	Total
2017Lynx02	14.98	0.05	1.70	0.02	2.36	4.57	0.98	0.02	3.60	0.17	0.01	70.04	0.05	0.39	0.82	99.69
2017Lynx03	11.93	0.05	8.67	0.01	15.53	0.93	4.80	0.21	2.47	0.29	0.01	50.19	0.05	3.34	0.95	99.36
2017Lynx04	11.62	0.05	8.33	0.01	15.51	0.93	5.08	0.21	2.50	0.28	0.01	50.22	0.04	3.34	1.34	99.4
2017Lynx05	11.51	0.05	8.39	0.01	15.71	1.05	5.13	0.21	2.45	0.28	0.01	49.67	0.04	3.37	1.61	99.42
2017Lynx06	11.80	0.05	8.37	0.01	16.50	1.01	5.16	0.22	2.17	0.27	0.01	49.82	0.05	3.42	1.36	100.15
2017Lynx07	12.12	0.05	7.90	0.01	15.69	1.50	4.98	0.20	2.35	0.35	0.01	50.01	0.05	3.60	1.51	100.24
2017Lynx08	11.77	0.05	7.47	0.01	14.59	1.01	5.64	0.25	3.05	0.26	0.01	50.76	0.03	3.15	2.13	100.12
2017Lynx09	11.82	0.05	8.73	0.01	16.06	1.08	5.09	0.20	2.12	0.28	0.01	49.70	0.05	3.38	0.78	99.29
2017Lynx10	11.91	0.05	8.75	0.01	15.70	1.12	5.19	0.19	2.15	0.27	0.01	49.98	0.05	3.26	0.91	99.48
2017Lynx11	11.76	0.05	8.04	0.01	15.96	1.15	4.96	0.21	2.70	0.28	0.01	49.67	0.05	3.38	1.23	99.39
2017Lynx12	11.66	0.05	6.98	0.01	14.82	1.02	6.05	0.18	2.63	0.26	0.18	49.57	0.03	2.98	3.37	99.73
2017Lynx13	11.86	0.05	8.90	0.01	16.03	1.05	5.05	0.19	2.08	0.26	0.01	50.28	0.05	3.35	0.48	99.58
2017Lynx14	11.33	0.05	8.12	0.01	15.52	1.12	5.00	0.22	4.76	0.28	0.01	48.57	0.05	3.30	1.18	99.44
2017Lynx15	11.82	0.05	8.71	0.01	15.98	1.09	4.97	0.19	2.19	0.27	0.11	49.99	0.06	3.40	0.55	99.34
2017Lynx16	11.74	0.05	9.03	0.01	16.09	0.98	5.24	0.20	2.07	0.26	0.09	50.19	0.05	3.31	0.84	100.11
2017Lynx17	11.78	0.05	8.20	0.01	15.87	1.23	4.93	0.21	2.26	0.28	0.07	50.05	0.05	3.39	1.17	99.49
2017Lynx18	11.83	0.05	8.21	0.01	15.67	1.15	5.05	0.19	2.34	0.24	0.09	49.78	0.05	3.25	1.15	99.02
2017Lynx19	11.69	0.05	7.43	0.01	15.16	1.13	5.50	0.20	2.55	0.25	0.10	50.38	0.04	3.12	1.97	99.54
2017Lynx20	11.61	0.05	8.47	0.01	15.52	1.25	5.17	0.22	2.75	0.25	0.14	49.51	0.05	3.29	1.12	99.36
2017Lynx21	12.71	0.05	7.05	0.01	12.80	1.71	4.18	0.18	2.77	0.21	0.04	54.35	0.05	2.64	1.02	99.7
2017Lynx22	11.92	0.05	7.27	0.01	14.54	1.26	5.09	0.20	2.78	0.26	0.05	51.14	0.04	3.15	1.72	99.42
2017Lynx23	15.47	0.05	2.27	0.01	3.57	4.17	1.37	0.03	3.70	0.14	0.01	67.48	0.05	0.60	0.71	99.56

Appendix E: Sable WRSA Design Report Version 2

TETRA TECH

Sable Project Waste Rock Storage Area Design Version 2



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Appendix B Slope Stability Analysis Results
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LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Dominion Diamond Ekati ULC and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Dominion Diamond Ekati ULC, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech's Services Agreement. Tetra Tech's Limitations on Use of this Document are provided in Appendix C of this report.

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by Dominion Diamond Ekati ULC (DD Ekati) to revise the Sable Pit Waste Rock Storage Areas (WRSAs) design at Ekati Diamond Mine (Ekati), NT. Tetra Tech submitted the thermal evaluation report for the area in 2016. The design updates the previously submitted Version 1 WRSA design (Tetra Tech 2017b) to increase setbacks from Two Rock Sedimentation Pond. It includes the pile geometries and stability analyses.

This document details the design for the WRSAs and the resulting pile configurations. Analysis results are compared to the appropriate design criteria.

2.0 PROJECT DETAILS

The Sable area is located approximately 20 km north of the Ekati main camp and is accessed by an all-season road. The Sable Pit will be developed using surface mining methods and recovered ore will be hauled to the Ekati main camp area for processing. Waste rock will be stored locally in three WRSAs adjacent to the pit. The general site plan is shown in Figure 1.

The WRSAs are planned for construction with one pile to the north and one south of Two Rock Lake, and one pile northeast of Sable Pit. The development of Sable Pit will include the footprint of Sable Lake, and as such, Sable Lake will be dewatered into Two Rock Lake prior to mining activities.

2.1 Sable Waste Rock Storage Areas

Mining commenced in Sable Pit in August 2017 and it is expected to continue through 2025. Approximately 103 million tonnes (Mt) of waste rock will be produced during the 8 year mine life. The waste rock produced during pit development will be placed in three designated storage areas: South WRSA, East WRSA, and West WRSA.

The proposed WRSAs have a capacity of 53 Mt, 58 Mt, and 8 Mt in West, South, and East WRSAs, respectively. This provides an aggregate 119 Mt of storage capacity, allowing for some contingency in the storage volumes.

3.0 EXISTING CONDITIONS

The footprints of the proposed waste rock piles are on native tundra. No geotechnical site investigation was conducted in the footprints of the proposed WRSAs. The soil profiles of the foundation were assumed based on soil conditions in nearby historical boreholes, surficial geology, permafrost feature mapping, and site experience.

3.1 Historical Borehole Information

Historical borehole information was adopted from the July 2002 report titled “Two Rock Sedimentation Pond, 2002 Geotechnical Investigation” that was prepared by Tetra Tech (known as EBA Engineering Consultants Ltd. at the time of issue). A geotechnical site investigation was conducted in April 2002 along the proposed alignments of the Two Rock Dam and Two Rock Filter Dike.

The investigation consisted of drilling, logging, and sampling of 13 boreholes in the general vicinity and 5 boreholes along the proposed alignment of Two Rock Dam. The borehole information from this report was used to conceptualize and support assumptions made on the stratigraphy and ground conditions.

3.2 Surficial Geology

Surficial geology mapping was carried out via stereoscopic interpretation (Sokkia MS27 stereoscope) using 3X binoculars on coloured air photos that were acquired by DD Ekati in August of 1993. Surficial geology units were delineated according to extrapolated surface appearance from terrain units that have had ground conditions confirmed by field data from the 2002 geotechnical investigation. A surficial geology map was generated at a 1:15,000 scale with the extrapolated surficial units underlying the proposed mine facilities and the 2015 orthophotographs used as a base image.

The overall project site area consists primarily of glacial deposits that can be broken down into three subgroups: till veneer (**Tv**), till blanket (**Tb**), and rolling ground moraine (**Tm**). Till veneer is up to 1 m thick with the surface mimicking the form of underlying bedrock. Till blanket is 1 m to 5 m thick with the surface also reflecting bedrock topography, but may also be fluted of drumlinized. Rolling ground moraine is 5 m to 15 m thick and generally consists of a mix of unsorted compacted lodgment till and loose ablation till. Its surface forms hills with gentle to moderate slopes and is generally well drained, though it includes a few small patches of imperfectly drained areas underlain by organic deposits. Areas that are underlain predominantly by ablation till tend to contain significant accumulations of massive ground ice. The surficial geology map of the WRSA can be referenced in Figure 2.

The South WRSA footprint overlays primarily a rolling ground moraine deposit with the northwest corner overlaying till veneer and the southeast corner overlaying a combination of till veneer and organic material. The West WRSA overlays a combination of till veneer, till blanket, rolling ground moraine, and organic material. The organic material is evident in areas near the centre of the waste rock pile and in a small section that extends near the northern boundary of the Sable Pit. The East WRSA footprint overlays a rolling ground moraine deposit with two localized areas of organics. The north end of the East WRSA overlays a combination of rolling ground moraine, till veneer, and bedrock.

3.3 Ground Temperature and Permafrost Conditions

In situ ground temperatures have been measured at Ekati since 1994. Generally, ground temperatures at depths greater than 15 m (beyond the depth influenced by seasonal variations in ambient air temperatures) are between -4°C and -6°C (Tetra Tech 2016). The permafrost thickness in the area is approximately 300 m to 400 m.

In 2002, two ground temperature cables (GTCs) were installed in the Two Rock Dam area. GTC SBT extends from 2 m below the original ground surface into 1 m of bedrock. The measured ground temperatures recorded beyond the depth influenced by seasonal temperature fluctuation ranges from -2°C to -3°C. GTC 1605 extends from the original ground surface into approximately 7 m of bedrock. The measured ground temperatures recorded beyond the depth influenced by seasonal temperature fluctuation range from 0°C to -1.5°C. Since both GTCs SBT and 1605 are positioned near lake margins and active stream valleys, the ground temperatures are expected to be somewhat warmer than typical permafrost temperatures. The GTC locations are shown on a site layout plan Figure B1 in Appendix B.

GTC 1471 was installed south of Sable Pit in 2001 and extends deep into the bedrock. The measured ground temperature recorded beyond the depth influenced by seasonal temperature fluctuation is approximately -6.5°C.

The ground temperatures recorded at GTCs SBT and 1605 are too warm to accurately represent the WRSA areas due to their proximity to waterbodies. The ground temperatures recorded at GTC 1471 best represent ground conditions under the WRSA areas and were used as a basis in the thermal analysis.

3.4 Deposition Status

Placement of waste rock material in the South WRSA began in August 2017. The till and overburden materials were stripped from the pit area and stockpiled next to the pit and allowed to freeze. In December 2017, the frozen till and overburden materials were placed in the South WRSA and covered with waste rock to maintain the material in a frozen condition.

4.0 WASTE ROCK STORAGE AREA DESIGN

The WRSA designs were completed using Dessault Geovia Gems 6.8 software. Pit slopes were generated by creating toe and crest lines for every 5 m in elevation, which resulted in a minimum of three design lines per bench slope. Triangulation surfaces were subsequently generated from the design lines to form the WRSA shapes. These shapes were used to prepare 1 m contour elevations such that sections could be prepared to confirm that geotechnical criteria have been met.

4.1 Design Criteria

The following criteria have been applied to the WRSA designs:

- The WRSAs have an offset of a minimum of 50 m from the crest of the Sable Pit.
- The WRSAs have been designed to have an offset of 100 m from high water marks of surrounding lakes and an offset of 30 m from the high water elevation of Two Rock Sedimentation Pond.
- The WRSAs are located within watershed catchments such that the flow from the WRSAs is predominantly directed to Ulu Lake, Horseshoe Lake, or Two Rock Sedimentation Pond.

4.2 Waste Rock Characteristics

Waste rock characteristics used in the design are shown in Table 4-1.

Table 4-1: Waste Rock Characteristics

Attribute	Value
Angle of repose	35°
Bank density[1]	2.73 t/m^3
Placed density	2.28 t/m^3

[1] For granitic waste rock

The WRSAs are required for granitic waste rock and sediment waste from the Sable Pit. The waste rock will be mined and placed using CAT 793 sized trucks with bulldozers for levelling, pushing, and spreading loads. No compaction machinery will be used during WRSA construction.

The WRSAs will be constructed by end dumping, by pushing tipped loads over the lift crest using a bulldozer, and through tipping of individual loads on the footprint of each bench or lift up to the design elevation.

4.3 Haul Roads

The haul roads are designed with a maximum slope of 10% and a minimum width of 34 m to allow for two-way traffic.

4.4 Pile Geometry

The WRSA configurations and layouts are shown in Figure 3. The pile layouts generally conform to the design criteria outlined in Section 4.1; however the design was adapted such that a small portion of the southern toe of the South WRSA drains to unnamed lakes south of the area.

Slope formation geometry is based on geotechnical stability criteria as listed in the slope stability analysis (Section 6.0). A minimum operating bench width of 25 m was included as part of the final design for all piles.

4.5 Design Volumes

The WRSAs have been designed in three locations as identified in Table 4-2.

Table 4-2: WRSA Design Volumes

WRSA	Volume (Mm^3)
South	25.38
West	23.19
East	3.37
Total for all WRSAs	**51.94**

4.6 Ramps

A ramp has been designed for the East, West, and South WRSAs. Table 4-3 provides the length and grade of the ramps as designed.

Table 4-3: Ramps as Designed

WRSA	Ramp Length	Average Ramp Grade
West	634 m	9.3%
South	848 m	7.7%
South (Extension)	192 m	7.3%
East	363 m	9.4%

5.0 THERMAL EVALUATION

A thermal evaluation was completed to evaluate WRSA foundation conditions and the thermal performance of the WRSA. The thermal evaluation was completed to support the Version 1 WRSA design (Tetra Tech 2017a) and submitted to DD Ekati in a 2016 memorandum (2016b).

The 2016 thermal analysis was reviewed in preparation of the Version 2 design. Analysis was completed for the South and West WRSAs but is considered applicate to all pile configurations in the Version 2 design. Tetra Tech assumes that the East WRSA and the extension on the South WRSA will have thermal characteristics similar to the piles modelled in the evaluation.

Thermal analysis results are summarized in the following sections.

5.1 Thermal Analysis Model

5.1.1 GEOTHERM Software

Geothermal analyses were carried out using Tetra Tech's proprietary two-dimensional finite element computer model, GEOTHERM. The model simulates transient, one-dimensional, and two-dimensional (or three dimensional axisymmetric) heat conduction with phase change for a variety of boundary conditions. Boundary conditions include conductive or convective heat flux, ground to air heat exchange, and temperature boundaries. As opposed to other commercial FEA software packages, GEOTHERM also models heat exchange at the ground-air interface, which considers the effects induced by climate conditions including air temperature, wind speed, snow density and thickness, solar radiation, evaporation, and even the long-term influence of global warming. GEOTHERM also accounts for progressive latent heat release during freezing and thawing in both fine-grained and saline soils.

GEOTHERM results are checked with closed form solutions and field observations. The software has been used successfully for thermal design and evaluations in a large number of projects in the arctic and subarctic, including tailings, dykes, dams, foundations, pipelines, utilidor systems, landfills, and ground freezing systems, as well as the design of several structures at Ekati including: Panda Diversion Dam, Long Lake Outlet Dam, the Misery Site Dams, Bearclaw Diversion Dam, and Panda/Koala and Misery WRSAs (EBA 1997a; 1997b; 2000; 2002; 2006).

5.1.2 Modelling Approach and Assumptions

5.1.2.1 One-dimensional Thermal Analysis

Thermal analyses for the WRSAs were first carried out using a series of one-dimensional thermal models. Growing mesh technology was employed to simulate the waste rock placement history. The waste rock construction history is based on a conceptual model and may change during operations.

The following assumptions were adopted for the thermal analyses:

- The South WRSA will start receiving waste rock in January 2018, and will reach a design crest elevation of 555.0 m by March 2020;
- The West WRSA will start receiving waste rock in March 2020, and will reach a crest elevation of 550.0 m by December 2025 (end of mine life);
- Waste rock material will be placed at the WRSAs in uniform lifts; and
- The initial waste rock temperatures, as listed in Table 5-1, were adopted for the thermal analyses.

Table 5-1: Initial Waste Rock Temperatures Assumed for One-dimensional Thermal Analysis

Season	Months	Initial Temperature (°C)
Winter	December, January, February	-10
Spring	March, April, May	-7
Summer	June, July, August	7
Fall	September, October, November	-1

5.1.2.2 Two-dimensional Thermal Analysis

The South WRSA will be constructed adjacent to the Two Rock Lake. In order to evaluate the lake effect on the long-term ground temperatures beneath the waste rock pile, a two-dimensional thermal analysis was carried out along Section A-A of the South WRSA (Appendix A, Figure A1). A separate two-dimensional analysis was not conducted for the West WRSA as it would have been considerably similar. The waste rock construction history is based on a conceptual model and may change during operations.

The following assumptions were adopted for the two-dimensional thermal analyses:

- The South WRSA will start receiving waste rock in January 2018, and will reach a design crest elevation of 555.0 m by March 2020;
- Waste rock material will be placed at the South WRSA in one lump sum;
- A uniform temperature of -4°C was adopted as the initial waste rock temperature for the two-dimensional thermal analyses. This temperature was based on the one-dimensional model results;
- Approximately 80 m of the lake was incorporated into the two-dimensional thermal model to simulate external effects on the pile; and
- Monthly lakebed temperatures, as listed in Table 5-2, were adopted for the thermal analyses.

Table 5-2: Monthly Lakebed Temperatures Assumed for Two-dimensional Thermal Analysis

Months	Lakebed Temperature (°C)
January - April	1
May	6
June - August	13
September	5
October - December	2

5.1.3 Soil Profile and Material Properties

The soil profile below the original ground was assumed to be 2.0 m of glacial till overlying bedrock. The thermal properties of the materials were determined indirectly from well-established correlations with soil index properties (Johansen1975; Farouki 1986) or past experience. Physical properties of overburden material and bedrock were determined based on the past experience with similar material for other thermal work at Ekati and available geotechnical information. Table 5-3 summarizes the material properties used in the thermal analyses.

Table 5-3: Material Properties Used in Thermal Analyses of the Sable WRSAs

Material	Moisture Content (%)	Bulk Density (Mg/m³)	Thermal Conductivity (W/m-K)		Specific Heat (kJ/kg-K)		Latent Heat (MJ/m³)
			Frozen	Unfrozen	Frozen	Unfrozen	
Granite Waste Rock	2	2.04	1.07	1.27	0.76	0.80	13
Glacial Till	10	2.14	2.18	1.84	0.86	1.05	65
Bedrock	1	2.58	3.00	3.00	0.75	0.77	9

5.1.4 Climatic Data Input

Climatic data has been collected at Ekati since 1993; however, this data set is considered to be of too short of a duration for evaluating long-term climatic trends at this site. The nearest station with long-term data is Lupin, located approximately 100 km north of Ekati. The Lupin station was originally referred to as Contwoyto Lake and was located on the west shore of an island in Contwoyto Lake. The Contwoyto Lake Station was in operation from 1956 to 1981. In 1982 the Lupin Station was constructed to the north on the west side of Contwoyto Lake. Lupin replaced the Contwoyto Lake Station as the monitoring site for that area. Data collected from this area is a composite of the Contwoyto Lake and Lupin Station data. Other nearby stations with long-term data are Yellowknife, located approximately 300 km southwest of Ekati and Fort Reliance, located approximately 220 km south of Ekati. Climatic data has been collected from the Yellowknife and Fort Reliance stations since 1942 and 1948, respectively.

The monthly air temperature record from Lupin was compared with the corresponding monthly record from Ekati for the period of 1993 to 2005 (EBA 2006). The results show that monthly air temperatures are typically warmer (by between 0.3°C and 1.5°C) at Ekati. On average, annual air temperatures at Ekati have been 1.0°C warmer than at Lupin. Long-term temperatures at Ekati were estimated by adding the mean monthly difference in air temperatures between Ekati and Lupin to the mean monthly air temperatures at Lupin for the period of 1971 to 2005. The mean annual air temperature at Ekati was estimated to be -10.2°C for the period of 1971 to 2005; the average mean annual air temperature at Ekati was measured to be -9.1°C for the period of 1993 to 2014. The monthly air temperature data estimated from 1971 to 2005 was used to calibrate the thermal models, and the monthly air temperature data measured from 1993 to 2014 was used for the thermal analyses.

Long-term monthly wind speeds at Ekati have been estimated by interpolating the monthly data, proportional with latitude, from Contwoyto Lake/Lupin and Fort Reliance for the climate normal period of 1961 to 1990 (EBA 1995). Monthly snow depths at Ekati have also been estimated using the same method, but multiplied by a fixed factor based on calibration of the geothermal model against measured ground temperature data and on anecdotal observations of snow cover on top of the waste rock pile surface as reported by EBA (2006). Daily solar radiation is available for only a limited number of sites in the Arctic. Based on their similar latitudes, the mean daily solar radiation from Baker Lake, located approximately 700 km east of Ekati, for the climate normal period of 1951 to 1980 (Environment Canada 1982) was used for Ekati. Table 5-4 summarises the mean climatic data used for the thermal analyses.

Table 5-4: Mean Climatic Data Used for Thermal Analyses

Month	Estimated Monthly Air Temperature (°C) (1971-2005)	Measured Monthly Air Temperature (°C) (1993-2014)	Monthly Wind Speed (km/h)	Monthly Snow Cover (cm)	Daily Solar Radiation (W/m^2)
January	-29.9	-28.3	18	39	9.1
February	-28.1	-26.5	12	47	38.7
March	-24.6	-23.5	13	54	119.5
April	-14.8	-13.4	14	56	206.4
May	-3.8	-3.8	15	38	259.7
June	7.2	8.3	14	0	252.0
July	12.2	13.5	15	0	226.4
August	9.9	10.4	17	0	160.8
September	2.7	3.8	21	0	124.9
October	-7.3	-6.3	19	7	41.3
November	-19.8	-18.4	16	19	14.4
December	-26.1	-24.6	15	31	3.7
Mean	**-10.2**	**-9.1**	**-**	**-**	**-**

5.1.5 Climate Change Scenarios

A historical annual air temperature warming trend of approximately 0.5°C per decade has been observed at the Yellowknife and Lupin stations since 1959 (EBA 2006). It is expected that a similar warming trend may have existed in the past at the Ekati site. Based on the observed warming trend in the historical air temperatures and current state-of-practice, the thermal prediction for the Sable WRSAs should consider the long-term effects of climate change (or global warming).

The Adaptation and Impacts Research Section (AIRS) of Environment Canada recently produced a report (Environment Canada 2009) summarizing findings from the most recent modelling assessment for the Arctic. AIRS adopted an ensemble approach (multi-model means/medians) to reduce the uncertainty associated with any individual model. Model validation over the historical period from 1971 to 2000 was first used to identify those models which best reproduced the mean annual temperature of this period against the National Centre for Environmental Prediction global gridded dataset. Subsequently, only the four best-agreement models were used to produce the final ensemble projections. The four best ranking models within each sector were then used as an ensemble to produce projections of temperature change in the 2020s, 2050s, and 2080s for both the 'A1B' (moderate emission) and 'A2' (high emission) scenarios. CSA (2010) adopted the climate change projections in Environment Canada (2009).

Both high (A2) and moderate (A1B) green-house gas emission scenarios were considered in the thermal analyses to evaluate the sensitivity of the thermal analysis results to the assumed climate change scenarios. The Ekati site (64° N, 110° W) is located at the Arctic Zone C1 in Environment Canada (2009) and CSA (2010). The projected mean temperature changes from the 1971 to 2000 baseline data in Zone C1 are presented in Tables 5-5 and 5-6 for the A1B and A2 scenarios, respectively.

Table 5-5: Projected Seasonal Air Temperature Changes under A1B Scenario in Zone C1 (CSA 2010)

Period	Projected Seasonal Air Temperature Changes from 1971-2000 Baseline under Moderate (A1B) Green-house Gas Emission Scenario (°C)			
	Winter	Spring	Summer	Fall
2011–2040	1.9	1.0	0.8	1.3
2041–2070	4.2	2.1	1.8	2.7
2071-2100	6.2	2.8	2.4	3.4

Table 5-6: Projected Seasonal Air Temperature Changes under A2 Scenario in Zone C1 (CSA 2010)

Period	Projected Seasonal Air Temperature Changes from 1971-2000 Baseline under Moderate (A2) Green-house Gas Emission Scenario (°C)			
	Winter	Spring	Summer	Fall
2011–2040	2.2	1.0	0.9	1.4
2041–2070	4.9	2.0	1.8	2.8
2071-2100	8.9	3.5	3.0	4.7

5.1.6 Ground Temperature Initialization and Boundary Conditions

Initial ground temperatures prior to construction of the Sable WRSAs were estimated by applying the mean climatic conditions described in Section 5.1.4 over a 35 year period, by which time ground temperatures had stabilized and varied very little from year to year. The predicted permafrost temperature at a depth of 20 m is approximately -4.9°C, which is found within the range of typical permafrost temperatures (-4.0°C to -6.0°C) at Ekati.

A reduced snow cover at the crest of the waste rock pile was assumed in the analyses to account for wind-blown effects. Snow drifting on pile benches was also considered during the construction of the WRSAs due to slopes and changes in topography.

A heat flux boundary was assigned at the model base in the thermal analyses to simulate the natural geothermal gradient at depths in the region. The heat flux value was calculated based on the typical thermal gradient at Ekati (1.7°C/100 m) and the thermal conductivity of the bedrock.

5.1.7 Considered Cases

Three cases were used to evaluate the future thermal performance of the WRSAs:

- Case 1: thermal performance under long-term mean air temperature conditions;
- Case 2: thermal performance under the A1B climate change scenario; and
- Case 3: thermal performance under the A2 climate change scenario.

5.2 Thermal Analyses Results and Discussion

A series of one-dimensional and two-dimensional thermal analyses were carried out to evaluate the thermal performance of the West and South WRSAs for the Sable Project. The results are presented in Figures A2 through A14 in Appendix A. The summary of the figures is provided in Table 5-7.

Table 5-7: Thermal Analysis Summary

Thermal Evaluation Figure Description	South WRSA	West WRSA
Initial ground temperatures of the original ground	Figure A2	-
Temperature profiles during construction periods of the WRSAs	Figure A3	Figure A10
Temperature profiles of the WRSAs once they have reached a frozen condition	Figure A4	Figure A11
Typical thaw depth under mean climate condition after 100 years	Figure A5	Figure A12
Typical thaw depth under A2 climate condition after 100 years	Figure A6	Figure A13
Predicted ground temperatures after 100 years under mean climate conditions	Figure A7	-
Predicted ground temperatures after 100 years under A2 climate conditions	Figure A8	-
Predicted temperature profiles after 10 years, 50 years, and 100 years under mean, A1B, and A2 climate conditions	Figure A9	Figure A14

Based on the thermal analysis results, the following conclusions can be made:

- Typical permafrost ground temperatures within the South WRSA footprint vary from -4°C to -5°C.
- The South WRSA will be in a frozen condition after 5 years from initial placement, except for the seasonal freezing/thaw layer.
- The West WRSA will be in a frozen condition after 3 years from initial placement, except for the seasonal freezing/thaw layer.
- The maximum seasonal thaw depths at the South and West WRSAs were estimated to be approximately 4.8 m and 5.6 m 100 years after construction under mean climate condition and A2 climate change scenario, respectively.
- Typical permafrost ground temperatures at the South WRSA vary from -1°C to -4°C under A2 conditions after 100 years.
- Both the South and West WRSAs will stay in a frozen condition 100 years after construction under the worst case climate scenario (A2 climate change scenario).

6.0 GEOTECHNICAL SLOPE STABILITY ANALYSIS

Limit equilibrium slope stability analyses were carried out using Slope/W, GeoStudio 2016, Version 8.16.1.13452 to confirm the stability of the WRSAs.

No geotechnical site investigation was conducted in the footprints of the East, West and South WRSAs. The soil profiles of the foundation were assumed based on soil conditions in nearby historical boreholes, surficial geology, permafrost feature mapping, and site experience.

A series of slope stability analyses were carried out to evaluate the stability of several design sections of the South, East, and West WRSAs near the Sable Pit. The analyses involved several design scenarios including short-term construction stage, long-term conditions with frozen ground, long-term conditions with thawing active layer, and other sensitivity cases. Both static and seismic loading conditions were evaluated during the long-term with frozen ground design scenarios. The analysis results indicate that all the calculated minimum factors of safety for the South, East, and West WRSAs meet or exceed the adopted minimum factors of safety.

The current construction loading condition assumes the ground condition to bear the entire load of the waste rock pile at an instantaneous point in time, rather than over the life of the construction sequence. This assumption means the excess porewater pressure generated from the $\overline{B}$ parameter in our current model is considering the entire load of the waste rock piles, rather than the change in overburden pressure from each constructed lift. This assumption generally provides a conservative factor of safety since the porewater pressure generated from a single lift is less than the porewater pressure generated from the entire weight of the pile.

This assumption should be revisited if the geometry of the waste rock piles need to be redesigned. Tetra Tech recommends revisiting the stability analysis with provided construction sequence and the information obtained from the geotechnical investigation to better approximate the effects of excess porewater pressures generated from staged construction.

6.1 General Waste Rock Pile Design

The waste rock pile's configuration and site infrastructure are shown in Figure 1. The existing ground elevations and WRSA design elevations were modelled using AutoCAD Civil 3D 2017 and the existing ground surface was obtained from 2013 LiDAR data. The South WRSA is a roughly rectangular shaped pile approximately 1,400 m long and 600 m wide. The West WRSA is an irregularly shaped pile that is approximately 1,200 m at the greatest length and 1,100 m at the greatest width. The East WRSA is a roughly rectangular shaped pile approximately 650 m in length and 500 m in width. The design limits and elevation contours are shown in Figure 1.

All three WRSAs are benched pile designs. The South WRSA has a final design elevation of 563 m with intermediate crest elevations at 555 m, 540 m, 525 m, and 510 m. The final design elevation of the West WRSA is 550 m with intermediate crest elevations at 535 m, 520 m, and 505 m. The East WRSA has a final design elevation of 535 m, with intermediate crest elevations at 505 m and 520 m. The bench widths are approximately 25 m wide and the typical intermediate bench slopes are approximately 1.4H:1V.

The overall pile slope for the West, South, and East WRSAs range from approximately 2.5H:1V to 8.25H:1V, 2.5H:1V to 6.5H:1V, and 2.5H:1V to 6.7H:1V from the steepest to the shallowest for the respective waste rock piles. The base of the waste rock piles will overlay natural tundra where the edge of the footprint meets the original ground at geodetic elevations of 480 m to 499 m for the West WRSA, 486 m to 511 m for the South WRSA, and 486 m to 504 m for the East WRSA.

Table 6-1 provides preliminary design geometry of the waste rock piles containing the following design features:

Table 6-1: General Design Geometry of the West and South WRSAs

Feature	West Waste Rock Storage Area	South Waste Rock Storage Area	East Waste Rock Storage Area
Bench Widths (m)	25	25	25
Bench Heights (m)	15	15	15
Intermediate Crest Elevations (m)	535, 520, 505	555, 540, 525, 510	520, 505
Elevation of the Top of Pile (m)	550	563	535
Height of Pile (m) (1)	65	60	42
Intermediate Bench Slopes	1.4H:1V	1.4H:1V	1.4H:1V
Overall Pile Slope	2.5H:1V to 8.25H:1V	2.5H:1V to 6.5H:1V	2.5H:1V to 6.7H:1V

(1) The height of the pile is approximated from the average ground elevation beneath the pile. The original ground topography varies greatly under the piles.

6.2 Starter Bench Design

A starter bench, with a different height and width, in some cases, is designated in areas of the South, East, and West WRSAs where the natural topography is sloping down and away from the toe of the WRSAs. This generally occurs in areas directly adjacent to Two Rock Pond and Ulu Lake. The starter benches are required in these areas to provide sufficient stability of the WRSAs. Starter benches for the South, West, and East WRSAs are detailed as Type 1, Type 2, and Type 3, respectively. The sections with Type 1, 2, and 3 starter benches is detailed on Figures 4 and 5.

Table 6-2 lists the locations of the starter bench types with the corresponding bench widths and crest elevations.

Table 6-2: Starter Bench General Design Features

Starter Bench Type	Location	Starter Bench Width (m)	Starter Bench Height (m)	Crest Elevation of Starter Bench (m)
Type 1	South WRSA	40.0	10.0	500
Type 2	West WRSA	20.0	10.0	495
Type 3	East WRSA	25.0	16.8	505

6.3 Thermal Analysis

For the slope stability analysis, the temperature profile from the projected 100 year global warming condition was used as it is the worst-case scenario of the two ground profiles. The active layer is divided into zones and assigned a temperature that correlates to the results of the thermal analysis.

The temperatures assigned to each zone of active layer underneath the WRSAs are summarized in Table 6-3.

Table 6-3: Design Features of the West and South WRSAs

Zone Number	Zone Extents (distance from the toe to the centre of the WRSA)	Temperature (°C)
1	0 m to 36 m	0
2	36 m to 80 m	-1
3	80 m to 124 m	-2
4	124 m to 191 m	-3
5	191 m to 280 m	-4

6.4 Selection of Governing Stability Sections

Eight governing design sections were chosen for each of the WRSAs to determine the overall stability of the waste rock pile as shown in Figure 3 and summarized in Table 6-4. Section names were started at Section K to differentiate from the previous report. Several factors were considered in selecting the governing cross-sections such as pile geometry, topography of the existing ground, proximity to Two Rock Lake and Ulu Lake, and the surficial geological units of the underlain material. Refer to Figures 4 and 5 for the profiles of the selected governing design sections.

Table 6-4: Governing Sections with Justification on their Selection

Section Name	Location	Justification
Section K-K’	South WRSA	Tallest section of the pile on original ground sloping toward Two Rock Pond
Section L-L’	South WRSA	Section of the pile where the underlying warm permafrost remains warmer due to pile geometry and underlying organic layer
Section M-M’	South WRSA	Section influenced by frozen till incorporated into the pile
Section N-N’	South WRSA	The spur of the south pile
Section O-O’	West WRSA	Tallest part of the pile
Section P-P’	West WRSA	Closest to Ulu Lake
Section Q-Q’	West WRSA	Largest slope of the original ground underneath the pile
Section R-R’	East WRSA	Tallest section of the pile sloping toward Ulu Lake

6.5 Analysis Methodology

Limit equilibrium stability analyses was carried out using the Morgenstern-Price method with a half-sine interslice force assumption was adopted in the analyses.

The principles underlying the method of limit equilibrium analyses of the slope stability area are as follows:

- A slip mechanism is postulated;
- The shear resistance required to equilibrate the assumed slip mechanism is calculated by means of statics;
- The calculated shear resistance required for equilibrium is compared with the available shear strength in terms of factor of safety; and
- The slip mechanism with the lowest factor is determined through iteration.

A factor of safety is used to account for the uncertainty and variability in the strength and porewater pressure parameters and to limit deformation.

6.6 Cases Evaluated

The analyses were conducted under the following loading conditions:

- Construction stage with the generation of excess porewater pressure in the fine-grained soils of the active layer;
- Long-term conditions with frozen original ground. No generation of excess porewater;
- Long-term conditions with a generation of excess porewater pressure in the thawing active layer; and
- Long-term frozen ground conditions under seismic loading.

The construction stage loading condition assumed the excess porewater pressure to be generated from the entire load of the waste rock pile at an instantaneous point in time, rather than over the life of the construction sequence as described in Section 6.0.

6.7 Soil Profile

The till veneer deposit is modelled to have a 1 m thick unit of silt with peat overlaying bedrock. The rolling ground moraine deposit is modelled to have 2 m of silt with peat, 1 m of ice-rich silt (frozen or thawed depending on the case), and approximately 7 m of ice-poor sand and gravel till overlaying bedrock. The organics deposit was modelled to have 2 m of unfrozen organic material overlaying 1 m of either frozen or thawed organics and bedrock.

The overburden and lakebed sediments that were stripped from the Sable Pit in August 2017 area were stockpiled and allowed to freeze. They are being added to the South WRSA in approximately 2 to 4 m lifts in the centre of the pile. Placement of the till commenced in December 2017 covered with more than 2 m of rock to keep the lakebed sediments frozen within the pile. As the remainder of the till is placed in the South WRSA, it will be in an unfrozen condition.

6.8 Material Input Parameters

No shear strength tests were conducted for any of the soils in this study; therefore, most of the soil input parameters for the analyses were estimated or assumed based on experience and published data in literature for similar soils.

The shear strength of the frozen ice-rich silt and frozen organics have been estimated using the empirical relationship as follows:

$$\mathrm{C} = 35 + 28\mathrm{T}$$

Where,

C = Cohesion (kPa)

T = Temperature below freezing point (°C)

The strength properties of the waste rock vary with the overburden stress in the pile. It has been assumed that the angle of internal friction varies from 37° to 42° from the bottom to the top of the pile.

Table 6-5 presents the key soil parameters used in the stability analyses.

Table 6-5: Key Soil Parameters

Soil Type	Cohesion (kPa)	Internal Angle of Friction (°)	Bulk Unit Weight (kN/m³)
Clean Rock and Waste Rock			
Zone 1 (0 m to 15 m from top)	0	42°	20
Zone 2 (15 m to 30 m from top)		40°	
Zone 3 (>30 m from top)		37°	
Lakebed Sediment	19	28°	18
Ice-Poor Sand and Gravel Till	0	35°	20
Silt with Peat	0	28°	18
Ice-Rich Silt (1)			
Zone 1 (0 m to 36 m), thawed	0	28°	16
Zone 2 (36 m to 80 m), frozen	63	0°	
Zone 3 (80 m to 124 m), frozen	91	0°	
Zone 4 (124 m to 191 m), frozen	119	0°	
Zone 5 (191 m to 280 m), frozen	147	0°	
Organics (1)			
Zone 1 (0 m to 36 m), thawed	0	28°	11
Zone 2 (36 m to 80 m), frozen	63	0°	
Zone 3 (80 m to 124 m), frozen	91	0°	
Zone 4 (124 m to 191 m), frozen	119	0°	
Zone 5 (191 m to 280 m), frozen	147	0°	

(1) The zones are used to approximate the change in thermal condition beneath the pile as described in Section 3.3.

Potential post-construction seismic loading was modelled as pseudo-static with a design horizontal peak ground acceleration (PGA) of 0.036 g. This is the value estimated from the 2010 National Building Code of Canada seismic hazard website (http://earthquakescanada.nrcan.gc.ca) for a 2% in 50 years probability of exceedance (0.000404 per annum or 1 in 2,475-year return) for the Ekati area.

Table 6-6 presents the excess porewater pressure parameters assigned during the construction stage and thawing of the active layer.

Table 6-6: Excess Porewater Pressure Parameters

Soil Type	Excess Porewater Pressure During Construction Stage ($\bar{B}$)	Excess Porewater Pressure During Thawing of Active Layer ($\bar{B}$)
Clean Rock and Waste Rock	0	0
Lakebed Sediment	0	0
Silt with Peat	0.2	0
Frozen Ice-Rich Silt	0	-
Thawed Ice-Rich Silt	0.2	0.2
Organics	0.2	0
Frozen Organics	0	-
Thawed Organics	-	0.2
Ice-Poor Sand and Gravel Till	0	0

1. $\bar{B}$=0.2 for porewater pressure analysis.

6.9 Design Criteria

The British Columbia Mine Waste Rock Pile Research Committee publication “Mined Rock and Overburden Piles, Investigation and Design Manual, Interim Guidelines, May 1991” provides accepted minimum stability factors of safety for various conditions. The selection of a design factor of safety is based on the importance of the structure, potential failure consequences, uncertainties involved in design loads and soil parameters (especially shear strength parameters), the additional cost associated with a higher factor of safety, and the risk that the owner of the structure is willing to take as reproduced in Table 6-7.

Table 6-7: Suggested Minimum Design Values for Factor of Safety

Stability Condition	Suggested Minimum Design Values for Factor of Safety	
	Case A	Case B
Stability of Dump Surface		
▪ Short Term (During Construction)	1.0	1.0
▪ Long Term (Reclamation – Abandonment)	1.2	1.1
Overall Stability (Deep Seated Stability)		
▪ Short Term (Static)	1.3 - 1.5	1.1 - 1.3
▪ Long Term (Static)	1.5	1.3
▪ Pseudo-Static (Earthquake)[2]	1.1 - 1.3	1.0
Case A: ▪ Low level of confidence in critical analysis parameters ▪ Possibly unconservative interpretation of conditions and assumptions ▪ Severe consequences of failure ▪ Simplified stability analysis method (charts, simplified method of slices) ▪ Stability analysis method poorly simulates physical conditions ▪ Poor understanding of potential failure mechanism(s)		
Case B: ▪ High level of confidence in critical analysis parameters ▪ Conservative interpretation of conditions, assumptions ▪ Minimal consequences of failure ▪ Rigorous stability analysis method ▪ Stability analysis method simulates physical conditions well ▪ High level of confidence in critical failure mechanism(s)		

1. A range of suggested minimum design values are given to reflect different levels of confidence in understanding site conditions, material properties, consequences of instability, and other factors.
2. Where pseudo-static analyses, based on PGAs, which have a 10% probability of exceedance in 50 years, yield a FOS < 1.0, dynamic analyses of stress-strain response, and comparison of results with stress-strain characteristics of dump material is recommended.

Based on the criteria provided in Table 6-7, the Case B scenario is considered appropriate on all sides of the West, East, and South WRSAs. This is justified due to the conservative interpretation of ground conditions in the rolling ground moraine deposit, minimal consequences of failure, a rigorous stability analysis method, the physical conditions being simulated well, and a high level of confidence in the failure mechanisms.

The rolling ground moraine deposit was modelled to contain a continuous layer of ice-rich silt material as stated in Section 6.7. The strength of the material was determined using an empirical formula in which the strength is a function of the temperature of the material (Section 6.8). A thermal analysis was conducted to determine the temperature zones within the ice-rich silt material for the worst-case scenario in which the waste rock pile is adjacent to the lake. Although the strength of the ice-rich material was not tested using in situ or laboratory methods, the general assumption that this material exists continuously in the rolling ground moraine is considered a conservative interpretation for this geological deposit.

The South, East, and West WRSAs are considered to have minimal consequences of failure due to the low risk to loss of life, environmental and cultural values, infrastructure, and economics in the situation of a failure. During the short term, the population at risk is considered only temporary, in which any loss of life would be to personnel working directly or within the proximity of the waste rock piles. After the closure of the mine, the population at risk is considered none and would have zero loss of life in the event of a failure.

The consequence to environmental and cultural values are considered minimal due to the scale of Two Rock Lake and no known culturally significant sites are located within the proximity of the South and West WRSAs. No significant loss of fish or wildlife habitat are predicted in the case of failure into Two Rock Lake.

Although surrounding the South and West WRSAs are the Sable Haul Road, West Access Road, Cap Mag Road, and Horseshoe Lake Access Road, the impact on infrastructure is considered minimal because most of the roads are located a considerable distance away from the footprint of the South and West WRSAs, except for the Sable Haul Road and West Access Road on the southern and eastern perimeters of the South WRSA. Furthermore, the life of the infrastructure is designed to operate only during the life of the mine and will have no significant impact after the closure of the mine.

As stated in the guidelines, the Morgenstern-Price method used in this analysis is considered a rigorous form of stability analysis. In addition, the physical ground conditions of the existing ground were not simplified and simulated using LiDAR data that was obtained in 2013.

6.10 Stability Analysis Results

The tables below summarize the results of the stability analyses. The graphical results of the analyses are shown in Appendix B.

Tables 6-8, 6-9, and 6-10 summarize the stability results for the South and West WRSAs, respectively.

Table 6-8: Stability Results for the South WRSA

Cross-Section	Loading Conditions	Minimum Required Factor of Safety	Minimum Calculated Factor of Safety	Comments
South WRSA K-K	Construction stage, $\bar{B}$=0.2 for unfrozen silt with peat and thawed frozen ice-rich silt, $\bar{B}$=0 for frozen ice-rich silt, static loading	1.1 - 1.3	1.3 (Figure B1)	Considering potential excess porewater pressures developing in the unfrozen silt with peat and thawed ice-rich silt (Zone 1) layers due to construction of the South WRSA.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, thawed ice-rich silt, and frozen ice-rich silt, static loading	1.3	1.3 (Figure B2)	No potential of excess porewater pressures developing in the unfrozen silt with peat and thawed ice-rich silt (Zone 1) layers during the long term.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, $\bar{B}$=0.2 for thawed ice-rich silt, static loading	1.3	1.4 (Figure B3)	Considering potential excess porewater pressures developing in the thawed ice-rich silt layers (Zone 2 to Zone 5) due to thawing in the long term.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, thawed ice-rich silt, and frozen ice-rich silt, **seismic** loading	1.0	1.1 (Figure B4)	No potential of excess porewater pressures developing during the long term. Horizontal PGA of 0.036 g was used for seismic loading.
South WRSA L-L	Construction stage, $\bar{B}$=0.2 for unfrozen and thawed organics, $\bar{B}$=0 for frozen organics, static loading	1.1 - 1.3	1.2 (Figure B5)	Considering potential excess porewater pressures developing in the organics layer due to construction of the South WRSA.
	Long term, $\bar{B}$=0 for unfrozen, thawed and frozen organics, static loading	1.3	1.3 (Figure B6)	No potential of excess porewater pressures developing in the organic layer during the long term.
	Long term, $\bar{B}$=0 for organics, $\bar{B}$=0.2 for thawed organics, static loading	1.3	1.6 (Figure B7)	Considering potential excess porewater pressures developing in the thawed organic layers (Zone 2 to Zone 4) due to thawing in the long term.
	Long term, $\bar{B}$=0 for unfrozen, thawed and frozen organics, **seismic** loading	1.0	1.1 (Figure B8)	No potential of excess porewater pressures developing during the long term. Horizontal PGA of 0.036 g was used for seismic loading.

Table 6-8: Stability Results for the South WRSA

Cross-Section	Loading Conditions	Minimum Required Factor of Safety	Minimum Calculated Factor of Safety	Comments
South WRSA M-M	Construction stage, $\bar{B}$=0.2 for unfrozen silt with peat and thawed frozen ice-rich silt, $\bar{B}$=0 for frozen ice-rich silt, static loading	1.1 - 1.3	1.2 (Figure B9)	Considering potential excess porewater pressures developing in the unfrozen silt with peat and thawed ice-rich silt (Zone 1) layers due to construction of the South WRSA.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, thawed ice-rich silt, and frozen ice-rich silt, static loading	1.3	1.4 (Figure B10)	No potential of excess porewater pressures developing in the unfrozen silt with peat and thawed ice-rich silt (Zone 1) layers during the long term.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, $\bar{B}$=0.2 for thawed ice-rich silt, static loading	1.3	1.3 (Figure B11)	Considering potential excess porewater pressures developing in the thawed ice-rich silt layers (Zone 2 to Zone 5) due to thawing in the long term.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, thawed ice-rich silt, and frozen ice-rich silt, **seismic** loading	1.0	1.2 (Figure B12)	No potential of excess porewater pressures developing during the long term. Horizontal PGA of 0.036 g was used for seismic loading.
South WRSA N-N	Construction stage, $\bar{B}$=0.2 for unfrozen silt with peat and thawed frozen ice-rich silt, $\bar{B}$=0 for frozen ice-rich silt, static loading	1.1 - 1.3	1.2 (Figure B13)	Considering potential excess porewater pressures developing in the unfrozen silt with peat and thawed ice-rich silt (Zone 1) layers due to construction of the South WRSA.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, thawed ice-rich silt, and frozen ice-rich silt, static loading	1.3	1.4 (Figure B14)	No potential of excess porewater pressures developing in the unfrozen silt with peat and thawed ice-rich silt (Zone 1) layers during the long term.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, $\bar{B}$=0.2 for thawed ice-rich silt, static loading	1.3	1.3 (Figure B15)	Considering potential excess porewater pressures developing in the thawed ice-rich silt layers (Zone 2 to Zone 5) due to thawing in the long term.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, thawed ice-rich silt, and frozen ice-rich silt, **seismic** loading	1.0	1.3 (Figure B16)	No potential of excess porewater pressures developing during the long term. Horizontal PGA of 0.036 g was used for seismic loading.

Table 6-9: Stability Results for the West WRSA

Cross-Section	Loading Conditions	Minimum Required Factor of Safety	Minimum Calculated Factor of Safety	Comments
West WRSA O-O	Construction stage, $\bar{B}$=0.2 for unfrozen silt with peat, static loading	1.1 - 1.3	1.7 (Figure B17)	Considering potential excess porewater pressures developing in the unfrozen silt with peat layer due to construction of the South WRSA.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, static loading	1.3	1.9 (Figure B18)	No potential of excess porewater pressures developing in the unfrozen silt with peat layer during the long term.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, **seismic** loading	1.0	1.7 (Figure B19)	No potential of excess porewater pressures developing during the long term. Horizontal PGA of 0.036 g was used for seismic loading.
West WRSA P-P	Construction stage, $\bar{B}$=0.2 for unfrozen silt with peat and thawed frozen ice-rich silt, $\bar{B}$=0 for frozen ice-rich silt, static loading	1.1 - 1.3	1.3 (Figure B20)	Considering potential excess porewater pressures developing in the unfrozen silt with peat and thawed ice-rich silt (Zone 1) layers due to construction of the South WRSA.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, thawed ice-rich silt, and frozen ice-rich silt, static loading	1.3	1.3 (Figure B21)	No potential of excess porewater pressures developing in the unfrozen silt with peat and thawed ice-rich silt (Zone 1) layers during the long term.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, $\bar{B}$=0.2 for thawed ice-rich silt, static loading	1.3	1.5 (Figure B22)	Considering potential excess porewater pressures developing in the thawed ice-rich silt layers (Zone 2 to Zone 5) due to thawing in the long term.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, thawed ice-rich silt, and frozen ice-rich silt, **seismic** loading	1.0	1.1 (Figure B23)	No potential of excess porewater pressures developing during the long term. Horizontal PGA of 0.036 g was used for seismic loading.

Table 6-9: Stability Results for the West WRSA

Cross-Section	Loading Conditions	Minimum Required Factor of Safety	Minimum Calculated Factor of Safety	Comments
West WRSA Q-Q	Construction stage, $\bar{B}$=0.2 for unfrozen silt with peat and thawed frozen ice-rich silt, $\bar{B}$=0 for frozen ice-rich silt, static loading	1.1 - 1.3	1.7 (Figure B24)	Considering potential excess porewater pressures developing in the unfrozen silt with peat and thawed ice-rich silt (Zone 1) layers due to construction of the South WRSA.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, thawed ice-rich silt, and frozen ice-rich silt, static loading	1.3	1.8 (Figure B25)	No potential of excess porewater pressures developing in the unfrozen silt with peat and thawed ice-rich silt (Zone 1) layers during the long term.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, $\bar{B}$=0.2 for thawed ice-rich silt, static loading	1.3	2.1 (Figure B26)	Considering potential excess porewater pressures developing in the thawed ice-rich silt layers (Zone 2 to Zone 5) due to thawing in the long term.
	Long term, $\bar{B}$=0 for unfrozen silt with peat, thawed ice-rich silt, and frozen ice-rich silt, **seismic** loading	1.0	1.6 (Figure B27)	No potential of excess porewater pressures developing during the long term. Horizontal PGA of 0.036 g was used for seismic loading.

Table 6-10: Stability Results for the East WRSA

Cross-Section	Foundation and Loading Conditions	Minimum Required Factor of Safety	Minimum Calculated Factor of Safety	Comments
East WRSA R-R	Construction stage, $\bar{B}$=0.2 for unfrozen and thawed organics, $\bar{B}$=0 for frozen organics, static loading	1.1 - 1.3	1.1 (Figure B28)	Considering potential excess porewater pressures developing in the organics layer due to construction of the South WRSA.
	Long term, $\bar{B}$=0 for unfrozen, thawed and frozen organics, static loading	1.3	1.3 (Figure B29)	No potential of excess porewater pressures developing in the organic layer during the long term.
	Long term, $\bar{B}$=0 for organics, $\bar{B}$=0.2 for thawed organics, static loading	1.3	1.3 (Figure B30)	Considering potential excess porewater pressures developing in the thawed organic layers (Zone 2 to Zone 4) due to thawing in the long term.
	Long term, $\bar{B}$=0 for unfrozen, thawed and frozen organics, **seismic** loading	1.0	1.2 (Figure B31)	No potential of excess porewater pressures developing during the long term. Horizontal PGA of 0.036 g was used for seismic loading.

7.0 CONCLUSION

Tetra Tech concludes that adequate volume is available for storage of waste rock volumes estimated for the current mine plan.

The slope stability analyses were carried out to evaluate the stability of several design sections of the South, East and West WRSAs. The analyses involved several design scenarios including short-term construction stage, long-term conditions with frozen ground, long-term conditions with thawing active layer, and other sensitivity cases. Both static and seismic loading conditions were evaluated during the long term with frozen ground design scenarios. The analysis results indicate that the calculated minimum factors of safety for the South, East, and West WRSAs meet or exceed the adopted minimum factors of safety.

8.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

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PERMIT TO PRACTICE
TETRA TECH CANADA INC.

Signature ______________

Date March 22, 2018

PERMIT NUMBER: P 018
NT/NU Association of Professional Engineers and Geoscientists

REFERENCES

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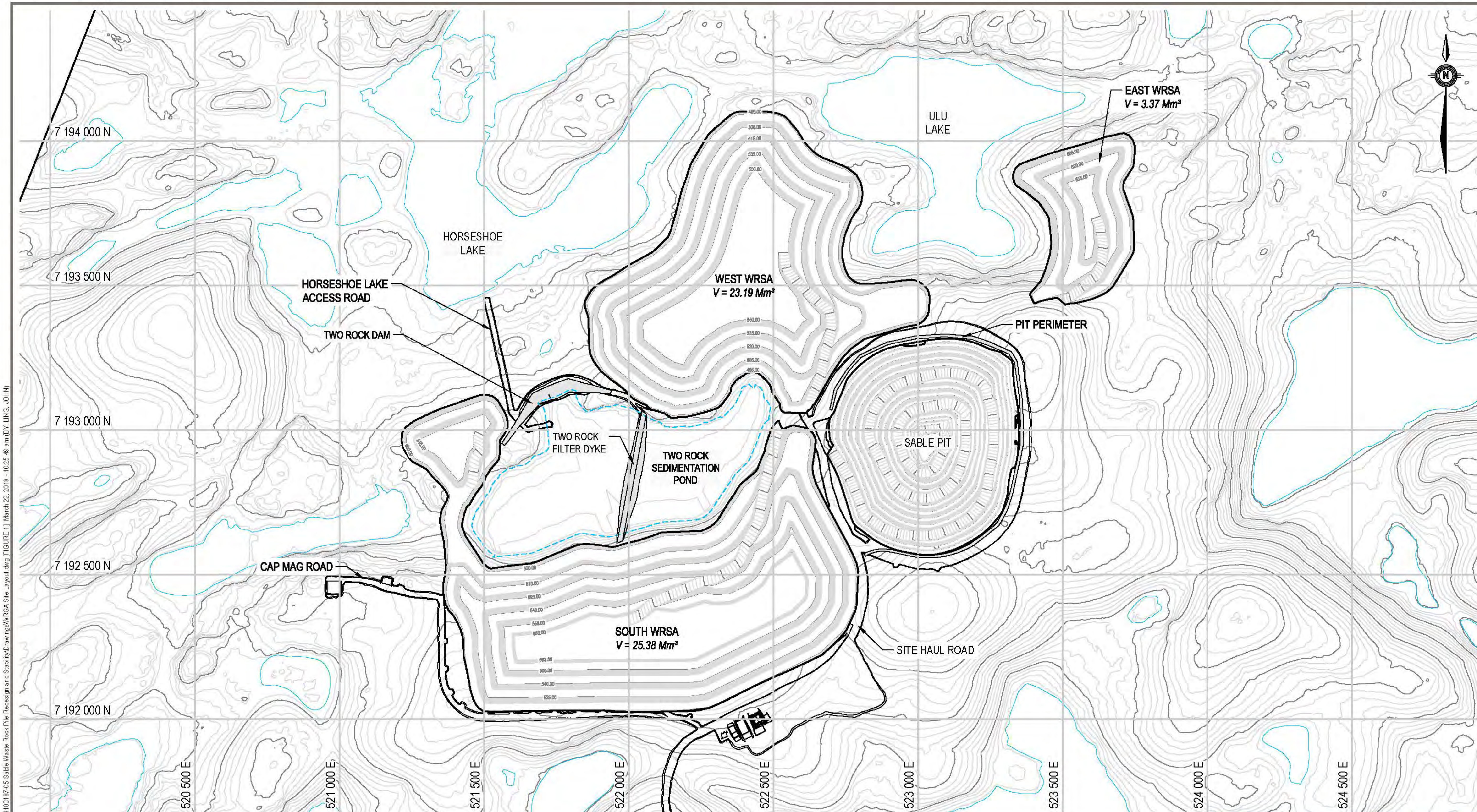
FIGURES

Figure 1 General Site Layout
Figure 2 Surficial Geology with Proposed Site Layout
Figure 3 General Site Layout Showing Section Locations
Figure 4 Sections K to N
Figure 5 Sections O to R



LEGEND:

– – – APPROXIMATE HIGH WATER MARK

0 — 500 m

Scale: 1: 12 500

NOTES

- VOLUME OF SOUTH, WEST & EAST PILES = 51.94 Mm³

STATUS
ISSUED FOR USE

CLIENT

Dominion Diamond Mines

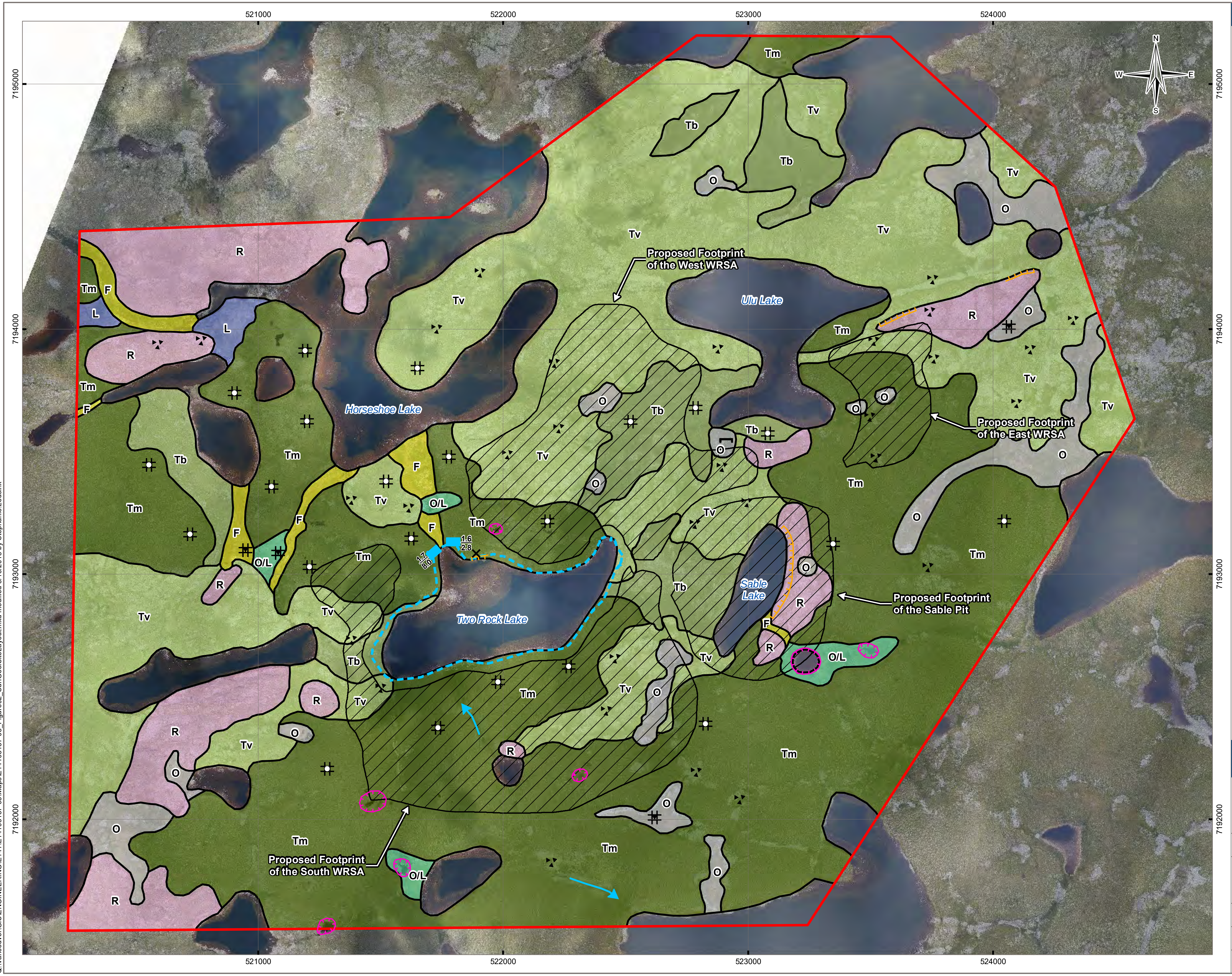
TETRA TECH

SLOPE STABILITY EVALUATION OF THE SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

GENERAL SITE LAYOUT

PROJECT NO.	DWN	CKD	REV
E14103187-05	JL	EG	0
OFFICE	DATE		
EDM	March 22, 2018		

Figure 1



LEGEND

- Mapping Boundary
- Two Rock Sedimentation Pond
- Sable Pit and WRSA

Surficial Geology

- O — **Organic Deposits:** peat and muck; contain excess ground ice.
- F — **Fluvial Deposits (Alluvium):** stratified silt and sand; commonly cobbly or bouldery.
- L — **Lacustrine Deposits:** mainly silt and sand; contain excess ground ice.
- O/L — **Organic Deposits** underlain by **Lacustrine Deposits:** contain excess ground ice.
- Tv — **Till Veneer:** unsorted glacial debris (diamicton); up to 1 m thick; surface reflects underlying bedrock; commonly includes patches of exposed bedrock, till blanket, glaciofluvial material, and felsenmeer.
- Tb — **Till Blanket:** unsorted glacial debris; 1 to 5 m thick; may include patches of till veneer, exposed bedrock, and felsenmeer.
- Tm — **Rolling Ground Moraine:** unsorted glacial debris; 5 to 15 m thick; surface expression is rolling; may include patches of till blanket, organic veneer in depressions and felsenmeer; contains accumulations of massive ground ice.
- R — **Bedrock:** undifferentiated granitoid, graywacke, schist, diabase and gabbro rocks, locally frost shattered and frost jacked, commonly includes patches of till veneer, till blanket and felsenmeer.

- Bedrock Outcrop
- Felsenmeer
- Ice Wedge Polygon(s)
- Patterned Ground: undifferentiated non-sorted and sorted polygons and circles
- Polygonal Peat Plateau
- 1.7/8.0 Massive Ice Bed
  Numerator: depth (m) to top of bed
  Denominator: depth (m) to base of bed
- Escarpment
- Direction of Drainage
- Isolated Thermokarst Depression
- Geologic Boundary

NOTES
Base data source:
Imagery provided by Dominion Diamond Corporation.

STATUS
ISSUED FOR USE

SABLE WASTE ROCK STORAGE AREAS
EKATI DIAMOND MINE, NT

Surficial Geology with Proposed Site Layout

PROJECTION	DATUM	CLIENT
UTM Zone 12	NAD83	Dominion Diamond Mines

Scale: 1:15,000
200 100 0 200
Metres

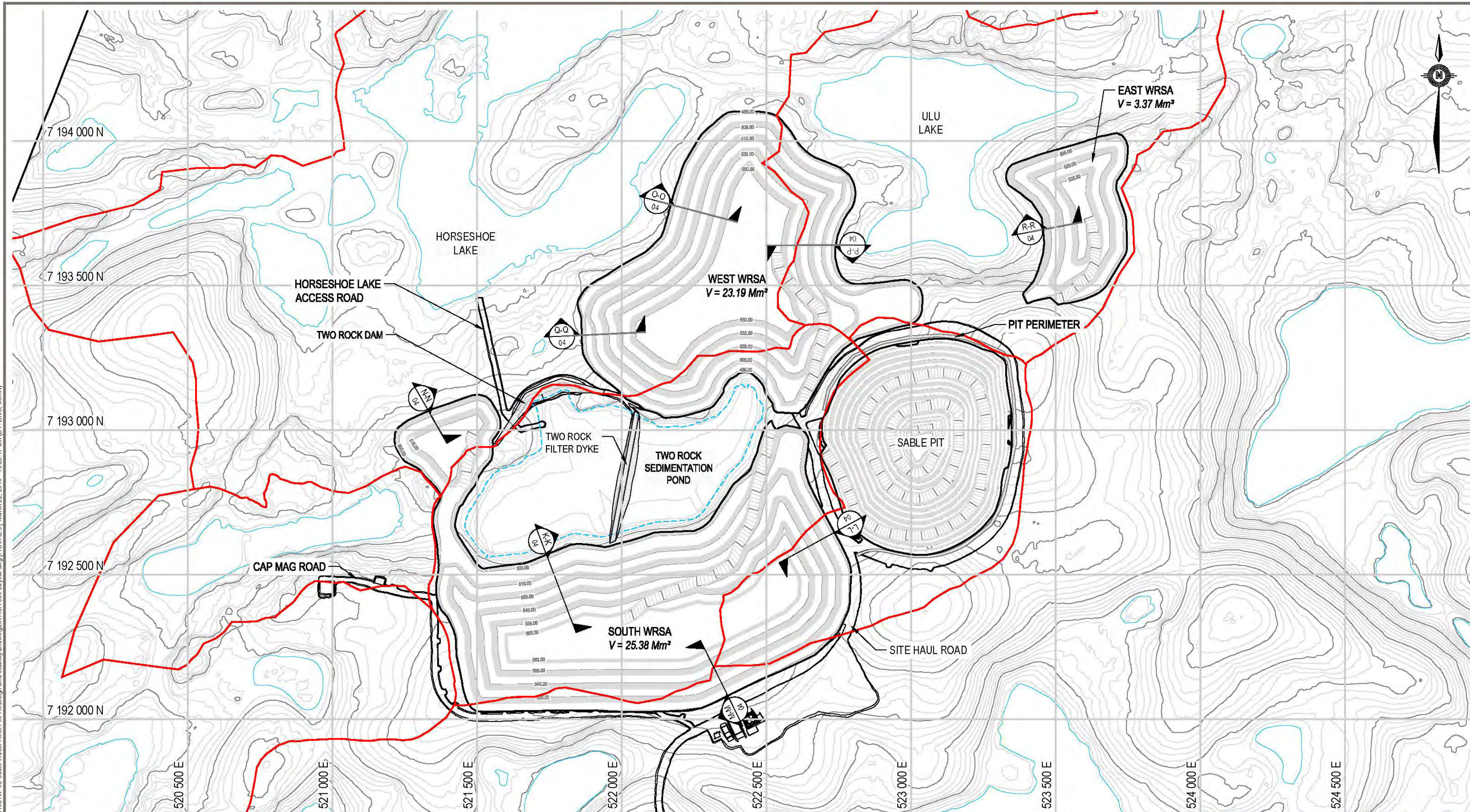
TETRA TECH

FILE NO.
E14103187-05_Figure02_SurfGeolSiteLayout.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	MEZ	VR	0

DATE	PROJECT NO.
March 21, 2018	E14103187-05

Figure 2



LEGEND:

WATERSHED BOUNDARIES

APPROXIMATE HIGH WATER MARK

0 500 m

Scale: 1: 12 500

NOTES

- VOLUME OF SOUTH, WEST & EAST PILES = 51.94 Mm³

STATUS
ISSUED FOR USE

CLIENT

Dominion Diamond Mines

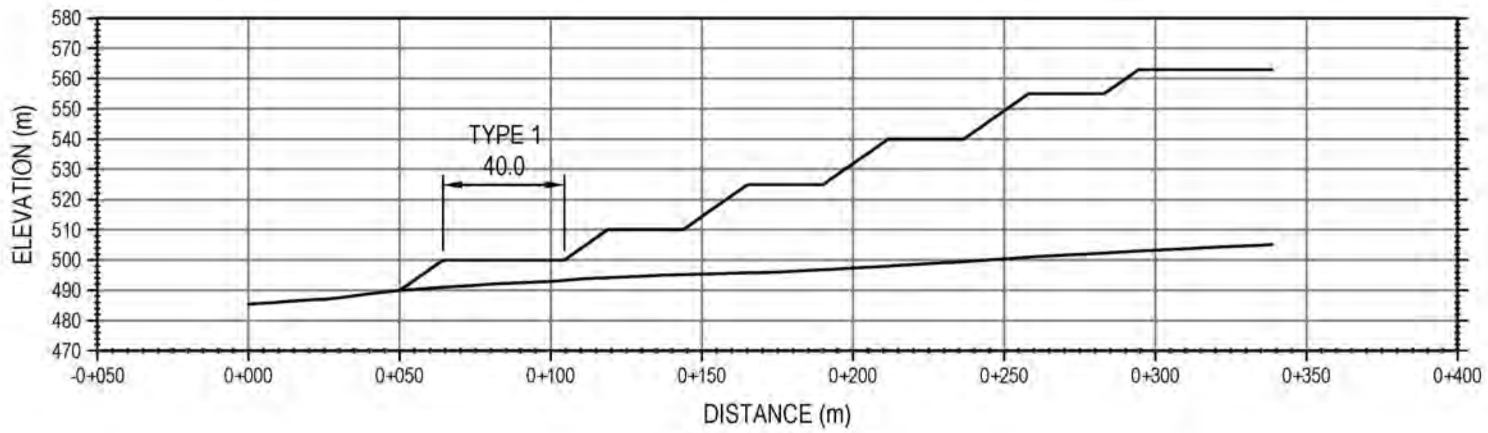
TETRA TECH

SLOPE STABILITY EVALUATION OF THE SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

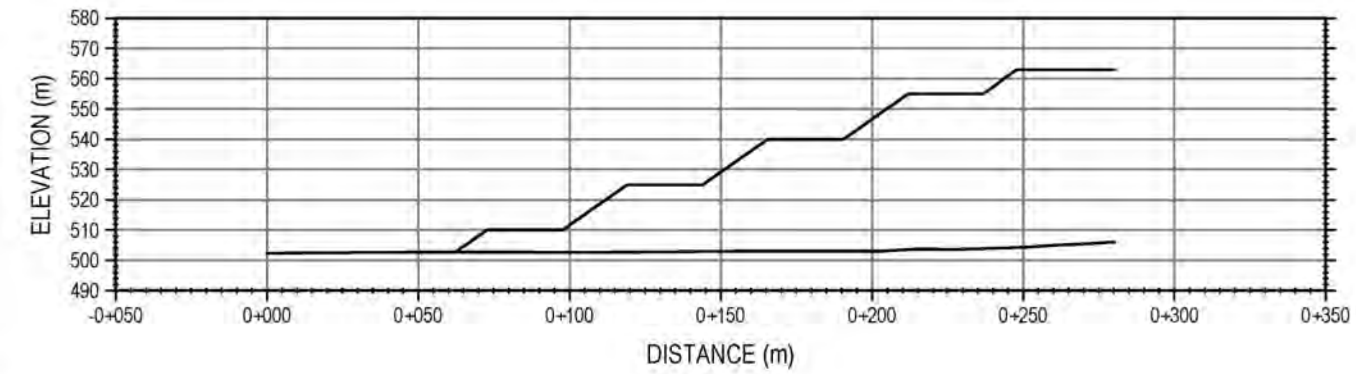
GENERAL SITE LAYOUT SHOWING SECTION LOCATIONS

PROJECT NO.	DWN	CKD	REV	
E14103187-05	JL	EG	0	Figure 3
OFFICE	DATE			
EDM	March 22, 2018			

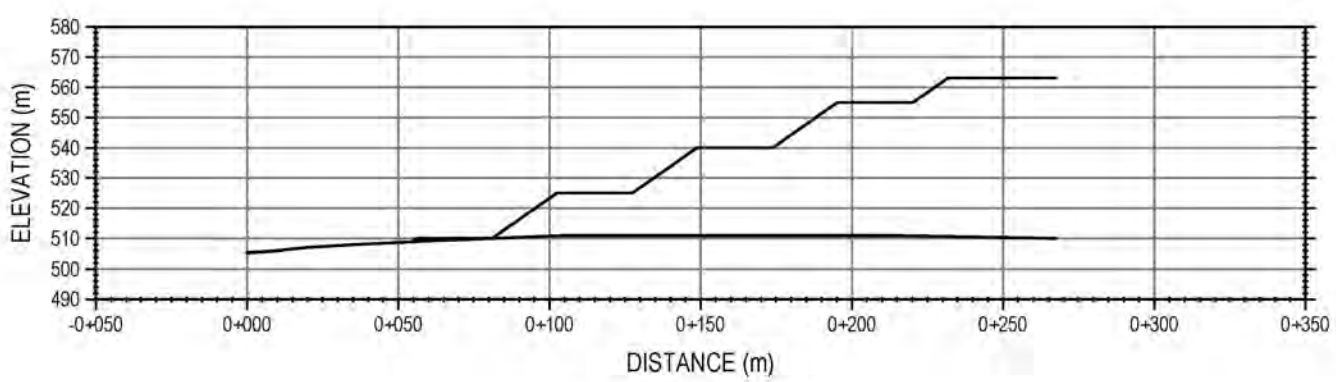
Q:\Edmonton\Engineering\E141\Projects_EKATI\E14103187-05 Sable Waste Rock Pile Redesign and Stability\Drawings\WRSA Site Layout.dwg [FIGURE 3] March 22, 2018 - 10:25:17 am (BY: LING, JOHN)



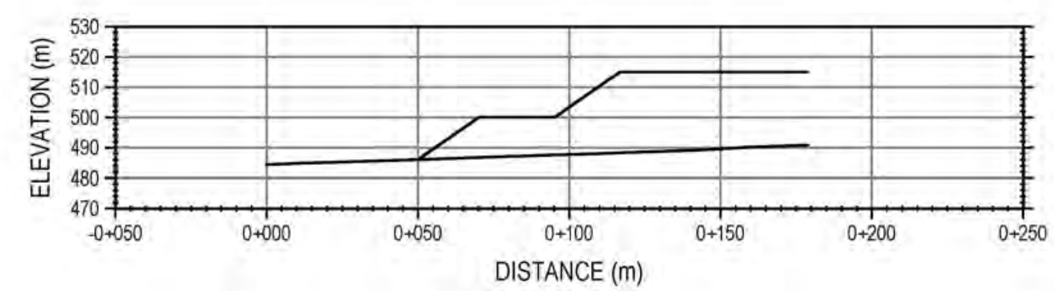
Section K-K



Section L-L



Section M-M



Section N-N

SOUTH WRSA

NOTES:
— TYPE 1 STARTER BENCH

STATUS
ISSUED FOR USE

CLIENT
Dominion Diamond Mines

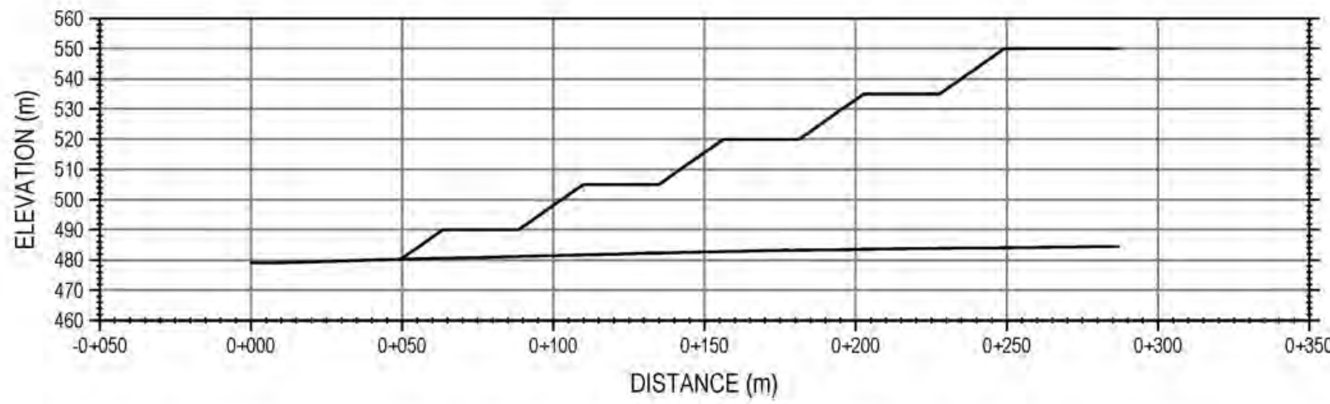
TETRA TECH

SLOPE STABILITY EVALUATION OF THE SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

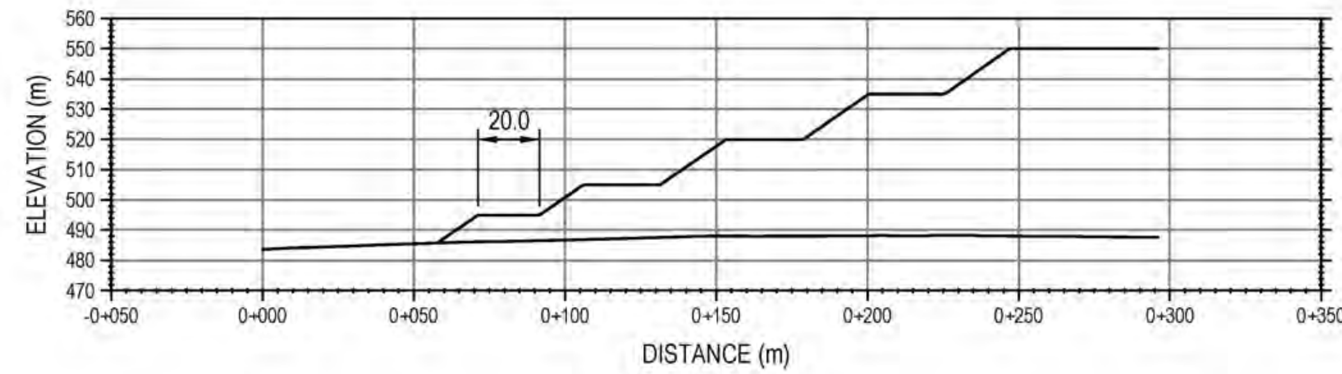
SECTIONS K TO N

PROJECT NO.	DWN	CKD	REV
E14103187-05	JL	EG	0
OFFICE	DATE		
EDM	March 22, 2018		

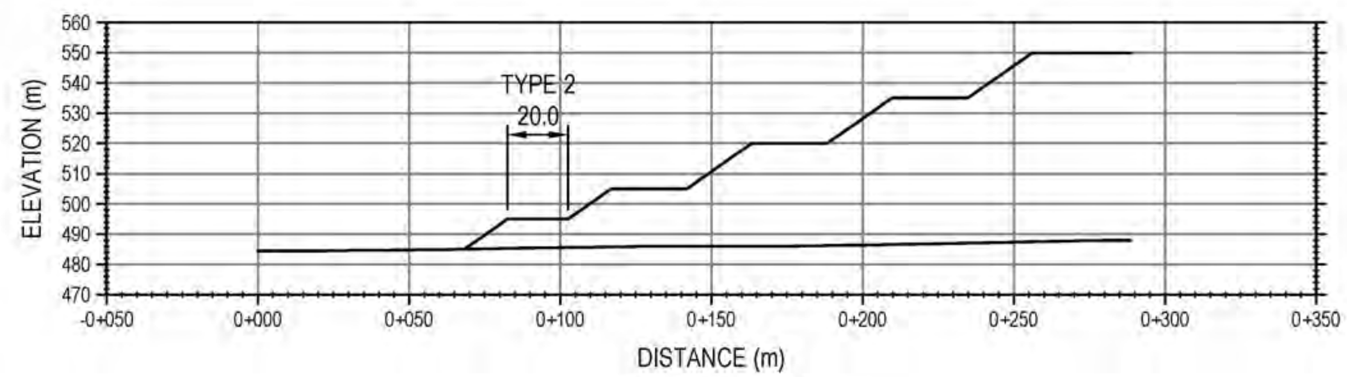
Figure 4



Section O-O

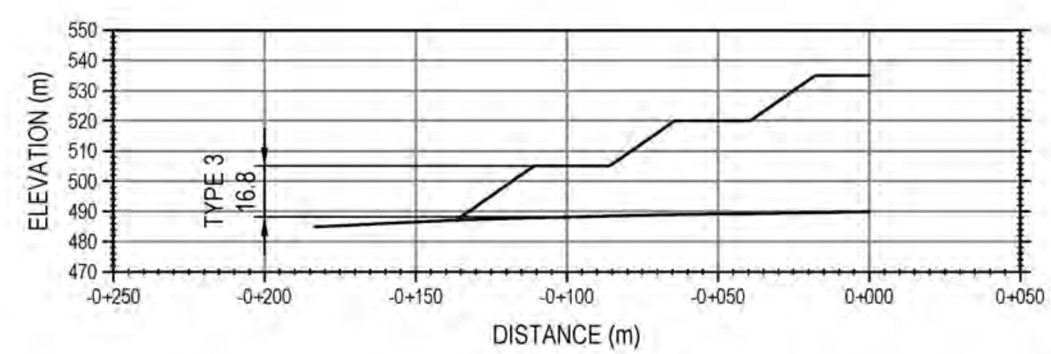


Section P-P



Section Q-Q

WEST WRSA



Section R-R

EAST WRSA

NOTES:
TYPE 2 AND TYPE 3 STARTER BENCHES

STATUS
ISSUED FOR USE

CLIENT
Dominion Diamond Mines

TETRA TECH

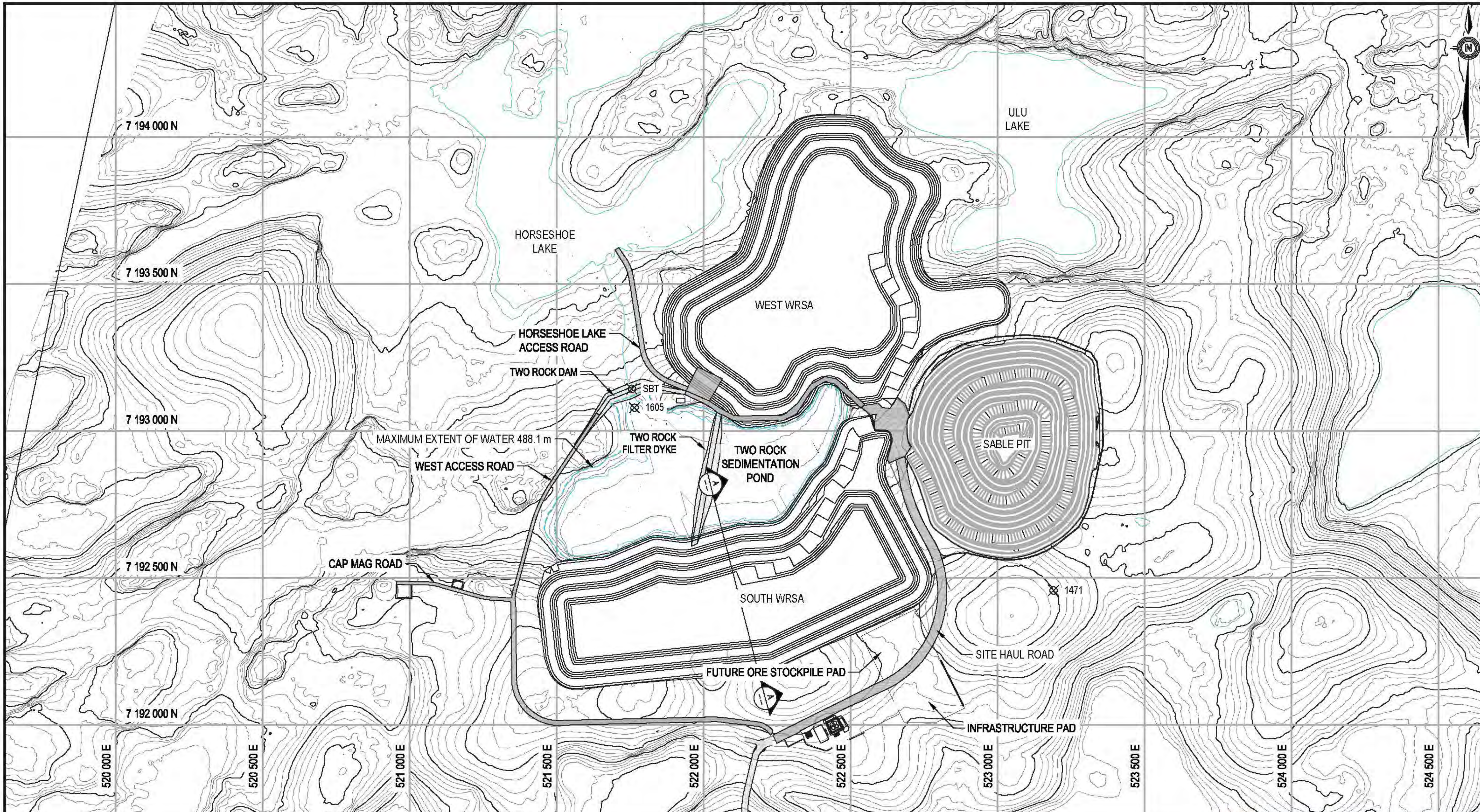
SLOPE STABILITY EVALUATION OF THE SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

