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September 30, 2021

W2020L2-0004

Harry O'Keefe  
Arctic Canadian Diamond Company Ltd.  
900-606 4 Street SW  
Calgary, AB T2P 1T1

Sent via email

Dear Harry O'Keefe,

**Re: Ekati Diamond Mine – Two Rock Outfall Report Version 3.0**

The Wek'èezhii Land and Water Board (WLWB) met on September 30, 2021 and considered Version 3.0 of the Two Rock Outfall Report. Version 3.0 was submitted to address the Board's Reasons for Decision for Version 2.0 of the Two Rock Outfall Report and includes a proposal to use bank Discharge from the Two Rock Sedimentation Pond according to a Precautionary Discharge Plan.

As detailed in the Reasons for Decision, the Board has approved the Two Rock Outfall Report Version 3.0 with additional direction for Version 3.1. The Board is requiring Arctic to submit the updated Two Rock Outfall Report and the Two Rock Plume Delineation Study Report on or before January 4, 2022. In addition, the Board has updated the SNP to reflect decisions outlined in the attached Reasons for Decision. The current Licence with the updated SNP can be viewed on the Online Registry.<sup>1</sup>

The Two Rock Outfall Report was required to be submitted one year prior to Discharge from the Two Rock Sedimentation Pond (TRSP). Communication between Board staff and Arctic regarding the need to update the Two Rock Outfall Report to include Discharge without a diffuser began as early as February 2019.<sup>2</sup> No revised submission was received by Arctic prior to the open water season in 2019 or 2020. On September 29, 2020, the Board clarified that if planned Discharge differed from the approved Two Rock Outfall Report, the Company was to submit an updated Two Rock Outfall Report for approval prior to Discharge from the TRSP.<sup>3</sup> Version 2.0 of the Report was submitted by Arctic on January 5, 2021. The Board did not

<sup>1</sup> See WLWB Online Registry ([www.wlwb.ca](http://www.wlwb.ca)) for [Ekati – Water Licence – Sep 30 21](#)

<sup>2</sup> See WLWB Online Registry for [W2012L2-0001 – Ekati – Sable Diffuser Construction Plan V1.1 – WLWB Letter to Dominion – Nov 25 19](#)

<sup>3</sup> See WLWB Online Registry for [W2012L2-0001 - Ekati - Requests and Notifications letter - Reasons for Decision - Sep 29 20.pdf](#)

approve Version 2.0 because it determined that the submission did not meet the requirements of the Licence.<sup>4</sup> In its March 19, 2021 Decision Letter for Version 2.0, the Board stated: “in consideration of the Company’s request for an expedient public review, the Board recommends a revised Report be provided as soon as possible.” The Board understands that this submission has been a priority for Arctic and has been prepared to address it as expediently as possible once received. The current Version (i.e., 3.0) was submitted in late July 2021 and indicated the need for Discharge during the open-water season of 2021 “to avoid an emergency next freshet as water levels in TRSP could reach or exceed capacity”. In response to an Information Request related to this submission, Arctic stated that it “would like to remind the Board that an inability to Discharge this water will more than likely result in irreparable damage to the frozen core dam and potential failure of containment at the TRSP.” The Board understands that Arctic has been aware of the desired change in Discharge method since 2019 and the Board has been committed to timely reviews. Arctic is well aware of the Board’s timelines for review and consideration of submissions. It is the company’s responsibility to ensure adequate time is provided to reviewers and the Board. The Board should not be pressured into making rushed decisions as a result of the Company’s late submissions. The Board expects Arctic to be more proactive and timelier in its submissions moving forward.

Sincerely,

A handwritten signature in blue ink, appearing to read "J Mackenzie".

Joseph Mackenzie  
Acting Chair, Wek’èzhìi Land and Water Board

BCC: Ekati Distribution List

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<sup>4</sup> See WLWB Online Registry for [W2012L2-0001 – Ekati – Two Rock Outflow Design Report – Version 2.0 – Reasons for Decision – Mar 19 21](#)



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## Reasons for Decision

|                               |   |
|-------------------------------|---|
| <b>Reference/File Number:</b> | W2020L2-0004 (Type "A" Water Licence)         |
| <b>Licensee:</b>              | Arctic Canadian Diamond Company Ltd. (Arctic) |
| <b>Subject:</b>               | Two Rock Outfall Report Version 3.0           |

## Decision from the Wek'èezhìi Land and Water Board Meeting of September 30, 2021

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### 1.0 Decision

At the Wek'èezhìi Land and Water Board's (WLWB's or the Board's) September 30, 2021 meeting, the Board decided the following:

1. To approve Version 3.0 of the Two Rock Outfall Report;
2. To require Arctic to submit Version 3.1 of the Two Rock Outfall Report by January 4, 2022 to include Revisions A to C;
3. To direct Arctic to submit the Plume Delineation Study Report by January 4, 2022 according to the Two Rock Outfall Report and information required by Decisions 6 and 7;
4. To approve the use of a 100 m mixing zone within Horseshoe Lake;
5. To require that the frequency of sampling at SNP Station 0008-Sa9b be consistent with SNP Station 0008-Sa3;
6. To direct Arctic to include tabular data of expected effluent and receiving water quality in the Plume Delineation Study Report;
7. To require the Two Rock Plume Delineation Report to present the Study results as described in Section 4.0 of the Two Rock Outfall Report (i.e., at the reduced Discharge rate) and results from a Plume Delineation Study at the highest Discharge rate achieved in 2021, if it exceeds 0.015 m<sup>3</sup>/s;
8. If Arctic does not achieve the operational Discharge rate (0.1 m<sup>3</sup>/s) in 2021, to require Arctic to include a revision to the Plume Delineation Study, in Version 3.1 of the Report that explains

Arctic's plan for conducting a Plume Delineation Study at 'worst-case scenario conditions' to fulfill the requirements of Part H, Condition 31 of the Licence.

9. To direct Arctic to measure specific conductivity along the 100 m contour line for each Discharge rate and use the location with the highest specific conductivity as SNP Station 0008-Sa9b; and
10. To require Arctic to submit a notification to the Board and the Inspector prior to any Discharge rate increases. The notification is to include a summary of the results of the steps outlined in Section 5.2 of the Report demonstrating that water quality predictions at the edge of the mixing zone will meet water quality benchmarks at the next Discharge rate.

## **2.0 Background**

Part H, Condition 30 of Water Licence W2020L2-0004<sup>5</sup> requires Arctic to submit a Two Rock Outfall Report (the Report) "detailing the final proposed design of the outfall from Two Rock Sedimentation Pond into Horseshoe Lake to the Board for approval" at least one year prior to discharging from Two Rock Sedimentation Pond (TRSP). The requirements for the Report are outlined in Schedule 6, Condition 6.

The Two Rock Outfall Report Version 1.1 was approved on August 27, 2018<sup>6</sup> and described Discharge into Horseshoe Lake via a diffuser. The Sable Diffuser Construction Report was approved with additional direction on July 27, 2018.<sup>7</sup> Following approval of these Reports, conversations between Board staff and Arctic identified that the Company was considering Discharging from the TRSP without a diffuser. On September 29, 2020, the Board clarified that if planned Discharge differed from the approved Two Rock Outfall Report, the Company was to submit an updated Two Rock Outfall Report for approval prior to Discharge from the TRSP.<sup>8</sup> Arctic submitted Version 2.0 of the Report on January 5, 2021, which proposed Discharging directly to the area that was formerly the Two Rock-Horseshoe Lake Stream, upstream of the Horseshoe Lake shoreline.<sup>9</sup> On March 18, 2021, the Board decided not to approve Version 2.0 of the Two Rock Outflow Report and provided direction for the next version to address Licence requirements and the potential impacts to fish habitat related to the newly proposed bank Discharge. .<sup>10</sup>

Version 3.0 of the Two Rock Outfall Report (the Report) was submitted on July 23, 2021.<sup>11</sup> The cover letter of the Report also requested "authorization to Discharge an estimated pumping volume of 100,000 to 150,000 m<sup>3</sup> of water from TRSP to Horseshoe Lake in 2021 in accordance with the Precautionary Discharge Plan described in the Report attached, should approval of this plan be further delayed." The Report was distributed for public review on July 27, 2021. Review comments were due on August 24, 2021, with

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<sup>5</sup> Board staff note that the Report was originally submitted under [W2012L2-0001](#); however, on August 18, 2021, the renewed Licence, [W2020L2-0004](#), came into effect.

