Attachment A.1. Response 7 (KIA-NWB-71)

As per the DFO protocol for mitigating water withdrawal effects on fish and fish habitat in ice-covered waterbodies in the North (DFO 2010), potential water sources are waterbodies deeper than 3.5 m (i.e., lakes) and available water volumes in those waterbodies are no more than 10% of the under ice volume. The potential water sources for the winter ice road construction for the Marine Laydown Area (MLA) includes MLA Pond S1 and MLA Pond S2, both of which are deeper than 3.5 m (Table 1; also see Sabina's reply to DFO-FPP Comment 1). Predicted water volumes for MLA Pond S1 and MLA Pond S2 are provided in Table 1, with cumulative volumes per depth are provided in Table 2. Information provided in these tables combined with the assessment criteria described in Golder (2018) are used to confirm that the 10% under-ice volume withdrawal targets are protective of fish and fish habitat for the source waterbodies for winter ice road construction at the MLA (see further below).

Table 1. Marine Laydown Area (MLA) Source Lakes for Winter Ice Road Construction

Waterbody[1]	Max Depth (m)	Volume (m^3)	Surface Area (m^2)	V:SA	Under Ice Volume (m^3)[2]	10% Under-Ice Volume
MLA Pond S1	4.1	857,422	377,255	2.2	206,368	20,637
MLA Pond S2	3.7	580,841	440,531	1.3	18,322	1,832

[1] waterbodies were surveyed for bathymetry in July 2014 and are expected to be representative of average or below-average fall conditions based on a qualitative assessment of historical hydrometric data for Contwoyto Lake (station 10QC003) and Burnside River (station 10QC001) (see Government of Canada 2018);

[2] assumes ice thickness of 2 m;

Note: table modified from Sabina's reply to DFO-FPP Comment 2; updated estimates based on outputs from a spatial analysis of field-collected bathymetry data summarized in Table 2.

Table 2. Bathymetric Output Summary for MLA Source Lakes for Winter Ice Road Construction

Lake	Depth (increments of 0.5 m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
MLA Pond S1	0	857,423	377,255
	-0.5	675,086	352,712
	-1	504,577	329,006
	-1.5	346,851	300,414
	-2	206,369	255,699
	-2.5	93,979	187,434
	-3	21,488	79,433
	-3.5[a]	880	11,926
MLA Pond S2	0	580,841	440,531
	-0.5	384,684	356,847
	-1	221,503	295,981
	-1.5	90,595	221,245
	-2	18,323	56,816
	-2.5	3,188	12,361
	-3[a]	133	2,340

a volumes include small volumes of water calculated in the next depth increment category

Based on the winter ice road water withdrawal analysis provided in Golder (2018), each lake responds differently to water withdrawals in that the ratio of lake volume to surface area can influence the magnitude of water level change in response to a water withdrawal. For example, water levels are particularly sensitive to withdrawals for lakes characterized by a deep ‘bathtub’ or ‘bowl’ shape (i.e., a high ratio of volume to surface area). However, the physical dimensions of both MLA Pond S1 and MLA Pond S2 show a relatively low ratio of lake volume to surface area (Table 1) compared to the 55 lakes that were assessed for the winter ice road construction in Golder (2018). Therefore, the expectation is that a 10% under ice water withdrawal would result in minor changes in water levels in both MLA Pond S1 and MLA Pond S2.

To illustrate the general relationship between lake shape (specifically the ratio of water volume to surface area) and water level changes related to a 10% under-ice water withdrawal, a polynomial model was fit using the results in Table 2 of Golder (2018). Based on the resulting regression equation illustrated in Figure 1, and the V:SA values for MLA Pond S1 and MLA Pond S2 in Table 1, the predicted water level changes under a 10% under ice water withdrawal for either MLA Pond S1 and MLA Pond S2 are less than 15 cm. Similarly, if considering the lake-specific relationship between cumulative volume and depth (derived from the data in Table 2), the predicted decreases in water level for a 10% under-ice water volume withdrawal are approximately 10 cm for MLA Pond S1, and 2 cm for MLA Pond S2. These changes are expected to result in minimal risk to fish and fish habitat (see evaluation criteria in Golder 2018), and therefore, DFO’s protocol is expected to be sufficiently protective of fish and fish habitat for both proposed source lakes.