SECTIONS O TO R

PROJECT NO.	DWN	CKD	REV
E14103187-05	JL	EG	0
OFFICE	DATE		
EDM	March 22, 2018		

Figure 5

APPENDIX A
THERMAL EVALUATION FIGURES



LEGEND

⊗ GROUND TEMPERATURE CABLE

0 500m

Scale: 1:12,500 @ 11"x17"

STATUS
ISSUED FOR USE

CLIENT

DOMINION DIAMOND CORPORATION

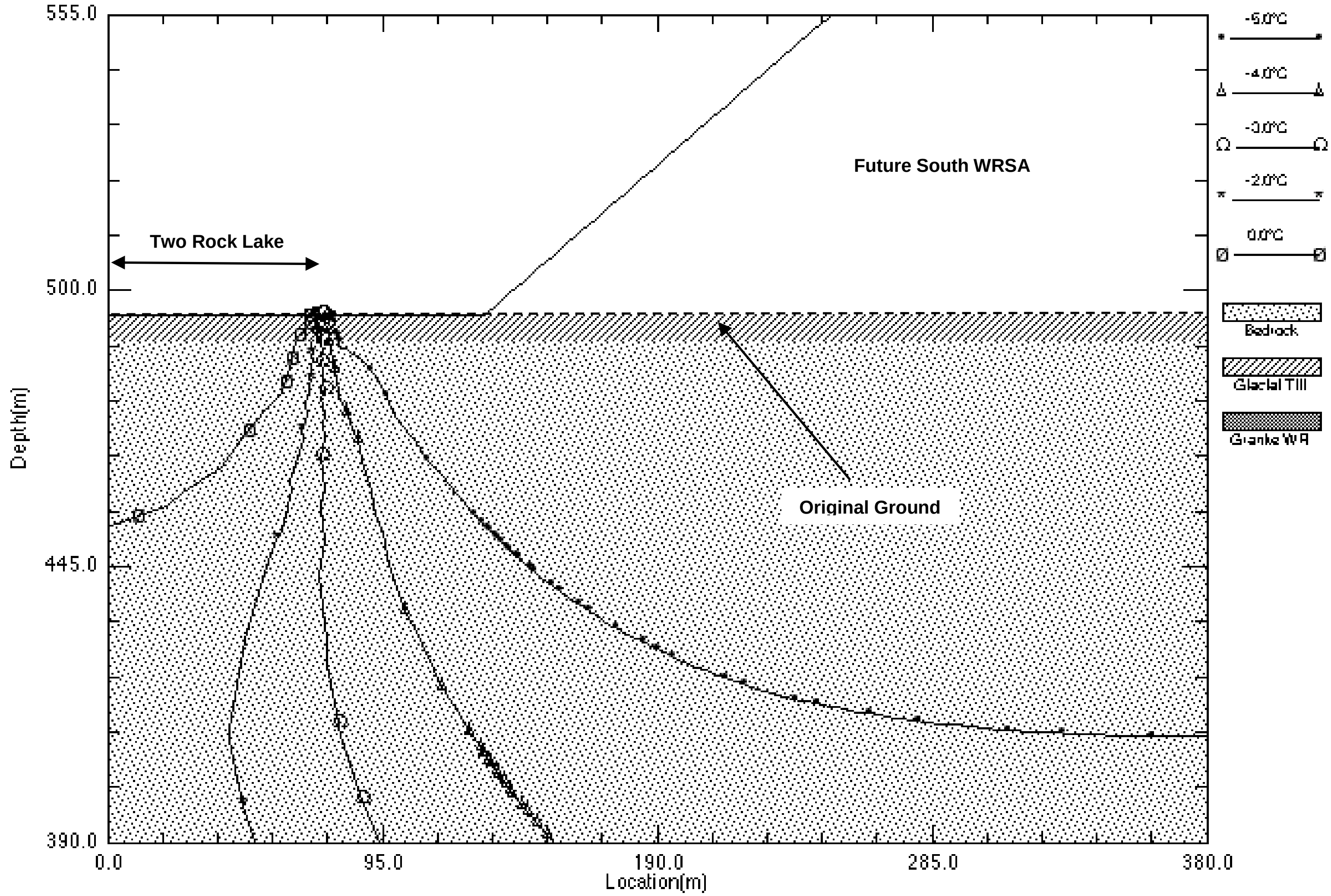
THERMAL EVALUATION OF THE SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

GENERAL SITE LAYOUT OF SABLE AREA

TETRA TECH EBA

PROJECT NO.	DWN	CKD	REV
E14103187-03	CP	I I	GK
OFFICE	DATE		
EDM	MAY 2016		

Figure A1



LEGEND

NOTES

STATUS
ISSUED FOR USE

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH EBA

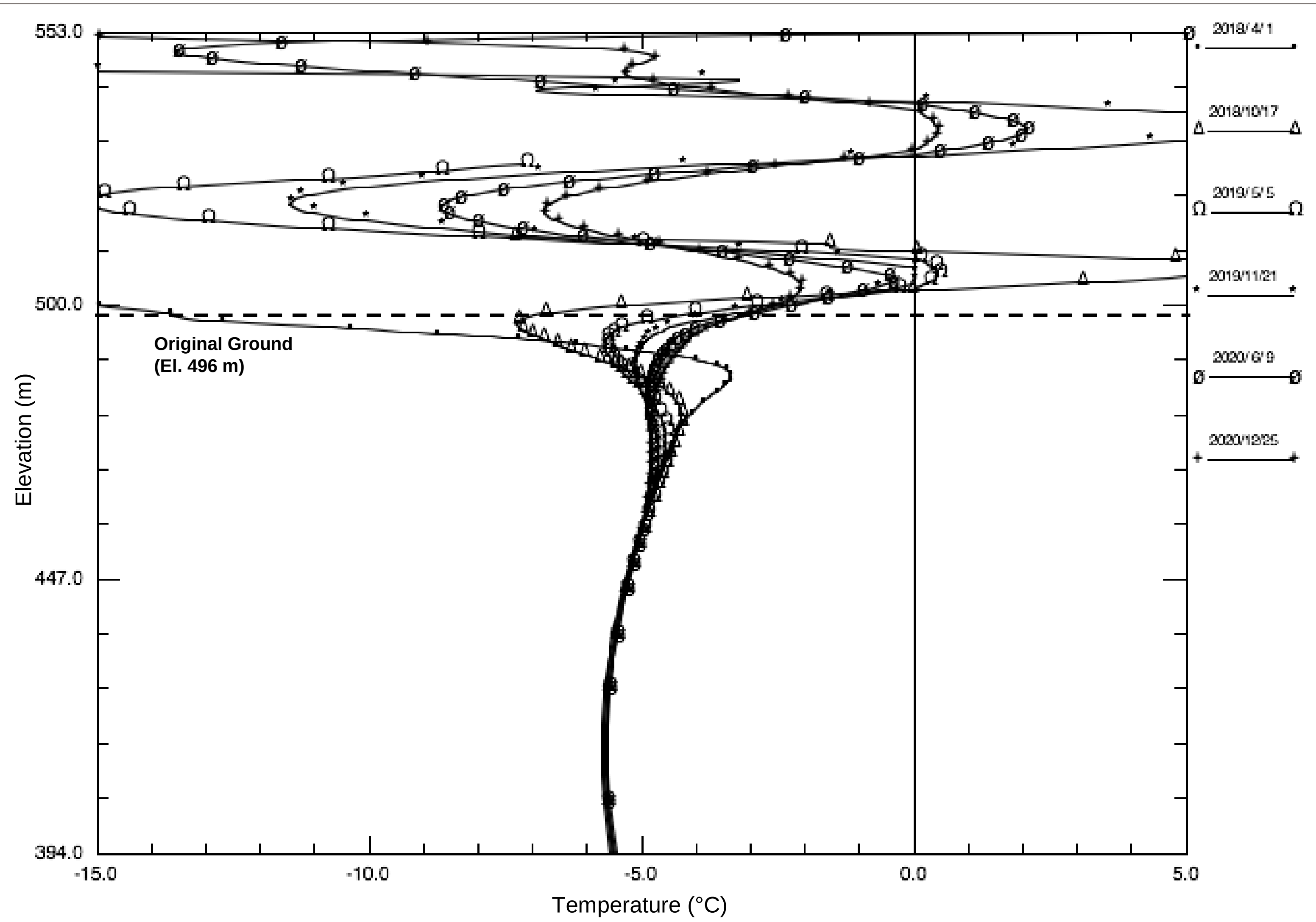
THERMAL EVALUATION OF SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

INITIAL GROUND TEMPERATURES AT THE SOUTH WRSA FOOTPRINT

PROJECT NO.	DWN	CKD	APVD	REV
E14103187-03	CP	HX	GK	0

OFFICE	DATE
EDM	April 2016

Figure A2



LEGEND

NOTES

STATUS
ISSUED FOR USE

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH EBA

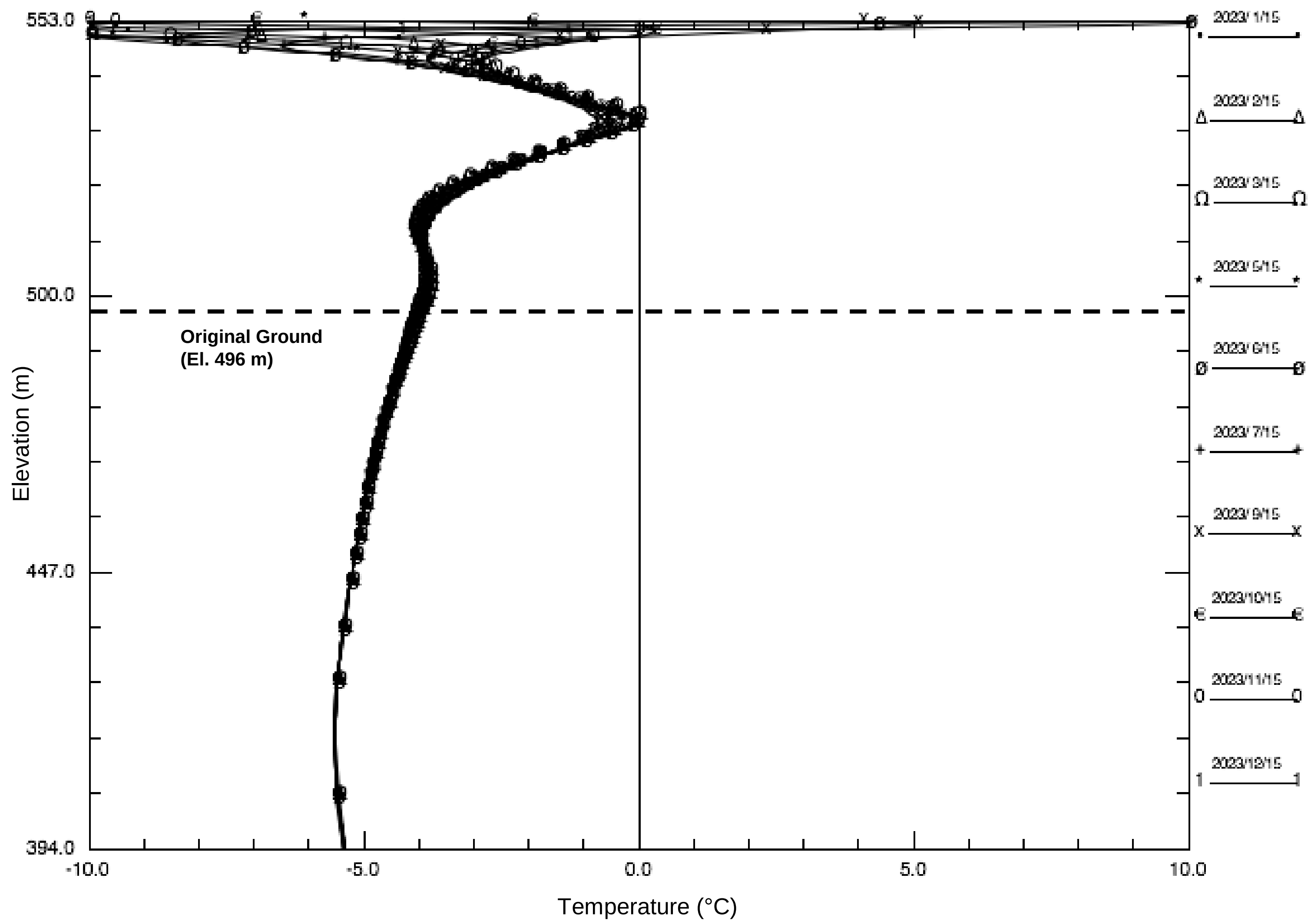
THERMAL EVALUATION OF SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

TEMPERATURE PROFILE AT THE SOUTH WRSA DURING CONSTRUCTION

PROJECT NO.	DWN	CKD	APVD	REV
E14103187-03	CP	HX	GK	0

OFFICE	DATE
EDM	April 2016

Figure A3



LEGEND

NOTES

STATUS
ISSUED FOR USE

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH EBA

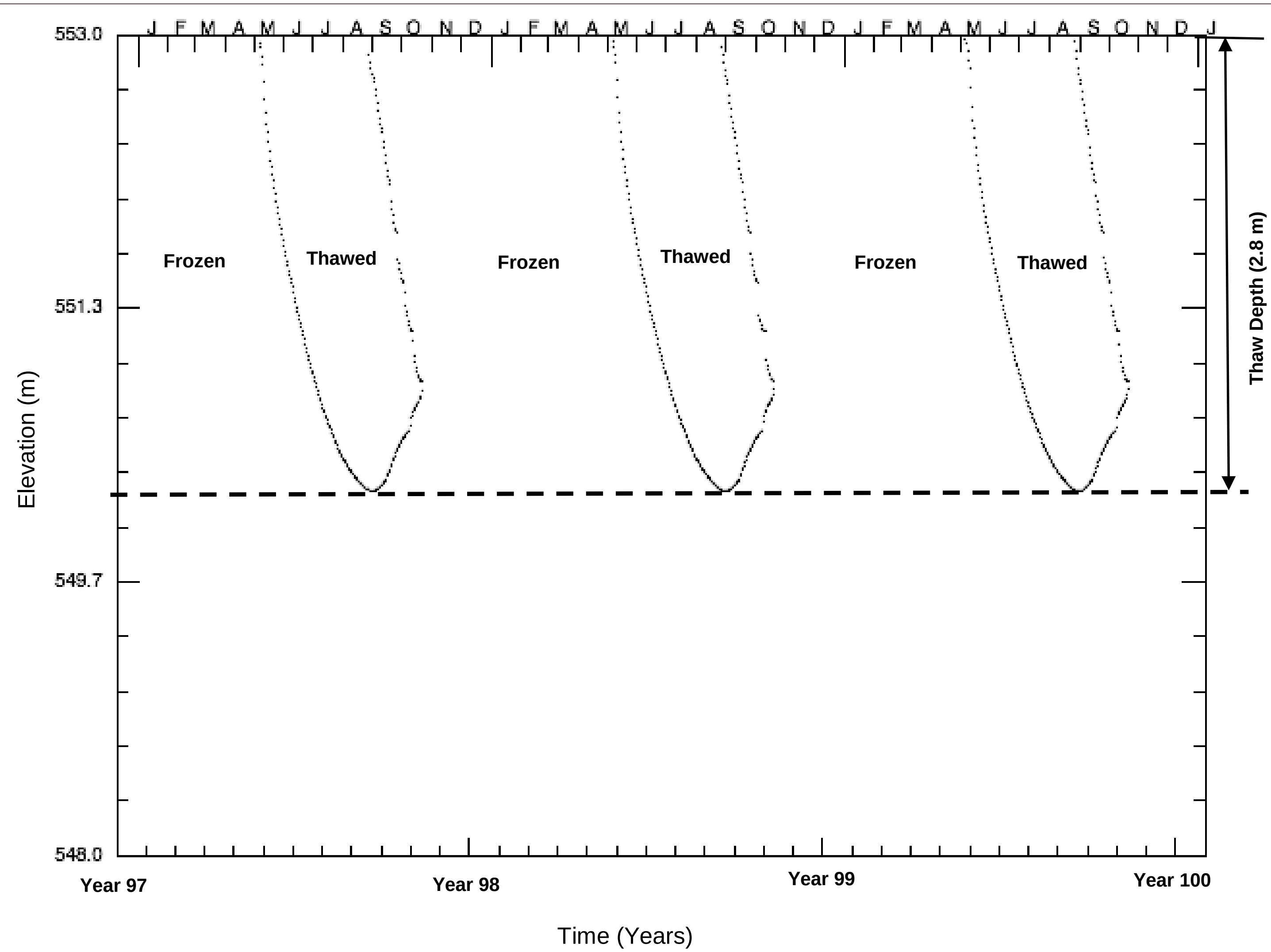
THERMAL EVALUATION OF SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

TEMPERATURE PROFILE AT THE SOUTH WRSA IN YEAR 2023 (3 YEARS AFTER CONSTRUCTION)

PROJECT NO.	DWN	CKD	APVD	REV
E14103187-03	CP	HX	GK	0

OFFICE	DATE
EDM	April 2016

Figure A4



LEGEND

NOTES

STATUS
ISSUED FOR USE

CLIENT
DOMINION DIAMOND CORPORATION

TETRA TECH EBA

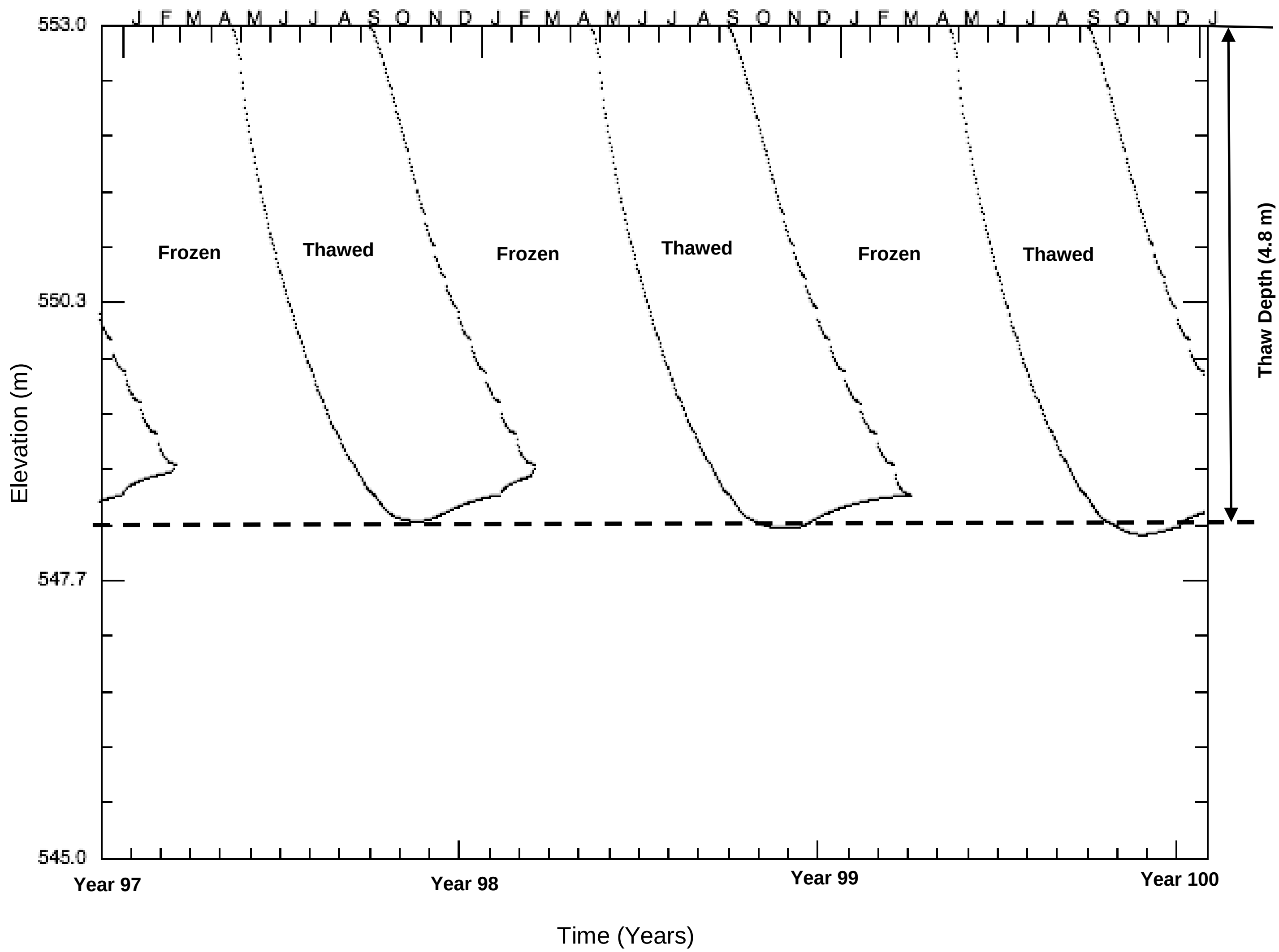
THERMAL EVALUATION OF SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

TYPICAL THAW DEPTH AT THE SOUTH WRSA UNDER MEAN AIR CONDITIONS AFTER 100 YEARS

PROJECT NO.	DWN	CKD	APVD	REV
E14103187-03	CP	HX	GK	0

OFFICE	DATE
EDM	April 2016

Figure A5



LEGEND

NOTES

STATUS
ISSUED FOR USE

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH EBA

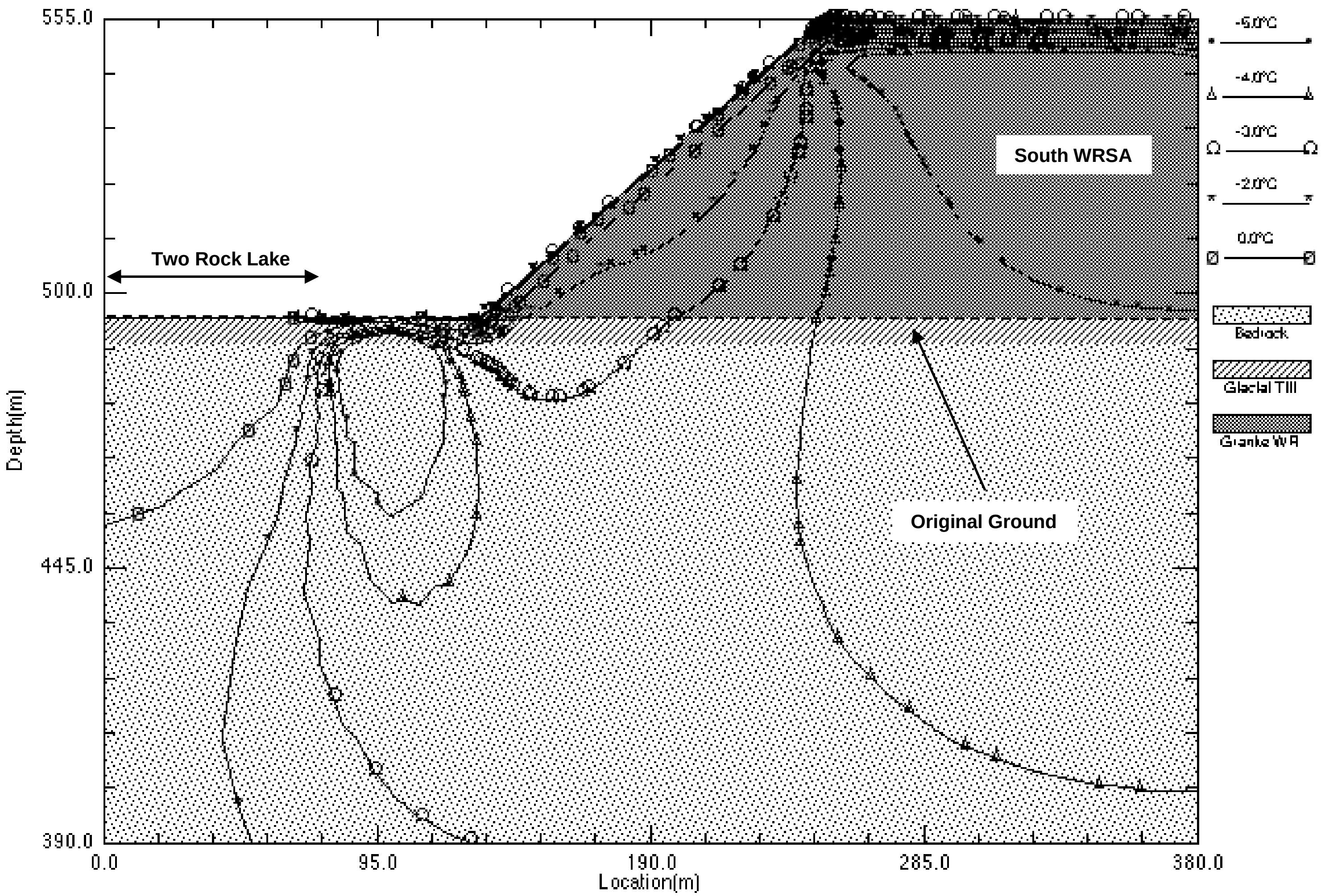
THERMAL EVALUATION OF SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

TYPICAL THAW DEPTH AT THE SOUTH WRSA UNDER A2 CLIMATE CONDITIONS AFTER 100 YEARS

PROJECT NO.	DWN	CKD	APVD	REV
E14103187-03	CP	HX	GK	0

OFFICE	DATE
EDM	April 2016

Figure A6



LEGEND

NOTES

Predicted isotherms for October 2118

STATUS

ISSUED FOR USE

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH EBA

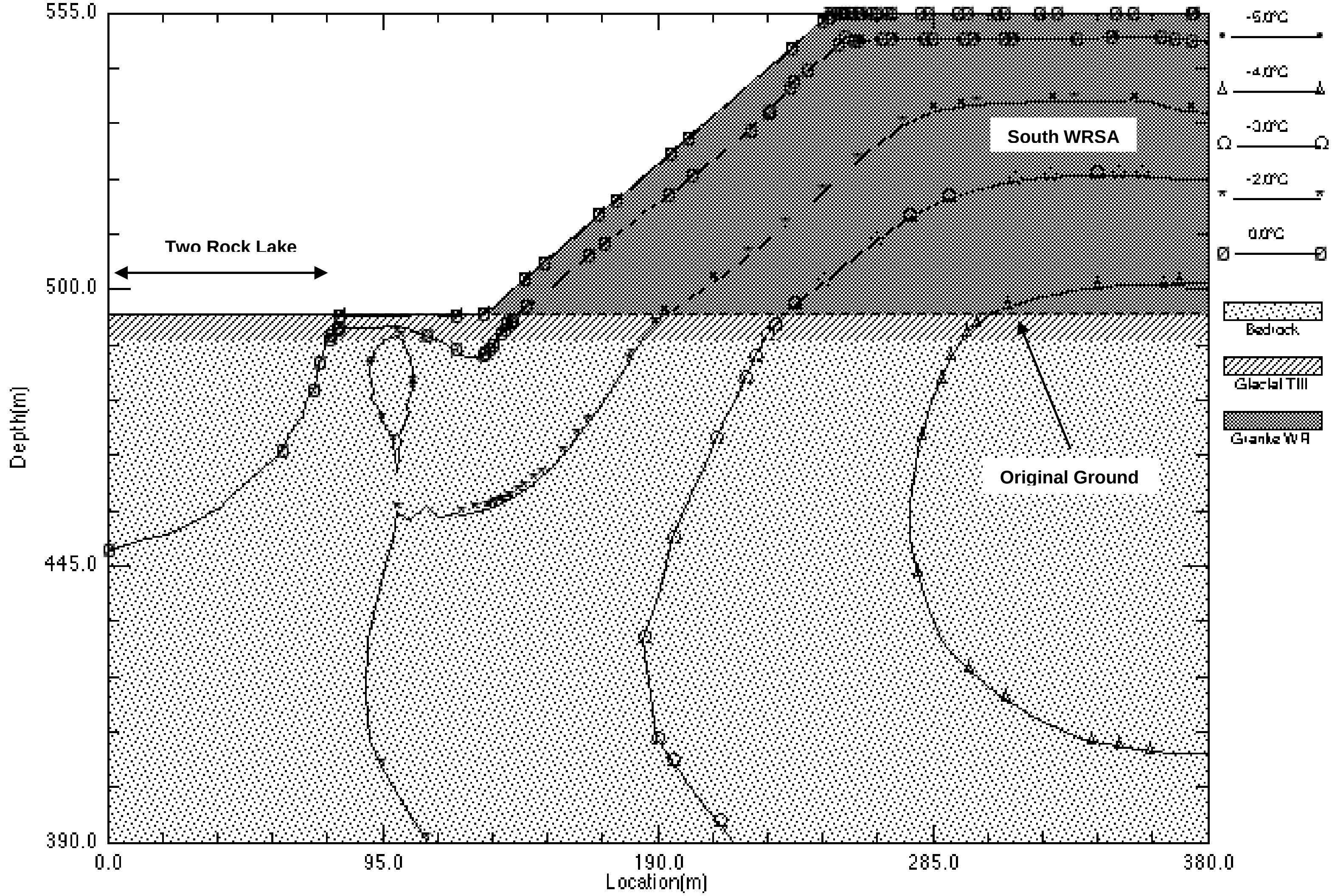
THERMAL EVALUATION OF SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

PREDICTED GROUND TEMPERATURES AT THE SOUTH WRSA UNDER MEAN CONDITIONS AFTER 100 YEARS

PROJECT NO.	DWN	CKD	APVD	REV
E14103187-03	CP	HX	GK	0

OFFICE	DATE
EDM	April 2016

Figure A7



LEGEND

NOTES

Predicted isotherms for October 2118

STATUS

ISSUED FOR USE

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH EBA

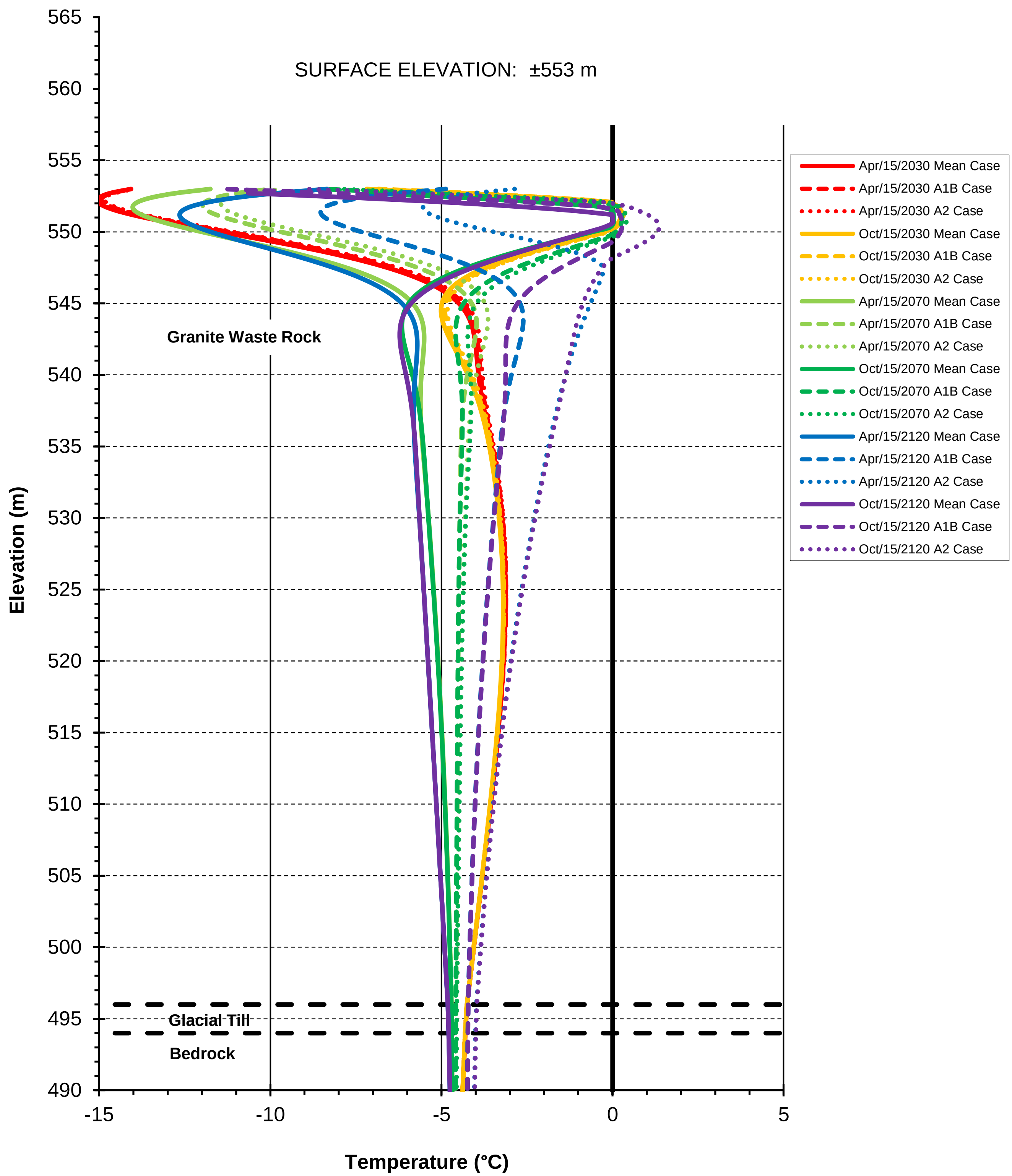
THERMAL EVALUATION OF SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

PREDICTED GROUND TEMPERATURES AT THE SOUTH WRSA UNDER A2 CONDITIONS AFTER 100 YEARS

PROJECT NO.	DWN	CKD	APVD	REV
E14103187-03	CP	HX	GK	0

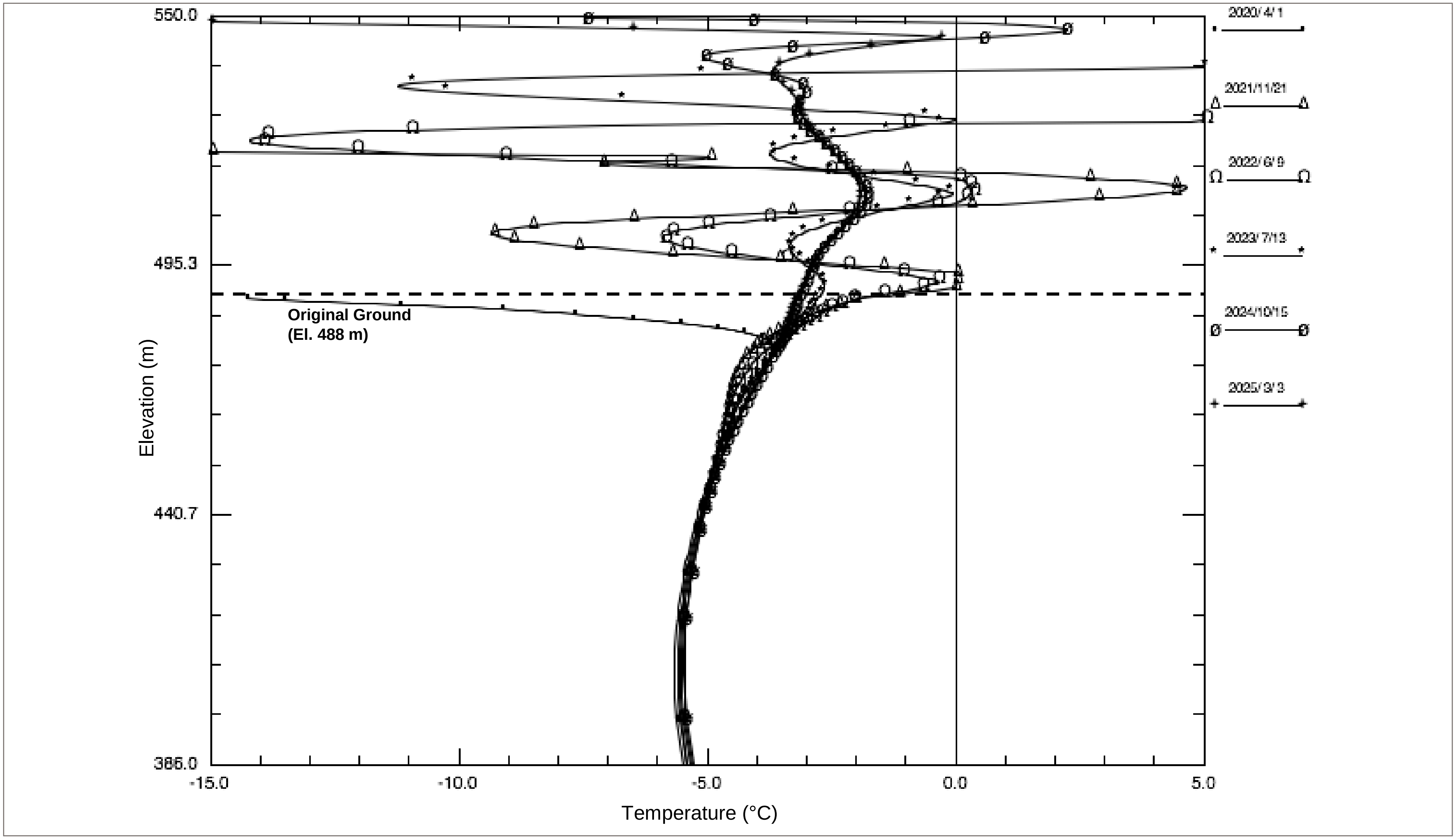
OFFICE	DATE
EDM	April 2016

Figure A8



LEGEND	NOTES	CLIENT	THERMAL EVALUATION OF SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT
		DOMINION DIAMOND CORPORATION	TEMPERATURE PROFILE AT THE SOUTH WRSA AFTER 10, 50 AND 100 YEARS UNDER MEAN, A1B AND A2 CLIMATIC CONDITIONS
	STATUS ISSUED FOR USE	TETRA TECH EBA	PROJECT NO. E14103187-03; DWN CP; CKD HX; APVD GK; REV 0; OFFICE EDM; DATE April 2016

Figure A9



LEGEND

NOTES

STATUS
ISSUED FOR USE

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH EBA

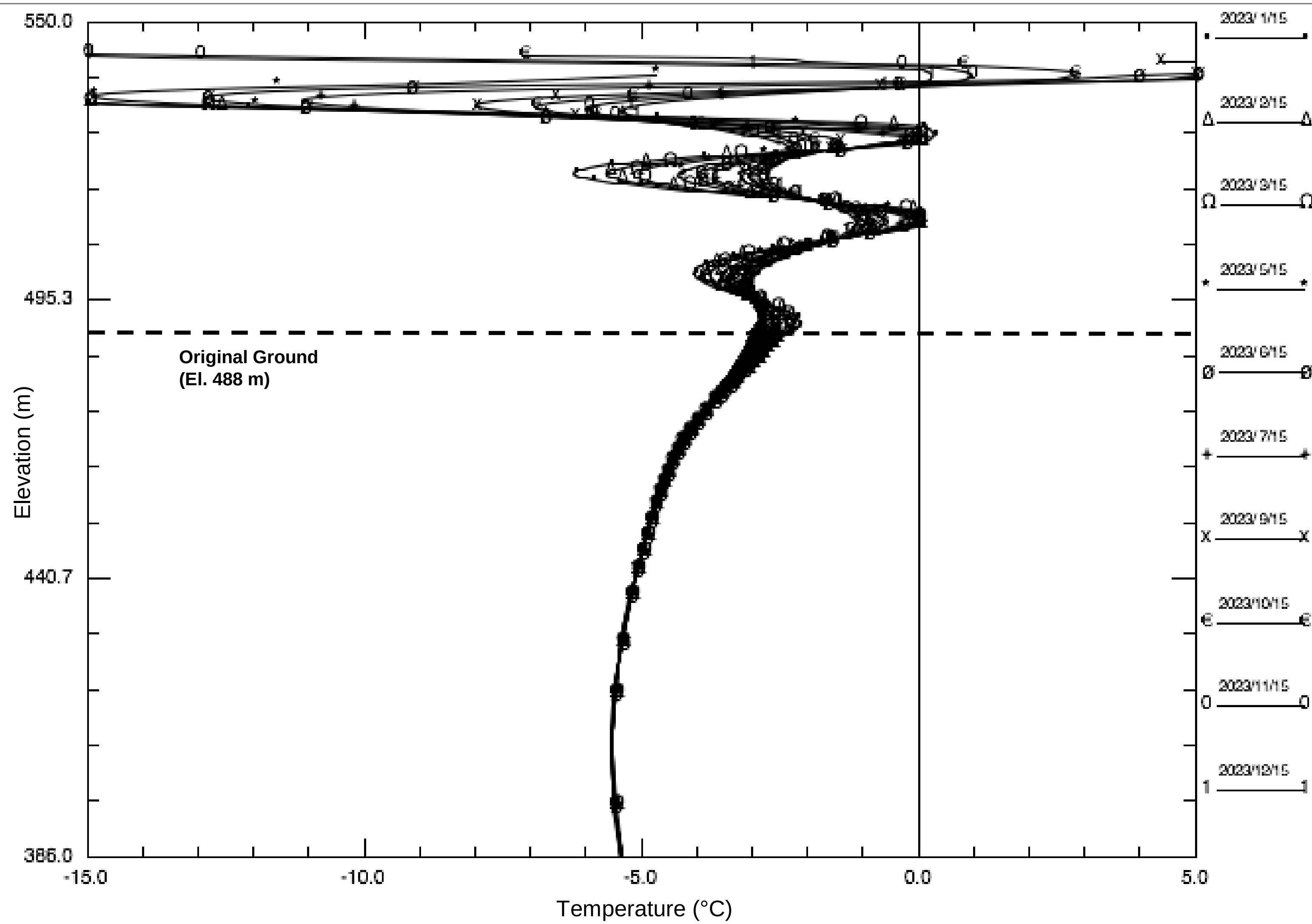
THERMAL EVALUATION OF SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

TEMPERATURE PROFILE AT THE WEST WRSA DURING CONSTRUCTION

PROJECT NO.	DWN	CKD	APVD	REV
E14103187-03	CP	HX	GK	0

OFFICE	DATE
EDM	April 2016

Figure A10



LEGEND

NOTES

STATUS
ISSUED FOR USE

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH EBA

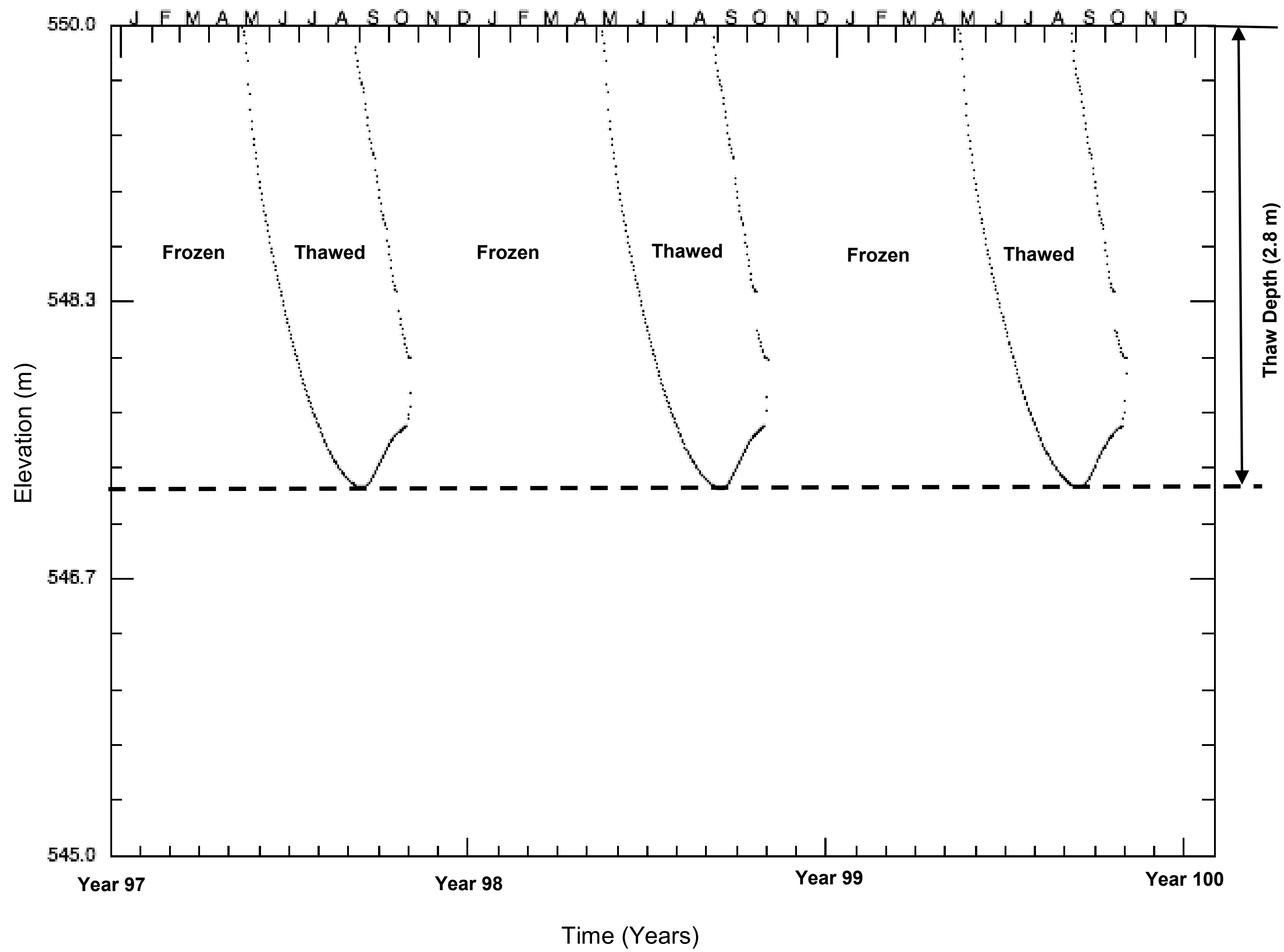
THERMAL EVALUATION OF SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

TEMPERATURE PROFILE AT THE WEST WRSA IN YEAR 2023 (3 YEARS INTO CONSTRUCTION)

PROJECT NO.	DWN	CKD	APVD	REV
E14103187-03	CP	HX	GK	0

OFFICE	DATE
EDM	April 2016

Figure A11



LEGEND

NOTES

STATUS
ISSUED FOR USE

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH EBA

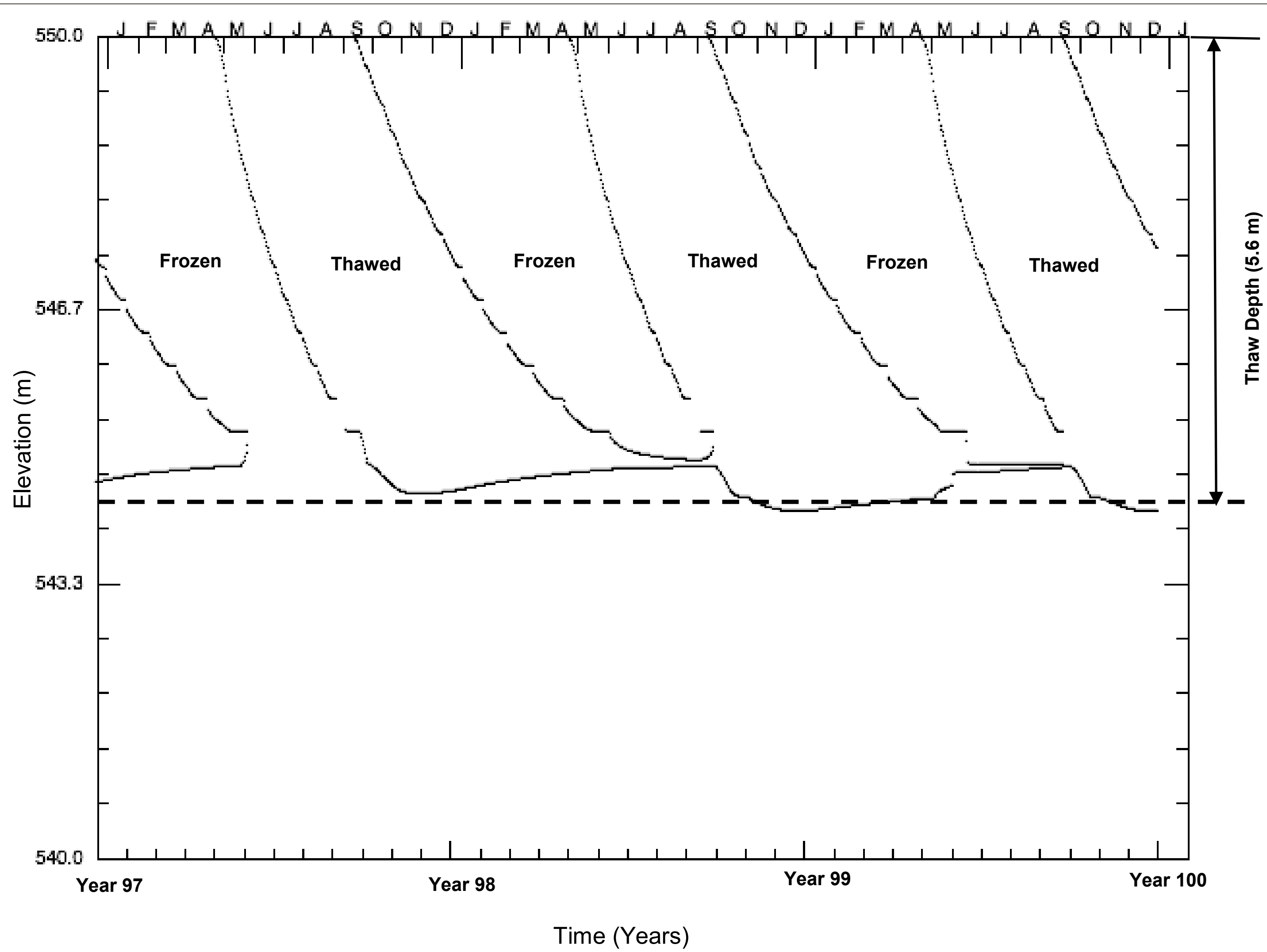
THERMAL EVALUATION OF SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

TYPICAL THAW DEPTH AT THE WEST WRSA UNDER MEAN AIR CONDITIONS AFTER 100 YEARS

PROJECT NO.	DWN	CKD	APVD	REV
E14103187-03	CP	HX	GK	0

OFFICE	DATE
EDM	May 2016

Figure A12



LEGEND

NOTES

STATUS
ISSUED FOR USE

CLIENT

DOMINION DIAMOND CORPORATION

TETRA TECH EBA

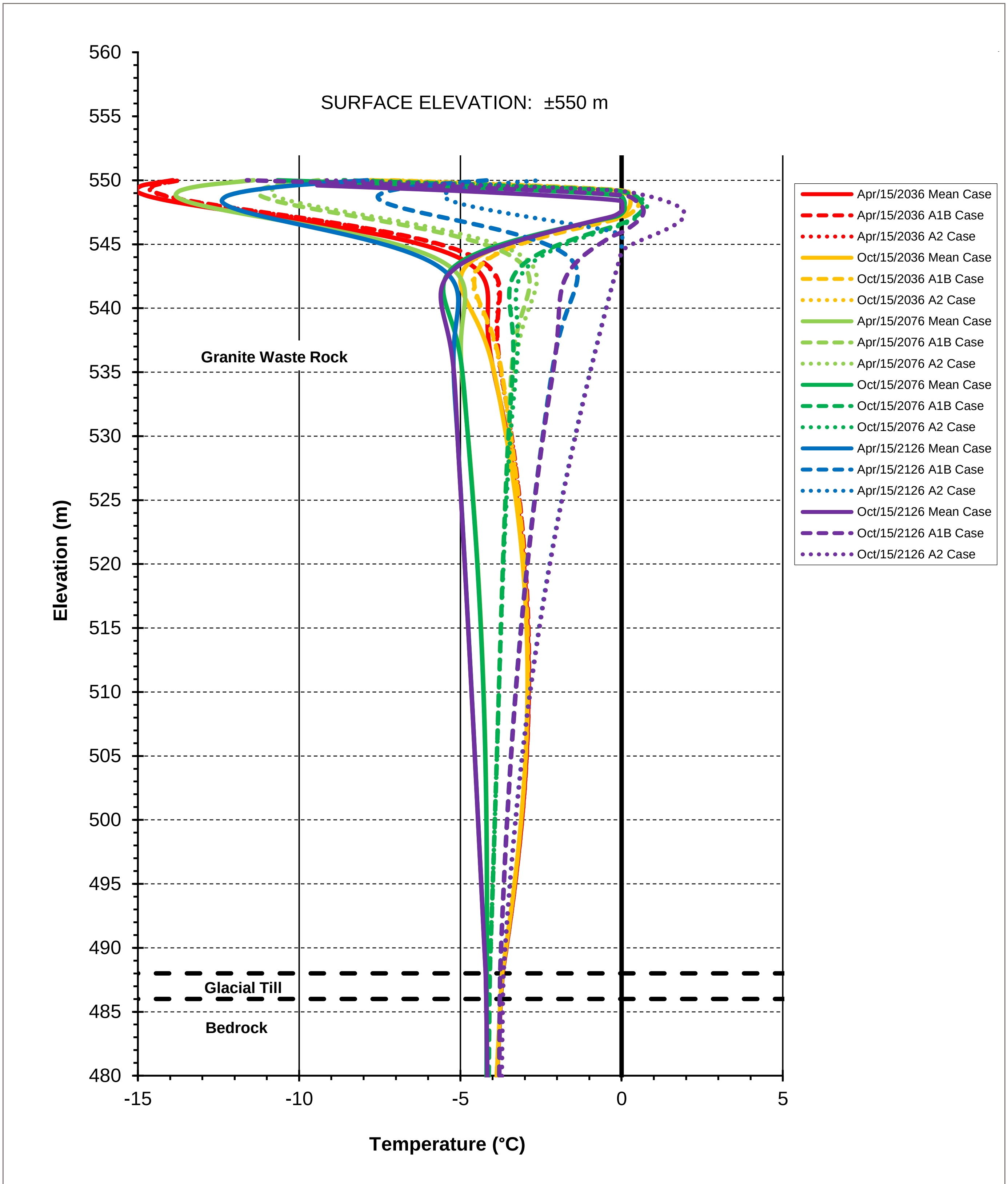
THERMAL EVALUATION OF SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

TYPICAL THAW DEPTH AT THE WEST WRSA UNDER A2 CLIMATE CONDITIONS AFTER 100 YEARS

PROJECT NO.	DWN	CKD	APVD	REV
E14103187-03	CP	HX	GK	0

OFFICE	DATE
EDM	May 2016

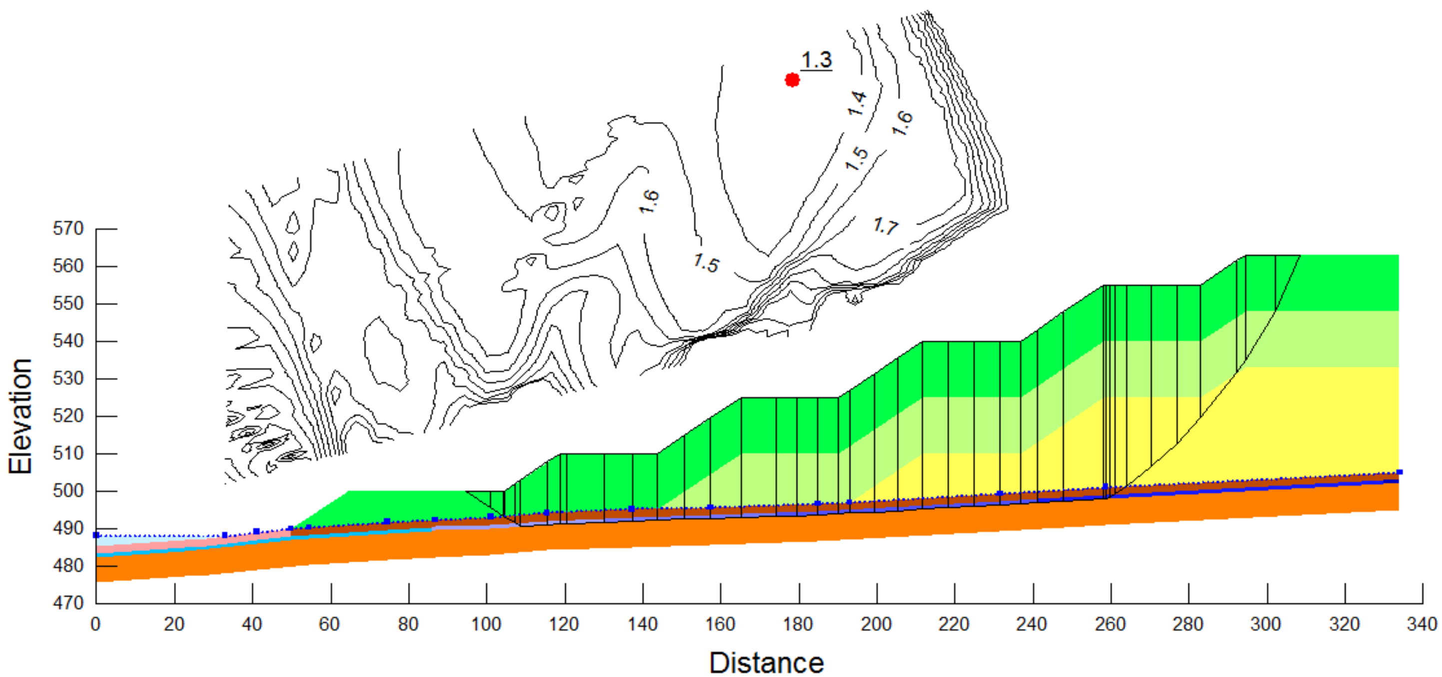
Figure A13



LEGEND	NOTES	CLIENT	THERMAL EVALUATION OF SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT
		DOMINION DIAMOND CORPORATION	TEMPERATURE PROFILES AT THE WEST WRSA AFTER 10, 50 AND 100 YEARS UNDER MEAN, A1B AND A2 CLIMATIC CONDITIONS
	STATUS ISSUED FOR USE	TETRA TECH EBA	

PROJECT NO.	DWN	CKD	APVD	REV	
E14103187-03	CP	HX	GK	0	Figure A14
OFFICE	DATE				
EDM	April 2016				

APPENDIX B
SLOPE STABILITY ANALYSIS RESULTS



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

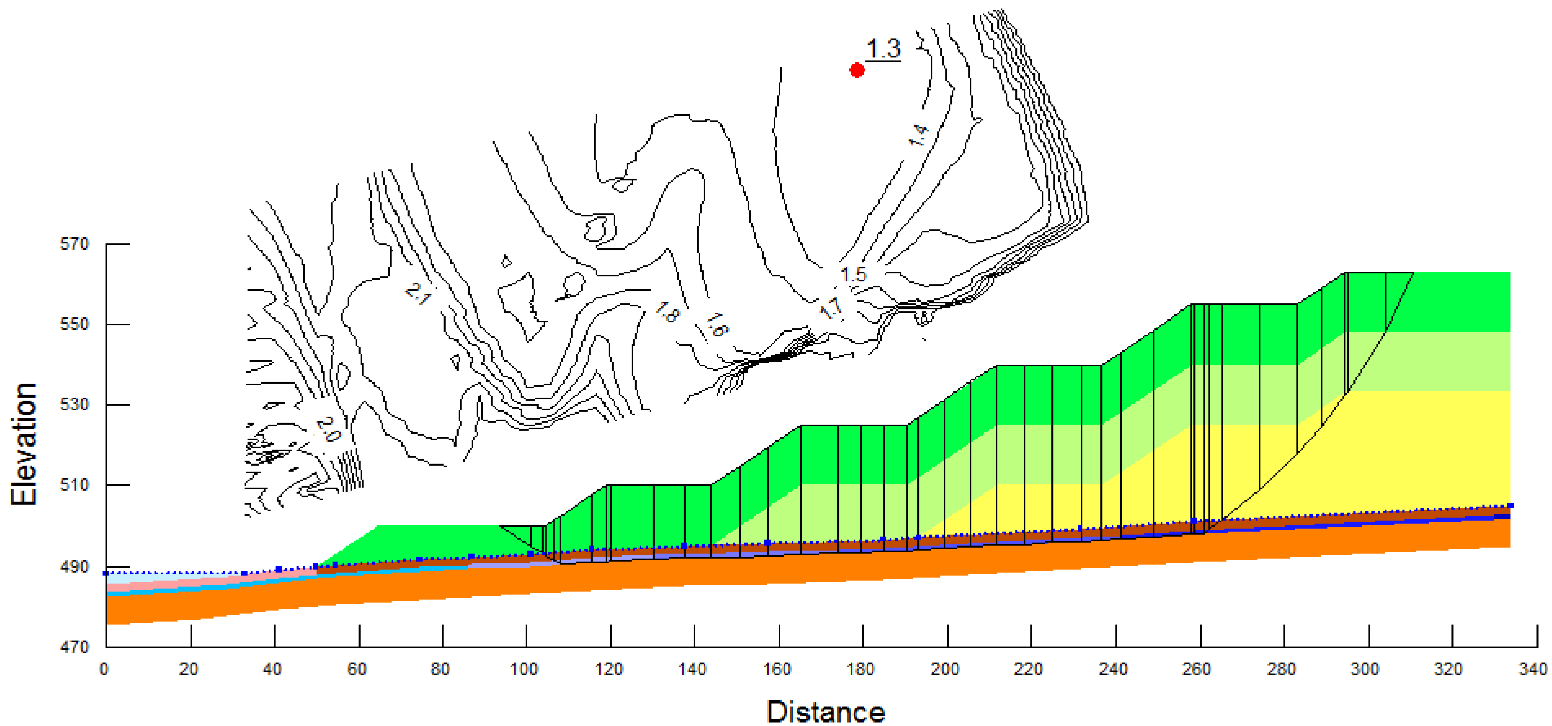
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

South WRSA Section K-K, Ice-Rich Silt, Construction Stage, Frozen Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B1



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

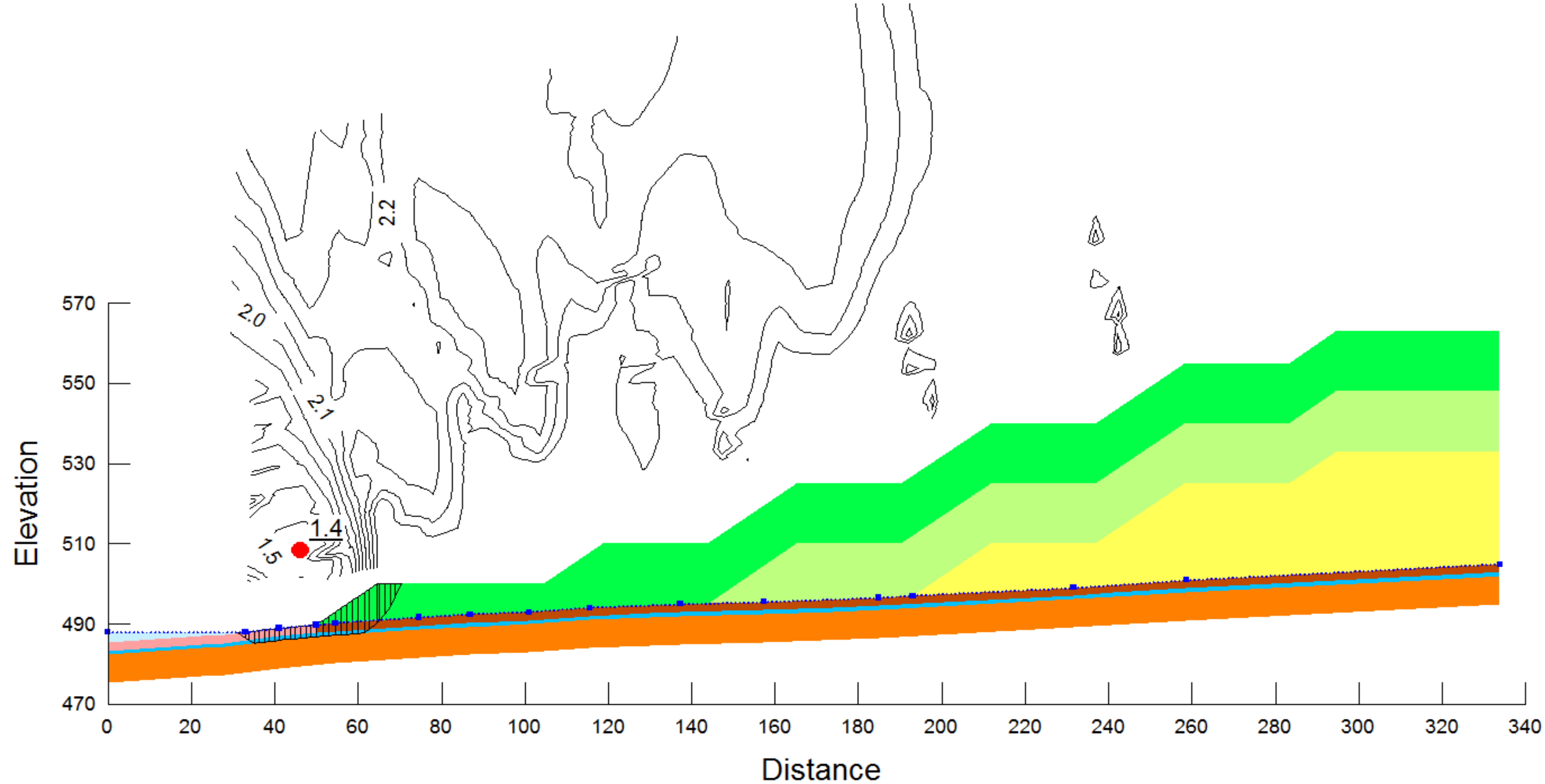
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

South WRSA Section K-K, Ice-Rich Silt, Long-Term, Frozen Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B2



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

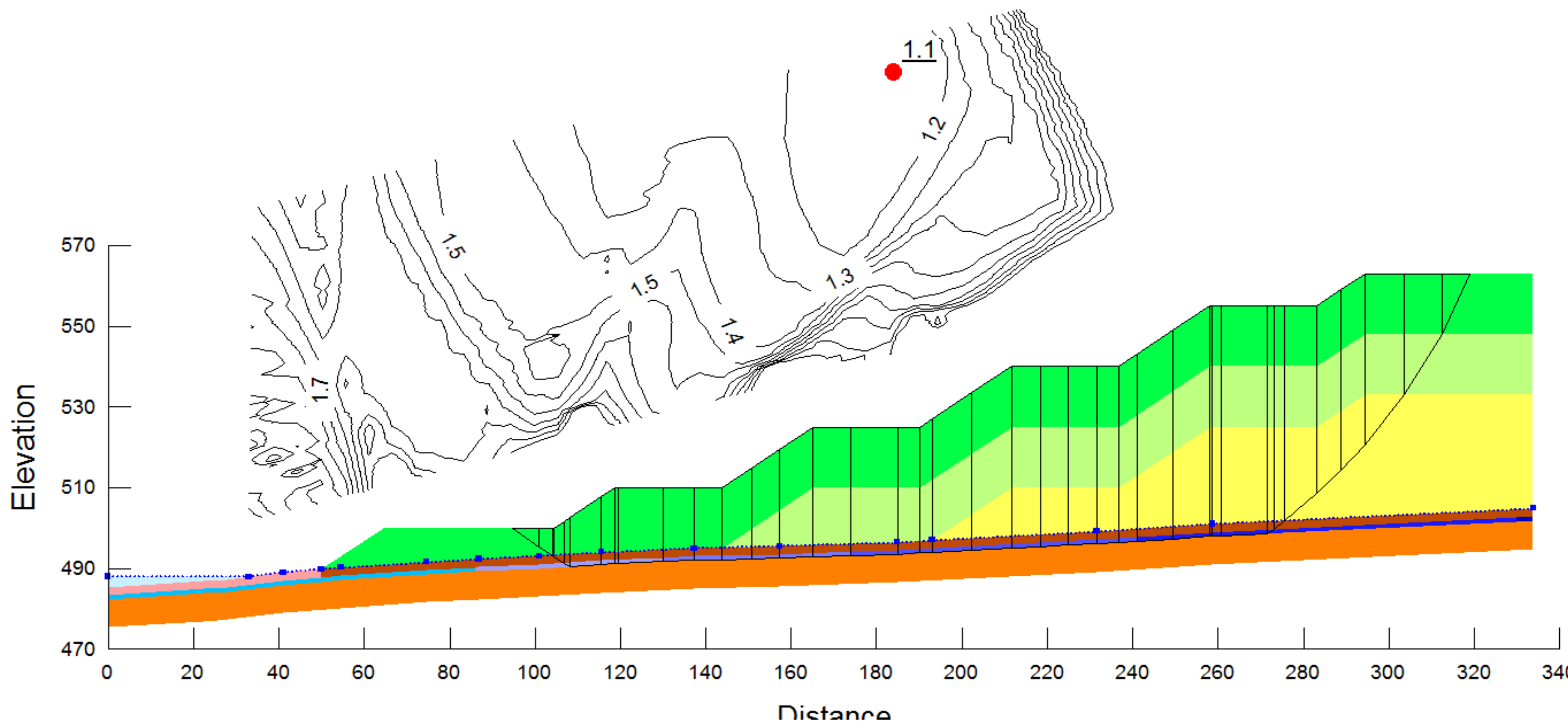
TETRA TECH

SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

South WRSA Section K-K, Ice-Rich Silt, Long-Term, Thawed Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0
OFFICE	DATE			
EDM	March 2018			

Figure B3



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

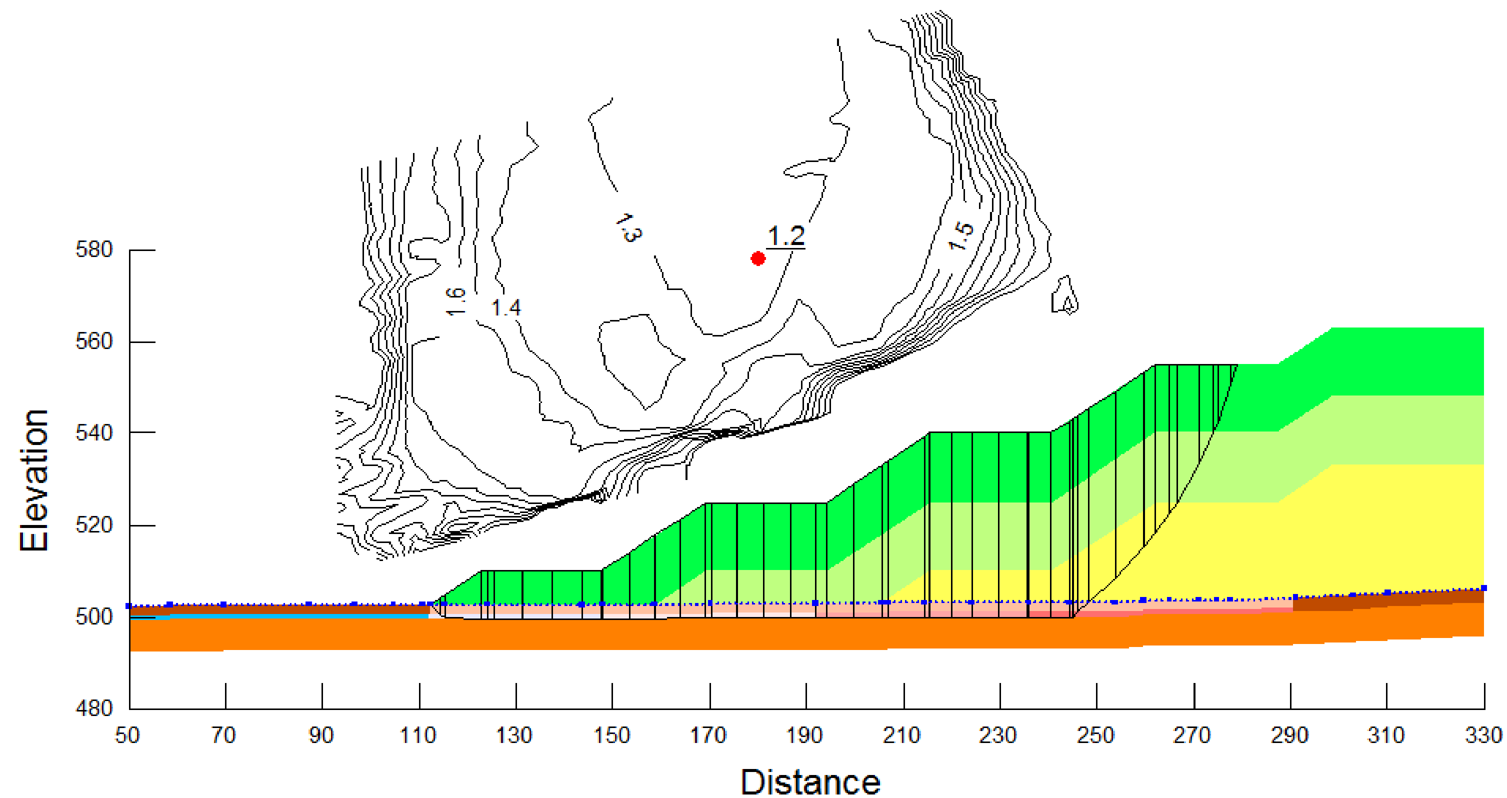
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

South WRSA Section K-K, Ice-Rich Silt, Long-Term, Frozen Conditions, Seismic Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B4



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Sand and Gravel Till
- Silt with Peat
- Thawed Ice-rich Silt
- Peat/Organics
- Ice Rich Peat/Organics Zone 2
- Ice Rich Peat/Organics Zone 3
- Ice Rich Peat/Organics Zone 4
- Ice Rich Peat/Organics Zone 1 (Thawed)

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

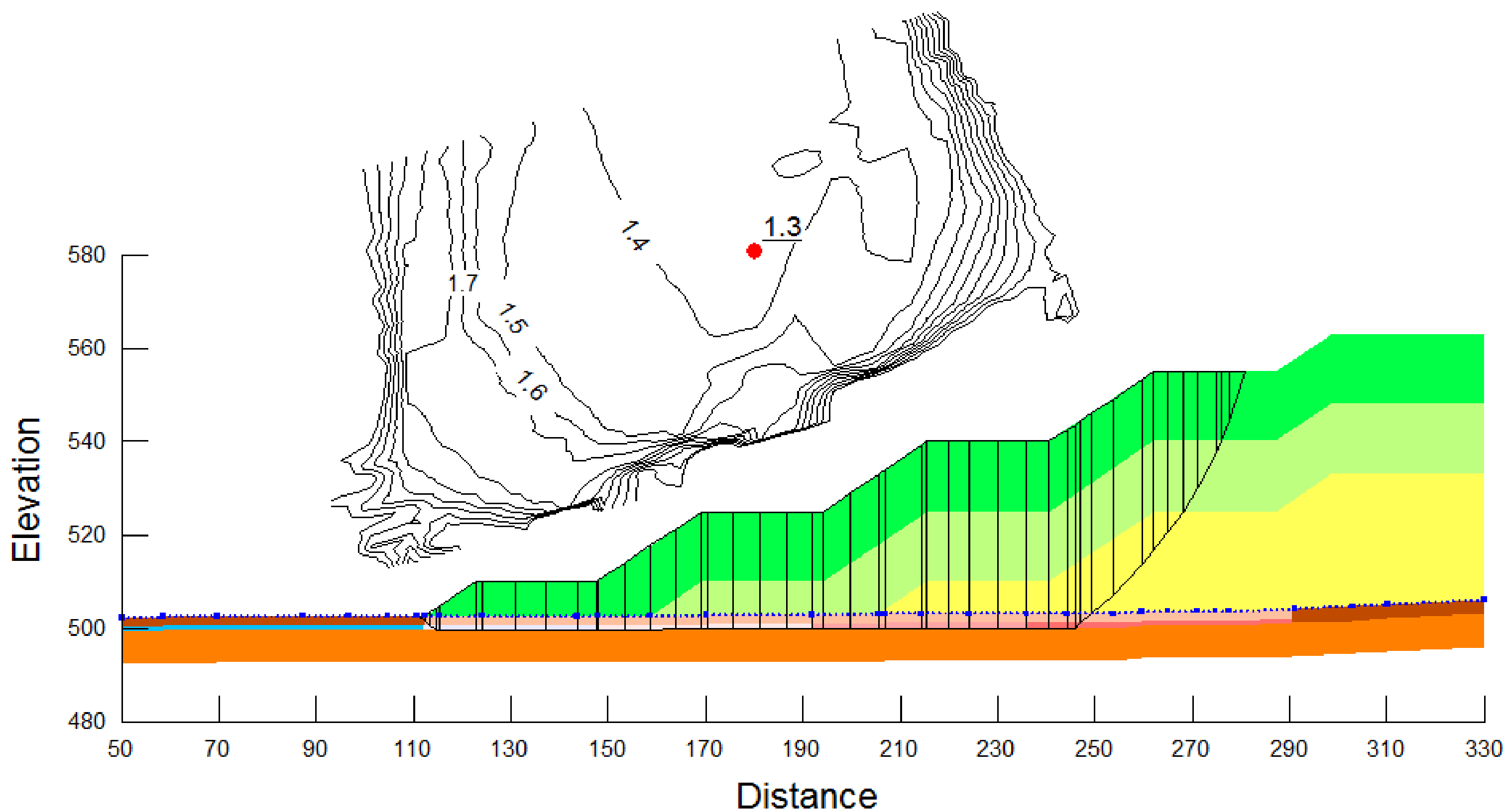
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

South WRSA Section L-L, Frozen Organics, Construction Stage, Frozen Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B5



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Sand and Gravel Till
- Silt with Peat
- Thawed Ice-rich Silt
- Peat/Organics
- Ice Rich Peat/Organics Zone 2
- Ice Rich Peat/Organics Zone 3
- Ice Rich Peat/Organics Zone 4
- Ice Rich Peat/Organics Zone 1 (Thawed)

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

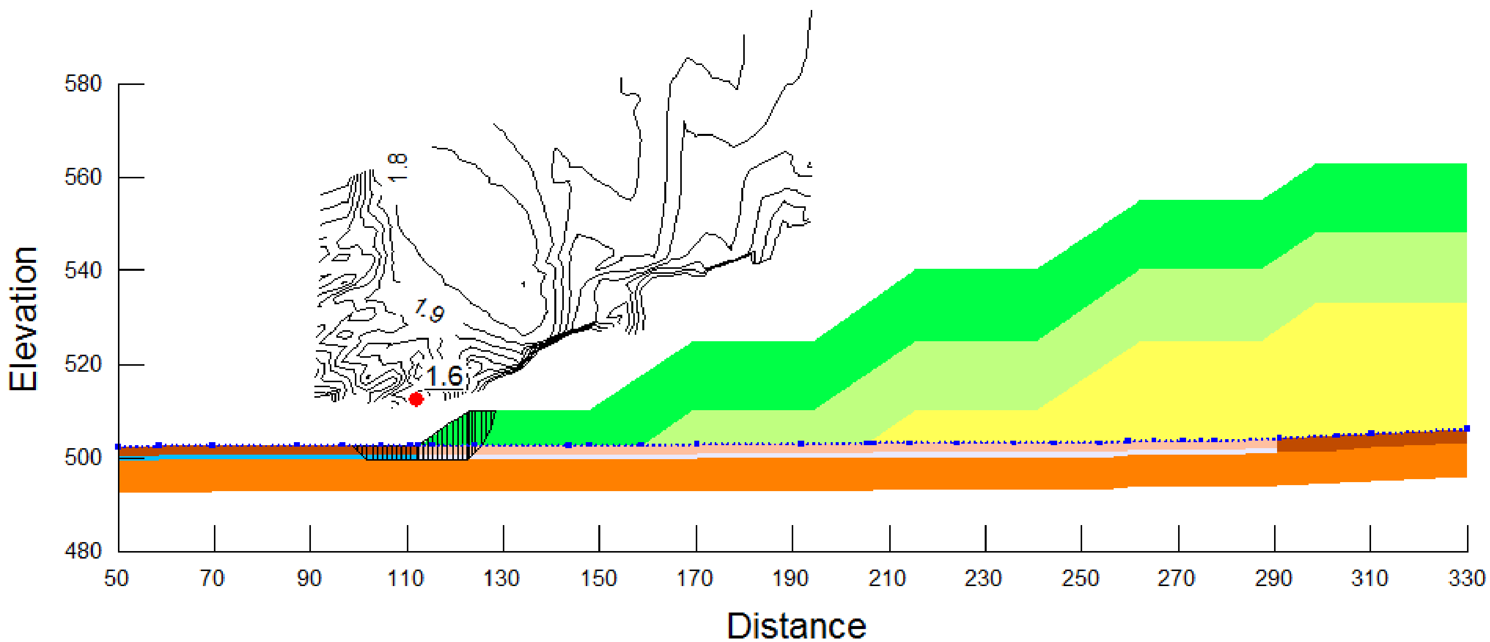
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

South WRSA Section L-L, Frozen Organics, Long-Term, Frozen Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B6