<sup>6</sup> See WLWB Online Registry at [www.wlwb.ca](http://www.wlwb.ca) for [W2012L2-0001 - Ekati - Two Rock Outfall Design Report - Version 1.1 - Board Letter - Aug 27 18.pdf](#)

<sup>7</sup> See WLWB Online Registry for [W2012L2-0001 - Ekati - Sable Diffuser Construction Plan - Directive and Reasons for Decision - Jul 27 18.pdf](#)

<sup>8</sup> See WLWB Online Registry for [W2012L2-0001 - Ekati - Requests and Notifications letter - Reasons for Decision - Sep 29 20.pdf](#)

<sup>9</sup> See WLWB Online Registry for [W2012L2-0001 - Ekati - Two Rock Outflow Report - Version 2.0 - Jan 5 21](#)

<sup>10</sup> See WLWB Online Registry for [W2012L2-0001 - Ekati - Two Rock Outflow Design Report - Version 2.0 - Reasons for Decision - Mar 19 21](#)

<sup>11</sup> See WLWB Online Registry for [W2012L2-0001 - Ekati - Two Rock Outfall Report - Version 3.0 - Jul 23 21](#)

Proponent responses due on August 31, 2021. Comments and recommendations were received from Environment and Climate Change Canada (ECCC), Government of Northwest Territories – Environment and Natural Resources (GNWT-ENR), Independent Environmental Monitoring Agency (IEMA), and Fisheries and Oceans Canada (DFO); Board staff also asked questions. The Wek'èezhii Renewable Resources Board indicated it had no comments or recommendations at this time. Arctic responded to all recommendations by the August 31, 2021 deadline. Reviewer comments and proponent responses are available on the WLWB Online Registry.<sup>12</sup>

Ecometrix Inc. was contracted to assist in the analysis of reviewer comments and recommendations and proponent responses.

In the analysis of reviewer comments and recommendations and proponent response, it was unclear if Arctic had provided sufficient information to address DFO's recommendation. The Board relies on DFO to obtain expert input and additional information in relation to fish and fish habitat. Therefore, as per rule #6 of the Board's Rules of Procedure,<sup>13</sup> an Information Request (IR)<sup>14</sup> was issued to DFO on September 13, 2021 to assist the Board in its decision-making process on Version 3.0 of the Report. DFO responded by the deadline of September 15, 2021.<sup>15</sup> Arctic was then given an opportunity to respond and provided its response on September 16, 2021.<sup>16</sup>

A second IR was issued to Arctic on September 15, 2021 to answer follow-up questions regarding Arctic's responses to reviewer comments and recommendations.<sup>17</sup> Arctic responded by the deadline of September 17, 2021.<sup>18</sup>

Further clarifications regarding the Precautionary Discharge Plan were requested from Arctic on September 21, 2021.<sup>19</sup> Arctic responded later that day and provided the requested information.<sup>20</sup>

On September 29, Arctic was contacted to provide additional clarification on the IR that was issued to Arctic on September 15, 2021.<sup>21</sup> Arctic responded later that day and provided the requested information.<sup>22</sup>

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<sup>12</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report V3.0 – Review Summary and Attachments – Aug 31 21](#)

<sup>13</sup> [MVLWB Rules of Procedure, Including Public Hearings \(2018\)](#)

<sup>14</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Version 3.0 – Information Request to DFO – Sep 13 21](#)

<sup>15</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Version 3.0 – DFO Response to IR – Sep 15 21](#)

<sup>16</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Arctic Response to DFO Response to IR – Sep 16 21](#)

<sup>17</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Version 3.0 – Information Request to Arctic – Sep 15 21](#)

<sup>18</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Arctic Response to WLWB IRs – Sep 17 21](#)

<sup>19</sup> See WWLB Online Registry for [Ekati – Two Rock Outfall Report – Correspondence with Arctic Re Monitoring – Sep 21 21](#)

<sup>20</sup> *Ibid.*

<sup>21</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Correspondence with Arctic Re Sept 15 IR – Sep 29 21](#)

<sup>22</sup> *Ibid.*

### **3.0 Reasons for Decision**

Part H, Condition 30 of Water Licence W2020L2-0004 (formerly W2012L2-0001) requires Arctic to submit a Two Rock Outflow Report in accordance with Schedule 6, Condition 6. The Board did not approve Version 2.0 because it determined that the submission did not meet the requirements of the Licence. In addition, the Board stated that it was unclear how Arctic had considered and addressed concerns associated with fish habitat that were raised in 2009.<sup>23</sup> The Board thus required Arctic to submit Version 3.0 to include: the design of a plume delineation study; the results of modelling the initial effluent into Horseshoe Lake; proposed location(s) of Surveillance Network Program (SNP) station 0008-Sa9; an updated Figure 2-3 to include infrastructure required for Discharge; and information pertaining to any fish habitat that could potentially be impacted by the proposed Discharge location.<sup>24</sup> These Licence requirements and Board direction from Version 2.0 are discussed in sections below.

### **3.1 Overall Decision**

The Report was reviewed for conformity to: Part H, Condition 30 of the Licence;<sup>25</sup> Schedule 6, Condition 6 of the Licence;<sup>26</sup> and the Board's decision on Version 2.0 of the Report.<sup>27</sup> The Report is currently proposing to Discharge from the TRSP into the Two Rock-Horseshoe Lake Stream which flows into Horseshoe Lake. The relative conservatism of the water quality and mixing models (Section 3.3 of this Reasons for Decision) in combination with the Precautionary Discharge Plan (Section 3.7 of this Reasons for Decision) and updated monitoring through the Surveillance Network Program (SNP) gives the Board confidence that Discharge from the TRSP is not anticipated to exceed water quality benchmarks and will be adjusted, as necessary, to ensure no adverse impacts to the receiving environment occurs. Additionally, Arctic has resolved outstanding concerns regarding the impacts to fish habitat (Section 3.8 of this Reasons for Decision).

The Board also reviewed all reviewer recommendations and proponent responses submitted during the public review period. In consideration of Arctic's submission, reviewer comments, proponent responses, the Board has approved Version 3.0 of the Two Rock Outfall Report. The Board has also identified additional requirements for the Plume Delineation Study Report (see Section 3.5) and is requiring notifications to the Board and the Inspector in advance of increases to the Discharge rate during bank Discharge (see Section 3.7). Through this review process, Arctic has also committed to conduct additional fish monitoring at the Two Rock - Horseshoe Lake Stream (see Section 3.8). To ensure these additional requirements and commitments are reflected in the Report, the Board requires Arctic to submit Version 3.1 of the Report to include Revisions A through C, as outlined in the Reasons for Decision. As discussed in Section 3.5 of this Reasons for Decision, the Board is requiring submission of the Plume Delineation Study Report on or before January 4, 2022. Because results of the Plume Delineation Study may inform

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<sup>23</sup> See WLWB Online Registry for [W2009L2-0001 – BHP – Amended WL – Reasons for Decision and Letter to Minister – Jun 26 09](#)

<sup>24</sup> See WLWB Online Registry for [W2012L2-0001 – Ekati – Two Rock Outflow Design Report – Version 2.0 – Reasons for Decision – Mar 19 21](#)

<sup>25</sup> See WLWB Online Registry for [Ekati – Water Licence – Aug 24 21](#)

<sup>26</sup> *Ibid.*

<sup>27</sup> See WLWB Online Registry for [W2012L2-0001 – Ekati – Two Rock Outflow Design Report – Version 2.0 – Reasons for Decision – Mar 19 21](#)

additional changes to the Two Rock Outfall Report (Section 3.5 of this Reasons for Decision), the Board believes submitting the updated Two Rock Outfall Report with the Plume Delineation Study Report will provide for a more efficient process and limit the number of times the Two Rock Outfall Report may need to be updated and reviewed. Thus, the Board is also requiring Arctic to submit Version 3.1 of the Two Rock Outfall Report on or before January 4, 2022.

