Permafrost Development – Thermal Data Report
Whale Tail Project Expansion

60-Day Notice to Nunavut Water Board
In Accordance with Water License 2AM-WTP-1826

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AGNICO EAGLE
MEADOWBANK

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1 INTRODUCTION

Agnico Eagle Mines Limited – Meadowbank Division (Agnico Eagle) will develop the Whale Tail Pit (Project), a satellite deposit located on the Amaruq property, to continue mine operations and milling at Meadowbank Mine. The Amaruq property is a 408 square km^2 site located on Inuit Owned Land approximately 150 km north of the hamlet of Baker Lake and approximately 50 km northwest of Meadowbank Mine in the Kivalliq Region of Nunavut. The deposit will be mined as an open pit (i.e., Whale Tail Pit), and ore will be hauled to the approved infrastructure at Meadowbank Mine for milling.

The approved project consists of an open pit mine, mined by truck-and-shovel operation and will produce 8.3 million tonnes (Mt) of ore, 61.3 Mt of waste rock, and 5.6 Mt of overburden waste. With the proposed expansion project (Whale Tail Phase 2) under consideration for a Water Licence amendment, the production will increase to 23.5 Mt of ore, 167.8 Mt of waste rock and 11.3 Mt of overburden.

During the technical meeting as part of the Nunavut Water Board (NWB) Water Licence amendment process, Kivalliq Inuit Association (KivIA) has requested thermal data from the open pit walls at the Meadowbank site. The goal of this request was to assess the impact of rock fracturing from the open pit walls on the site water balance. Freeze-back and permafrost aggradation in the pit walls will prevent additional seepage from the mine walls.

2 BACKGROUND INFORMATION

The Meadowbank Gold project represents construction, operation, maintenance, reclamation, closure, and monitoring of an open pit gold mine in the Kivalliq Region of Nunavut. The project is located on Inuit-owned land approximately 70 km north of Baker Lake. The Meadowbank Gold project provided more than 3,000,000 oz of gold over the lifetime of the project. An all-weather haulage road from Baker Lake to the project provides access and re-supply, while on-site mine access roads will connect the open pit areas to site infrastructure. On-site facilities include a mill, power plant, maintenance facilities, tank farm for fuel storage, water treatment plant, sewage treatment plant, airstrip, and accommodations.

An instrumentation program was developed around the pit walls. Since the closure of the mine will rely on in-pit disposal of the tailings, measurement of the thermal properties of the ground around the pits is if interest. Figure 1 shows the general site layout of the southern portion of the Meadowbank mining site. Thermal data in the pit wall is being monitored on the eastern portion of both pits.

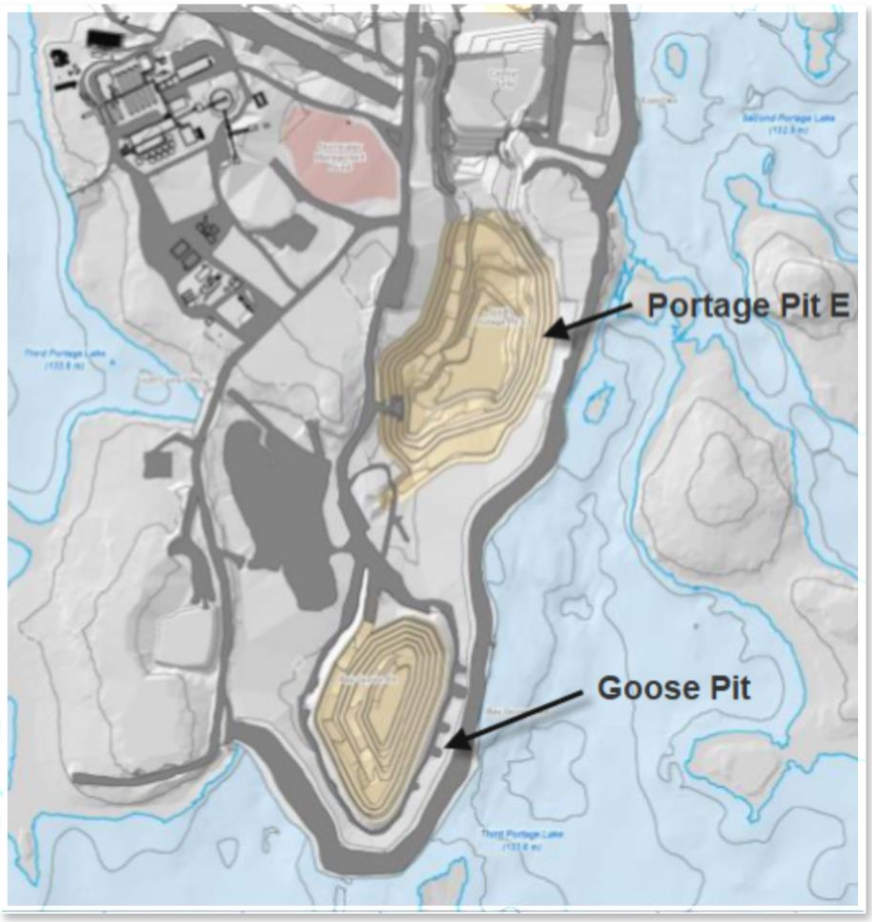

Figure 1: Meadowbank Site Layout and Location of Monitored Pits

3 GOOSE PIT THERMAL DATA

Thermal monitoring data is presented for the Goose Pit wall. Figure 2 shows the location of the monitoring stations. All the data presented in situated in the wall section between the open bit and the water body. The monitoring stations are located approximately 100 meters from each other. Figure 3 shows a cross-section of the pit aligned with the thermistors to provide elevations and context around the measured depths. The thermistors are located approximately at a distance of 820 m.