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Sand and Gravel Till
- Silt with Peat
- Thawed Ice-rich Silt
- Peat/Organics
- Ice Rich Peat/Organics Zone 2
- Ice Rich Peat/Organics Zone 3
- Ice Rich Peat/Organics Zone 4
- Ice Rich Peat/Organics Zone 1 (Thawed)

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

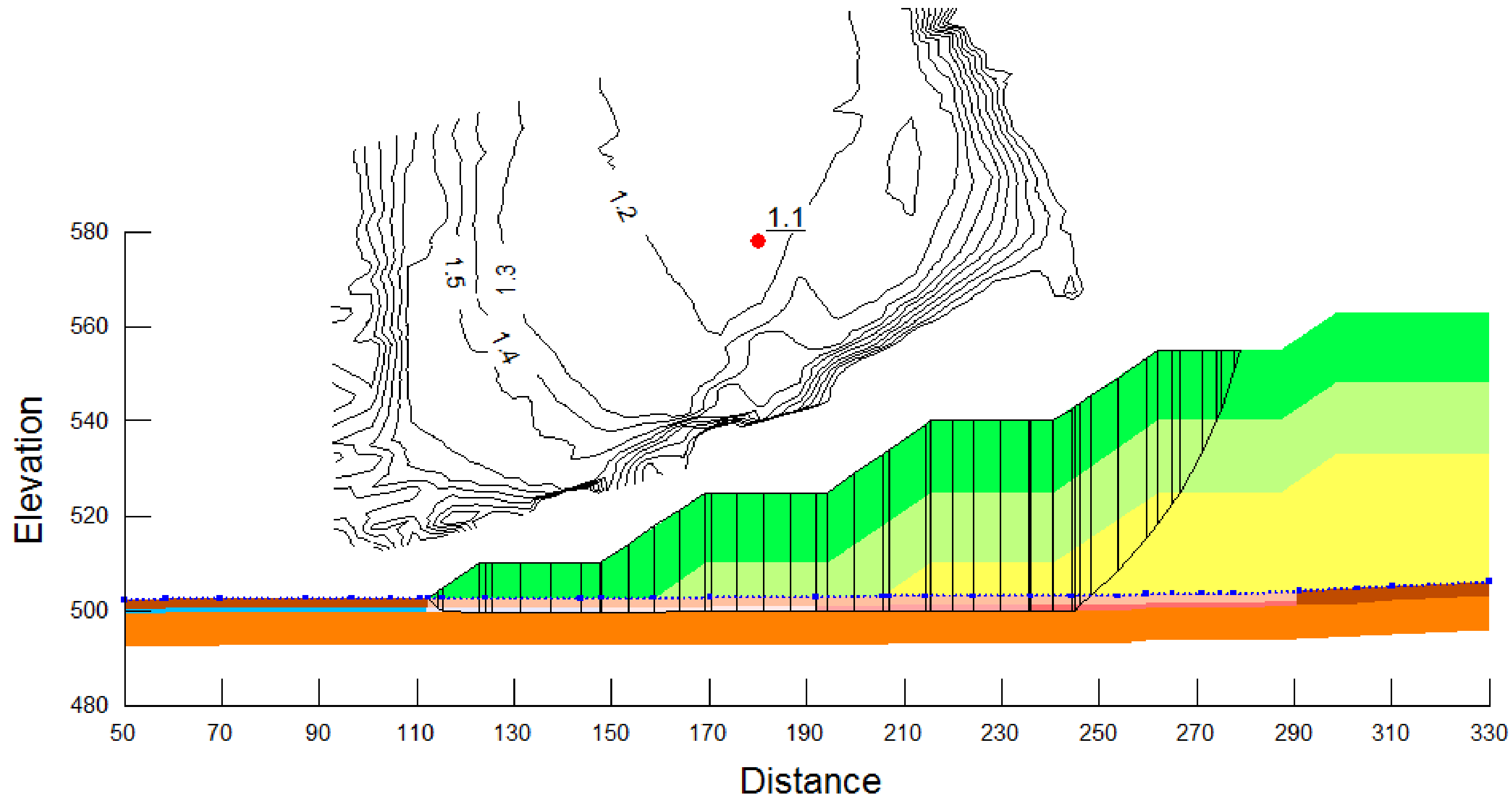
Dominion Diamond Mines

TETRA TECH

SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

South WRSA Section L-L, Frozen Organics, Long-Term, Thawed Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV	
E14103187-05	JL	EAG	GDK	0	**Figure B7**
OFFICE	DATE				
EDM	March 2018				



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Sand and Gravel Till
- Silt with Peat
- Thawed Ice-rich Silt
- Peat/Organics
- Ice Rich Peat/Organics Zone 2
- Ice Rich Peat/Organics Zone 3
- Ice Rich Peat/Organics Zone 4
- Ice Rich Peat/Organics Zone 1 (Thawed)

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

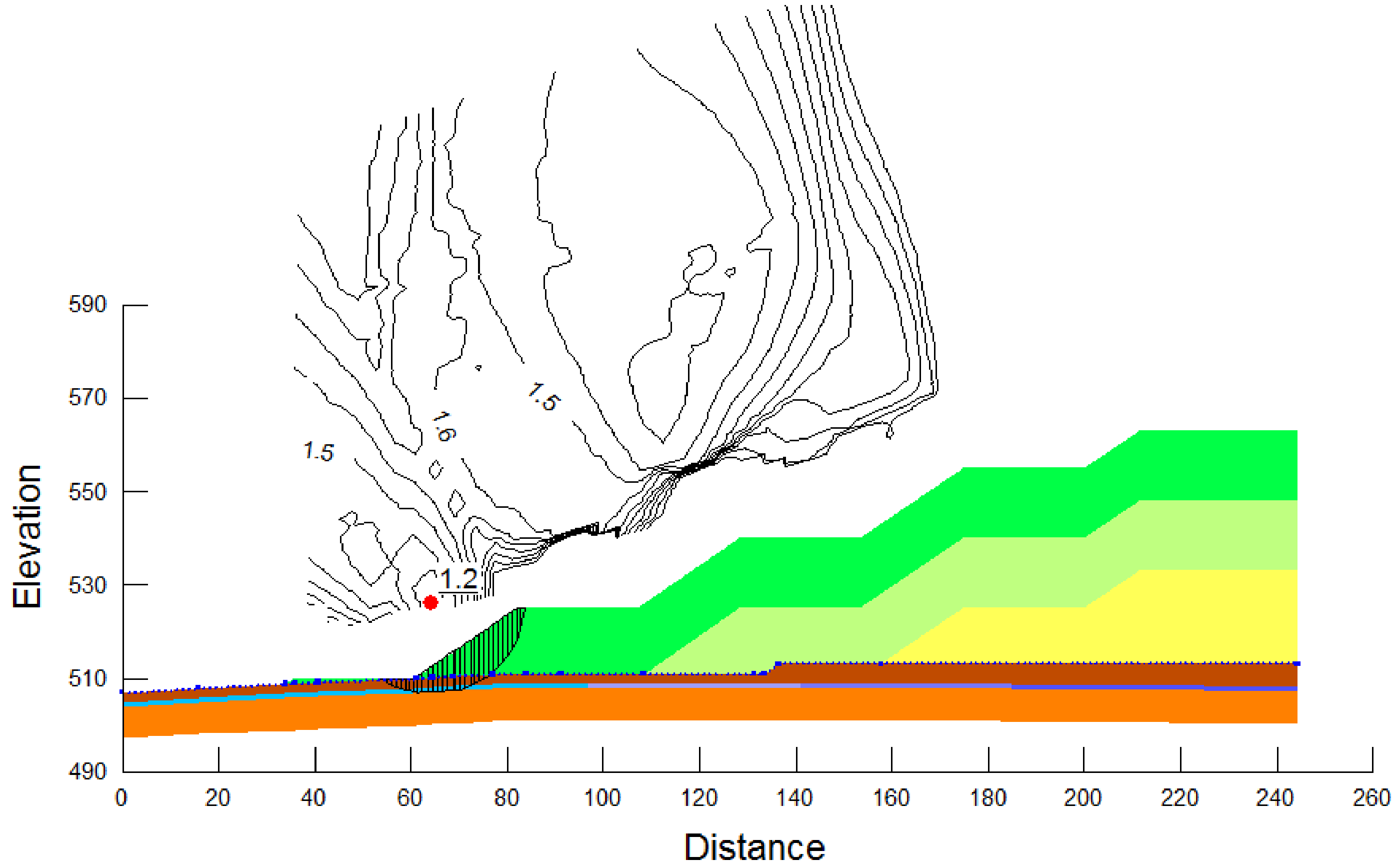
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

South WRSA Section L-L, Frozen Organics, Long-Term, Frozen Conditions, Seismic Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B8



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

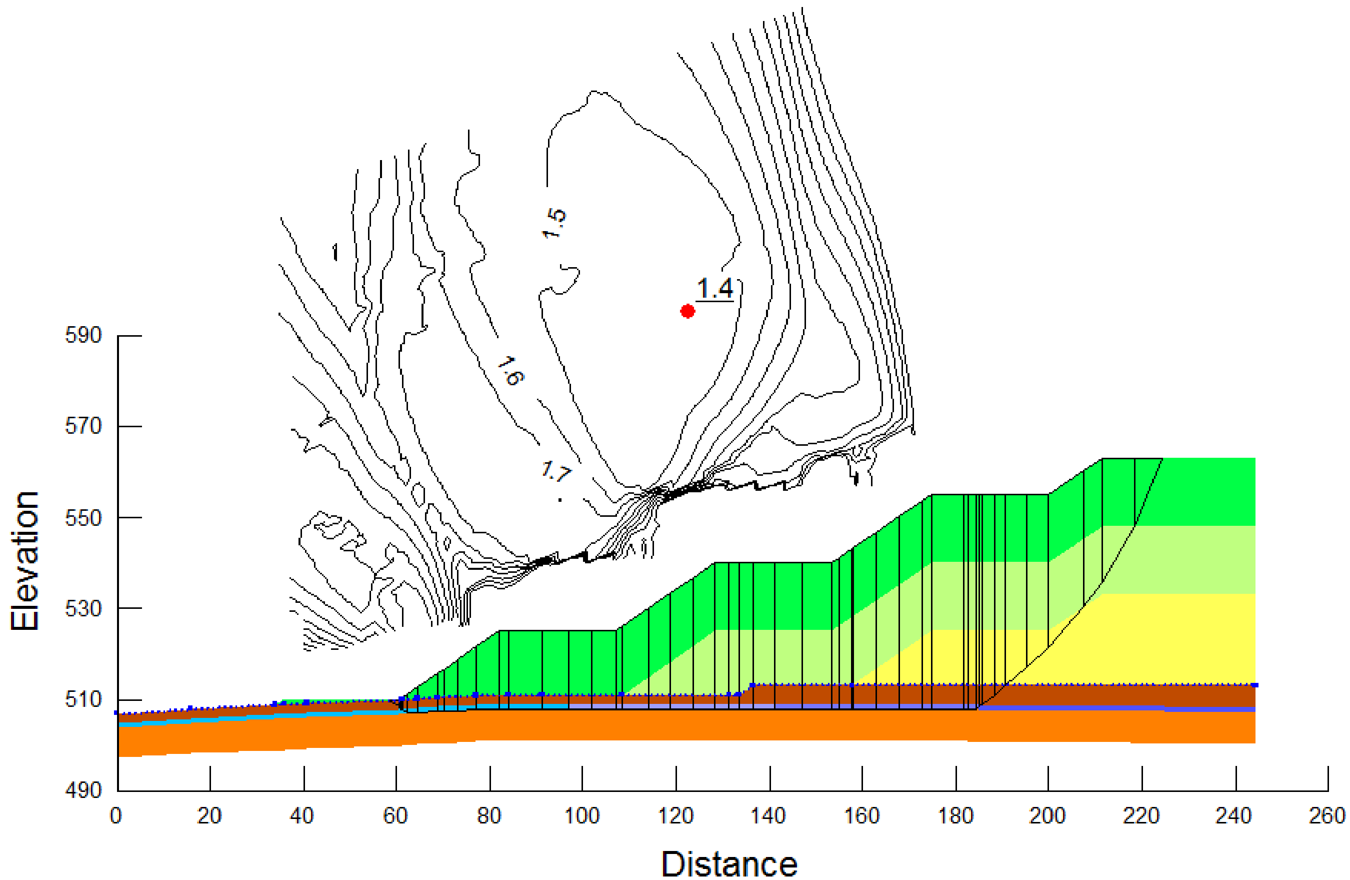
Dominion Diamond Mines

TETRA TECH

SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

South WRSA Section M-M, Ice-Rich Silt, Construction Stage, Frozen Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV	
E14103187-05	JL	EAG	GDK	0	**Figure B9**
OFFICE	DATE				
EDM	March 2018				



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

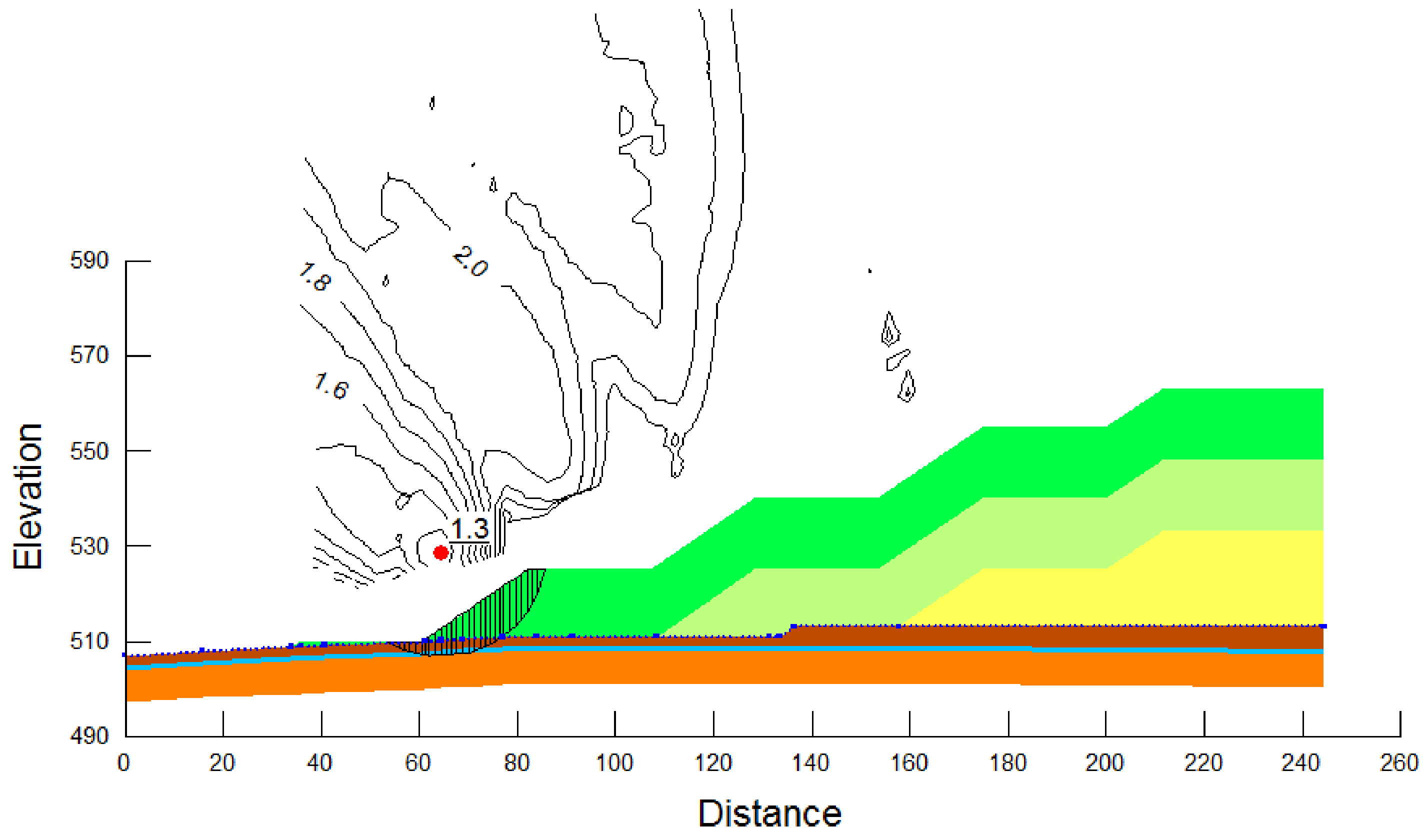
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

South WRSA Section M-M, Ice-Rich Silt, Long-Term, Frozen Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B10



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

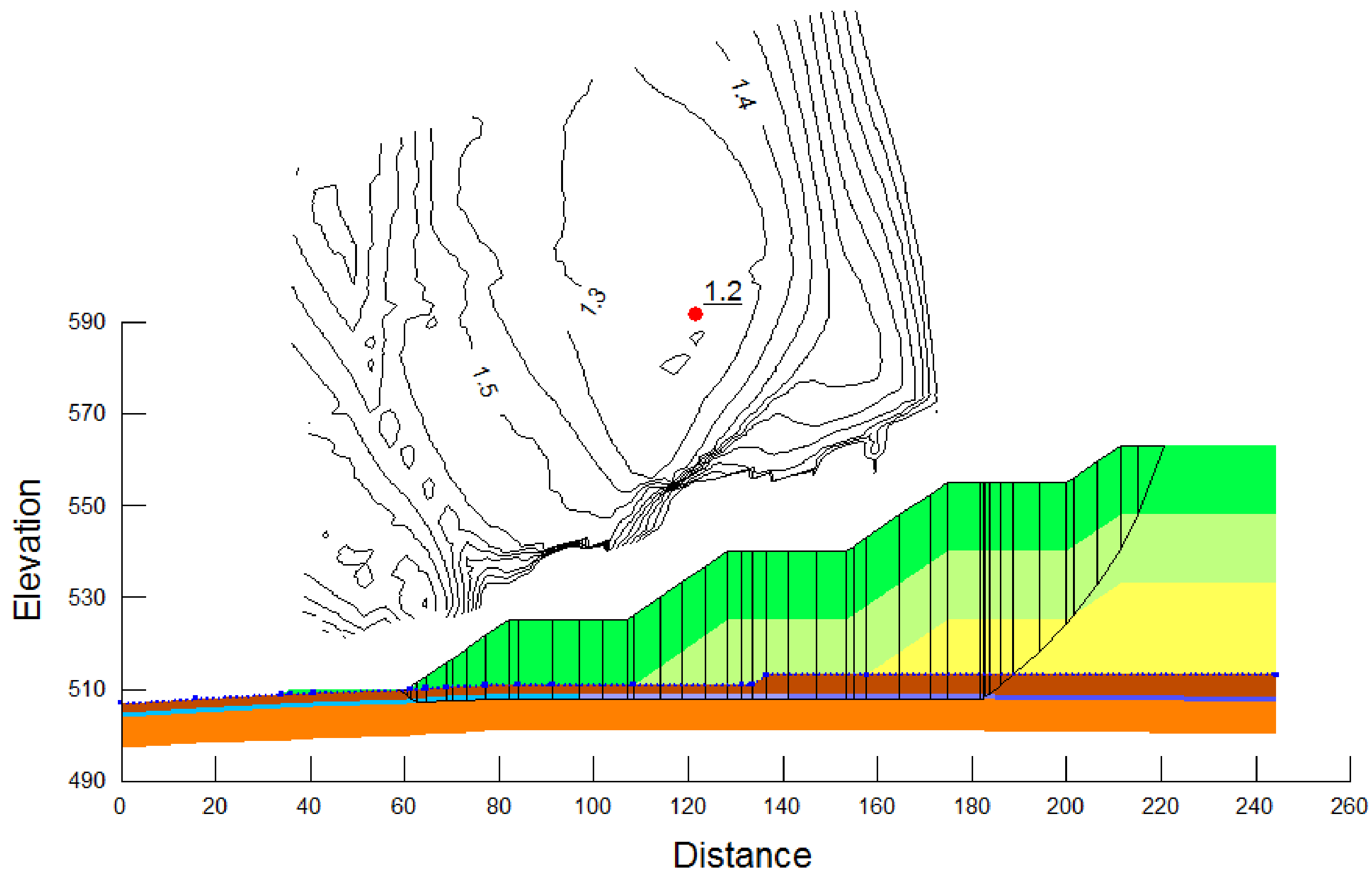
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

South WRSA Section M-M, Ice-Rich Silt, Long-Term, Thawed Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B11



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

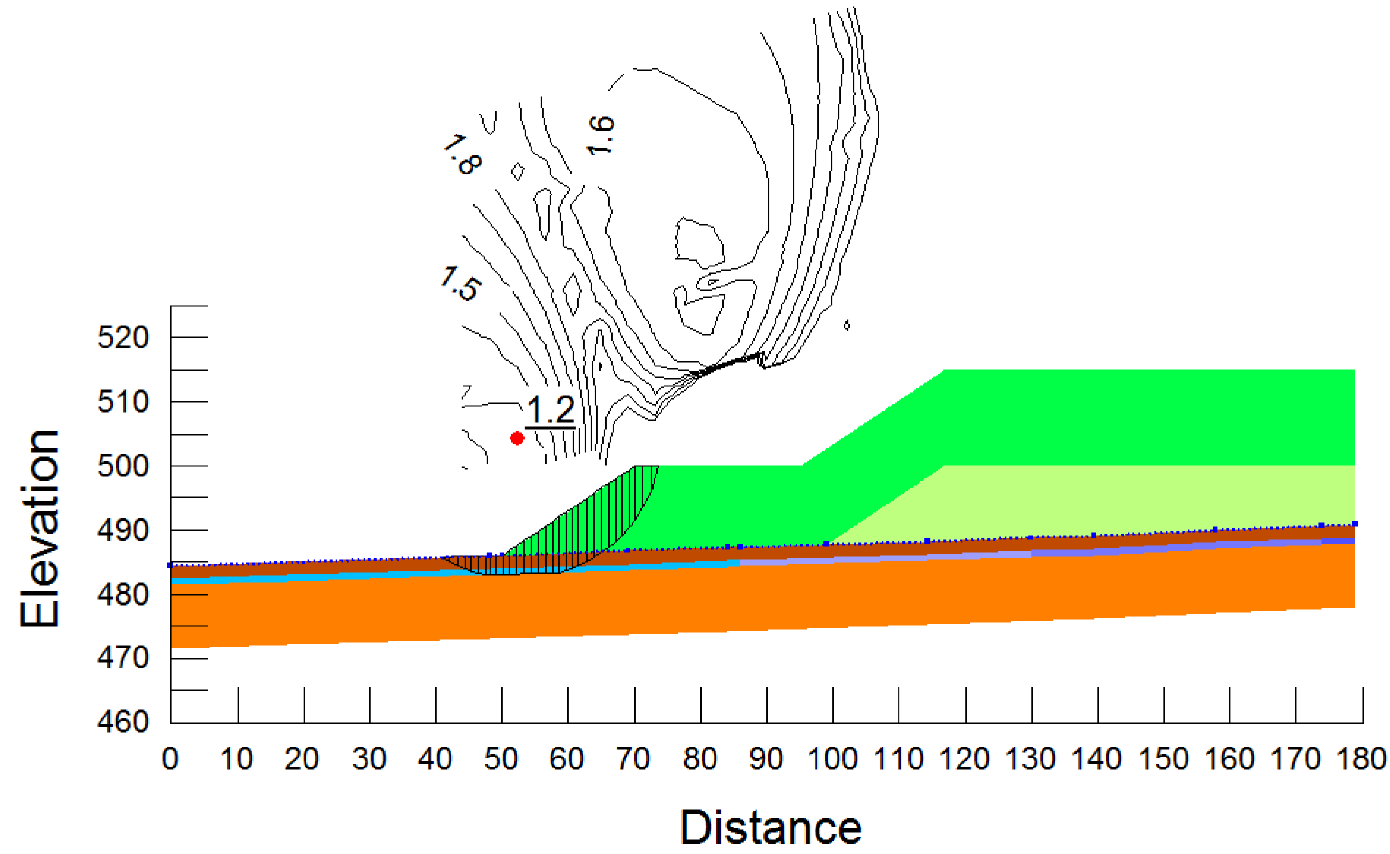
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

South WRSA Section M-M, Ice-Rich Silt, Long-Term, Frozen Conditions, Seismic Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B12



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

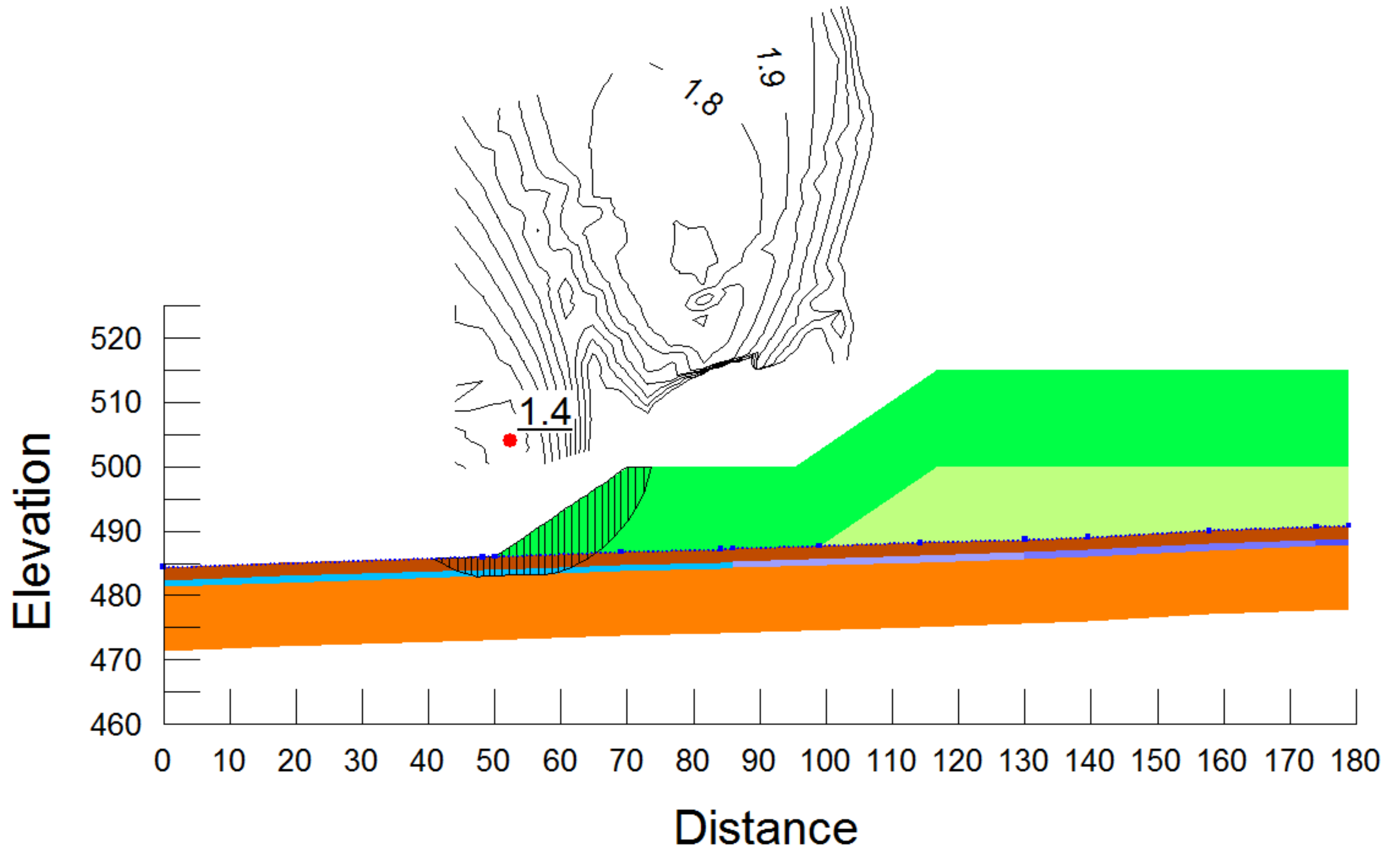
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

South WRSA Section N-N, Ice-Rich Silt, Construction Stage, Frozen Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B13



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

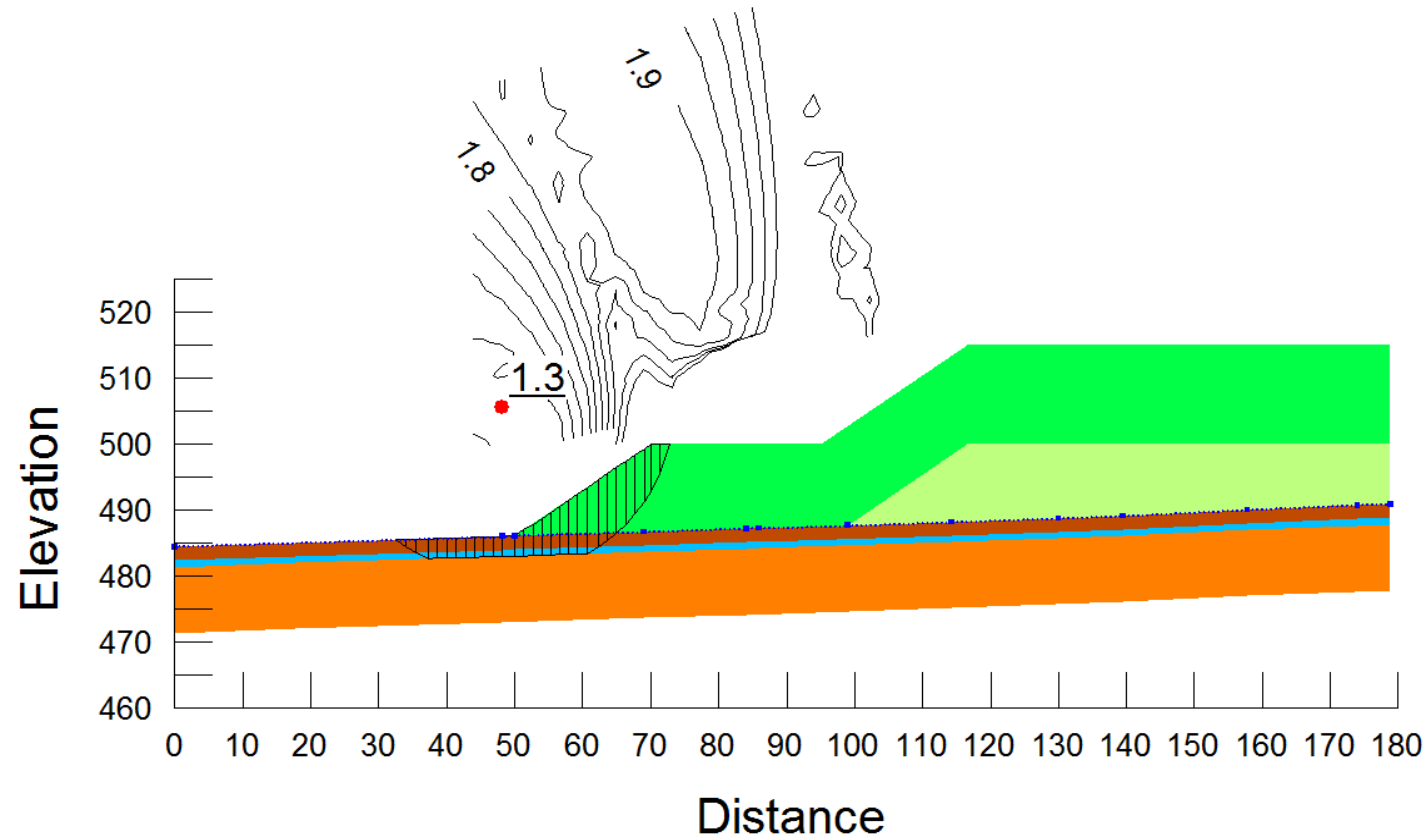
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

South WRSA Section N-N, Ice-Rich Silt, Long-Term, Frozen Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B14



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

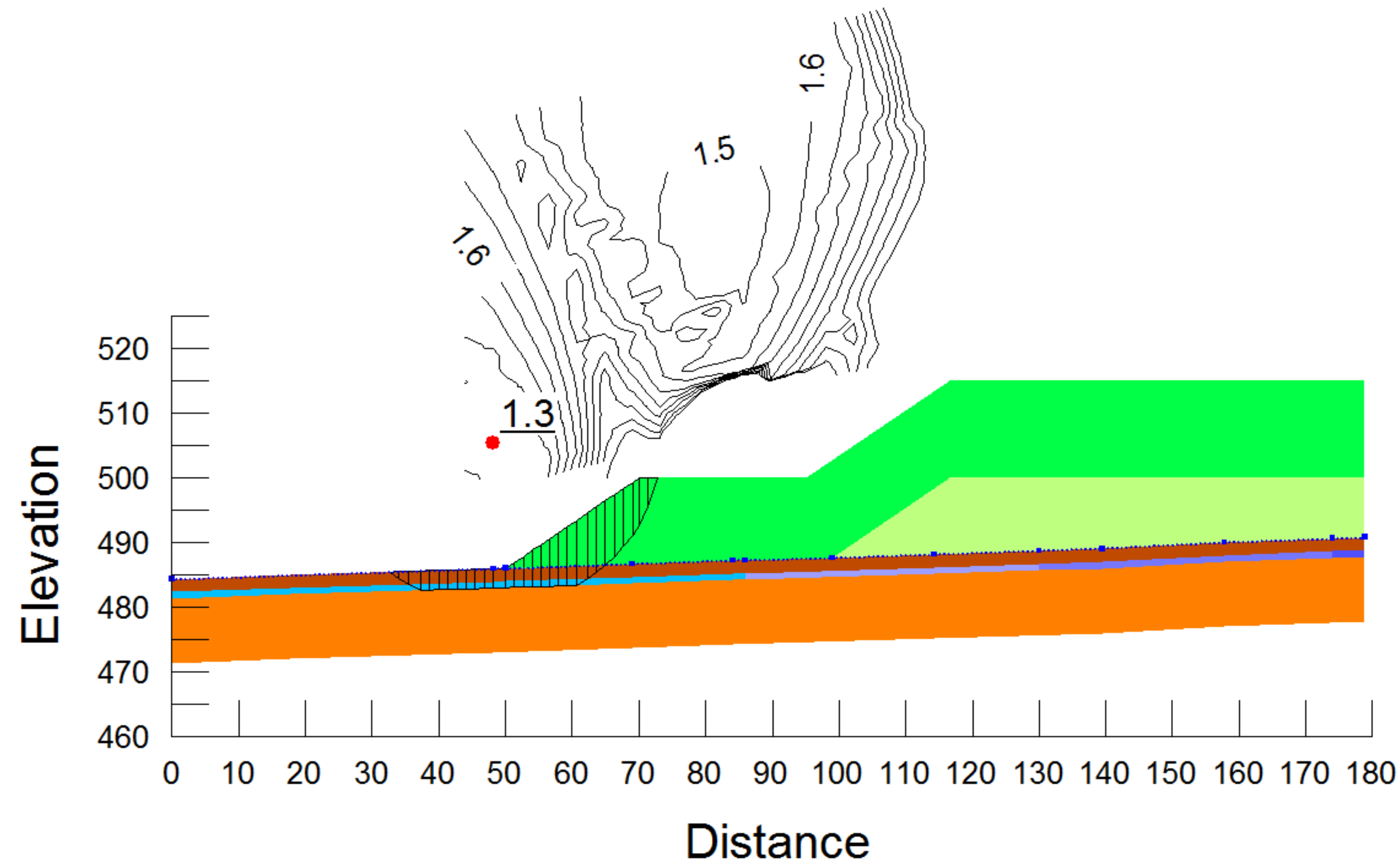
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

South WRSA Section N-N, Ice-Rich Silt, Long-Term, Thawed Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B15



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

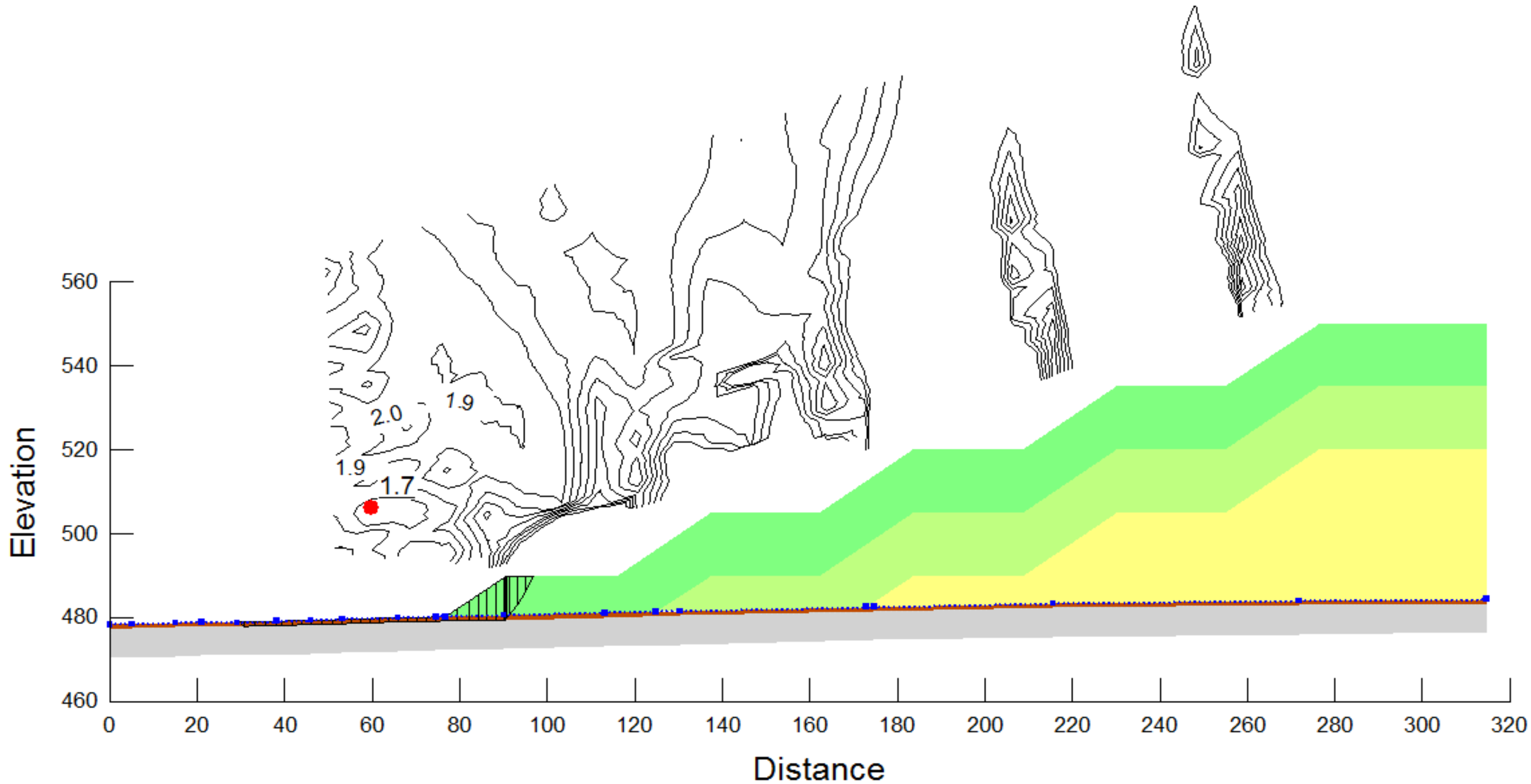
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

South WRSA Section N-N, Ice-Rich Silt, Long-Term, Frozen Conditions, Seismic Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B16



LEGEND

Materials

- Waste Rock Zone 3
- Waste Rock Zone 2
- Waste Rock Zone 1
- Silt with Peat
- Bedrock

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

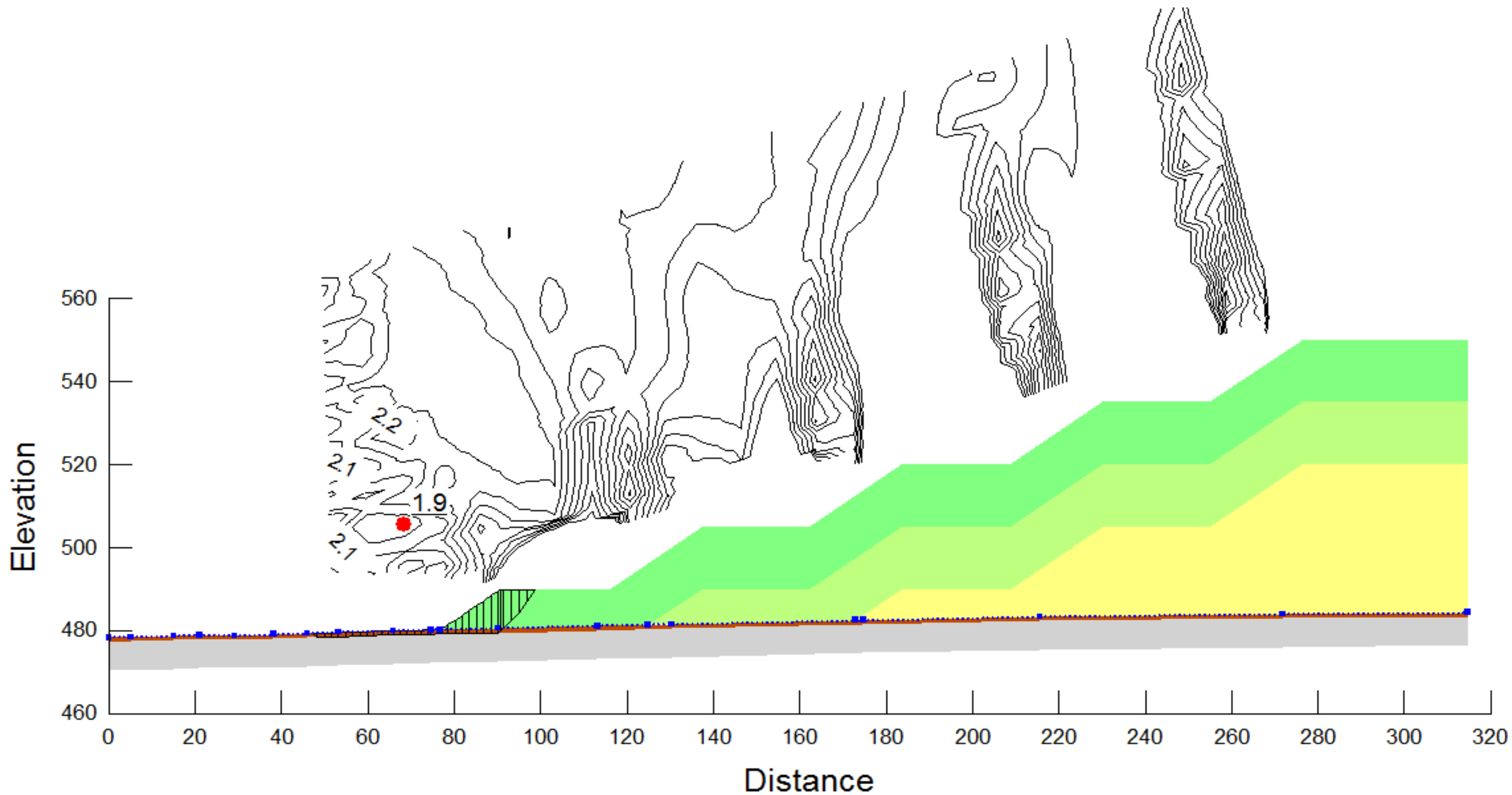
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

West WRSA Section O-O, Construction Stage, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B17



LEGEND

Materials

- Waste Rock Zone 3
- Waste Rock Zone 2
- Waste Rock Zone 1
- Silt with Peat
- Bedrock

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

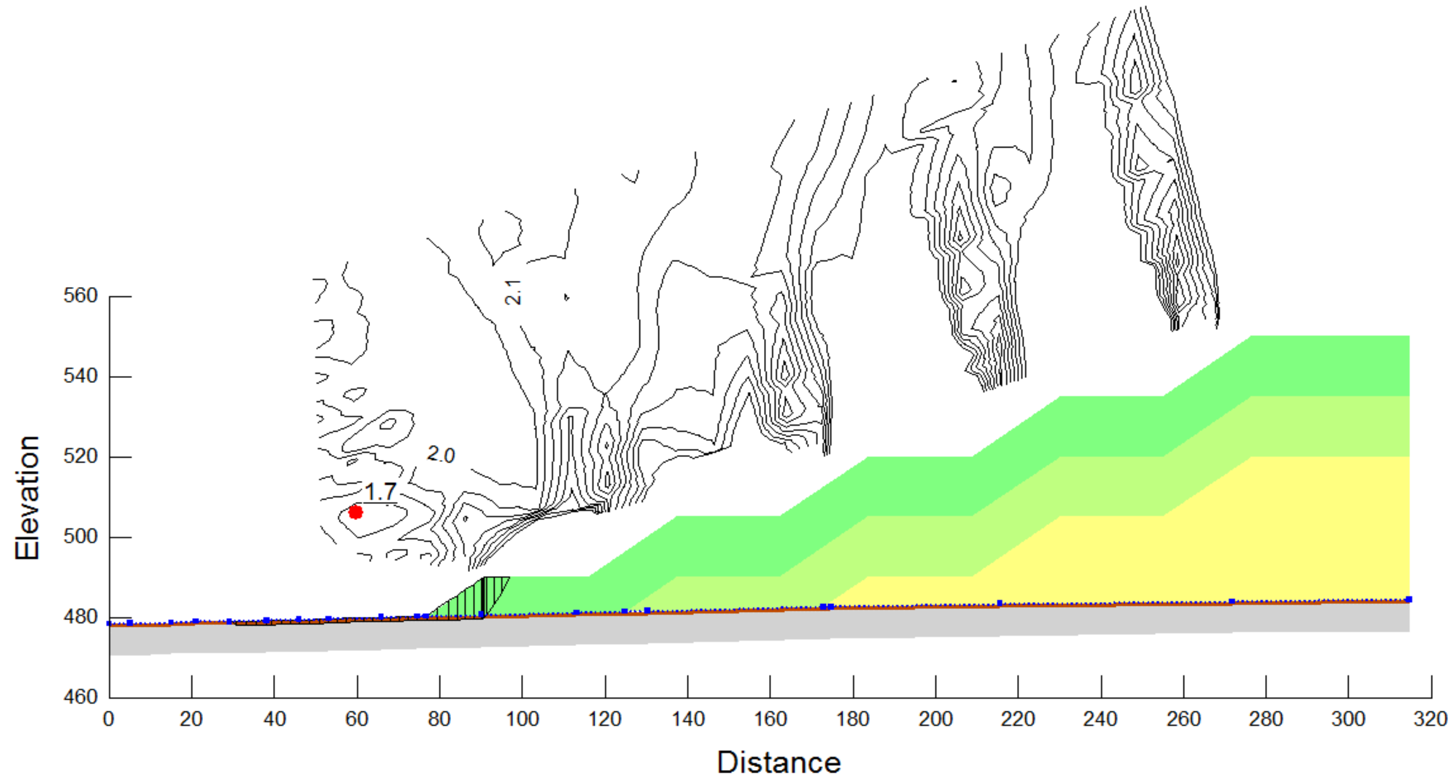
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

West WRSA Section O-O, Long-Term, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B18



LEGEND

Materials

- Waste Rock Zone 3
- Waste Rock Zone 2
- Waste Rock Zone 1
- Silt with Peat
- Bedrock

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

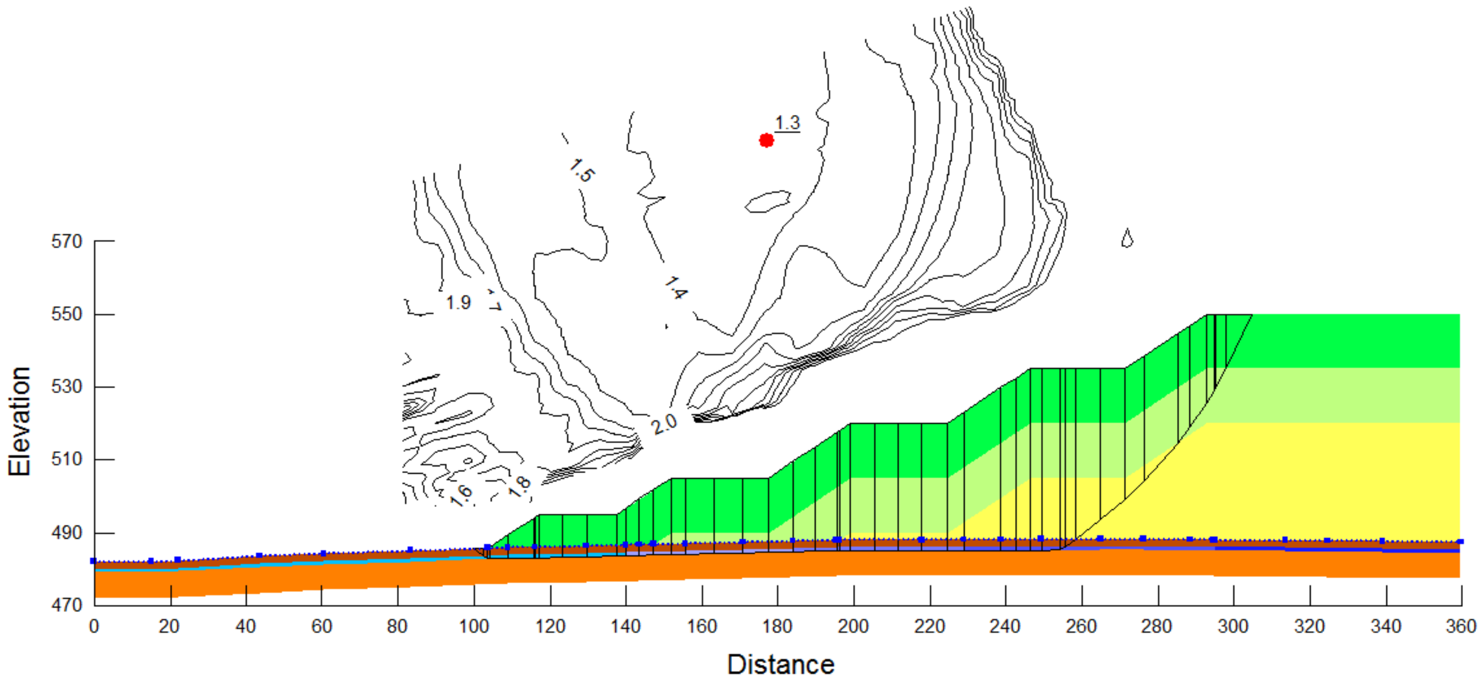
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

West WRSA Section O-O, Long-Term, Seismic Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B19



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

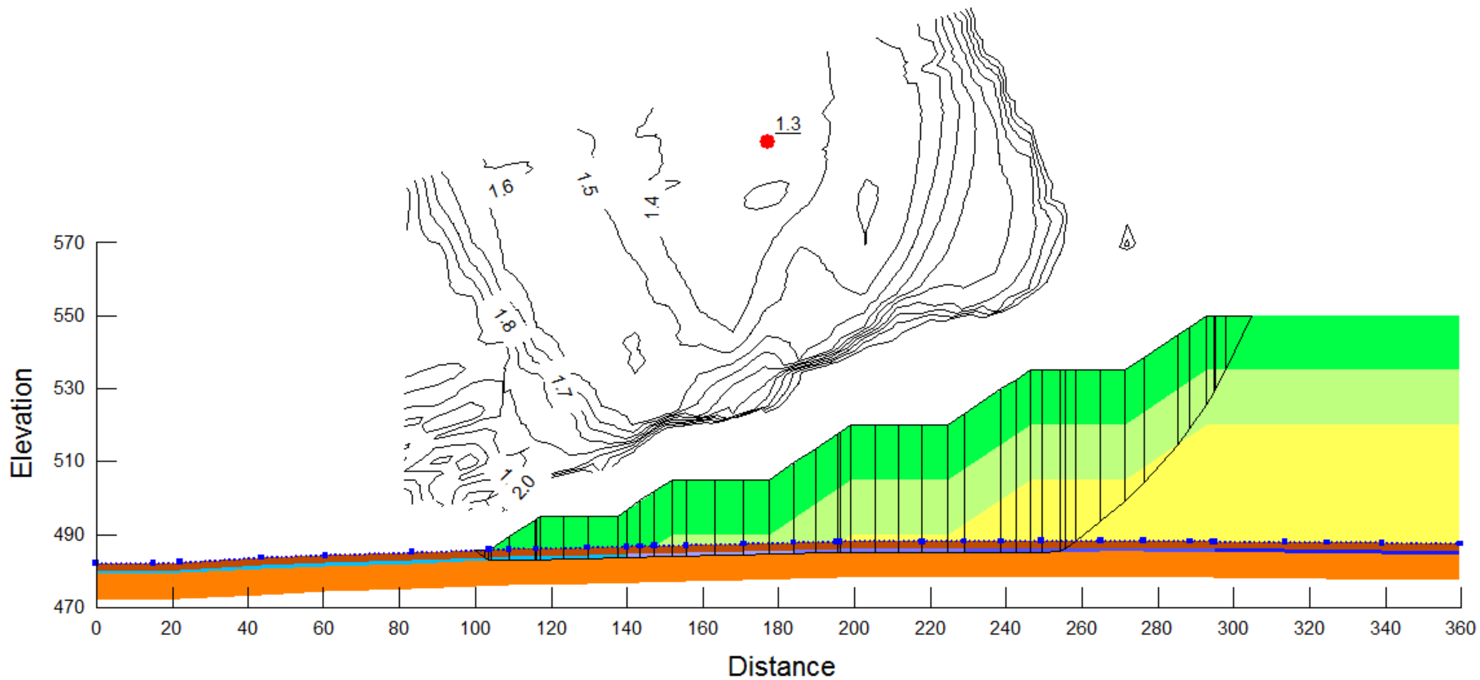
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

West WRSA Section P-P, Ice-Rich Silt, Construction Stage, Frozen Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B20



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

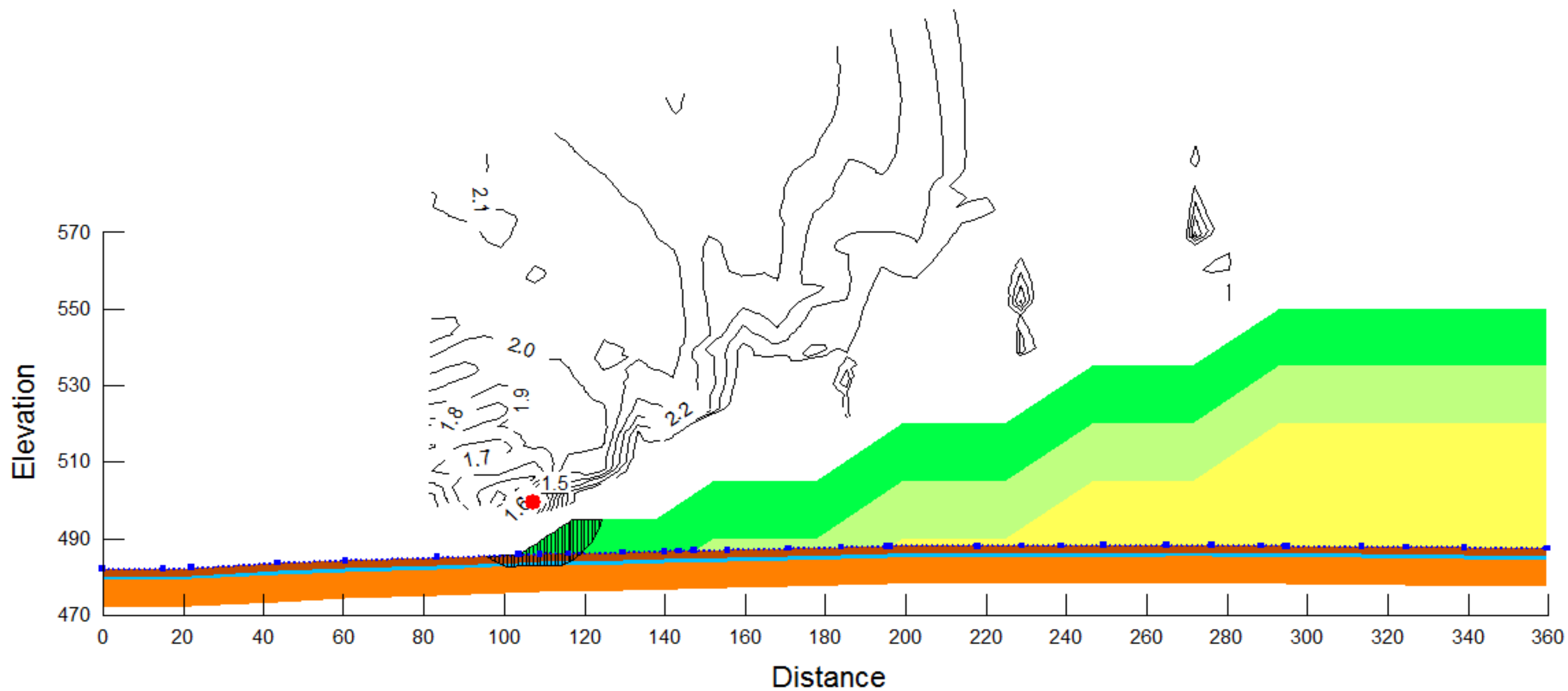
TETRA TECH

SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

West WRSA Section P-P, Ice-Rich Silt, Long-Term, Frozen Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0
OFFICE	DATE			
EDM	March 2018			

Figure B21



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

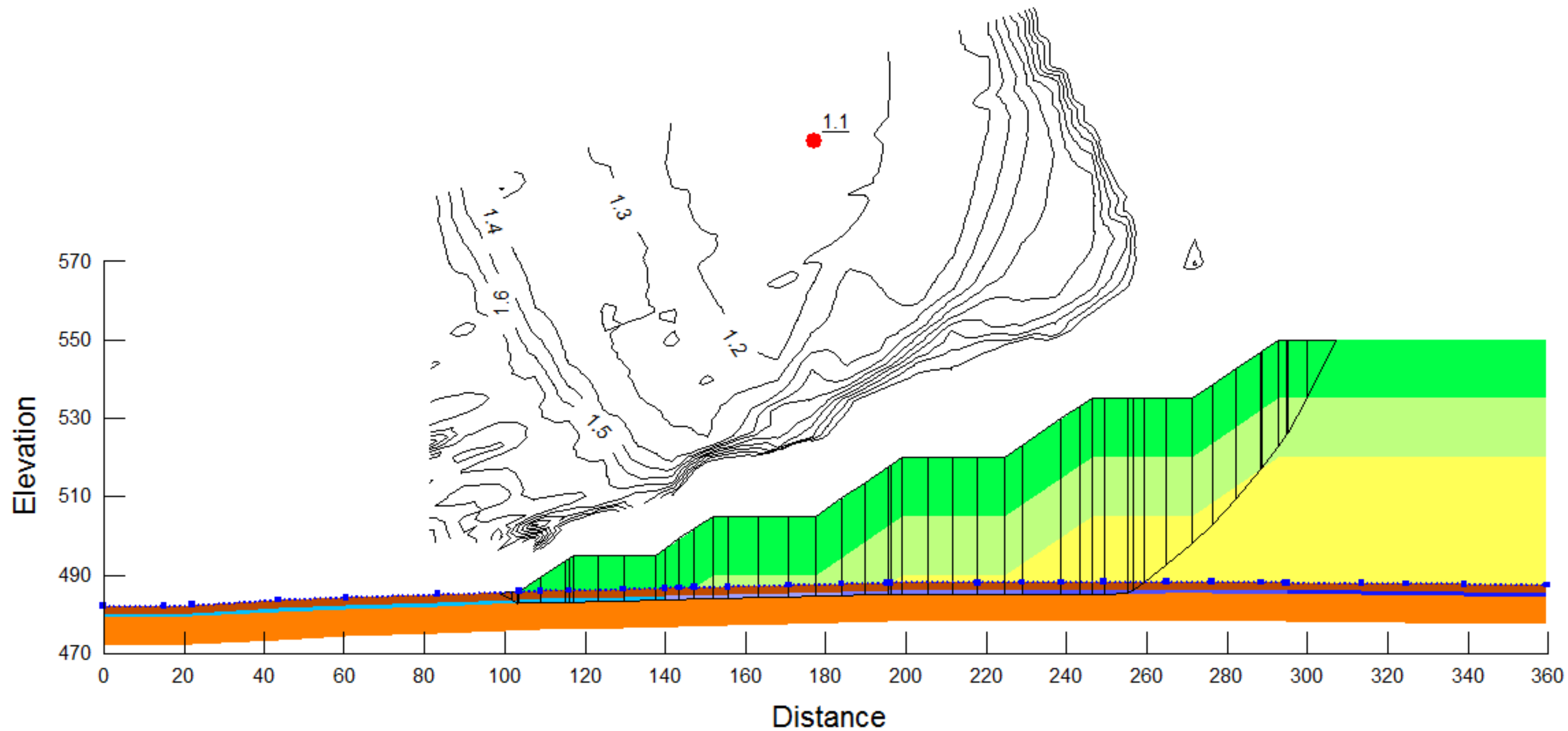
TETRA TECH

SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

West WRSA Section P-P, Ice-Rich Silt, Long-Term, Thawed Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0
OFFICE	DATE			
EDM	March 2018			

Figure B22



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

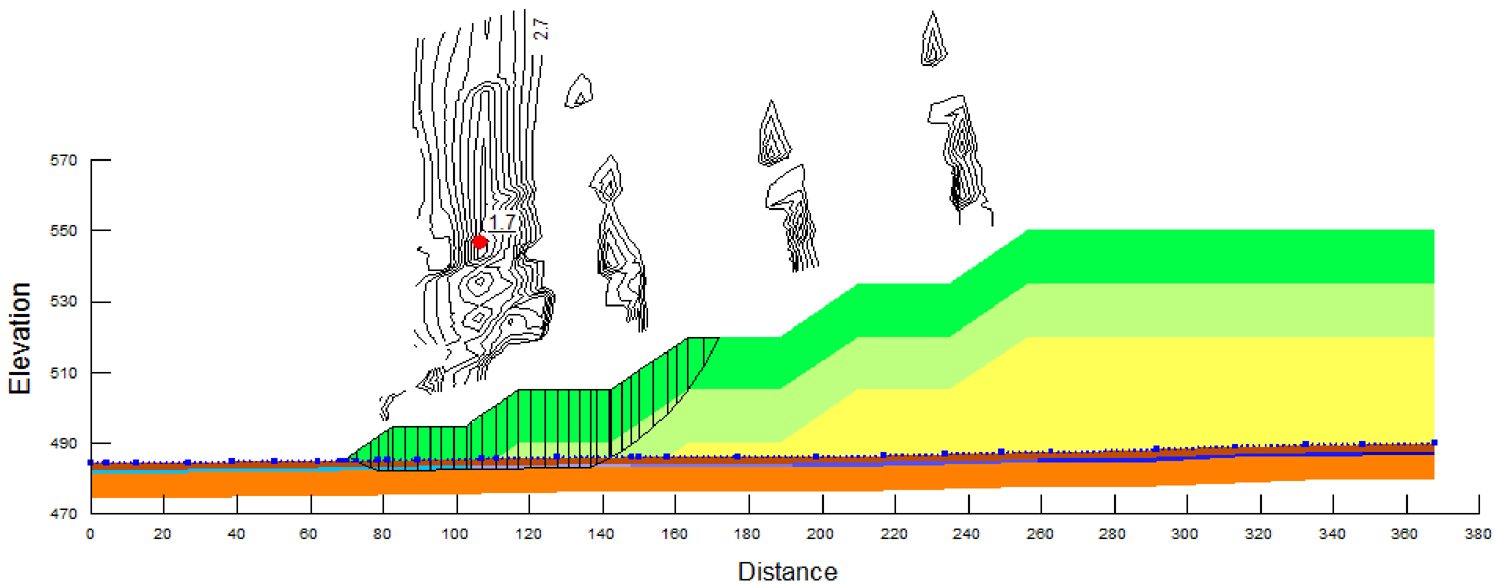
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

West WRSA Section P-P, Ice-Rich Silt, Long-Term, Frozen Conditions, Seismic Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B23



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

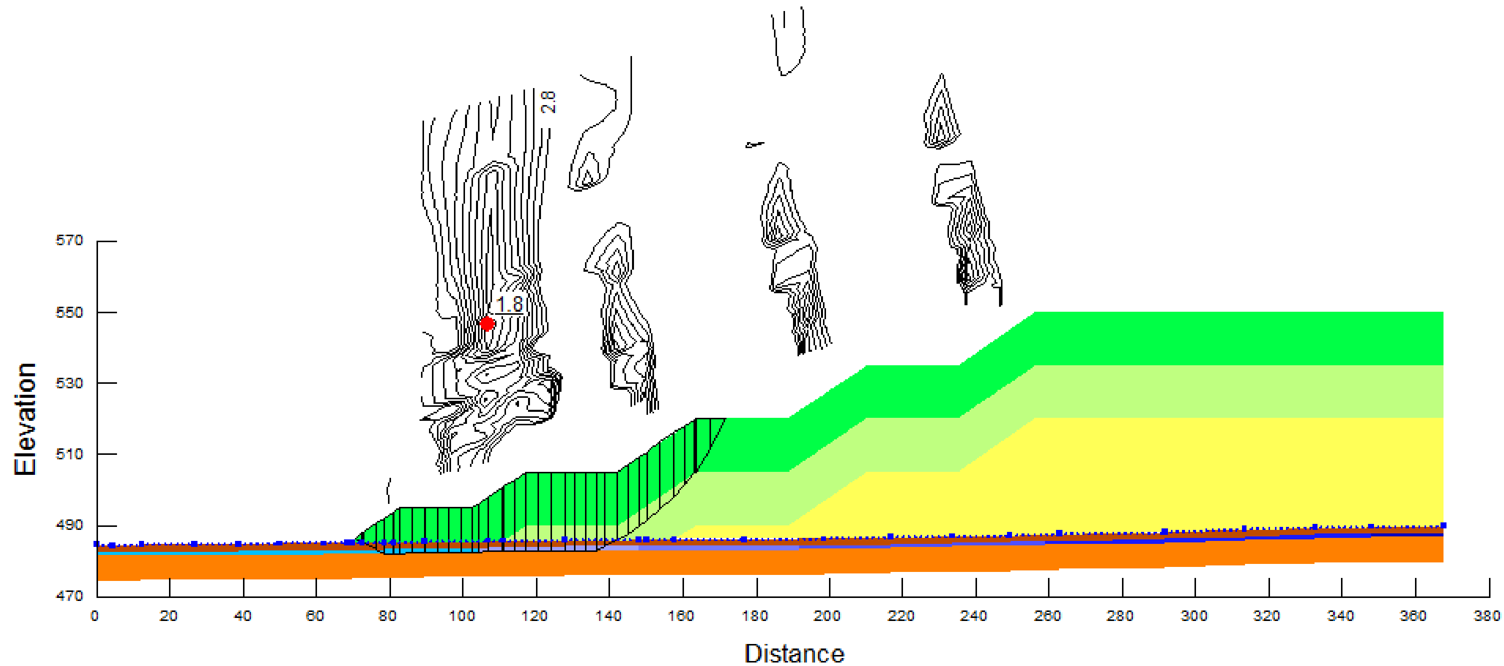
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

West WRSA Section Q-Q, Ice-Rich Silt, Construction Stage, Frozen Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B24



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

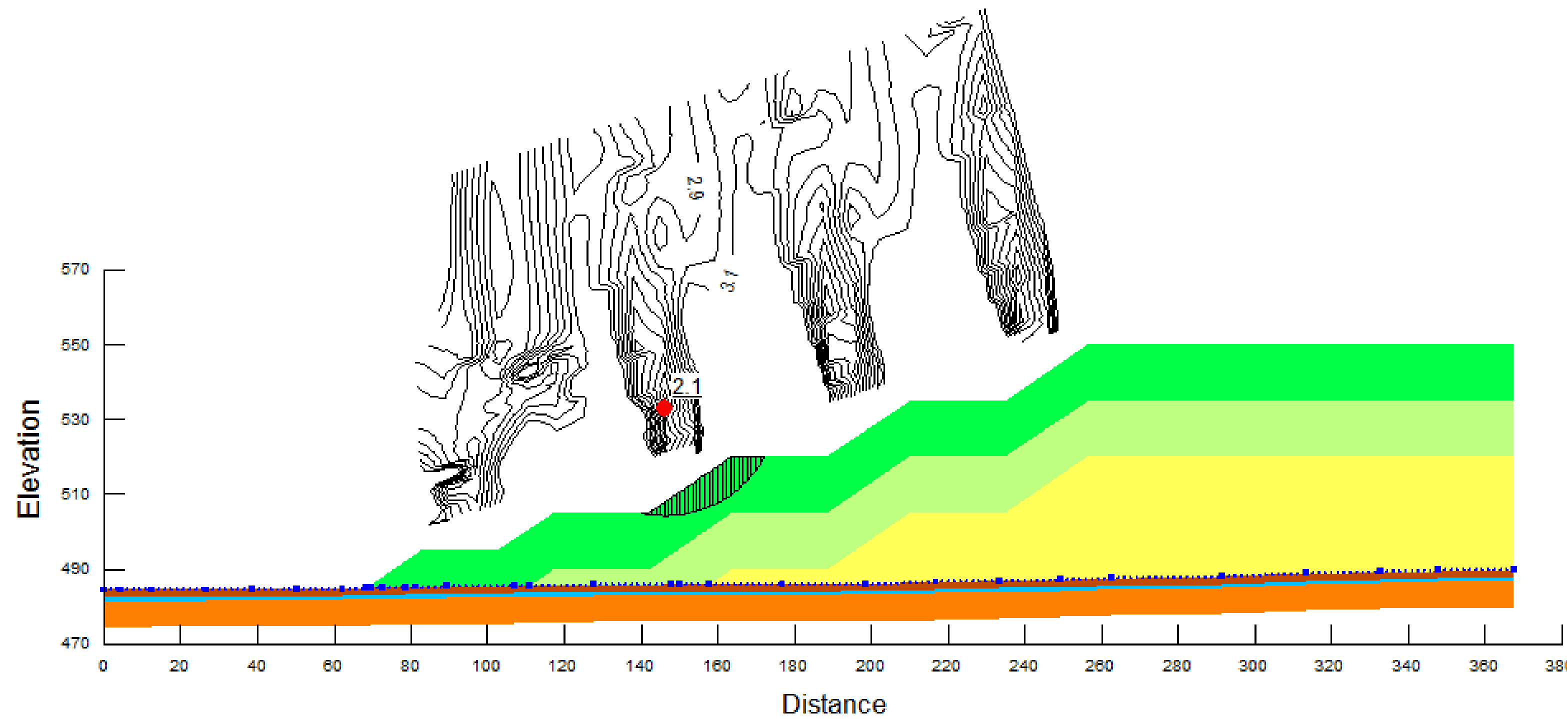
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

West WRSA Section Q-Q, Ice-Rich Silt, Long-Term, Frozen Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B25



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

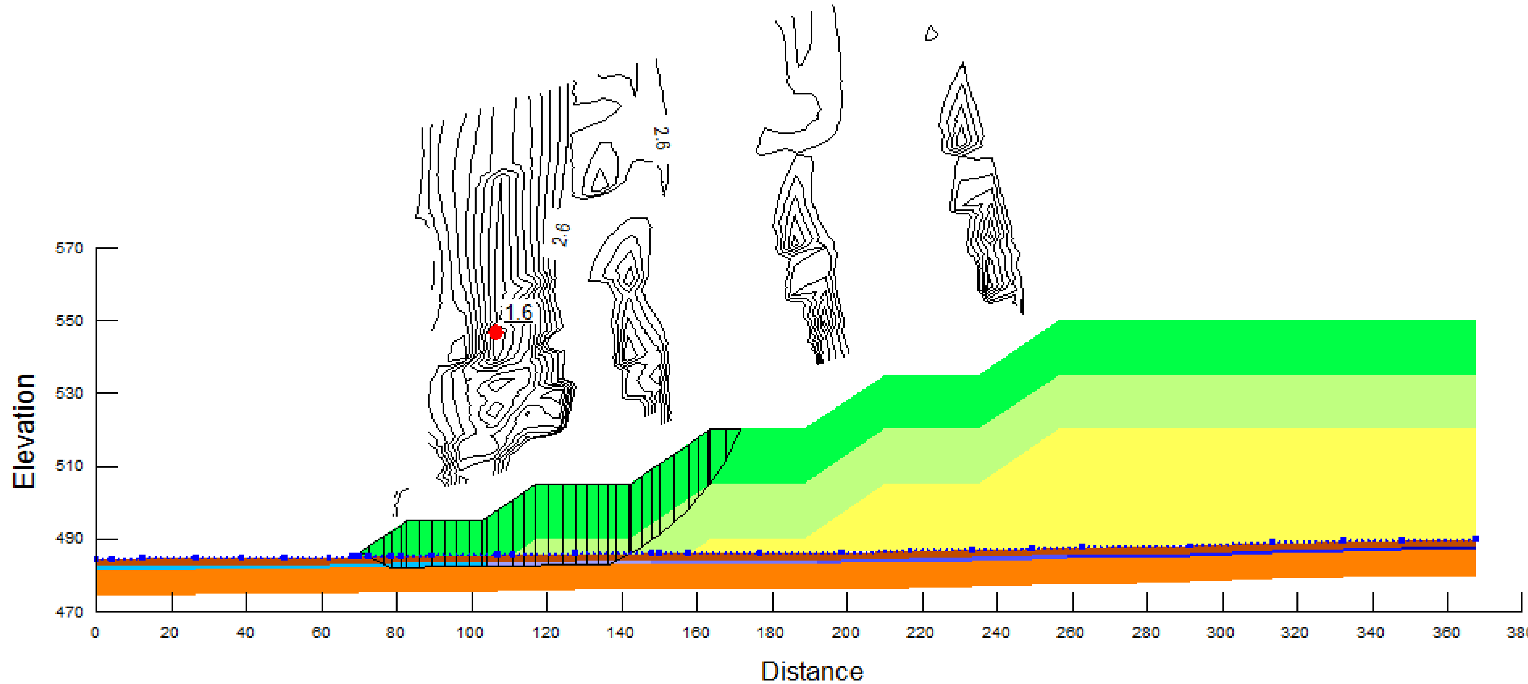
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

West WRSA Section Q-Q, Ice-Rich Silt, Long-Term, Thawed Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B26



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Lakebed Sediment
- Sand and Gravel Till
- Silt with Peat
- Ice Rich Silt Zone 1 (Thawed)
- Ice Rich Silt Zone 5
- Ice Rich Silt Zone 4
- Ice Rich Silt Zone 3
- Ice Rich Silt Zone 2

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

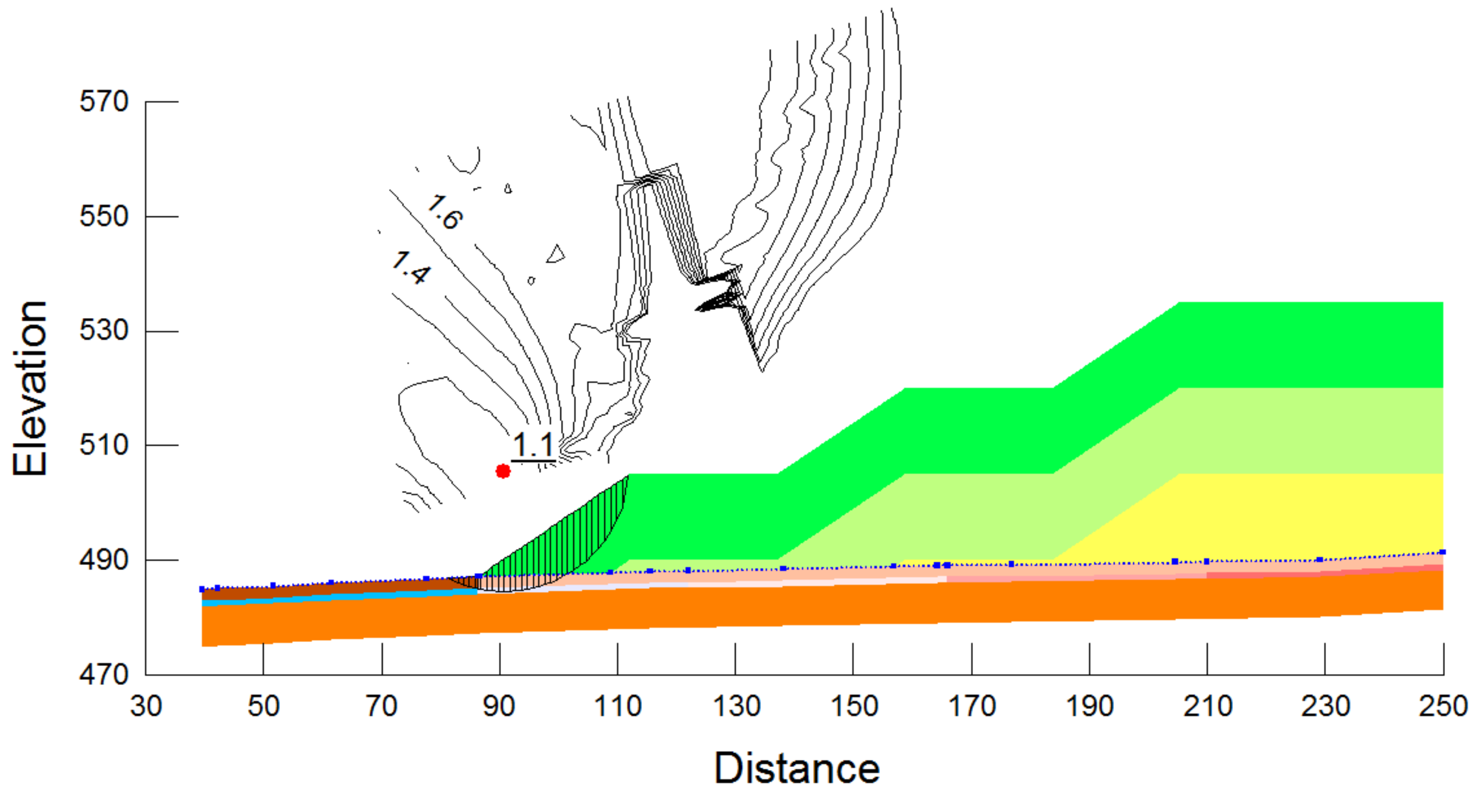
TETRA TECH

SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

West WRSA Section Q-Q, Ice-Rich Silt, Long-Term, Frozen Conditions, Seismic Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0
OFFICE	DATE			
EDM	March 2018			

Figure B27



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Sand and Gravel Till
- Silt with Peat
- Thawed Ice-rich Silt
- Peat/Organics
- Ice Rich Peat/Organics Zone 2
- Ice Rich Peat/Organics Zone 3
- Ice Rich Peat/Organics Zone 4
- Ice Rich Peat/Organics Zone 1 (Thawed)

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

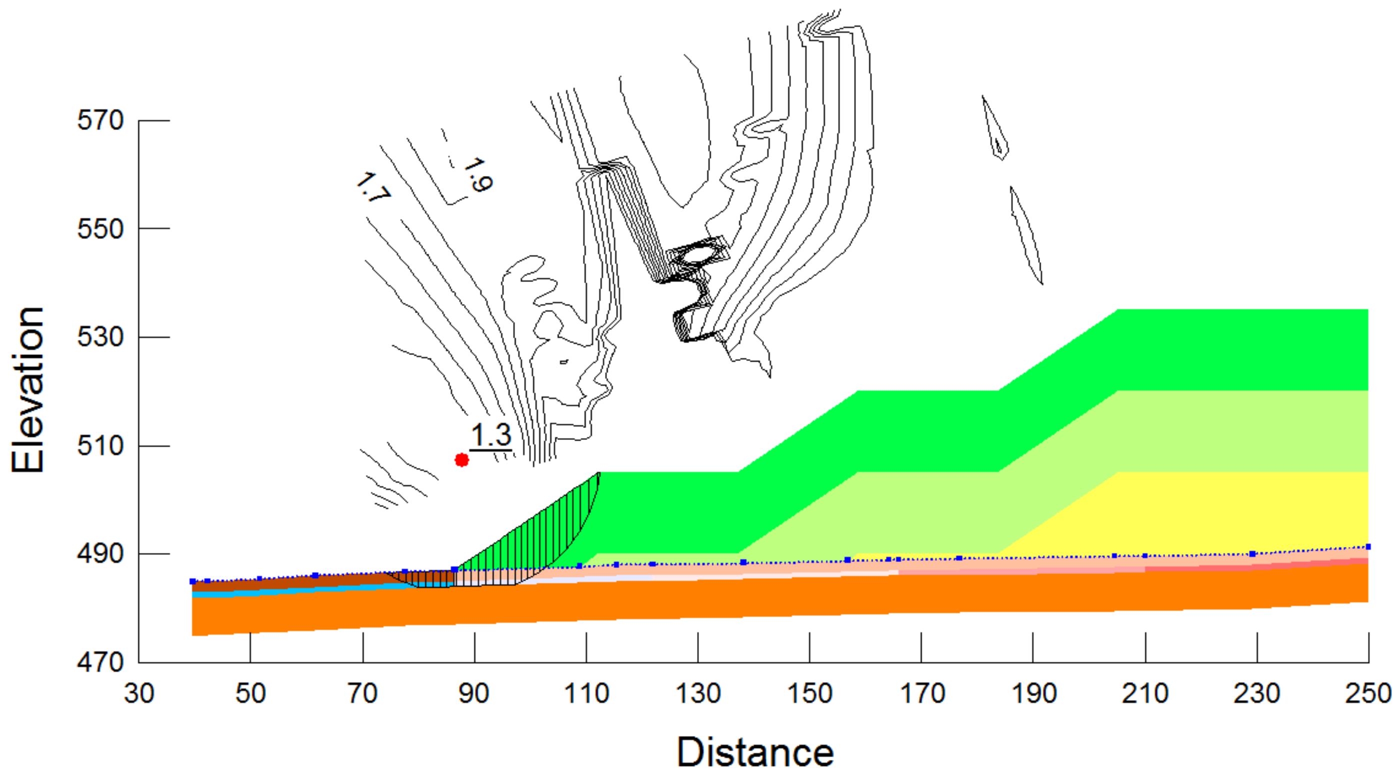
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

East WRSA Section R-R, Frozen Organics, Construction Stage, Frozen Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B28



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Sand and Gravel Till
- Silt with Peat
- Thawed Ice-rich Silt
- Peat/Organics
- Ice Rich Peat/Organics Zone 2
- Ice Rich Peat/Organics Zone 3
- Ice Rich Peat/Organics Zone 4
- Ice Rich Peat/Organics Zone 1 (Thawed)

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

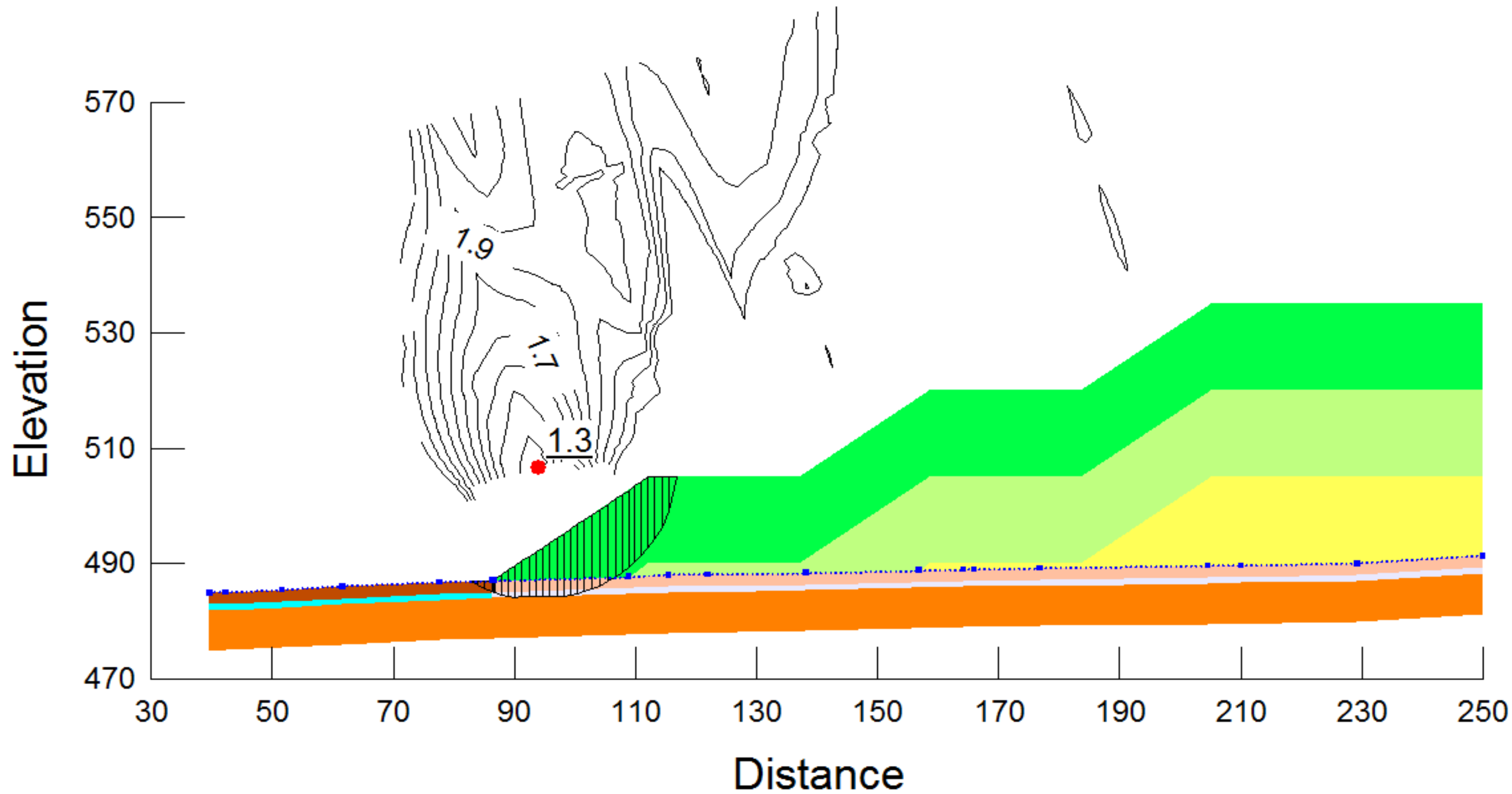
TETRA TECH

SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

East WRSA Section R-R, Frozen Organics, Long-Term, Frozen Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0
OFFICE	DATE			
EDM	March 2018			

Figure B29



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Sand and Gravel Till
- Silt with Peat
- Thawed Ice-rich Silt
- Peat/Organics
- Ice Rich Peat/Organics Zone 2
- Ice Rich Peat/Organics Zone 3
- Ice Rich Peat/Organics Zone 4
- Ice Rich Peat/Organics Zone 1 (Thawed)

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

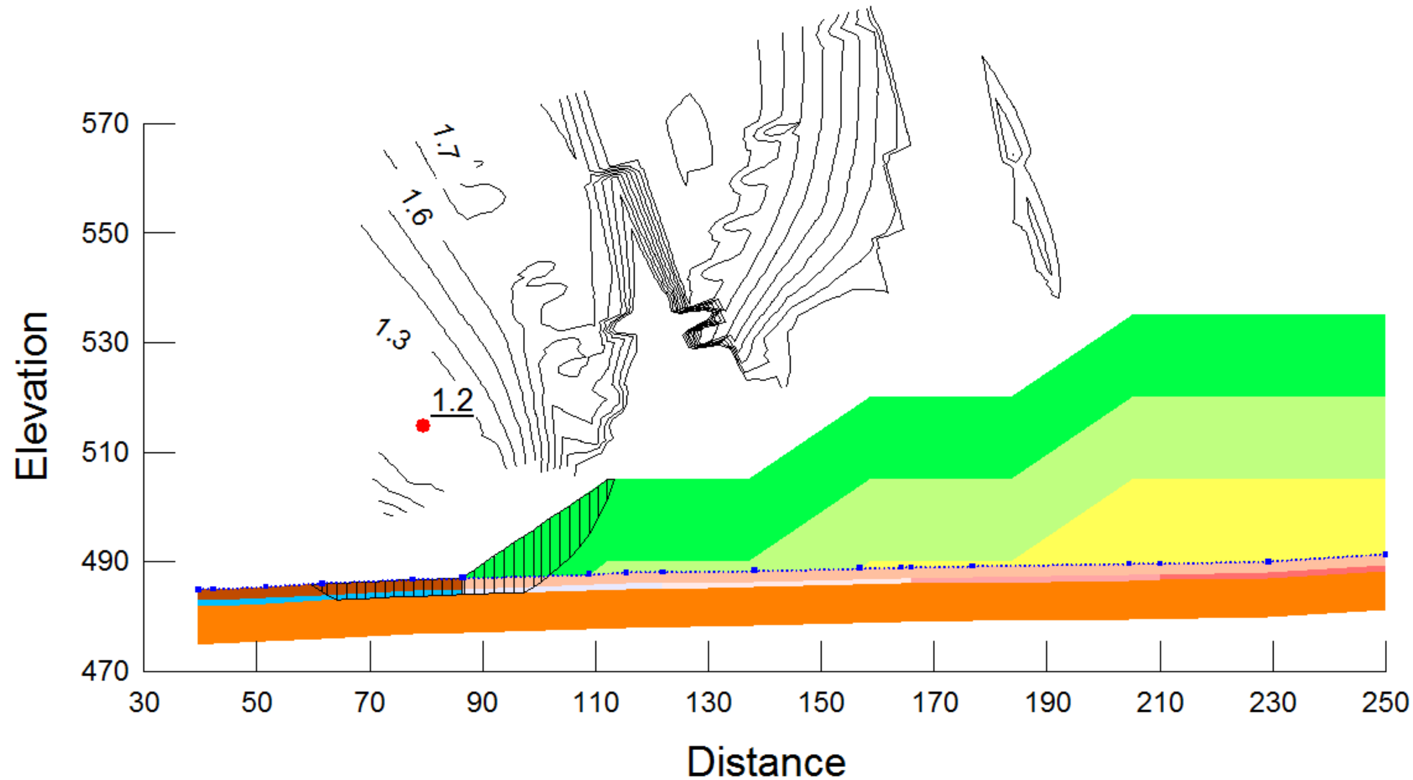
SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

East WRSA Section R-R, Frozen Organics, Long-Term, Thawed Conditions, Static Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B30



LEGEND

Materials

- Waste Rock Zone 1
- Waste Rock Zone 2
- Waste Rock Zone 3
- Sand and Gravel Till
- Silt with Peat
- Thawed Ice-rich Silt
- Peat/Organics
- Ice Rich Peat/Organics Zone 2
- Ice Rich Peat/Organics Zone 3
- Ice Rich Peat/Organics Zone 4
- Ice Rich Peat/Organics Zone 1 (Thawed)

NOTES

Slope stability analysis

STATUS

Issued for Use

CLIENT

Dominion Diamond Mines

TETRA TECH

SABLE WASTE ROCK STORAGE AREAS, EKATI DIAMOND MINE, NT

East WRSA Section R-R, Frozen Oragnics, Long-Term, Frozen Conditions, Seismic Loading

PROJECT NO.	DWN.	CKD	APVD.	REV
E14103187-05	JL	EAG	GDK	0

OFFICE	DATE
EDM	March 2018

Figure B31

APPENDIX C
TETRA TECH'S LIMITATIONS ON USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

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Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by persons other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary investigation and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.8 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.9 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.10 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

1.11 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.12 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.13 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

1.14 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.15 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

1.16 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

1.17 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client’s expense upon written request, otherwise samples will be discarded.

