1

2a

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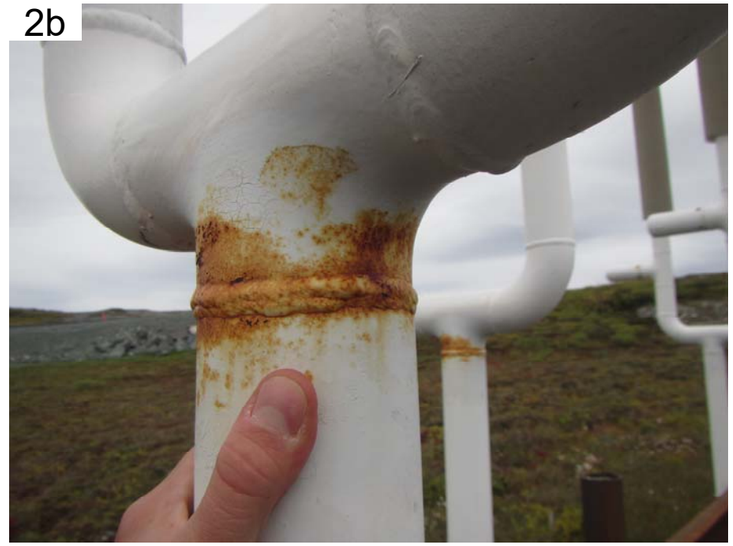

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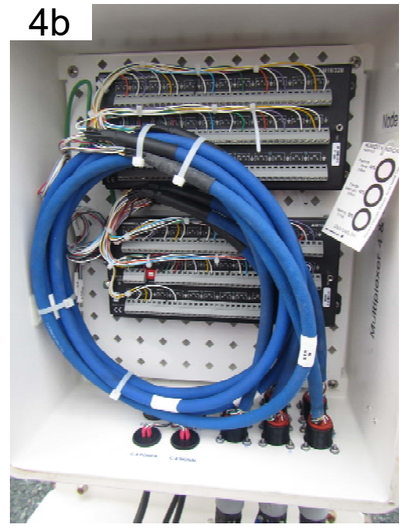

Photos:
Photo 1: North view of east thermosyphon risers and radiators
Photo 2a: Approx. north-north east view of west thermosyphon radiators and risers
Bottom Left: Overview photo (south-southwest view) of North Dam. Photo locations shown on overview.
Photo 3: Set of instrumentation on / through downstream dam slope.
Photo 4a and 4b: Example of ground temperature cable datalogger housing and wiring.

srk consulting	MAC RESOURCES	2019 Annual Geotechnical Inspection
		North Dam Instrumentation and Thermosyphons
Job No: 1CT022.038 Filename: 2019NDGeotechInsp_Rev1_sw.pptx	Doris TIA	Date: March 2020 / Approved: PL / JK / Photolog: 3

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Photos:
Photo 1: Aerial photo of the South Dam, looking north-northeast
Photo 2: Aerial photo of the East central tailings beach, looking west
Photo 3: Aerial photo of the South Dam, looking east
Photo 4: The upstream face of the South Dam, looking west
Photo 5: The downstream face of the South Dam, looking west
Photo 6: Active tailings deposition off the South Dam crest.

srk consulting	TMAC RESOURCES	2019 Annual Geotechnical Inspection
		South Dam Inspection
Job No: 1CT022.038 Filename: 2019NDGeotechInsp_Rev1_sw.pptx	Doris TIA	Date: March 2020 / Approved: PL / JK / Photolog: **4**