- ***Decision 1: The Board has approved Version 3.0 of the Two Rock Outfall Report.***
- ***Decision 2: The Board requires Arctic to submit Version 3.1 of the Report by January 4, 2022 to include Revisions A through C.***

Part H, Condition 31 of the Licence requires Arctic to submit a Plume Delineation Study Report within eight months of the beginning of Discharge from TRSP. The Study Report is to present the results from the Plume Delineation Study, discussed in Section 3.5, and may also be used to support a change to the location of SNP Station 0008-Sa9b. The Board has approved Version 3.0 of the Two Rock Outfall Report, which allows for Arctic to change the Discharge rate according to water quality monitoring results. The Board has decided to require Arctic to submit the Plume Delineation Study Report on or before January 4, 2022. While the Licence requires that the Plume Delineation Study Report be submitted within eight months of the beginning of Discharge from TRSP, the Board is requiring an earlier timeline to ensure adequate time is available prior to Discharge in 2022 to consider any changes to the SNP station or the Two Rock Outfall Report that may be required as a result of the Study.

- ***Decision 3: The Board directs Arctic to submit the Plume Delineation Study Report by January 4, 2022, according to the Two Rock Outfall Report and information required by Decisions 6 and 7.***

### **3.2 Proposed Discharge Method**

As per Schedule 6, Condition 6(a), the Two Rock Outfall Report must provide specifications of the proposed Discharge pipeline and diffuser. Section 2.5 of the Report provides specifications for Discharge through the former Two Rock-Horseshoe Stream (bank Discharge) and the formerly proposed diffuser (diffuser Discharge). As required by the Board, a figure indicating the end-of-pipe location was included in the Report. Arctic states that it is proposing to only use the bank Discharge method. The Report details that the Two Rock-Horseshoe Stream is not fish habitat, has natural features that will reduce velocity and erosion, and will promote dispersion into Horseshoe Lake. Additionally, the Report noted that bank Discharge eliminates the need to disturb the lakebed to install a diffuser. IEMA expressed support for the bank Discharge method proposed in the Report (IEMA comment 2); no other reviewers provided an overall recommendation with regards to the bank Discharge method. The Board is therefore satisfied that the Schedule 6, Condition 6(a) requirement has been met and Board direction from Version 2.0 has been addressed.

### 3.3 Modelling Results

In the Report, Arctic has presented three models that collectively serve to predict where water quality benchmarks will be met as required by Schedule 6, Condition 6(c) of the Licence. Comments and recommendations about the models were received from ECCC, GNWT-ENR, IEMA, and Board staff. The models are as follows:

- TRSP Water Quality Model;
- Horseshoe Lake Plume Mixing Model; and
- Horseshoe Lake Three-Dimensional GEMSS Model.

#### 3.3.1 TRSP Water Quality Model

The TRSP Water Quality Model predicts water quality in the TRSP and is used to determine if the effluent that will be Discharged will meet Effluent Quality Criteria (EQC). Predictions from this model were also used as inputs to the mixing models discussed below. In the Report, the model was updated with more recent data from the Sable Pit sump to accurately reflect current conditions. In Version 2.0 of the Report, it was unclear whether Arctic understood that all Discharges from the TRSP were subject to the EQC at SNP Station 0008-Sa3 outlined in Part H, Condition 21(d) of the Licence. The model included in Version 3.0 predicts that EQC will be met in the TRSP prior to Discharge at SNP Station 0008-Sa3.

Given that the results of this model are used as inputs to the Horseshoe Lake mixing model, ensuring that the model is using representative data and incorporates conservatism is a key consideration. ECCC recommended Arctic provide information on the sample sizes and discuss limitations associated with eliminating samples with TSS concentrations greater than 50 mg/L TSS (ECCC comment 2). Arctic provided the requested information in its response and indicated that the sample size (15 with 2 samples eliminated) is adequate to predict future concentrations in the TRSP. The Board is of the opinion that the information provided in Arctic's response, in addition to information in the Report suggest that the dataset is adequate for the model. GNWT-ENR recommended Arctic clarify if modifying model inputs using Calibrated Scaling Factors (for metals) and Calibrated Decay Rates (for nutrients) incorporates any degree of conservatism into the model and that Arctic include modifications that correspond to the 95<sup>th</sup> percentile of measured values in the TRSP to ensure the model outputs are conservative (GNWT-ENR comment 4). In response to GNWT-ENR's recommendation, Arctic stated that the modification factors reduce overprediction of concentrations in the TRSP without eliminating it; however, no evidence of conservatism in predicted concentrations was included in the Report. To determine the degree to which the model is overpredicting concentrations in the TRSP, the Board issued an IR to Arctic.<sup>28</sup> In response to the IR, Arctic provided plots of predicted water quality over time in the TRSP with an overlay of observed water quality in the TRSP. In Arctic's response to IR, the source of the modelled data was unclear and Arctic was contacted to provide clarification.<sup>29</sup> In its response, Arctic confirmed that the modelled data in the plots were from the TRSP Water Quality Model and represent the Base Case and Reduced Discharge

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<sup>28</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Version 3.0 – Information Request to Arctic – Sep 15 21](#)

<sup>29</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Correspondence with Arctic Re Sept 15 IR – Sep 29 21](#)



Trucking Out scenarios in the Report for 2018 to 2020. Therefore, these plots confirmed that the model generally overpredicts concentrations of parameters in the TRSP when compared to recent years; however, there are some parameters that are not always overestimated (i.e., aluminum, iron, magnesium, zinc, nitrate, and nitrite). These plots suggest that the model is slightly conservative and generally not underpredicting the concentrations in the TRSP.

### ***3.3.2 Horseshoe Lake Plume Mixing Model***

Water quality predictions from the TRSP Water Quality Model were used as an input into the Horseshoe Lake Plume Mixing Model to characterize plume mixing and concentrations in the initial mixing zone in Horseshoe Lake. This model predicts the dilution of effluent under four different scenarios: (1) diffuser Discharge, high current; (2) diffuser Discharge, low current; (3) bank Discharge, high current; and (4) bank Discharge, low current. All scenarios use a Discharge rate of 0.1 m<sup>3</sup>/s, which Arctic refers to as an “operational Discharge rate.” Based on the model inputs, Arctic states that a 20:1 dilution ratio must be achieved to meet water quality benchmarks at the edge of the proposed mixing zone. Using a Discharge rate of 0.1 m<sup>3</sup>/s, the 20:1 dilution ratio is achieved at different distances from the point of Discharge for each scenario: (1) 2.08 m; (2) 51.48 m; (3) 347.37 m; and (4) 216.97 m. Arctic has acknowledged that at a 0.1 m<sup>3</sup>/s Discharge rate, the 20:1 dilution ratio would not be achieved within the proposed mixing zone using bank Discharge (Scenario 3 and 4). Arctic states “in the case that the Discharge flow rate is reduced to 0.015 m<sup>3</sup>/s from 0.1 m<sup>3</sup>/s, the 20:1 dilution ratio can be met at a shorter distance for Scenario 3 and Scenario 4, at 98.45 and 57.72 m.” No comments or recommendations were received from reviewers regarding the Horseshoe Lake Plume Mixing Model.

### ***3.3.3 Horseshoe Lake Three-Dimensional GEMSS Model***

The purpose of this model is to model whole-lake and near-field effluent mixing in Horseshoe Lake, accounting for seasonal changes, lake stratification, ice cover, and detailed diffuser specifications. The model evaluated the concentrations of 15 water quality variables. Six variables (aluminum, ammonia, copper, nitrite, nitrate, total phosphorus) had concentrations that were close to water quality benchmarks at the edge of the proposed mixing zone and therefore, the Report focused on these variables. The following scenarios were modelled to determine water quality at the edge of the proposed mixing zone:

- No Discharge;
- Diffuser Discharge base case;
- Bank Discharge base case;
- Diffuser Discharge with trucking;
- Bank Discharge with trucking; and
- Reduced flow.