Appendix F: Point Lake WRSA Design Plan Version 1.1

See WLWB Online Registry for Ekati - Point Lake WRSA Design and Seepage Prediction Report V 1.1 - Jul 5_23

Part 1 of 3

Part 2 of 3

Part 3 of 3

Appendix G: Ekati Mine: Evaluation of geochemical classification criteria

GOLDER

TECHNICAL MEMORANDUM

DATE 30 April 2018 **Reference No.** 1895916-E18035-TM-Rev0-8110

TO Mr. Lukas Novy
Dominion Diamond Ekati ULC

FROM Kristin Salzsauler and Ermanno Rambelli **EMAIL Ermanno_Rambelli@golder.com**

DOMINION DIAMOND EKATI
EKATI MINE: EVALUATION OF GEOCHEMICAL CLASSIFICATION CRITERIA

1.0 INTRODUCTION

Geochemical characterization of waste rock for the Ekati Diamond Mine (Ekati mine) was initiated in 1995, and includes the results of pre-mining geochemical testing, and routine geochemical testing of waste rock. Dominion Diamond Ekati ULC (Dominion Diamond) characterizes waste rock samples collected from the Ekati mine on an ongoing basis, as a requirement of the Waste Rock and Ore Storage Management Plan (WROMP). The interpretation of geochemical test results forms the basis of the waste rock management strategy at the Ekati mine, outlined in the WROMP (Dominion 2018). The waste rock monitoring results are presented in the annual Waste Rock and Waste Rock Storage Area Seepage Survey Reports (referred to herein as the “Annual Reports”), as a requirement of Water Licence W2012L2-0001. Water Licence W2012L2-0001 also requires the submission of a report interpreting the results of all survey data every three years (referred to herein as the “3 Year Reports”). The results of waste rock characterization presented in the Annual and 3 Year Reports are screened with respect to acid generation potential according to the guidelines presented in DIAND (1992). The Ekati mine geochemical dataset was compiled and used as the basis of the geochemical evaluation for the Jay Project (DDEC 2014), where acid generation potential was derived by comparing acid base accounting (ABA) results to the screening criteria in MEND (2009).

In the letter of decision regarding the 2016 Three Year Seepage Survey Report (SRK 2017), the Wek’èezhìı Land and Water Board (WLWB) provided several items to be addressed by Dominion in the 2017 Annual Seepage Report (WLWB 2018). Reference Item C of the WLWB direction relates to geochemical classification criteria:

“Rationale for whether Dominion believes the MEND 2009 Guidelines would be appropriate for the Ekati site, and Indicate how differences between the use of MEND 2009 and AANDC 1992 Guidelines (e.g., cutoffs of 2 vs 3) may affect its calculations for how rock is classified (i.e., non-PAG, uncertain, and PAG), implications to the placement of rock, and closure planning.”

This memorandum discusses the difference between the geochemical classification criteria presented in DIAND (1992) and MEND (2009), and provides recommendations with respect to the geochemical classification criteria that should be used to screen the results of static geochemical testing at the Ekati mine.

2.0 EKATI MINE GEOCHEMICAL TESTING DATASET

The geochemical dataset includes the results of baseline geochemical testing and routine operation samples. Baseline geochemistry samples generally consist of exploration drill core samples, collected prior to the start of mining. The objective of baseline geochemical testing is to confirm the acid rock drainage (ARD) and metal leaching (ML) potential of waste rock prior to mining, to inform waste rock management protocols.

In addition, samples for routine waste rock characterization during mining are collected from blasted muck in order to confirm the geochemical characteristics of waste rock during mining. This information is used to confirm the waste rock management protocols and, if necessary, determine if adaptive management is required. Prior to 2007, samples were collected at a minimum frequency of one sample per 100,000 tonnes of mined material. Since 2007, samples are collected at a frequency of three samples per rock type per bench every three years for the Fox Pit (until 2014 when open-pit mining was completed in Fox Pit), and three samples per rock type per bench at the Misery, Pigeon, Sable, and Lynx pits.

Currently, the combined (baseline and routine waste rock characterization) Ekati mine dataset consists of 3,649 samples in total, including overburden, granite, diabase, metasediment, kimberlite, processed kimberlite, and “mixed” waste rock (undefined lithology) collected from the Panda and Koala pits and WRSA. Geochemical test results in the dataset include ABA, net acid generation (NAG) testing, whole rock and bulk metal analysis, short-term leach testing (shake flask extraction [SFE]) and kinetic testing according to the humidity cell test (HCT) method. The discussion in this memorandum focuses on the results of ABA for diabase, granite, and metasediment, for which analytical data are available for 2,069 samples.

3.0 GEOCHEMICAL CLASSIFICATION CRITERIA

For the purpose of operational waste rock management at the Ekati mine, granite and diabase waste rock are classified as non-potentially acid generating (non-PAG), and metasediment is classified as potentially acid generating (PAG). Granite and metasediment at the Pigeon Pit occur as a geologically intermixed rock type and, as such, all waste rock mined from the Pigeon Pit is operationally conservatively managed as though it is PAG. Metasediment is currently only mined from the Misery and Pigeon pits, although baseline geochemical testing of metasediment from the Jay deposit has been performed.

The operational waste rock classification was derived during pre-mining geochemical testing of 260 samples (Norecol, Dames, and Moore 1997). In this evaluation, sulphide sulphur concentrations were used to calculate the acid potential (AP) of each sample and neutralization potential (NP) was measured using the modified Sobek procedure. Norecol, Dames and Moore (1997) screened the initial results of geochemical testing using an NP/AP ratio of 2.

The initial results of geochemical testing indicated that granite had a low potential for acid generation and metal leaching, owing to low total sulphur content (Norecol, Dames and Moore, 1997). Therefore, all granite was operationally defined as “non-reactive” and suitable for construction. Approximately half of the metasediment samples submitted for geochemical testing (16 of 30) were classified as PAG based on ABA results ($NP/AP < 1$), and 12 of 30 samples were classified as “uncertain” ($1 < NP/AP < 2$). All metasediment was operationally defined as “reactive” and cannot be used for construction at the Ekati mine. Diabase was initially classified as having an “uncertain” acid generation potential (Norecol, Dames and Moore 1997); however, ensuing geochemical testing has confirmed that the acid generation potential of diabase is low and diabase is suitable for construction (Dominion 2018).

Subsequent geochemical testing programs (e.g., routine monitoring of waste rock samples presented in the annual seepage monitoring reports and 3 Year Report) used an NP/AP ratio of 3 as a screening criterion for non-PAG samples, consistent with the recommendation in DIAND (1992) (Table 3-1). However, the Geochemistry Baseline Report for the Jay Project (DDEC 2014) used the more recent recommendations in MEND (2009) to screen ABA results for acid generation potential (Table 3-1).

Table 3-1: Criteria to Identify the Acid Generation Potential from Acid Base Accounting Results

Acid Generation Potential	NP/AP Criteria – MEND 2009	NP/AP Criteria – DIAND 1992	Comments
Potentially Acid Generating (PAG)	NP/AP < 1	NP/AP < 1.2 (tailings) NP/AP < 1 (waste rock)	Potentially acid generating unless sulphide minerals are non-reactive.
Uncertain Acid Generation Potential	1 < NP/AP < 2	1 < NP/AP < 3	Possibly acid generating if NP is insufficiently reactive or is depleted at a rate faster than sulphides.
Non-Acid Generating (non-PAG)	2 < NP/AP	3 < NP/AP	Not expected to generate acidity.

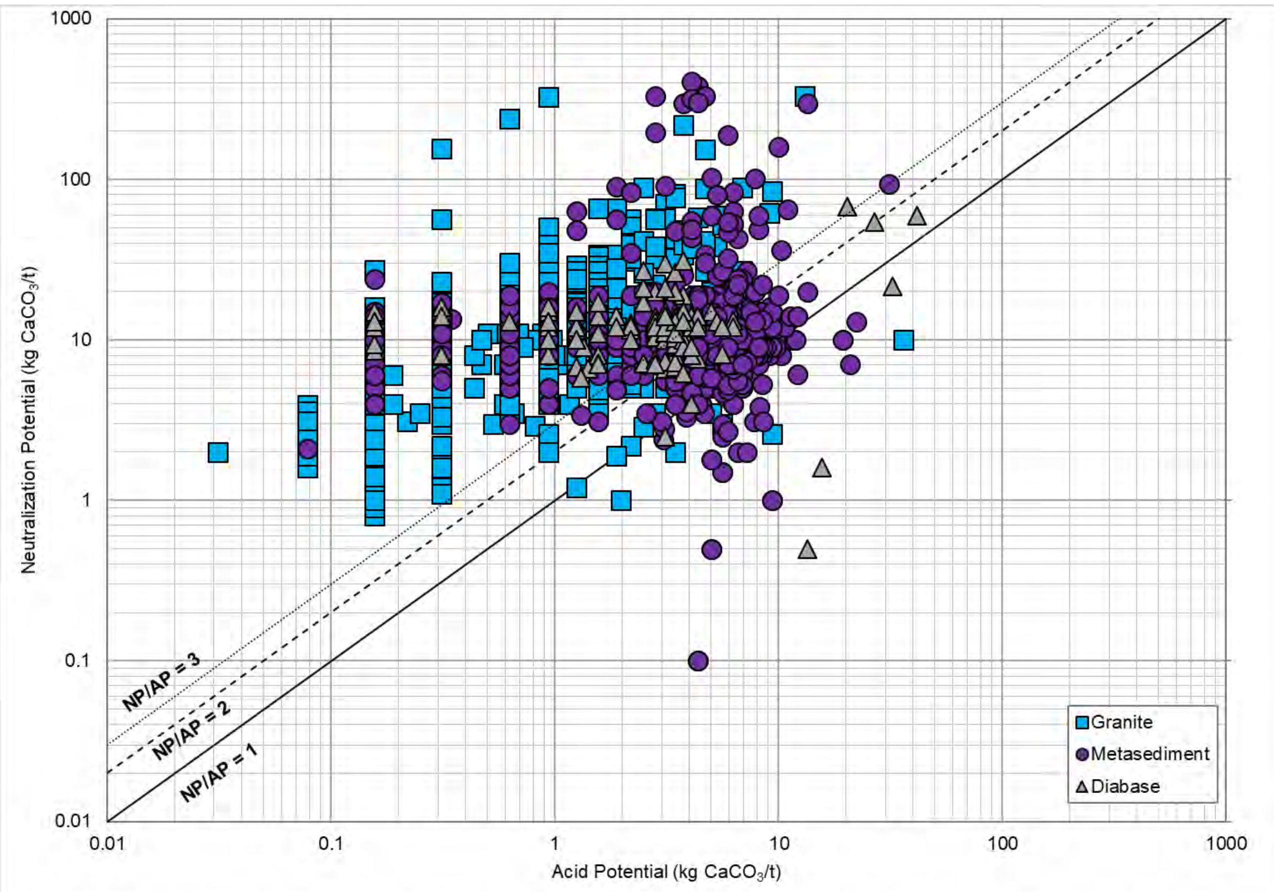
The recommendations in MEND (2009) are also promulgated and promoted by the International Network for Acid Prevention (INAP) in the Global Acid Rock Drainage (GARD) Guide (INAP 2009). These guidelines are considered the current best practise for the initial screening of ABA data. After the initial screening of ABA data using these criteria, the acid generation potential inferred by the NP/AP ratio must be considered in the context of kinetic testing data or NAG test results. This comparison is completed to determine if the generic screening criteria are sufficient for identifying PAG material at a given site. In addition, this comparison provides insight as to the long-term acid generation potential of material classified as “uncertain”.

3.1 Comparison of Geochemical Classification Criteria Using Static Test Data

Table 3-2 compares the number of samples classified as non-PAG, uncertain, and PAG according to the MEND (2009) and DIAND (1992) classification criteria, based on the results of static testing (i.e., ABA). This information is also presented in Figure 3-1, which compares NP and AP by sample in the main rock types (granite, metasediment, and diabase).

Table 3-2: Classification of Ekati Mine Waste Rock Samples According to Geochemical Criteria in MEND (2009) and DIAND (1992)

Number of Samples		MEND (2009)			DIAND (1992)		
Classification		PAG	Uncertain	Non-PAG	PAG	Uncertain	Non-PAG
Criteria		NP/AP < 1	1 < NP/AP < 2	NP/AP > 2	NP/AP < 1	1 < NP/AP < 3	NP/AP > 3
Diabase	168	2%	3%	95%	2%	17%	81%
Granite	1189	1%	2%	97%	1%	4%	95%
Metasediment	712	12%	33%	55%	12%	53%	35%



Acid Potential was calculated using total sulphur values. All values below detection were assigned a value of half their respective detection limit.

Figure 3-1: Comparison of Neutralization Potential and Acid Potential in Ekati Mine Waste Rock Samples

Granite samples were predominantly classified as non-PAG according to both criteria. According to the MEND (2009) criteria, 95% of the diabase samples are classified non-PAG, 81% of the diabase dataset is classified as non-PAG according to the DIAND (1992) criteria, and only 2% of the diabase dataset is PAG. In the metasediment dataset, 55% of the samples were classified as non-PAG based on the MEND (2009) criteria, and 35% were non-PAG according to the DIAND (1992) criteria. The average total sulphur content of metasediment is 0.14%.

Although all three rock types have a similar range of total sulphur content (Figure 3-2), granite has a negligible average sulphur content (0.03%); 85% of the granite dataset contains less than 0.05% total sulphur. Diabase has a higher average total sulphur content than granite (0.1%); however, as stated in BHP (2007), diabase is highly competent and, as such, does not generate an abundance of fines when blasted, which limits the surface area of waste rock exposed to physical and chemical weathering. Metasediment, overall, has a higher total sulphur content than granite and diabase; the average total sulphur concentration of metasediment samples is 0.14%.

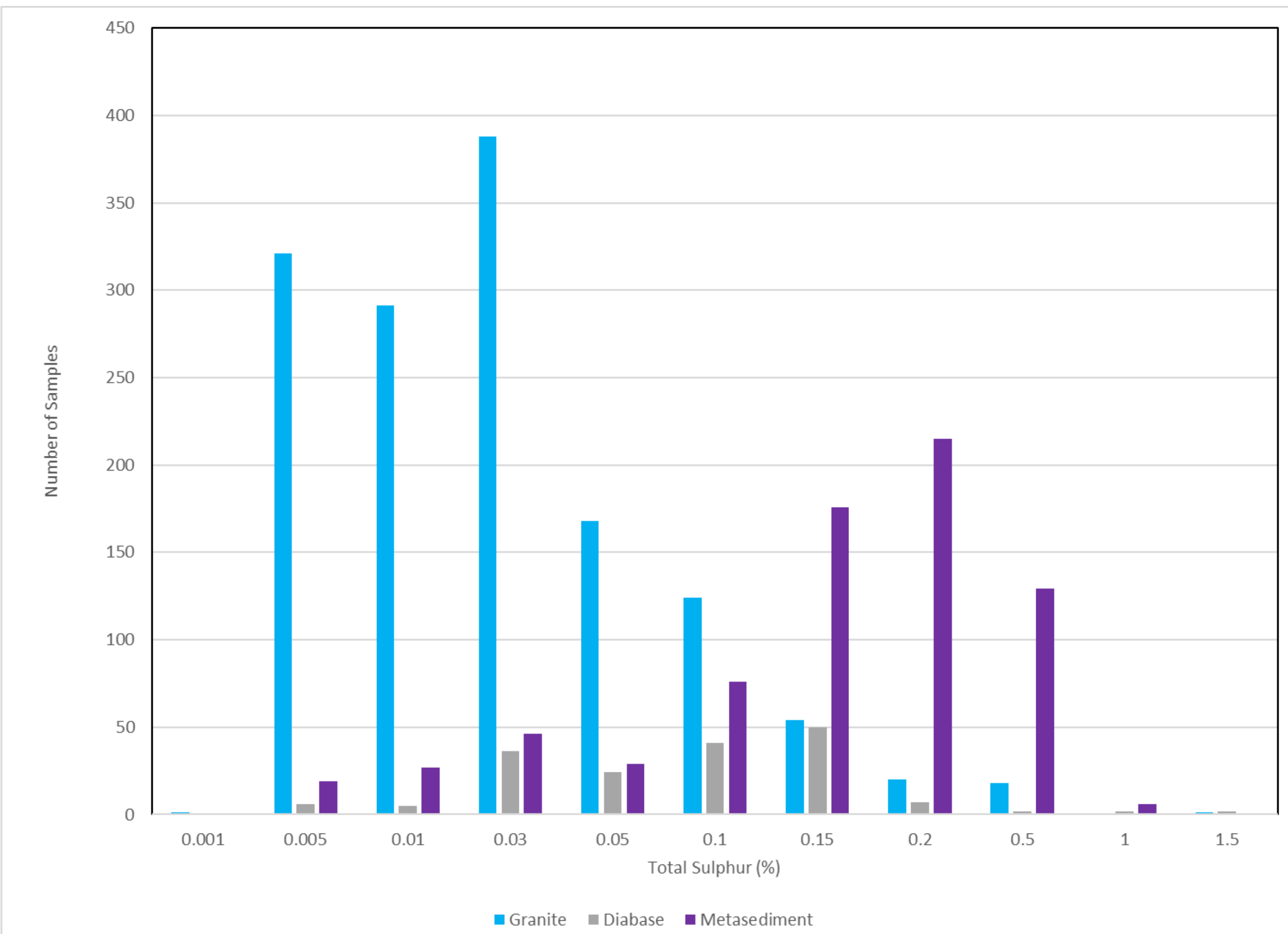


Figure 3-2: Sulphur Distribution in the Ekati Mine Geochemistry Dataset

3.2 Confirmation of Acid Generation Potential Using Kinetic Testing Results

As part of the geochemical characterization evaluation for the Jay Project, the acid generation potential inferred by ABA results was confirmed with HCT results. The HCT results were used to evaluate the rates of sulphide mineral oxidation and reaction of neutralizing minerals, to confirm if and when ARD would be generated by the sample. This is a standard approach promulgated by MEND (2009) and INAP (2010). This information is also useful to compare the efficacy of the MEND (2009) and DIAND (1992) criteria for acid generation potential classification.

The HCT dataset consists of 30 samples (13 samples of granite, 6 samples of diabase, and 11 samples of metasediment), of which sufficient information is available to calculate NP/AP ratio for 26 samples. Figure 3-3 compares the final pH measured in HCT leachates to the NP/AP ratio:

- Sixteen samples had NP/AP ratios greater than 2 (non-PAG).
  - 15 out of 16 (i.e., 94%) waste rock samples with an NP/AP ratio greater than 2 did not generate acidity during the tests (pH less than 5.5). These samples generated neutral pH leachates and were confirmed to have a low long-term acid generation potential based on rates of sulphur and NP depletion.
  - One sample (HC-Pdef-10) reported an acidic leachate pH during kinetic testing. Sample HC-Pdef-10 consists of metasediment collected from Pigeon Pit drill core. The sample interval was described as fine-grained metasediment with 1 to 2% visible sulphides, and no visible carbonate. This sample contains 0.27% total sulphur, and has a NP/AP ratio of 2.6. The sample generated acidic pH leachate (less than pH 5.5) after 38 weeks of testing; the minimum pH measured in leachate from this HCT was 3.97. This sample represents an outlier in the HCT dataset for the Ekati mine.
- Nine samples had NP/AP ratios between 1 and 2 (uncertain).
  - 6 of 9 samples reported acidic leachate pH values (pH less than 5.5).
  - 3 of 9 three samples were confirmed to have a low long-term acid generation potential, owing to low total sulphur contents (0.05 to 0.1%), and low rates of sulphide mineral oxidation. In particular, samples Pigeon HC-2 (biotite granite) and Beartooth HC-2 (biotite schist) had NP/AP values of 2 and did not generate acidity during the HCT test.
- One sample had an NP/AP ratio less than 1 (PAG).
  - Although the final HCT leachate of this sample was 5.8, depletion calculations indicated that NP had been completely consumed from this sample by the end of the HCT test (133 weeks), and that it would take approximately 35 years to deplete the remaining sulphur in the sample in laboratory conditions (DDEC 2014). As such, it is anticipated that this sample will generate acidic conditions over the long term.

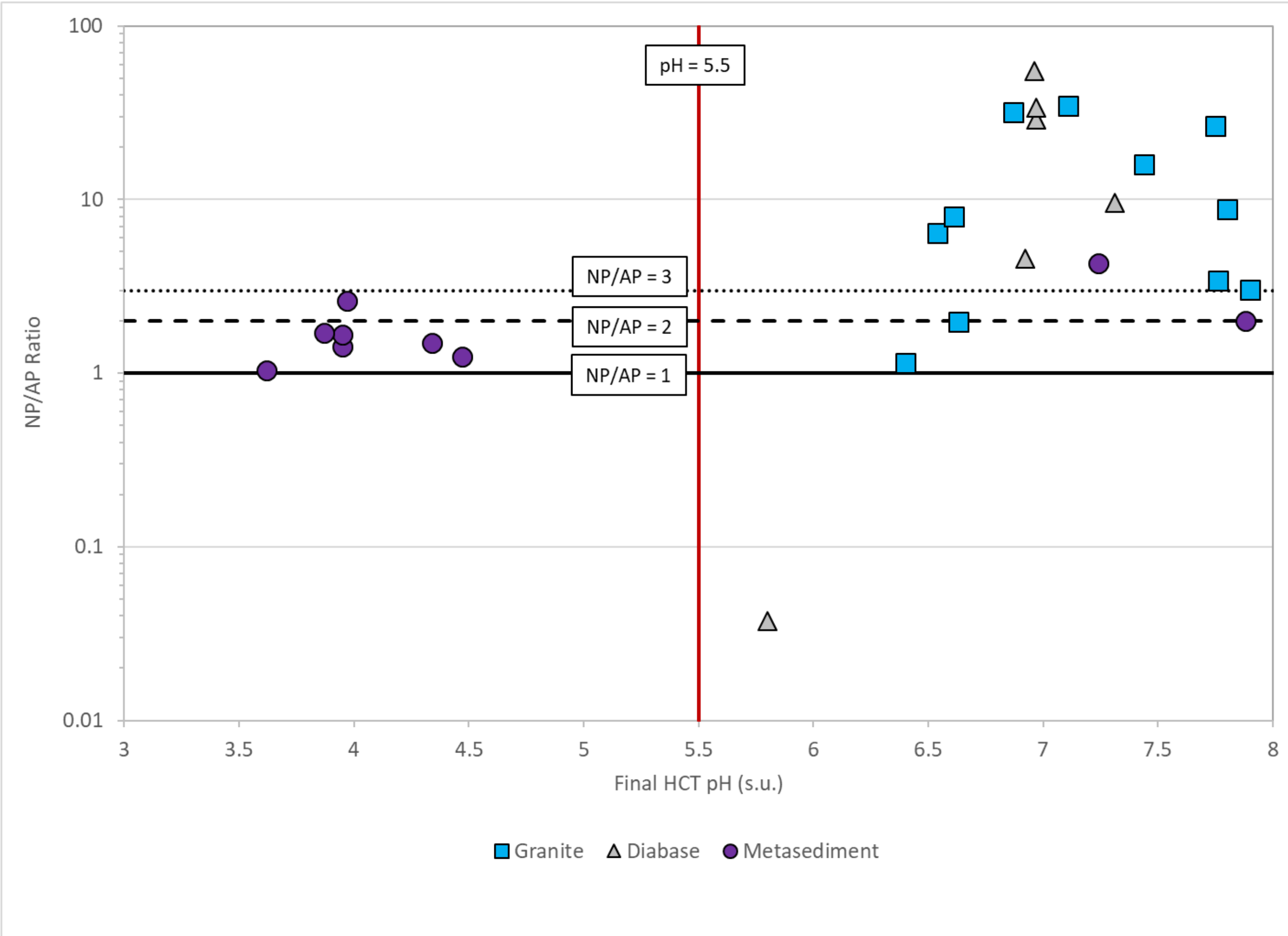


Figure 3.3: Comparison of NP/AP Ratio and Final HCT pH

Based on the HCT program, an NP/AP ratio of 2 is an accurate predictor of long-term acid generation, correctly predicting long-term acid generation potential in all but one sample (HC-Pdef-10). The three samples with an NP/AP ratio less than 2 that were not predicted to have a long-term acid generation potential had low total sulphur concentrations and, as such, have a negligible acid generation potential regardless of NP/AP ratio.

4.0 SUMMARY AND RECOMMENDATIONS

The size of the geochemical dataset has increased by one order of magnitude (more than 10 times) during the 19 years of operation at the Ekati mine, and the results of geochemical testing continue to be consistent with the initial static geochemical dataset. The MEND (2009) versus DIAND (1992) geochemical classification criteria were used to conduct an initial screening of ABA results; the long-term acid generation potential is confirmed by the results of humidity cell testing. Humidity cell test results were also used to confirm the appropriateness of using the MEND (2009) versus DIAND (1992) classification criteria for the initial screening of ABA results.

A comparison of the MEND (2009) and DIAND (1992) criteria for geochemical classification of waste rock confirmed that Ekati mine granite is classified as non-PAG regardless of classification criterion. Granite is a low-sulphur waste rock type. The results of kinetic testing confirm that granite has a low potential for acid generation, owing to the lack of sulphide minerals required to generate acidity. The WROMP for the Ekati mine designates granite as a suitable material for construction (Dominion 2018).

The majority of the diabase samples in the Ekati mine dataset are classified as non-PAG (95% according to MEND [2009) an 81% according to DIAND [1992]). Diabase also has a low total sulphur content and owing to its competency and resistance to generation of fines, it is considered to have a low acid generation potential in site conditions. The WROMP also designates diabase as a suitable construction material at the Ekati mine (Dominion 2018).

Metasediment contains more sulphide and, as such, has a higher potential for acid generation than diabase and granite. More samples are classified as uncertain and PAG according to the MEND (2009) criteria than the DIAND (1992) criteria. However, the results of kinetic testing have indicated that the MEND (2009) criteria are appropriate for predicting long-term acid generation potential. Despite the fact that a portion of the metasediment is classified as PAG using either set of criteria, the WROMP designates all metasedimentary waste rock as PAG, regardless of NP/AP ratio. To date, metasediment has only been mined from the Misery pit, and it is encapsulated in the Misery WRSA. Metasediment is not used for construction at the Ekati mine.

The use of the MEND (2009) versus DIAND (1992) screening criteria will not influence waste rock placement and closure planning, as granite and diabase is predominantly non-PAG (regardless of screening criteria), and is suitable for construction. All metasedimentary rock is currently classified as PAG, and managed as such. A single classification criterion should be adopted for consistent use at the Ekati mine. An NP/AP ratio of 2 is an accurate predictor of long-term acid generation according to the results of long-term laboratory testing and, therefore, the MEND (2009) criteria are suitable for use in initial data screening.

5.0 CLOSURE

The reader is referred to the Study Limitations, which follows the text and forms an integral part of this memorandum.

We trust that the information provided in this technical memorandum meets your present needs. Should you have any questions or require additional information, please feel free to contact the undersigned.

Golder Associates Ltd.

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Attachment: Study Limitations

https://golderassociates.sharepoint.com/sites/10514g/eng project deliverables/2. issued/1895916-e18035-tm-rev0-8110/1895916-e18035-tm-rev0-8110-ekatimine_geochemclassification_30apr_18.docx

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STUDY LIMITATIONS

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Appendix H: Point Lake Project Metasediment Geochemical Assessment Update - August 2022 *(Appendix G to ERM, 2023)*

ARCTIC CANADIAN DIAMOND COMPANY

Naturally Beautiful. Mined Right.

Ekati Diamond Mine

Point Lake Project Metasediment Geochemical Assessment Update

August 2022

EXECUTIVE SUMMARY

Arctic Canadian Diamond Company Ltd. (Arctic Canadian) is planning the construction, operation and reclamation of open pit mining of the Point Lake kimberlite pipe and two smaller satellite pipes (Phoenix and Challenge). Arctic Canadian committed to the initiation of three humidity cell tests (HCTs) to better understand the geochemistry of the metasediment of the Point Lake open pit.

Schedule 6, Condition 6(b) of the amended water licence requires the results of the kinetic testing, as well as an investigation into the discrepancies between laboratory Net Acid Generating (NAG) pH results, previously identified by ERM Consultants Canada Ltd. (ERM), be documented in a Point Lake Metasediment Net Acid Generation Report. The objective of this report is to address specific items related to Schedule 6 Condition 6(b) of the water licence.

To initiate kinetic testing, ERM selected three Point Lake metasediment core samples from the initial database of 85 metasediment samples. The samples selected included PLDC-05-03 (HCT 1), PLDC-06-15 (HCT 2), and PLDC-08-10 (HCT 3). The samples were selected based on the static acid base accounting (ABA) and NAG and SFE (shake flask extraction) leachate results to represent average and conservative metal leaching potentials, to the extent practicable. Further, HCT 2 was selected with the specific intent of characterizing leaching in acidic drainage (pH<4.5) due to its low neutralization potential (NP) and classification as potentially acid forming (PAF) based on the NAG pH results.

The HCT samples were submitted for Xray Diffraction with Rietveld Refinement (XRD) analysis. The XRD results indicated that sulphides were present as pyrrhotite, which can be a faster reacting sulphide than pyrite (MEND 2009). However, when the Point Lake sulphate release rates were compared to the Ekati Diamond Mine site-wide HCT sulphate released rates, the actual rates of reactivity were determined to be similar. The primary mineral with NP in the samples selected for HCT analyses was identified as biotite by the XRD analyses. Approximately 10% of the Point Lake metasediment samples had measurable amounts of carbonate; however, these samples were not selected for HCT analyses.

Overall, the metasediment in HCT 2 was capable of developing drainage with a pH below 4.5 based on the observations in the laboratory; however, buffering occurred slightly above pH of 4 over the time frame of the test. The pH in HCT 1 had not reached steady state during the time frame of the kinetic test, and HCT 3 was capable of buffering acid generated at a pH above 5.4.

The parameters of potential concern (PoPCs) associated with the Point Lake HCT metasediment leachate were defined as those with trends of increasing concentrations with time or exceedances of Ekati Diamond Mine water quality benchmarks, or where Ekati Diamond Mine benchmarks are not established, Canadian Council of Ministers of the Environment guidelines for the protection of freshwater aquatic life. These parameters should be considered for preliminary screening purposes and may be evaluated in the context of the receiving environment through the use of water quality modelling. The PoPCs identified as part of geochemical screening are aluminum, arsenic, beryllium, cadmium, cobalt, copper, iron, lead, manganese, nickel, and zinc.

The investigation into the laboratory discrepancy regarding the NAG pH results indicated that sulphides were likely completely oxidized in the tests and that the difference between the measurements was likely related to the slow reacting aluminosilicates in the material; although, the exact cause remains unclear. This discrepancy does not affect the findings of the kinetic tests.

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ACRONYMS AND ABBREVIATIONS

ABA	Acid Base Accounting
ACA	Average Crustal Abundance
AMIRA	Australian Minerals Industry Research Association
AP	Acid Generating Potential
CCME	Canadian Council of Ministry of the Environment
CMR	Carbon Molar Ratios
DO	Dissolved Oxygen
HCT	Humidity Cell Test
ICP-MS	Inductively-Coupled Plasma-Mass Spectrometry
IRNP	Insufficiently Reactive Neutralizing Potential
ML	Metal Leaching
NAG	Net Acid Generating
NP	Neutralizing Potential
NPR	Net Potential Ratio
ORP	Oxidation Reduction Potential
PAF	Potentially Acid Forming
PAG	Potential Acid Generating
PoC	Parameters of Concern
PoPC	Parameters of Potential Concern
SFE	Shake Flask Extraction
The Board	Wek'éezhìi Land and Water Board
TIC	Total Inorganic Carbon
WRSA	Waste Rock Storage Area
XRD	Xray Diffraction with Rietveld Refinement
XRF	Xray Fluorescence

1. INTRODUCTION

Arctic Canadian Diamond Company Ltd. (Arctic Canadian) is planning the construction and operation of open pit mining of the Point Lake kimberlite pipe and two smaller satellite pipes (Phoenix and Challenge). The Point Lake kimberlite pipes are in close proximity to the existing Misery site at the Ekati Diamond Mine. The Point Lake Project (the Project) will operate under Water Licence W2020L2-0004 (formerly W2012L2-0001) issued by the Wek'éezhìi Land and Water Board (the Board).

As part of the Water Licence amendment application process, documents that summarize and interpret the available geochemical information for the Project were submitted. These documents support the current work, including:

- The Ekati Diamond Mine Point Lake Geochemistry Technical Report (ERM 2021a) documenting and interpreting the available acid base accounting (ABA) and net acid generating (NAG) pH geochemical information of 2019 core collected from the Point Lake kimberlite pipe.
- The Point Lake Project SFE Leachate and NAG Leachate Memorandum (ERM 2021b) documenting subsequent geochemical static testing results of the core, including shake flask extraction (SFE) results, updated NAG pH results and NAG leachate results.
  - As part of this assessment, a discrepancy was identified between the NAG pH values measured as part of the original geochemical information from 2019 and the updated NAG pH values measured in 2021. This is described further in Section 6.8.
- The Point Lake Project Overburden Geochemical Assessment (ERM 2021c) documenting the preliminary results of overburden sampling.
  - This sampling program will form part of the Waste Rock and Ore Storage Management Plan once updated to incorporate the Project.

During the regulatory proceedings for the Project, Arctic Canadian committed to the initiation of three kinetic humidity cell tests (HCTs) to better understand the geochemistry of the metasediment at the Project site. Schedule 6, Condition 6(b) of the amended water licence subsequently required the results of the kinetic testing, as well as an investigation into the discrepancies between NAG laboratory results identified in the Point Lake Project SFE Leachate and NAG Leachate Memorandum (ERM 2022b), be included in a Point Lake Metasediment Net Acid Generation Report (this report). Concordance with Schedule 6, Condition 6(b) is provided in Table 1-1.

The intent of this report is to address these water licence requirements and document and interpret the results from the HCT program for the Project. The information gained from the HCT program will inform source term development for waste rock storage area (WRSA) seepage predictions.

Table 1-1: Concordance with Water Licence W2020L2-0004

Water Licence W2020L2-0004 Requirement	Water Licence Section	Report Section
Discussion and application of shake flask extraction and Net Acid Generation test results	Schedule 6, Condition 6(b)i	Section 6.7 and ERM 2022
An investigation into cause of consistently lower pH values in 2021 samples compared with previous Acid Base Accounting samples as related to Point Lake metasediment	Schedule 6, Condition 6(b)ii	Section 6.8
Identification of parameters of potential concern	Schedule 6, Condition 6(b)iii	Section 6.1
Comparison of Point Lake Shake Flask Extraction leachate concentrations with Jay Project metasediment Shake Flask Extraction Leachate concentrations	Schedule 6, Condition 6(b)iv	Section 6.7 and Appendix E
Inclusion of all data and test results in the report, including results from Humidity Cell Tests	Schedule 6, Condition 6(b) v	Appendix A
Prediction of the range of potential timeframes to onset of acidic conditions based on Humidity Cell Tests	Schedule 6, Condition 6(b) vi	Section 6.2 and ERM 2022
A description of how ongoing/future Humidity cell test data will be incorporated into Point Lake seepage predictions	Schedule 6, Condition 6(b) vii	Section 7
A description of any further necessary testing	Schedule 6, Condition 6(b) viii	Section 7

2. POINT LAKE GEOCHEMICAL DATABASE AND METHODOLOGY

In 2019, geochemical tests were conducted on a suite of 85 samples of core recovered from drill holes collected at the location of the proposed Point Lake open pit. Eighty of the core samples were classified as metasediment and five of the core samples were classified as pegmatite. The samples were submitted to SGS Laboratories in Burnaby British Columbia for geochemical analysis which included static ABA testing. The static laboratory tests included:

- Paste pH;
- Total sulphur;
- Sulphate sulphur;
- Total inorganic carbon (TIC);
- Modified neutralizing potential (NP);
- Acid generating potential (AP);
- Fizz rating;
- Metals with multi-acid digestion and Inductively-coupled Plasma-Mass Spectrometry (ICP-MS) finish;
- Whole rock analysis by Xray fluorescence (XRF); and
- NAG pH.

A brief description of each geochemical test used to characterize the rock, and a reference to the report documenting the geochemical results for each test, is provided in Table 2-1.

Table 2-1: Summary of Geochemical Tests

Geochemical Tests	Test Description	Reference
ABA Tests	ABA tests are used to classify material as PAG or non-PAG and consist of paste pH, TIC, bulk NP, AP, and NPR. The specific tests are discussed in additional detail below. NPR values below two were classified as uncertain and NPR values below one were classified as PAG. NPR values above two were classified as non-PAG.	ERM 2021a / Updated ABA for HCT tests in this report
Elemental Solid-Phase Content	These tests are used to identify parameters of potential concern (PoPCs) by comparing concentrations to average crustal abundance (ACA). Solid-phase content of material is determined using a multi-digest or Aqua Regia digestion followed by (ICP-MS). The parameters analyzed include aluminum, antimony, arsenic, barium, beryllium, bismuth, cadmium, calcium, cerium, cesium, chromium, cobalt, copper, gallium, hafnium, indium, iron, potassium, lanthanum, lithium, lutetium, magnesium, manganese, molybdenum, niobium, lead, nickel, phosphorus, rubidium, scandium, selenium, silver, sodium, strontium, sulphur, tantalum, tin, tellurium, terbium, thallium, thorium, titanium, tungsten, uranium, vanadium, yttrium, ytterbium, zinc and zirconium.	ERM 2021a

Geochemical Tests	Test Description	Reference
Whole Rock Analysis	Whole rock analyses are assays which measure the total concentrations of cations in the solid phase using wet chemical digestion procedures and analysis by XRF. The parameters included in whole rock analyses include aluminum, calcium, chromium, iron, magnesium, manganese, phosphorus, potassium, silicone, sodium titanium, and vanadium.	ERM 2021a
SFE Tests	SFE tests are conducted to identify which PoPCs may be released from the mine material to drainage water through dissolution. They are one-time tests conducted on crushed material and indictors of short-term release of readily soluble constituents. Because the material is crushed, the exposed surface area of the tested material is larger than what is typically observed in the field. The tests are based on 1:3 solid:water ratio by weight that is gently agitated for 24 hours.	ERM 2021b
NAG Tests	The NAG pH tests are conducted according to the protocols outlined by the Australian Minerals Industry Research Association (AMIRA 2002) to evaluate potential for acid generation following the complete oxidation within a pulverized sample. A pH below 4.5 indicates the sample is PAF and there is insufficient NP to buffer acidity generated by sulphide oxidation. NAG leachates can also be submitted for analysis to determine PoPC that are elevated following complete oxidation.	ERM 2021a (2019 NAG pH) / ERM 2021b (Updated NAG pH and NAG pH leachate)
Humidity Cells	Humidity cells are conducted to determine which parameters may be released to contact water as a result of sulphide oxidation and to determine the amount of time it will take for acidic drainage to develop based on calculations outlined by MEND (2009). Tests consist of 1 kg of material that is subjected to three days of dry air permeation, three days of humid air permeation, and one day of flushing with a fixed volume of water. The parameters in the leachate are analyzed for general parameters, anions, and trace metals. The data are presented in Appendix A.	This report
Xray Diffraction with Rietveld Refinement (XRD)	Standard XRD provides information on the quantitative abundance of a mineral within a sample, by weight. It is not accurate below 5% mineral abundance or for clay species / amorphous minerals.	This report

The 2019 static test results were used to classify samples as potential acid generating (PAG), Uncertain, or non-PAG. The PAG classification was defined by the net potential ratio (NPR) value, which is calculated as NP/AP. In this report, the term PAG refers to any samples with NPR values below one (Price 2009) and the term Uncertain applies to samples with NPR values between one and two (Price 2009). Metasediments with NPR values above two are referred to as non-PAG. PAG rock is a useful classification as it can be used to identify rock that has the potential to develop net acidic conditions at some point in the future. It is important to identify net acidic drainage as metal leaching (ML) typically increases as the pH of the drainage water decreases. The net acidity from the rock results from the fact that the NP in the sample is less than the AP. NP is a measure of the amount of buffering capacity of the sample; whereas AP is a measure of the acid generating potential. Importantly, the PAG classification does not indicate that the material will be a net acid contributor immediately; however, it does indicate that the potential exists for the sample to become a net acid contributor at some point in time, once the NP in the rock is depleted (primarily through dissolution). The HCTs are conducted to determine the rate at which the NP is depleted relative to the AP. Using these rates, the HCTs can be used to help establish if the NP will be depleted in a sample (at some point in time) before the AP. The time it takes for the NP of a sample to be depleted is referred to as the “lag time”.

The term potentially acid forming (PAF) refers to any material with a NAG pH below 4.5 (AMIRA 2002). In this report, the distinction between PAG and PAF is important because a PAF classification allows for the accounting of aluminosilicate buffering. As is discussed throughout this report, aluminosilicate dissolution is expected to be the primary source of NP in the metasediment (ERM 2021a). The aluminosilicate buffering typically occurs at a pH below 6 and can increase as the pH decreases (Acker and Becker 1991). The PAF classification is extended into the interpretation of the HCTs to account for aluminosilicate buffering at or above aluminum hydroxide buffering which occurs between pH 4 and 4.3 (MEND 2009). The mechanisms responsible for aluminosilicate buffering coupled with aluminum hydroxide buffering are discussed in additional detail in Section 5.

The 2021 geochemical assessment consisted of 85 core samples. Of the 80 metasediment core samples recovered at Point Lake, 73 (91%) of the samples were classified as Uncertain/PAG. The total sulphur content of the samples was low and typically fell below 0.3% total-sulphur. The NP measured in the metasediment samples was also low and largely attributed to aluminosilicate dissolution. However, only 5 of 80 (6%) of the Point Lake metasedimentary samples had acidic NAG pHs below 4.5 and were considered PAF in the 2019 dataset.

Eleven samples (of the 85) were selected for additional SFE and NAG leachate analysis in 2021. The updated 2021 NAG pH results indicated that of the 11 samples submitted for analysis, seven of those samples had NAG pH values less than 4.5 and were considered PAF samples.

The samples selected for HCT analysis (documented in this report) were selected from the 11 samples submitted for additional SFE and NAG leachate analyses. The samples were selected based on the results of the ABA and leachate testing.

3. HCT SAMPLES SELECTION

Three HCT samples were selected based on the results of the static and leachate tests to achieve three general objectives, as follows:

- Represent average metal leaching conditions based on static testing results;
- Represent conservative metal leaching conditions based on static testing results; and
- Evaluate the potential for acidic drainage to develop in the HCT cells by selecting a sample with a low NP content and classified as PAF.

The HCT samples selected from the initial database of 85 metasediment samples included PLDC-05-03, PLDC-06-15, and PLDC-08-10. These samples were selected to represent the aforementioned objectives to the extent possible based on the percentile statistics presented in this section.

In this report the following nomenclature applies to these samples:

- The HCT and NAG tests completed using PLDC-05-03 core are referred to as HCT 1 and NAG 1, respectively.
- The HCT and NAG tests completed using PLDC-16-05 core are referred to as HCT 2 and NAG 2, respectively.
- The HCT and NAG tests completed using PLDC-08-10 core are referred to as HCT 3 and NAG 3, respectively.

The ABA parameters of the HCT samples were compared to the larger Project geochemical ABA results to help provide context to how the samples selected could meet the sampling selection objectives, to the extent practicable. The parameters used to select HCT samples included Modified NP, total sulphur, NPR, and NAG pH. Table 3-1 presents the percentile rank of the HCT samples selected.

Table 3-1: HCT Sample ABA Compared to Point Lake ABA Dataset

Samples	Modified NP kg $CaCO_3$/tonne	Total Sulphur %	NP/AP	NAG pH
ABA Sample Set Comparison				
PLDC-05-03/HCT 1	5.4	0.275	0.62	4.71
PLDC-06-15/HCT 2	4.5	0.224	0.64	4.4
PLDC-08-10/HCT 3	5.6	0.143	1.25	5.25
ABA Sample Set Percentile Rank				
PLDC-05-03/HCT 1	68	97	5	12
PLDC-06-15/HCT 2	21	85	7	3
PLDC-08-10/HCT 3	75	19	79	69

The samples selected for HCT analysis included a sample (PLDC-05-03 in HCT 1) with a total sulphur content greater than the 95th percentile. Importantly, elevated total sulphur content often results in elevated metal leaching if the release of metals is associated with sulphide oxidation (i.e., elevated total sulphur content often translate to increased metal leaching for some metals).

One sample (HCT 2) was also selected from one of the five 2019 samples classified as PAF. This sample had a NAG pH consistent with the 3rd percentile (PLDC-06-15). This sample was selected to help fulfill the conservative metal leaching objective because metal leaching increases as pH decreases. This sample was also selected to evaluate metal leaching in acidic drainage. The HCT 2 sample also had a low Modified NP within the 21st percentile rank. The low Modified NP increased the probability that this sample would generate acidic drainage in the time frame of the laboratory tests.

Approximately 10% of the samples in the Point Lake metasediment database had measurable carbonate contents which correlated to higher Modified NPs (ERM 2021a); however, these samples were not selected for HCT analyses.

The solid contents of the parameters in the Project dataset were examined to determine which were elevated above average crustal abundances (ACA), as these parameters were elevated above ACA in the Project geochemical dataset (ERM 2021a). The comparison showed that arsenic, lithium, nickel and uranium were elevated. The solid contents of these parameters measured in the HCT samples are shown in Table 3-2. Overall, the solid contents of HCTs were considered to provide a conservative representation of the Project solid content.

Table 3-2: HCT Sample Solid Content Compared to the Point Lake Solid Content Dataset

Samples	Arsenic ppm	Lithium Ppm	Nickel Ppm	Uranium ppm
Solid Metal Content				
Crustal Abundance	1.8	20	84	2.7
PLDC-05-03	56	56	80	1.94
PLDC-06-15	15	53	71	1.71
PLDC-08-10	16	67	91	1.66
Solid Metal Content Percentile Rank				
PLDC-05-03	93	40	90	70
PLDC-06-15	68	30	40	25
PLDC-08-10	70	85	100	18

The SFE leachate concentrations of the HCT samples and a comparison to the larger dataset is provided in Table 3-3. Overall, the selected HCT samples had SFE leachate concentrations that ranged between the 20th percentile and 80th percentile for sulphate, arsenic and nickel (ERM 2021b). The samples compared were based on the PoPC identified in the SFE leachate analysis.

A comparison of HCT sample NAG leachates to the NAG leachate Points Lake database (11 samples) is presented in Table 3-4. The PoPCs identified in the NAG leachate included sulphate, aluminum, arsenic, cadmium, copper, nickel, selenium and vanadium (ERM 2021b). The NAG leachate concentrations for sample PLDC-05-03 consistently exceeded the 80th percentile concentrations in the NAG leachate, with the exception of arsenic. However, arsenic measured in PLDC-06-15 was representative of the 70th percentile concentration.

Table 3-3: SFE Leachate Concentrations for the Three HCT Samples Compared to the Point Lake SFE Leachate Dataset

Samples	Sulphate mg/L	Arsenic mg/L	Nickel mg/L
SFE Leachate Concentrations			
PLDC-05-03	9.8	0.0109	0.0092
PLDC-06-15	16.7	0.0085	0.0107
PLDC-08-10	5	0.0095	0.0005
SFE Leachate Concentrations Percentile Rank			
PLDC-05-03	50	70	50
PLDC-06-15	80	50	60
PLDC-08-10	20	60	20

Table 3-4: NAG Leachate Concentrations for the Three HCT Samples Compared to the Point Lake NAG Leachate Dataset

Samples	Sulphate mg/L	Aluminum mg/L	Arsenic mg/L	Cadmium mg/L	Copper mg/L	Nickel mg/L	Selenium mg/L	Vanadium mg/L
NAG Leachates								
PLDC-05-03	71	0.18	0.03	0.0001	0.05	0.27	0.0018	0.046
PLDC-06-15	62	0.13	0.05	0.0001	0.036	0.2	0.0013	0.035
PLDC-08-10	40	0.13	0.02	<0.00003	0.01	0.08	0.001	0.046
NAG Leachate Concentrations Percentile Rank								
PLDC-05-03	91	85	60	80	90	90	90	90
PLDC-06-15	82	60	70	80	82	82	70	55
PLDC-08-10	40	60	25	-	40	40	30	90

4. HCT SAMPLE ABA DATA

The HCT samples were submitted for a second round of ABA testing (in addition to the initial ABA testing). The updated ABA test results were compared to the initial ABA measurements and the wider Project dataset in Table 4-1. This table also identifies the difference between the initial and updated ABA results of the HCT samples ([updated measurement-initial measurement]/initial measurement). Overall, the difference between the parameters is acceptable (within 40%).

Table 4-1: Comparison Between Original ABA Statistics and Updated ABA Statistics

Samples	Modified	Total Sulphur	NP/AP
	NP	%	
PLDC-05-03	7.4	0.285	0.82
PLDC-06-15	5.9	0.215	0.87
PLDC-08-10	6.1	0.148	1.33
Percent Difference from Initial Dataset			
PLDC-05-03	37	4	32
PLDC-06-15	31	-4	36
PLDC-08-10	-8.9	3	6.4

5. MINERALOGICAL RESULTS AND DISCUSSION

The three HCT samples were submitted for XRD analysis. The mineralogical composition of the samples is summarized in Table 5-1. The laboratory XRD results are provided in Appendix A. The XRD results help to enhance an overall understanding of the geochemical processes potentially occurring within the HCTs. The XRD results indicated that sulphide was present at a concentration at or below 0.3% wt (converted to sulphur %) and the primary neutralizing minerals (calcite and dolomite) were below detection, signifying that aluminosilicates are likely to be the primary minerals responsible for the neutralization of acid. The XRD results were consistent with the ABA interpretations suggesting that the metasediment be characterized as a low AP, low NP material.

Table 5-1: XRD Results for HCT 1, HCT 2 and HCT 3

Mineral	Chemical Formula	HCT -1 PLDC-05-03 (wt%)	HCT-2 PLDC-06-15 (wt%)	HCT-3 PLDC-08-10 (wt%)
Quartz	SiO_2	42.0	45.4	36.7
Albite	$NaAlSi_3O_8$	24.4	25.1	16.8
Diopside	$CaMgSi_2O_6$	2.2	1.6	1.9
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	3.4	9.4	10.2
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$	19.7	16.4	24.3
Magnetite	(Fe(II,III) oxide), $Fe^{2+}Fe^{3+}{}_2O_4$	1.1	0.4	1.0
Hematite	(Fe(III)oxide), Fe_2O_3	1.2	0.4	1.8
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$	-	0.7	5.6
Hornblende	$(Ca,Na)_{2\text{-}3}(Mg,Fe,Al)_5Si_6(Si,Al)_2O_{22}(OH)_2$	0.8	0.3	0.8
Pyrrhotite	Fe_7S_8	0.6	0.3	0.8
Talc	$Mg_3Si_4O_{10}(OH)_2$	4.6	-	-

Notes: Dashes indicate that the mineral was not identified by the analyst and not included in the refinement calculation for the sample.

The weight percent quantities indicated have been normalized to a sum of 100%. The quantity of amorphous material has not been determined.

The sulphides in the Project metasediment were identified by the XRD analysis as pyrrhotite. The XRD also identified the presence of magnetite and hematite which could be markers for the weathering of pyrrhotite over geological time scales. Pyrrhotite tends to oxidize at a faster rate than pyrite (MEND 2009), which is the primary sulphide identified in other kimberlite deposits within the Ekati Diamond Mine mineral lease area (Golder 2021). The identification of this mineral is important to the overall geochemical interpretation as the rate at which pyrrhotite reacts may be faster than previously observed rates associated with pyrite oxidation (MEND 2009). The common impurities associated with pyrrhotite include nickel, cobalt, manganese and copper (MEND 2009). Similar to pyrite, the oxidation of pyrrhotite and the precipitation of iron as ferrihydrite produces two moles of acid (H^+) per mole of sulphide-S.
This relationship is important when evaluating the amount of acid released from the HCTs.

$$FeS + \frac{9}{4}O_2 + \frac{5}{2}H_2O \rightarrow Fe(OH)_3 + SO_4^{2-} + 2H^+$$

Pyrrhotite is generally more reactive than pyrite in solutions with neutral or mildly acidic pH; however, pyrrhotite behaves differently from pyrite in acidic drainage. In solution with pH between 3.0 and 3.5, iron hydrolysis does not occur and the oxidation of pyrrhotite consumes hydrogen irons which can instead act to increase the pH of the solution. Therefore, the presence of pyrrhotite may limit the amount of acidity released to the drainage water at lower pH ranges.

$$FeS + \frac{9}{4}O_2 + H^+ \rightarrow Fe^{3+} + SO_4^{2-} + 1/2H_2O$$

In pH drainage above 3.5, acid production can also result from the oxidation of ferrous iron (Fe II) to ferric iron (Fe III) and the subsequent precipitation of ferric iron to an insoluble solid, such as goethite (FeOOH).

$$4Fe^{2+} + \frac{1}{4}O_2 + \frac{3}{2}H_2O \rightarrow FeOOH + 2H^+$$

Iron released to oxic drainage (above pH 3.5) will commonly precipitate as a secondary iron mineral, including: ferrihydrite, goethite or schwermannite (Blowes and Ptacek, 1994); however, goethite is the primary ferric oxyhydroxide precipitate in slightly acidic pH (MEND, 2009). An understanding of the precipitation of ferric(oxy)hydroxides is important in iron rich systems, such as the Point Lake HCTs because of the iron bearing aluminosilicates minerals identified in the XRD.

In fact, the hydrolysis of several metals such as Fe (III), Al, Cu, Zn, Mn, and Fe(II) can produce acidity. However, the subsequent dissolution and precipitation of aluminum as $Al(OH)_3$ can also buffer acid at a pH between 4.0 and 4.3, and the subsequent dissolution of iron(oxy)hydroxides can buffer pH between 2.5 and 3.5.

$$Al^{3+} + 3OH^- \rightarrow Al(OH)_3$$

$$Fe^{3+} + 3OH^- \rightarrow Fe(OH)_3$$

Aluminosilicates themselves can also neutralize acidity through dissolution; however, the rate of aluminosilicate mineral dissolution can be kinetically limited. Typically, aluminosilicates dissolve in solutions with pH values lower that six. The rate of dissolution can also increase as the pH decreases (Acker and Becker 1991). As aluminosilicates dissolve, secondary precipitates can replace the weathered grains as metal hydroxides (or hydroxyl sulphates) at a pH greater than 4.8, including amorphous $Fe(OH)_3$ and $Al(OH)_3$, gibbsite, ferrihydrite, goethite, and schwertmannite (Blowes and Ptacek 1994).

The neutralizing potential of the aluminosilicate minerals identified in the XRD is provided in Table 5-2, as determined by Jambor (2006) by measuring mineralogical NP and summarized by Karlsson (2018) through the quantification of the relative reactivity. The primary aluminosilicates identified with neutralizing potentials in the XRD include biotite, diopside and chlorite, the most abundant of which is biotite, an iron bearing mineral. In fact, several of the minerals identified in the XRD have high iron contents, including magnetite, hematite, chlorite, and hornblende, in addition to pyrrohite. Magnetite is generally stable except under in waters with low pH (Jambor and Blowes 2009) and thus will likely not contribute materially to the NP. However, biotite and chlorite are likely to be NP contributors through mineral dissolution.

The contribution of each mineral to NP measured in the HCT 1, HCT 2, and HCT 3 samples were calculated based on mineralogy. The mineralogical NP (Jambor 2002) and the reactive NP (Karlsson 2018) for each mineral can be determined respectively through the following approximations:

$$Mineralogical\ Sobek\ NP\ \left(kg\frac{CaCO_3}{tonne}\right) = (\left(Sobek\ NP_{minerals}\left(kg\frac{CaCO_3}{tonne}\right) * \frac{wt\%_{minerals}}{100}\right))$$

$$Reactive\ Mineralogical\ NP\ \left(kg\frac{CaCO_3}{tonne}\right) = 10 * wt\%_{mineral} * \frac{molecular\ weight_{calcite}}{molecular\ weight_{mineral}} * relative\ reactivity_i$$

Table 5-2: Neutralizing Potential Minerals according to the Neutralizing Potential and the Relative Reactivity

Mineral	Chemical Formula	Molecular Weight (g/mol)	Intermediate Weathering	Mineralogical NP (kg $CaCO_3$/t)	Relative Reactivity
Quartz	SiO_2	60.083	Inert	0	-
Albite	$NaAlSi_3O_8$	263.02	slow	1-5	0.01
Diopside	$CaMgSi_2O_6$	216.55	-	5	0.02
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	256.24	Slow	1	0.01
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$	433.53	Intermediate	8	0.02
Magnetite	(Fe(II,III) oxide), $Fe^{2+}Fe^{3+}{}_2O_4$	231.53	-	2	-
Hematite	(Fe(III)oxide), Fe_2O_3	159.69	-	2	-
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$	595.22	-	6	0.02
Hornblende	$(Ca,Na)_2^-$ $3(Mg,Fe,Al)_5Si_6(Si,Al)_2O_{22}(OH)_2$	947.22 (Fe) - 821.16 (Mg)	Intermediate	3	0.02
Pyrrhotite	Fe_7S_8	85.12	-	-	-
Talc	$Mg_3Si_4O_{10}(OH)_2$	379.27	-	2	0.02

The calculated total mineralogical NP is provided in Table 5-3. The mineralogical NP is generally less than the Modified NP; however, there is potentially more uncertainty with the mineralogical NP (as dissolution and buffering of aluminosilicates can be complicated and dependant on the degree of weathering). Overall, the mineralogical NP calculations confirm that biotite is the largest overall contributor to NP.

The dissolution of biotite does not occur at a constant rate or release constant concentrations of cations (incongruent weathering) and is difficult to identify in leachate due to its complicated structure.
The dissolution mechanisms of biotite can vary between the tetrahedral layer of biotite and the octahedral layer. However, a potential dissolution mechanism in atmospheric conditions is the conversion of biotite to vermiculite (Acker and Bricker 1991):

$$3\,K_2(Mg_3Fe_3)Al_2Si_6O_{20} + 8H_2O + 12H_2CO_3 + 6H^+ + \frac{3}{2}O_2 \rightarrow 2[(Mg_3Fe_3)Al_3Si_5O_{20}(OH)_4 \cdot H_2O] + 6K^+ + 3Mg^{2+} + 3Fe^{2+} + * SiO_2 + 12HCO_3^- + 3H_2O$$

The dissolution mechanisms proposed for biotite are often coupled with oxidation (Acker and Bricker 1991). The iron within the biotite sheets can be present as ferrous iron (Fe II) or, if it has undergone oxidation, it can also be converted to ferric iron (Fe III) directly within the crystal lattice itself (Acker and Bricker 1991). Although the dissolution to vermiculite consumes acidity, when ferrous iron (Fe II) is released to solution in oxic environments, it will oxidize to ferric iron (Fe III). As discussed, ferric iron (Fe III) can precipitate as an insoluble ferric(oxy)hydroxide at pH values greater than 3.5, which in turn can release acidity. The release of dissolved iron from biotite dissolution was found to occur at a pH below 5; however, at a pH above 5 iron precipitated as $Fe(OH)_3$ (Acker and Bricker 1991).
Likewise, aluminum released from biotite at a pH of 5.3 will precipitate as $Al(OH)_3$.

Table 5-3: Neutralizing Potential of Humidity Cells according to the Modified NP, Neutralizing Mineralogical NP and the Reactive Mineralogy

NP Mineral	HCT 1			HCT 2			HCT 3		
	Modified NP	Mineralogical NP	Relative Reactive NP	Modified NP	Mineralogical NP	Relative Reactive NP	Modified NP	Mineralogical NP	Relative Reactive NP
Quartz	-	0	0	-	0	0	-	0	0
Albite	-	0.61	0.929	-	0.6275	0.955	-	0.42	0.639
Diopside	-	0.11	0.203	-	0.08	0.148	-	0.095	0.176
Muscovite	-	0.034	0.133	-	0.094	0.367	-	0.102	0.398
Biotite	-	1.576	0.910	-	1.312	0.757	-	1.944	1.122
Magnetite	-	0.022	0.000	-	0.008	0.000	-	0.02	0.000
Hematite	-	0.024	0.000	-	0.008	0.000	-	0.036	0.000
Chlorite	-		0.000	-	0.042	0.024	-	0.366	0.188
Hornblende	-	0.024	0.017	-	0.009	0.006	-	0.024	0.017
Pyrrhotite	-	0	0.000	-	0	0.000	-	0	0.000
Talc	-	0.092	0.243	-	0	0.000	-	0	0.000
Calculated NP	5.4	2.49	2.43	4.5	2.18	2.257	5.6	2.977	2.541

Note: NP units in kg $CaCO_3$/tonne

Biotite dissolution is also typically associated with a release of potassium whereby hydrogen ions (H^+) are thought to replace potassium and sodium cations in the interlayers during early stages of weathering (Acker and Bricker 1991; Lanman 2014). As the pH decreases, the amount of potassium tends to decrease relative to magnesium (Acker and Bricker 1991; Langman 2014) and the closer the ratio of potassium/magnesium, the more extensive the weathering (Langman 2014), with an increase in magnesium release correlated to a decreasing pH (Acker and Bricker 1991). Given this, when evaluating how biotite (a primary NP contributor as identified by XRD) dissolves in HCTs, it becomes important to also monitor the concentrations of iron as well as the major cations (calcium, magnesium, potassium and sodium) to help determine how weathering is progressing. This differs from standard HCT analysis where calcium and magnesium are analyzed to determine the rate of calcite ($CaCO_3$) and dolomite ($CaMg(CO_3)_2$ dissolution.

In acidic solutions, the dissolution of chlorite (a mineral also identified in the XRD) is a significant consumer of acid, according to the reaction defined by Lowson et al (2005).

$$(Mg.Fe,Al)_6[AlSi_3O_{10}](OH)_8 + 16H^+ \rightarrow [6(Mg,Fe,Al)]^{13+} + Al^{3+} + 3H_4SiO_4 + 6H_2O$$

Chlorite dissolution releases predominately ferrous iron which will oxidize to ferric iron and precipitate as $Fe(OH)_3$ in solutions with pH values greater than 5. This oxidation of iron generates acidity and exerts a net downward effect on pH, at pH values above 5. However, below a pH of 5, chlorite dissolution acts as a net buffer and drives the pH upwards (Lowson et al. 2005).

As has been shown through the above discussion, the aluminosilicate dissolution and the release of iron and aluminum can have implications related to buffering and the formation of hydroxides. The dissolution process of some aluminosilicate minerals may also involve oxidation which in turn can impact the redox environment of the local system. As such, the large potential for the release of ferrous iron is an important consideration as its mobility is highly dependant on redox conditions. Ferrous iron can be mobile at neutral and mildly acidic pH in oxygen depleted environments. This makes the presence of dissolved iron in neutral water a key redox indicator. Another key redox indicator is manganese, as manganese in anoxic water will be mobile in its reduced state (Mn II) but is generally present as insoluble Mn(VI) solids in highly oxic conditions (Christensen 2000).

6. HUMIDITY CELL LEACHATE ANALYSIS

The humidity cell analysis was based on the leachate concentrations measured in each HCT over 26 weekly cycles (i.e., the reporting period).

An interpretation of the HCT leachate information is presented below according to the following steps:

- The PoPCs are identified by comparing average concentrations to Ekati Diamond Mine water quality benchmarks and Canadian Council of Ministry of the Environment (CCME) water quality guidelines for freshwater aquatic life.
- The depletion rates for all parameters are calculated.
- Concentrations and trends observed in each individual HCT (HCT 1, HCT 2 and HCT 3) are discussed with time.
- Trends and patterns common to all HCTs are identified and discussed.

Each of the following subsections describe the individual HCT analyses and interpretation of the observed leachate trends based on groupings, as follows:

- The pH, acidity and alkalinity are discussed together in relation to the ABA information provided in Section 3 and depletion rates described in Section 6.2. Key to this discussion is the identification of Insufficiently Reactive NP (IRNP) which refers to NP that may not dissolve at rates capable of buffering the acid generated through sulphide oxidation.
- The sulphate concentrations are discussed as they are key indicators of acid produced through sulphide oxidation, which also tends to release sulphide-associated metals.
- The iron and aluminum concentrations are discussed together for the reason that aluminum and iron hydrolysis are capable of buffering the pH at concentrations between 4.0 and 4.3 and 2.5 and 3.5, respectively. Iron and aluminum concentrations released above these pH values tend to precipitate out of solution.
- The dissolved iron and manganese concentrations are also discussed collectively, as they are key redox indicators as both iron and manganese will precipitate to insoluble solids in oxic neutral drainage.
- The major cation (calcium, magnesium, potassium and sodium) concentrations are discussed collectively to provide an understanding of aluminosilicate buffering. Importantly, the key cation in biotite-dominated NP environments is potassium. Typically, calcium and magnesium are key indicator parameters as they are liberated to the drainage water due to the dissolution of calcium and dolomite; however, the carbonate content in the metasediments is typically below the detection limits, and therefore, calcium and magnesium are more likely indicators of aluminosilicate buffering progression. It is for this reason that carbon molar ratios (CMRs) are not discussed in this report.
- Finally, the trace parameter PoPCs are identified based on increasing concentrations. PoPC above guidelines are also identified based on concentrations measured at each cycle. Trace parameter trends are discussed to provide an understanding of how contaminates may be liberated to the drainage water during Point Lake mining operations.

A concern raised during the Water Licence Amendment process was the discrepancies identified between the NAG pH values (ERM 2021b). Therefore, the HCT interpretations endeavour to incorporate trends associated with NAG leachate concentrations, where possible. An expanded discussion of the NAG pH discrepancies is provided in Section 6.8. This discussion is provided to address the water licence requirement of Schedule 6, Part H, Item 6(b)ii.

The raw HCT results are presented in Appendix A, and plots of the concentrations of all parameters with time are presented in Appendix B. The calculated loading rates are provided in Appendix C, and a comparison between the NAG leachate concentrations and the HCT concentrations during the last five weeks of analysis is provided in Appendix D. The NAG and SFE leachate are compared to leachate from the Jay Project in Appendix E.

6.1 Parameters of Potential Concern

The average HCT leachate concentrations are compared to the Ekati Diamond Mine water quality benchmarks (ERM 2021d) and, for parameters that do not have benchmarks, Canadian Council of Ministers of the Environment (CCME) guidelines, in Table 6.1-1. The hardness used to calculate the benchmarks and guideline values for those incorporating hardness as a toxicity modifying factor was 20 mg/L (consistent with the hardness in HCT 2). Parameters that are observed to increase in the HCTs with time (based on visual assessment of time series) or that were greater than the Ekati Diamond Mine water quality benchmarks or CCME guidelines were considered PoPCs in this analysis.

The inclusion of a given constituent in this list of PoPCs does not indicate a potential environmental effect, but rather that the PoPC requires evaluation prior to being discharged to the environment. Constituents that are screened in as PoPCs in this report will be further evaluated in the context of discharges to the environment as part of the Point Lake WRSA Seepage Prediction Report (ERM 2022).

The average concentrations measured during the initial flush (first 5 weeks/cycles of analysis), over the course of the HCT tests (26 weeks/cycles of analysis) and during the final 5 weeks/cycles of analysis are shown in Table 6.1-1.

6.2 Depletion Rates

Depletion rates help to establish if an HCT will develop acidic drainage in the future. The depletion rate calculations include the depletion of NP minerals with time and the depletion of sulphides over time. If the sulphide content is predicted to outlast the NP content (i.e., the NP depletes prior to the sulphides), the HCT will likely develop acidic drainage.

The depletion calculations do not consider rate-limited reactions (e.g., IRNP) or the occlusion of NP (or sulphides) grains unless the NP is depleted in the cell and the NP that is not effective can be identified. The depletion calculations are also based on the Modified NP measurements; although, the mineralogical NP measurements are approximately half the amount of the Modified NP measurement.

The rate of NP depletion (i.e., the lag time) will also likely be slower in the field. The temperature scaling factor can be used to convert the lag times to field scale lag times. A temperature scaling factor of 0.2 was calculated based on a comparison between the sulphate concentrations in leachate from cold HCT tests conducted on metasediment at 4˚C and leachate from HCT tests conducted on split samples at 20˚C (Golder 2021). A temperature scaling factor of 0.2 is consistent with information provided by Tetra Tech indicating the temperature in the WRSA will likely be 3˚C (personal communication, Gary Koop, Tetra Tech, July 6th, 2022) and by using the relationship between the relative reaction rates (calculated with the Arrhenius equation) and temperatures at an average temperature of 3˚C (MEND 2006). This is also consistent with the average annual scaling factor calculated from the monthly scaling factors based on average ambient monthly temperatures approximated with the Arrhenius equation (MEND 2006), as shown in Table 6.2-1.

Table 6.1-1: Average Concentrations Measured during the Initial Flush, the Entire HCT Run (26 Cycles), and the Last Five Weeks of Analysis Compared to Ekati Diamond Mine Water Quality Benchmarks and CCME Guidelines

Parameters	Ekati Water Quality Benchmark/ CCME Guideline	First 10 Weeks			Entire Period			Last Five Weeks		
		HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3
		PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10
pH	6.5	6.69	6.06	7.10	6.00	4.97	6.22	5.22	4.19	5.55
Hardness		14.0	16.9	9.4	15.4	23.9	12.3	17.4	24.4	15.4
Conductivity		61.9	103.9	53.4	66.5	139.0	54.1	81.9	149.9	58.6
Acidity		1.19	1.75	1.34	4.01	10.62	1.29	8.86	13.59	1.39
Total Alkalinity		3.93	2.79	6.15	2.81	2.45	3.75	1.93	below detection	2.24
Sulphate	85	19.6	34.3	12.2	20.9	46.0	14.6	28.8	50.0	19.2
Bromide		0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Chloride	145	0.55	0.55	0.55	0.52	0.52	0.52	0.50	0.50	0.50
Fluoride	1.5	0.058	0.030	0.073	0.041	0.061	0.047	0.030	0.140	0.030
Aluminum	0.1	0.0062	0.0206	0.0369	0.0128	0.7712	0.0171	0.0418	1.3300	0.0038
Antimony	0.006	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045
Arsenic	0.005	0.0111	0.0080	0.0099	0.0054	0.0043	0.0055	0.0009	0.0013	0.0014
Barium	1	0.0084	0.0049	0.0026	0.0111	0.0061	0.0016	0.0163	0.0080	0.0009
Beryllium		0.000004	0.000012	0.000004	0.000083	0.000377	0.000004	0.000309	0.000686	0.000004
Bismuth		0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050
Boron	1.5	0.0109	0.0147	0.0134	0.0090	0.0129	0.0096	0.0062	0.0130	0.0082
Cadmium	0.00004	0.000024	0.000075	0.000044	0.000181	0.000449	0.000037	0.000455	0.000627	0.000059
Calcium		2.16	1.35	1.15	2.38	2.03	1.38	2.84	2.71	1.53
Chromium	0.001	0.000040	0.000054	0.000050	0.000044	0.000176	0.000047	0.000060	0.000160	0.000054
Cobalt		0.00237	0.04136	0.00008	0.03850	0.20552	0.00053	0.10750	0.23280	0.00160
Copper	0.002	0.00023	0.00080	0.00033	0.00138	0.01789	0.00035	0.00304	0.04266	0.00042
Iron	0.3	0.010	0.194	0.014	0.867	1.350	0.010	3.686	0.058	0.010

Parameters	Ekati Water Quality Benchmark/ CCME Guideline	First 10 Weeks			Entire Period			Last Five Weeks		
		HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3
		PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10
Lead	0.001	0.000078	0.000045	0.000064	0.000186	0.000410	0.000056	0.000562	0.000780	0.000064
Lithium		0.0096	0.0104	0.0038	0.0143	0.0204	0.0045	0.0276	0.0325	0.0072
Magnesium		2.09	3.28	1.57	2.28	4.59	2.15	2.50	4.29	2.82
Manganese	0.43	0.043	0.117	0.0080	0.193	0.266	0.0331	0.430	0.241	0.0908
Mercury	0.000026	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000006
Molybdenum	0.5	0.00045	0.00057	0.00375	0.00047	0.00030	0.00156	0.00078	0.00016	0.00015
Nickel	0.025	0.0173	0.1840	0.0008	0.1629	0.7999	0.0048	0.4220	0.9330	0.0145
Phosphorus		0.0036	0.0022	0.0047	0.0023	0.0018	0.0027	0.0018	0.0015	0.0015
Potassium	41	4.24	9.50	4.33	3.37	9.21	3.81	2.98	8.07	3.61
Selenium	0.0015	0.000243	0.000505	0.000166	0.000261	0.000609	0.000119	0.000444	0.000498	0.000094
Silicon		1.21	1.21	0.76	1.40	2.30	0.91	1.85	3.91	1.25
Silver	0.00025	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025
Sodium		1.59	3.79	2.71	0.85	1.95	1.57	0.37	0.59	0.68
Strontium		0.0264	0.0194	0.0074	0.0320	0.0279	0.0079	0.0434	0.0279	0.0085
Sulphur		7.01	12.15	5.31	7.73	16.75	6.12	10.80	16.60	7.60
Thallium	0.0008	0.0000041	0.0000059	0.0000025	0.0000050	0.0000118	0.0000026	0.0000053	0.0000178	0.0000025
Tin		0.000086	0.000159	0.000061	0.000067	0.000088	0.000084	0.000062	0.000042	0.000070
Titanium		0.000115	0.000197	0.000349	0.000076	0.000122	0.000195	0.000040	0.000083	0.000118
Uranium	0.015	0.000014	0.000074	0.000039	0.000074	0.002812	0.000024	0.000246	0.003728	0.000005
Vanadium	0.03	0.000212	0.000135	0.000937	0.000107	0.000062	0.000469	0.000054	0.000039	0.000124
Zinc	0.0081	0.0066	0.0190	0.0157	0.0230	0.2310	0.0077	0.0666	0.3336	0.0042
Zirconium		0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010

Assumed hardness of 20 $CaCO_3$ mg/L.

Concentrations in mg/L.

Shading indicates an exceedance of the Ekati Diamond Mine water quality benchmark or CCME guideline.