Figures 4 to 7 shows yearly temperature profiles around the month of August between 2013 and 2019. One profile per year is shown to reduce effect on yearly variation on the profiles. For some stations, data from 2015 is not shown as it was not recorded due to malfunctioning of certain data loggers.

The temperature profiles show that the freeze-back progresses at a steady rate for all the instrumented boreholes. Figure 4 shows that the depth of sub-zero ground temperatures significantly increased in a matter of a few years after the pit wall is exposed to colder air.

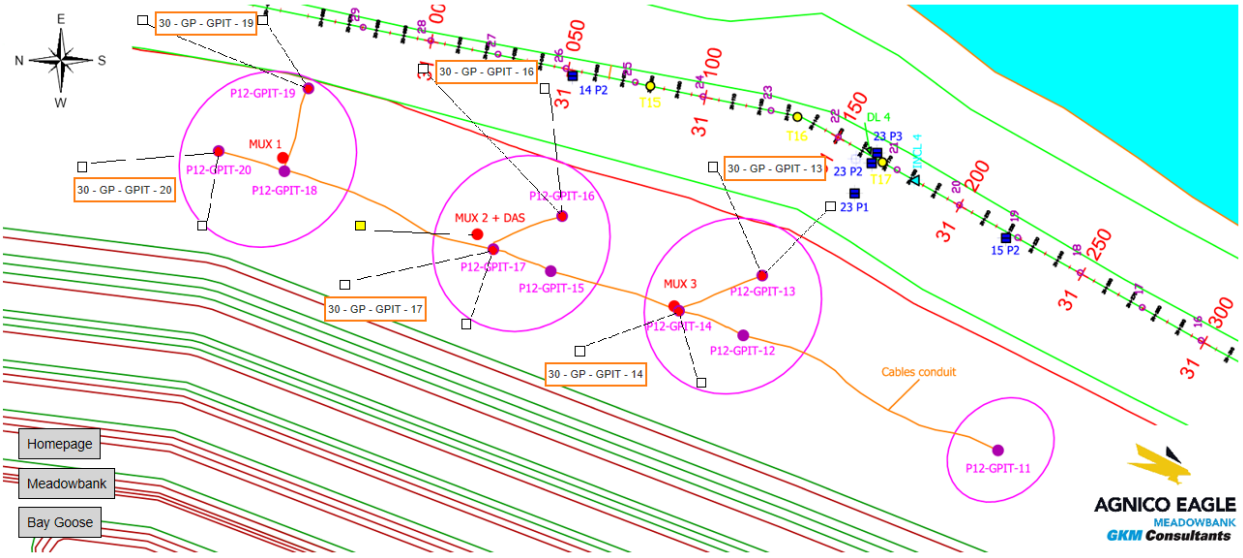

Figure 2:Thermistor String Location in Goose Pit, Meadowbank

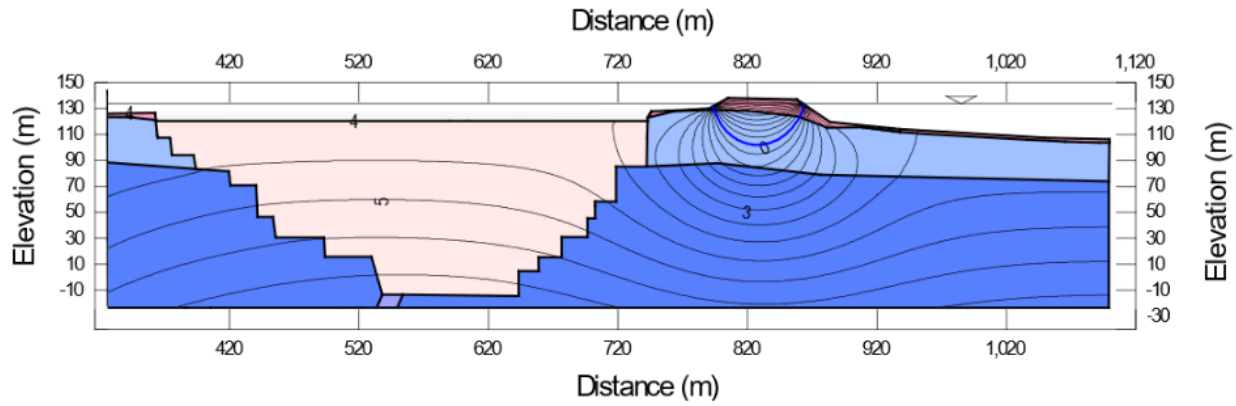

Figure 3: Cross-section and Elevations of Goose Pit

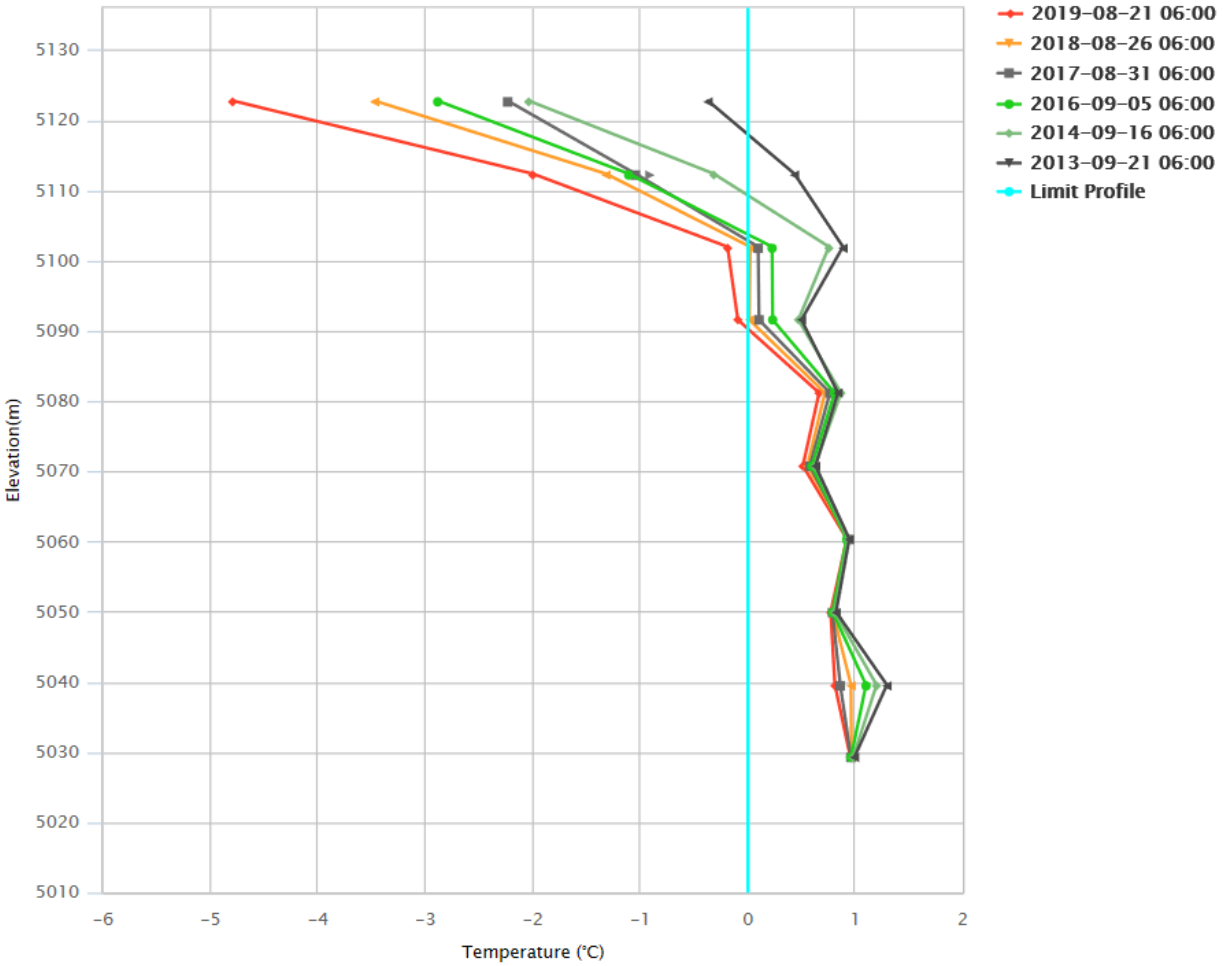

Figure 4: Goose Pit Yearly Temperature Profile: GP-13 Monitoring Station

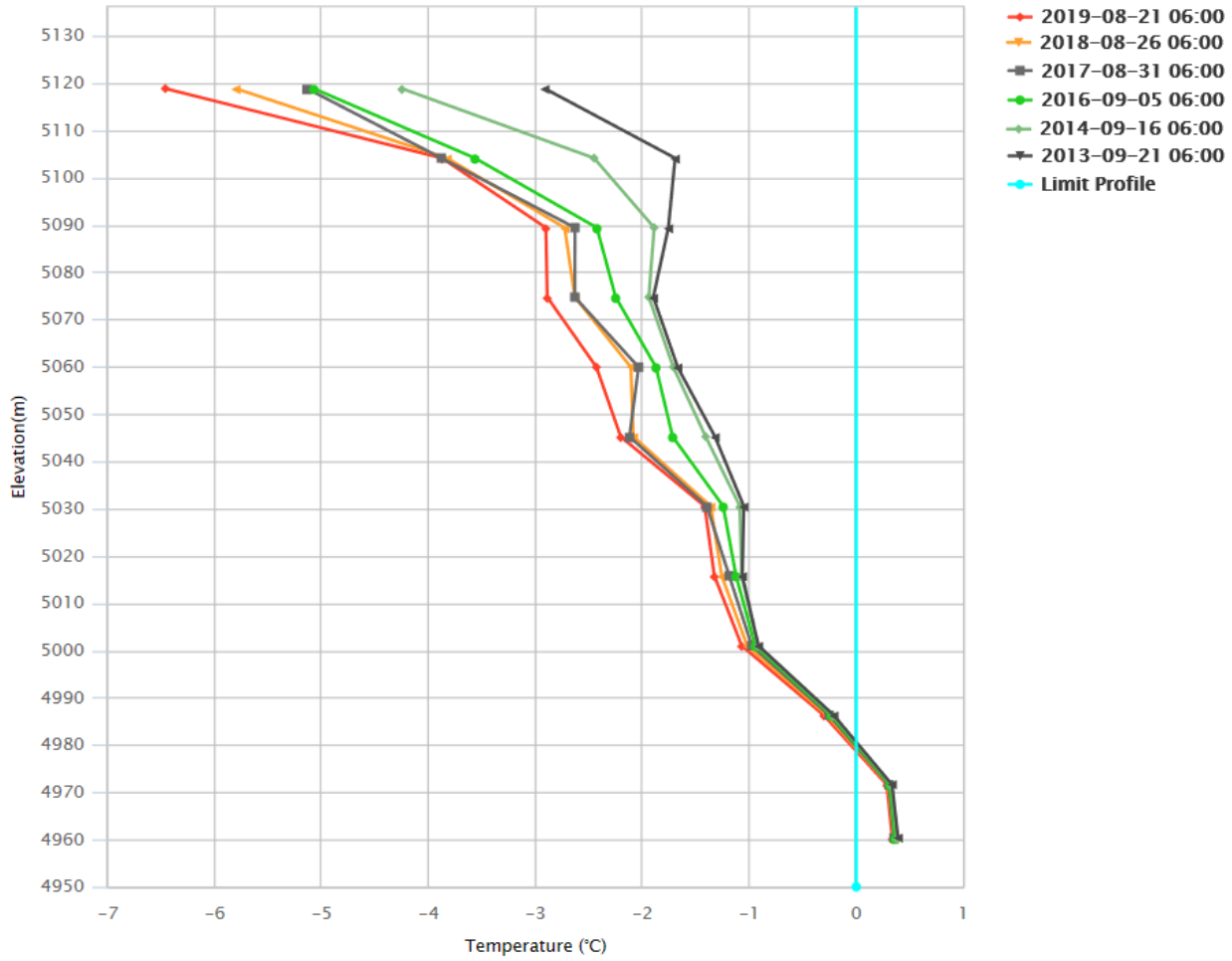

Figure 5: Goose Pit Yearly Temperature Profile: GP-14 Monitoring Station