Table 3-10 in the Report presents the background concentrations in Horseshoe Lake that were used in the model. ECCC and GNWT-ENR commented that the background concentrations for Horseshoe Lake provided in Table 3-10 do not include a description of what data the values were based on (ECCC comment 4; GNWT-ENR comment 5). GNWT-ENR’s comment stated, “a better understanding of the ambient

concentrations incorporated into the model of Horseshoe Lake is required to evaluate whether model outputs reflect a conservatively realistic prediction of the influence TRSP effluent will have on the receiving environment.” Reviewers recommended that Arctic provide additional information on the Horseshoe Lake background concentrations, including the sample size and what statistical metric the values represent. Arctic responded with the sample sizes and indicated that the values in Table 3-10 represent the average median baseline data values from Horseshoe Lake, Two Rock Lake, and Ulu Lake that were collected prior to the construction of the TRSP and Sable Pit development. Arctic highlighted that this information was used in the development of the Sable AEMP and conservatism has been included in the modelling approach through many different means. An IR was issued to Arctic to provide plots demonstrating that predicted concentrations reflect measured concentrations in Horseshoe Lake.<sup>30</sup> In its response, Arctic provided plots demonstrating that modelled concentrations were generally overpredicting concentrations when compared to observed concentrations in Horseshoe Lake.<sup>31</sup> Upon review of the Horseshoe Lake plots, the source of the modelled predictions included in Arctic’s response to the IR was unclear and Arctic was contacted to provide clarification.<sup>32</sup> In its response, Arctic stated that the plots provided in response to the IR were not from the GEMSS model but from the GoldSim model. The GoldSim model was not used in the Report to predict future concentrations in Horseshoe Lake, but was used to model downstream waterbodies to verify that the model was not leading to unreasonable concentrations when results were carried downstream. Additionally, Arctic stated that the results from the GoldSim model are similar to the GEMSS model before 2021 because there was no Discharge from the TRSP therefore “both models predict the same results and both models agree with the observed data to extent shown in the plots [provided in response to the September 15, 2021 IR].” Based on the information provided in the Report, Arctic’s response to reviewer recommendations, and information provided in response to the WLWB’s IR, the Board is of the opinion that the dataset used for baseline characterization is acceptable and that the model adequately predicts concentrations in Horseshoe Lake under recent existing conditions.

In Section 3.2.4.7 of the Report, Arctic states that total phosphorus (TP) is predicted to exceed benchmarks under all scenarios and links these predicted exceedances with naturally occurring TP concentrations in Horseshoe Lake. The Report also highlights that aluminum, ammonia, nitrate, and copper exceed the respective benchmarks in the modelled base case but are below the respective benchmarks in both mitigation scenarios (i.e., trucking out water and reduced flow) during Discharge. ECCC recommended that Arctic provide additional information related to the naturally elevated TP concentrations in Horseshoe Lake and evidence that Discharging into Horseshoe Lake and the associated TP water quality benchmark exceedances are within the range of natural variability (ECCC comment 5). Arctic responded by discussing the measured background concentrations in Horseshoe Lake and stating that the model suggests: that benchmark exceedances for TP only occur under ice in any scenario; there is little difference between base case concentrations and any Discharge scenario; TP is predicted to remain below benchmarks throughout the open-water season; and TP is not elevated in the Discharge. Based on this

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<sup>30</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Version 3.0 – Information Request to Arctic – Sep 15 21](#)

<sup>31</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Arctic Response to WLWB IRS – Sep 17 21](#)

<sup>32</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Correspondence with Arctic Re Sept 15 IR – Sep 29 21](#)

information Arctic has concluded that TP is not predicted to adversely affect aquatic life in Horseshoe Lake. This information supports Arctic's conclusion that Discharge from TRSP contributes minimally to phosphorus in Horseshoe Lake and it remains within the range of natural variability.

In the Report, Arctic states that the six water quality variables predicted to exceed benchmarks are predicted to exceed them during the under-ice period for one to six days in December in the shallow sections of Horseshoe Lake. To quantify the under-ice exceedances, GNWT-ENR recommended that Arctic initiate sampling at the location where solute exclusion is likely to cause water quality benchmark exceedances to confirm if the exceedances are a result of ice formation or if the exceedances are occurring under ice (GNWT-ENR comment 8). Arctic indicated that the ice thickness in Horseshoe Lake exceeds the depth of Horseshoe Lake where the solute exclusion is predicted to occur. Therefore, Arctic stated that obtaining representative samples would not be operationally feasible. The Board agrees that sampling to determine if solute exclusion is occurring in shallow areas would be operationally difficult and would not provide significant benefit.

Based on Arctic's proposed operational Discharge rate (0.1 m<sup>3</sup>/s) and annual duration of Discharge (45 days), GNWT-ENR highlighted that this corresponds to approximately 26% of the total volume of Horseshoe Lake (GNWT-ENR comment 6). GNWT-ENR recommended Arctic clarify if interannual loading was included in the model and that Arctic characterize the turnover of Horseshoe Lake to clarify whether the interannual increase in concentrations modelled in the nearfield and midfield reflect interannual loading or the project increases over time as a result of Discharge. Arctic confirmed that interannual loading, including accumulation of constituents over time, and vertical stratification with the potential for turnover was accounted for in the model. Arctic also indicated that Horseshoe Lake does not turnover because it is too shallow and provided vertical profiles of TP to demonstrate this. Overall, the Board is satisfied that this recommendation has been addressed because Arctic has demonstrated that interannual loading and vertical stratification is accounted for in the model.

### ***3.3.4 Summary of Modelling Results***

Overall, the Board is of the opinion that Arctic has demonstrated that the models are adequately conservative to demonstrate predicted water quality at the edge of the proposed mixing zone. Although the model is predicting exceedances for some of the variables, when paired with Arctic's Precautionary Discharge Plan (discussed below in section 3.7), it gives Arctic the flexibility to adapt Discharge to real-time water quality in Horseshoe Lake and prevent benchmark exceedances. Additional information regarding the details of how Arctic will execute the Precautionary Discharge Plan and report on changes is provided below.

### **3.4 Mixing Zone**

Based on the modelling results presented above, Arctic is proposing a 100 m mixing zone in Horseshoe Lake. Board staff asked Arctic to clarify what information Arctic is using to support the 100 m mixing zone, what contingencies are available to minimize the size of the mixing zone, and to confirm where Arctic intends to meet water quality benchmarks (WLWB staff comment 2). Arctic indicated that a 100 m mixing

zone is a “nearly universal size for a regulatory mixing zone.” With respect to site-specific reasons, Arctic indicated that 100 m is necessary to reach an area in Horseshoe Lake which is deep enough to allow for complete effluent mixing. Additionally, in the Precautionary Discharge Plan described below, Arctic has proposed to begin Discharge at a reduced rate (0.015 m<sup>3</sup>/s) using Presumptive Mitigation Measures, outlined in Section 5.1.1 of the Report, to ensure all parameters will remain below the water quality benchmarks at the edge of the proposed mixing zone.

Board staff also asked Arctic to provide specific references for where the MVLWB/GNWT Guidelines for Effluent Mixing Zone (Mixing Zone Guidelines)<sup>33</sup> were addressed in the Report and to provide the information if it does not exist within the Report (WLWB staff comment 1). This information, along with the Board’s assessment, is provided within Table 1.