Table 6.2-1: Mean Monthly Temperature and Scaling Factor

Month	Mean Monthly Temperature	Monthly Temperature Scaling Factor
Jan	Frozen – no sulphide oxidation	0
Feb	Frozen – no sulphide oxidation	0
March	Frozen – no sulphide oxidation	0
April	Frozen – no sulphide oxidation	0
May	Frozen – minor sulphide oxidation	0.2
June	7.4	0.4
July	12.5	0.6
Aug	10.6	0.5
Sep	3.8	0.3
Oct	Frozen – minor sulphide oxidation	0.2
Nov	Frozen – no sulphide oxidation	0
Dec	Frozen – no sulphide oxidation	0
Annual Scaling Factor		0.2

The depletion times estimates can be scaled to field settings based on a scaling factor of 0.2; however, another item to be considered is IRNP. Although IRNP may be identified in the lab (sulphate rates are accelerated in the laboratory relative to the field), IRNP may not occur in the field to the same degree because the sulphate oxidation rate will be reduced compared to the laboratory rate. Given that the NP is dependent on biotite dissolution (a rate limited process), even if the biotite is unable to dissolve at a rate sufficient to buffer acid generated (through sulphide oxidation) in the laboratory, this may not be the case in the field at the reduced sulphide oxidation rates. Simply speaking, the IRNP in the lab may not equate to IRNP in the field and thus the lag time identified in the lab may be greater in the field, even after considering the temperature scaling factor to adjust sulphide oxidation rates. This concept is explored further as part of source term development in the Point Lake WRSA Seepage Prediction Report (ERM 2022).

The laboratory depletion rates are summarized in Table 6.2-2. The depletion rates were calculated based on the initial contents (determined by ABA analysis) and the amount of depletion that has occurred in the HCTs. Specifically, the NP depletion rate is calculated based on the amount of acid generated, measured by the amount of sulphate in the leachate. One mole of sulphate released to solution equates to one mole of pyrrhotite dissolved. Therefore, the sulphide depletion rate and the NP depletions rates can be calculated by the equations outlined by MEND (2009):

$$Sulphate\ Production\ Rate\ \left(\frac{\frac{mg}{kg}}{wk}\right) = \frac{sulphate\ \left(\frac{mg}{L}\right) x\ Volume\ Leachate\ Collected\ (L)}{Sample\ Weight\ (kg)}$$

The Remaining Total-S is calculated as:

$$\%\ of\ Original = 100x\frac{Initial\ Total\ S\ \% - Cumulative\ Sulphate\ Production\ Rate\ \left(\frac{mg}{kg}\right) x\frac{32.06}{96.06}/10000}{Initial\ Total - S\%}$$

The NP consumption rate is calculated based on the Empirical Open System NP consumption rate, by converting the amount of sulphate released to calcium carbonate units as follows:

$$Theoretical\ NP\ Consumption\ at\ a\ pH\ of\ 6\ \left(\frac{mg\frac{CaCO3}{kg}}{wk}\right) = Sulphate\ Production\ rate\ \left(\frac{\frac{mg\ SO4}{kg}}{wk}\right)\ x\ 100.09/96.06$$

$$Empirical\ Open\ System\ NP\ Consumption\ around\ Neutral\ pH\ (mg\ CaCO3/kg/wk) = Theoretical\ NP\ Consumption\ (mg\ CaCO3/kg/wk) +\ Alkalinity\ Production\ Rate\ \left(\frac{mg\frac{CaCO3}{kg}}{wk}\right) - Acidity\ Production\ Rate\ (mg\ CaCO3/kg/wk)$$

Overall, the NPs of HCT 1 and HCT 2 are predicted to be depleted prior to sulphide depletion, consistent with the classification of these cells as PAG and PAF. The depletion rates are discussed by evaluating the pH, alkalinity and acidity trends in sections 6.3.1, 6.4.1 6.5.1, for HCT 1, HCT 2, and HCT 3, respectively. An overview of that discussion is as follows. As shown in Table 6.2-1, the NP in HCT 1 is expected to be depleted in nine years (laboratory time frame); however, the pH has dropped below 5. Therefore, the actual effective buffering pH of this HCT has yet to be identified (as buffering via aluminosilicates may increase as the pH decreases). The pH remains above the 4.5 pH which is the pH selected in this report to identify PAF material. The alkalinity in HCT 2 is depleted, indicating that HCT 2 (in the lab) may already be considered PAF (the pH is below 4.5 – Section 6.4.1) and that there is a large amount of IRNP in HCT 2 (based on a PAF classification of pH <4.5). The pH appears to have reached a buffering plateau slightly above 4, potentially related to aluminum hydroxide dissolution (occurs between a pH of 4 and 4.3). The NP measured in HCT 3 is predicted to outlast the sulphide content, consistent with the classification of the HCT as Uncertain (based on the Modified NP). As previously stated, the depletion calculations do not account for potential IRNP or occluded NP that is not available to react. Therefore, HCT 3 cannot be reclassified as non-PAG based on this analysis.

6.3 HCT 1 Analysis and Interpretation

6.3.1 HCT 1 – Acidity, Alkalinity, and pH

Figure 6.3-1 shows the change in acidity, alkalinity, and pH with time in HCT 1. The pH measured in the leachate of HCT 1 progressively dropped from above 7 to 4.95 during the reporting period. The acidity generated from the HCT began to outpace the amount of alkalinity in the drainage water between cycles (weeks) 15 and 20. Although neutralizing minerals were dissolving during these cycles, the rate at which acid was generated outpaced the rate of dissolution of net NP bearing minerals. In other words, the NP in this cell may be insufficiently reactive (i.e., IRNP) as evidenced by the gradual decline in the pH. However, the pH of this cell remains above 4.5 which is the pH cut-off value used to identify PAF material for aluminosilicate buffered systems in this report.

Table 6.2-2: Depletion Rates Calculated in the HCTs for Sulphides, NP, and Trace Metals

Parameters	Initial Solid Content (mg/kg)			Amount Depleted (mg)			Rate of Last 5 Weeks (mg/wk)			% Depleted			Predicted Time to Cell Depletion (weeks)			Predicted Depletion Time (weeks)		
	HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3
	PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10
pH							5.22	4.19	5.55									
Hardness																		
Modified NP (mg $CaCO_3$)	5400.0	4500.0	5600.0	245.0	468.1	220.8	10.52	depleted	9.66	4.5372	10.4025	3.9423	490	depleted	557	517	depleted at 15 weeks	584
Acidity				51.83	137.01	16.49	4.0	6.4	0.6									
Total Alkalinity				34.74	13.87	47.75	0.9	depleted	1.0									
Sulphur (%)	0.275	0.224	0.143	0.00840	0.01894	0.00607	0.0004	0.0008	0.0003	3.0529	8.4546	4.2448	616	260	466	643	287	493
Bromide				1.73	1.77	1.78	0.07	0.07	0.07									
Chloride				5.96	6.08	6.17	0.23	0.24	0.23									
Fluoride				0.471	0.733	0.554	0.014	0.066	0.014									
Aluminum	88300.0	83900.0	94100.0	0.1487	9.2855	0.1969	0.0189	0.6279	0.0017	0.0002	0.0111	0.0002	4681114	133603	54330140	4681141	133630	54330167
Antimony	0.2	0.2	0.1	0.00520	0.00531	0.00535	0.00020	0.00021	0.00021	2.6010	3.5370	8.9138	962	683	266	989	710	293
Arsenic	56.0	15.0	16.0	0.0618	0.0504	0.0653	0.0004	0.0006	0.0006	0.1103	0.3360	0.4083	135149	23707	25549	135176	23734	25576
Barium	627.0	601.0	793.0	0.1284	0.0721	0.0187	0.0074	0.0038	0.0004	0.0205	0.0120	0.0024	85129	159559	1924899	85156	159586	1924926
Beryllium	1.6	1.1	1.6	0.000974	0.004538	0.000042	0.000139	0.000323	0.000002	0.0608	0.4126	0.0026	11482	3389	1000287	11509	3416	1000314
Bismuth	0.3	0.3	0.2	0.0000578	0.0000590	0.0000594	0.0000023	0.0000024	0.0000023	0.0214	0.0184	0.0270	119974	135856	96254	120001	135883	96281
Boron				0.1021	0.1515	0.1141	0.0028	0.0061	0.0038									
Cadmium	0.1	0.1	0.1	0.002113	0.005388	0.000434	0.000205	0.000296	0.000027	1.5094	4.4897	0.4819	673	387	3339	700	414	3366
Calcium	11600.0	9400.0	10800.0	27.47	24.10	16.54	1.28	1.28	0.70	0.2368	0.2564	0.1532	9063	7351	15405	9090	7378	15432
Chromium	164.0	127.0	179.0	0.000508	0.002075	0.000546	0.000027	0.000075	0.000025	0.0003	0.0016	0.0003	6051642	1694661	7303119	6051669	1694688	7303146
Cobalt	25.4	23.8	29.5	0.45006	2.46037	0.00635	0.04846	0.10988	0.00073	1.7719	10.3377	0.0215	515	194	40368	542	221	40395
Copper	49.9	58.9	52.1	0.01617	0.21566	0.00420	0.00137	0.02002	0.00019	0.0324	0.3661	0.0081	36459	2931	275785	36486	2958	275812
Iron	45600.0	40600.0	55000.0	10.186	15.983	0.117	1.667	0.027	0.005	0.0223	0.0394	0.0002	27346	1477663	12177545	27373	1477690	12177572
Lead	16.9	11.5	13.4	0.002133	0.004912	0.000665	0.000252	0.000364	0.000029	0.0126	0.0427	0.0050	67132	31597	460221	67159	31624	460248
Lithium	56.0	53.0	67.0	0.1657	0.2434	0.0537	0.0125	0.0153	0.0033	0.2960	0.4592	0.0802	4482	3448	20376	4509	3475	20403
Magnesium	18100.0	17100.0	20900.0	26.39	54.52	25.77	1.13	2.02	1.29	0.1458	0.3188	0.1233	16037	8436	16173	16064	8463	16200
Manganese	457.0	434.0	555.0	2.251	3.172	0.3960	0.194	0.114	0.0415	0.4926	0.7309	0.0714	2347	3793	13361	2374	3820	13388
Mercury				0.000058	0.000059	0.000062	0.000002	0.000002	0.000003									
Molybdenum	1.7	1.8	2.0	0.00534	0.00349	0.01839	0.00035	0.00007	0.00007	0.3179	0.1993	0.9429	4813	23557	28015	4840	23584	28042
Nickel	80.0	71.0	91.0	1.9018	9.5739	0.0570	0.1902	0.4402	0.0066	2.3772	13.4844	0.0626	411	140	13706	438	167	13733
Phosphorus	700.0	500.0	700.0	0.0271	0.0208	0.0316	0.0008	0.0007	0.0007	0.0039	0.0042	0.0045	862567	707685	1021106	862594	707712	1021133
Potassium	22700.0	22700.0	26500.0	38.52	108.23	45.32	1.34	3.81	1.65	0.1697	0.4768	0.1710	16898	5932	15997	16925	5959	16024
Selenium	1.0	1.0	1.0	0.002997	0.007197	0.001414	0.000200	0.000235	0.000043	0.2997	0.7197	0.1414	4983	4217	23169	5010	4244	23196

Parameters	Initial Solid Content (mg/kg)			Amount Depleted (mg)			Rate of Last 5 Weeks (mg/wk)			% Depleted			Predicted Time to Cell Depletion (weeks)			Predicted Depletion Time (weeks)		
	HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3
	PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10
Silicon				16.30	27.62	10.93	0.83	1.85	0.57									
Silver	0.1	0.1	0.1	0.000289	0.000295	0.000297	0.000011	0.000012	0.000011	0.2627	0.3275	0.3301	9752	7618	7851	9779	7645	7878
Sodium	20600.0	20200.0	17300.0	9.60	22.34	18.60	0.17	0.28	0.31	0.0466	0.1106	0.1075	123148	71784	55523	123175	71811	55550
Strontium	315.0	269.0	288.0	0.3698	0.3311	0.0942	0.0196	0.0132	0.0039	0.1174	0.1231	0.0327	16092	20421	73411	16119	20448	73438
Sulphur	0.0	0.0	0.0	89.16	198.47	73.19	4.86	7.82	3.48									
Thallium	0.5	0.4	0.6	0.0000580	0.0001408	0.0000313	0.0000024	0.0000084	0.0000011	0.0112	0.0335	0.0056	217777	49965	490126	217804	49992	490153
Tin	1.4	1.2	1.2	0.000780	0.001018	0.001005	0.000028	0.000020	0.000032	0.0557	0.0849	0.0837	49865	61017	38051	49892	61044	38078
Titanium	4000.0	3800.0	4500.0	0.000882	0.001350	0.002188	0.000018	0.000039	0.000053	0.0000	0.0000	0.0000	224089586	98675634	84182917	224089613	98675661	84182944
Uranium	2.1	1.7	1.7	0.000860	0.033740	0.000283	0.000111	0.001753	0.000002	0.0410	1.9731	0.0171	18922	956	683574	18949	983	683601
Vanadium	125.0	114.0	144.0	0.001235	0.000699	0.005511	0.000024	0.000018	0.000057	0.0010	0.0006	0.0038	5184519	6231173	2512993	5184546	6231200	2513020
Zinc	78.0	83.0	84.0	0.2681	2.7760	0.0903	0.0300	0.1574	0.0019	0.3438	3.3446	0.1075	2590	510	43863	2617	537	43890
Zirconium	117.0	121.0	121.0	0.0116	0.0118	0.0119	0.0005	0.0005	0.0005	0.0099	0.0097	0.0098	259974	256875	264744	260001	256902	264771

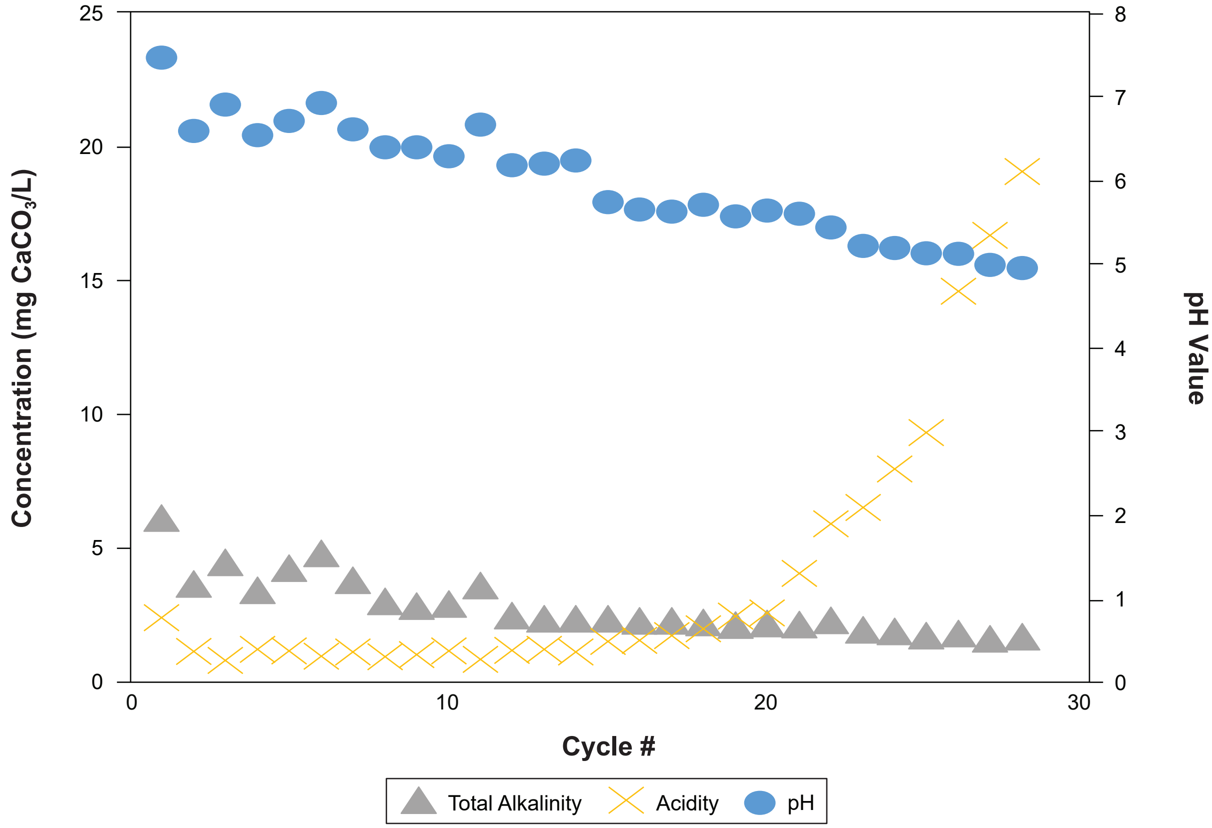
Amount Depleted measured in mg/kg.

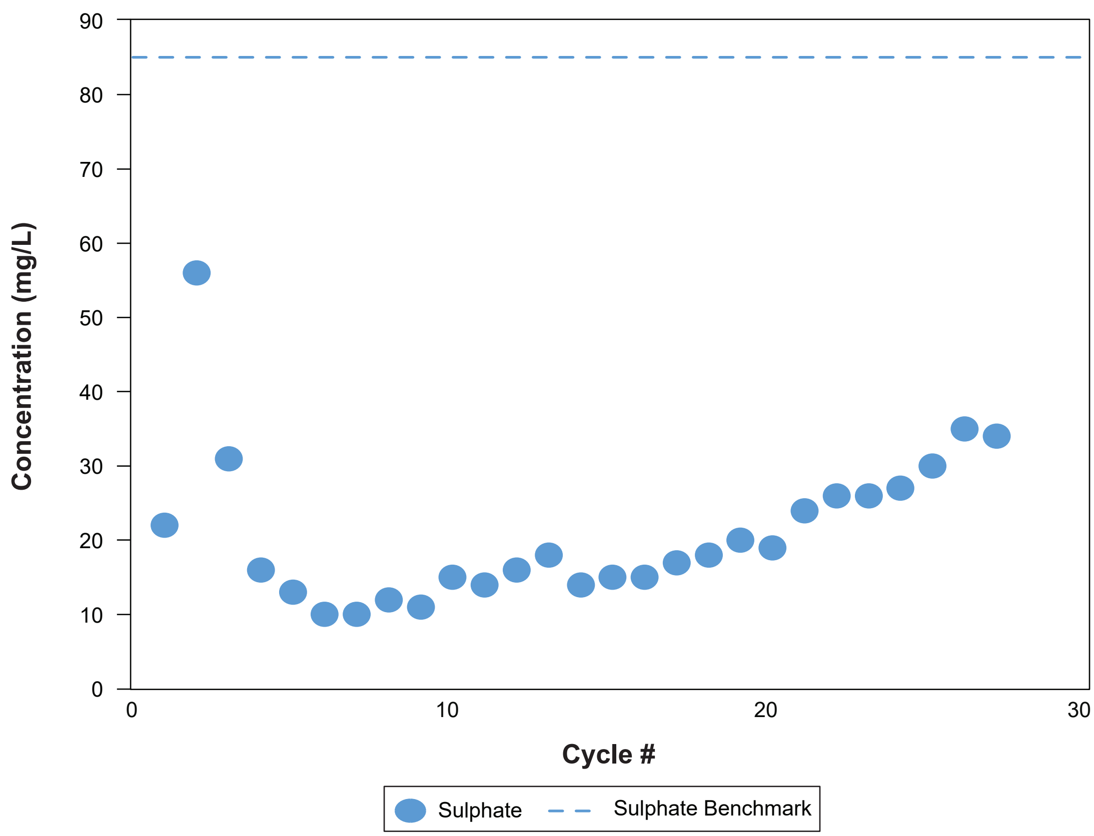
Initial Solid Content Measured in mg/kg.

% Depleted is the initial depleted/initial amount.

Sulphate converted to sulphur.

NP depletion calculated as sulphate production rate + alkalinity production rate - acidity production rate.





Note: Benchmark for sulphate based on a hardness of 20 mg/L

Figure 6.3-1: The pH, Alkalinity, Acidity, and Sulphate Concentrations in HCT 1 with Time

The sulphide oxidation rate (as well as the rate that iron is oxidized) is dependant on temperature. At the Ekati Diamond Mine site, the temperature may reduce the sulphide oxidation rate to 20% of the reaction rate measured in the lab assuming an average temperature of 3˚C in the WRSA. Therefore, as stated in Section 6.2 it is possible that the amount of acid generated by sulphide oxidation (at reduced rates) in the cold-temperature field conditions at the Ekati Diamond Mine may be buffered by aluminosilicate dissolution for a prolonged period of time. The impact of this buffering is not fully understood as this stage as the rate of biotite dissolution and ferrous iron oxidation may also be impacted by temperature. The oxidation of ferrous iron and precipitation of ferric(oxy)hydroxides is also a reaction that generates acid and may be driving the pH downwards in the HCT 1 leachate.

Overall, the pH of HCT 1 remained above the original NAG pH measured in 2019 (4.71) and the updated NAG pH measured in 2021 (3.93); however, the HCT leachate has not reached steady state. The HCT 1 had a higher modified NP content compared to HCT 2 which is classified as PAF (Section 6.4.1).

6.3.2 HCT 1 – Sulphate

Figure 6.3-1 shows the change in sulphate concentration with time in the HCT 1 leachate. The sulphate concentration in HCT 1 underwent an initial flush prior to week five and reached a maximum concentration of 56 mg/L. After the flush, sulphate gradually increased from approximately 10 to 35 mg/L. This increase corresponded to the observed drop in pH during these cycles, as sulphide oxidation accelerates as the drainage becomes progressively acidic drainage.

The sulphate measured in the NAG test was 70 mg/L (twice as high as the sulphate measured in the HCT leachate during the last five weeks of analysis); therefore, the NAG leachate may be an overly conservative analog of water quality for this sample.

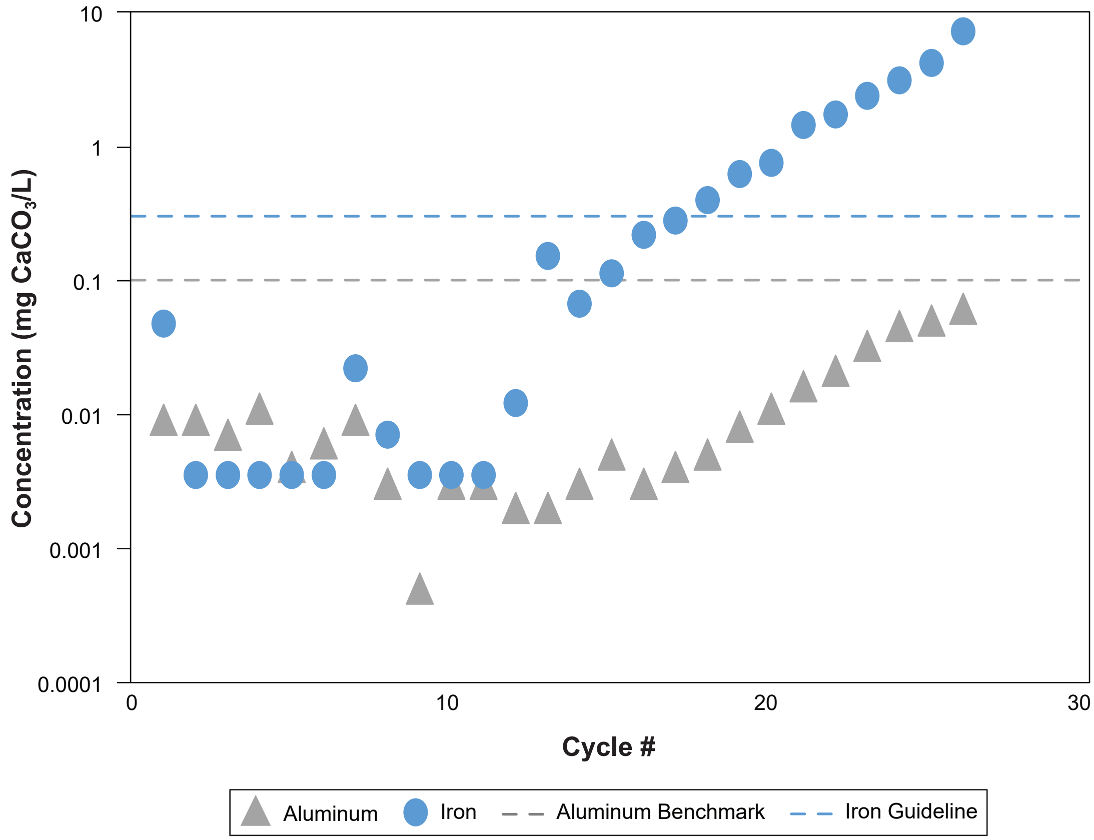
6.3.3 HCT 1 – Aluminum and Iron

Aluminum concentrations in the HCT 1 leachate increased over the reporting period (Figure 6.3-2). This indicates weathering within HCT 1 in response to sulphide oxidation occurred. The released acid would have been neutralized (in part) through the dissolution of aluminosilicates as described in Section 5, which also likely contributed aluminum to the drainage water. Above a pH of 6, the aluminum concentration remained near the detection limit and well below the Ekati Diamond Mine water quality benchmark. However, at cycle 20, the aluminum concentration began to increase as the pH dropped below 5.6. The increase in aluminum is likely in response to accelerated dissolution of minerals such as biotite as well as a reduction in the amount of free aluminum that precipitated as $Al(OH)_3$. At cycle 26, aluminum remained below the Ekati Diamond Mine water quality benchmark; however, as steady state conditions have not been achieved, it is possible that aluminum will increase above this value as weathering progresses. Dissolved aluminum in the NAG test leachate (0.18 mg/L) was higher than the HCT leachate (0.04 mg/L), likely due to the lower pH of the NAG leachate.

The concentration of iron began to increase around cycle 12 and reached a maximum concentration of 7 mg/L, which exceeded the CCME guideline of 0.3 mg/L. In contrast, the dissolved iron in the NAG test was below the detection limit. This was likely due to complete oxidation of iron to a ferric(oxy)hydroxide. The presence of iron in the HCT 1 leachate at a pH greater than 3.5 suggests that the leachate from the HCT leachate was reduced (as discussed in the following section).

6.3.4 HCT 1 – Redox Indicators (Iron and Manganese)

Several sources of iron were identified in the XRD; however, the primary source is likely biotite dissolution. Potential sources of manganese include sulphide oxidation and the dissolution of chlorite (although chlorite was not detected in the XRD).



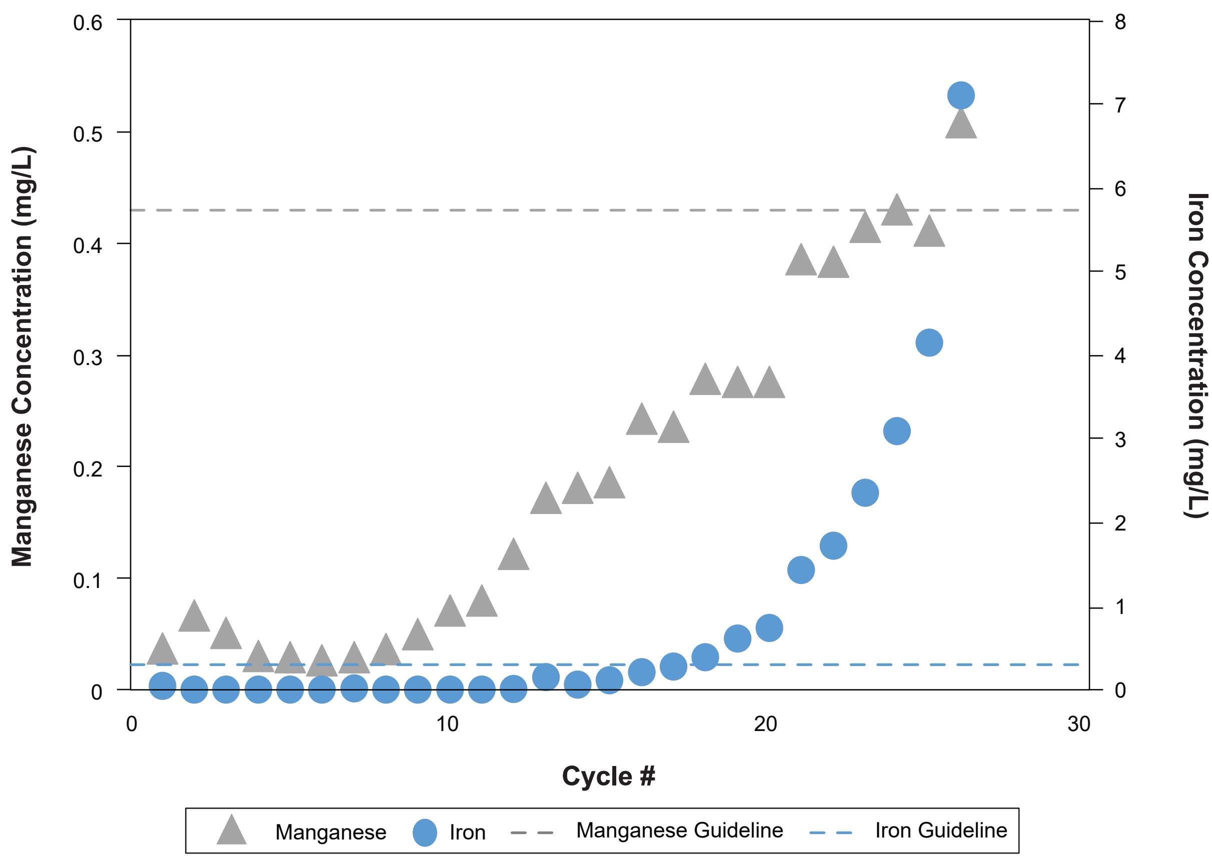


Figure 6.3-2: The Aluminum, Iron, and Manganese Concentrations in HCT 1 with Time

In oxic conditions with pH values greater than 5, both iron and manganese tend to be present in solution in their oxidized states as Fe (III) and Mn (VI) and form insoluble solids (Christensen et al. 1999); however, the presence of dissolved iron and manganese in drainage water indicates the parameters exist as reduced species (Fe [II] and Mn [II]) which are mobile in anoxic environments. Figure 6.4-2 in Section 6.4 shows the change in iron and manganese with time in HCT 1. During the last five weeks of analysis, manganese concentrations increased above the CCME guideline in HCT 1. A gradual increase in manganese preceded the increase in iron which began around cycle eight. This could indicate a redox front has formed within the HCT and that oxygen was consumed in the pore space of the HCT during flushing (resulting in the increase in manganese to meet CCME guideline and the increase in iron well above CCME guideline).

The major mechanisms for oxygen consumption (which would promote anoxic and reduced drainage indicative of a redox front) are sulphide oxidation, oxidation of ferrous iron, and oxidation of biotite as part of biotite dissolution (which also liberates ferrous iron). Ferrous iron is associated with reducing conditions (e.g., anoxic groundwater is typically elevated in ferrous iron in neutral pH); however, the oxidation of ferrous iron to ferric iron (generally present as insoluble ferric(oxy)hydroxides at neutral pH - likely as goethite at the observed pH) may be kinetically limited in the HCT (i.e. not reached thermodynamic week equilibrium); however, the bacterial oxidation of ferrous iron to ferric iron is primarily only rate limiting at lower pH values below 3.5 (MEND 2009).

During the last cycle, the leachate was monitoring for oxidation reduction potential (ORP) and dissolved oxygen (DO). The ORP was 342 mv and the DO was 4.7 mg/L. These reading suggest that the sampled drainage had DO, indicating that iron concentrations may have been high due to complexation, potentially with sulphate ($FeSO_4^+$, $Fe(SO_4)_2^-$) and hydroxo complexes ($FeOH^{2+}$, $Fe(OH)_2^+$, $Fe_3(OH)_4^{5+}$). Studies on mine drainage have shown that the free cations are only presence at extremely acidic pH but metal sulphate complexes are stable between 1.5 and 6; whereas hydroxides forms are dominant at near neutral conditions (Sanchez España 2007).

PHREEQC geochemical modelling analyses with the minteq.V4 database was conducted on the leachate of the last HCT cycle (assuming a pe of 5.5 and a pH of 5.1) as part of source term development (ERM 2022). The geochemical modelling showed that goethite was supersaturated in the HCT leachate with a saturation index (SI) of 2.2. Geothite was determined to be saturated (SI of 0) at a pe of 3.3 (at the observed pH and dissolved iron concentrations) indicating that goethite precipitation exerts downward pressure on redox state of the solution. The impact of pe on dissolved iron concentrations and pH is evaluated in additional detail as part of source term development (ERM 2022).

6.3.5 HCT 1 – Cations

During the first five cycles, a flush (spike in concentration) of potassium, magnesium, sodium and calcium was observed (Figure 6.3-3). At cycle five, the potassium and sodium concentration reached relatively steady-state values while calcium, magnesium and silicon continued to increase throughout the reporting period. This is consistent with the weathering fronts typically observed for biotite (potassium and sodium are initially released from the inter-sheet, likely by displacement with free hydrogen ions) as described in Section 5. The gradual increase in silicon and magnesium may indicate the accelerated dissolution of biotite (or other aluminosilicates), potentially augmented by the drop in pH.

A comparison between the cations measured in the HCT leachate and the NAG leachate indicated that the NAG leachate was consistently elevated in major cations relative to the HCT leachate. The calcium and magnesium concentrations in the NAG leachate were approximately double the concentrations in the HCT leachate. Potassium was approximately six times greater which may be due to more complete biotite dissolution during the NAG test. Sodium is an additive in the NAG leachate testing and thus not representative of dissolution processes.

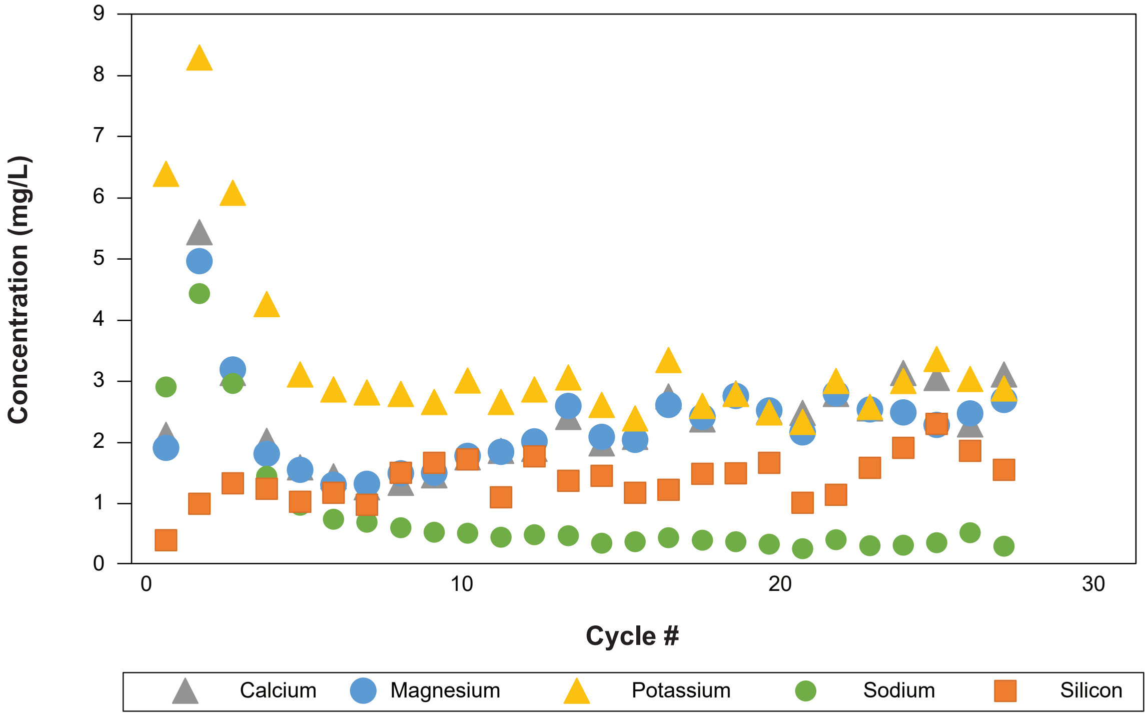


Figure 6.3-3: The Cation Concentrations in HCT 1 with Time

6.3.6 HCT 1 – Trace Metals

Arsenic initially exceeded the Ekati Diamond Mine water quality benchmark of 0.005 mg/L, but the arsenic concentration dropped below 0.005 mg/L after 11 weeks of analysis (Appendix B). Arsenic is an oxyanion, and the mobility of oxyanions tends to be higher at neutral pH (consistent with the observed decrease in concentrations as the pH decreased). However, the observed decrease may simply have resulted from flushing processes. The concentration of arsenic in the NAG leachate (0.032 mg/L) was over an order of magnitude higher than the arsenic concentration in the HCT leachate during the last five weeks of analysis.

The concentrations of beryllium, cadmium, copper, lead, cobalt, nickel and zinc increased with time over the course of the test (Figure 6.3-4). None of these parameters attained steady state concentrations during the reporting period–consistent with the pH of the leachate (which dropped over the same time period). The mobility of these metals tends to increase in increasing acidic drainage. Beryllium, cadmium, cobalt, manganese and zinc concentrations were higher in the HCT leachate than the NAG leachate. The higher HCT leachate concentrations compared to the NAG leachate may be due to co-precipitation and/or adsorption that occurred during the NAG test or possibly sample heterogeneity.

6.4 HCT 2 Analysis and Interpretation

6.4.1 HCT 2 – Acidity, Alkalinity, and pH

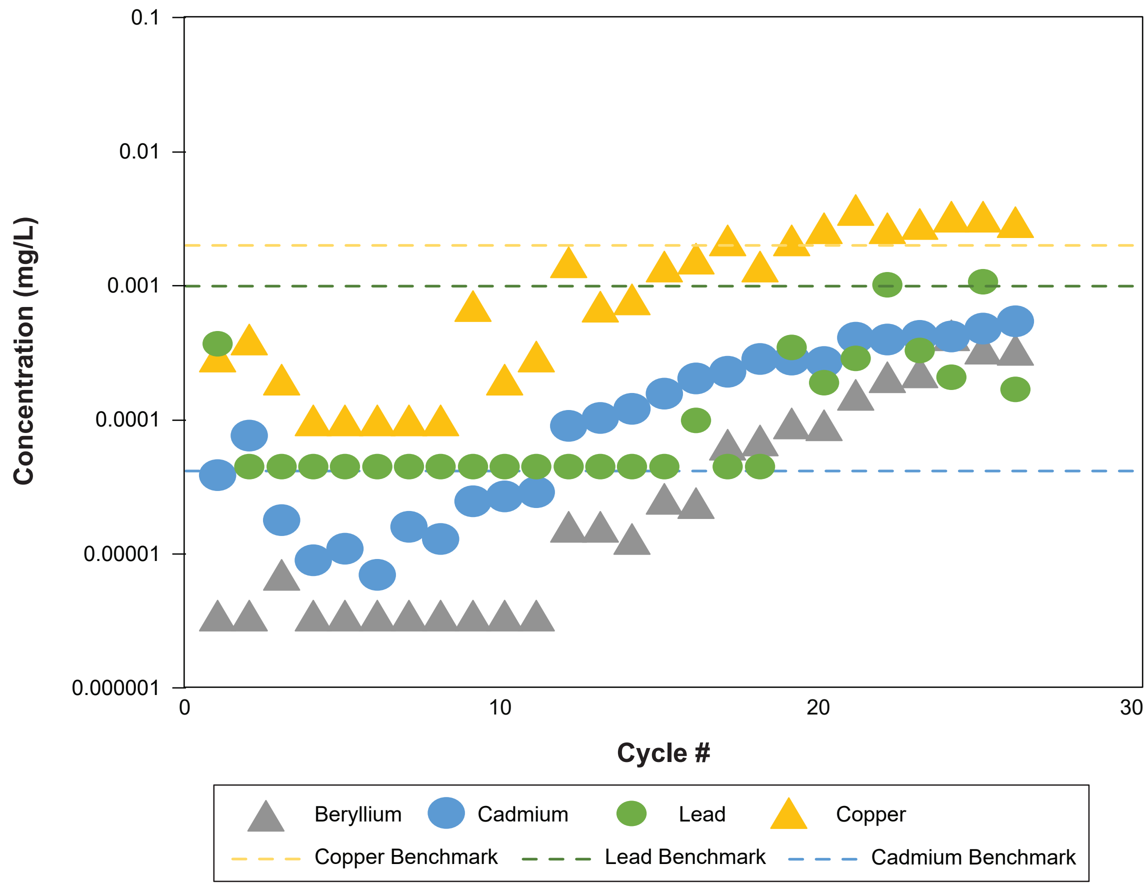
Figure 6.4-1 shows the change in pH, acidity, and alkalinity throughout the reporting period for HCT 2. The pH measured in the leachate of HCT 2 progressively dropped from above 7 to 4.47 between cycle one and cycle 12. The pH remained between 4.47 and 4.16 between cycles 12 and 26. The acidity generated from the HCT began to outpace the amount of alkalinity in the drainage water at cycle 10, and alkalinity dropped below the detection limit at cycle 15. Based on the absence of measurable alkalinity, it can be assumed that the NP of this cell was depleted prior to what the depletion calculations suggested, indicating that the NP is insufficiently reactive (IRNP) and potentially also occluded. However, the relatively constant pH may indicate that aluminum hydroxide and/or aluminosilicate buffering is maintaining a pH above 4.0. In the field, the rate of sulphide oxidation is expected to be lower than in the lab; therefore, it is possible the rate of aluminosilicate buffering will maintain a higher pH in seepage water than in the HCT leachate.

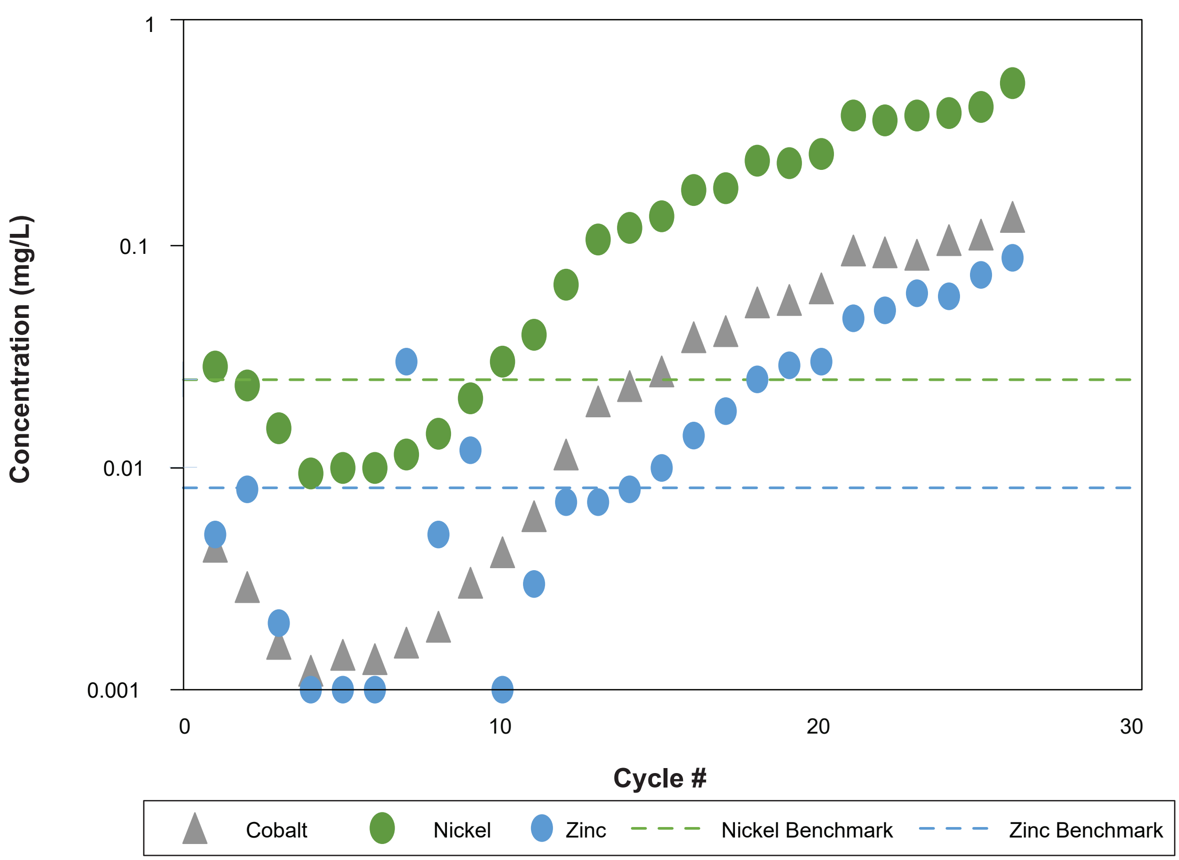
The pH of HCT 2 leachate during the last five cycles of analysis fell between the original NAG pH value (4.4) and the updated NAG pH value (3.75). This indicates the original NAG pH value may have over-estimated the NAG pH values used to classify PAF, although this is difficult to establish as single addition NAG tests are not able to evaluate rates of dissolution and the HCT leachate is currently being buffered at a pH above 4.

6.4.2 HCT 2 – Sulphate

The sulphate concentration in HCT 2 underwent a brief initial flush prior to cycle two and reached a maximum concentration of 67 mg/L (Figure 6.4-1). After cycle two, the sulphate decreased to 22 mg/L, then it began to increase at cycle five, and by cycle 14 reached a concentration of 66 mg/L. Sulphate slightly decreased between cycle 14 and cycle 26 with variable concentrations measured as low as 34 mg/L. This corresponded to the pH measurements which reached relatively stable concentrations during this period.

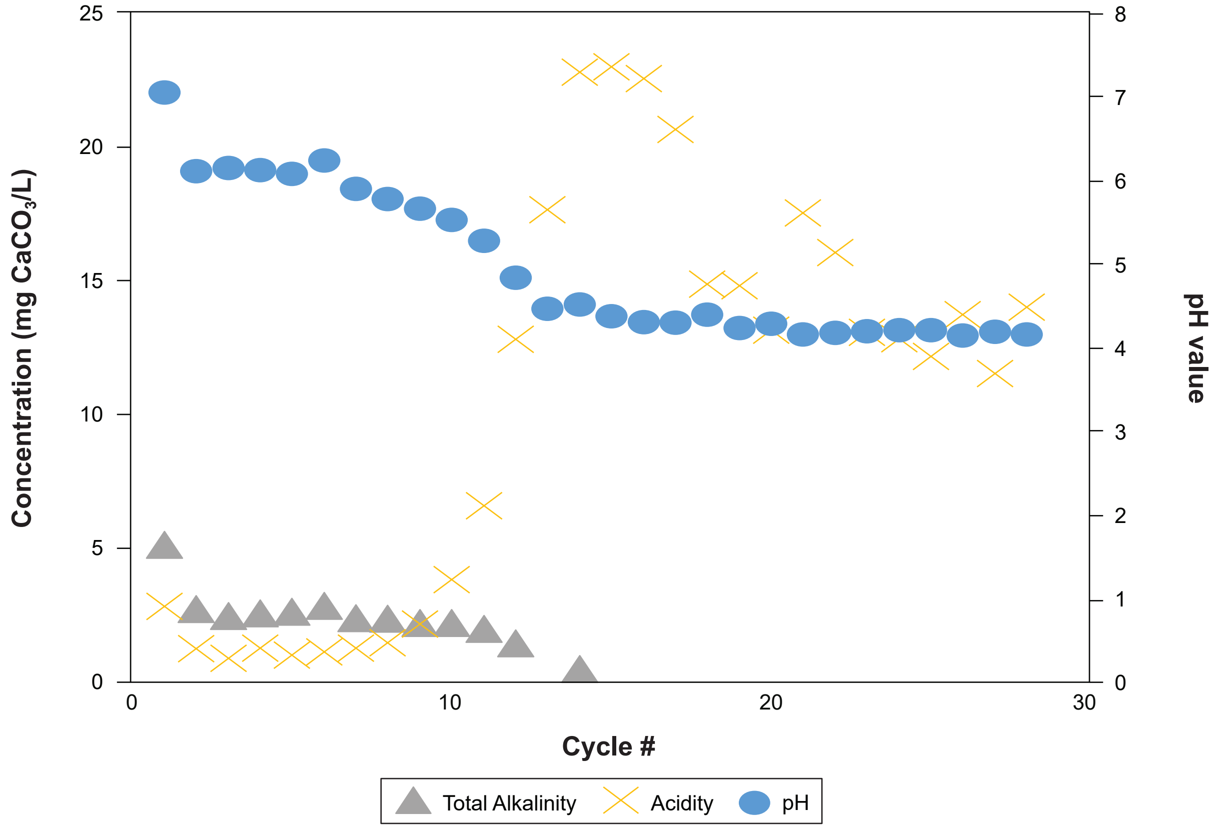
The sulphate measured in NAG test 2 (62 mg/L) was comparable to the HCT leachate concentrations.

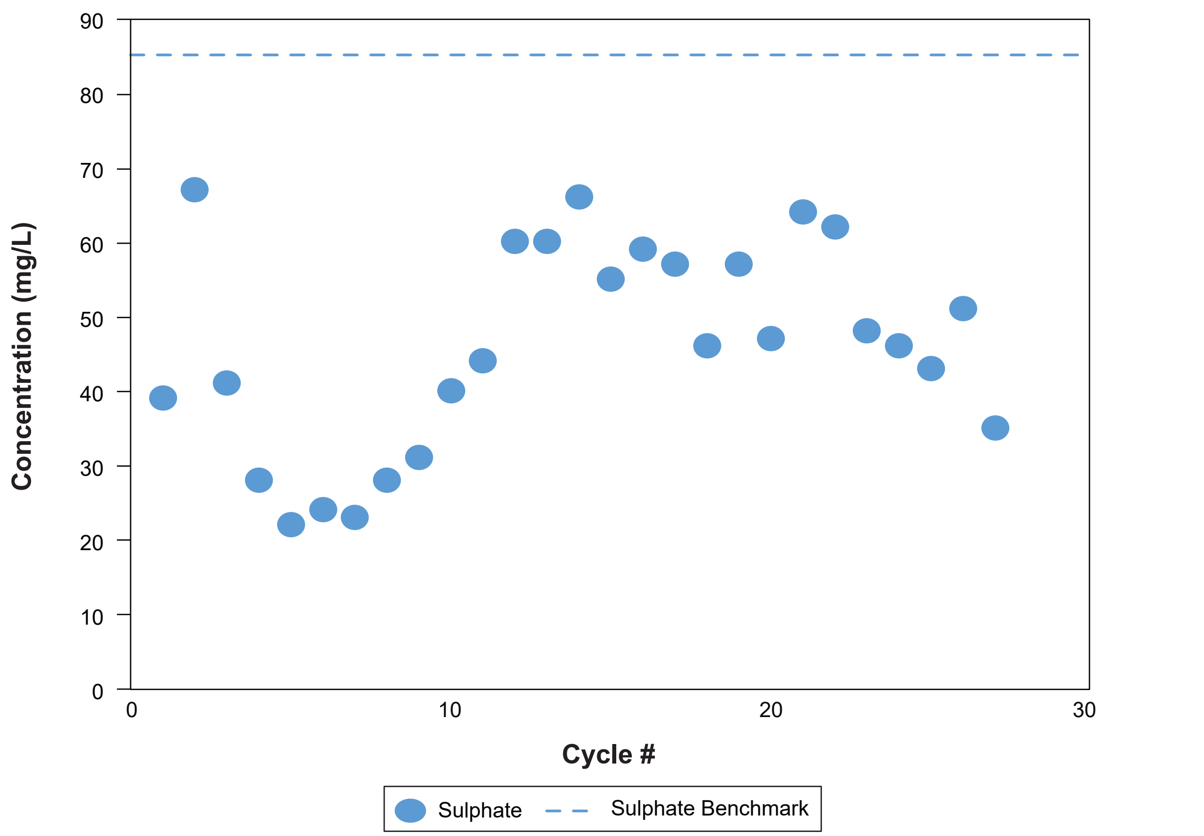




Note: Benchmarks and guidelines for cadmium, copper, lead, nickel and zinc are based on a hardness of 20 mg/L

Figure 6.3-4: Trace Metal Concentrations in HCT 1 with Time





Note: Benchmark for sulphate based on a hardness of 20 mg/L

Figure 6.4-1: The pH, Alkalinity, Acidity, and Sulphate Concentrations in HCT 2 with Time

6.4.3 HCT 2 – Aluminum and Iron

Aluminum in the HCT 2 leachate began to increase at cycle 10 (Figure 6.4-2). This increase lagged behind an increase of iron which began at cycle three. The increase of both metals indicates weathering within the HCT in response to sulphide oxidation and potentially subsequent aluminosilicate buffering at a pH above 4.

Aluminum exceeded the Ekati Diamond Mine water quality benchmark of 0.1 mg/L at cycle 11. Since cycle 11, the aluminum concentrations have remained relatively stable at concentrations just above 1 mg/L. As with HCT 1, a drop in pH below 5.5 corresponded to a sharp increase in aluminum concentrations. The increase in aluminum may have been in response to accelerated dissolution of minerals such as biotite as well as a reduction in the amount of dissolved aluminum that precipitates as $Al(OH)_3$. The aluminum concentrations measured in the NAG 2 leachate were approximately an order of magnitude below the HCT 2 leachate concentrations during steady state conditions; however, the pH measured in the NAG 2 leachate extraction test (4.62) was greater than the NAG pH (3.75). A drop of pH between 5.5 and 4.5 corresponded to a rapid increase in dissolved aluminum in the HCT leachate data. Therefore, in the NAG leachate, aluminum was likely lost from the leachate through precipitation of $Al(OH)_3$.

Iron exceeded the CCME guideline of 0.3 mg/L by cycle nine (Figure 6.4-2); however, the concentration of iron peaked at cycle 14 (7.38 mg/L), after which it decreased. The maximum concentration observed in HCT 2 was similar to the maximum concentration of iron observed in the HCT 1 leachate at cycle 26. In the HCT 2 leachate, the iron concentrations fell below the CCME guideline by cycle 20. The dissolved iron measured in the NAG 2 leachate was below the detection limit (consistent with NAG 1 observations), likely due to the complete oxidation of iron to insoluble ferric(oxy)hydroxides during the test.

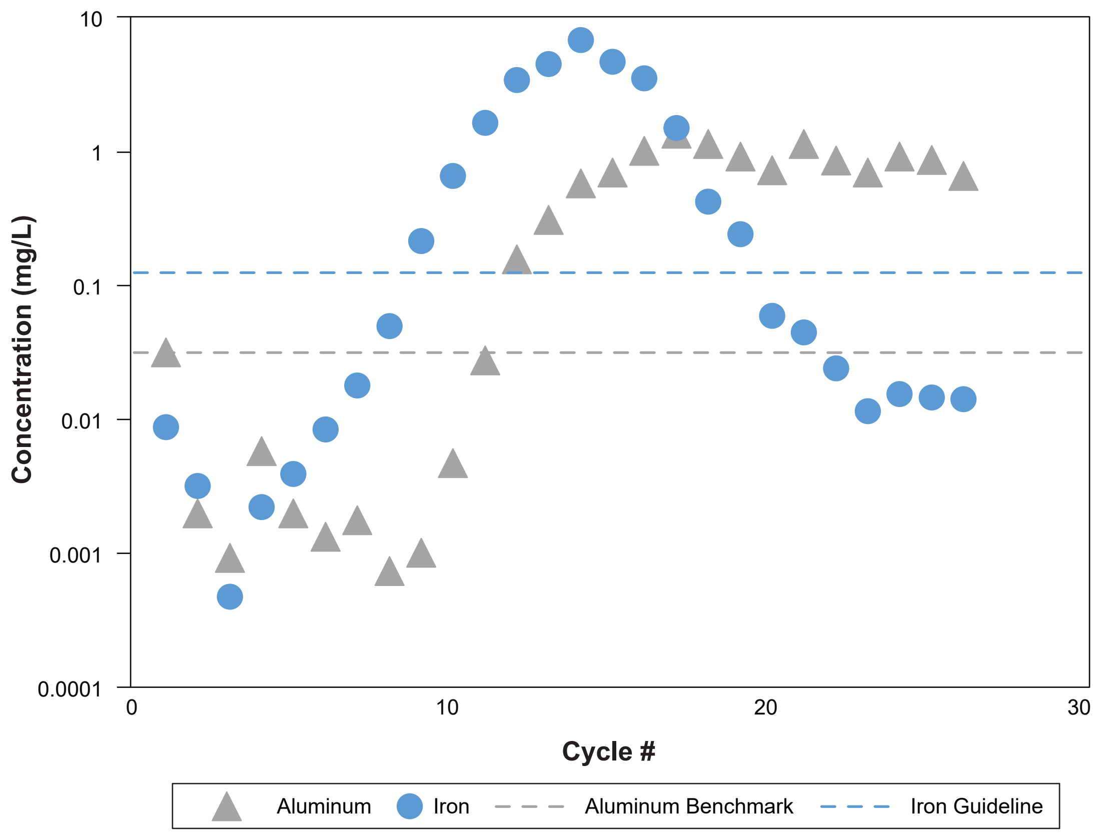
6.4.4 HCT 2 – Redox Indicators (Iron and Manganese)

As discussed in Section 6.3.4, iron and manganese tend to be present in oxic solutions in their oxidized states as ferric iron (Fe III) and Mn (VI), which form insoluble solids (Christensen et al. 1999). Therefore, the detection of these parameters in the HCT leachate suggests the leachate from the HCT was reduced. The observed increase in manganese preceded the increase of iron (Figure 6.4-2), typical of a redox front where dissolved manganese concentrations tend to precede iron (Christensen et al. 1999).

Manganese exceeded the CCME guideline between cycles 11 and 17. The peak of the manganese concentration and the iron concentration both occurred around cycle nine; however, the manganese peak was prolonged compared to the sharp iron peak.

The source of manganese to the leachate may be sulphide oxidation. Chlorite is also a potential source of iron to the leachate. The dissolution of chlorite tends to decrease the pH above a pH of 5 which is thought to be related to ferrous iron oxidation and ferric iron precipitation (Lowson 2005). Again, several sources of iron were identified in the XRD; however, the primary source is likely biotite dissolution which is thought to release ferrous iron to the leachate. The oxidation of iron (and sulphides) within the HCT may have reduced the amount of oxygen in the pore space, limiting the precipitation of iron and manganese as insoluble solids. The presence of dissolved iron and manganese could indicate that thermodynamic equilibrium is not attained with HCT 2 (similar to HCT 1); however, the elevated iron may also be due to complexation of iron with another anion such as sulphate. Like HCT 1, iron is likely present in the leachate as sulphate or hydroxo complexes ($FeOH^{2+}$, $Fe(OH)_2^{+}$, $Fe_3(OH)_4^{5+}$).

During the last cycle, the leachate was monitored for ORP and DO. The ORP was 472 mv and the DO was 4.8 mg/L, higher than HCT 1 (corresponding with the lower iron and manganese concentrations). PHREEQC geochemical modelling conducted using the minteq.V4 database indicated that the observed iron concentrations are in thermodynamic equilibrium with the goethite minerals phase (SI 0.02) at a pe of 8 and a pH 4.1 (ERM 2022). Geochemical modelling is discussed in additional detail as part of the source term described in the Point Lake WRSA Seepage Prediction Report (ERM 2022).



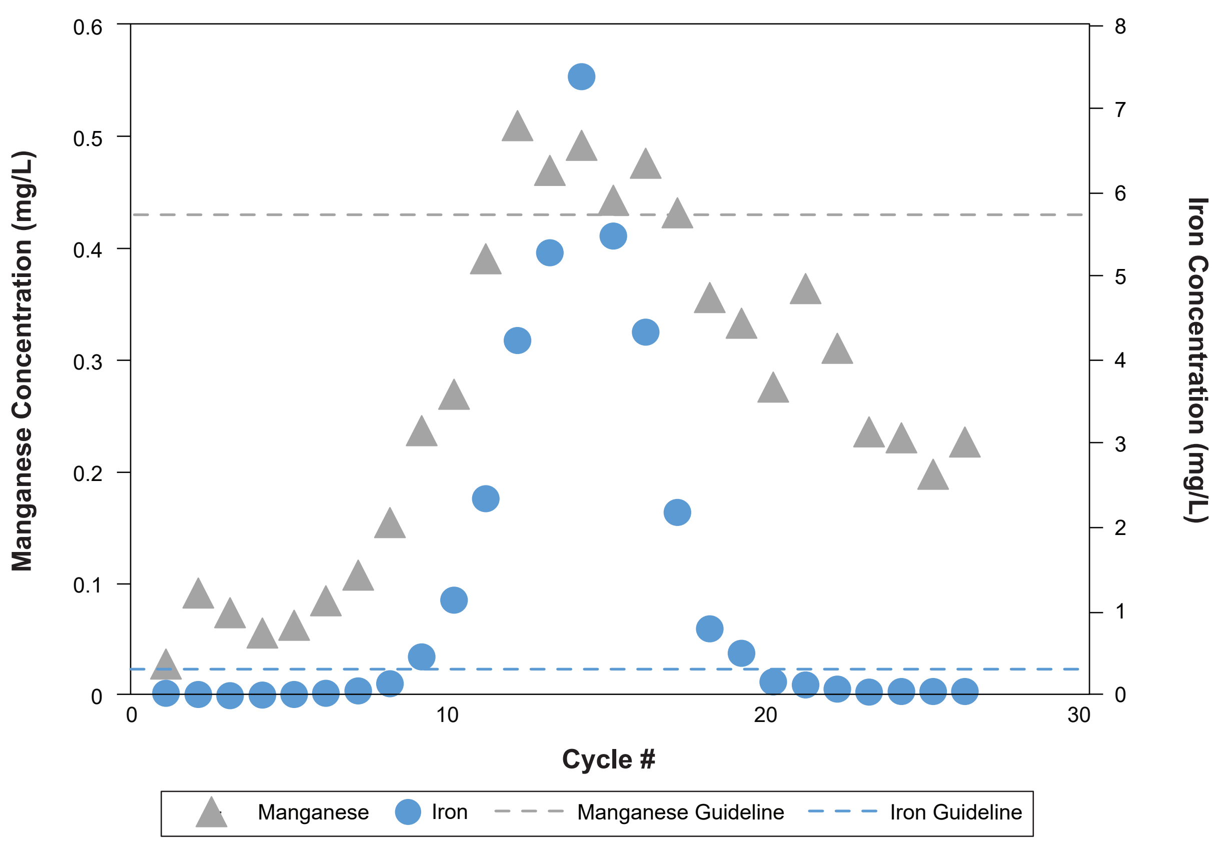


Figure 6.4-2: The Aluminum, Iron, and Manganese Concentrations in HCT 2 with Time

6.4.5 HCT 2 – Cations

During the first three cycles of HCT 2, a flush (spike in concentration) of potassium, magnesium, sodium and calcium was observed (Figure 6.4-3). The maximum cation concentrations tended to be greater than the concentrations measured in the HCT 1 leachate; however, the overall trends were similar. By week five, the potassium and sodium concentrations reached relatively steady state constant values, while calcium and silicon continually increased throughout the reporting period. Magnesium concentrations increased until cycle 10 and began slightly decreasing after cycle 20. This pattern could indicate biotite weathering as it is similar to the leaching pattern expected for biotite (Section 5).

Unlike HCT 1, a comparison between the cations measured in the HCT 2 leachate and the NAG 2 leachate showed that that the cation concentrations in the NAG 2 leachate were similar to the HCT 2 leachate cation concentrations (with the exception of sodium – an additive during NAG leachate testing). This similarity was also observed for sulphate concentrations.

6.4.6 HCT 2 – Trace Metals

Similar to the arsenic trend in HCT 1, arsenic concentrations in the HCT 2 leachate initially exceeded the Ekati Diamond Mine water quality benchmark of 0.005 mg/L but dropped below 0.005 mg/L by cycle eight (a quicker rate than HCT 1; Appendix B-2). As described in Section 6.3.6, the mobility of arsenic increases in neutral conditions. The observed decrease in arsenic was consistent with the pH measurements (The pH in HCT 2 initially dropped at a quicker rate than HCT 1). The concentration of arsenic in the NAG leachate (0.05 mg/L) was over an order of magnitude higher than the arsenic concentration in the HCT 2 during the last five weeks of analysis.

The trace metals measured in the HCT 2 leachate that increased with time at some point during the test were similar to the parameters identified in the HCT 1 leachate; however, the concentrations measured in the HCT 2 leachate (Figure 6.4-4) tended to be higher, corresponding to increased metal mobility with a decrease in pH. The PoPCs identified based on the increasing concentrations included beryllium, cadmium, copper, lead, cobalt, nickel and zinc. The concentrations reached steady state (beryllium, zinc, cadmium and lead) or decreased with time (cobalt, nickel) by the end of the reporting period. This is consistent with the pH of the HCT 2 leachate which had also reached steady state. The exception to this was copper, as the copper concentrations were observed to steadily increase with time.

The parameters that exceeded Ekati Diamond Mine water quality benchmarks in the HCT 2 leachate included chromium (one time), cadmium, copper, lead (periodically), nickel and zinc. Similar to the HCT 1-NAG 1 comparison, the concentrations of cadmium, cobalt, manganese, nickel, uranium, and zinc were lower in the NAG leachate than in the HCT leachate. This could be related to the complete oxidation of ferric iron (oxy)hydroxide and absorption of metals in the NAG leachate. The concentration of iron in the NAG leachate was below the detection limit indicating complete oxidation (and precipitation) of ferrous iron to ferric iron(oxy)hydroxides. Further, the pH of the NAG leachate was higher than the HCT leachate, which could also have been impacting trace metal mobility.

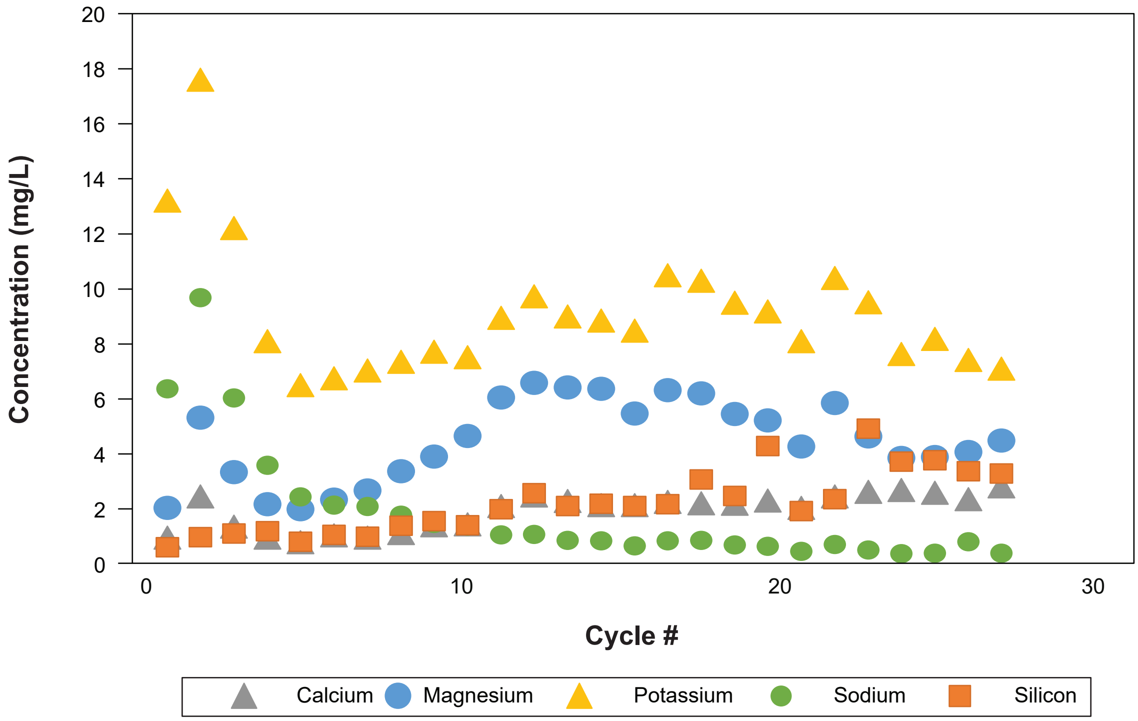
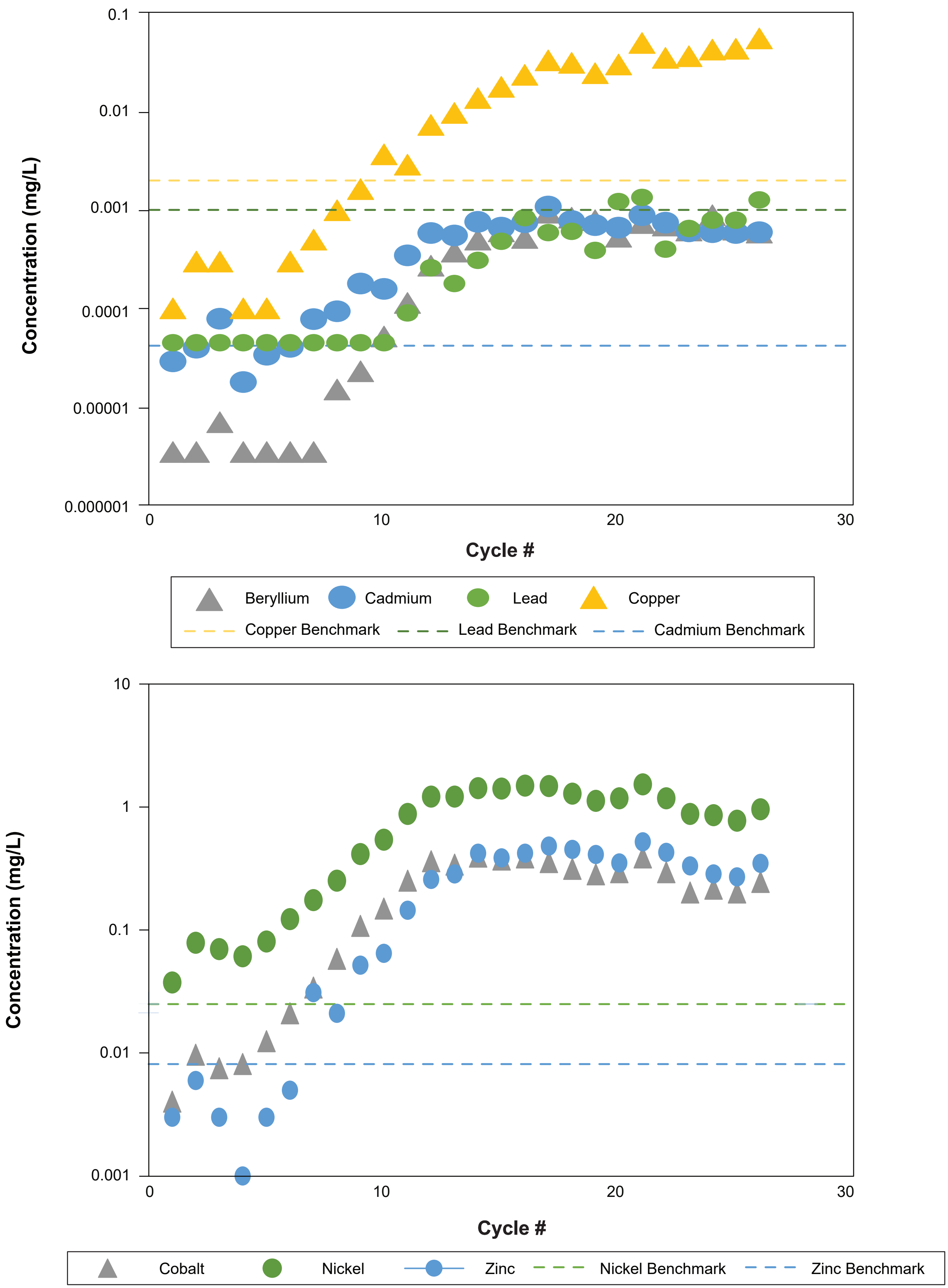


Figure 6.4-3: Cation Concentrations in HCT 2 with Time



Note: Benchmarks and guidelines for cadmium, copper, lead, nickel and zinc are based on a hardness of 20 mg/L

Figure 6.4-4: Trace Metal Concentrations in HCT 2 with Time

6.5 HCT 3 Analysis and Interpretation

6.5.1 HCT 3 – Acidity, Alkalinity, and pH

The pH of HCT 3 dropped from an initial pH of 7.47 to a pH above 5.6 by cycle 15, after which point the pH remained relatively constant (Figure 6.5-1). Although a pH of 5.6 is mildly acidic, this pH is considered to be within the expected buffering range for aluminosilicates. Accordingly, the alkalinity also remained above acidity throughout the reporting period; although, alkalinity decreased from 10 mg/L to just over 2 mg/L over the first 10 cycles. Acidity within the cell increased to just below 2 mg/L. The HCT may have reached near steady state conditions, although, the NAG 3 pH values were slightly lower than the pH of the HCT 3 leachate (original value of 5.25 and updated value of 4.78).

6.5.2 HCT 3 – Sulphate

The sulphate concentrations measured in the HCT 3 leachate were relatively constant, around 15 mg/L (Figure 6.5-1). Sulphate during the last five weeks was slightly greater than the average concentration over the entire 26 cycle HCT run; however, that was largely related to the lower sulphate concentration measured during the initial flush. Although the sulphate concentration was lower than the sulphate concentrations measured in HCT 1 and HCT 2 leachate during the last five weeks, it was similar to the sulphate concentrations released from both HCT 1 and HCT 2 in leachate measured at pH values between 5.5 and 6. The rate of sulphide oxidation is dependant on pH and therefore, this was not unexpected. The sulphate concentration was approximately half the sulphate concentration in the NAG leachate.

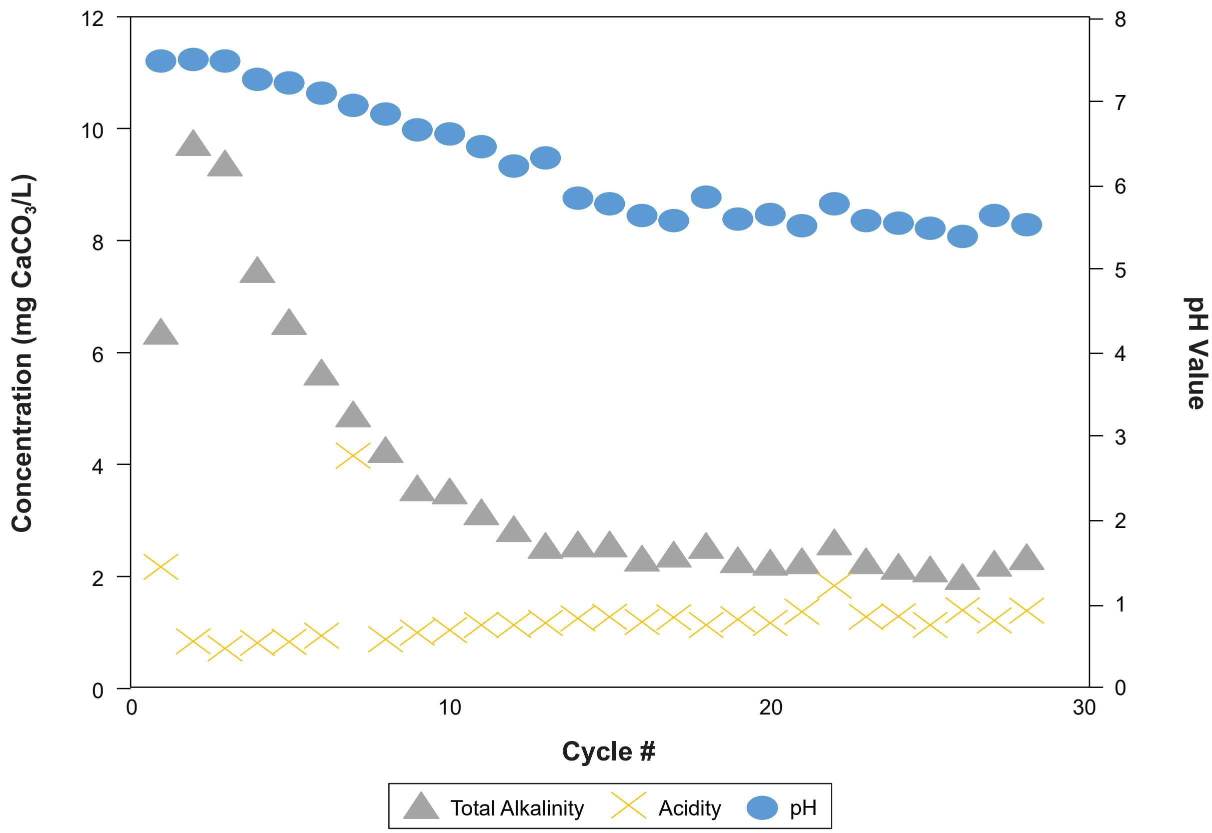
6.5.3 HCT 3 – Aluminum and Iron

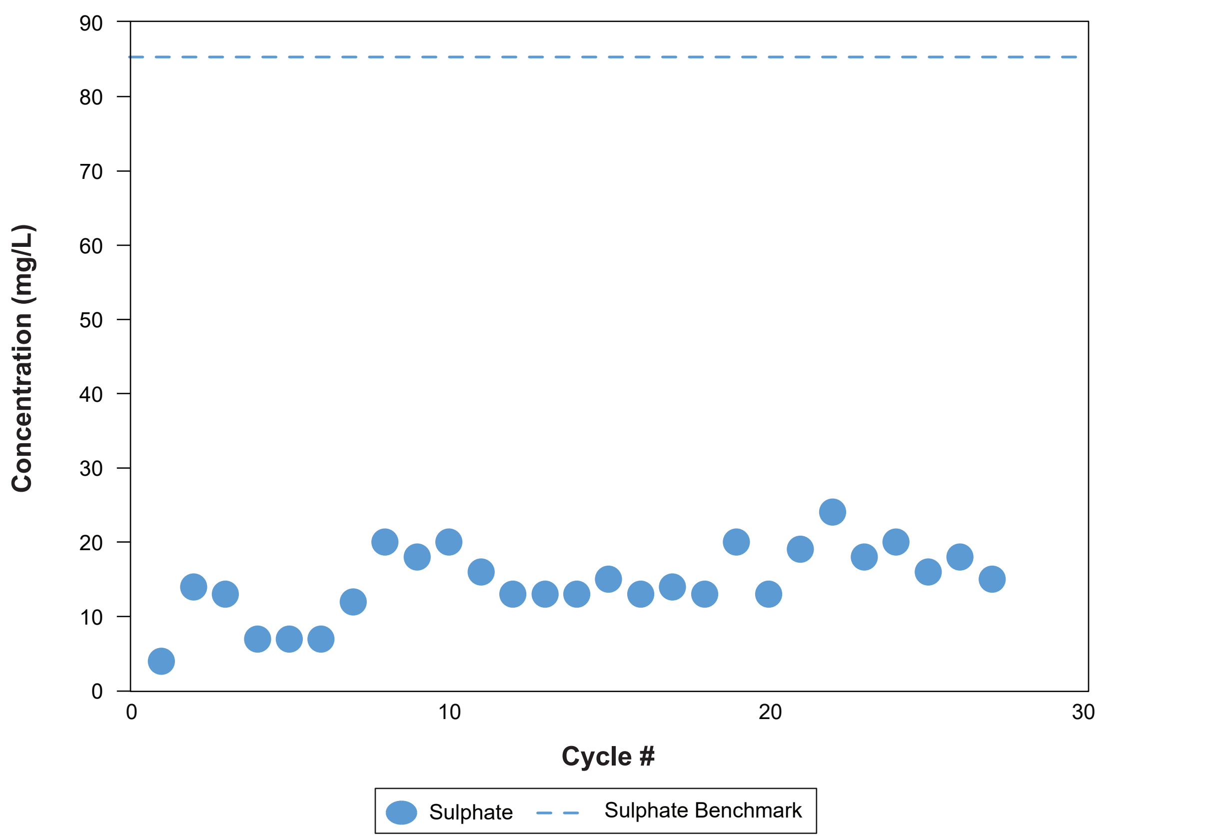
Aluminum and iron were observed below Ekati Diamond Mine water quality benchmark and CCME guideline, respectively, in HCT 3 (Figure 6.5-2). The concentration of aluminum decreased with time between cycle one and cycle 15 after which point it remained low. This progressive flush of aluminum was not observed in HCT 1 or HCT 2. Iron was generally at or near the detection limit throughout the 26 week run. The relatively low aluminum and iron concentrations likely resulted from the precipitation of aluminum and iron respectively as $Al(OH)_3$ and $Fe(OH)_3$ to thermodynamic equilibrium in the leachate. Iron was also below the detection limit in the NAG 3 leachate; however, the dissolved aluminum concentrations were higher in the NAG leachate owing to the lower pH of the NAG leachate.

6.5.4 HCT 3 – Redox Indicators (Iron and Manganese)

In HCT 3, the concentration of iron and manganese were measured well below CCME guidelines (Figure 6.5-2); however, manganese concentrations began to increase slightly at cycle 20. This could indicate the onset of the redox front that was observed in HCT 1 and HCT 2 (described in Sections 6.3.4 and 6.4.4).

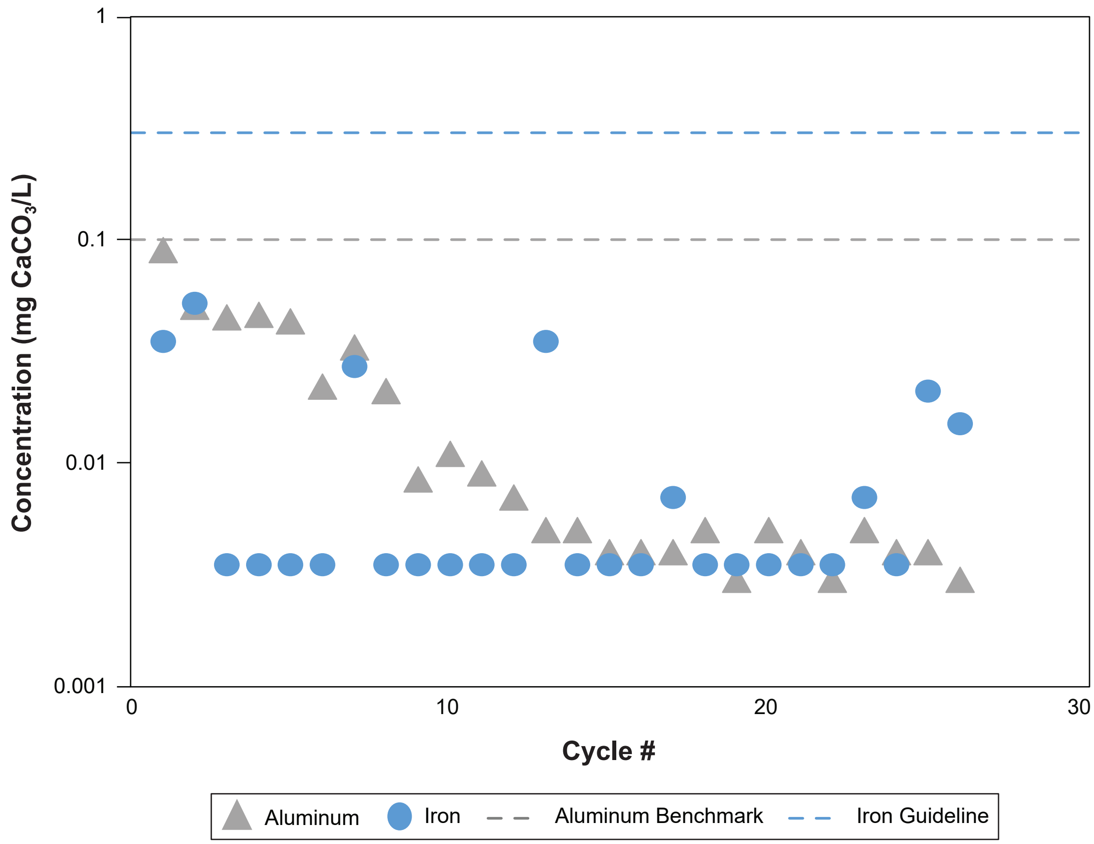
During the last cycle, the leachate was monitored for ORP and DO. The ORP was 492 mv and the dissolved oxygen was 4.5 mg/L.