Sabina is also committed to annual evaluations of water withdrawal targets prior to construction of winter ice roads as part of the DFO ‘self-assessment’ process. Waterbody-specific targets will be adjusted if and when annual precipitation totals are identified as below average for the region (i.e., dry years). The adaptive management of source lakes for winter ice road construction combined with adherence to DFO’s protocol for winter water withdrawal from ice-covered waterbodies will reduce, if not eliminate, any risks to fish and fish habitat at the MLA.

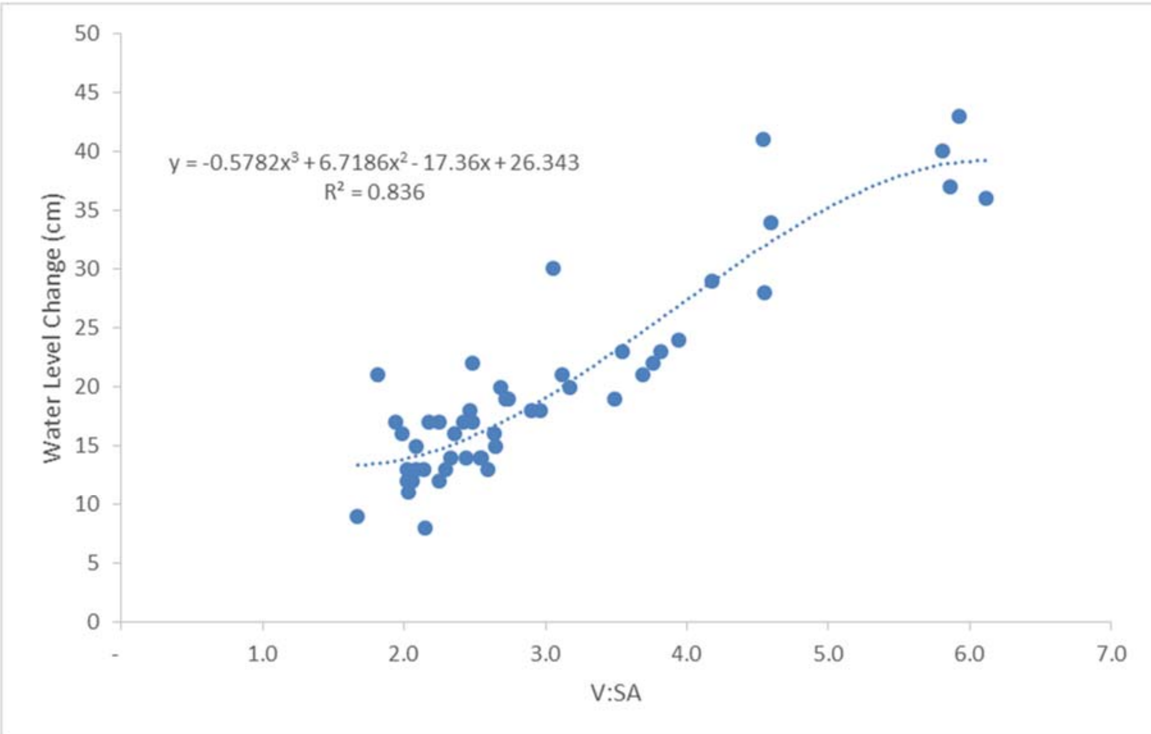

Figure 1. Relationship between Waterbody Shape (Measured by the Volume to Surface Area Ratio) and Water Level Change Assuming 10% Under-Ice Water Withdrawals (n = 51).

Note: Of the 55 lakes examined in Golder (2018), four waterbodies were omitted from the modelling exercise because of their unusually high V:SA values (i.e., ratios for Lake 999, Lake 17-0, Lake 34-0, and Lake 31-0 ranged from 8.0 to 33.6).

References

DFO (Fisheries and Oceans Canada). 2010. DFO protocol for winter water withdrawal from ice-covered waterbodies in the Northwest Territories and Nunavut. Prepared June 20, 2010. 3 pp.

Golder (Golder Associates Ltd.). 2018. Winter Ice Road Water Withdrawal Evaluation – Back River Project. Prepared by Golder Associates Ltd. Prepared for Sabina Gold & Silver Corp. Reference No. 1776921_021_MEM_RevB. February 5, 2018. 56 pp.

Government of Canada. 2018. Historical Hydrometric Data. See http://climate.weather.gc.ca/. Visited February 2018.