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<sup>33</sup> [MVLWB/GNWT Guidelines for Effluent Mixing Zones \(2017\)](#)

Table 1. Mixing Zone Decision Criteria

| Decision Criteria   | Arctic's Response  | Board Analysis   |
|---|--|--|
| The dimensions of the mixing zone must be as small as practicable.  | 100 m is the minimum distance to reach parts of the lake that are smaller than 1.5 m which allow for sufficient mixing throughout the year.  | Based on the evidence provided in Arctic's response to WLWB staff comment 1 and to WLWB staff comment 2 discussed above, the Board has determined that this decision criterion has been addressed. |
| The mixing zone must not be of such size or shape as to cause or contribute to the impairment of existing or future water uses in the receiving environment.  | No other use is planned or likely within the proposed mixing zone.   | The Board has determined that this decision criterion has been addressed by Arctic's response to WLWB staff comment 1.   |
| Mixing zones must not be used as an alternative to reasonable and practical pollution prevention practices, including wastewater treatment.   | Arctic manages the water quality in the TRSP and will only Discharge water that meets approved EQC. Additional treatments have been proposed if needed to ensure water quality benchmarks are being met.   | Based on the evidence provided, the Board has determined that this decision criterion has been addressed.  |
| The mixing zone should not impinge on or contact critical fish or wildlife habitats (e.g., spawning or rearing areas for fish, habitats for migratory waterfowl).   | Section 3.0 of the Report provides evidence that the Two Rock-Horseshoe Lake Stream does not provide fish habitat because it is a braided, intermittent stream with many barriers to fish passage. The Discharge location is within a boulder garden which allows for dissipation of energy, preventing erosion of the stream bed. | Based on the evidence provided, the Board has determined that this decision criterion has been addressed and there is no evidence that critical fish habitat exists within the mixing zone.        |
| Mixing zones must not be established such that drinking water intakes are contained therein or otherwise negatively affected. Ideally, mixing zones should always be located as far away (i.e., downstream) as practical from drinking water intakes. | Horseshoe Lake does not have any drinking water intakes.   | Based on the evidence provided, the Board has determined that this decision criterion has been addressed.  |
| Conditions within the mixing zone should not cause acute toxicity to aquatic organisms.   | Effluent must meet EQC to be Discharged from the TRSP and the models presented above do not predict acute toxicity.  | The Board notes that EQC are set below acute toxicity concentrations and therefore, the Board has determined that this decision criterion has been addressed.                                      |

|   |  |   |
|---|--|---|
| <p>Mixing zones must not be established for substances that are persistent, toxic and bioaccumulative.</p>  | <p>None of the substances of concerns are bioaccumulative and water circulation within Horseshoe Lake will further prevent accumulation in the lake.</p>   | <p>An IR was issued to obtain Arctic's decision-making criteria for determining if a substance is bioaccumulative.<sup>34</sup> Arctic's response indicates that it reviewed the characteristics of the Discharge and TRSP source concentrations to determine if any of the variables are likely to be bioaccumulative. Arctic indicated that the main variables of concern are nitrate and TP which are readily metabolized and do not bioaccumulate. Therefore, the Board has determined that this decision criterion has been addressed.</p> |
| <p>The mixing zone must allow an adequate zone of passage for the movement or drift of all stages of aquatic life. The mixing zone should not interfere with migratory routes including migration into tributaries; specific portions of a cross-section of flow or volume may be allocated by the Boards for the purpose of migration.</p> | <p>In Section 3.0 of the Report, Arctic has indicated that the mixing zone will allow for movement of aquatic life and is not creating habitat for aquatic life within the Two Rock-Horseshoe Lake stream.</p>   | <p>Based on the evidence provided, the Board has determined that this decision criterion has been addressed as no evidence has been provided to indicate that the mixing zone will interfere with movement of aquatic life or create habitat.</p>   |
| <p>Water in the mixing zone should be free from nutrients in concentrations that create nuisance growths of aquatic weeds or algae or that results in an unacceptable degree of eutrophication of the receiving water.</p>  | <p>The model currently predicts that TP and nitrate may exceed the water quality benchmarks at the edge of the mixing zone. Arctic has many adaptive mitigation measures in place to ensure that benchmark exceedances at the edge of the mixing zone will be prevented.</p> | <p>The Board notes that the adaptive management measures include beginning Discharge at a reduced rate, nitrogen source and release control practices, and restricting Discharge to the open water season. Additionally, the modelling predicts that exceedances are related to solute exclusion when Horseshoe Lake is frozen and are likely to dissipate during the open-water season. For these reasons, the Board has determined that this decision criterion has been addressed.</p>   |
| <p>Mixing zones should not unduly attract aquatic life or wildlife, thereby causing increased exposure to substances of potential concern.</p>  | <p>Arctic has stated that nothing in the configuration of the mixing zone is anticipated to attract wildlife and aquatic life.</p>   | <p>The Board has determined that this decision criterion has been addressed by Arctic's response to WLWB staff comment 1.</p>   |

<sup>34</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Version 3.0 – Information Request to Arctic – Sep 15 21](#)

|   |  |   |
|---|--|---|
| <p>Accumulation of toxic substances in sediment to toxic levels should not occur in the mixing zone.</p>  | <p>Arctic anticipates that the substances in the Discharge will primarily be dissolved and plans to confirm this through the Aquatic Effects Monitoring Program (AEMP).</p> <p>During the public review, IEMA recommended Arctic provide an analysis of potential effects the Discharge may have on Horseshoe Lake sediment quality and the biota located within the area of the dispersion plume (IEMA comment 2). Arctic responded that the TRSP is designed to filter out suspended solids and therefore Discharge has low suspended solids and constituents are expected to be primarily dissolved. The dissolved parameters are not expected to precipitate or settle into the mixing zone and therefore will not have a measurable effect on the sediment quality.</p> | <p>Based on Arctic's response to IEMA comment 2, the Board is of the opinion that it is a reasonable expectation that suspended solids from the TRSP will be low and erosion in the Two Rock-Horseshoe Lake Stream will be identified through inspections and mitigated if necessary. Therefore, this decision criterion is addressed because impacts to sediment quality are not expected.</p> |
| <p>Mixing zones should not contain substances that render the mixing zone aesthetically unacceptable, including, for example, materials which form objectionable deposits (e.g., scums, oil, or floating debris) or substances producing objectionable colour, odour, taste or turbidity.</p> | <p>No aesthetically unacceptable substances are planned for the Discharge.</p>   | <p>The Board has determined that this decision criterion has been addressed by Arctic's response to WLWB staff comment 1.</p>   |
| <p>The mixing zone must be able to maintain its assimilative capacity (e.g., loading).</p>  | <p>The modelling included in the Report incorporates loading and assimilative capacity, and demonstrates that the mixing zone can maintain the assimilative capacity.</p>  | <p>Based on the modelling results presented in the Report and Arctic's response to WLWB staff comment 1, the Board has determined that this decision criterion has been addressed.</p>  |

Based on the information provided in Table 1 and Arctic's response to questions, the Board is of the opinion that Arctic has addressed the Mixing Zone Guideline's decision-making criteria for allocation of a regulated mixing zone. As discussed in Section 3.5, the Plume Delineation Study will be used to verify the size of the mixing zone and the associated location of SNP Station 0008-Sa9b where water quality benchmarks are anticipated to be met. If the Plume Delineation Study suggests that SNP Station 0008-Sa9b needs to be relocated (i.e., no longer at 100 m from the bank Discharge), the Board expects the Plume Delineation Study Report to be submitted with a request to change the location of SNP Station 0008-Sa9b with supporting rationale. The rationale for changing the location of an SNP station should, at minimum, include evidence as required by the Mixing Zone Guidelines to support the proposed change to the mixing zone.

Based on the information provided during this proceeding, lack of reviewer comments indicating concern with a 100 m mixing zone, and the opportunity to confirm the location of SNP Station 0008-Sa9b, the Board has determined that the size of the mixing zone is as minimized as possible and the impacts to the receiving environment will be minimized to the extent practicable. Therefore, at this time, the Board is approving the use of a 100 m mixing zone. The Board notes that if Arctic proposes to change the location of SNP Station 0008-Sa9b, that change would be subject to public review and Board approval and is further discussed in Section 3.6 of this Reasons for Decision.