Note: Benchmark for sulphate based on a hardness of 20 mg/L

Figure 6.5-1: The pH, Alkalinity, Acidity, and Sulphate Concentrations in HCT 3 with Time



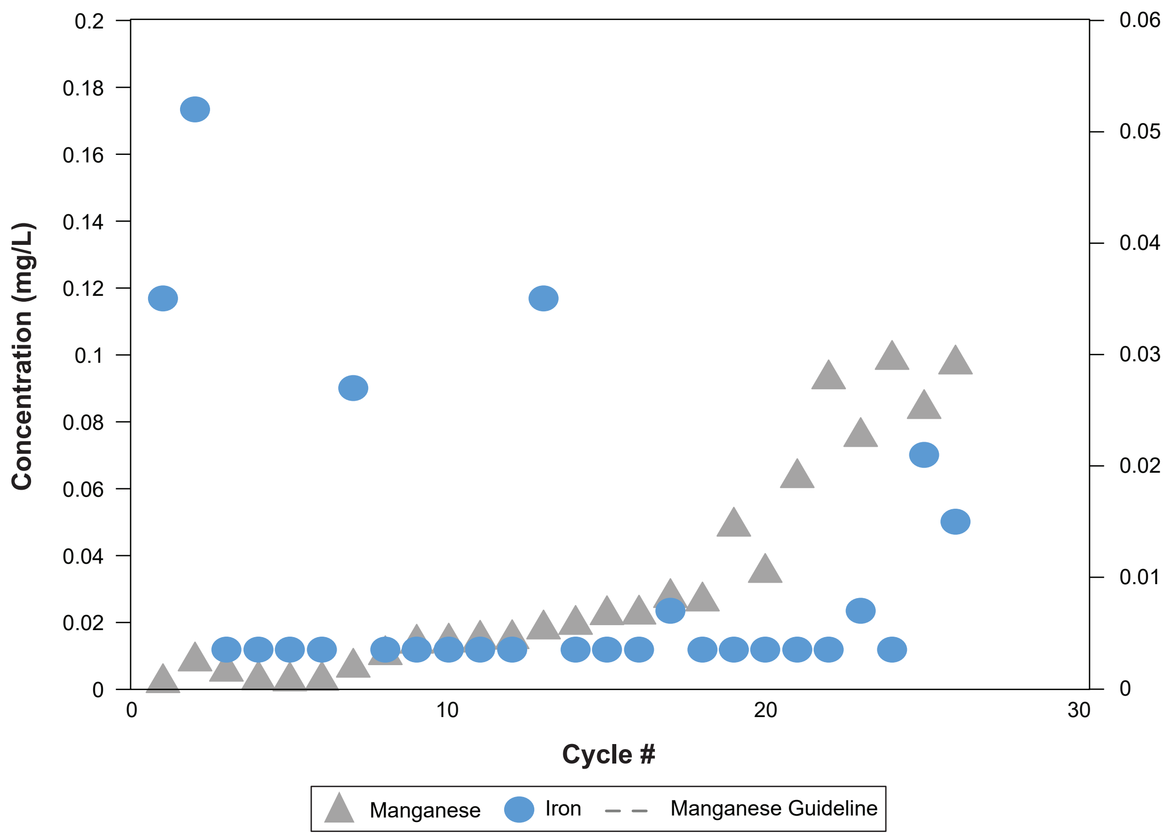


Figure 6.5-2: The Aluminum, Iron, and Manganese Concentrations in HCT 3 with Time

6.5.5 HCT 3 – Cations

Similar to the cation concentrations measured in HCT 1 and 2, initially, a flush of potassium and sodium was released to the HCT 3 leachate (Figure 6.5-3). This could indicate initial displacement of these cations from the interstitial layers within the biotite sheets. Potassium was the most abundant cation in the leachate water throughout the entire HCT run. Calcium and silicon concentrations were relatively constant with time; whereas sodium concentrations decreased with time. The observed trends are potentially reflective of the incongruent dissolution of biotite. Overall, concentrations tended to be similar to concentrations measured in HCT 1, this suggests a similar rate of aluminosilicate dissolution in the two cells. The cations in the HCT 3 leachate were approximately half of the NAG leachate concentrations with the exception of potassium which was approximately four times greater in the NAG leachate.

6.5.6 HCT 3 – Trace Metals

During the initial flush, arsenic, cadmium and zinc exceeded the Ekati Diamond Mine water quality benchmarks; however, arsenic dropped below water quality benchmark after 12 cycles (corresponding to a slower decline in pH over time relative to HCT 1 and 2, and the reduced mobility of arsenic). The cadmium and zinc concentrations were variable (Figure 6.5-4); however, relatively constant throughout the reporting period. As with HCT 1 and 2 the concentrations of cobalt and nickel increased with time (Figure 6.5-4). These parameters have not reached steady state. Unlike HCT 1 and HCT 2, beryllium, copper, lead and zinc concentrations did not increase with time during the reporting period. The dissolved trace metal concentrations in the NAG 3 leachate tended to be higher than the concentrations in the HCT 3 leachate.

6.6 Kinetic Test Trends and Patterns

The concentrations measured in the HCT leachates were evaluated to determine potential controls over concentrations. The identified correlations and comparison will be used as part of source term development (ERM 2022) as well as to explain the existing drainage chemistry from seeps at the site.

To facilitate trend analysis, the leachate concentration measured in each of the three HCTs were plotted on the same figure to determine if trends and patterns were similar between cells. The concentrations were compared to either sulphate concentrations or pH.

Sulphate was also compared against pH in Figure 6.6-1. Sulphate release rates did correspond to pH (concentrations increased as pH decreased), although release rates for HCT 2 appeared slightly higher. The highest sulphide content (0.28%) was measured in HCT 1; however, the rates of sulphate release between HCT 1 and HCT 3 (which had the lowest sulphate content of 0.15%) were comparable across similar pH ranges. This suggests that sulphate release rates are not dependent on total sulphide content but may be related to effective NP (HCT 2 had the lowest modified NP). When compared to the larger Ekati Diamond Mine metasediment HCT dataset, the sulphate release rates of the Point Lake HCTs were also within the observed ranges measured in the site-wide metasediment HCT cells which ranged between 0.73 mg/L and 143 mg/L during the last five cycles of analysis (Golder 2014).

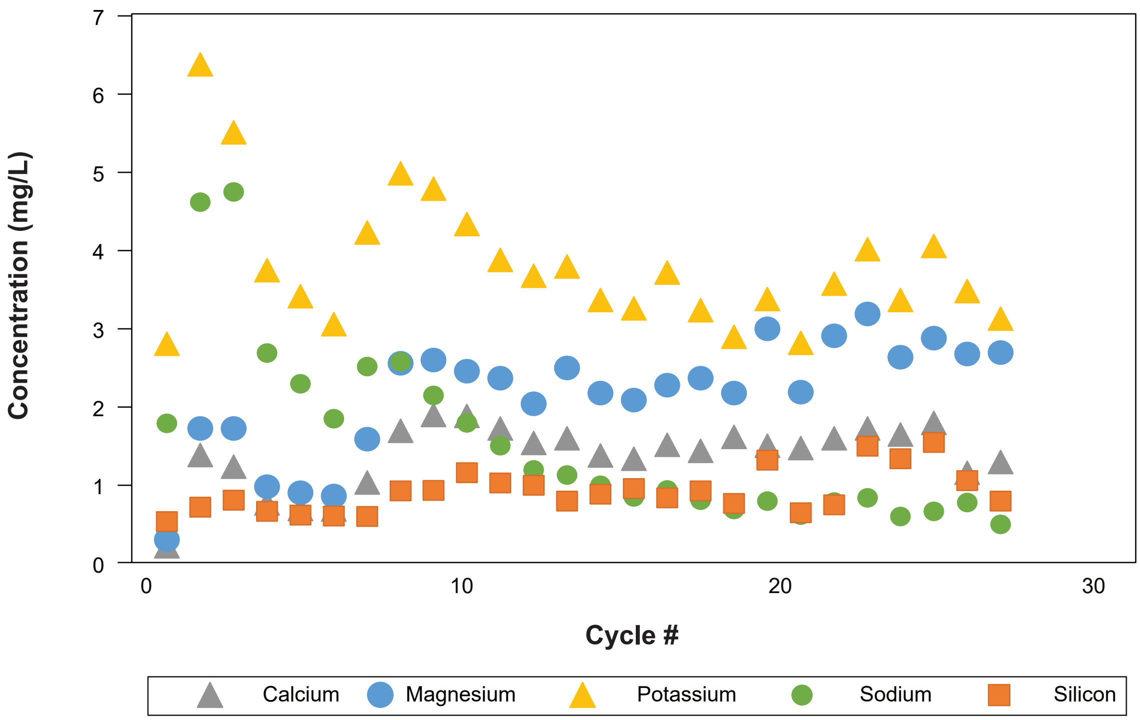
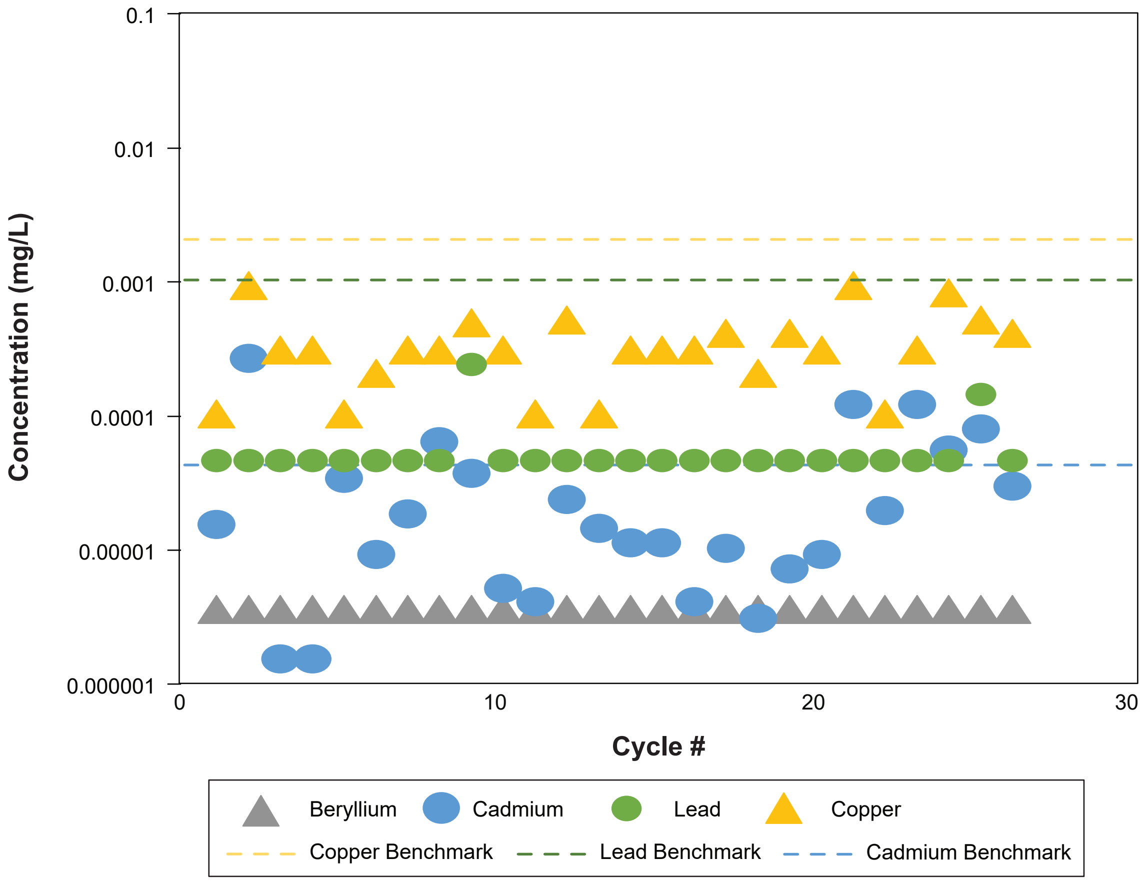
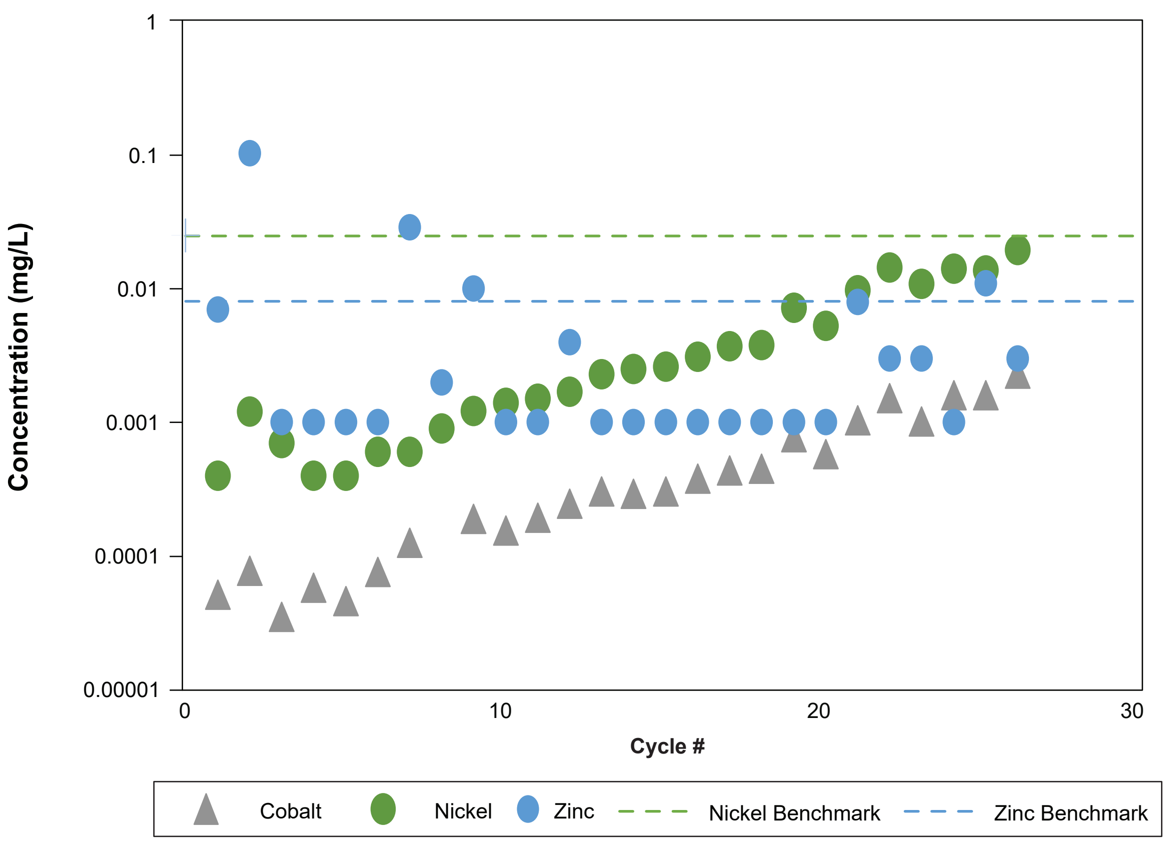


Figure 6.5-3: Cation Concentrations in HCT 3 with Time





Note: Benchmarks and guidelines for cadmium, copper, lead, nickel and zinc are based on a hardness of 20 mg/L

Figure 6.5-4: Trace Metal Concentrations in HCT 3 with Time

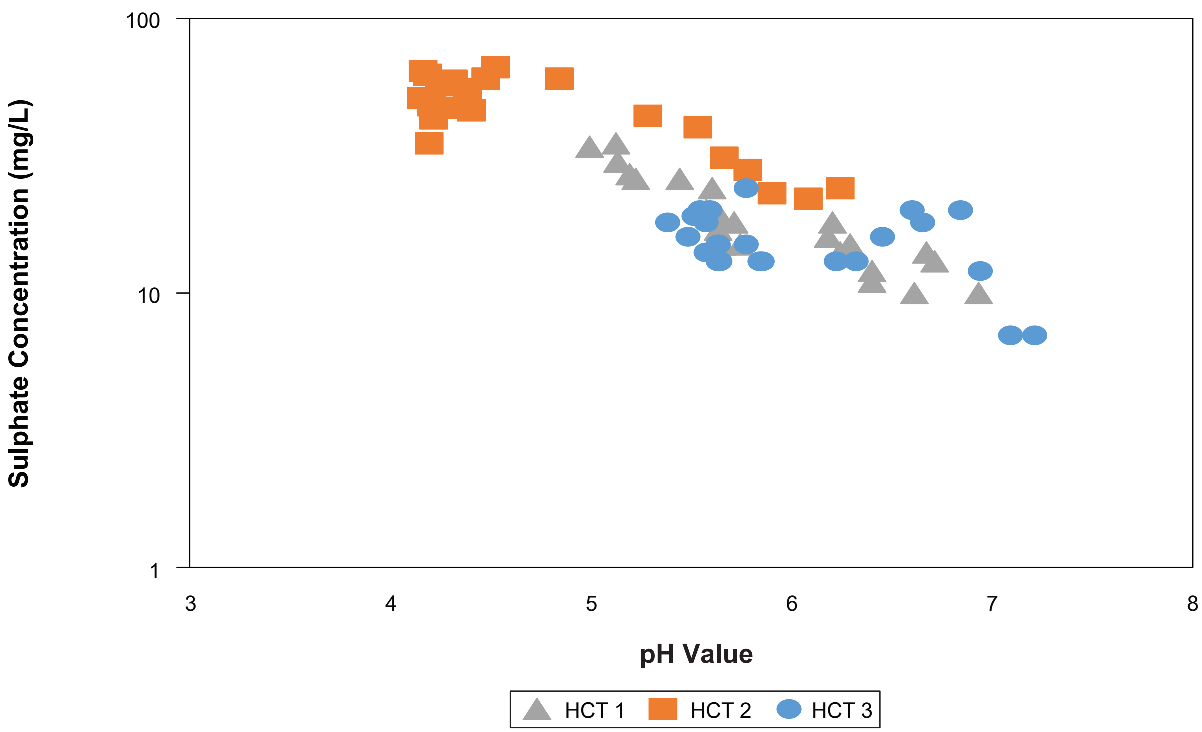


Figure 6.6-1: The Sulphate Concentrations of HCT 1, HCT 2, and HCT 3 as a Function of pH

6.6.1 Parameters that Correlate to Sulphate

Parameter concentrations in the HCT leachates were compared to sulphate to determine which parameters were potentially liberated to the leachate through sulphide oxidation. A correlation between sulphate and parameter concentration potentially indicates that the parameters will scale to field conditions at similar rates as sulphate. The parameters that had the highest correlation with sulphate included cobalt and nickel (Figure 6.6-2). These were two of the parameters that were observed to increase in HCT 3 with time. They are also impurities commonly associated with pyrrhotite, along with manganese and copper (MEND 2009). The linear equation of a line calculated in HTC 2 (largest range) was extrapolated to evaluate fit for HCT 1 and HCT 3 concentrations. The HCT 1 and 3 concentrations tend to fit between the equation of the lines calculated for HCT 2 concentration by assuming an intercept and setting the intercept to zero.

6.6.2 Parameters that Correlate to pH

The mobility of trace metals often dependant on pH as this can influence adsorption and mineral precipitation. A correlation to pH could indicate mineralogical constraints on concentrations, particularly if the correlation applies to various HCTs and seepage concentrations. The parameters that had the strongest correlation to pH included arsenic, beryllium, cadmium, copper and zinc (Figures 6.6-3 to 6.6-5). Concentrations that were measured near the detection limit did not correlate well to the observed trends. For parameters above the detection limit, the largest parameter concentration deviations from the curve occurred near a pH of 5, which corresponded to the period of elevated dissolve iron in the leachate. This perhaps indicates that ability of ferric(oxy)hydroxides to scavenge metals is reduced at this pH in the HCTs.

The concentrations of aluminum, iron and manganese are plotted against pH in Figures 6.6-6 and 6.6-7. The solubility curve of these parameters with pH is evident in the data. The aluminum concentration followed a curve with concentrations slightly higher than the solubility curve for amorphous $Al(OH)_3$ (Huittinen 2009). Iron concentrations tended to increase as the pH dropped between 6 and 4.5, after which they rapidly decreased. Manganese concentrations exhibit a similar pattern to iron (there was a high correlation between the two parameters); however, the increase in manganese in HCT 3 occurred at a slightly lower pH, potentially indicating reduced oxidation consumption in HCT 3. Manganese is associated with pyrrhotite oxidation and the concentrations associated with manganese were not unexpected.

The iron concentrations of metasediment HCTs for the wider Ekati Diamond Mine geochemical database were evaluated to determine if the observed iron concentrations were unique to the Project. It was found that iron in HCT's Misery MCH3 220-258, Pigeon HC-Pdef 3, Pigeon HC-Pdef-10, and Pigeon HC-Pdef-16, reached 18 mg/L, 16 mg/L, 16 mg/L, and 4 mg/L, respectively (Golder 2014). In contrast, the maximum dissolved iron concentration in seepage from the Pigeon WRSA was 0.7 mg/L (May 8th, 2018 at Seep 389). This value is above the CCME guideline but well below the concentration observed in the HCT leachate. Conversely, during this high iron reading, the sulphate concentration was 87 mg/L (generally above the concentrations measured in HCT leachate). This field data suggests that although iron is released in the HCT, it may be attenuated within the field where thermodynamic equilibrium conditions are more likely to be achieved through the precipitation of ferric(oxy)hydroxides.

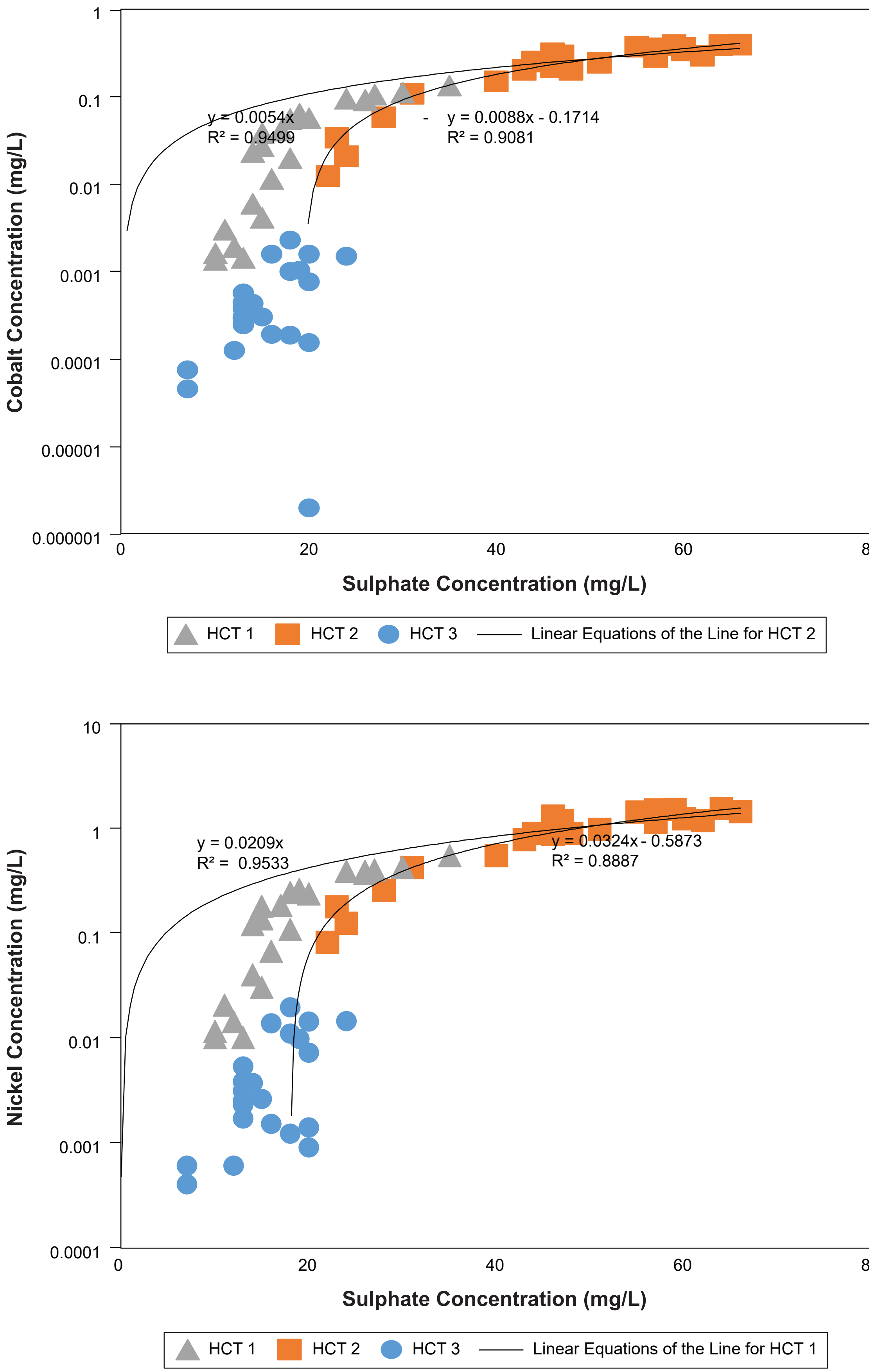
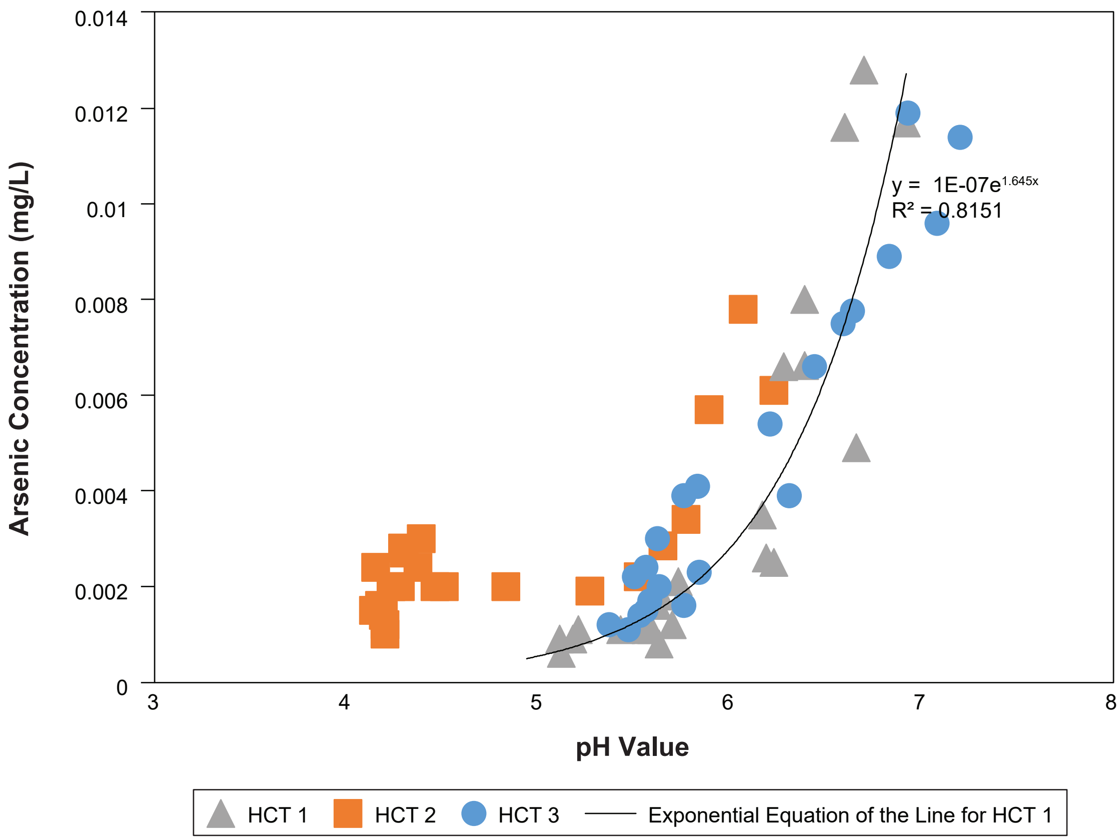


Figure 6.6-2: The Cobalt and Nickel Concentrations Compared to Sulphate Concentrations



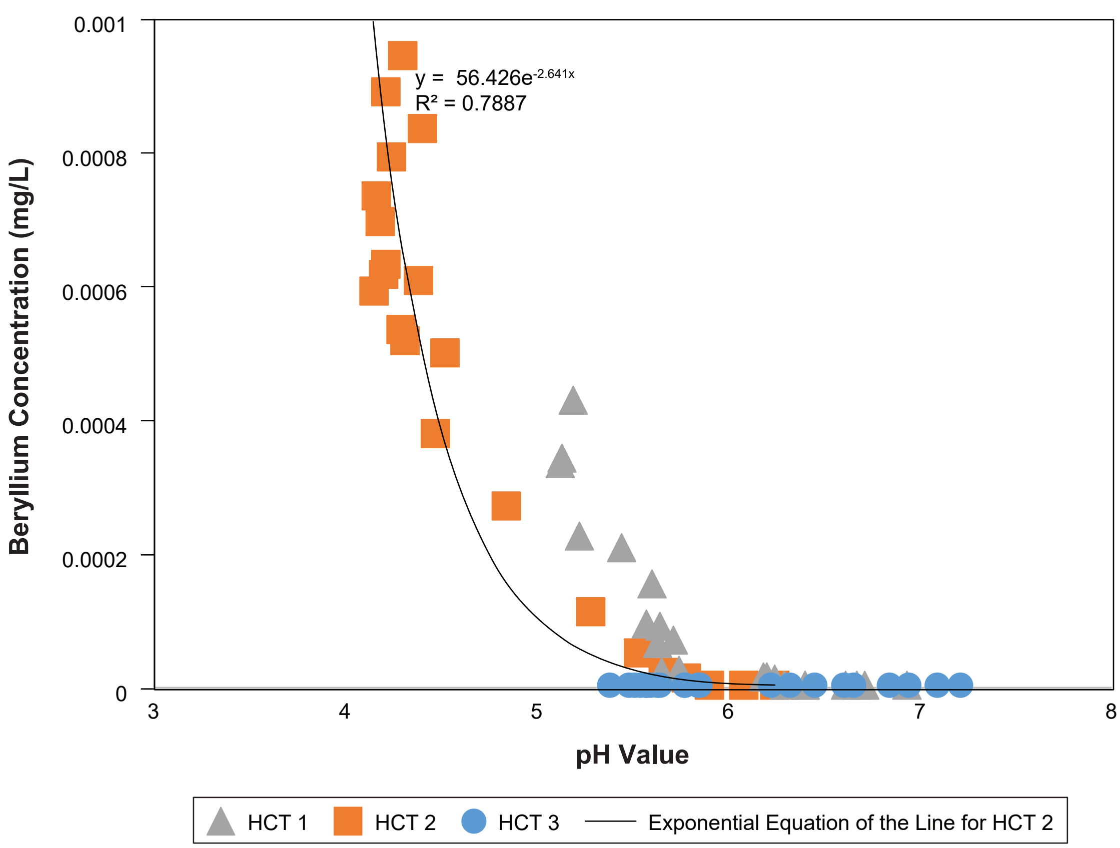
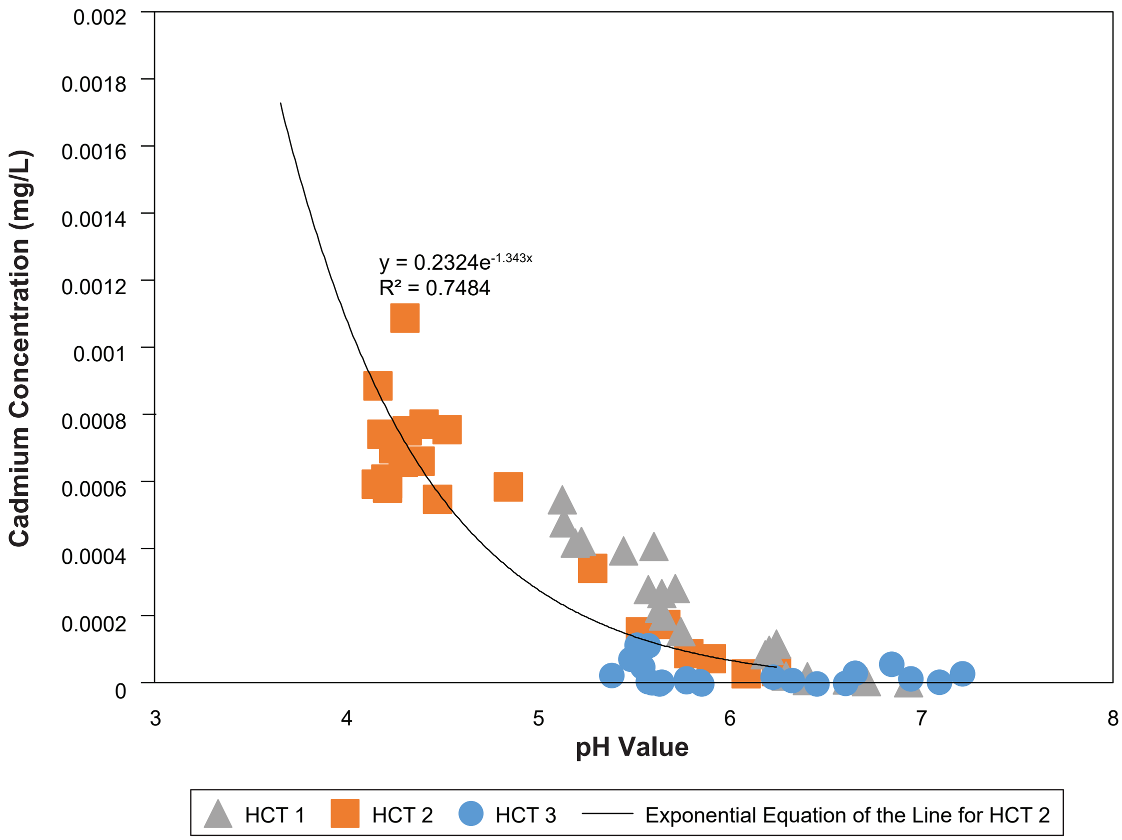


Figure 6.6-3: The Arsenic and Beryllium Concentrations Compared to pH



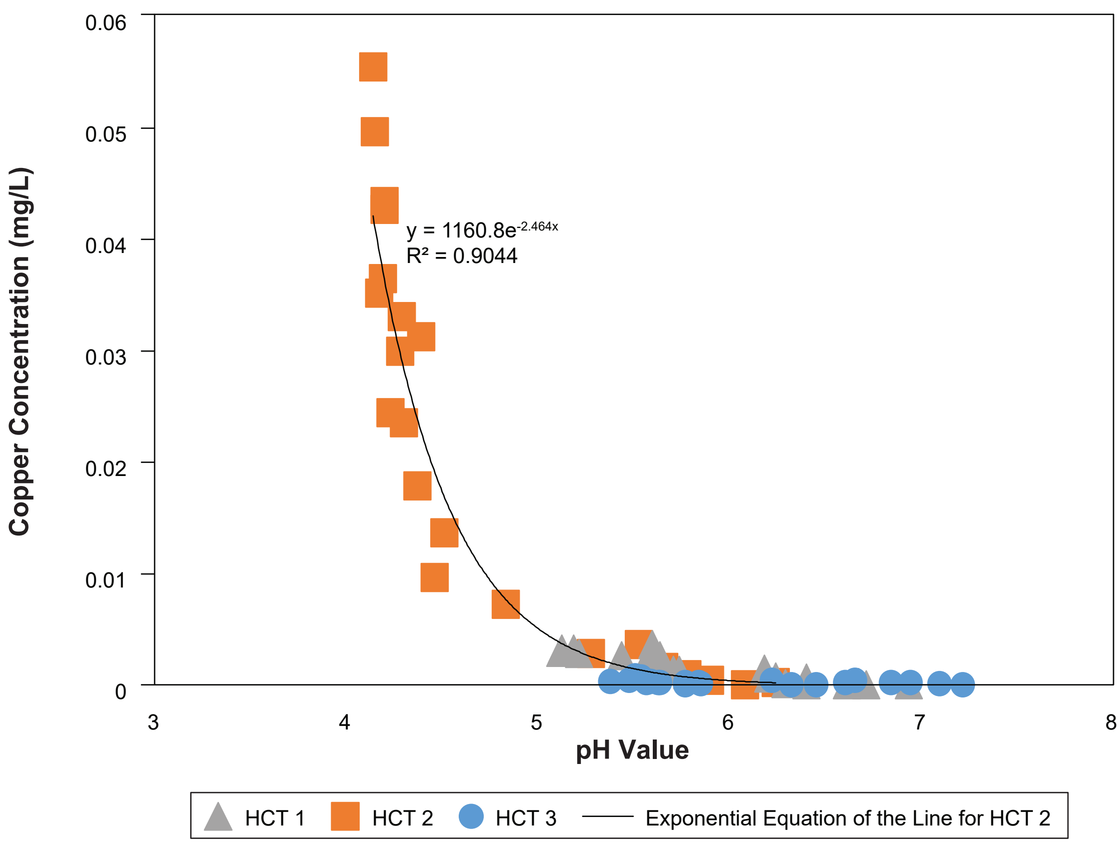


Figure 6.6-4: The Cadmium and Copper Concentrations Compared to pH

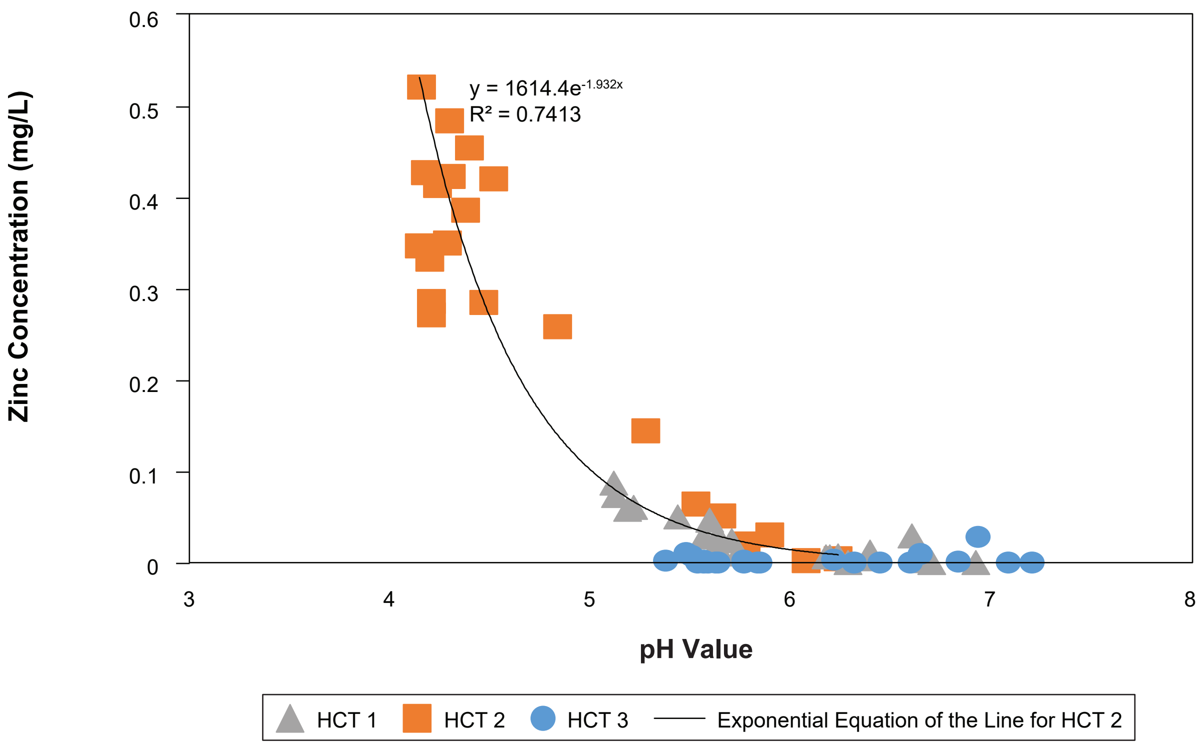


Figure 6.6-5: The Zinc Concentrations Compared to pH

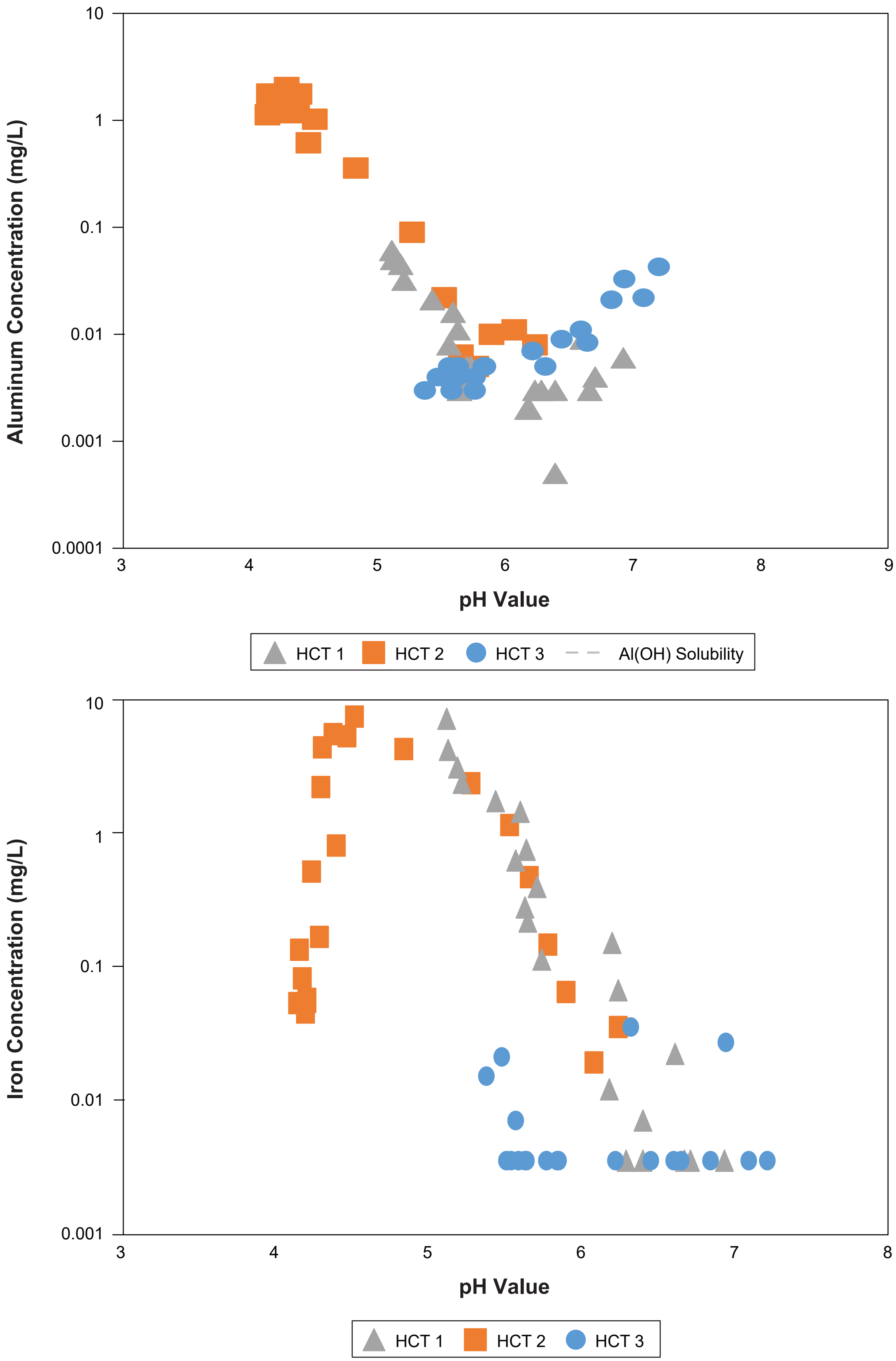


Figure 6.6-6: The Aluminum and Iron Concentrations Compared to pH

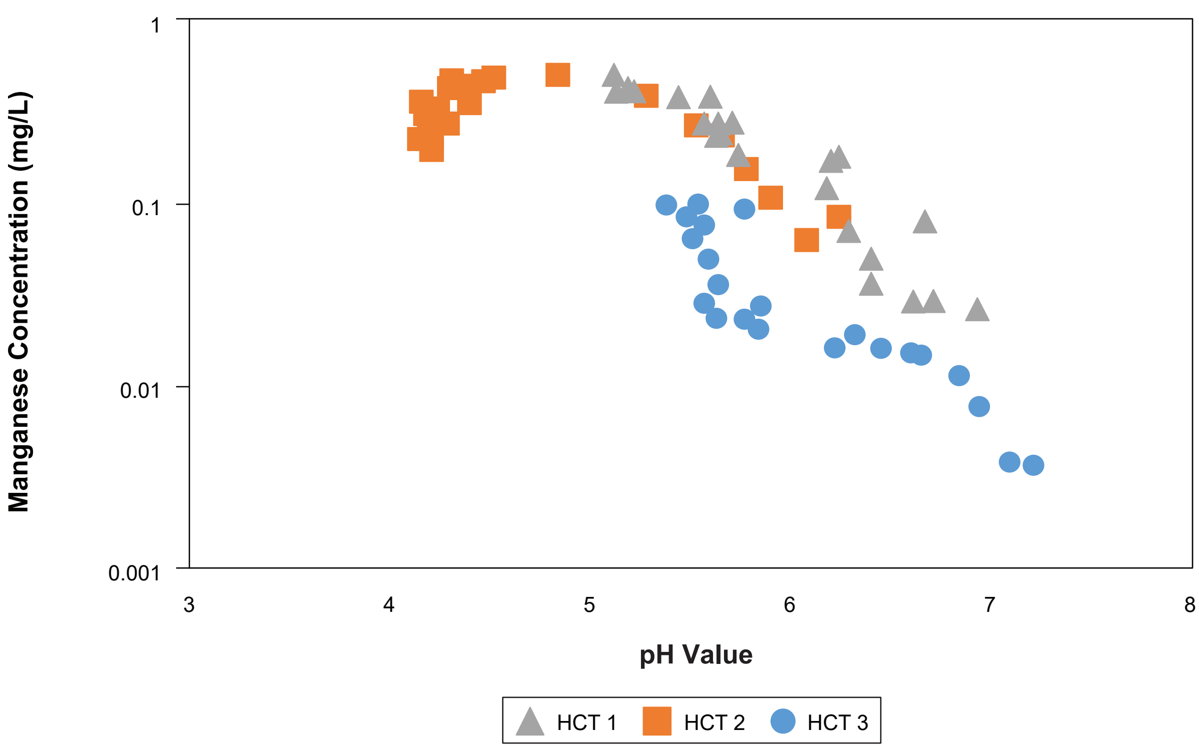


Figure 6.6-7: The Manganese Concentrations Compared to pH

6.7 Comparison of SFE and NAG Leachate to HCT Leachate

The NAG leachate and SFE leachate concentrations are compared to the concentrations measured in the HCT leachate during the final five cycles and the HCT leachate during the initial flush (initial five cycles), respectively, in Appendix D. The NAG leachate is compared to the HCT leachate concentrations measured during the last five weeks because the NAG test leachate is a measure of concentrations released from highly oxidized material, whereas the long-term HCT tests are a measure of concentrations released due to sulphide oxidation. The SFE tests concentrations are compared to the initial flush concentrations in the HCTs, as both tests measure the amounts of soluble constituents released through dissolution.

A discussion of the comparison between the NAG leachate and HCT leachate (last five cycles) is provided throughout Section 6. Overall, the sulphate concentrations and the major cation concentrations (calcium, magnesium and potassium) in the HCT 2 leachate and the NAG 2 leachate were similar. The HCT 2 concentrations had reached relatively constant values during the last five cycles and the pH of the HCT 2 leachate was similar to the NAG pH. The sulphate and cation concentrations in the HCT 1 and HCT 3 leachate (final five cycles) were lower than the concentrations measured in the NAG 1 and NAG 3 leachate. Concentrations in the HCT 1 leachate had not attained steady state during the last five weeks (i.e., they were changing with time) and, therefore, may increase with time as the HCT progresses. HCT and NAG leachate sodium concentrations cannot be compared, as sodium is an additive in the NAG tests (sodium phosphate).

The arsenic concentrations in the HCT leachates (last five weeks) were consistently lower than the arsenic concentrations in the NAG leachates. However, the trace metal PoPCs (cadmium, cobalt, nickel, and zinc) in the HCT leachates tended to be greater than the NAG leachate concentrations (HCT 1 and HCT 2). For HCTs with drainage pH above five (HCT 1 and HCT 3) during the last five cycles, aluminum concentrations tended to be less than the corresponding NAG leachate aluminum concentrations. HCT leachate with a pH below 4.5 during the last five cycles (HCT 2) had aluminum concentrations that were higher than the NAG leachate concentrations. The presence of dissolved aluminum is highly dependant on pH (and drives pH through the release of acid) due to the precipitation (and dissolution) of aluminum as $Al(OH)_3$ between a pH of 4 and 5. Therefore, the difference in aluminum concentrations are likely related to pH. Finally, iron concentrations measured in the leachate of the HCTs during the last five cycles were generally higher than the NAG leachate iron concentrations, indicating the complete oxidation of ferrous iron to ferric(oxy)hydroxide occurred in the NAG leachates. The precipitation of iron(oxy)hydroxides may provide adsorption surfaces for the trace metals and may account for the lower trace metal concentrations measured in the NAG 1 and 2 leachates relative to the HCT 1 and 2 leachate (which had higher iron contents).

A comparison of the SFE leachate results to the initial flush (initial five cycles) in the HCT cells was not evaluated in depth in Section 6. This is largely because the core samples had not been exposed to weathering for a prolonged period. SFE tests are typically conducted to evaluate the release of soluble parameters, which tend to accumulate as weathering progresses. Therefore, as the core was fresh, the liberation of soluble parameters to the SFE leachate was minimal. Nonetheless, the comparison is presented in Appendix D. The comparison indicates the initial flush in the HCTs (initial five weeks) tends to consistently be either similar (within 30%) or greater than the parameters released during the SFE tests. This was likely due to the combined loading from an initial flush of material in the HCT and sulphide oxidation. The one consistent exception to this was aluminum (concentrations were greater in the SFE tests); however, that may be due to incomplete filtering of dissolved solids of the SFE water samples.

Condition 26b Part H iv indicates that comparison of Point Lake SFE leachate concentrations with Jay Project metasediment SFE leachate concentrations should be provided. The SFE concentrations from the Point Lake project were compared to the SFE Concentrations in the Jay Project as part of the leachate analysis reporting (ERM 2021b). Specifically, the comparison is provided in Table 4-5 and Table 4-6, as well as a series box and whisker plots. Tables 4-5 and 4-6 of the leachate report have been attached to this document as Appendix E.

6.8 NAG pH Comparison

Single addition NAG tests were conducted in accordance with guidance outlined by AMIRA (2002). The NAG tests consist of pulverizing the samples and reacting them with 15% hydrogen peroxide (H_2O_2) until boiling ceases. The objective of the hydrogen peroxide addition is to rapidly oxidize the sulphide minerals to determine if a sample can neutralize the released acidity. After the reaction is completed, the samples are heated on a hot plate until effervescence stops (for a minimum of two hours) to accelerate the oxidation of remaining sulphides. The sample is later cooled to room temperature and diluted to 250 mL; after this point the NAG pH is recorded. The samples are filtered and the NAG liquor can be titrated to a solution with a pH of 7 using NaOH, to assist in interpretation of the results by providing an indication of acidity. The leachate is submitted for analysis prior to the titration step.

The interpretations of the NAG pH results assume complete oxidation of the material, with samples below 4.5 being classified as PAF. To evaluate if the sulphides were fully oxidized, the total sulphur content (measured in the ABA) was converted to sulphate concentrations and compared to the leachate concentrations in Table 6.8-1. The relative percent difference (RPD) between the measurements was less than 5% and; therefore, based on the leachate analysis, the sulphur was determined to be fully oxidized. The equivalent amount of acid titrated is also presented in Table 6.8-1; however, hydrogen peroxide can contribute to the total acidity.

Table 6.8-1: Comparison of ABA Total Sulphur (as Sulphate) and AP of the Point Lake NAG Leachate Samples Compared to the Sulphur Released to the Leachate

Sample	Total Sulphur (%)	AP (kg $CaCO_3$/ tonne)	Measured Sulphate in Leachate (mg/L)	Calculated Sulphate from %S (mg/L)	RPD	Titrated Acidity in NAG Test (kg $CaCO_3$/tonne)
PLDC-09-11	0.093	2.91	26	28	1.76	11
PLGT-03-09	0.131	4.09	41	39	-1.06	6.4
PLDC-06-07	0.494	15.44	141	148	1.24	11.6
PLDC-09-03	0.161	5.03	50	48	-0.86	11
PLGT-03-04	0.171	5.34	53	51	-0.81	9
PLDC-05-03	0.275	8.59	71	82	3.75	11.5
PLDC-06-02	0.151	4.72	38	45	4.38	11.9
PLDC-06-15	0.224	7.00	62	67	2.01	8.5
PLDC-07-05	0.074	2.31	21	22	1.39	13
PLDC-08-10	0.143	4.47	40	43	1.75	8.6
PLDC-08-03	0.17	5.31	49	51	1.00	10.1

Sulphate conversion assumes 2.5 g of material in 250 mL

It was noted in the Point Lake Project SFE Leachate and NAG Leachate memorandum (ERM 2021b) that the NAG pH readings measured in 2021 (updated values) were less than the NAG pH readings measured in 2019. This resulted in seven of the 11 samples (63%) submitted for leachate analysis being reclassified as PAF samples, when initially only two of the samples (18%) submitted were classified as PAF (the 18% of the 2019 NAG pH samples translated to 6% of the entire 2019 Project sample set). The updated NAG pH values were compared to the original NAG pH values (Figure 6.8-1). The reclassification of samples to PAF did not correlate to pH. The updated NAG pH values were on average approximately 89% lower than the original values.

To evaluate the discrepancy between the 2019 and 2021 NAG pH results, the laboratory was contacted to determine if there was any change to laboratory procedure that may have resulted in the change in classification of material to PAF. The laboratory indicated that procedures remained the same, reagent additions were consistent, and that the same laboratory employee conducted the analysis. This is important because discrepancies have been identified for NAG pH results between various laboratories.

Parbhaker-Fox et al. (2018) found that errors can result from discrepancies in the preparation of the hydrogen peroxide (H_2O_2) oxidizing agent and that erroneously high values can be attributed to reading the NAG pH prior to allowing for sufficient reaction times to occur. They also identified that the method outlined for NAG tests is not well designed. For example, there is no defined time or temperature specified for heating and no time specified for the length of time the sample is cooled. The potential inconsistency in the NAG pH method could produce variable results and impact classification. Inaccuracies in NAG test results have also been attributed to the CO_2 disequilibrium during the heating stage; however, this source of error is primarily applicable to samples with high calcium carbonate concentrations (Charles et al. 2015). Karlsson et al (2018) found that the NAG tests conducted on slower-reacting NP-contributing minerals (like the NP contributing minerals for the project) might require a longer time to react than is specified in the method. Other common discrepancies in NAG pH values have been attributed to the presence of organic acids and other sources of reactive metals that catalyze the decomposition of hydrogen peroxide (MEND 2009).

PAF is classified in this report as material with NAG pH values less than 4.5 as this titration value includes acidity due to free acid (H_2SO_4) and soluble iron and aluminum (MEND 2009). However, ferrous iron was identified in the HCT leachate at concentrations that exceeded the CCME guideline. The iron concentrations were attributed to liberation during aluminosilicate dissolution which may involve oxidation (Acker and Bricker 1991), in addition to the oxidation of liberated iron. The lack of dissolved iron and low manganese concentrations in the NAG tests indicates these parameters may have been oxidized during the test and present as insoluble solids. It is unclear how (or if) the oxidation involving aluminosilicates may have impacted the NAG readings of single addition NAG tests. However, it is likely that the aluminosilicate NP minerals may have contributed to the discrepancy given their slower reaction time which would make them more sensitive to slight discrepancies in the method. Ultimately, it is important to highlight that the aluminosilicates minerals are net acid contributors albeit in mildly acid pH.

Although the source of discrepancy in the NAG test remains unclear, the HCT leachate data can be used as a more accurate measure of potential drainage pH (in laboratory conditions) and identify IRNP and PAG material that will potential generate acidic conditions if not managed, based on calculated depletion rates. The HCT leachate pH values were observed to drop below the original (2019) NAG pH values but not the updated (2021) NAG pH values during the kinetic testing. This indicates that the updated 2021 values may be a more accurate and conservative measure of NAG pH for a PAF classification. Although this results in a larger percentage of tests classified as PAF, none of the updated NAG pH values were recorded below 3.75.

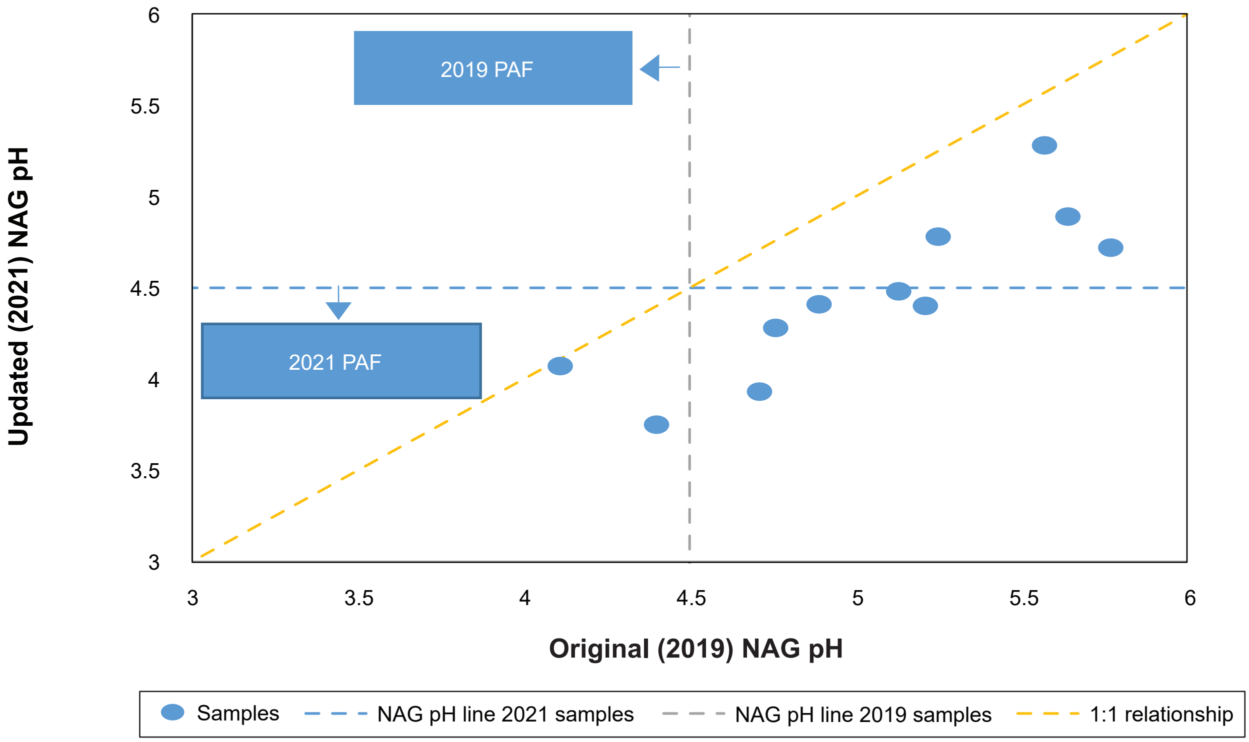


Figure 6.8-1: The Original NAG pH Values Compared to the Updated NAG pH Values

7. SUMMARY AND RECOMMENDATIONS

The results from the HCT analysis documented in this report can be used to understand and manage drainage chemistry at the Project site. The XRD results indicated that sulphides are present as pyrrhotite, which can be a faster reacting sulphide than pyrite (MEND 2009). This means the rate at which acid is generated from the Project metasediments may be quicker than acid generated from other PAG material on the Ekati Diamond Mine site, assuming the site-wide sulphides are present as pyrite. However, when the Project sulphate release rates were compared to the Ekati Diamond Mine site wide HCT sulphate released rates, the actual rates of reactivity were determined to be similar.

Overall, the metasediment samples are capable of developing net drainage with pH below 4.5 based on the observations from the conservative HCT in laboratory conditions (HCT 2); however, buffering reactions occurring slightly above pH of 4 appear capable of buffering acid released from sulphide oxidation at this pH (HCT 2) over the time frame of the test. The pH drop below 4.5 is largely due to the presence of IRNP in the samples at the laboratory setting. Leachate with a pH of 4.5 was used to define PAF material because $Al(OH)_3$ buffering (between a pH of 4 and 4.3) can result in significant increases of dissolved aluminum as well as the potential liberation of adsorbed trace metals. It is important to also identify that sulphide oxidation rates are expected to be reduced in the field to approximately 20% of the sulphide oxidation rates measured in the lab on an annual basis. In other words, sulphate concentrations of 60 mg/L (HCT 2) would be reduced to 12 mg/L in the field, based on the difference in temperature between the two settings. The HCT analysis (HCT 1 and HCT 3) indicates that biotite dissolution may be able to buffer acid generated at this rate; however, the impact of colder temperatures on biotite dissolution (which may also require oxidation) remains unclear. The NP and sulphide depletion rate calculations based on the kinetic test data from HCT 3 indicate that sulphide depletion may occur prior to NP depletion (measured by Modified NP) for NPR values of 1.25; however, the occlusion of NP minerals and sulphide minerals due to precipitation of secondary iron and aluminum minerals on the grain surfaces remains unknown. It is also important to highlight that samples bearing measurable carbonates were not selected for HCT analyses, but they did consist of approximately 10% of the samples (ERM 2021a) and may contribute to the buffering capacity during operations.

The PoPCs associated with the Point Lake HCT metasediment leachate were identified by increasing trends or exceedances of Ekati Diamond Mine water quality benchmarks and/or CCME guidelines. They do not account for dilution sources likely to occur in the field along the flow path and therefore their identification is for preliminary screening purposes only so that the parameters are not eliminated from consideration during subsequent modelling efforts. The parameters of concern will be identified by the combination of source term development, water quality modelling, and potentially an effects assessment. The PoPCs should not be interpreted as parameters of concern. The PoPCs identified as part of geochemical screening are aluminum, arsenic, beryllium, cadmium, cobalt, copper, iron, lead, manganese, nickel and zinc. The geochemical screening level PoPCs exhibited the following behaviour:

- Aluminum concentrations tended to increase above the Ekati Diamond Mine water quality benchmark below a pH of 5 and follow a solubility curve similar to amorphous $Al(OH)_3$.
- Arsenic appeared to be released at higher pH values and/or during the initial flush of soluble oxidation products from the material but was not liberated as the leachate became progressively more acidic.
- Cadmium, beryllium, copper, iron (increase around pH of 5 and subsequent decrease), lead (variable concentrations), manganese (increase correlated to dissolved iron increase), nickel and zinc all demonstrated increasing trends, in some instances increasing above their respective Ekati Diamond Mine water quality benchmark or CCME guideline value. The cadmium, copper, and zinc concentrations correlated to pH, with concentrations increasing as the pH decreased.
- Given that the pH of the drainage is expected to remain above 3.5, increased iron concentrations are not expected in oxic drainage; however, the elevated dissolved iron in the HCT indicates that it may

be liberated. HCTs are designed to identify primary reaction rates; therefore, it is likely that within the pore space of the WRSA, thermodynamic constrains will be met. The dissolved iron concentrations may be limited by oxygen ingress to the WRSA.

- Nickel and cobalt concentrations correlated strongly to sulphide concentrations, indicating these parameters are released through sulphide oxidation and will likely scale conservatively with sulphate.

The information gathered from the HCT leachate data, as well as the SFE and NAG leachate data, will be used to develop source terms and predict drainage from the Point Lake metasediment WRSA. The source terms are described in detail as part of the Point Lake WRSA Prediction Report (ERM 2022).

The recommendations for continued geochemical analysis of metasedimentary material include the following:

- HCT tests should continue to be operated and analyzed until their 40^{th} week. At that time, data should be reviewed by a Qualified Professional to determine whether each test should continue or be decommissioned.
- Once the HCTs are decommissioned, the material in the HCTs should be submitted for post analysis, including mineralogical testing, to determine potential mechanisms for mineral occlusion of the grains.
- A key uncertainty at the site is NP dissolution in cold climates. Therefore, the amount of aluminosilicate buffering within the HCT material with IRNP should be further evaluated in colder temperatures to reduce uncertainty.
- The presence of iron suggests that ferric(oxy)hydroxides are precipitating in the HCTs. The potential dissolution of ferric(oxy)hydroxides should be evaluated using weathered material. Therefore, material that has been exposed on site for a prolonged period (several months to years) during Point Lake operations should be submitted for SFE tests as well as sequential extractions to evaluate leaching under various conditions for closure planning purposes. It is important to submit weathered material for the reason that soluble secondary minerals will have formed within this material.
- The majority of the parameters have reached concentrations amenable to trend and pattern detection. Therefore, the analysis of trace metal concentration should be reduced to a biweekly frequency. The sulphate, alkalinity, conductivity and pH readings should continue on a weekly basis.

8. CLOSING

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APPENDIX A SAMPLE RESULTS

Appendix A-1: HCT Acid Base Accounting Test Results

Appendix A-2: HCT Results

Appendix A-3: XRD Results

Appendix A-1: HCT Acid Base Accounting Test Results

SGS Project #: 2147

Test: Modified Acid-Base Accounting

Date: December 21, 2021

Sample ID	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	S(S-2) %	AP	Modified NP	Net Modified NP	Fizz Test
Method Code	Sobek	CSB02V	Calc.	CSA06V	CSA07C1	Calc	Calc.	Modified	Calc.	Sobek
LOD	0.2	0.01	#N/A	0.005	0.01		#N/A	0.5	#N/A	#N/A
PLDC-05-03	9.64	<0.01	<0.8	0.285	<0.01	0.285	8.9	7.4	-1.5	None
PLDC-06-15	9.41	<0.01	<0.8	0.215	<0.01	0.215	6.7	5.9	-0.8	None
PLDC-08-10	9.54	<0.01	<0.8	0.148	<0.01	0.148	4.6	0.5	-4.1	None
Duplicates										
PLDC-05-03	9.61							6.9		None
PLDC-08-10				0.151						
QC										
RTS-3a					0.96					
OREAS 278										
Std-SY4		0.92								
NBM-1								43.5		Slight
GS314-2				2.518						
Expected Values		0.91		2.56	0.98	0.699		46.0		Slight
Tolerance +/-		0.07		0.14	0.25	0.060		10.1		

NET Modified NP = Modified NP - AP

Carbonate NP is calculated from TIC originating from carbonate minerals and is expressed in kg $CaCO_3$/tonne.

Sulphate Sulphur determined by 25% HCl Leach with S by ICP Finish.

Sulphide Sulphur determined by calculation.

Appendix A-1: HCT Acid Base Accounting Test Results

SGS Proposal: 18897-COS 3 **Sample Receipt Date:** 2020
SGS Project #: 2147 **Report Date:** 12/5/2022
Version: Final

ABA Report

Test	S(T)	$S(SO_4)$	S(S-2)	Insoluble S	AP
Units	%	%	%	%	kg $CaCO_3$/t
Method Code	CSA06V	CSA07V	Calc.	Calc.	Calc.
LOD	0.005	0.01	0.01	#N/A	#N/A
Sample ID					
PLDC-08-10				NA	
				NA	
				NA	
				NA	
Duplicates					
QA/QC					
Blank					
Certified Standards					

Test	C(T)	TIC	$CaCO_3$ NP	CO3 NPR	Modified NP	Net Modified	Bulk NPR	Fizz Test	Paste pH
Units	%	%	kg $CaCO_3$/t		kg $CaCO_3$/t	kg $CaCO_3$/t			
Method Code	CSA06V	CSB02V	Calc.	Calc.	Modified	Calc.	Calc.	Sobek	Sobek
LOD	0.005	0.01			0.5				0.2
Sample ID									
PLDC-08-10					6.1			None	9.47
Duplicates									
PLDC-08-10					6.7			None	9.47
QA/QC									
Blank									
Certified Standards									
NBM-1					43.5			Slight	

Appendix A-2: HCT Results

Cell No.	Sample ID	Sample Type	Method Reference	Column Dimensions		Column Packing			Total Volume of Initial Flushings (mL)	Flushing Rate/ Weekly Input (mL)	Temp (°C)	Sampling Frequency	Start-up Date 2021	Sampling Day	Operation Procedure	Sample Prep. for Flushings
				Inner Diameter (cm)	Length (cm)	Dry Wt. of Sample (kg)	Other Materials Used	Column Material								
HC 1	PLDC-05-03	Waste Rock	MEND	10.00	20.00	1.00	Plexiglas perforated	Plexiglas	600	500	20-22	Weekly	29-Nov	Monday	Flood Leach	
HC 2	PLDC-06-15	Waste Rock	MEND	10.00	20.00	1.00	Plexiglas perforated	Plexiglas	600	500	20-22	Weekly	29-Nov	Monday	Flood Leach	
HC 3	PLDC-08-10	Waste Rock	MEND	10.00	20.00	1.00	Plexiglas perforated	Plexiglas	600	500	20-22	Weekly	29-Nov	Monday	Flood Leach	

Appendix A-2: HCT Results

HC 1

Sample = PLDC-05-03

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. µmhos/cm	Acidity (pH 4.5) $mgCaCO_3/L$	Acidity $mgCaCO_3/L$	Total Alkalinity $mgCaCO_3/L$	Sulphate mg/L	Bromide mg/L	Chloride mg/L	Fluoride mg/L	Hardness $CaCO_3$ mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L
29-Nov-21	1	600	355	7.47	83	#N/A	2.4	6.1	22	< 0.3	1	< 0.06	13.2	0.009	< 0.0009	0.0019	0.0158	< 0.000007	< 0.00001	0.019
06-Dec-21	2	500	430	6.59	141	#N/A	1.1	3.7	56	< 0.3	< 1	< 0.06	34.0	0.009	< 0.0009	0.0225	0.0160	< 0.000007	< 0.00001	0.021
13-Dec-21	3	500	445	6.91	92	#N/A	0.8	4.5	31	< 0.3	< 1	< 0.06	21.0	0.007	< 0.0009	0.0152	0.00979	0.000007	< 0.00001	0.018
20-Dec-21	4	500	455	6.54	55	#N/A	1.2	3.4	16	< 0.3	< 1	< 0.06	12.6	0.011	< 0.0009	0.0144	0.00731	< 0.000007	< 0.00001	0.011
27-Dec-21	5	500	445	6.71	46	#N/A	1.2	4.3	13	< 0.3	< 1	0.31	10.4	0.004	< 0.0009	0.0128	0.00637	< 0.000007	< 0.00001	0.008
03-Jan-22	6	500	445	6.93	39	#N/A	1.0	4.8	10	< 0.3	< 1	< 0.06	9.0	0.006	< 0.0009	0.0117	0.00518	< 0.000007	< 0.00001	0.007
10-Jan-22	7	500	445	6.61	36	#N/A	1.1	3.8	10	< 0.3	< 1	< 0.06	8.7	0.009	< 0.0009	0.0116	0.00491	< 0.000007	< 0.00001	0.008
17-Jan-22	8	500	455	6.40	38	#N/A	0.9	3.0	12	< 0.3	< 1	< 0.06	9.6	0.003	< 0.0009	0.0080	0.00531	< 0.000007	< 0.00001	0.005
24-Jan-22	9	500	460	6.40	42	#N/A	1.0	2.8	11	< 0.3	< 1	< 0.06	9.90	< 0.001	< 0.0009	0.00662	0.00620	< 0.000007	< 0.00001	0.00461
31-Jan-22	10	500	450	6.29	47	#N/A	1.2	2.9	15	< 0.3	< 1	< 0.06	11.8	0.003	< 0.0009	0.0066	0.00711	< 0.000007	< 0.00001	0.007
07-Feb-22	11	500	415	6.67	49	#N/A	0.8	3.6	14	< 0.3	< 1	< 0.06	12.3	0.003	< 0.0009	0.0049	0.00726	< 0.000007	< 0.00001	0.007
14-Feb-22	12	500	465	6.18	51	#N/A	1.2	2.5	16	< 0.3	< 1	< 0.06	13.1	0.002	< 0.0009	0.0035	0.0103	0.000016	< 0.00001	0.006
21-Feb-22	13	500	465	6.20	60	#N/A	1.2	2.4	18	< 0.3	< 1	< 0.06	16.8	0.002	< 0.0009	0.0026	0.011	0.000016	< 0.00001	0.005
28-Feb-22	14	500	455	6.24	53	#N/A	1.1	2.4	14	< 0.3	< 1	< 0.06	13.6	0.003	< 0.0009	0.0025	0.01	0.000013	< 0.00001	0.005
07-Mar-22	15	500	435	5.74	53	#N/A	1.5	2.4	15	< 0.3	< 1	< 0.06	14	0.005	< 0.0009	0.0021	0.0104	0.000026	< 0.00001	0.006
14-Mar-22	16	500	435	5.65	58	#N/A	1.6	2.3	15	< 0.3	< 1	< 0.06	18	0.003	< 0.0009	0.0018	0.0108	0.000024	< 0.00001	0.003
21-Mar-22	17	500	460	5.63	56	#N/A	1.7	2.3	17	< 0.3	< 1	< 0.06	16	0.004	< 0.0009	0.0016	0.011	0.000066	< 0.00001	0.004
28-Mar-22	18	500	440	5.71	61	#N/A	2.0	2.2	18	< 0.3	< 1	< 0.06	18	0.005	< 0.0009	0.0012	0.0123	0.000071	< 0.00001	0.005
04-Apr-22	19	500	465	5.57	62	#N/A	2.5	2.1	20	< 0.3	< 1	< 0.06	16.7	0.008	< 0.0009	0.0011	0.0122	0.000095	< 0.00001	0.007
11-Apr-22	20	500	435	5.64	61	#N/A	2.6	2.2	19	< 0.3	< 1	< 0.06	15.1	0.011	< 0.0009	0.0008	0.0126	0.000092	< 0.00001	0.042
18-Apr-22	21	500	455	5.60	74	#N/A	4.1	2.2	24	< 0.3	< 1	< 0.06	18.6	0.016	< 0.0009	0.0011	0.0161	0.000155	< 0.00001	0.004
25-Apr-22	22	500	450	5.44	76	#N/A	5.9	2.3	26	< 0.3	< 1	< 0.06	16.9	0.021	< 0.0009	0.0011	0.0156	0.000209	< 0.00001	0.007
02-May-22	23	500	440	5.22	77	#N/A	6.5	2.0	26	< 0.3	< 1	< 0.06	18.1	0.032	< 0.0009	0.0011	0.0143	0.000227	< 0.00001	0.006
09-May-22	24	500	455	5.19	78	#N/A	8.0	1.9	27	< 0.3	< 1	< 0.06	17.0	0.045	< 0.0009	0.0009	0.0171	0.000430	< 0.00001	0.006
16-May-22	25	500	445	5.13	80	#N/A	9.3	1.7	30	< 0.3	< 1	< 0.06	16	0.05	< 0.0009	0.0006	0.0157	0.000343	< 0.00001	0.006
23-May-22	26	500	460	5.12	98	#N/A	14.6	1.8	35	< 0.3	< 1	< 0.06	18.9	0.061	< 0.0009	0.0009	0.0190	0.000335	< 0.00001	0.006
30-May-22	27	500	485	4.99	94	#N/A	16.7	1.6	34											
06-Jun-22	28	500	500	4.95	100	#N/A	19.1	1.7												

Appendix A-2: HCT Results

HC 1

Sample = PLDC-05-03

Date	Cycle No.	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L
29-Nov-21	1	0.000039	2.13	< 0.00008	0.00442	0.0003	0.047	0.00037	0.0141	1.92	0.0369	< 0.01	0.00170	0.0286	< 0.003	6.40	0.00042	0.41	< 0.00005	2.91
06-Dec-21	2	0.000077	5.44	< 0.00008	0.00290	0.0004	< 0.007	< 0.00009	0.0126	4.97	0.0665	< 0.01	0.00048	0.0235	< 0.003	8.30	0.00076	1.00	< 0.00005	4.44
13-Dec-21	3	0.000018	3.14	< 0.00008	0.001612	0.0002	< 0.007	< 0.00009	0.0116	3.20	0.0509	< 0.01	0.00011	0.0151	< 0.003	6.09	0.00038	1.34	< 0.00005	2.97
20-Dec-21	4	0.000009	2.03	< 0.00008	0.00122	< 0.0002	< 0.007	< 0.00009	0.0120	1.82	0.0304	< 0.01	0.00010	0.0094	< 0.003	4.27	0.00013	1.25	< 0.00005	1.45
27-Dec-21	5	0.000011	1.60	< 0.00008	0.00144	< 0.0002	< 0.007	< 0.00009	0.0076	1.56	0.0294	< 0.01	0.00009	0.0100	< 0.003	3.12	0.00013	1.04	< 0.00005	0.98
03-Jan-22	6	0.000007	1.45	< 0.00008	0.00137	< 0.0002	< 0.007	< 0.00009	0.0071	1.31	0.0265	< 0.01	0.00060	0.0100	0.022	2.87	0.00009	1.18	< 0.00005	0.75
10-Jan-22	7	0.000016	1.27	< 0.00008	0.00163	< 0.0002	0.022	< 0.00009	0.0064	1.33	0.0292	< 0.01	0.00018	0.0115	< 0.003	2.82	0.00013	0.99	< 0.00005	0.70
17-Jan-22	8	0.000013	1.35	< 0.00008	0.00192	< 0.0002	0.007	< 0.00009	0.0076	1.50	0.0366	< 0.01	0.00016	0.0142	< 0.003	2.80	0.00012	1.51	< 0.00005	0.61
24-Jan-22	9	0.000025	1.47	< 0.00008	0.00303	0.000708	< 0.007	< 0.00009	0.00721	1.51	0.0502	< 0.01	0.000923	0.0205	< 0.003	2.67	0.000132	1.67	< 0.00005	0.542
31-Jan-22	10	0.000027	1.76	< 0.00008	0.00415	0.0002	< 0.007	< 0.00009	0.0096	1.79	0.0711	< 0.01	0.00019	0.0301	< 0.003	3.02	0.00014	1.73	< 0.00005	0.52
07-Feb-22	11	0.000029	1.87	< 0.00008	0.00603	0.0003	< 0.007	< 0.00009	0.0091	1.85	0.0801	< 0.01	0.00049	0.0396	< 0.003	2.67	0.00016	1.11	< 0.00005	0.46
14-Feb-22	12	0.000091	1.9	< 0.00008	0.0115	0.0015	0.012	< 0.00009	0.0113	2.02	0.122	< 0.01	0.00098	0.0666	< 0.003	2.87	0.00013	1.78	< 0.00005	0.5
21-Feb-22	13	0.000104	2.42	< 0.00008	0.0199	0.0007	0.15	< 0.00009	0.0085	2.6	0.172	< 0.01	0.00015	0.107	< 0.003	3.07	0.00011	1.38	< 0.00005	0.48
28-Feb-22	14	0.000122	1.99	< 0.00008	0.0233	0.0008	0.066	< 0.00009	0.0112	2.1	0.181	< 0.01	0.0001	0.12	< 0.003	2.62	0.00009	1.46	< 0.00005	0.36
07-Mar-22	15	0.000158	2.10	< 0.00008	0.0272	0.0014	0.112	< 0.00009	0.0106	2.05	0.186	< 0.01	0.00027	0.136	< 0.003	2.40	0.00008	1.18	< 0.00005	0.38
14-Mar-22	16	0.000206	2.76	< 0.00008	0.0387	0.0016	0.216	0.0001	0.0079	2.62	0.243	< 0.01	0.00036	0.178	< 0.003	3.35	0.00021	1.23	< 0.00005	0.45
21-Mar-22	17	0.000229	2.38	< 0.00008	0.0412	0.0022	0.276	< 0.00009	0.0145	2.42	0.236	< 0.01	0.00041	0.182	< 0.003	2.6	0.00022	1.49	< 0.00005	0.41
28-Mar-22	18	0.000286	2.81	< 0.00008	0.0557	0.0014	0.392	< 0.00009	0.0171	2.77	0.279	< 0.01	< 0.00004	0.241	< 0.003	2.8	0.00025	1.5	< 0.00005	0.38
04-Apr-22	19	0.000283	2.51	< 0.00008	0.0568	0.0022	0.617	0.00035	0.0172	2.53	0.276	< 0.01	0.00078	0.235	< 0.003	2.5	0.00029	1.67	< 0.00005	0.34
11-Apr-22	20	0.000271	2.49	< 0.00008	0.0643	0.0027	0.742	0.00019	0.0138	2.17	0.276	< 0.01	0.00025	0.259	< 0.003	2.34	0.00027	1.02	< 0.00005	0.27
18-Apr-22	21	0.000411	2.80	< 0.00008	0.0953	0.0037	1.43	0.00029	0.0167	2.81	0.386	< 0.01	< 0.00004	0.387	< 0.003	3.01	0.00033	1.15	< 0.00005	0.42
25-Apr-22	22	0.000398	2.56	< 0.00008	0.0934	0.0027	1.72	0.00102	0.0227	2.55	0.384	< 0.01	0.00130	0.366	< 0.003	2.59	0.00043	1.59	< 0.00005	0.32
02-May-22	23	0.000426	3.14	< 0.00008	0.0911	0.0029	2.36	0.00033	0.0228	2.5	0.415	< 0.01	0.00029	0.385	< 0.003	3.01	0.0004	1.92	< 0.00005	0.33
09-May-22	24	0.000422	3.06	0.00014	0.106	0.0033	3.09	0.00021	0.0522	2.29	0.431	< 0.01	0.00066	0.396	0.003	3.37	0.00039	2.31	< 0.00005	0.37
16-May-22	25	0.000481	2.3	< 0.00008	0.112	0.0033	4.15	0.00108	0.0227	2.48	0.412	< 0.01	0.00154	0.422	< 0.003	3.04	0.00044	1.87	< 0.00005	0.53
23-May-22	26	0.000549	3.12	< 0.00008	0.135	0.0030	7.11	0.00017	0.0178	2.70	0.509	< 0.01	0.00009	0.541	< 0.003	2.89	0.00056	1.56	< 0.00005	0.31
30-May-22	27																			
06-Jun-22	28																			