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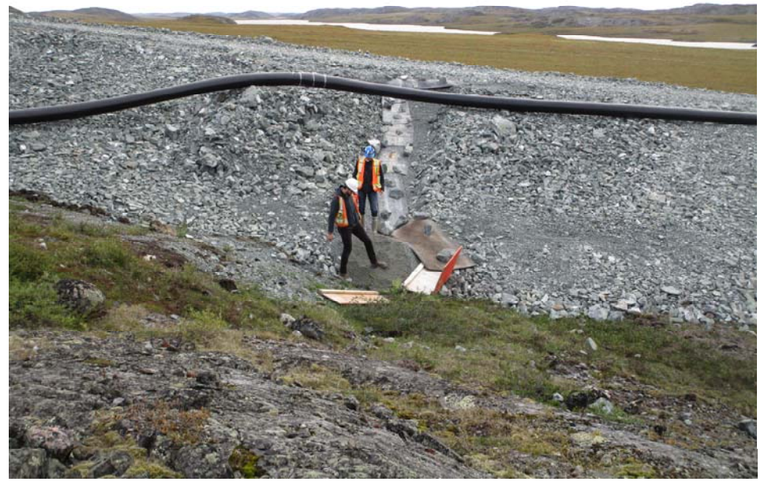

Photos:
Photo 1: Aerial photo of the South Dam, looking east
Photo 2: One of the data logger nodes on the upstream crest. Plywood casing is used to prevent animal damage.
Photo 3: Close-up of the BeadedStream DL505 datalogger and solar panel units
Photo 4: Photo along the crest showing the tailings discharges and monitoring instrumentation
Photo 5: Example fixed settlement monitoring point along the crest
Photo 6: One of the locations where a GTC has been repaired and will be further backfilled / covered (done post inspection)

srk consulting	MAC RESOURCES	2019 Annual Geotechnical Inspection
		South Dam Instrumentation
Job No: 1CT022.038 Filename: 2019NDGeotechInsp_Rev1_sw.pptx	Doris TIA	Date: March 2020 / Approved: PL / JK / Photolog: **5**

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Photos:
Photo 1a: Permafrost degradation near the reclaim pond access road (partially backfilled with tailings). Location noted in past / earlier year inspections.
Photo 1b: Second view of the permafrost degradation near the reclaim pond access road
Photo 2: Aerial photo of the Reclaim Pond Pumphouse and northeastern shore of the TIA
Photo 3: The historic discharge pipelines over the tundra, with the pumphouse in the background
Photo 4: West-southwest view of the reclaim pumphouse.
Photo 5: Tension cracking on reclaim pad on the north side of the 710 pumphouse.

srk consulting	TMAC RESOURCES	2019 Annual Geotechnical Inspection
		Reclaim Pond Access and Pump House
Job No: 1CT022.038 Filename: 2019NDGeotechInsp_Rev1_sw.pptx	Doris TIA	Date: March 2020 / Approved: PL / JK / Photolog: **6**

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Photos:
Photo 1: Photo of the east side of the TIA with the primary spigot points and the overburden dump along the shoreline
Photo 2: East shoreline of the TIA, showing the northern-most historic spigot point (not active)
Photo 3: The South Dam and beach looking south east
Photo 4: The South Dam in August 2018 showing the tailings beach extents one year prior (looking north)
Photo 5: The South Dam in August 2019 showing the tailings beach extents (looking north-northwest)

Note:
All photos from 2019 unless specifically noted

srk consulting	MAC RESOURCES	2019 Annual Geotechnical Inspection
		TIA Shoreline and Tailings Deposition (South End)
Job No: 1CT022.038 Filename: 2019NDGeotechInsp_Rev1_sw.pptx	Doris TIA	Date: March 2020 / Approved: PL / JK / Photolog: 7

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Photos:
Photo 1: The Western EDCB looking south
Photo 2: The Western EDCB looking northwest
Photo 3: The Eastern EDCB looking north-northwest (panoramic view)
Photo 4: Approx. east aerial view of Emergency Dump Catch Basins.

srk consulting	MAC RESOURCES	2019 Annual Geotechnical Inspection
		Emergency Dump Catch Basins
Job No: 1CT022.038 Filename: 2019NDGeotechInsp_Rev1_sw.pptx	Doris TIA	Date: March 2020 / Approved: PL / JK / Photolog: **8**