➤ ***Decision 4: The Board approves the use of a 100 m mixing zone within Horseshoe Lake.***

### **3.5 Plume Delineation Study Design**

As per Schedule 6, Condition 6(e), the Two Rock Outfall Report must contain the design of a Plume Delineation Study (Study) to confirm initial mixing in Horseshoe Lake. Part H, Condition 31 of the Licence requires Arctic to submit a Two Rock Plume Delineation Report to the Board that includes the results of the Study and will be used to verify the location of SNP Station 0008-Sa9. The Study design for bank Discharge was also required by the Board's decision on Version 2.0 of the Two Rock Outfall Report.<sup>35</sup> Section 4 of the Report outlines the proposed plan for the Study with the objective of confirming how the Discharge from the TRSP will behave in the receiving environment. Arctic is proposing to conduct the Study after one week of Discharge at the reduced Discharge rate of 0.015 m<sup>3</sup>/s. Comments and recommendations about the Study Design were received from ECC and GNWT-ENR.

Currently, Arctic is proposing to use SNP station 0008-Sa9b to demonstrate that Arctic is meeting water quality benchmarks at the edge of the mixing zone. Arctic stated that there is a significant difference between the specific conductivity of the Discharge and water in Horseshoe Lake; therefore, Arctic is proposing to sample specific conductivity along the 100 m distance contour<sup>36</sup> at different depths to determine the direction and distance the plume is travelling within the mixing zone, following Discharge at 0.015 m<sup>3</sup>/s for one week. Currently, Arctic is proposing to select the location of SNP Station 0008-Sa9b

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<sup>35</sup> See WLWB Online Registry for [W2012L2-0001 – Ekati – Two Rock Outfall Design Report – Version 2.0 – Reasons for Decision – Mar 19 21](#)

<sup>36</sup> Figure 4-1 in the Report depicts the 100 m line which represents 100 m in any direction in Horseshoe Lake from the point of bank Discharge.



along the 100 m distance contour, in the deeper part of Horseshoe Lake, where specific conductivity indicates the plume is located. SNP Station 0008-Sa9b will then be sampled, in accordance with the SNP requirements, to determine the dilution ratio and confirm that water quality remains below benchmarks. The current SNP sampling requirements for SNP Station 0008-Sa9b are “once each year after spring break-up and before fall freeze-up,” to commence with Construction of the Sable Pit. In Section 2.7.6, the Board understands that Arctic has indicated that sampling at SNP Station 0008-Sa9b will be collected at the same frequency as SNP Station 0008-Sa3. The sampling frequency for SNP Station 0008-Sa3 when Discharging from TRSP is:

- Up to four weeks prior to Discharge;
- On the first day of Discharge, weekly during period of Discharge, and on the final day of Discharge; and
- Once each year during first week of Discharge (after spring break-up) and once each year during the last week of Discharge (before fall freeze-up).

This sampling frequency ensures that samples are being collected when Discharge from the TRSP is occurring and not limited to once at spring break-up and once before fall freeze-up. The Board has therefore decided that the frequency of sampling for SNP Station 0008-Sa9b must be consistent with SNP Station 0008-Sa3.

- ***Decision 5: The Board has decided that the frequency of sampling for SNP Station 0008-Sa9b must be consistent with SNP Station 0008-Sa3 and has updated the SNP accordingly.***

With respect to the Study, ECCC commented that there is no clear summary table of what the expected effluent and water quality concentrations at the edge of the mixing zone may be and that this information would be expected to be used for comparison and evaluation purposes as part the Study (ECCC comment 6). ECCC recommended that Arctic provide this information to be used for analysis as part of the Study. Arctic responded that predicted Discharge concentrations over time are presented in graphical format in Appendix B and also provided a tabular summary of these data in its response. The Board is of the opinion that the graphical data included in the Report was sufficient for consideration at this time; however, the Board is of the opinion that tabular data for predicted concentrations at 100 m in Horseshoe Lake should also be included in the Plume Delineation Report for comparison and evaluation purposes. Therefore, the Board directs Arctic to include tabular data of expected effluent and receiving water quality in the Plume Delineation Study Report. Because the Board is already requiring an updated version of the Two Rock Outfall Report (see section 3.1 of this Reasons for Decision), the Board is directing Arctic to reflect the requirement for tabular data in Section 4 of Version 3.1 of the Two Rock Outfall Report.

- ***Decision 6: The Board directs Arctic to include tabular data of expected effluent and receiving water quality in the Plume Delineation Study Report.***
- ***Revision A: The Board directs Arctic to include the requirement for tabular data in the Plume Delineation Study Report in Section 4 of Version 3.1 of the Two Rock Outfall Report.***

GNWT-ENR commented that the Report indicates the Study will be conducted at Arctic's reduced flow rate (0.015 m<sup>3</sup>/s) and will not be repeated if Arctic increases to the operational flow rate (0.1 m<sup>3</sup>/s; GNWT-ENR comment 3). GNWT-ENR recommended that Arctic confirm the location of SNP Station 0008-Sa9b at the reduced flow rate and conduct a second Study at the operational flow rate. Arctic responded the Discharge rates will vary through the open water season and that a review of the data from the existing plume delineation study will be performed to account for these changing pumping scenarios; however, a second Study is not required. The Board notes that the Licence requires that the Two Rock Plume Delineation Report include the results of a plume delineation study that, at minimum, will be performed under worst-case conditions with respect to mixing within Horseshoe Lake. It is the Board's opinion that that the reduced Discharge rate that Arctic will begin Discharging at does not represent 'worst-case scenario conditions' with respect to mixing because as the Discharge rate increases, a reduction in the dilution rate and assimilative capacity would be expected. It is also unclear if the plume may behave differently as Discharge rate increases. Thus, the Board is requiring the Two Rock Plume Delineation Report to present the Study results as described in Section 4.0 of the Two Rock Outfall Report (i.e., at the reduced Discharge rate). In addition, to meet the requirement of Part H, Condition 31, the Board also requires the Study to be conducted at the highest Discharge rate achieved in 2021 (if greater than 0.015 m<sup>3</sup>/s) with those results also presented in the Two Rock Plume Delineation Report. In other words, the Plume Delineation Study Report, required on or before January 4, 2022, must include results from the reduced flow rate and from the highest Discharge rate achieved in 2021, if it is greater than 0.015 m<sup>3</sup>/s.

- ***Decision 7: The Board is requiring the Two Rock Plume Delineation Report to present the Study results as described in Section 4.0 of the Two Rock Outfall Report (i.e., at the reduced Discharge rate) and results from a Plume Delineation Study at the highest Discharge rate achieved in 2021, if it exceeds 0.015 m<sup>3</sup>/s.***

If Arctic does not achieve the maximum proposed Discharge rate (0.1 m<sup>3</sup>/s) in 2021, it is possible that many incremental increases in the Discharge rate may be required in the future. Every increase in Discharge rate would then represent 'worst-case scenario conditions' and require an updated Plume Delineation Study Report. Updating the Plume Delineation Study Report would be cumbersome and place unnecessary burden on Arctic, reviewers, and the Board. If Arctic does not achieve the operational Discharge rate (0.1 m<sup>3</sup>/s) in 2021, the Board directs Arctic to include a revision to the Plume Delineation Study, proposed in Version 3.1 of the Report, that explains Arctic's plan for conducting a Plume Delineation Study at 'worst-case scenario conditions' to fulfill the requirements of Part H, Condition 31 of the Licence.

- ***Decision 8: That Board had decided that if Arctic does not achieve the operational Discharge rate (0.1 m<sup>3</sup>/s) in 2021, the Board directs Arctic to include a revision to the Plume Delineation Study, proposed in Version 3.1 of the Report, that explains Arctic's plan for conducting a Plume Delineation Study at 'worst-case scenario conditions' to fulfill the requirements of Part H, Condition 31 of the Licence.***

Section 5.2 of the Mixing Zone Guidelines discusses plume delineation studies and states that mixing is dependent on flow characteristics of the receiving waterbody (e.g., current, wind, temperature) and Discharge characteristics.<sup>37</sup> Additionally, the Mixing Zone Guidelines state “the study is usually conducted by analyzing samples of water taken at different locations around the discharge point and extending into the receiving water body in a grid like pattern.”<sup>38</sup> Given that Arctic is proposing to Discharge according to the Precautionary Discharge Plan, which allows for changes to the flow rate based on real-time water quality, the Board is of the opinion that a static location of SNP Station 0008-Sa9b is not sufficient to ensure the plume is being captured given the anticipated increases in Discharge rate. For example, if the SNP is updated to reflect a specific location for SNP 0008-Sa9b and the plume shifts as a result of increased Discharge rates, the measurements at the SNP station may no longer be accurately measuring the effluent plume. To ensure the plume is being captured in SNP sampling, while accounting for changes in environmental conditions and Discharge rates, the Board decided to update the SNP as discussed in Section 3.6 below.