Appendix A-2: HCT Results

HC 1

Sample = PLDC-05-03

Date	Cycle No.	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L	SGS File #	Major Anions	Major Cations	Diff	Diff (%)
29-Nov-21	1	0.0324	9	< 0.000005	< 0.00006	< 0.00005	0.000020	0.00011	0.005	< 0.002	CA15055-DEC21	0.63	0.57	-0.06	-5.4%
06-Dec-21	2	0.0626	17	0.000009	< 0.00006	0.0002	0.000021	0.00029	0.008	< 0.002	CA15254-DEC21	1.24	1.10	-0.14	-6.1%
13-Dec-21	3	0.04060	11	0.000009	< 0.00006	0.00008	0.000011	0.00024	0.002	< 0.002	CA15090-FEB22	0.74	0.71	-0.02	-1.5%
20-Dec-21	4	0.0239	6	< 0.000005	< 0.00006	0.00023	0.000011	0.00029	< 0.002	< 0.002	CA15565-DEC21	0.40	0.43	0.03	3.4%
27-Dec-21	5	0.0185	4	< 0.000005	0.00009	0.00016	0.000009	0.00026	< 0.002	< 0.002	CA15633-DEC21	0.37	0.34	-0.04	-5.2%
03-Jan-22	6	0.0154	3	< 0.000005	0.00046	0.00009	0.000028	0.00025	< 0.002	< 0.002	CA15026-JAN22	0.30	0.29	-0.01	-2.3%
10-Jan-22	7	0.0141	3	< 0.000005	< 0.00006	0.00027	0.000012	0.00022	0.030	< 0.002	CA15113-JAN22	0.28	0.28	0.00	-0.7%
17-Jan-22	8	0.0158	4	< 0.000005	0.00010	0.00005	0.000013	0.00022	0.005	< 0.002	CA15227-JAN22	0.31	0.29	-0.02	-2.9%
24-Jan-22	9	0.0182	7.07	< 0.000005	< 0.00006	< 0.00005	< 0.000002	0.000154	0.012	< 0.002	CA15332-JAN22	0.29	0.29	0.01	1.2%
31-Jan-22	10	0.0220	6	0.000005	< 0.00006	0.00007	0.000012	0.00009	< 0.002	< 0.002	CA15042-FEB22	0.37	0.34	-0.03	-4.4%
07-Feb-22	11	0.0238	6	< 0.000005	0.00012	< 0.00005	0.000017	0.00008	0.003	< 0.002	CA15152-FEB22	0.36	0.34	-0.03	-3.6%
14-Feb-22	12	0.0252	6	0.000005	< 0.00006	< 0.00005	0.000013	0.00007	0.007	< 0.002	CA15339-FEB22	0.38	0.36	-0.02	-3.0%
21-Feb-22	13	0.0293	6	0.000032	0.00008	< 0.00005	< 0.000002	0.00004	0.007	< 0.002	CA15400-FEB22	0.42	0.44	0.02	1.9%
28-Feb-22	14	0.031	8	< 0.000005	< 0.00006	0.00025	0.000031	0.00005	0.008	< 0.002	CA15037-MAR22	0.34	0.36	0.02	3.0%
07-Mar-22	15	0.0292	6	< 0.000005	< 0.00006	0.00008	0.000032	0.00007	0.010	< 0.002	CA15169-MAR22	0.36	0.36	0.00	-0.4%
14-Mar-22	16	0.032	7	< 0.000005	< 0.00006	< 0.00005	0.000033	0.00002	0.014	< 0.002	CA15343-MAR22	0.36	0.46	0.11	12.8%
21-Mar-22	17	0.0317	7	< 0.000005	< 0.00006	< 0.00005	0.00004	0.00002	0.018	< 0.002	CA15451-MAR22	0.40	0.44	0.04	4.6%
28-Mar-22	18	0.0378	7	< 0.000005	< 0.00006	< 0.00005	0.000064	< 0.00001	0.025	< 0.002	CA15991-MAR22	0.42	0.50	0.08	9.1%
04-Apr-22	19	0.0352	7	< 0.000005	< 0.00006	< 0.00005	0.000079	0.00003	0.029	< 0.002	CA15076-APR22	0.46	0.47	0.01	1.3%
11-Apr-22	20	0.0353	8	< 0.000005	< 0.00006	0.0001	0.000093	< 0.00001	0.03	< 0.002	CA15275-APR22	0.44	0.45	0.01	1.3%
18-Apr-22	21	0.0416	9	0.000005	0.00014	< 0.00005	0.000146	< 0.00001	0.047	< 0.002	CA15320-APR22	0.54	0.58	0.04	3.3%
25-Apr-22	22	0.0443	9	0.000007	< 0.00006	< 0.00005	0.000162	0.00003	0.051	< 0.002	CA15428-APR22	0.59	0.55	-0.04	-3.4%
02-May-22	23	0.0458	11	0.000006	< 0.00006	0.0001	0.000228	0.00014	0.061	< 0.002	CA15029-MAY22	0.58	0.62	0.04	3.4%
09-May-22	24	0.0415	13	0.000005	0.00019	< 0.00005	0.000231	0.00005	0.059	< 0.002	CA15145-MAY22	0.60	0.66	0.06	4.6%
16-May-22	25	0.0392	10	< 0.000005	< 0.00006	< 0.00005	0.000252	0.00002	0.074	< 0.002	CA15285-MAY22	0.66	0.69	0.03	2.1%
23-May-22	26	0.0464	11	0.000006	< 0.00006	< 0.00005	0.000357	0.00003	0.088	< 0.002	CA15743-MAY22	0.77	0.90	0.14	8.2%
30-May-22	27														
06-Jun-22	28														

Appendix A-2: HCT Results

HC 2

Sample = PLDC-06-15

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. µmhos/cm	Acidity (pH 4.5) mgCaCO$_3$/L	Acidity mgCaCO$_3$/L	Total Alkalinity mgCaCO$_3$/L	Sulphate mg/L	Bromide mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO$_3$ mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L
29-Nov-21	1	600	360	7.05	127	#N/A	2.9	5.2	39	< 0.3	1	< 0.06	11.5	0.101	< 0.0009	0.0055	0.00792	< 0.000007	< 0.00001	0.016
06-Dec-21	2	500	450	6.11	192	#N/A	1.3	2.8	67	< 0.3	< 1	< 0.06	28.7	0.011	< 0.0009	0.0156	0.00845	< 0.000007	< 0.00001	0.023
13-Dec-21	3	500	460	6.15	127	#N/A	0.9	2.5	41	< 0.3	< 1	< 0.06	17.8	0.006	< 0.0009	0.0191	0.00510	0.000007	< 0.00001	0.018
20-Dec-21	4	500	445	6.12	85	#N/A	1.3	2.6	28	< 0.3	< 1	< 0.06	12.0	0.026	< 0.0009	0.0122	0.00416	< 0.000007	< 0.00001	0.014
27-Dec-21	5	500	445	6.08	69	#N/A	1.1	2.7	22	< 0.3	< 1	< 0.06	10.8	0.011	< 0.0009	0.0078	0.00377	< 0.000007	< 0.00001	0.011
03-Jan-22	6	500	445	6.24	74	#N/A	1.2	2.9	24	< 0.3	< 1	< 0.06	12.9	0.008	< 0.0009	0.0061	0.00333	< 0.000007	< 0.00001	0.011
10-Jan-22	7	500	435	5.90	76	#N/A	1.3	2.4	23	< 0.3	< 1	< 0.06	14.0	0.010	< 0.0009	0.0057	0.00337	< 0.000007	< 0.00001	0.024
17-Jan-22	8	500	450	5.78	85	#N/A	1.5	2.4	28	< 0.3	< 1	< 0.06	17.3	0.005	< 0.0009	0.0034	0.00397	0.000015	< 0.00001	0.011
24-Jan-22	9	500	460	5.66	96	#N/A	2.2	2.3	31	< 0.3	< 1	< 0.06	20.2	0.006	< 0.0009	0.0029	0.00444	0.000023	< 0.00001	0.009
31-Jan-22	10	500	440	5.53	108	#N/A	3.9	2.3	40	< 0.3	< 1	< 0.06	23.4	0.022	< 0.0009	0.0022	0.00441	0.000052	< 0.00001	0.010
07-Feb-22	11	500	455	5.28	133	#N/A	6.6	2.0	44	< 0.3	< 1	< 0.06	30.8	0.090	< 0.0009	0.0019	0.00549	0.000114	< 0.00001	0.010
14-Feb-22	12	500	465	4.84	157	#N/A	12.8	1.5	60	< 0.3	< 1	< 0.06	34.0	0.361	< 0.0009	0.0020	0.00696	0.000272	< 0.00001	0.011
21-Feb-22	13	500	455	4.47	174	0.6	17.7	#N/A	60	< 0.3	< 1	< 0.06	32.8	0.623	< 0.0009	0.0020	0.00627	0.000380	< 0.00001	0.009
28-Feb-22	14	500	455	4.52	183	#N/A	22.8	0.5	66	< 0.3	< 1	< 0.06	32.2	1.030	< 0.0009	0.0020	0.00546	0.000501	< 0.00001	0.010
07-Mar-22	15	500	445	4.38	184	1.5	23.0	#N/A	55	< 0.3	< 1	< 0.06	28.0	1.190	< 0.0009	0.0024	0.00555	0.000609	< 0.00001	0.009
14-Mar-22	16	500	455	4.31	183	2.1	22.5	#N/A	59	< 0.3	< 1	< 0.06	32	1.61	< 0.0009	0.0027	0.00553	0.000519	< 0.00001	0.007
21-Mar-22	17	500	470	4.30	184	2.1	20.6	#N/A	57	< 0.3	< 1	0.07	32	2.04	< 0.0009	0.0028	0.00659	0.000945	< 0.00001	0.011
28-Mar-22	18	500	450	4.40	155	1.2	14.9	#N/A	46	< 0.3	< 1	< 0.06	28	1.77	< 0.0009	0.003	0.0054	0.000836	< 0.00001	0.011
04-Apr-22	19	500	480	4.24	166	2.3	14.8	#N/A	57	< 0.3	< 1	0.08	27.8	1.48	< 0.0009	0.002	0.00779	0.000794	< 0.00001	0.015
11-Apr-22	20	500	455	4.29	147	1.9	13.2	#N/A	47	< 0.3	< 1	0.1	23.3	1.23	< 0.0009	0.002	0.00615	0.000536	< 0.00001	0.019
18-Apr-22	21	500	460	4.16	188	3.3	17.5	#N/A	64	< 0.3	< 1	0.13	30.8	1.770	< 0.0009	0.0024	0.00843	0.000735	< 0.00001	0.011
25-Apr-22	22	500	495	4.18	177	3.1	16.1	#N/A	62	< 0.3	< 1	0.14	26.2	1.410	< 0.0009	0.0016	0.00916	0.000697	< 0.00001	0.013
02-May-22	23	500	460	4.20	148	2.7	13.1	#N/A	48	< 0.3	< 1	0.14	23.2	1.19	< 0.0009	0.0014	0.00719	0.000618	< 0.00001	0.013
09-May-22	24	500	460	4.21	139	2.4	12.9	#N/A	46	< 0.3	< 1	0.13	23.1	1.49	< 0.0009	0.0012	0.00735	0.000891	< 0.00001	0.014
16-May-22	25	500	490	4.21	130	2.5	12.2	#N/A	43	< 0.3	< 1	0.13	23.3	1.42	< 0.0009	0.001	0.00762	0.000633	< 0.00001	0.013
23-May-22	26	500	450	4.15	156	3.2	13.8	#N/A	51	< 0.3	< 1	0.16	26.2	1.14	< 0.0009	0.0015	0.00861	0.000593	< 0.00001	0.012
30-May-22	27	500	480	4.19	118	2.5	11.5	#N/A	35											
06-Jun-22	28	500	460	4.16	130	2.9	14.0	#N/A												

Appendix A-2: HCT Results

HC 2

Sample = PLDC-06-15

Date	Cycle	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na
	No.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
29-Nov-21	1	0.000029	1.06	0.00018	0.00402	< 0.0002	0.036	< 0.00009	0.0126	2.14	0.0287	< 0.01	0.00067	0.0376	< 0.003	13.3	0.00063	0.70	< 0.00005	6.46
06-Dec-21	2	0.000040	2.55	< 0.00008	0.00972	0.0003	0.016	< 0.00009	0.0137	5.42	0.0921	< 0.01	0.00081	0.0790	< 0.003	17.7	0.00096	1.07	< 0.00005	9.78
13-Dec-21	3	0.000079	1.46	< 0.00008	0.00755	0.0003	< 0.007	< 0.00009	0.0101	3.44	0.0745	< 0.01	0.00009	0.0700	< 0.003	12.3	0.00067	1.20	< 0.00005	6.13
20-Dec-21	4	0.000018	1.05	< 0.00008	0.00812	< 0.0002	0.012	< 0.00009	0.0111	2.27	0.0563	< 0.01	0.00006	0.0611	< 0.003	8.20	0.00038	1.29	< 0.00005	3.69
27-Dec-21	5	0.000034	0.89	< 0.00008	0.0125	< 0.0002	0.019	< 0.00009	0.0076	2.08	0.0635	< 0.01	0.00042	0.0811	< 0.003	6.60	0.00027	0.90	< 0.00005	2.54
03-Jan-22	6	0.000041	1.14	< 0.00008	0.0211	0.0003	0.035	< 0.00009	0.0079	2.43	0.0851	< 0.01	0.00037	0.123	0.007	6.84	0.00025	1.15	< 0.00005	2.24
10-Jan-22	7	0.000078	1.05	< 0.00008	0.0342	0.0005	0.064	< 0.00009	0.0076	2.76	0.108	< 0.01	0.00050	0.176	0.003	7.13	0.00045	1.09	< 0.00005	2.18
17-Jan-22	8	0.000094	1.22	< 0.00008	0.0584	0.0010	0.145	< 0.00009	0.0110	3.46	0.155	< 0.01	0.00006	0.253	< 0.003	7.45	0.00034	1.49	< 0.00005	1.87
24-Jan-22	9	0.000180	1.51	< 0.00008	0.1080	0.0016	0.466	< 0.00009	0.0098	4.00	0.237	< 0.01	0.00043	0.416	< 0.003	7.82	0.00052	1.65	< 0.00005	1.57
31-Jan-22	10	0.000159	1.54	< 0.00008	0.1500	0.0037	1.140	< 0.00009	0.0123	4.75	0.270	< 0.01	0.00232	0.543	< 0.003	7.62	0.00058	1.51	< 0.00005	1.47
07-Feb-22	11	0.000346	2.21	< 0.00008	0.2530	0.0029	2.350	0.00009	0.0145	6.14	0.391	< 0.01	0.00006	0.883	< 0.003	9.04	0.00067	2.08	< 0.00005	1.15
14-Feb-22	12	0.000588	2.59	< 0.00008	0.3640	0.0073	4.240	0.00026	0.0206	6.68	0.510	< 0.01	0.00009	1.220	< 0.003	9.82	0.00088	2.66	< 0.00005	1.17
21-Feb-22	13	0.000551	2.38	0.00011	0.3400	0.0097	5.280	0.00018	0.0172	6.52	0.470	< 0.01	< 0.00004	1.220	< 0.003	9.09	0.00072	2.20	< 0.00005	0.95
28-Feb-22	14	0.000758	2.23	0.00018	0.3970	0.0137	7.380	0.00031	0.0207	6.47	0.492	< 0.01	0.00043	1.430	< 0.003	8.94	0.00107	2.28	< 0.00005	0.93
07-Mar-22	15	0.000664	2.23	0.00018	0.3760	0.0179	5.480	0.00048	0.0205	5.56	0.443	< 0.01	0.00007	1.420	< 0.003	8.57	0.00068	2.21	< 0.00005	0.76
14-Mar-22	16	0.000754	2.35	0.00031	0.391	0.0236	4.34	0.00084	0.0169	6.41	0.476	< 0.01	< 0.00004	1.5	< 0.003	10.6	0.0009	2.27	< 0.00005	0.94
21-Mar-22	17	0.00109	2.3	0.00021	0.359	0.0331	2.19	0.00059	0.0323	6.29	0.432	< 0.01	0.00028	1.49	< 0.003	10.4	0.00082	3.17	< 0.00005	0.95
28-Mar-22	18	0.000774	2.29	0.00027	0.314	0.0313	0.801	0.00061	0.0304	5.54	0.356	< 0.01	< 0.00004	1.29	< 0.003	9.6	0.00066	2.57	< 0.00005	0.78
04-Apr-22	19	0.000702	2.4	0.00013	0.284	0.0245	0.51	0.00039	0.0344	5.31	0.333	< 0.01	0.00023	1.13	< 0.003	9.28	0.00068	4.38	< 0.00005	0.73
11-Apr-22	20	0.000662	2.13	0.00148	0.297	0.03	0.166	0.00122	0.0261	4.37	0.276	< 0.01	0.00012	1.18	< 0.003	8.2	0.0005	2.02	< 0.00005	0.55
18-Apr-22	21	0.000888	2.55	0.00028	0.3910	0.0497	0.133	0.00135	0.0306	5.94	0.364	< 0.01	< 0.00004	1.530	< 0.003	10.50	0.00072	2.46	< 0.00005	0.81
25-Apr-22	22	0.000745	2.71	0.0001	0.2950	0.0352	0.081	0.0004	0.0310	4.74	0.311	< 0.01	0.00004	1.180	< 0.003	9.61	0.00068	5.02	< 0.00005	0.61
02-May-22	23	0.000611	2.78	0.00012	0.203	0.0365	0.045	0.00065	0.0285	3.95	0.236	< 0.01	0.00013	0.884	< 0.003	7.73	0.00046	3.81	< 0.00005	0.47
09-May-22	24	0.000598	2.69	0.00026	0.217	0.0427	0.057	0.00079	0.0558	3.99	0.231	< 0.01	0.00018	0.864	< 0.003	8.28	0.00043	3.87	< 0.00005	0.49
16-May-22	25	0.000585	2.46	0.00016	0.203	0.0434	0.054	0.00079	0.0261	4.16	0.198	< 0.01	0.00037	0.775	< 0.003	7.52	0.00043	3.47	< 0.00005	0.91
23-May-22	26	0.000597	2.92	0.00016	0.246	0.0555	0.053	0.00127	0.0213	4.59	0.227	< 0.01	0.00006	0.962	< 0.003	7.19	0.00049	3.38	< 0.00005	0.48
30-May-22	27																			
06-Jun-22	28																			

Appendix A-2: HCT Results

HC 2

Sample = PLDC-06-15

Date	Cycle No.	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L	SGS File #	Major Anions	Major Cations	Diff	Diff (%)
29-Nov-21	1	0.0194	13	0.000007	< 0.00006	0.00081	0.000032	0.0004	0.003	< 0.002	CA15055-DEC21	0.97	0.87	-0.10	-5.3%
06-Dec-21	2	0.0328	23	0.000013	< 0.00006	0.00014	0.000036	0.00034	0.006	< 0.002	CA15254-DEC21	1.45	1.46	0.01	0.4%
13-Dec-21	3	0.0214	15	0.000012	0.00007	0.00009	0.000013	0.00012	0.003	< 0.002	CA15090-FEB22	0.90	0.95	0.04	2.2%
20-Dec-21	4	0.0139	9	0.000006	< 0.00006	0.00019	0.000017	0.00014	< 0.002	< 0.002	CA15565-DEC21	0.64	0.62	-0.02	-1.3%
27-Dec-21	5	0.0122	7	< 0.000005	0.00010	0.00016	0.000020	0.00011	0.003	< 0.002	CA15633-DEC21	0.51	0.50	-0.01	-0.9%
03-Jan-22	6	0.0136	7	< 0.000005	0.00059	0.00008	0.000039	0.00012	0.005	< 0.002	CA15026-JAN22	0.56	0.54	-0.02	-1.8%
10-Jan-22	7	0.0143	8	< 0.000005	0.00060	0.00042	0.000036	0.00005	0.031	< 0.002	CA15113-JAN22	0.53	0.57	0.04	3.9%
17-Jan-22	8	0.0177	11	< 0.000005	0.00008	< 0.00005	0.000074	0.00005	0.021	< 0.002	CA15227-JAN22	0.63	0.63	0.00	0.1%
24-Jan-22	9	0.0243	14	< 0.000005	< 0.00006	< 0.00005	0.000104	0.00002	0.052	< 0.002	CA15332-JAN22	0.69	0.71	0.02	1.2%
31-Jan-22	10	0.0246	15	0.000008	< 0.00006	< 0.00005	0.000372	0.00002	0.065	< 0.002	CA15042-FEB22	0.88	0.83	-0.05	-2.9%
07-Feb-22	11	0.0355	18	0.000009	< 0.00006	< 0.00005	0.001040	< 0.00001	0.145	< 0.002	CA15152-FEB22	0.96	1.05	0.09	4.5%
14-Feb-22	12	0.0426	23	0.000011	< 0.00006	< 0.00005	0.002670	0.00001	0.259	< 0.002	CA15339-FEB22	1.28	1.33	0.05	1.9%
21-Feb-22	13	0.0366	21	0.000015	< 0.00006	< 0.00005	0.003120	< 0.00001	0.286	< 0.002	CA15400-FEB22	1.25	1.30	0.05	2.1%
28-Feb-22	14	0.0384	26	0.000012	< 0.00006	0.00009	0.005350	< 0.00001	0.421	< 0.002	CA15037-MAR22	1.38	1.45	0.07	2.6%
07-Mar-22	15	0.0385	22	0.000014	0.00010	0.0001	0.006330	< 0.00001	0.387	< 0.002	CA15169-MAR22	1.15	1.27	0.13	5.2%
14-Mar-22	16	0.0342	21	0.000011	< 0.00006	0.00005	0.0049	< 0.00001	0.424	< 0.002	CA15343-MAR22	1.23	1.39	0.17	6.3%
21-Mar-22	17	0.0368	23	0.000016	< 0.00006	< 0.00005	0.00629	0.00002	0.485	< 0.002	CA15451-MAR22	1.19	1.31	0.13	5.1%
28-Mar-22	18	0.032	20	0.000016	< 0.00006	0.00025	0.00685	< 0.00001	0.455	< 0.002	CA15991-MAR22	0.96	1.12	0.16	7.6%
04-Apr-22	19	0.0345	19	0.000021	< 0.00006	< 0.00005	0.00566	0.00001	0.414	< 0.002	CA15076-APR22	1.19	1.11	-0.08	-3.7%
11-Apr-22	20	0.0293	17	0.000013	< 0.00006	0.00014	0.00465	< 0.00001	0.351	< 0.002	CA15275-APR22	0.98	0.93	-0.05	-2.7%
18-Apr-22	21	0.0337	21	0.000021	0.00011	< 0.00005	0.006870	< 0.00001	0.522	< 0.002	CA15320-APR22	1.34	1.24	-0.10	-4.1%
25-Apr-22	22	0.0342	18	0.000027	< 0.00006	0.00006	0.004130	< 0.00001	0.428	< 0.002	CA15428-APR22	1.30	1.05	-0.25	-10.6%
02-May-22	23	0.0287	17	0.000018	< 0.00006	0.00013	0.00457	0.00006	0.333	< 0.002	CA15029-MAY22	1.01	0.89	-0.12	-6.4%
09-May-22	24	0.0251	19	0.000017	0.00009	0.00008	0.00344	0.00005	0.287	< 0.002	CA15145-MAY22	0.97	0.94	-0.03	-1.4%
16-May-22	25	0.0244	15	0.00001	< 0.00006	< 0.00005	0.0028	0.00006	0.272	< 0.002	CA15285-MAY22	0.90	0.92	0.02	1.1%
23-May-22	26	0.0270	14	0.000017	< 0.00006	0.00012	0.00370	0.00002	0.348	< 0.002	CA15743-MAY22	1.07	0.93	-0.14	-7.0%
30-May-22	27														
06-Jun-22	28														

Appendix A-2: HCT Results

HC 3

Sample = PLDC-08-10

Date	Cycle No.	Volume mL		pH	Cond. µmhos/cm	Acidity (pH 4.5) $mgCaCO_3/L$	Acidity $mgCaCO_3/L$	Total Alkalinity $mgCaCO_3/L$	Sulphate mg/L	Bromide mg/L	Chloride mg/L	Fluoride mg/L	Hardness $CaCO_3$ mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L
		Input	Output																	
29-Nov-21	1	600	395	7.47	25	#N/A	2.2	6.4	4	< 0.3	< 1	< 0.06	1.8	0.090	< 0.0009	0.0053	0.00063	< 0.000007	< 0.00001	0.017
06-Dec-21	2	500	455	7.49	72	#N/A	0.8	9.8	14	< 0.3	1	0.11	10.6	0.050	< 0.0009	0.0110	0.00049	< 0.000007	< 0.00001	0.020
13-Dec-21	3	500	465	7.47	68	#N/A	0.7	9.4	13	< 0.3	< 1	0.14	10.2	0.045	< 0.0009	0.0144	0.00107	< 0.000007	< 0.00001	0.018
20-Dec-21	4	500	450	7.25	41	#N/A	0.8	7.5	7	< 0.3	< 1	0.12	6.0	0.046	< 0.0009	0.0113	0.00737	< 0.000007	< 0.00001	0.012
27-Dec-21	5	500	450	7.21	37	#N/A	0.8	6.6	7	< 0.3	< 1	0.10	5.5	0.043	< 0.0009	0.0114	0.00551	< 0.000007	< 0.00001	0.012
03-Jan-22	6	500	450	7.09	35	#N/A	0.9	5.7	7	< 0.3	< 1	< 0.06	5.3	0.022	< 0.0009	0.0096	0.00258	< 0.000007	< 0.00001	0.010
10-Jan-22	7	500	450	6.94	50	#N/A	4.2	4.9	12	< 0.3	< 1	< 0.06	9.2	0.033	< 0.0009	0.0119	0.00139	< 0.000007	< 0.00001	0.014
17-Jan-22	8	500	470	6.84	67	#N/A	0.9	4.3	20	< 0.3	< 1	0.11	14.8	0.021	< 0.0009	0.0089	0.00159	< 0.000007	< 0.00001	0.012
24-Jan-22	9	500	465	6.65	70	#N/A	1.0	3.6	18	< 0.3	< 1	< 0.06	15.4	0.00843	< 0.0009	0.00776	0.00379	< 0.000007	< 0.00001	0.00855
31-Jan-22	10	500	465	6.60	67	#N/A	1.0	3.5	20	< 0.3	< 1	< 0.06	14.9	0.011	< 0.0009	0.0075	0.00141	< 0.000007	< 0.00001	0.010
07-Feb-22	11	500	460	6.45	63	#N/A	1.1	3.2	16	< 0.3	< 1	< 0.06	14.1	0.009	< 0.0009	0.0066	0.00128	< 0.000007	< 0.00001	0.008
14-Feb-22	12	500	455	6.22	52	#N/A	1.1	2.9	13	< 0.3	< 1	< 0.06	12.3	0.007	< 0.0009	0.0054	0.00124	< 0.000007	< 0.00001	0.008
21-Feb-22	13	500	460	6.32	56	#N/A	1.2	2.6	13	< 0.3	< 1	< 0.06	14.3	0.005	< 0.0009	0.0039	0.0011	< 0.000007	< 0.00001	0.006
28-Feb-22	14	500	450	5.84	51	#N/A	1.3	2.6	13	< 0.3	< 1	< 0.06	12.4	0.005	< 0.0009	0.0041	0.00087	< 0.000007	< 0.00001	0.008
07-Mar-22	15	500	465	5.77	53	#N/A	1.3	2.6	15	< 0.3	< 1	< 0.06	12	0.004	< 0.0009	0.0039	0.00099	< 0.000007	< 0.00001	0.006
14-Mar-22	16	500	445	5.63	49	#N/A	1.2	2.3	13	< 0.3	< 1	< 0.06	13	0.004	< 0.0009	0.003	0.00086	< 0.000007	< 0.00001	0.004
21-Mar-22	17	500	475	5.57	49	#N/A	1.3	2.4	14	< 0.3	< 1	< 0.06	13	0.004	< 0.0009	0.0024	0.00089	< 0.000007	< 0.00001	0.006
28-Mar-22	18	500	450	5.85	47	#N/A	1.1	2.6	13	< 0.3	< 1	< 0.06	13	0.005	< 0.0009	0.0023	0.0009	< 0.000007	< 0.00001	0.006
04-Apr-22	19	500	485	5.59	59	#N/A	1.2	2.3	20	< 0.3	< 1	< 0.06	16.1	0.003	< 0.0009	0.0017	0.00077	< 0.000007	< 0.00001	0.01
11-Apr-22	20	500	475	5.64	50	#N/A	1.2	2.3	13	< 0.3	< 1	< 0.06	12.7	0.005	< 0.0009	0.002	0.00104	< 0.000007	< 0.00001	0.009
18-Apr-22	21	500	465	5.51	62	#N/A	1.4	2.3	19	< 0.3	< 1	< 0.06	16	0.004	< 0.0009	0.0022	0.00079	< 0.000007	< 0.00001	0.005
25-Apr-22	22	500	490	5.77	74	#N/A	1.8	2.6	24	< 0.3	< 1	< 0.06	17.4	0.003	< 0.0009	0.0016	0.00092	< 0.000007	< 0.00001	0.009
02-May-22	23	500	455	5.57	58	#N/A	1.3	2.3	18	< 0.3	< 1	< 0.06	15	0.005	< 0.0009	0.0015	0.00081	< 0.000007	< 0.00001	0.008
09-May-22	24	500	445	5.54	61	#N/A	1.3	2.2	20	< 0.3	< 1	< 0.06	16.4	0.004	< 0.0009	0.0014	0.00104	< 0.000007	< 0.00001	0.010
16-May-22	25	500	450	5.48	49	#N/A	1.1	2.1	16	< 0.3	< 1	< 0.06	13.9	0.004	< 0.0009	0.0011	0.00067	< 0.000007	< 0.00001	0.007
23-May-22	26	500	445	5.38	51	#N/A	1.4	2.0	18	< 0.3	< 1	< 0.06	14.4	0.003	< 0.0009	0.0012	0.00107	< 0.000007	< 0.00001	0.007
30-May-22	27	500	455	5.63	50	#N/A	1.2	2.2	15											
06-Jun-22	28	500	450	5.52	50	#N/A	1.4	2.4												

Appendix A-2: HCT Results

HC 3

Sample = PLDC-08-10

Date	Cycle No.	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L
29-Nov-21	1	0.000015	0.22	0.00014	0.000051	< 0.0002	0.035	< 0.00009	0.0028	0.303	0.00319	< 0.01	0.00293	0.0004	0.009	2.81	0.00011	0.54	< 0.00005	1.79
06-Dec-21	2	0.000259	1.39	< 0.00008	0.000077	0.0009	0.052	< 0.00009	0.0035	1.73	0.00962	< 0.01	0.0133	0.0012	< 0.003	6.38	0.00029	0.72	< 0.00005	4.62
13-Dec-21	3	< 0.000003	1.24	< 0.00008	0.000035	0.0003	< 0.007	< 0.00009	0.0037	1.73	0.00648	< 0.01	0.00854	0.0007	< 0.003	5.51	0.00028	0.81	< 0.00005	4.75
20-Dec-21	4	< 0.000003	0.77	< 0.00008	0.000058	0.0003	< 0.007	< 0.00009	0.0051	0.983	0.00393	< 0.01	0.00374	0.0004	< 0.003	3.75	0.00022	0.67	< 0.00005	2.69
27-Dec-21	5	0.000033	0.70	< 0.00008	0.000046	< 0.0002	< 0.007	< 0.00009	0.0036	0.906	0.00370	< 0.01	0.00261	0.0004	< 0.003	3.42	0.00019	0.62	< 0.00005	2.30
03-Jan-22	6	0.000009	0.69	< 0.00008	0.000076	0.0002	< 0.007	< 0.00009	0.0025	0.866	0.00386	< 0.01	0.00154	0.0006	0.024	3.06	0.00009	0.61	< 0.00005	1.85
10-Jan-22	7	0.000018	1.04	< 0.00008	0.000126	0.0003	0.027	< 0.00009	0.0032	1.59	0.00779	< 0.01	0.00224	0.0006	0.003	4.23	0.00018	0.60	< 0.00005	2.52
17-Jan-22	8	0.000062	1.70	< 0.00008	< 0.000004	0.0003	< 0.007	< 0.00009	0.0052	2.56	0.0115	< 0.01	0.00097	0.0009	< 0.003	4.99	0.00009	0.93	< 0.00005	2.58
24-Jan-22	9	0.000036	1.90	< 0.00008	0.000189	0.000479	< 0.007	0.000234	0.00401	2.60	0.0149	< 0.01	0.000849	0.00122	< 0.003	4.79	0.000128	0.936	< 0.00005	2.15
31-Jan-22	10	0.000005	1.89	< 0.00008	0.000155	0.0003	< 0.007	< 0.00009	0.0046	2.46	0.0153	< 0.01	0.00078	0.0014	< 0.003	4.34	0.00008	1.16	< 0.00005	1.80
07-Feb-22	11	0.000004	1.73	< 0.00008	0.000194	< 0.0002	< 0.007	< 0.00009	0.004	2.37	0.0162	< 0.01	0.00044	0.0015	< 0.003	3.88	0.00008	1.03	< 0.00005	1.51
14-Feb-22	12	0.000023	1.54	< 0.00008	0.000247	0.0005	< 0.007	< 0.00009	0.0042	2.04	0.0163	< 0.01	0.00029	0.0017	< 0.003	3.68	0.00008	1	< 0.00005	1.2
21-Feb-22	13	0.000014	1.6	< 0.00008	0.000305	< 0.0002	0.035	< 0.00009	0.0035	2.5	0.0192	< 0.01	0.00012	0.0023	< 0.003	3.8	0.00007	0.8	< 0.00005	1.13
28-Feb-22	14	0.000011	1.38	< 0.00008	0.000291	0.0003	< 0.007	< 0.00009	0.0037	2.18	0.0206	< 0.01	0.00034	0.0025	< 0.003	3.37	< 0.00004	0.89	< 0.00005	1
07-Mar-22	15	0.000011	1.34	< 0.00008	0.000305	0.0003	< 0.007	< 0.00009	0.0036	2.09	0.0234	< 0.01	0.00016	0.0026	< 0.003	3.26	0.00006	0.96	< 0.00005	0.85
14-Mar-22	16	0.000004	1.52	< 0.00008	0.000378	0.0003	< 0.007	< 0.00009	0.0026	2.28	0.0236	< 0.01	0.0001	0.0031	< 0.003	3.72	0.00012	0.84	< 0.00005	0.94
21-Mar-22	17	0.00001	1.44	< 0.00008	0.000436	0.0004	0.007	< 0.00009	0.0046	2.37	0.0286	< 0.01	0.00028	0.0037	< 0.003	3.24	0.00009	0.93	< 0.00005	0.81
28-Mar-22	18	0.000003	1.62	< 0.00008	0.000448	0.0002	< 0.007	< 0.00009	0.0041	2.18	0.0276	< 0.01	0.00007	0.0038	< 0.003	2.9	0.0001	0.77	< 0.00005	0.69
04-Apr-22	19	0.000007	1.51	< 0.00008	0.00077	0.0004	< 0.007	< 0.00009	0.005	3	0.0499	< 0.01	0.00035	0.0072	< 0.003	3.38	0.00008	1.32	< 0.00005	0.8
11-Apr-22	20	0.000009	1.48	< 0.00008	0.000576	0.0003	< 0.007	< 0.00009	0.0032	2.19	0.0361	< 0.01	0.00015	0.0053	< 0.003	2.82	< 0.00004	0.65	< 0.00005	0.62
18-Apr-22	21	0.000118	1.6	< 0.00008	0.00104	0.0009	< 0.007	< 0.00009	0.0046	2.91	0.0645	< 0.01	0.00005	0.0097	< 0.003	3.58	0.00025	0.75	< 0.00005	0.79
25-Apr-22	22	0.000019	1.73	< 0.00008	0.00151	< 0.0002	< 0.007	< 0.00009	0.0062	3.19	0.094	0.01	0.00007	0.0144	< 0.003	4.02	0.00011	1.5	< 0.00005	0.84
02-May-22	23	0.000117	1.65	< 0.00008	0.00101	0.0003	0.007	< 0.00009	0.0057	2.64	0.0768	< 0.01	0.00022	0.0109	< 0.003	3.37	0.0001	1.34	< 0.00005	0.6
09-May-22	24	0.000054	1.80	0.00011	0.00160	0.0008	< 0.007	< 0.00009	0.0140	2.88	0.0998	< 0.01	0.00017	0.0142	< 0.003	4.06	0.00009	1.55	< 0.00005	0.67
16-May-22	25	0.000077	1.16	< 0.00008	0.00159	0.0005	0.021	0.00014	0.0055	2.68	0.0851	< 0.01	0.00024	0.0137	< 0.003	3.48	0.00008	1.06	< 0.00005	0.78
23-May-22	26	0.000029	1.30	< 0.00008	0.002306	0.0004	0.015	< 0.00009	0.0047	2.70	0.0985	< 0.01	0.00006	0.0195	< 0.003	3.13	0.00009	0.80	< 0.00005	0.50
30-May-22	27																			
06-Jun-22	28																			

Appendix A-2: HCT Results

HC 3

Sample = PLDC-08-10

Date	Cycle No.	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L	SGS File #	Major Anions	Major Cations	Diff	Diff (%)
29-Nov-21	1	0.00146	2	< 0.000005	< 0.00006	0.00209	0.000013	0.00117	0.007	< 0.002	CA15055-DEC21	0.21	0.20	-0.01	-1.9%
06-Dec-21	2	0.0083	6	< 0.000005	< 0.00006	0.00017	0.000083	0.00149	0.104	< 0.002	CA15254-DEC21	0.54	0.59	0.05	4.4%
13-Dec-21	3	0.00852	6	< 0.000005	0.00007	0.00011	0.000086	0.00125	< 0.002	< 0.002	CA15090-FEB22	0.46	0.56	0.10	10.1%
20-Dec-21	4	0.00527	3	< 0.000005	< 0.00006	0.00025	0.000071	0.00116	< 0.002	< 0.002	CA15565-DEC21	0.30	0.34	0.05	7.1%
27-Dec-21	5	0.00554	3	< 0.000005	< 0.00006	0.00024	0.000038	0.00108	< 0.002	< 0.002	CA15633-DEC21	0.28	0.31	0.03	4.8%
03-Jan-22	6	0.00411	2	< 0.000005	0.00027	0.00009	0.000038	0.00083	< 0.002	< 0.002	CA15026-JAN22	0.26	0.27	0.01	2.2%
10-Jan-22	7	0.00651	4	< 0.000005	< 0.00006	0.00021	0.000032	0.00087	0.029	< 0.002	CA15113-JAN22	0.35	0.41	0.06	8.1%
17-Jan-22	8	0.00982	8	< 0.000005	0.00006	0.00022	0.000022	0.00063	0.002	< 0.002	CA15227-JAN22	0.51	0.54	0.03	3.3%
24-Jan-22	9	0.0125	10.1	< 0.000005	< 0.00006	< 0.00005	< 0.000002	0.000483	0.010	< 0.002	CA15332-JAN22	0.45	0.53	0.08	8.5%
31-Jan-22	10	0.0118	9	< 0.000005	< 0.00006	0.00008	0.000009	0.00041	< 0.002	< 0.002	CA15042-FEB22	0.49	0.49	0.00	0.4%
07-Feb-22	11	0.0101	7	< 0.000005	0.00006	< 0.00005	0.000007	0.00033	< 0.002	< 0.002	CA15152-FEB22	0.40	0.45	0.05	6.4%
14-Feb-22	12	0.00822	6	< 0.000005	< 0.00006	< 0.00005	0.000005	0.00026	0.004	< 0.002	CA15339-FEB22	0.33	0.40	0.07	9.3%
21-Feb-22	13	0.00817	6	< 0.000005	< 0.00006	0.00007	0.000043	0.00024	< 0.002	< 0.002	CA15400-FEB22	0.32	0.43	0.11	15.0%
28-Feb-22	14	0.00821	8	< 0.000005	< 0.00006	0.00009	0.000005	0.00031	< 0.002	< 0.002	CA15037-MAR22	0.32	0.38	0.06	8.4%
07-Mar-22	15	0.00800	6	< 0.000005	0.00017	0.00015	0.000005	0.00018	< 0.002	< 0.002	CA15169-MAR22	0.36	0.36	0.00	-0.3%
14-Mar-22	16	0.00693	5	< 0.000005	< 0.00006	0.00006	0.000103	0.00018	< 0.002	< 0.002	CA15343-MAR22	0.32	0.40	0.08	11.7%
21-Mar-22	17	0.00696	6	< 0.000005	< 0.00006	0.00009	0.000005	0.00014	< 0.002	< 0.002	CA15451-MAR22	0.34	0.39	0.05	6.6%
28-Mar-22	18	0.00753	5	< 0.000005	< 0.00006	0.00008	0.000012	0.00014	< 0.002	< 0.002	CA15991-MAR22	0.32	0.37	0.05	6.6%
04-Apr-22	19	0.00785	7	< 0.000005	< 0.00006	0.00006	0.000009	0.00021	< 0.002	< 0.002	CA15076-APR22	0.46	0.45	-0.02	-1.7%
11-Apr-22	20	0.00753	6	< 0.000005	< 0.00006	0.00013	0.000005	0.0001	< 0.002	< 0.002	CA15275-APR22	0.32	0.36	0.04	6.1%
18-Apr-22	21	0.00866	6	0.000006	0.00076	0.00021	0.000005	0.00012	0.008	< 0.002	CA15320-APR22	0.44	0.45	0.01	0.7%
25-Apr-22	22	0.0106	8	< 0.000005	< 0.00006	< 0.00005	< 0.000002	0.00019	0.003	< 0.002	CA15428-APR22	0.55	0.50	-0.06	-5.4%
02-May-22	23	0.00867	7	< 0.000005	< 0.00006	0.00032	0.000006	0.00017	0.003	< 0.002	CA15029-MAY22	0.42	0.42	0.00	-0.2%
09-May-22	24	0.00911	11	< 0.000005	0.00023	0.00014	0.000006	0.00013	< 0.002	< 0.002	CA15145-MAY22	0.46	0.47	0.01	1.0%
16-May-22	25	0.00699	7	< 0.000005	< 0.00006	0.00008	0.000004	0.00007	0.011	< 0.002	CA15285-MAY22	0.38	0.41	0.03	4.1%
23-May-22	26	0.00735	5	< 0.000005	< 0.00006	< 0.00005	0.000010	0.00006	0.003	< 0.002	CA15743-MAY22	0.42	0.40	-0.02	-2.3%
30-May-22	27														
06-Jun-22	28														

Appendix A-3: XRD Results

Report Prepared for:	ARD-XRD (2147 ERM Dominion Diamond)
Project Number/ LIMS No.:	Custom XRD/MI7015-MAR22
Sample Receipt:	March 24, 2022
Sample Analysis:	April 11, 2022
Reporting Date:	May 2, 2022
Instrument:	Panalytical X'pert Pro Diffractometer
Test Conditions:	Co radiation, 40 kV, 45 mA
	Regular Scanning: Step: 0.033°, Step time:0.15s, 2θ range: 5-80°
Interpretations:	PDF2/PDF4 powder diffraction databases issued by the International Center for Diffraction Data (ICDD). DiffracPlus Eva and Topas software.
Detection Limit:	0.5-2%. Strongly dependent on crystallinity.
Contents:	1) Method Summary
	2) Quantitative XRD Results
	3) XRD Pattern(s)

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Huyun Zhou, Ph.D., P.Geo.

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Mineral Identification and Interpretation:

Mineral identification and interpretation involves matching the diffraction pattern of an unknown material to patterns of single-phase reference materials. The reference patterns are compiled by the Joint Committee on Powder Diffraction Standards - International Center for Diffraction Data (JCPDS-ICDD) database and released on software as Powder Diffraction Files (PDF).

Interpretations do not reflect the presence of non-crystalline and/or amorphous compounds, except when internal standards have been added by request. Mineral proportions may be strongly influenced by crystallinity, crystal structure and preferred orientations. Mineral or compound identification and quantitative analysis results should be accompanied by supporting chemical assay data or other additional tests.

Quantitative Rietveld Analysis:

Quantitative Rietveld Analysis is performed by using Topas 4.2 (Bruker AXS), a graphics based profile analysis program built around a non-linear least squares fitting system, to determine the amount of different phases present in a multicomponent sample. Whole pattern analyses are predicated by the fact that the X-ray diffraction pattern is a total sum of both instrumental and specimen factors. Unlike other peak intensity-based methods, the Rietveld method uses a least squares approach to refine a theoretical line profile until it matches the obtained experimental patterns.

Rietveld refinement is completed with a set of minerals specifically identified for the sample. Zero values indicate that the mineral was included in the refinement calculations, but the calculated concentration was less than 0.05wt%. Minerals not identified by the analyst are not included in refinement calculations for specific samples and are indicated with a dash.

Appendix A-3: XRD Results

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Appendix A-3: XRD Results

Summary of Rietveld Quantitative Analysis X-Ray Diffraction Results

Mineral/Compound	PLDC-05-03 MAR7015-01 (wt %)	PLDC-06-15 MAR7015-02 (wt %)	PLDC-08-10 MAR7015-03 (wt %)
Quartz	42.0	45.4	36.7
Albite	24.4	25.1	16.8
Diopside	2.2	1.6	1.9
Muscovite	3.4	9.4	10.2
Biotite	19.7	16.4	24.3
Magnetite	1.1	0.4	1.0
Hematite	1.2	0.4	1.8
Chlorite	-	0.7	5.6
Hornblende	0.8	0.3	0.8
Pyrrhotite	0.6	0.3	0.8
Talc	4.6	-	-
TOTAL	**100**	**100**	**100**

Zero values indicate that the mineral was included in the refinement, but the calculated concentration is below a measurable value.

Dashes indicate that the mineral was not identified by the analyst and not included in the refinement calculation for the sample.

The weight percent quantities indicated have been normalized to a sum of 100%. The quantity of amorphous material has not been determined.

Mineral/Compound	Formula
Quartz	SiO_2
Albite	$NaAlSi_3O_8$
Diopside	$CaMgSi_2O_6$
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$
Magnetite	Fe_3O_4
Hematite	Fe_2O_3
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$
Hornblende	$(Ca,Na)_{2-3}(Mg,Fe,Al)_5Si_6(Si,Al)_2O_{22}(OH)_2$
Pyrrhotite	Fe_7S_8
Talc	$Mg_3Si_4O_{10}(OH)_2$

APPENDIX B HCT LEACHATE CONCENTRATIONS WITH TIME

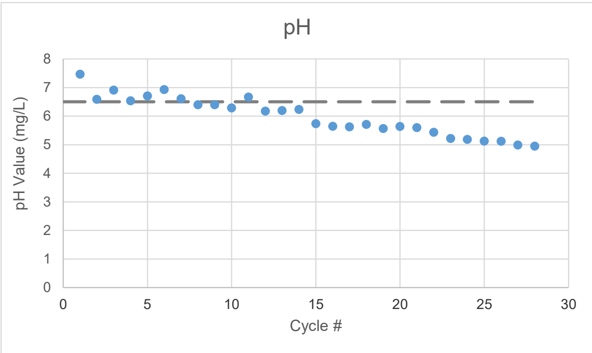
Appendix B-1: HCT 1 Leachate Concentrations with Time

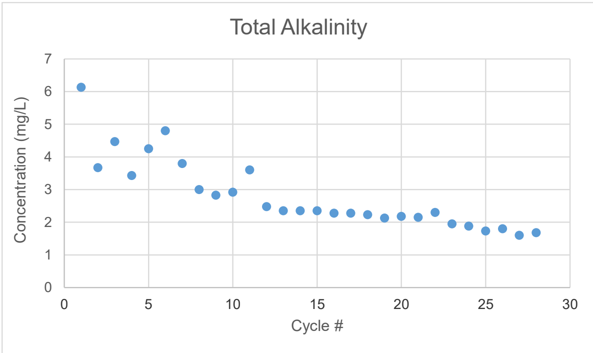
Appendix B-2: HCT 2 Leachate Concentrations with Time

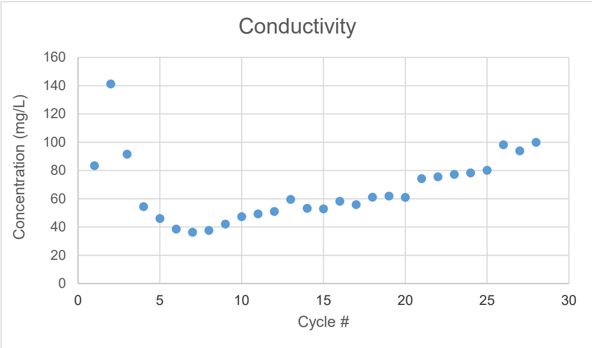
Appendix B-3: HCT 3 Leachate Concentrations with Time

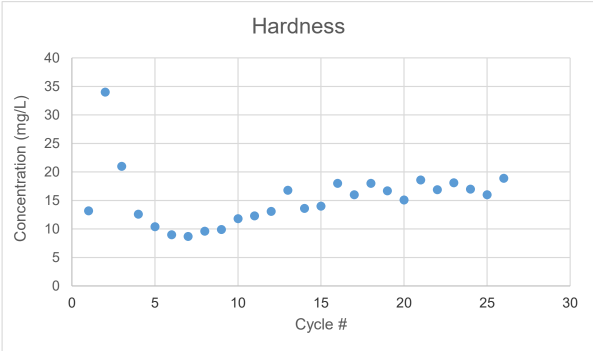
Appendix B: HCT Leachate Concentrations with Time

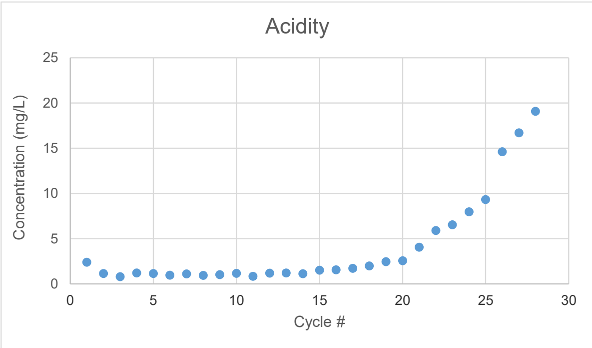
APPENDIX B-1: HCT 1 LEACHATE CONCENTRATIONS WITH TIME

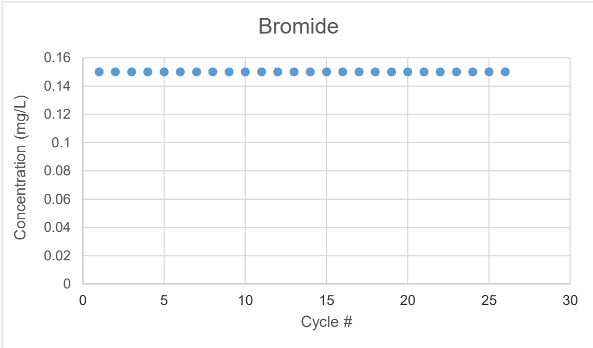


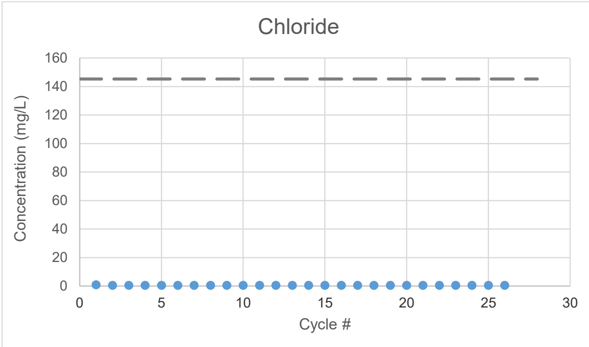


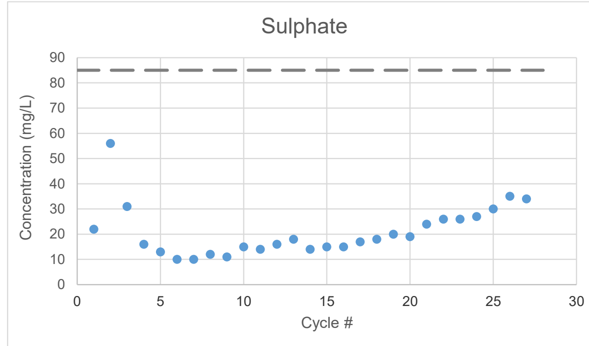









Chloride
Concentration (mg/L)
0 20 40 60 80 100 120 140 160
0 5 10 15 20 25 30
Cycle #


Sulphate
Concentration (mg/L)
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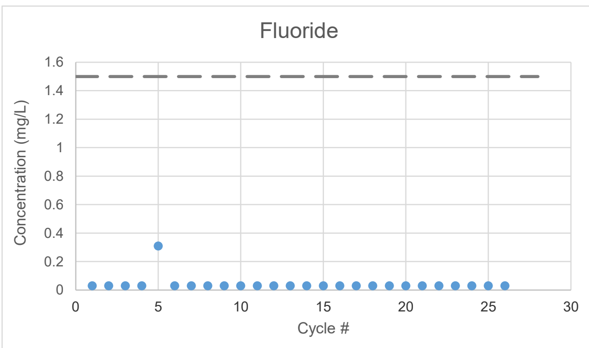
0 5 10 15 20 25 30
Cycle #


Fluoride
Concentration (mg/L)
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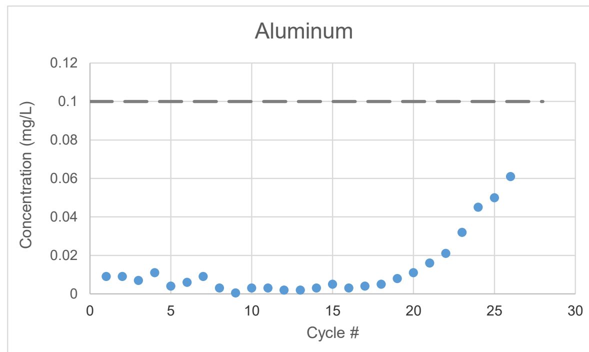
0 5 10 15 20 25 30
Cycle #


Aluminum
Concentration (mg/L)
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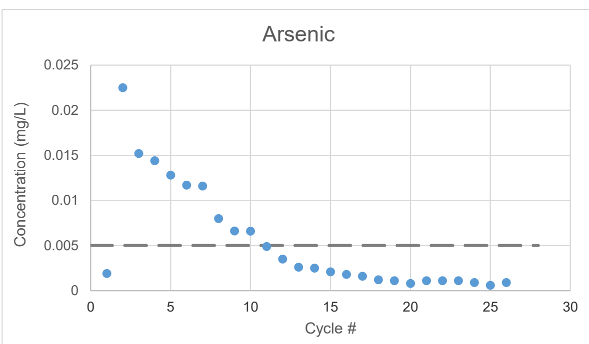
0 5 10 15 20 25 30
Cycle #


Arsenic
Concentration (mg/L)
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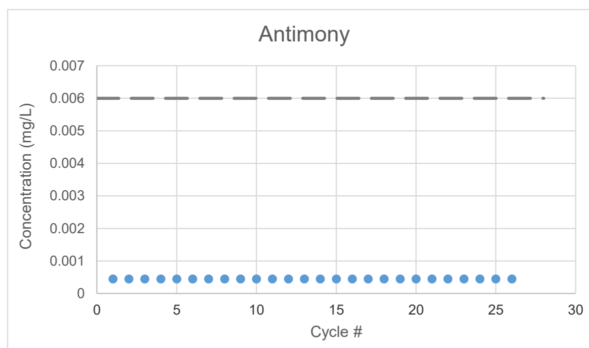
Cycle #


Antimony
Concentration (mg/L)
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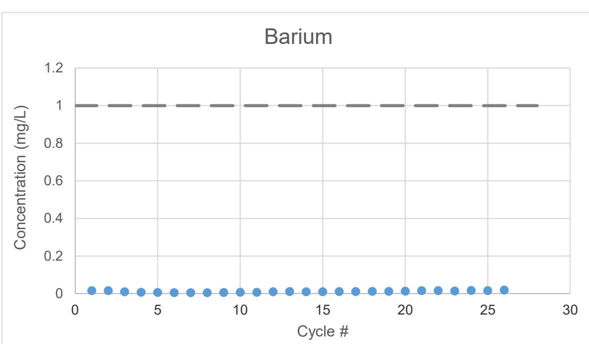
Cycle #


Barium
Concentration (mg/L)
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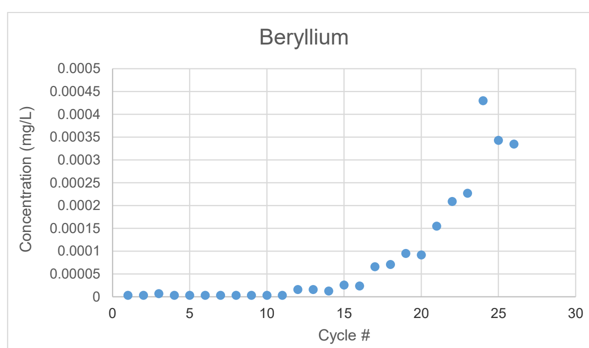
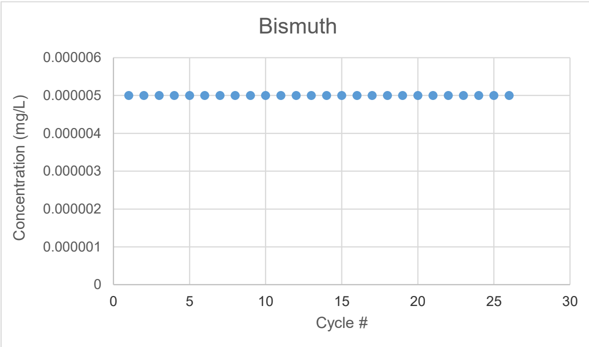
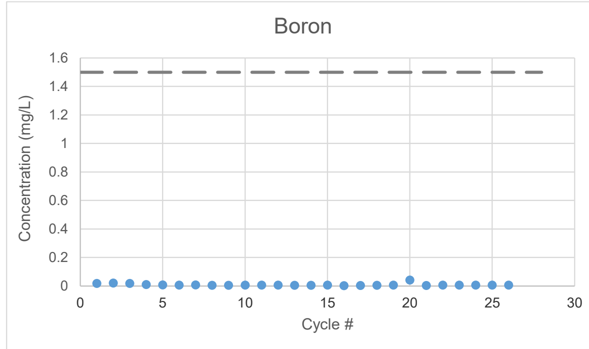
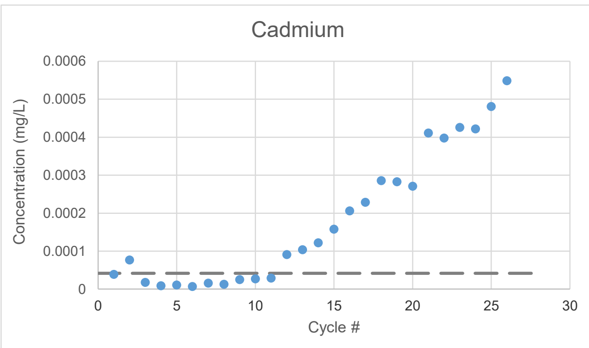
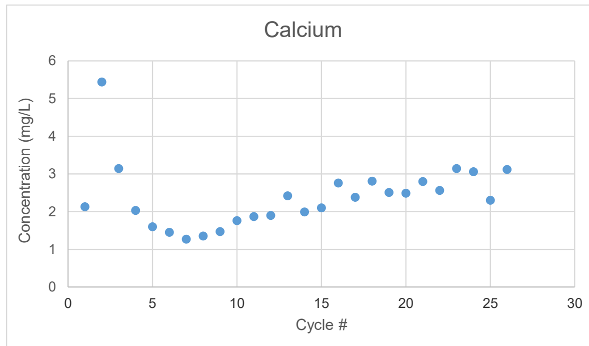
0 5 10 15 20 25 30
Cycle #

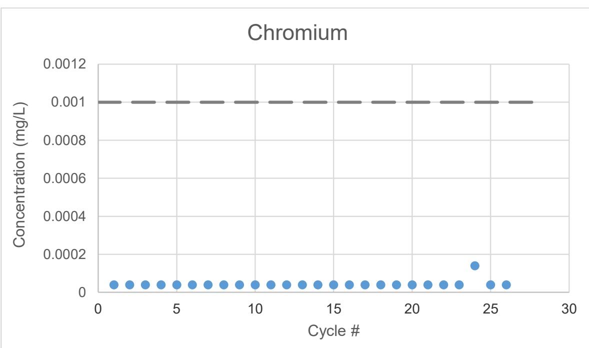

Beryllium
Concentration (mg/L)
0 0.00005 0.0001 0.00015 0.0002 0.00025 0.0003 0.00035 0.0004 0.00045 0.0005
0 5 10 15 20 25 30
Cycle #

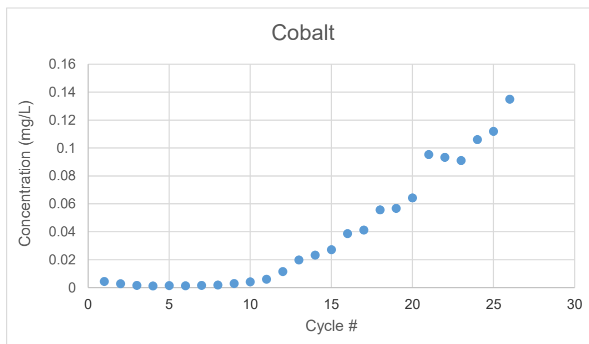

Bismuth
Concentration (mg/L)
Cycle #

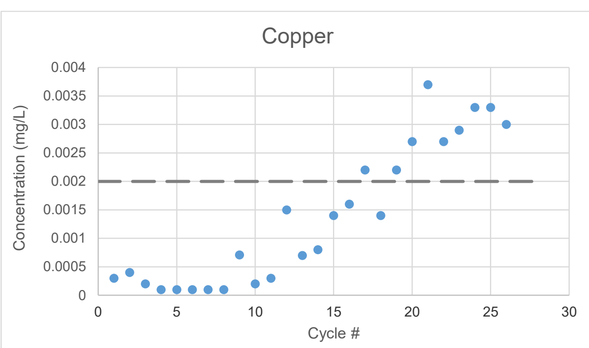

Boron
Concentration (mg/L)
Cycle #

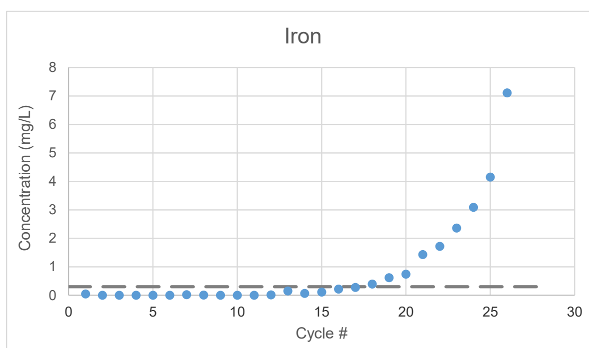

Cadmium
Concentration (mg/L)
Cycle #

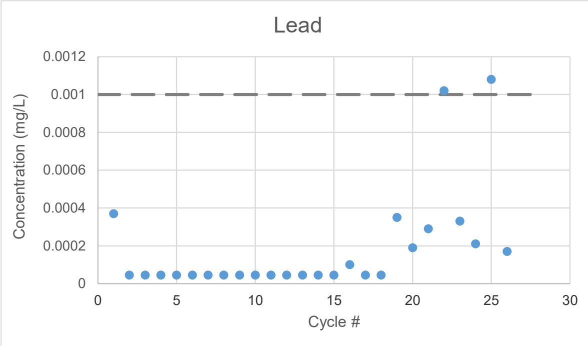

Calcium
Concentration (mg/L)
Cycle #

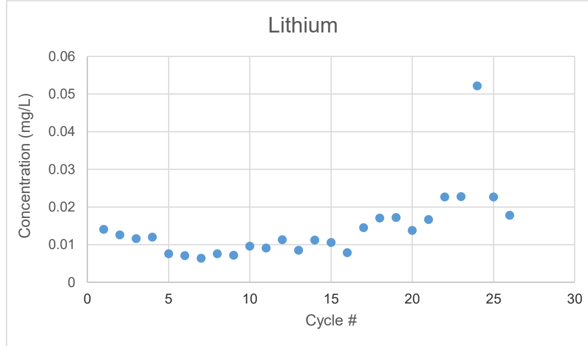

Chromium
Concentration (mg/L)
Cycle #

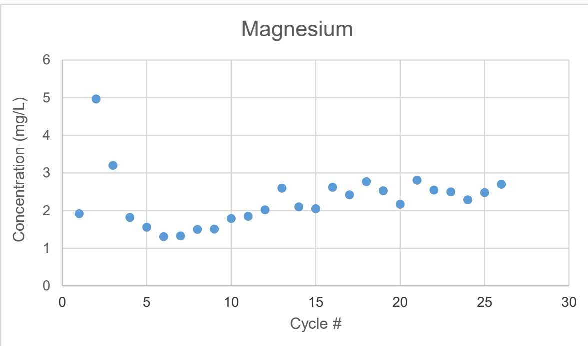

Cobalt
Concentration (mg/L)
Cycle #

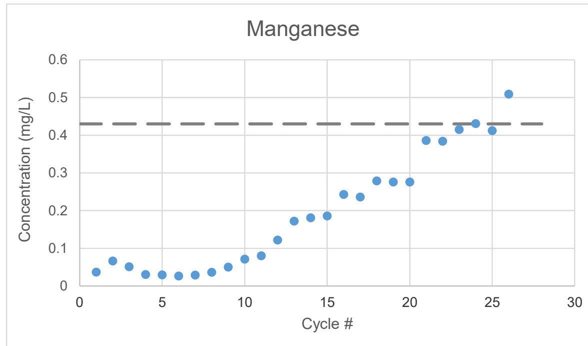

Copper
Concentration (mg/L)
Cycle #

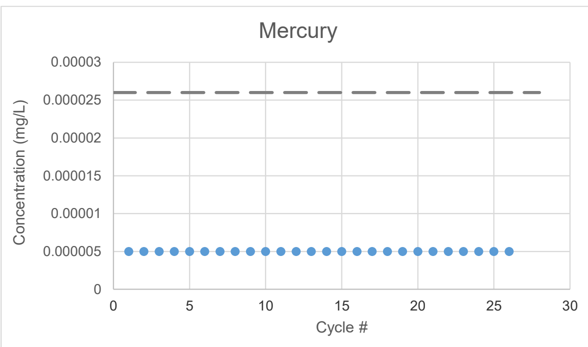

Iron
Concentration (mg/L)
Cycle #

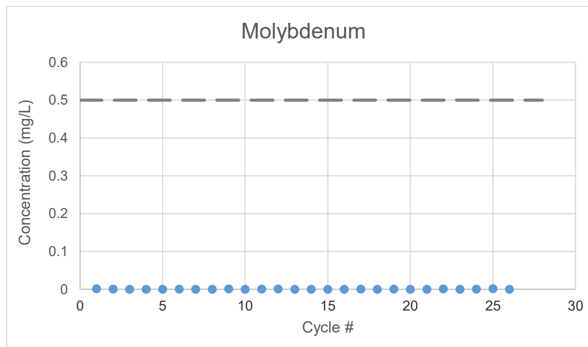

Lead
Concentration (mg/L)
Cycle #

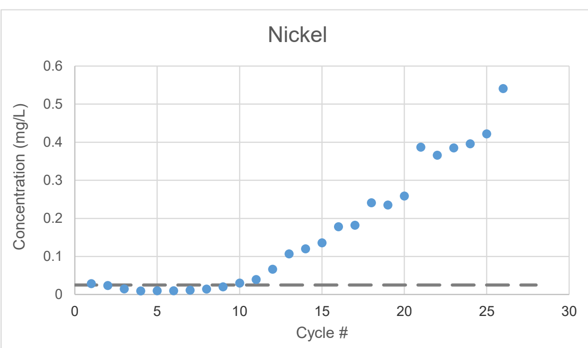

Lithium
Concentration (mg/L)
Cycle #

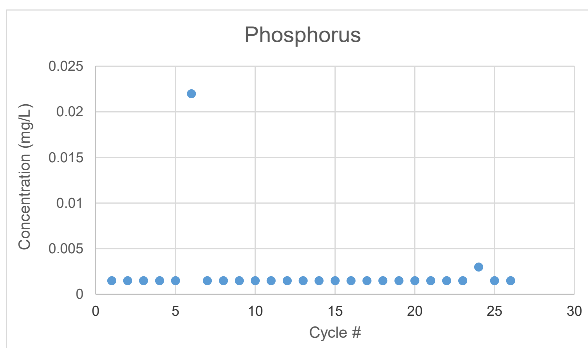

Magnesium
Concentration (mg/L)
Cycle #

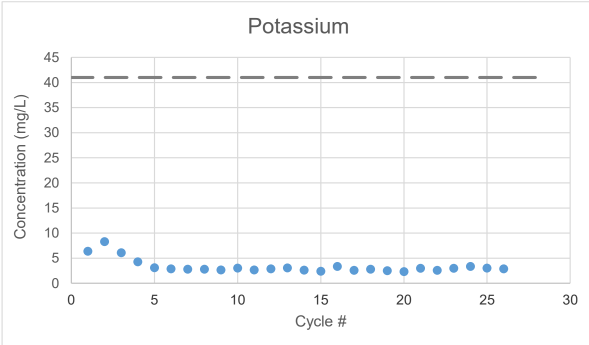

Manganese
Concentration (mg/L)
Cycle #

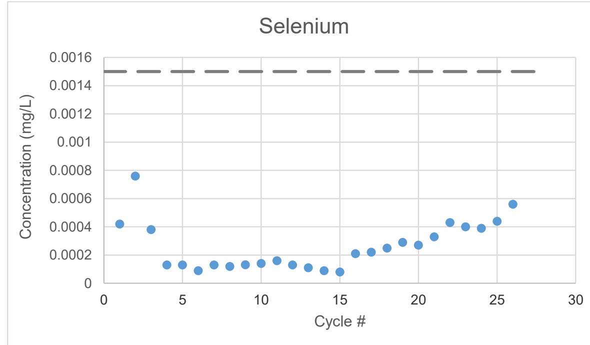

Mercury
Concentration (mg/L)
Cycle #

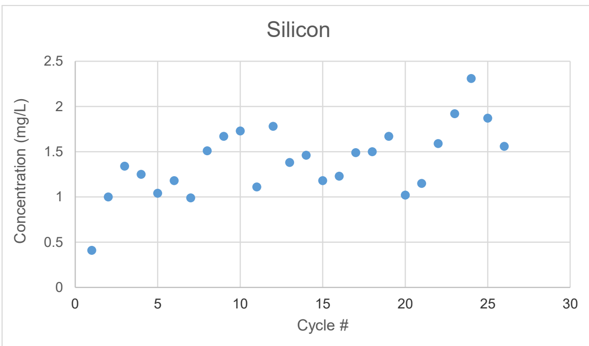

Molybdenum
Concentration (mg/L)
Cycle #

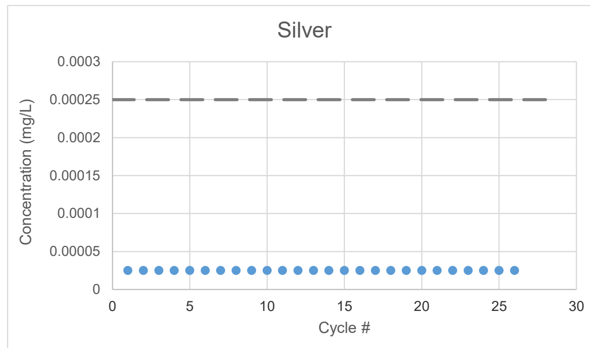

Nickel
Concentration (mg/L)
Cycle #

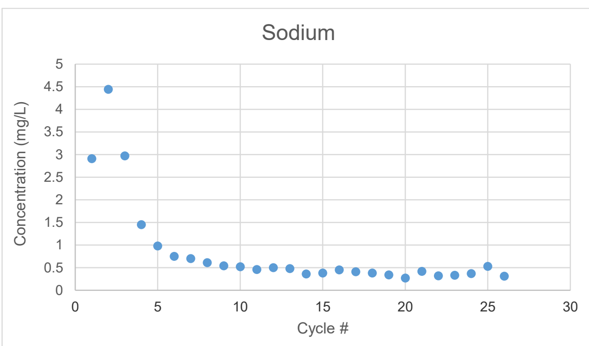

Phosphorus
Concentration (mg/L)
Cycle #

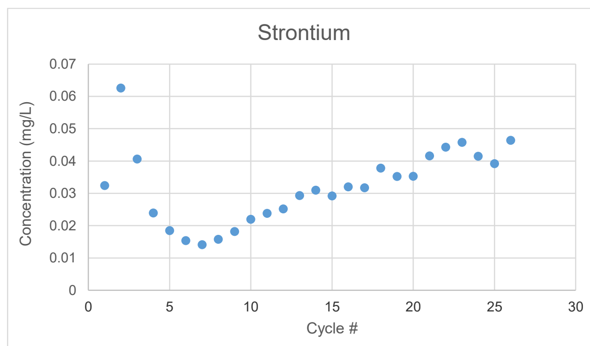

Potassium
Concentration (mg/L)
Cycle #

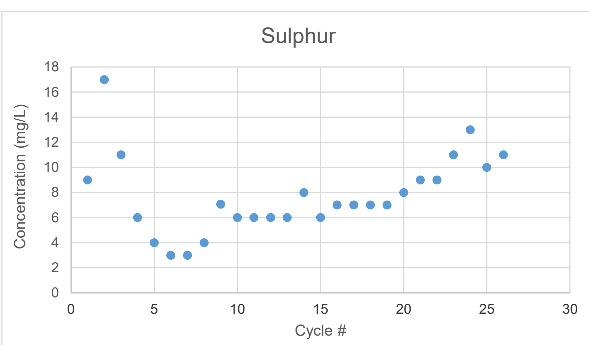

Selenium
Concentration (mg/L)
Cycle #

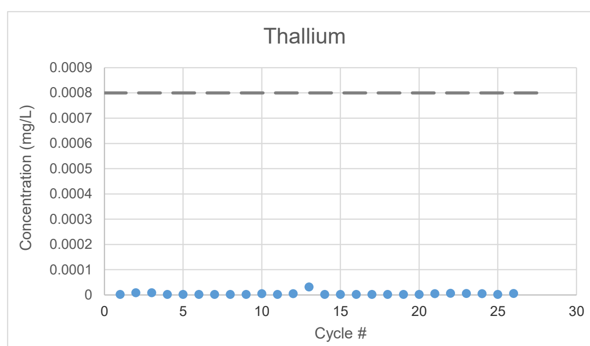

Silicon
Concentration (mg/L)
Cycle #

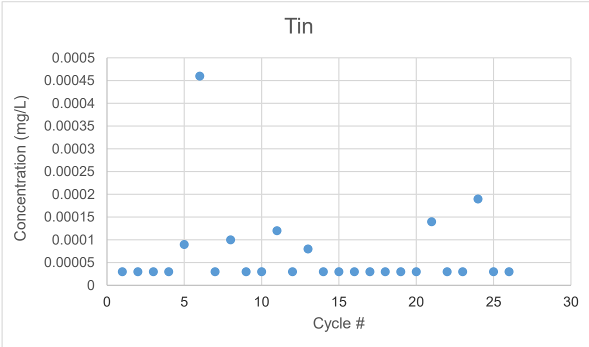

Silver
Concentration (mg/L)
Cycle #

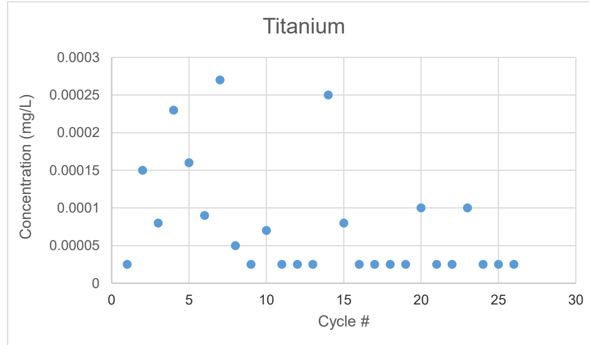

Sodium
Concentration (mg/L)
Cycle #

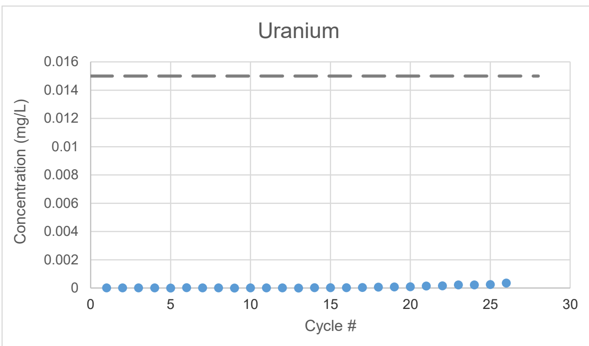

Strontium
Concentration (mg/L)
Cycle #

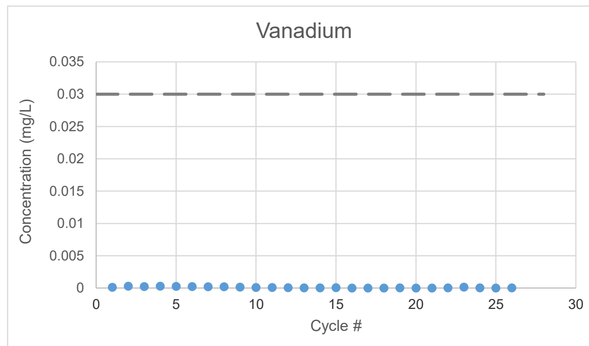

Sulphur
Concentration (mg/L)
Cycle #

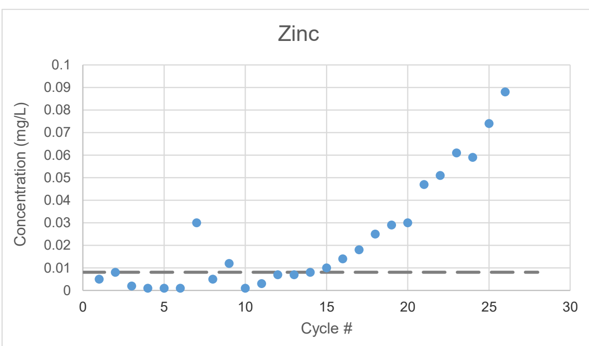

Thallium
Concentration (mg/L)
Cycle #

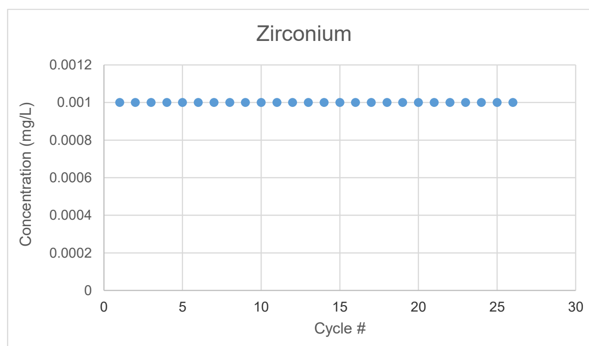

Tin
Concentration (mg/L)
0.0005
0.00045
0.0004
0.00035
0.0003
0.00025
0.0002
0.00015
0.0001
0.00005
0
0 5 10 15 20 25 30
Cycle #


Titanium
Concentration (mg/L)
0.0003
0.00025
0.0002
0.00015
0.0001
0.00005
0
0 5 10 15 20 25 30
Cycle #

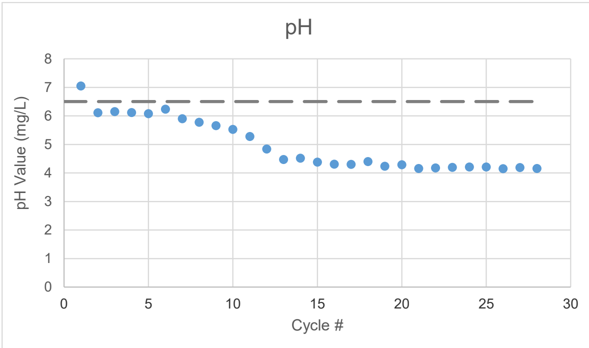

Uranium
Concentration (mg/L)
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
0 5 10 15 20 25 30
Cycle #

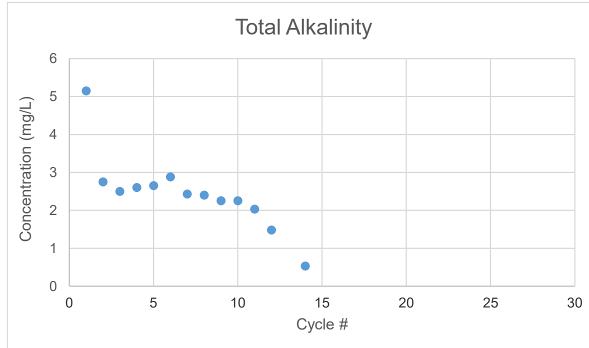

Vanadium
Concentration (mg/L)
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0 5 10 15 20 25 30
Cycle #

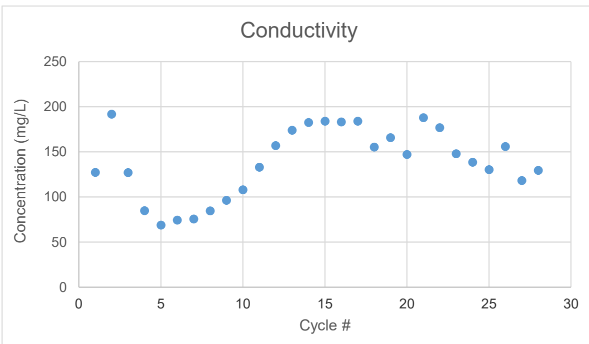

Zinc
Concentration (mg/L)
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0 5 10 15 20 25 30
Cycle #

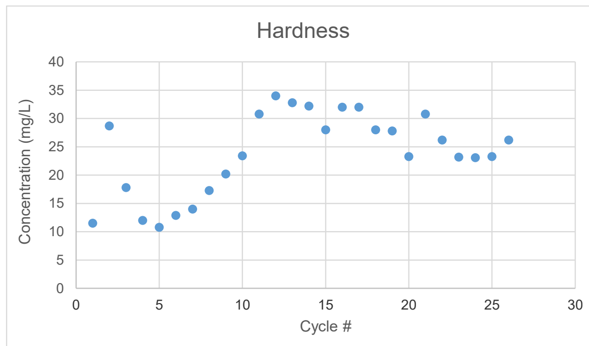

Zirconium
Concentration (mg/L)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
0 5 10 15 20 25 30
Cycle #