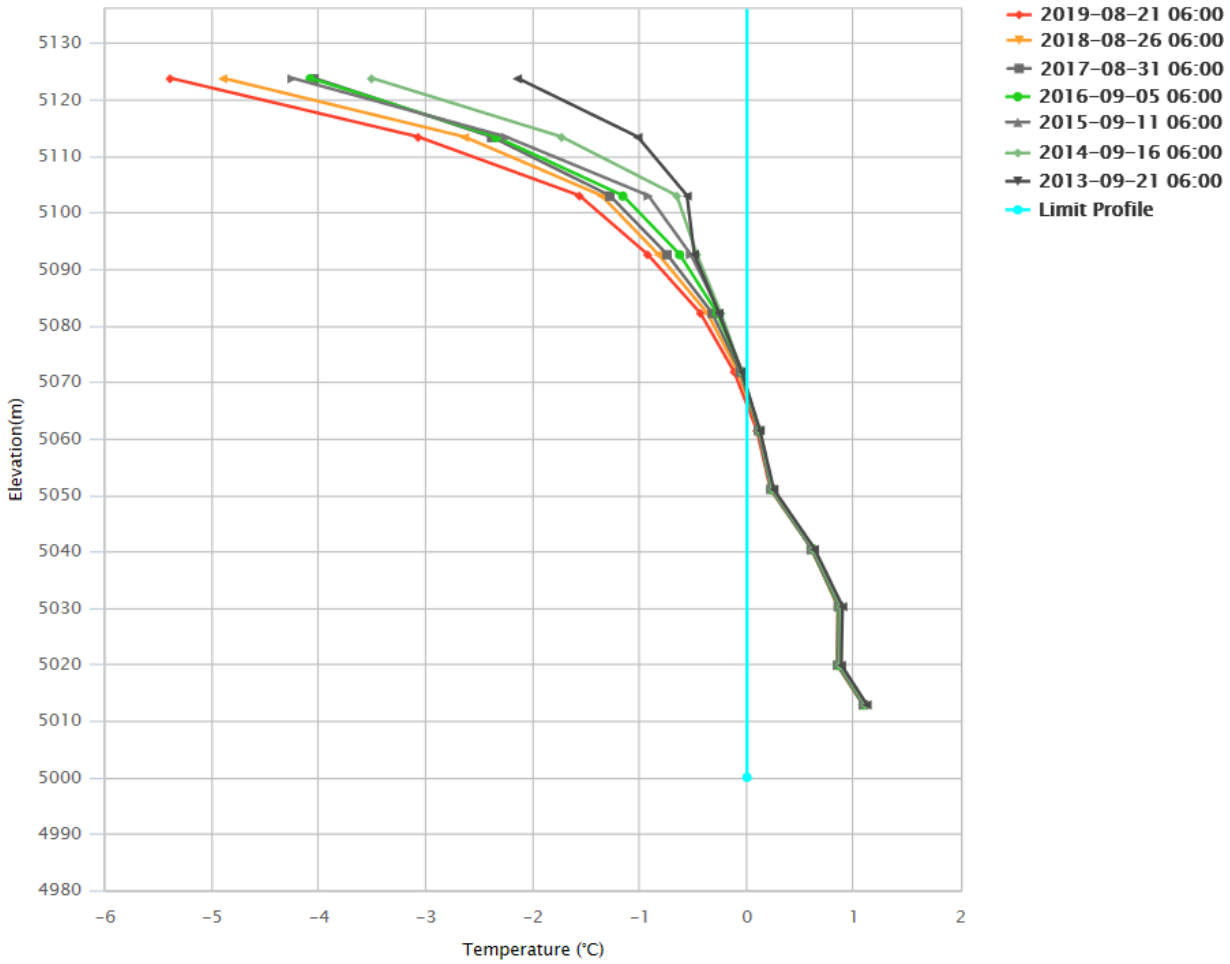

Figure 6: Goose Pit Yearly Temperature Profile: GP-16 Monitoring Station

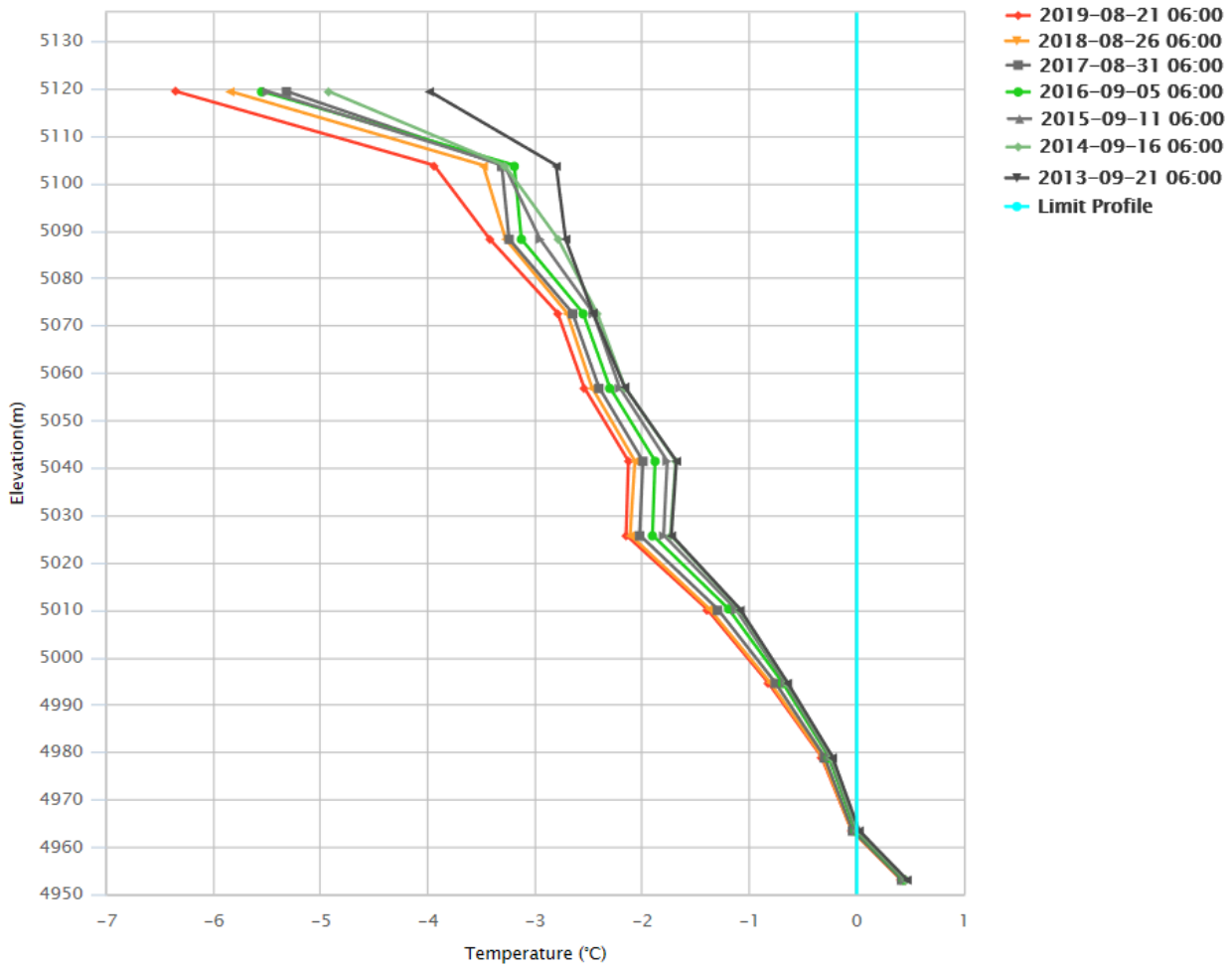

Figure 7: Goose Pit Yearly Temperature Profile: GP-17 Monitoring Station

4 PORTAGE PIT THERMISTOR DATA

Thermal monitoring data is presented for the Portage Pit E wall. Figure 8 shows the location of the monitoring stations. The thermal data presented in situated in the wall section between the open bit and the water body. Figure 9 shows a cross-section of the pit to provide elevations and context around the measured depths.

Figures 10 and 11 shows yearly temperature profiles at the end of December between 2017 and 2019. One profile per year is shown to reduce effect on yearly variation on the profiles.

The temperature profiles show that the freeze-back progresses at a steady rate for both monitoring stations. Figure 10 shows the depth of sub-zero temperature increasing by approximately 3 meters per year.