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Photos:
Photo 1: Doris Creek Bridge (East Abutment) showing the electrical line, tailings pipelines and racking, looking south
Photo 2: Doris Creek Bridge (West Abutment) showing the electrical line, tailings pipelines and racking, looking south
Photo 3: Reclaim pipeline over the south pipe racking on the Doris Creek Bridge, looking east
Photo 4: Reclaim pipeline over the south pipe racking on the Doris Creek Bridge, looking west
Photo 5: Tailings pipeline over the north pipe racking on the Doris Creek Bridge, looking west
Photo 6: Tailings pipeline over the north pipe racking on the Doris Creek Bridge, looking east.
The small grey box shows the top of the DCB West GTC.

srk consulting	TMAC RESOURCES	2019 Annual Geotechnical Inspection
		Tailings Discharge and Reclaim Pipeline (Near TIA)
Job No: 1CT022.038 Filename: 2019NDGeotechInsp_Rev1_sw.pptx	Doris TIA	Date: March 2020 / Approved: PL / JK / Photolog: **9**

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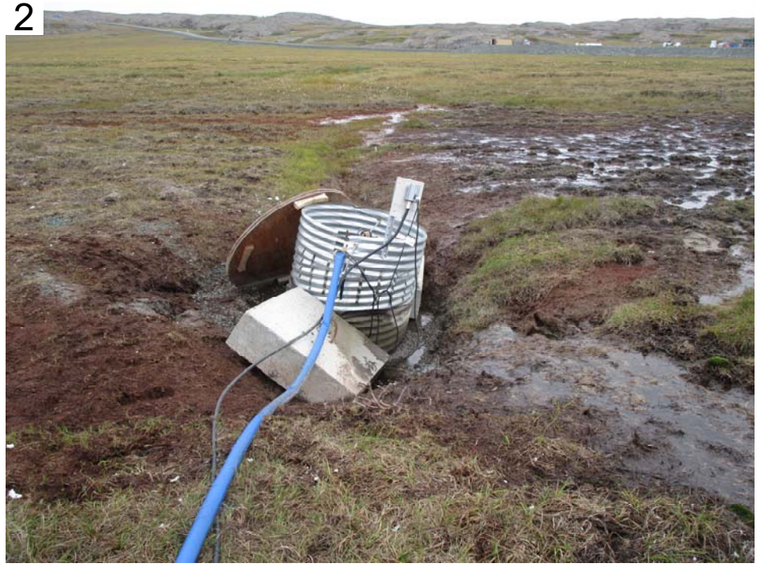

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Photos:
Photo 1: Sump #3 area and associated tundra / permafrost degradation visible. Looking approx. west toward Doris Mill Area
Photo 2: A different view of the same sump, looking south, the deformation and sunken blocks due to permafrost degradation.
Photo 3: Reclaim pipelines leading toward the TIA from the Doris Creek Bridge, looking southeast
Photo 4 through 6: Sumps (#1 and 2) with pipelines showing pipelines directly on tundra. Near Doris Camp.