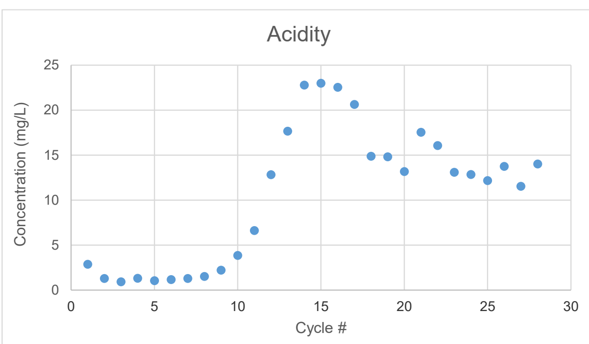
APPENDIX B-2: HCT 2 LEACHATE CONCENTRATIONS WITH TIME

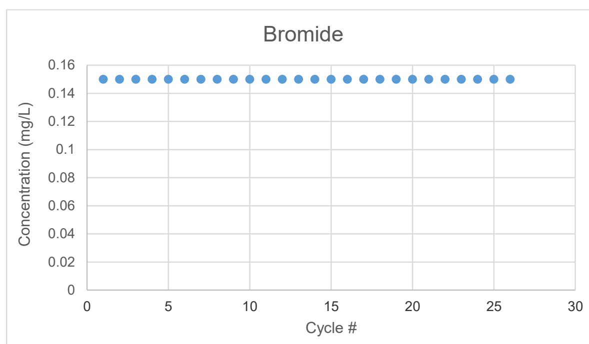


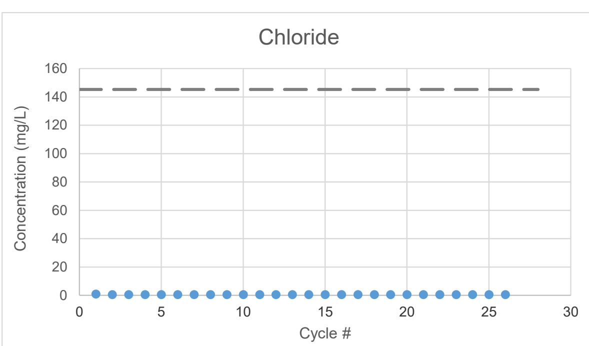


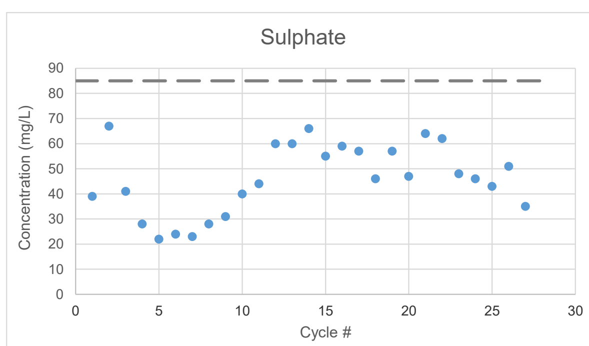


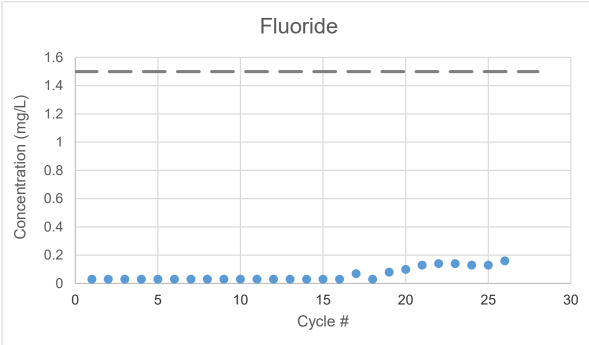


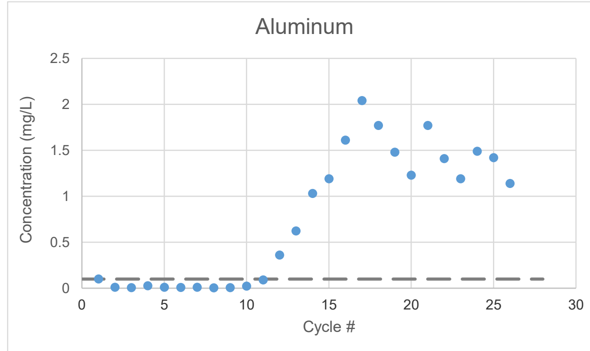


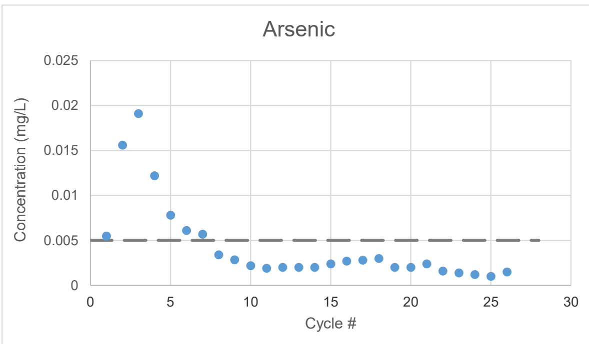


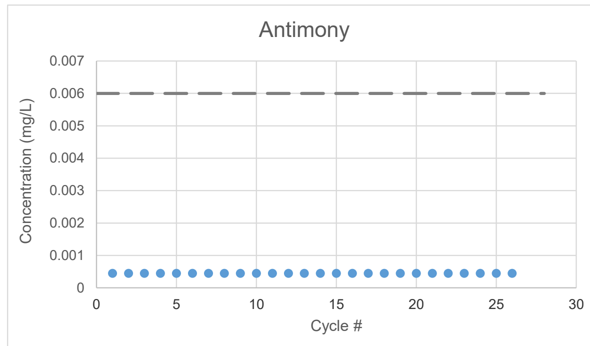


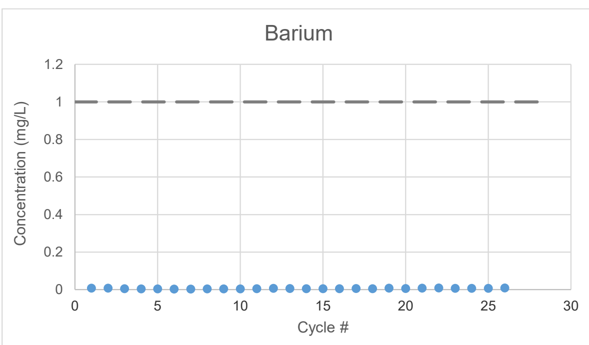


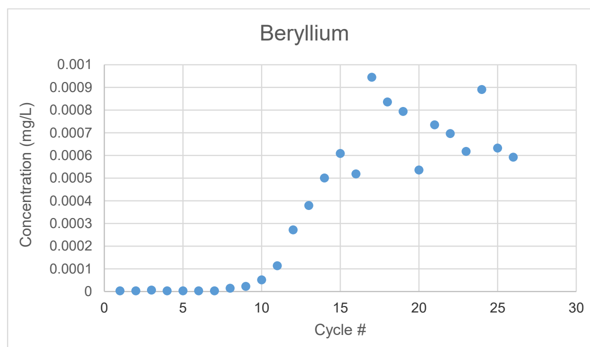

Fluoride
Concentration (mg/L)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
0
5
10
15
20
25
30
Cycle #

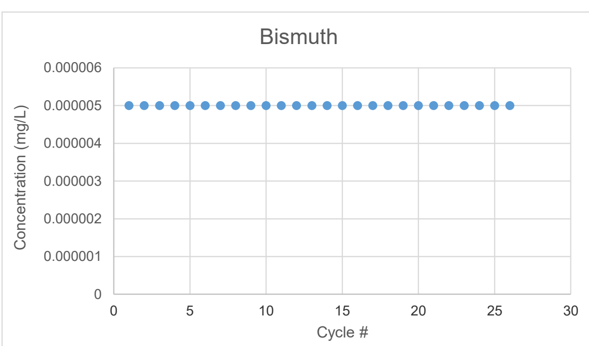

Aluminum
Concentration (mg/L)
0
0.5
1
1.5
2
2.5
0
5
10
15
20
25
30
Cycle #

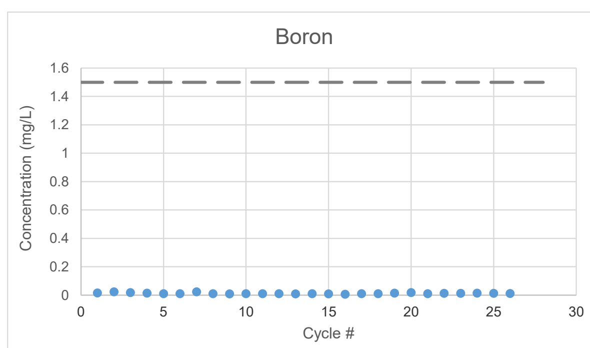

Arsenic
Concentration (mg/L)
0
0.005
0.01
0.015
0.02
0.025
0
5
10
15
20
25
30
Cycle #

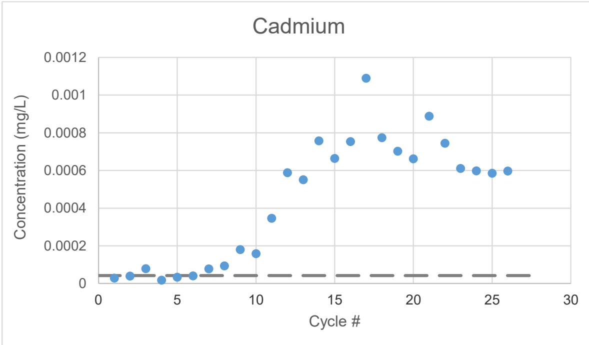

Antimony
Concentration (mg/L)
0
0.001
0.002
0.003
0.004
0.005
0.006
0.007
0
5
10
15
20
25
30
Cycle #

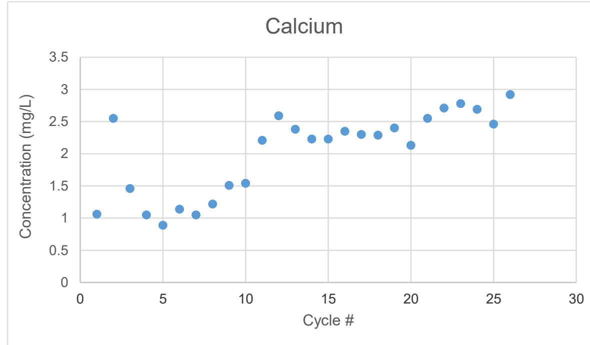

Barium
Concentration (mg/L)
0
0.2
0.4
0.6
0.8
1
1.2
0
5
10
15
20
25
30
Cycle #

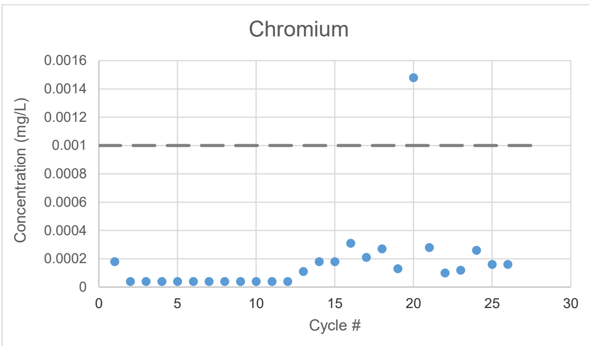

Beryllium
Concentration (mg/L)
0
0.0001
0.0002
0.0003
0.0004
0.0005
0.0006
0.0007
0.0008
0.0009
0.001
0
5
10
15
20
25
30
Cycle #

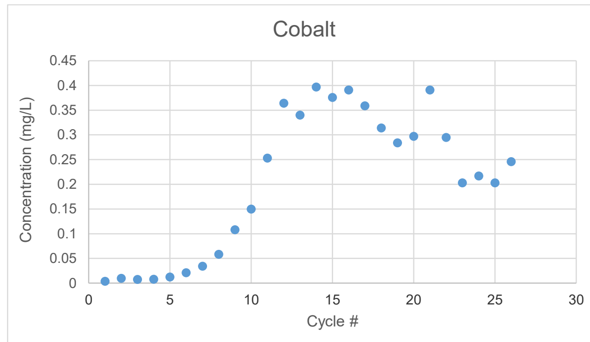

Bismuth
Concentration (mg/L)
0
0.000001
0.000002
0.000003
0.000004
0.000005
0.000006
0
5
10
15
20
25
30
Cycle #

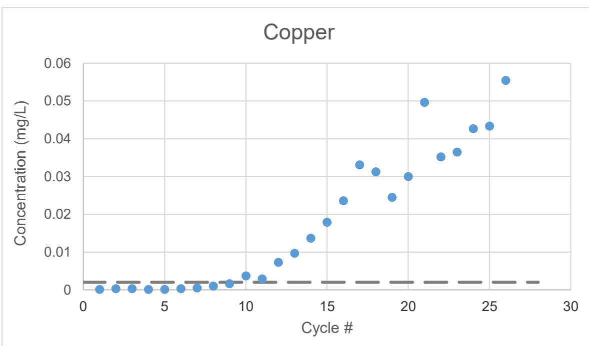

Boron
Concentration (mg/L)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
0
5
10
15
20
25
30
Cycle #

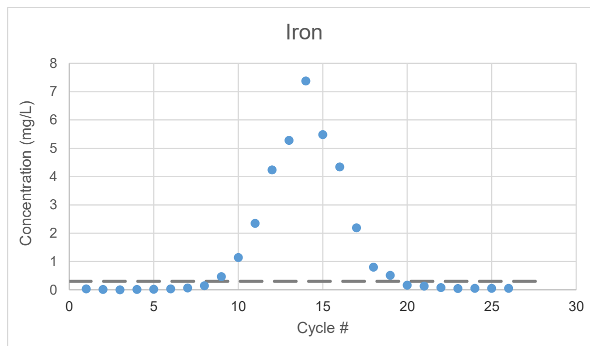

Cadmium
Concentration (mg/L)
Cycle #

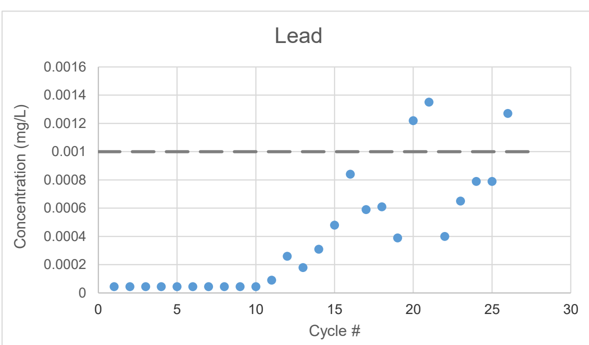

Calcium
Concentration (mg/L)
Cycle #

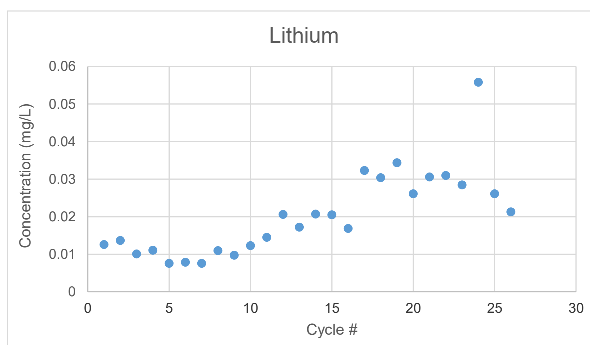

Chromium
Concentration (mg/L)
Cycle #

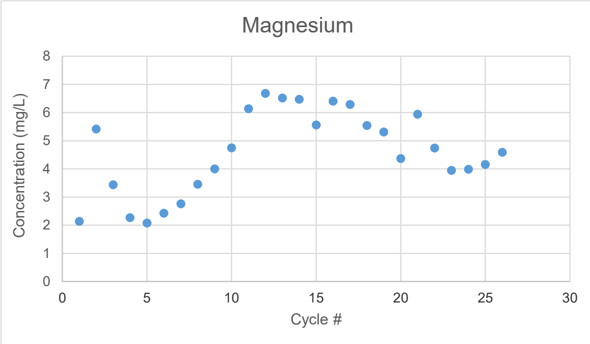

Cobalt
Concentration (mg/L)
Cycle #

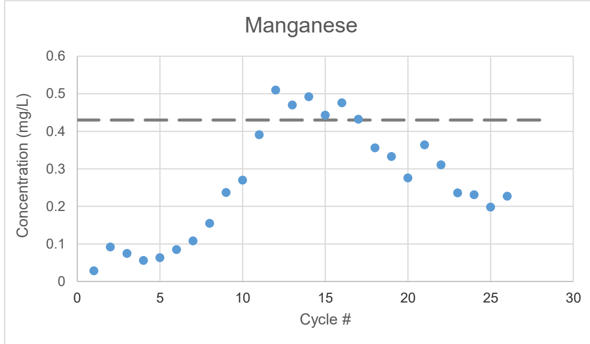

Copper
Concentration (mg/L)
Cycle #

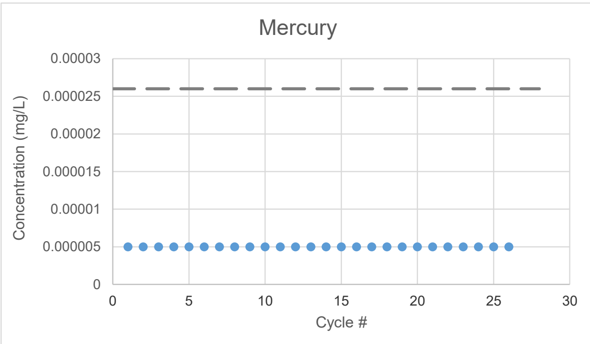

Iron
Concentration (mg/L)
Cycle #

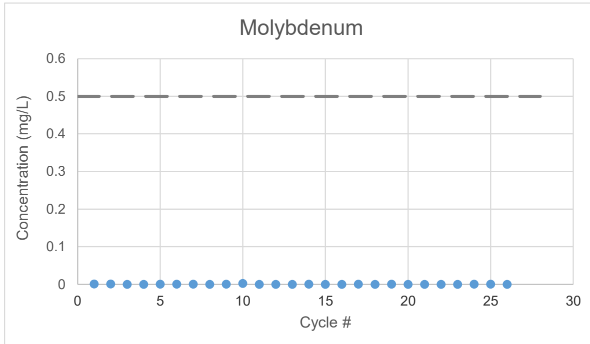

Lead
Concentration (mg/L)
Cycle #

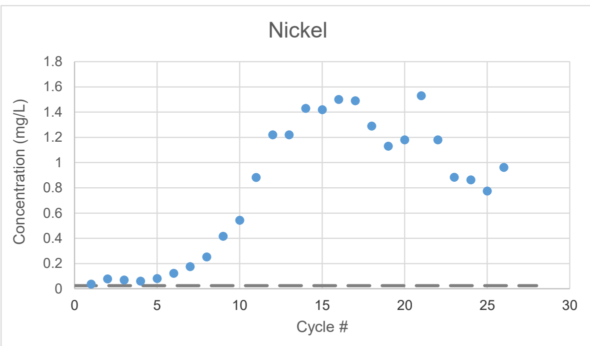

Lithium
Concentration (mg/L)
Cycle #

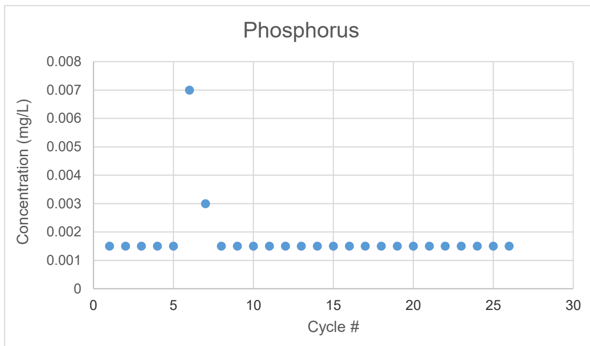

Magnesium
Concentration (mg/L)
Cycle #

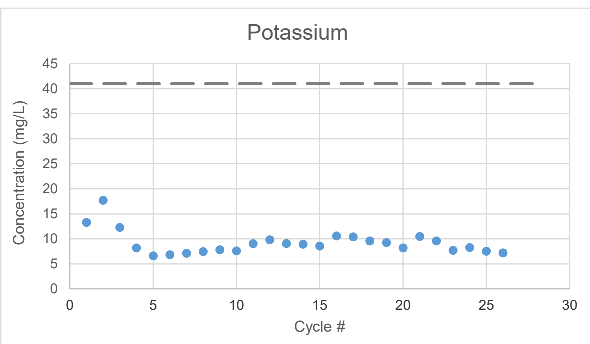

Manganese
Concentration (mg/L)
Cycle #

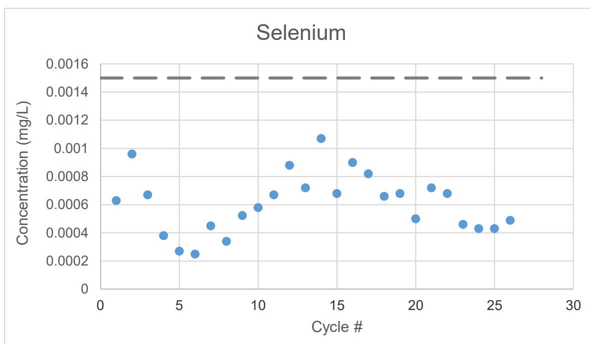

Mercury
Concentration (mg/L)
Cycle #

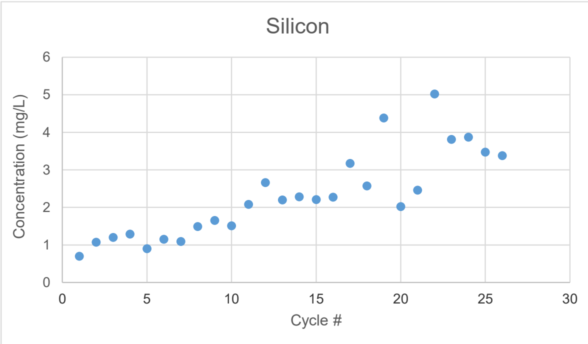

Molybdenum
Concentration (mg/L)
Cycle #

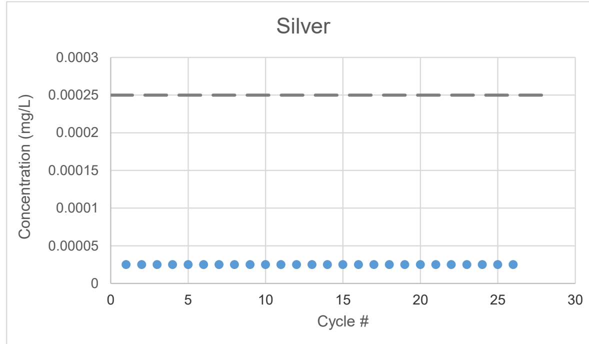

Nickel
Concentration (mg/L)
Cycle #

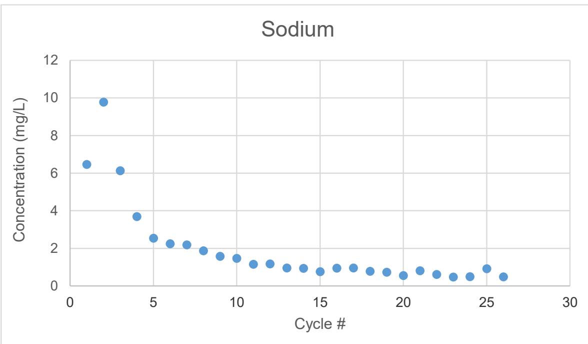

Phosphorus
Concentration (mg/L)
Cycle #

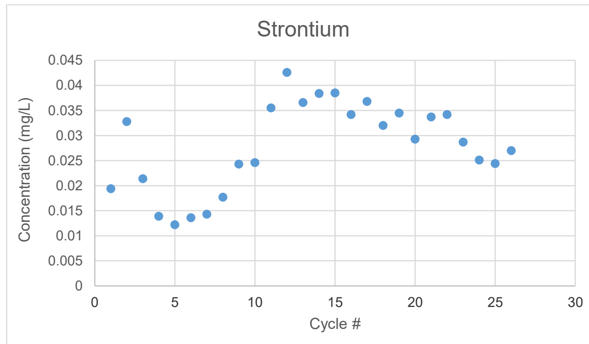

Potassium
Concentration (mg/L)
Cycle #

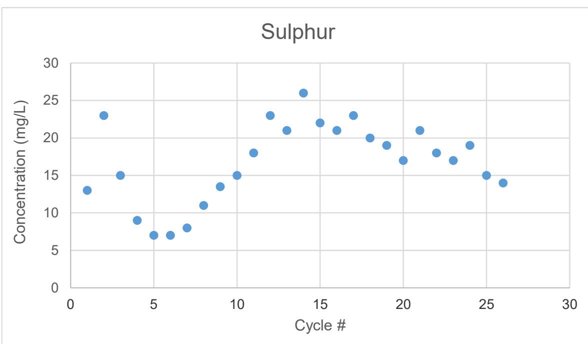

Selenium
Concentration (mg/L)
Cycle #

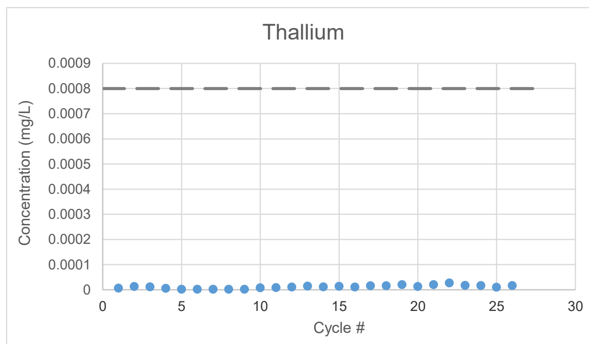

Silicon
Concentration (mg/L)
Cycle #

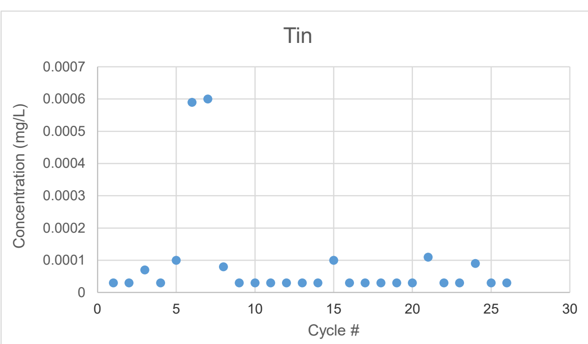

Silver
Concentration (mg/L)
Cycle #

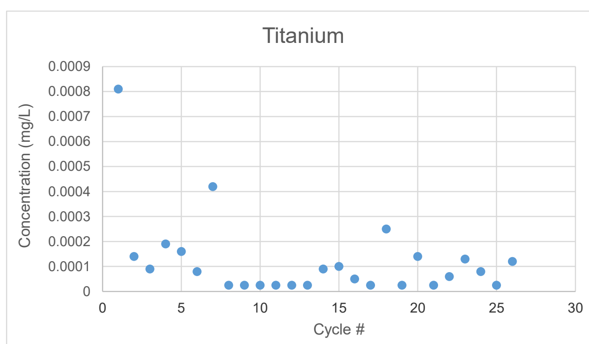

Sodium
Concentration (mg/L)
Cycle #

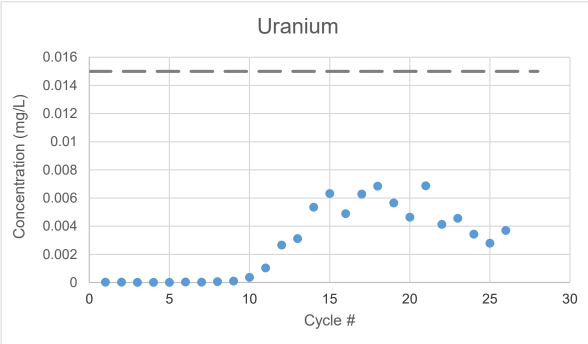

Strontium
Concentration (mg/L)
Cycle #

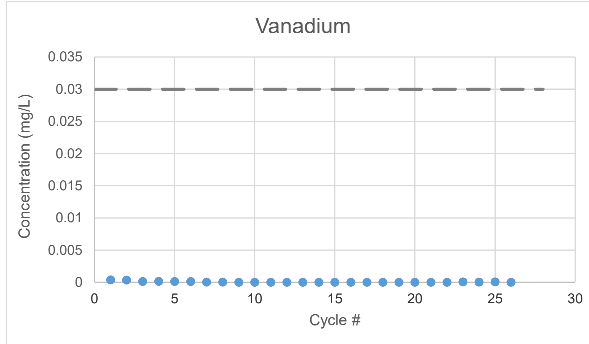

Sulphur
Concentration (mg/L)
Cycle #

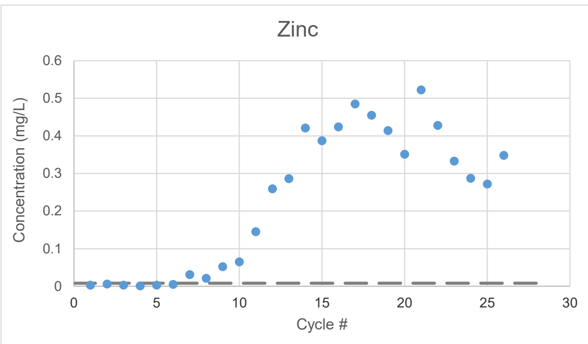

Thallium
Concentration (mg/L)
Cycle #

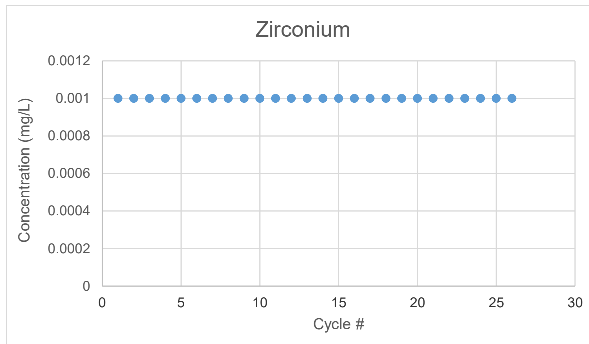

Tin
Concentration (mg/L)
Cycle #


Titanium
Concentration (mg/L)
Cycle #

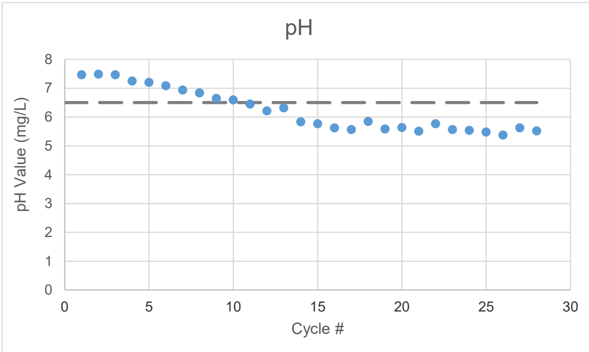

Uranium
Concentration (mg/L)
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
0
5
10
15
20
25
30
Cycle #

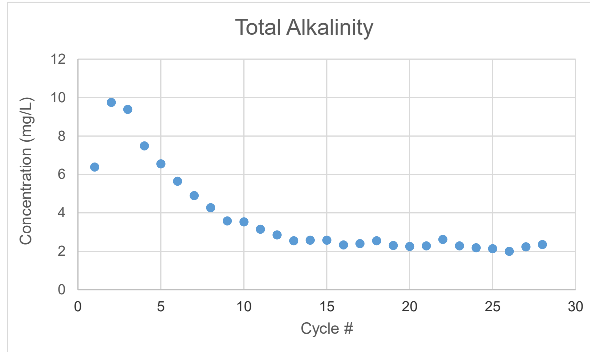

Vanadium
Concentration (mg/L)
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0
5
10
15
20
25
30
Cycle #

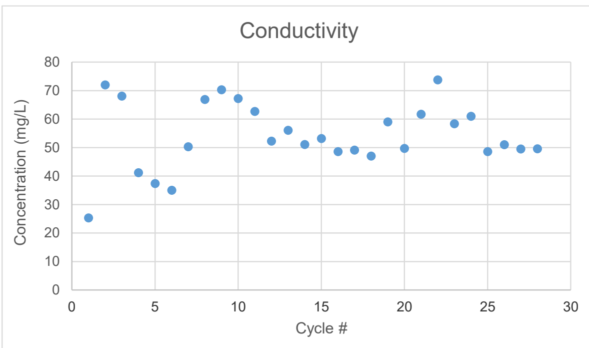

Zinc
Concentration (mg/L)
0.6
0.5
0.4
0.3
0.2
0.1
0
0
5
10
15
20
25
30
Cycle #

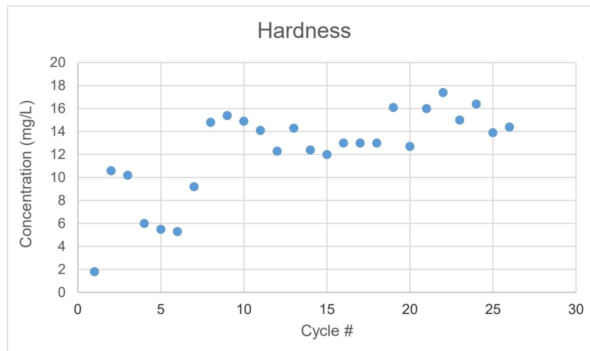

Zirconium
Concentration (mg/L)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
0
5
10
15
20
25
30
Cycle #

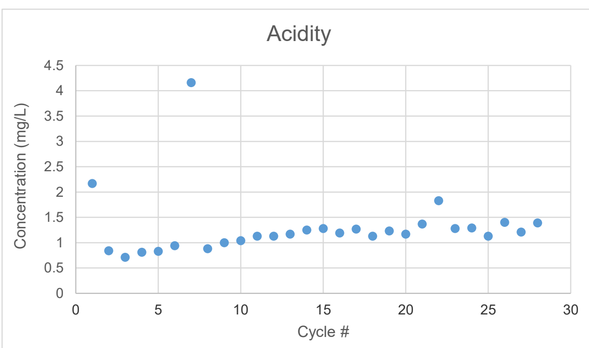
APPENDIX B-3: HCT 3 LEACHATE CONCENTRATIONS WITH TIME

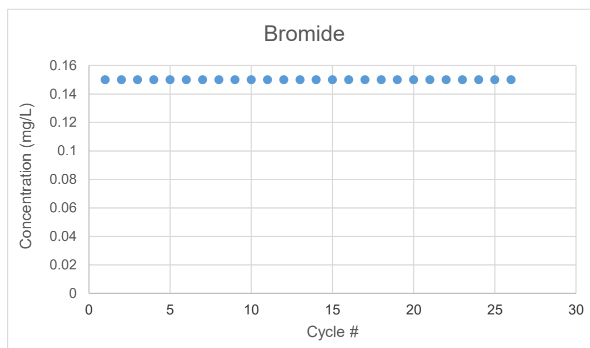


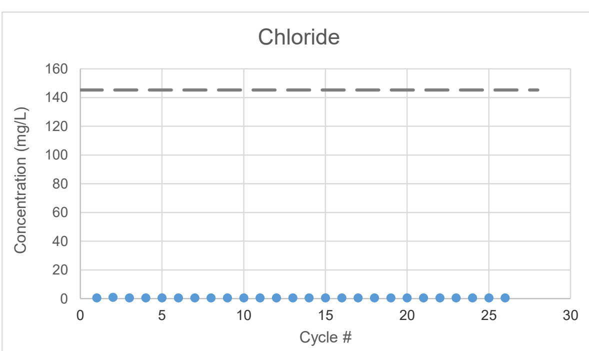


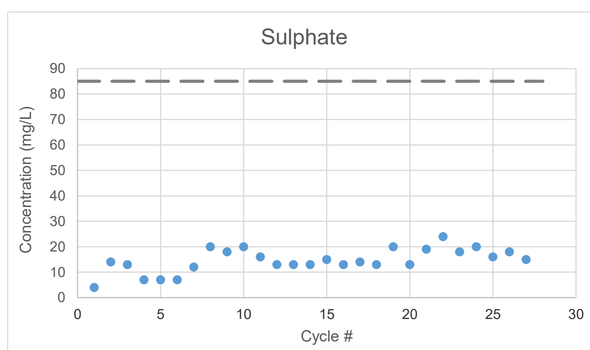


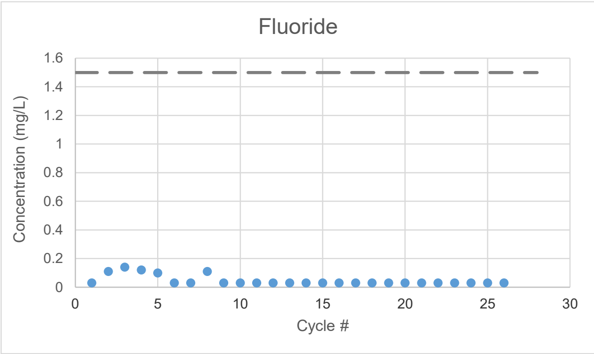


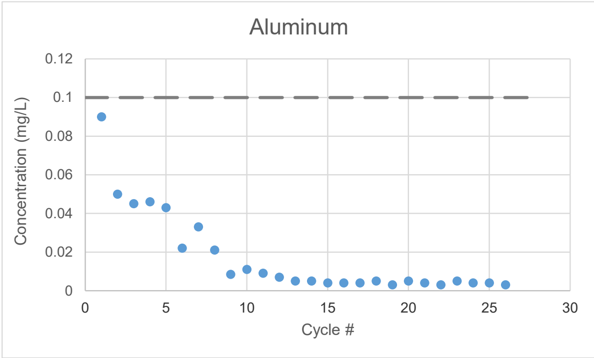


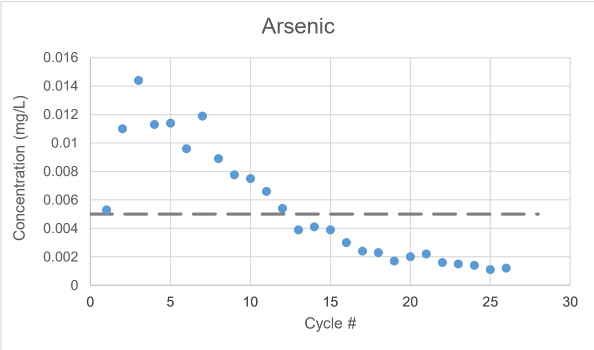


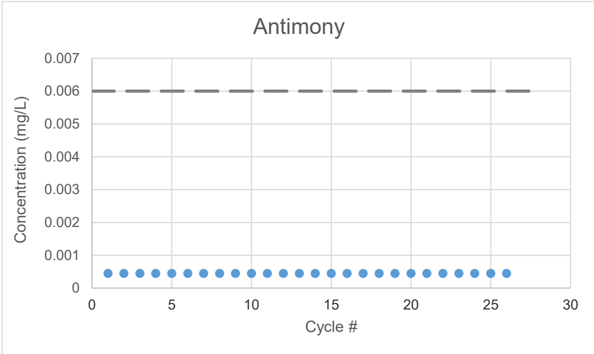


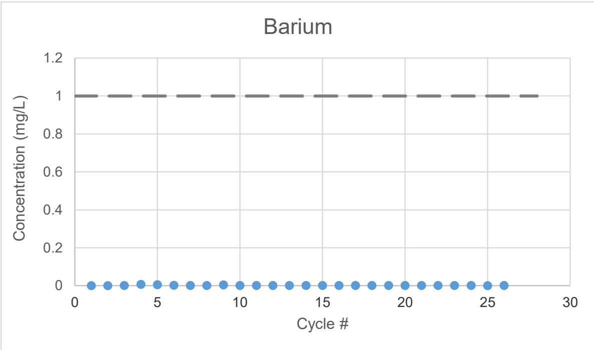


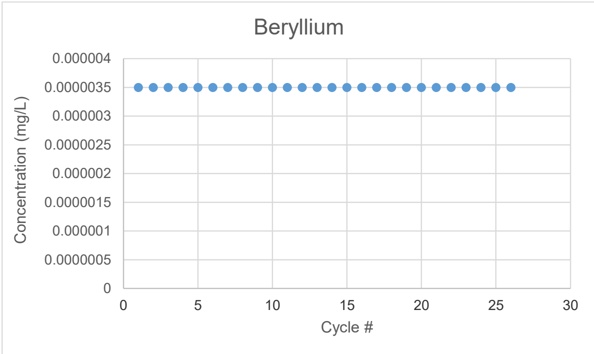

Fluoride
Concentration (mg/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
5
10
15
20
25
30
Cycle #

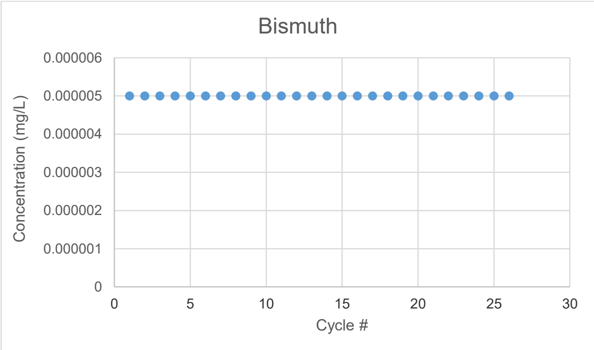

Aluminum
Concentration (mg/L)
0.12
0.1
0.08
0.06
0.04
0.02
0
0
5
10
15
20
25
30
Cycle #

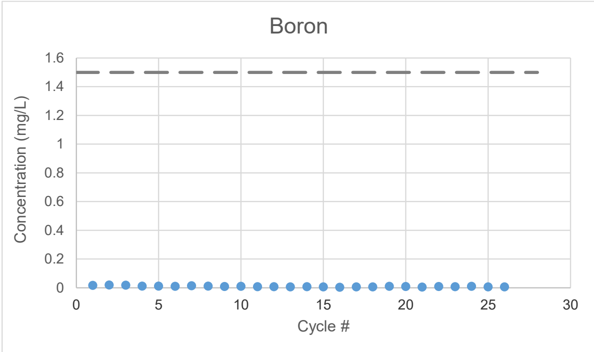

Arsenic
Concentration (mg/L)
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
0
5
10
15
20
25
30
Cycle #

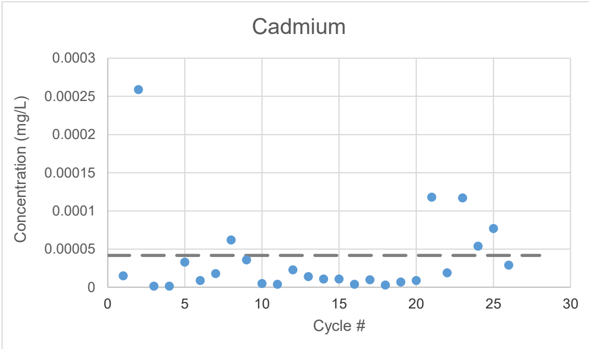

Antimony
Concentration (mg/L)
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
0
5
10
15
20
25
30
Cycle #

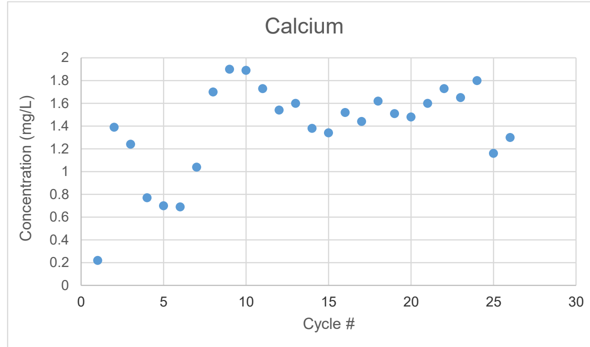

Barium
Concentration (mg/L)
1.2
1
0.8
0.6
0.4
0.2
0
0
5
10
15
20
25
30
Cycle #

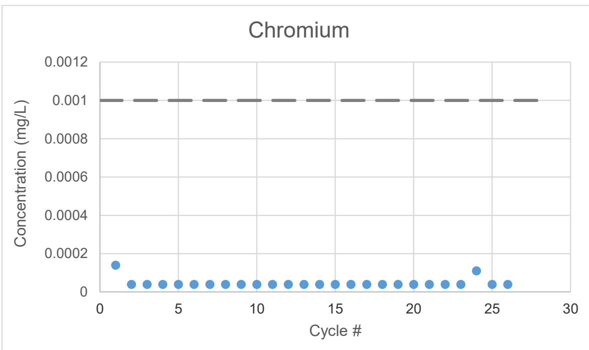

Beryllium
Concentration (mg/L)
0.000004
0.0000035
0.000003
0.0000025
0.000002
0.0000015
0.000001
0.0000005
0
0
5
10
15
20
25
30
Cycle #

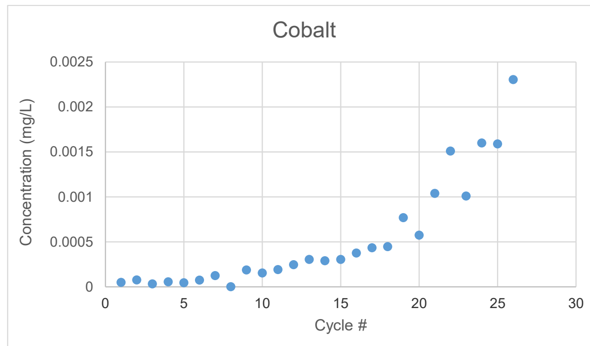

Bismuth
Concentration (mg/L)
0.000006
0.000005
0.000004
0.000003
0.000002
0.000001
0
0
5
10
15
20
25
30
Cycle #

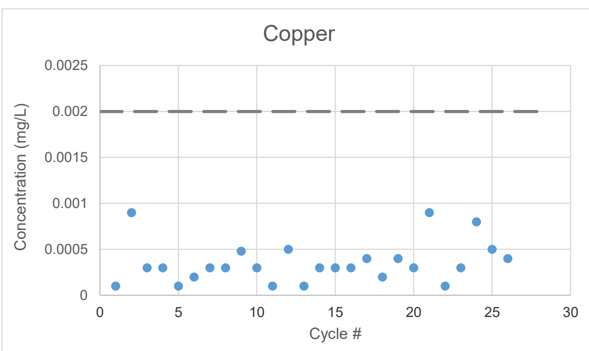

Boron
Concentration (mg/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
5
10
15
20
25
30
Cycle #

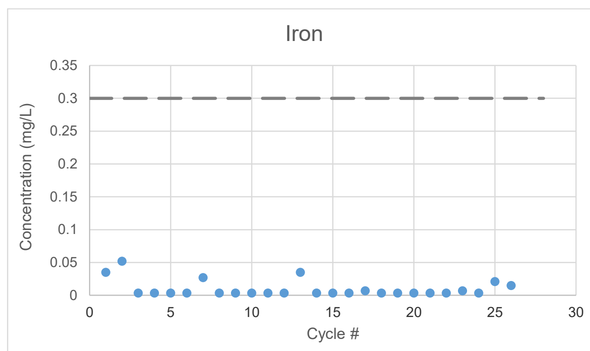

Cadmium
Concentration (mg/L)
0.0003
0.00025
0.0002
0.00015
0.0001
0.00005
0
0
5
10
15
20
25
30
Cycle #

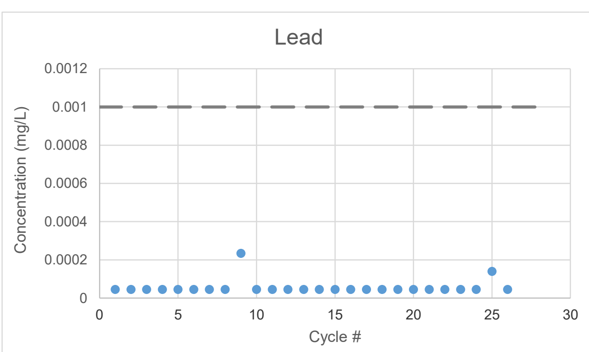

Calcium
Concentration (mg/L)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
5
10
15
20
25
30
Cycle #

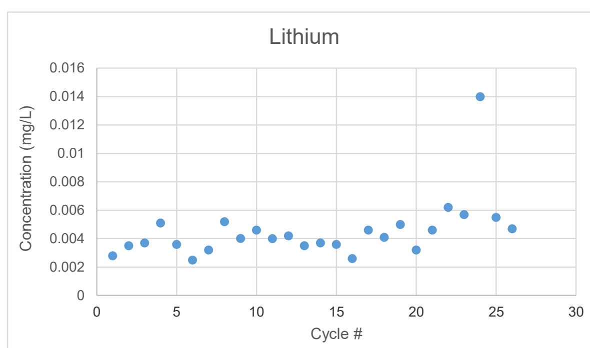

Chromium
Concentration (mg/L)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
0
5
10
15
20
25
30
Cycle #

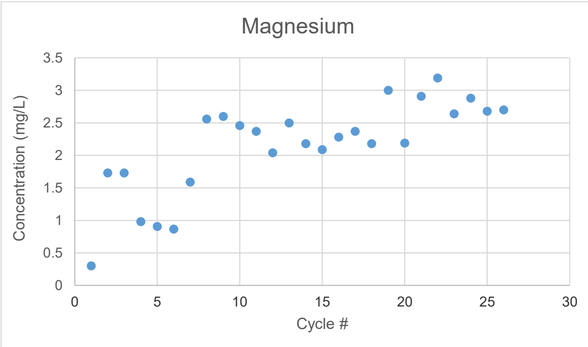

Cobalt
Concentration (mg/L)
0.0025
0.002
0.0015
0.001
0.0005
0
0
5
10
15
20
25
30
Cycle #

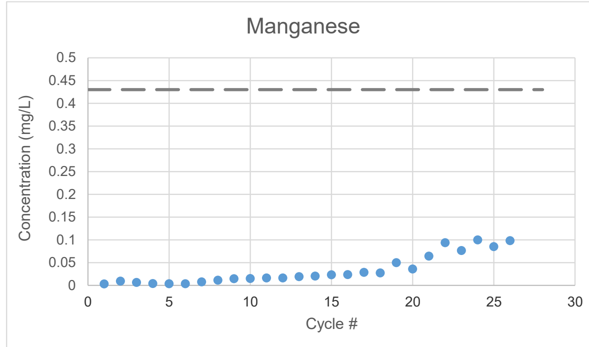

Copper
Concentration (mg/L)
0.0025
0.002
0.0015
0.001
0.0005
0
0
5
10
15
20
25
30
Cycle #

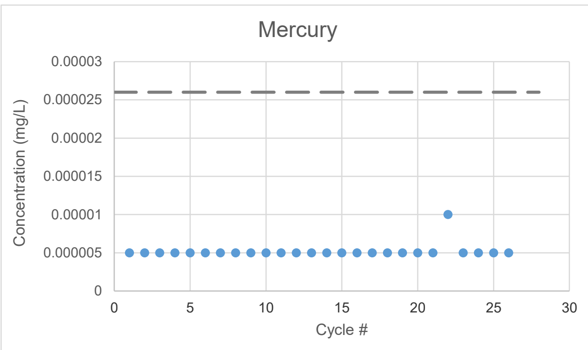

Iron
Concentration (mg/L)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
5
10
15
20
25
30
Cycle #

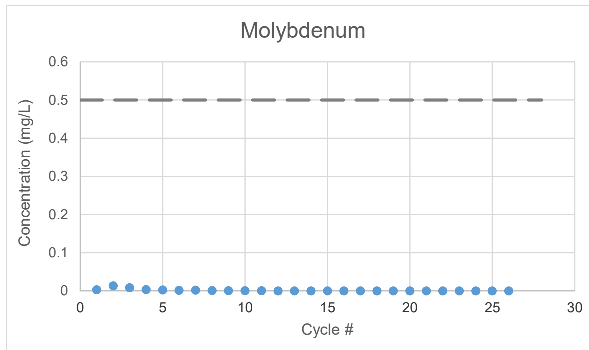

Lead
Concentration (mg/L)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
0
5
10
15
20
25
30
Cycle #

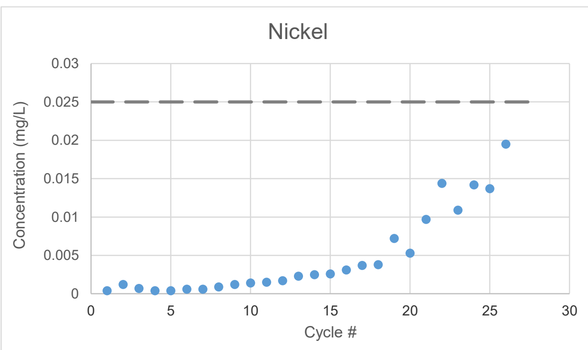

Lithium
Concentration (mg/L)
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
0
5
10
15
20
25
30
Cycle #

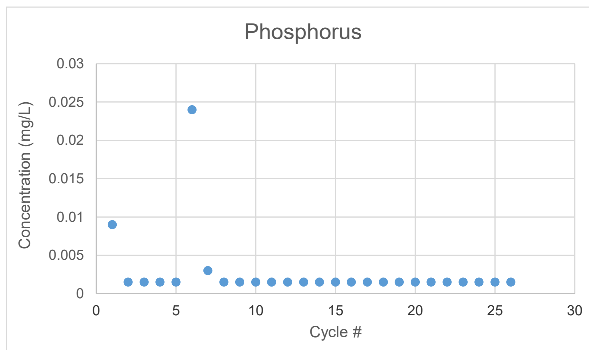

Magnesium
Concentration (mg/L)
Cycle #

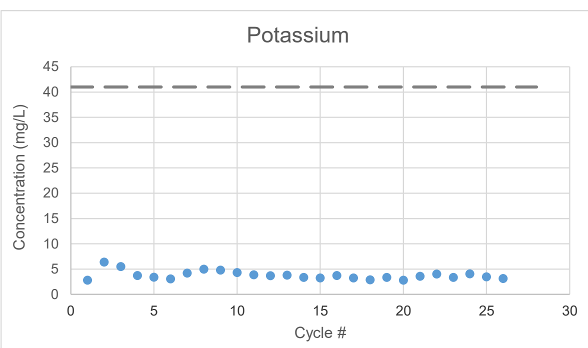

Manganese
Concentration (mg/L)
Cycle #

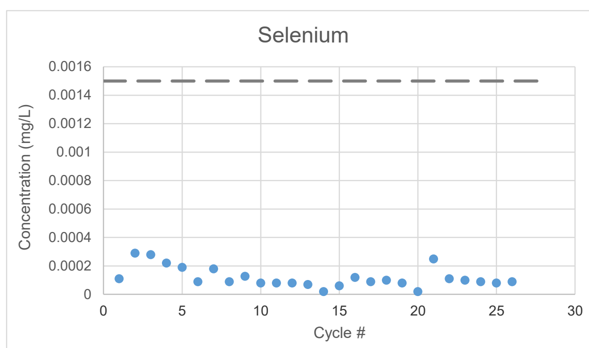

Mercury
Concentration (mg/L)
Cycle #

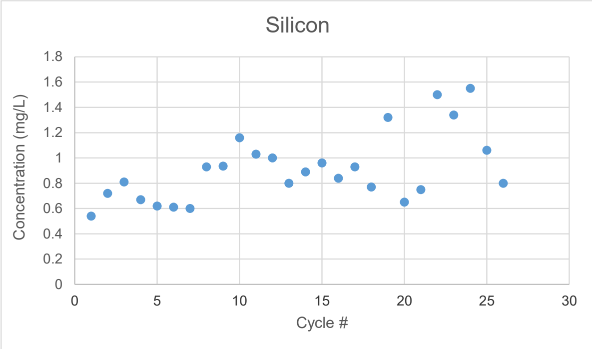

Molybdenum
Concentration (mg/L)
Cycle #

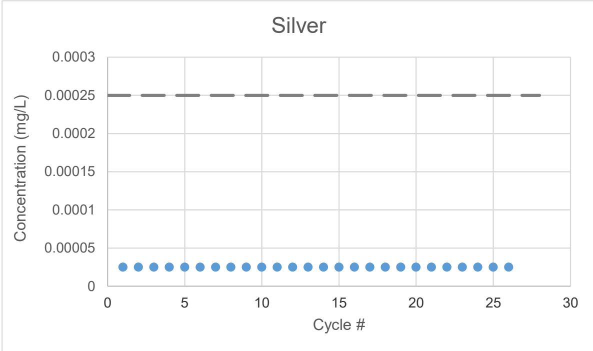

Nickel
Concentration (mg/L)
Cycle #

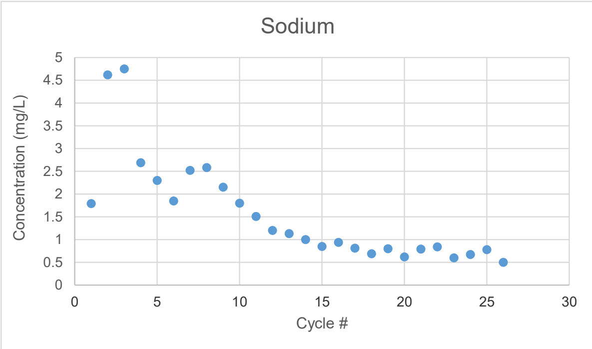

Phosphorus
Concentration (mg/L)
Cycle #

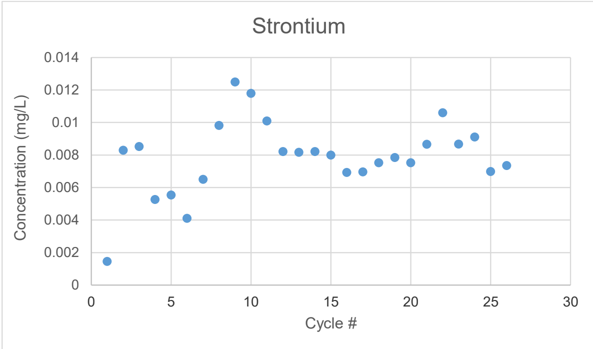

Potassium
Concentration (mg/L)
Cycle #

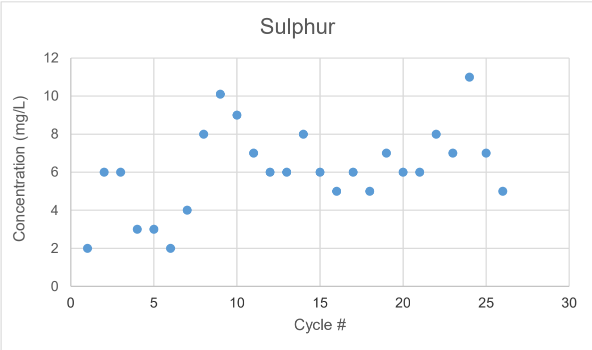

Selenium
Concentration (mg/L)
Cycle #

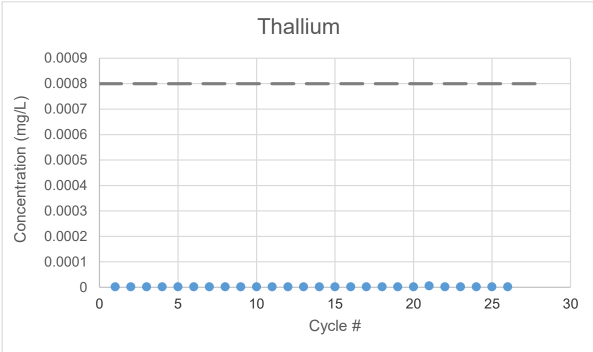

Silicon
Concentration (mg/L)
Cycle #

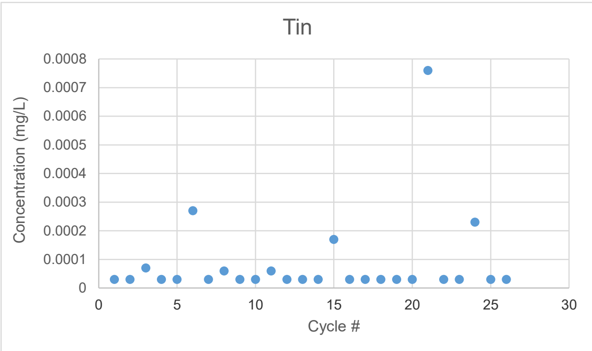

Silver
Concentration (mg/L)
Cycle #

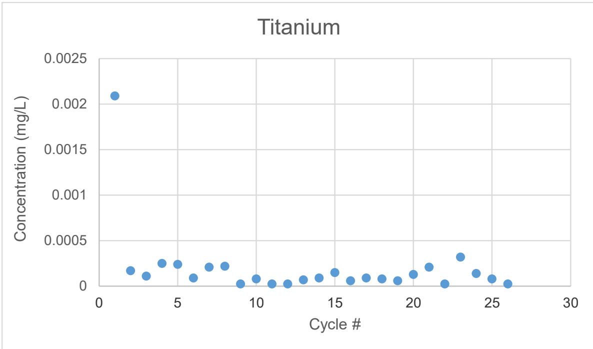

Sodium
Concentration (mg/L)
Cycle #

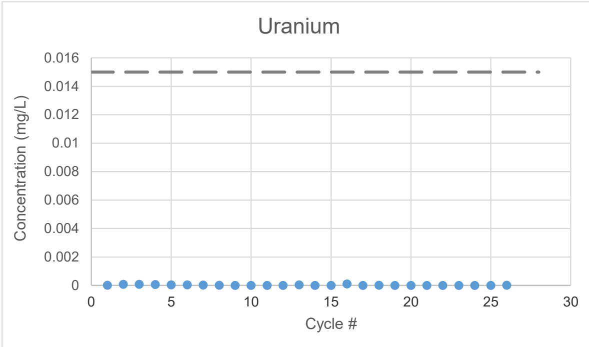

Strontium
Concentration (mg/L)
Cycle #

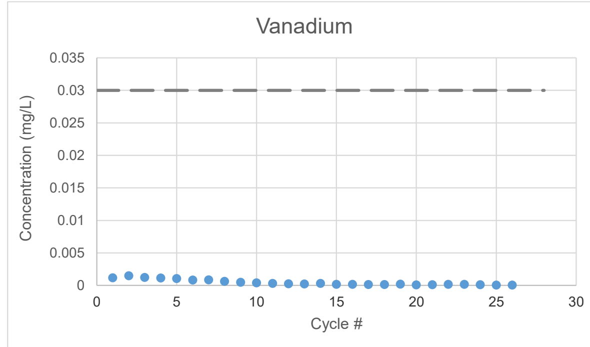

Sulphur
Concentration (mg/L)
Cycle #

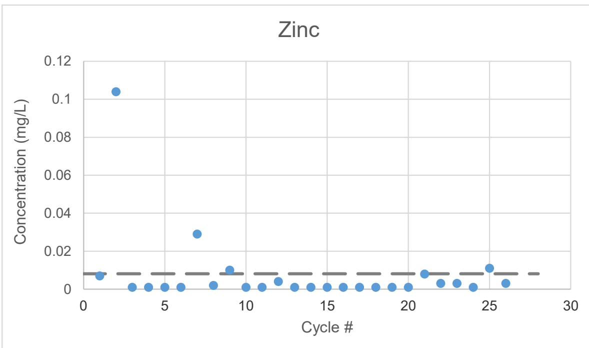

Thallium
Concentration (mg/L)
Cycle #

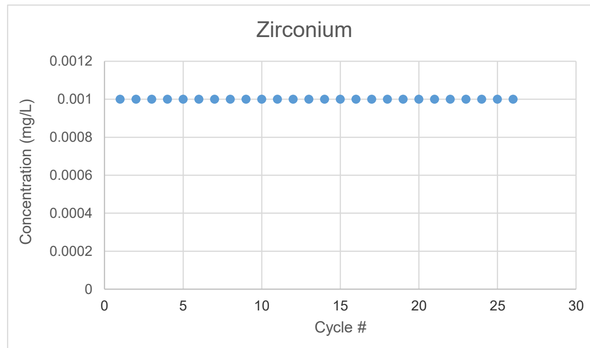

Tin
Concentration (mg/L)
Cycle #


Titanium
Concentration (mg/L)
Cycle #


Uranium
Concentration (mg/L)
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
0
5
10
15
20
25
30
Cycle #


Vanadium
Concentration (mg/L)
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0
5
10
15
20
25
30
Cycle #


Zinc
Concentration (mg/L)
0.12
0.1
0.08
0.06
0.04
0.02
0
0
5
10
15
20
25
30
Cycle #


Zirconium
Concentration (mg/L)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
0
5
10
15
20
25
30
Cycle #

APPENDIX C LOADING RATES CALCULATED FOR VARIOUS PERIODS OF HCT ANALYSIS (MG/KG)

Appendix C: Loading Rates Calculated for Various Periods of HCT Analysis (mg/kg)

Parameters	First 10 Weeks			Entire Period			Last Five Weeks		
	HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3
	PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10
pH	6.69	6.06	7.10	5.99	4.97	6.22	5.22	4.19	5.55
Hardness	6.1	7.5	4.3	6.8	10.9	5.7	7.8	11.5	7.1
Conductivity	61.9	103.9	53.4	66.5	139.0	54.1	81.9	149.9	58.6
Acidity	0.51	0.76	0.60	1.85	4.89	0.59	4.00	6.41	0.64
Total Alkalinity	1.70	1.20	2.77	1.24	1.07	1.71	0.87	below detection	1.03
Sulphate	8.5	15.0	5.6	9.3	21.0	6.7	13.0	23.6	8.8
Bromide	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Chloride	0.24	0.24	0.25	0.23	0.23	0.24	0.23	0.24	0.23
Fluoride	0.026	0.013	0.033	0.018	0.028	0.021	0.014	0.066	0.014
Aluminum	0.0027	0.0083	0.0163	0.0057	0.3571	0.0076	0.0189	0.6279	0.0017
Antimony	0.00020	0.00020	0.00020	0.00020	0.00020	0.00021	0.00020	0.00021	0.00021
Arsenic	0.0049	0.0036	0.0045	0.0024	0.0019	0.0025	0.0004	0.0006	0.0006
Barium	0.0036	0.0021	0.0012	0.0049	0.0028	0.0007	0.0074	0.0038	0.0004
Beryllium	0.000002	0.000005	0.000002	0.000037	0.000175	0.000002	0.000139	0.000323	0.000002
Bismuth	0.0000022	0.0000022	0.0000023	0.0000022	0.0000023	0.0000023	0.0000023	0.0000024	0.0000023
Boron	0.0047	0.0064	0.0060	0.0039	0.0058	0.0044	0.0028	0.0061	0.0038
Cadmium	0.000010	0.000034	0.000020	0.000081	0.000207	0.000017	0.000205	0.000296	0.000027
Calcium	0.94	0.59	0.53	1.06	0.93	0.64	1.28	1.28	0.70
Chromium	0.000018	0.000023	0.000022	0.000020	0.000080	0.000021	0.000027	0.000075	0.000025
Cobalt	0.00102	0.01847	0.00004	0.01731	0.09463	0.00024	0.04846	0.10988	0.00073
Copper	0.00010	0.00036	0.00015	0.00062	0.00829	0.00016	0.00137	0.02002	0.00019
Iron	0.004	0.086	0.006	0.392	0.615	0.005	1.667	0.027	0.005
Lead	0.000031	0.000020	0.000029	0.000082	0.000189	0.000026	0.000252	0.000364	0.000029
Lithium	0.0042	0.0045	0.0017	0.0064	0.0094	0.0021	0.0125	0.0153	0.0033
Magnesium	0.91	1.45	0.72	1.02	2.10	0.99	1.13	2.02	1.29
Manganese	0.019	0.052	0.0037	0.087	0.122	0.0152	0.194	0.114	0.0415
Mercury	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000003
Molybdenum	0.00019	0.00025	0.00170	0.00021	0.00013	0.00071	0.00035	0.00007	0.00007
Nickel	0.0075	0.0820	0.0004	0.0731	0.3682	0.0022	0.1902	0.4402	0.0066
Phosphorus	0.0016	0.0010	0.0021	0.0010	0.0008	0.0012	0.0008	0.0007	0.0007
Potassium	1.83	4.14	1.97	1.48	4.16	1.74	1.34	3.81	1.65
Selenium	0.000104	0.000221	0.000075	0.000115	0.000277	0.000054	0.000200	0.000235	0.000043
Silicon	0.54	0.53	0.35	0.63	1.06	0.42	0.83	1.85	0.57
Silver	0.000011	0.000011	0.000011	0.000011	0.000011	0.000011	0.000011	0.000012	0.000011
Sodium	0.68	1.65	1.23	0.37	0.86	0.72	0.17	0.28	0.31

Appendix C: Loading Rates Calculated for Various Periods of HCT Analysis (mg/kg)

Parameters	First 10 Weeks			Entire Period			Last Five Weeks		
	HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3	HCT 1	HCT 2	HCT 3
	PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10	PLDC 05-03	PLDC 06-15	PLDC-08-10
Strontium	0.0114	0.0085	0.0034	0.0142	0.0127	0.0036	0.0196	0.0132	0.0039
Sulphur	3.04	5.34	2.44	3.43	7.63	2.81	4.86	7.82	3.48
Thallium	0.0000018	0.0000026	0.0000011	0.0000022	0.0000054	0.0000012	0.0000024	0.0000084	0.0000011
Tin	0.000038	0.000070	0.000028	0.000030	0.000039	0.000039	0.000028	0.000020	0.000032
Titanium	0.000051	0.000080	0.000146	0.000034	0.000052	0.000084	0.000018	0.000039	0.000053
Uranium	0.000006	0.000033	0.000018	0.000033	0.001298	0.000011	0.000111	0.001753	0.000002
Vanadium	0.000094	0.000057	0.000421	0.000048	0.000027	0.000212	0.000024	0.000018	0.000057
Zinc	0.0029	0.0085	0.0071	0.0103	0.1068	0.0035	0.0300	0.1574	0.0019
Zirconium	0.0004	0.0004	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005

APPENDIX D COMPARISON OF THE SFE LEACHATES TO THE INITIAL FLUSH AND THE NAG LEACHATES TO THE LAST 5 WEEKS

Appendix D: Comparison of the SFE Leachates to the Initial Flush and the NAG Leachates to the Last 5 Weeks

Parameters	First 10 Weeks						Last Five Weeks					
	PLDC 05-03		PLDC 06-15		PLDC-08-10		PLDC 05-03		PLDC 06-15		PLDC-08-10	
	HCT 1	SFE	HCT 2	SFE	HCT 3	SFE	HCT 1	NAG	HCT 2	NAG	HCT 3	NAG
pH	6.69	7.61	6.06	7.62	7.10	7.73	5.22	4.21	4.19	4.61	5.55	4.93
Hardness	14.0	6.2	16.9	3.3	9.4	3.2	17.4	32.0	24.4	28.8	15.4	27.4
Conductivity	61.9	35.7	103.9	54.8	53.4	33.5	81.9	433.3	149.9	409.0	58.6	461
Acidity	1.19	3.09	1.75	2.71	1.34	2.32	8.86	240.98	13.59	219.73	1.39	218.38
Total Alkalinity	3.93	5.28	2.79	3.82	6.15	9.56	1.93	-0.36	#DIV/0!	-6.09	2.24	15.1
Sulphate	19.6	9.8	34.3	16.7	12.2	5.0	28.8	71.0	50.0	62.0	19.2	40
Bromide	0.15	< 0.3	0.15	< 0.3	0.15	< 0.3	0.15	< 3	0.15	< 3	0.15	< 3
Chloride	0.55	< 1	0.55	< 1	0.55	< 1	0.50	5.40	0.50	5.70	0.50	5.8
Fluoride	0.058	< 0.06	0.030	< 0.06	0.073	0.100	0.030	< 0.06	0.140	< 0.06	0.030	< 0.06
Aluminum	0.0062	0.0270	0.0206	0.0500	0.0369	0.0630	0.0418	0.1800	1.3300	0.1300	0.0038	0.13
Antimony	0.00045	< 0.0009	0.00045	< 0.0009	0.00045	< 0.0009	0.00045	< 0.009	0.00045	< 0.009	0.00045	< 0.009
Arsenic	0.0111	0.0109	0.0080	0.0085	0.0099	0.0095	0.0009	0.0320	0.0013	0.0510	0.0014	0.027
Barium	0.0084	0.0054	0.0049	0.0016	0.0026	0.0008	0.0163	0.0289	0.0080	0.0164	0.0009	0.0127
Beryllium	0.000004	0.000008	0.000012	< 0.000007	0.000004	< 0.000007	0.000309	0.000090	0.000686	< 0.00007	0.000004	< 0.00007
Bismuth	0.0000050	< 0.00001	0.0000050	< 0.00001	0.0000050	< 0.00001	0.0000050	< 0.0001	0.0000050	< 0.0001	0.0000050	0.0002
Boron	0.0109	0.0070	0.0147	0.0170	0.0134	0.0160	0.0062	0.1000	0.0130	0.1700	0.0082	0.08
Cadmium	0.000024	0.000007	0.000075	0.000008	0.000044	< 0.000003	0.000455	0.000050	0.000627	0.000100	0.000059	< 0.00003
Calcium	2.16	1.00	1.35	0.27	1.15	0.38	2.84	4.70	2.71	3.90	1.53	3.1
Chromium	0.000040	< 0.00008	0.000054	0.000120	0.000050	0.000090	0.000060	0.035000	0.000160	0.047400	0.000054	0.0455
Cobalt	0.00237	0.00072	0.04136	0.00097	0.00008	0.00001	0.10750	0.02820	0.23280	0.02530	0.00160	0.0041
Copper	0.00023	< 0.0002	0.00080	< 0.0002	0.00033	< 0.0002	0.00304	0.05100	0.04266	0.03600	0.00042	0.01
Iron	0.010	0.009	0.194	0.016	0.014	0.017	3.686	< 0.07	0.058	< 0.07	0.010	< 0.07
Lead	0.000078	0.000170	0.000045	< 0.00009	0.000064	< 0.00009	0.000562	< 0.0009	0.000780	< 0.0009	0.000064	< 0.0009
Lithium	0.0096	0.0103	0.0104	0.0085	0.0038	0.0047	0.0276	0.0390	0.0325	0.0300	0.0072	0.045
Magnesium	2.09	0.90	3.28	0.64	1.57	0.54	2.50	4.90	4.29	4.60	2.82	4.8
Manganese	0.043	0.017	0.117	0.010	0.0080	0.0052	0.430	0.107	0.241	0.087	0.0908	0.0557
Mercury	0.000005	< 0.00001	0.000005	< 0.00001	0.000005	< 0.00001	0.000005	< 0.0001	0.000005	< 0.0001	0.000006	< 0.0001
Molybdenum	0.00045	0.00014	0.00057	0.00054	0.00375	0.00458	0.00078	0.02770	0.00016	0.02730	0.00015	0.0247
Nickel	0.0173	0.0092	0.1840	0.0107	0.0008	0.0005	0.4220	0.3190	0.9330	0.2070	0.0145	0.08
Phosphorus	0.0036	< 0.003	0.0022	< 0.003	0.0047	< 0.003	0.0018	25.1000	0.0015	27.3000	0.0015	31.1
Potassium	4.24	4.54	9.50	7.64	4.33	4.88	2.98	12.50	8.07	10.40	3.61	14.5
Selenium	0.000243	0.000180	0.000505	0.000300	0.000166	0.000110	0.000444	0.001800	0.000498	0.001300	0.000094	0.001
Silicon	1.21	0.64	1.21	0.84	0.76	1.28	1.85	5.30	3.91	5.00	1.25	6.4
Silver	0.000025	< 0.00005	0.000025	< 0.00005	0.000025	< 0.00005	0.000025	< 0.0005	0.000025	< 0.0005	0.000025	< 0.0005
Sodium	1.59	1.51	3.79	3.37	2.71	2.45	0.37	53.80	0.59	50.70	0.68	51

Appendix D: Comparison of the SFE Leachates to the Initial Flush and the NAG Leachates to the Last 5 Weeks

Parameters	First 10 Weeks						Last Five Weeks					
	PLDC 05-03		PLDC 06-15		PLDC-08-10		PLDC 05-03		PLDC 06-15		PLDC-08-10	
	HCT 1	SFE	HCT 2	SFE	HCT 3	SFE	HCT 1	NAG	HCT 2	NAG	HCT 3	NAG
Strontium	0.0264	0.0106	0.0194	0.0042	0.0074	0.0021	0.0434	0.0318	0.0279	0.0218	0.0085	0.0173
Sulphur	7.01	3.00	12.15	5.00	5.31	< 1	10.80	1730.00	16.60	2520.00	7.60	1390
Thallium	0.0000041	0.0000050	0.0000059	< 0.000005	0.0000025	< 0.000005	0.0000053	< 0.00005	0.0000178	< 0.00005	0.0000025	< 0.00005
Tin	0.000086	< 0.00006	0.000159	< 0.00006	0.000061	< 0.00006	0.000062	0.102000	0.000042	0.312000	0.000070	0.0991
Titanium	0.000115	0.000490	0.000197	0.000650	0.000349	0.001030	0.000040	0.103000	0.000083	0.076300	0.000118	0.109
Uranium	0.000014	0.000023	0.000074	0.000030	0.000039	0.000014	0.000246	0.000860	0.003728	0.001370	0.000005	0.00049
Vanadium	0.000212	0.000180	0.000135	0.000310	0.000937	0.001590	0.000054	0.045800	0.000039	0.035400	0.000124	0.0462
Zinc	0.0066	< 0.002	0.0190	< 0.002	0.0157	< 0.002	0.0666	0.0200	0.3336	0.0300	0.0042	< 0.02
Zirconium	0.0010	< 0.002	0.0010	< 0.002	0.0010	< 0.002	0.0010	< 0.02	0.0010	< 0.02	0.0010	< 0.02

Assumed hardness of 20 $CaCO_3$ mg/L.

Concentrations in mg/L.

The average physical parameters over the entire cycle include 2 additional cycles.

APPENDIX E STATISTICAL SUMMARY AND COMPARISON OF LEACHATE DATA FOR THE POINT LAKE PROJECT (ERM 2021B)

Appendix E: Statistical Summary and Comparison of Leachate Data for the Point Lake Project (ERM, 2021b)

Waste Rock Grouping Statistic	pH		Sulphate		Aluminum		Arsenic		Cadmium		Chromium		Copper		Lead		Nickel		Phosphorus	
	Flush	Oxidized	Flush	Oxidized	Flush	Oxidized	Flush	Oxidized	Flush	Oxidized	Flush	Oxidized	Flush	Oxidized	Flush	Oxidize	Flush	Oxidize	Flush	Oxidiz
Point Lake Pegmatite																				
Minimum	7.62	4.49	2.2	**26**	**0.055**	0.1	**0.0173**	**1.04**	**0.000007**	0.000015	**0.00004**	0.049	0.0001	**0.006**	**0.00005**	**0.00045**	**0.0004**	0.008	0.001	10
Median	7.75	4.8	3.5	33.5	0.0715	0.15	**0.0357**	**1.045**	**0.000008**	0.000015	0.00008	0.05055	0.0002	0.0065	**0.0001**	**0.00045**	**0.0024**	0.0445	**0.03**	20
Maximum	7.88	5.11	4.8	41	0.088	0.2	0.0541	**1.05**	0.000008	0.000015	0.00012	0.0521	0.0003	0.007	**0.0001**	0.00045	0.0044	0.081	0.05	30
Point Lake Metasediment																				
Minimum	6.57	4.21	5	**21**	0.005	0.08	**0.0019**	**0.009**	0.000002	0.000015	**0.00004**	0.0283	0.0001	**0.007**	**0.0001**	**0.00045**	**0.0004**	**0.061**	0.001	16
Median	7.61	4.65	**12**	50	0.022	0.13	0.0048	0.023	**0.000007**	0.000015	0.00004	0.0474	0.0001	0.021	**0.0001**	**0.00045**	**0.0107**	0.137	0.001	29
Maximum	8.08	5.42	**33**	**141**	0.121	0.33	0.0411	**0.083**	**0.000041**	**0.00089**	0.00012	0.0573	0.0003	0.125	**0.0002**	**0.00285**	**0.17**	**0.441**	0.01	33
Jay Project Metasediment																				
Minimum	7.21	4.03	4	4	0.0383	0.108	0.0004	0.0018	0.000003	0.000328	0.00003	0.0414	0.0002	0.0035	0.00001	0.00004	0.0002	0.0086	0.01	24
Median	7.39	4.67	7	52	0.124	0.221	0.0217	0.0177	0.000003	0.000409	0.00011	0.049	0.0003	0.029	0.00002	0.00011	0.0013	0.115	0.02	29
Maximum	7.73	4.97	14	64	0.219	0.608	0.214	0.0477	0.000016	0.000563	0.00028	0.0691	0.0011	0.21	0.00003	0.00079	0.0056	0.333	0.06	40
HCT Metasediment																				
Minimum	4.7	3.6	1.3	0.73	0.011	0.012	0.00007	0.000092	0.000005	0.000005	0.00025	0.00025	0.0003	0.0003	0.00003	0.00002	0.0003	0.0001	0.13	0.1
Median	7.9	5.1	24	26	0.15	0.44	0.0014	0.0009	0.000025	0.0001	0.00025	0.00025	0.0006	0.0076	0.00013	0.00017	0.001	0.17	0.15	0.2
Maximum	8.5	7.8	142	143	0.34	5.3	0.029	0.0063	0.00048	0.00072	0.02	0.001	0.0084	0.68	0.0099	0.016	2.7	2.4	0.15	0.2

Notes:
Flush indicates SFE test or initial first five weeks of HCT testing.
Oxidized indicates NAG test or steady state last five weeks of HCT testing.
Bold indicates statistic is 30% greater than corresponding Jay Project statistic.
Red indicates statistic is 30% greater than corresponding HCT statistic.
Units are mg/L.

Appendix E: Statistical Summary and Comparison of Leachate Data for the Point Lake Project (ERM, 2021b)

Waste Rock Grouping Statistic	Selenium		Silver		Uranium		Vanadium	
	Flush	Oxidized	Flush	Oxidize	Flush	Oxidize	Flush	Oxidize
Point Lake Pegmatite								
Minimum	**0.00006**	0.0002	**0.00003**	**0.0002**	**0.00019**	**0.0059**	**0.0004**	**0.0008**
Median	0.00009	0.001	**0.00003**	0.0002	**0.0282**	**0.0884**	0.0004	0.0169
Maximum	0.00012	0.0017	**0.00003**	0.0002	**0.0562**	**0.171**	0.0005	0.0329
Point Lake Metasediment								
Minimum	**0.00011**	**0.0005**	**0.00003**	**0.0002**	0.00001	0.00049	0.0001	**0.0269**
Median	0.00031	0.0012	**0.00003**	0.0002	0.00002	0.00059	0.0002	**0.0389**
Maximum	0.00075	0.0025	**0.00003**	0.0009	0.00011	0.00257	0.0016	**0.0668**
Jay Project Metasediment								
Minimum	0.00004	0.0002	0.00001	0.00002	0.00002	0.00069	0.0003	0.0004
Median	0.00111	0.0013	0.00001	0.00029	0.00005	0.0017	0.0014	0.0221
Maximum	0.003	0.0024	0.00001	0.00078	0.00011	0.00642	0.0025	0.0283
HCT Metasediment								
Minimum	0.00005	0.0001	0.00001	0.00001	0.00004	0.00015	0.0005	0.0005
Median	0.0005	0.0005	0.00001	0.00001	0.00051	0.0012	0.0028	0.0005
Maximum	0.0022	0.0012	0.00084	0.00003	0.0029	0.022	0.005	0.003

Notes:

Flush indicates SFE test or initial first five weeks of HCT testing.

Oxidized indicates NAG test or steady state last five weeks of HCT testing.

Bold indicates statistic is 30% greater than corresponding Jay Project statistic.

Red indicates statistic is 30% greater than corresponding HCT statistic.

Units are mg/L.

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