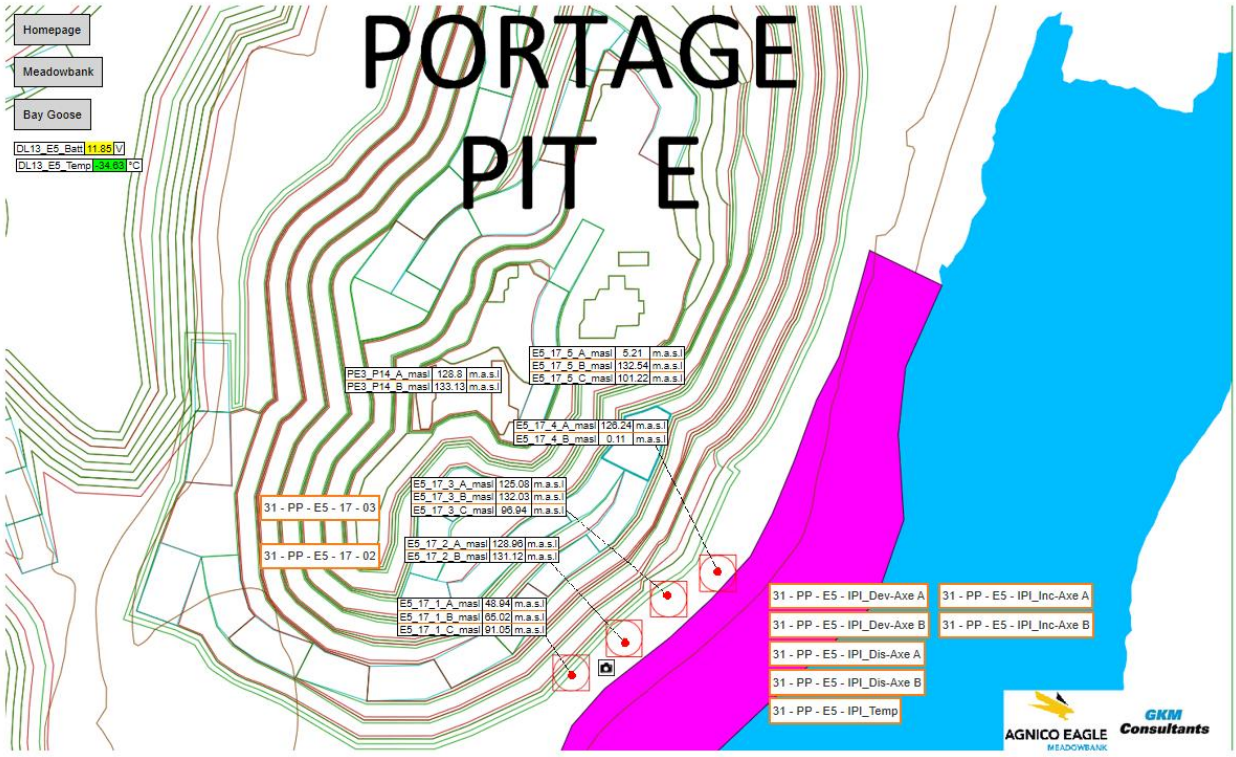

Figure 8: Thermistor String Location in Portage Pit, Meadowbank

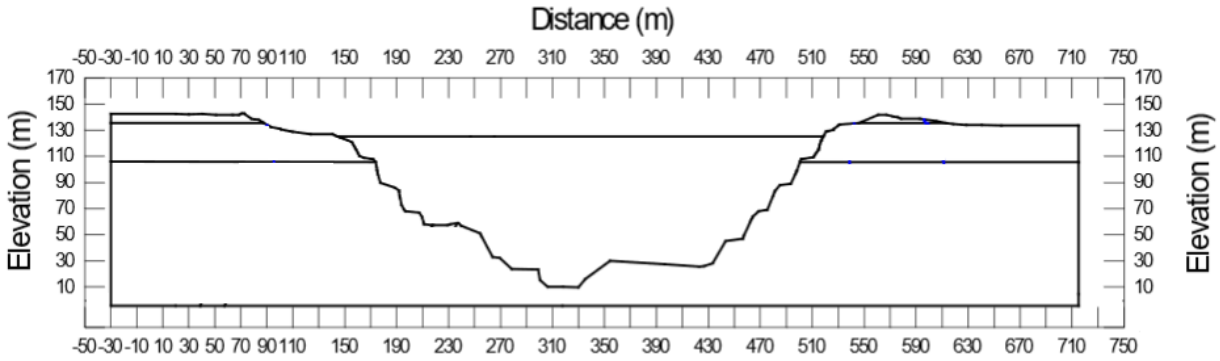