### **3.6 Proposed SNP Location**

As per Schedule 6, Condition 6(d), the Two Rock Outfall Report must propose a location for SNP Station 0008-Sa9 to verify the model of initial effluent mixing in Horseshoe Lake. Based on the modelling results and mixing zone discussed above, Arctic is proposing a 100 m mixing zone in Horseshoe Lake. Arctic is therefore proposing that SNP Station 0008-Sa9b be located 100 m from the point of bank Discharge. In the Report, Arctic states that the location of the plume will be determined using specific conductivity because the Discharge and Horseshoe Lake have measurable differences in specific conductivity. Along the 100 m contour line, the highest measured specific conductivity will be selected as the location for SNP Station 0008-Sa9b.

Board staff asked Arctic to confirm and explain how the location of SNP 0008-Sa9b will be used to verify initial mixing of effluent in Horseshoe Lake (WLWB staff comment 3). Arctic responded that SNP Station 0008-Sa9b is proposed to be located 100 m from the point of Bank Discharge, where Discharge from the TRSP is expected to be fully mixed in Horseshoe Lake. Measured water quality will be assessed against water quality benchmarks during bank Discharge and the location will be confirmed as part of the Plume Delineation Study, discussed in Section 3.5 of this Report.

The Board is of the opinion that a static SNP station is not sufficient to be confident the plume is being monitored through changing Discharge rates. To address this, the Board directs Arctic to measure specific conductivity along the 100 m contour line for each Discharge rate. The location with the highest specific conductivity along the 100 m contour line should be used to collect the SNP sampling for SNP Station 0008-Sa9b. This will allow for the location of SNP Station 0008-Sa9b to change based on potential changes in plume behaviour that may result from increasing Discharge rates. The Board has updated the SNP to reflect the dynamic location of SNP Station 0008-Sa9b.

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<sup>37</sup> [MVLWB/GNWT Guidelines for Effluent Mixing Zones \(2017\)](#)

<sup>38</sup> *Ibid.*

- ***Decision 9: The Board directs Arctic to measure specific conductivity along the 100 m contour line for each Discharge rate and use the location with the highest specific conductivity as SNP Station 0008-Sa9b and has updated the location of SNP Station 0008-Sa9b in the SNP accordingly.***

The Board understands that a dynamic location for an SNP station is unusual. The Board also acknowledges that it is making this decision without knowing the amount of effort and time required by the Company to complete measurements of specific conductivity along the 100 m contour line with every potential increase in Discharge rate. Arctic has indicated a need for a decision on the Report as soon as possible to begin Discharge and prevent “irreparable damage to the core dam and potential failure of containment at the TRSP”.<sup>39</sup> Given the time constraints imposed by this situation, the Board did not have sufficient time to follow up with Arctic on this topic. Thus, the Board is of the opinion that this dynamic SNP location is a reasonable approach to allow for Discharge before freeze-up in 2021 and ensure the appropriate location is sampled given the uncertainties related to potentially increasing Discharge rates. The Board also anticipates that the Plume Delineation Study will provide additional information about how changing Discharge rates will impact plume behaviour. As outlined in the Licence requirements, the location of SNP Station 0008-Sa9 may be moved as a result of the Plume Delineation Study Report. If the evidence suggests that a static location for SNP Station 0008-Sa9b would be appropriate despite changing Discharge rates, Arctic can submit this request with supporting rationale when it submits the Plume Delineation Study Report.

### **3.7 Precautionary Discharge Plan**

In the Report, Arctic has proposed a Precautionary Discharge Plan (the Plan) which follows a ‘plan-do-check-act’ framework to ensure modelling predictions are confirmed and water quality benchmarks are not exceeded at the edge of the mixing zone. In the cover letter of the Report, Arctic explained that the Plan “presumptively applies mitigation measures based on the worst-case model results, then places the burden of proof on monitoring results to incrementally remove mitigations.” More specifically, the Plan proposes pre-emptive mitigation measures to minimize the amount of waste being released, with additional mitigation measures that can be applied if water quality does not reflect modelled water quality. The Plan also proposes to begin bank Discharge at a reduced flow rate (0.015 m<sup>3</sup>/s) for one week or longer. This will allow the flow to be established through the Two Rock-Horseshoe Lake Stream and the mixing zone. Following one week of Discharge, Arctic will then conduct the Plume Delineation Study to evaluate mixing characteristics, update predictions about near-field dilution, and adjust the Discharge rate as necessary. Based on results from the Plume Delineation Study, Arctic will iteratively raise the Discharge rate, to a maximum of 0.1 m<sup>3</sup>/s, while ensuring EQC at SNP Station 0008-Sa3 are being met, an effluent dilution ration of 20:1 is being achieved, and concentrations at the edge of the mixing zone are below water quality benchmarks. During the public review, IEMA expressed support for the Plan (IEMA comment 5).

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<sup>39</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Correspondence with Arctic Re Monitoring – Sep 21\\_21](#)

With respect to ‘placing the burden of proof on monitoring results to incrementally remove mitigations’, Section 5.3 of the Report provides more information on the proposed steps as part of the ‘Check’ stage. Arctic explains that this will include “system-wide monitoring to reduce uncertainty upstream, in the TRSP, in the regulatory mixing zone, and in Horseshoe Lake.” More specifically:

1. Monitoring will be completed upstream of TRSP (at SNP Station 0008-Sa10)<sup>40</sup> to improve source term definition and allow for model updates;
2. Monitoring within the TRSP (at SNP Station 0008-Sa3)<sup>41</sup> to validate the GoldSim model and confirm that EQC will be met in the Discharge;
3. A Plume Delineation Study will be carried out to evaluate mixing characteristics within the plume, update predictions about near-field dilution, and adjust the Discharge rate as necessary; and
4. SNP Sampling at SNP Station 0008-Sa9b to confirm water quality at the edge of the mixing zone.

Currently, Arctic is proposing to evaluate the monitoring and update modelling results to inform its ability to increase the Discharge rate. The Board is of the opinion that the steps proposed by Arctic are adequate and appropriate; however, a confirmatory step is currently lacking. As Arctic has explained that it plans to iteratively increase the Discharge, the Board requires Arctic to submit a notification to the Board and the Inspector prior to any Discharge rate increase. This notification is to include a summary of the results of the steps outlined in Section 5.2 of the Report demonstrating that water quality predictions at the edge of the mixing zone will meet water quality benchmarks at the next Discharge rate.

- ***Decision 10: The Board requires Arctic to submit a notification to the Board and the Inspector prior to any Discharge rate increases. The notification is to include a summary of the results of the steps outlined in Section 5.2 of the Report demonstrating that water quality predictions at the edge of the mixing zone will meet water quality benchmarks at the next Discharge rate.***
- ***Revision B: The Board directs Arctic to update Section 5.4 of the Report to include the requirement to notify the Board and the Inspector prior to any Discharge rate increases in Version 3.1 of the Report.***

Overall, the Board is satisfied that the Plan, with the additional reporting requirement, is a robust and adaptive plan that will allow Arctic to Discharge from the TRSP at changing Discharge rates while monitoring to ensure water quality benchmarks are not being exceeded at the edge of the mixing zone.

### **3.7.1 Contingency Options**

The Plan proposes many contingency options that are either pre-emptively added or available to be added if the Plume Delineation Study indicates that water quality may exceed water quality benchmarks or does not align with modelled predictions. During the public review, comments and recommendations were received from reviewers regarding the contingency options.