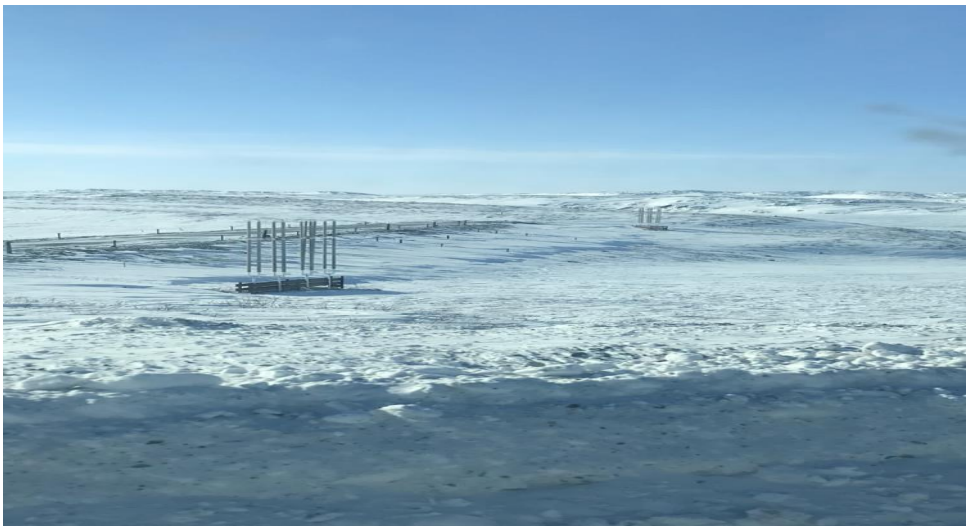
srk consulting	MAC RESOURCES	2019 Annual Geotechnical Inspection
		Tailings / Reclaim Pipelines and Sumps (Near Doris Camp)
Job No: 1CT022.038 Filename: 2019NDGeotechInsp_Rev1_sw.pptx	Doris TIA	Date: March 2020 / Approved: PL / JK / Photolog: **10**

Appendix A – Arctic Foundations of Canada Inspection Report

Arctic Foundations of Canada

Doris North Dam – North Thermosyphon #2

Discharge and Recharge of Thermosyphon June 4-6 / November 19-21 2019



1.0 Background Summary

In 2018 AFC was contracted to attend site to complete an inspection of the Thermosyphon system on Doris North Dam. During SRK Consulting's ground temperature sensor monitoring, a concern was brought forth that North #2 showed deviation from the other units and my not be operational.

April 10-11 AFC personnel attended site and found that all units were pressurized, in good condition and appeared to be functioning as designed. It is important to note that due to the timing of the 2018 inspection, the Thermosyphons were transitioning into their dormant stage. Although difficult to achieve, a thermal heat signature was captured from all 12 units

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2.0 Further Monitoring

Continued monitoring of the ground temperature sensors through the winter of 2018-2019 by SRK showed data similar to previous years. After much analyzing and discussions, TMAC contracted AFC to attend site to complete a controlled discharge and recharge of North #2. It was decided to complete these works in two separate trips. The first trip would be in the spring of 2019 after the Thermosyphons had entered their dormant stage. The second trip was planned for fall of 2019 when the Thermosyphons had transitioned into passive heat transfer stage. There were two main reasons for these works to be split into separate trips. The first, to allow for a slow, controlled discharge over a long period of time to ensure dry ice was not formed inside the evaporator. The second reason was to monitor the ground temperature data during the discharge process to see if any super-cooling of the material around the evaporator was produced.

3.0 Discharge

June 4-6 2019 One technician attended site to complete the discharge on North#2. Before the discharge, the protective valve cap, o ring and charge valve were in place, intact, and showed no signs of wear or damage. The unit was fully charged with refrigerant and showed no signs to indicate it should not be fully functional. The unit was discharged as planned and took many hours to completely depressurize.

4.0 Recharge

Nov. 19-21 2019 Two technicians attended site to recharge the previously discharged North #2 Thermosyphon. This unit was placed under a vacuum late morning. It drew down to the target vacuum within a few hours as expected. Upon completion of recharge, North#2 did not activate as anticipated. Nov. 20 it was found to be non-operational in the morning. During the course of the day, the charge rate was gradually decreased repeatedly. Despite numerous attempts, the technicians were unable to get the unit to operate.