Figure 9: Cross-section and Elevations of Portage Pit

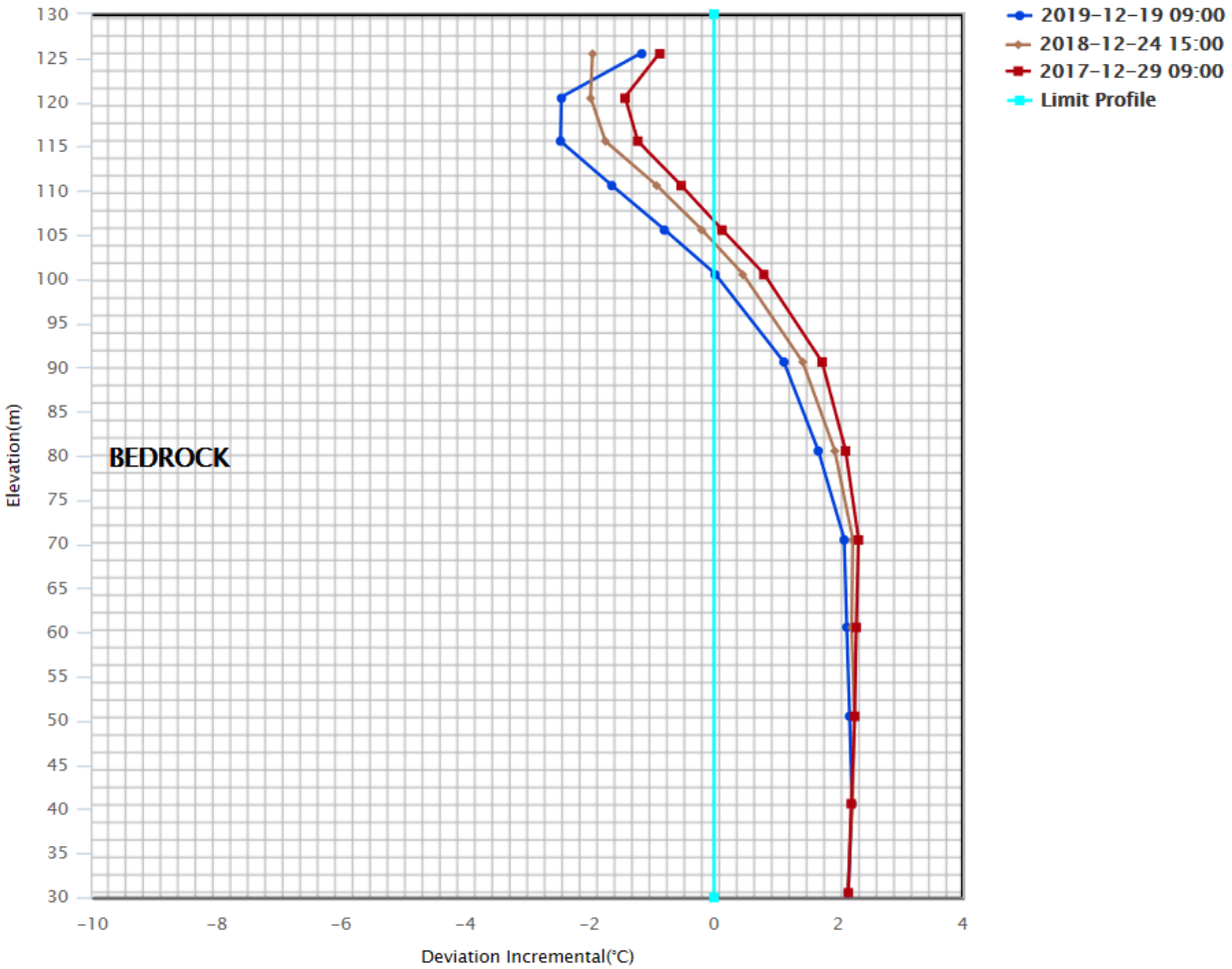

Figure 10: Portage Pit Yearly Temperature Profile: PP-E5-17-02 Monitoring Station