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<sup>40</sup> See WWLB Online Registry for [Ekati – Two Rock Outfall Report – Correspondence with Arctic Re Monitoring – Sep 21 21](#)

<sup>41</sup> *Ibid.*

GNWT-ENR commented that nitrate and TP are predicted to exceed the respective benchmarks under ice and both parameters are expected to fall below the corresponding benchmark at the onset of freshet supporting Arctic's conclusion that these exceedances are related to solute exclusion (GNWT-ENR comment 7). Given that these are nutrients, GNWT-ENR indicates that there is the potential to increase productivity in Horseshoe Lake above the ambient oligotrophic level and recommended that Arctic propose thresholds and triggers that would require mitigations and adaptive management for nitrate, TP, and chlorophyll *a*. Arctic responded that the Aquatic Effects Monitoring Program (AEMP) Response Framework is an existing management tool that ensures the protection of aquatic life in the Receiving Environment. The Response Framework links the results of the AEMP to specific management actions. It requires a proponent to develop benchmarks and responses should a pre-defined level of environmental change, called an 'action level,' be reached. Action levels are defined to ensure that environmental change does not reach a 'significance threshold,' a point at which an environmental change is considered significantly adverse. Nitrate, TP, and chlorophyll *a* concentrations at the AEMP station in Horseshoe Lake are subject to Action Level evaluation. When an Action Level is exceeded, Arctic is required to notify the Board within 60 days of an action level exceedance and submit a Response Plan within 90 days of the Action Level exceedance for approval. The requirements of a Response Plan are outlined in Schedule 8, Condition 4 of the Licence and include a summary of how the Action Level exceedance was determined and confirmed, as well as a description of the likely causes, potential mitigation options, and actions to be taken in response. The SNP is a separate monitoring program that ensures Arctic is meeting water quality benchmarks at specific locations but does not include spatial or temporal analyses. SNP Station 0008-Sa9b has been established to monitor water quality at the edge of the mixing zone and is the location at which water quality benchmarks are expected to be met. Data from this SNP station could be used to inform the Response Plan should an Action Level in Horseshoe Lake be triggered. The Board is thus satisfied that the Licence includes requirements designed to identify and address potential increases in nutrients related to Discharge in Horseshoe Lake.

GNWT-ENR also requested additional information about the contingency plans that would be added, if necessary, to reduce further loading in Horseshoe Lake and referenced the proposed flocculation for removing metals and the creation of anaerobic reducing conditions to encourage the precipitation of some metals (GNWT-ENR comment 9 and 10). Arctic responded to both comments indicating that mitigation measures will be considered on a case-by-case basis and will not be fully explored until it is deemed necessary. The Board agrees that it is not necessary to fully develop contingency plans before it is indicated by measured conditions and notes that Arctic must maintain compliance with its Licence EQC prior to Discharging from the TRSP. In addition to EQC requirements, some of the proposed contingency options may require updates to other submissions required by the Licence, such as management plans. For example, if Arctic was to use flocculants to remove metals in the TRSP and dredging was required, the dredged materials would require disposal not currently included in the approved Waste Management Plan (i.e. Version 7.0).<sup>42</sup>

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<sup>42</sup> See WLWB Online Registry for [W2012L2-0001 – Ekati – Waste Management Plan – Version 7.0 – Dec 16 20](#)

During the public review, IEMA commented that two of the modelled scenarios for Discharge included trucking water from the TRSP to the Long Lake Containment Facility or the Beartooth Pit (IEMA comment 4). IEMA stated that the trucking scenario has potential to significantly increase trucking traffic on the Sable Road, through the movement and migration pathway for caribou. IEMA recommended that Arctic provide information on the number of additional truck passages expected in the Trucking Out Scenarios and the potential impacts this increase would have on wildlife movement. Arctic responded that it has developed and implemented a Caribou Road Mitigation Plan that includes a tiered response dependent on the location of the caribou.<sup>43</sup> The Caribou Road Mitigation Plan is part of the Wildlife Effects Monitoring Program (WEMP) required and approved by GNWT-ENR. The Caribou Road Mitigation Plan ensures that traffic on the Misery Road avoids or minimizes its effect on caribou movement and migration. The Board is of the opinion that Arctic's response, in addition to the WEMP addresses IEMAs recommendation.

### **3.8 Fish Habitat**

In Version 2.0 of the Report, bank Discharge had not been approved in part because it was unclear how fish habitat could potentially be impacted by the Discharge location. The Board directed Arctic to provide information pertaining to any fish habitat that could potentially be impacted by the proposed Discharge location and the mitigation and management to prevent potential impacts. Section 3.3.2 of the Report discusses the potential impacts on fish habitat from bank Discharge. Arctic states that the location and configuration of bank Discharge is similar to what was used in the drawdown of Two Rock Lake, which includes a boulder garden in the Two Rock-Horseshoe Lake Stream. Previously, no fish habitat was observed in the Two Rock – Horseshoe Lake Stream; Arctic has attributed this lack of fish to the braided, intermittent nature of the stream, fish barriers, and subsurface flow. Additionally, Arctic states that erosion of the stream bed is prevented at the Discharge location as it is within a boulder garden and has dense vegetation that dissipates energy.

During the public review, DFO recommended that Arctic include a discussion of the possibility of fish entering the reactivated Two Rock-Horseshoe Lake Stream under the proposed flow rates and mitigation measures that would ensure fish are not being stranded in the stream (DFO comment 1). Arctic responded that the physical characteristics of the stream prevent fish passage, and that pumping rates will be maintained below the rates specified in the Licence. Arctic also committed to performing regular inspections of the area to identify erosion or turbidity issues that may arise and monitor for fish entering the outflow or becoming stranded. The Board relies on DFO's expert opinion to determine the potential impacts to fish and fish habitat and therefore issued DFO an IR to determine if DFO was satisfied that there is no possibility for fish to enter the Two Rock-Horseshoe Lake Stream and to provide mitigation measures that would be necessary to allow for bank Discharge.<sup>44</sup> DFO responded that it is satisfied that the potential for fish movement into the Two Rock-Horseshoe Lake stream is likely low.<sup>45</sup> DFO also indicated that mitigation measures do not need to be imposed at this time but acknowledges Arctic's

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<sup>43</sup> See WLWB Online Registry for [W2012L2-0001 – Ekati – WEMP – 2016 Technical Report – Mar 30 17](#)

<sup>44</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Version 3.0 – Information Request to DFO – Sep 13 21](#)

<sup>45</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Version 3.0 – DFO Response to IR – Sep 15 21](#)

commitment to conduct regular inspections and monitoring of the stream during Discharge.<sup>46</sup> Arctic then provided a response to DFO indicating it is committed to weekly visual inspection of the Two Rock-Horseshoe Lake Stream for fish presence during freshet, following high rainfall events, and at other times of the year when Discharging from the TRSP.<sup>47</sup> The Board is of the opinion that Arctic has addressed DFOs recommendation and requires Arctic to include these commitments in the next version of the Report.

- ***Revision C: The Board requires Arctic to include commitments made in response to DFO comment 1 and the DFO IR in Version 3.1 of the Report.***

### 3.9 Additional Comments

There were several recommendations to which Arctic responded by providing the information. No further discussion was required because Arctic provided the information addressing the recommendations.

- ECCC comment 3: ECCC recommended Arctic update Table 3-5 to include relevant water quality benchmarks for Sable Lake. Arctic provided this information.
- GNWT-ENR comment 2: GNWT-ENR recommended the revision history table indicate which changes were specific to Version 3.0 of the Report. Arctic provided this information.
- IEMA comment 3: IEMA recommended Arctic provide topographic information on a map or satellite image to illustrate topography of the Horseshoe Lake watershed. Arctic provided this information.

Signed the 30<sup>th</sup> day of September 2021, on behalf of the Wek'èezhìi Land and Water Board



Witness



Joe Mackenzie  
Acting Chair, Wek'èezhìi Land and Water Board

<sup>46</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Version 3.0 – DFO Response to IR – Sep 15 21](#)

<sup>47</sup> See WLWB Online Registry for [Ekati – Two Rock Outfall Report – Arctic Response to DFO Response to IR – Sep 16 21](#)