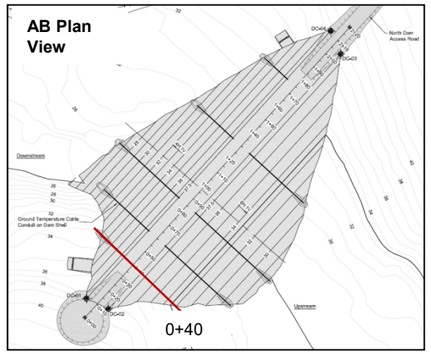
5.0 Conclusions

It appears that the subgrade evaporator section of North #2 has a blockage that is not allowing vapor to rise into the radiator section. It is possible that during the backfill process at the time of construction, the pipe was pinched or deviated to cause a liquid trap. AFC is of the opinion that this deviation or pinch is close to the radiator section of the system. If the blocked section of evaporator was closer to the end of the evaporator, the unit should have operated at a reduced capacity. It should have then started to operate more efficiently once the overall refrigerant charge was reduced. If this were the case, the unit would "short circuit" but still function. At no time did North #2 show any signs of functioning. This would indicate an obstruction close to the radiator section of the system. AFC estimates that the overall refrigerant remaining in the system is approximately 25% of the original charge volume.

5.0 Recommendations

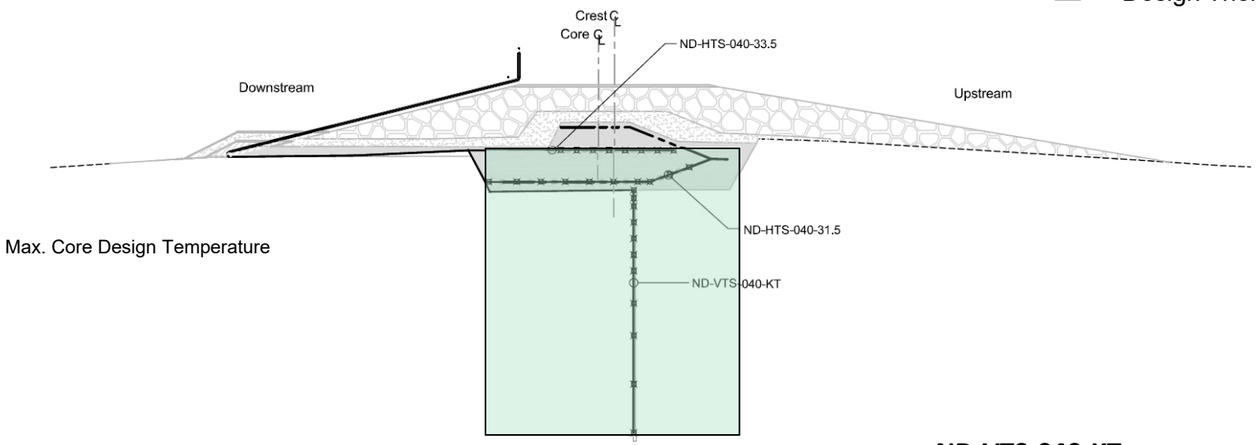
AFC recommends further monitoring of the subgrade temperatures to ensure the key-trench temperatures remain within the original design parameters. While original design parameters allowed for redundancy within the system, it is suggested that thermal modeling of the North side of the dam be completed using the five fully functional thermosyphons to ensure continued adequate sub-grade temperatures throughout the life of the project.