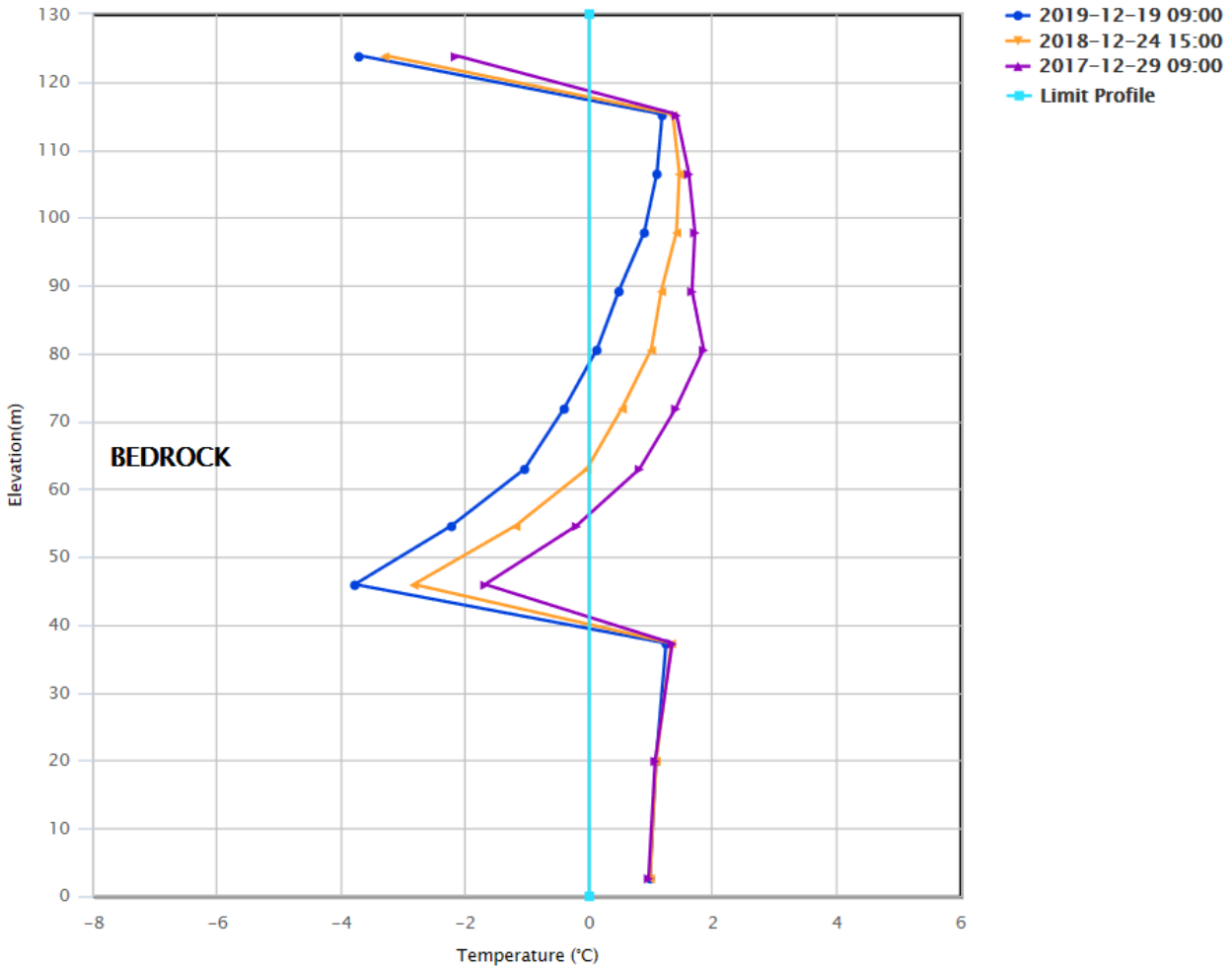

Figure 11: Portage Pit Yearly Temperature Profile: PP-E5-17-03 Monitoring Station

5 RESULTS ANALYSIS

Table 1 summarizes the changes in thermal conditions of the rock wall for both Goose Pit and Portage Pit E. In the cases where the limit between frozen and unfrozen ground was relatively close to the surface, a significant displacement of the limit was noted throughout the years. This translates into a lack of infiltration over the depth of the pit as water is immobile.

Table 1: Summary of Freeze-back Effect on Pit Wall Temperatures

Monitoring Station	Displacement of the zero-degree point (m)	Variation in near-surface temperature (°C)
GP-13	-25	-3
GP-14	0	-2
GP-16	0	-2
GP-17	0	-1
PP-E5-17-02	-5	-1
PP-E5-17-03	-25	-1

For all the thermal monitoring instruments, variation of temperature near the surface is present and shows a progressive decrease in time.

The data from the Meadowbank thermal monitoring stations supports the assumption that no pit-wall seepage will be observed in the Whale Tail Project Pits.