Appendix B – Ground Temperature Cables

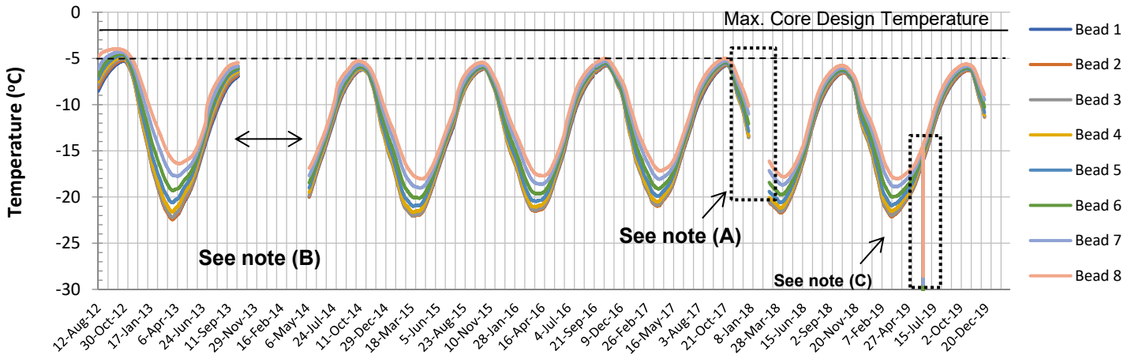


Legend:

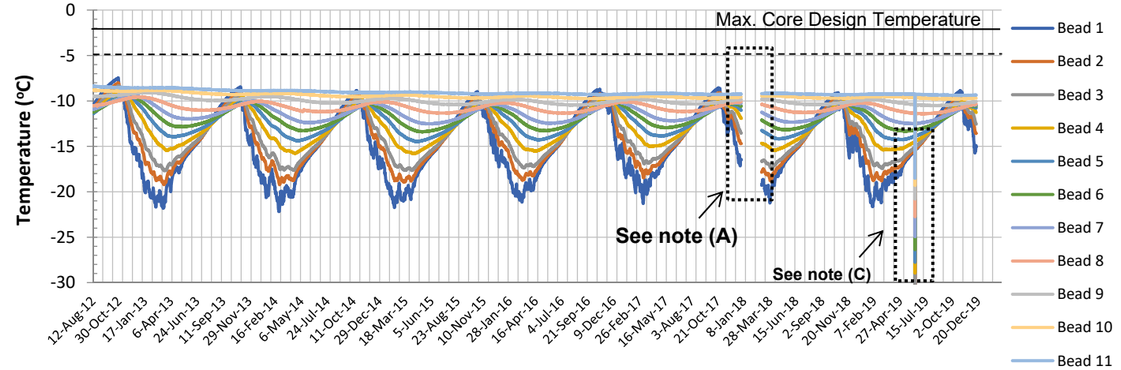
- GTC Status: Cable irreparably damaged
- GTC Status: Bead damaged or data missing
- Design Thermal Block



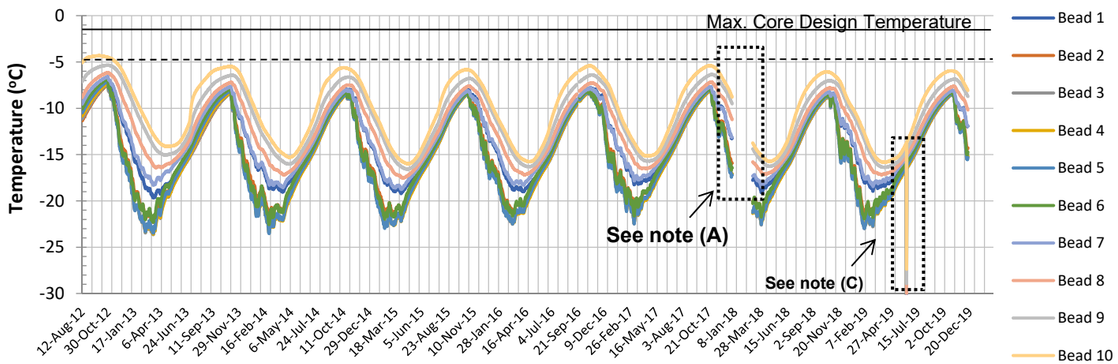
ND-HTS-040-33.5



ND-VTS-040-KT



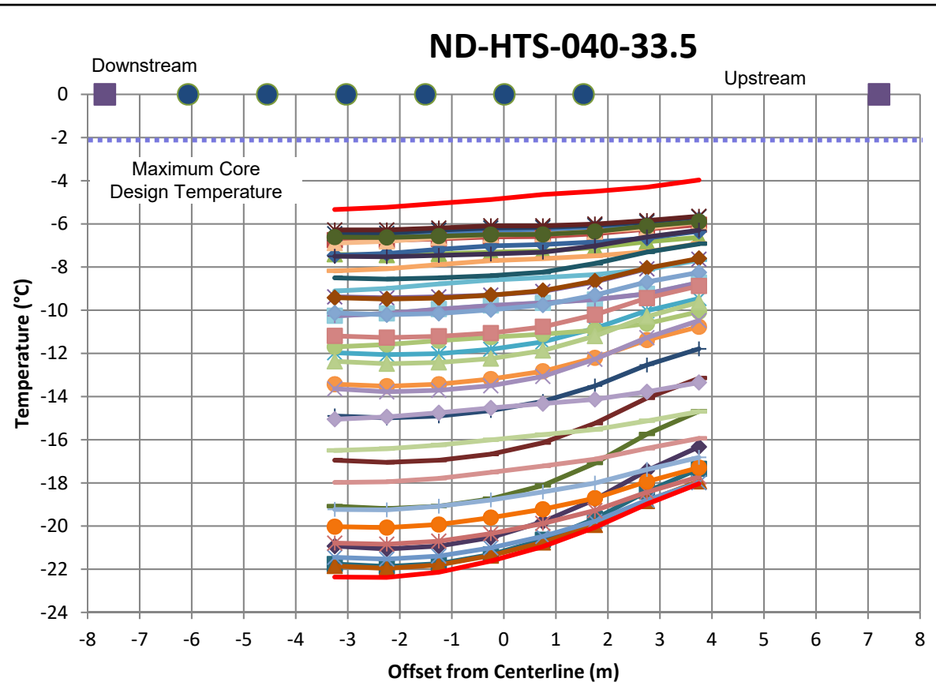
ND-HTS-040-31.5

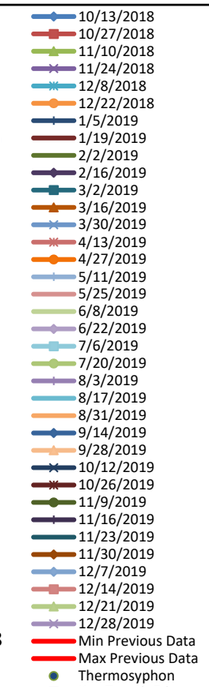


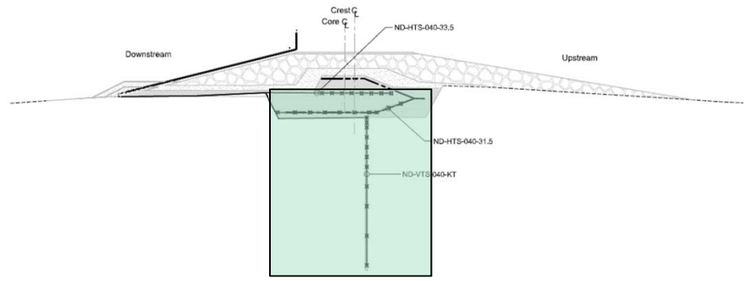
Notes:

- Bead numbers increase from downstream to upstream (horizontal) and top to bottom (vertical)
- **(A)** Data logger was disconnected from January 1, 2018 to March 3, 2018 for recalibration
- **(B)** GTC was disconnected from datalogger
- **(C)** A low temperature spike for all beads was observed for a single reading on June 12, 2019 and is attributed to an instrumentation error.

srk consulting	MAC RESOURCES	2019 AGI - North Dam
		Station 0+40 Ground Temperature Cable Temperature Vs. Time
Job No: 1CT022.038 Filename: AppB_1CT022.038_ND_GTC	**DORIS TIA**	Date: Feb. 2020 / Approved: AB / Figure: **B.1**

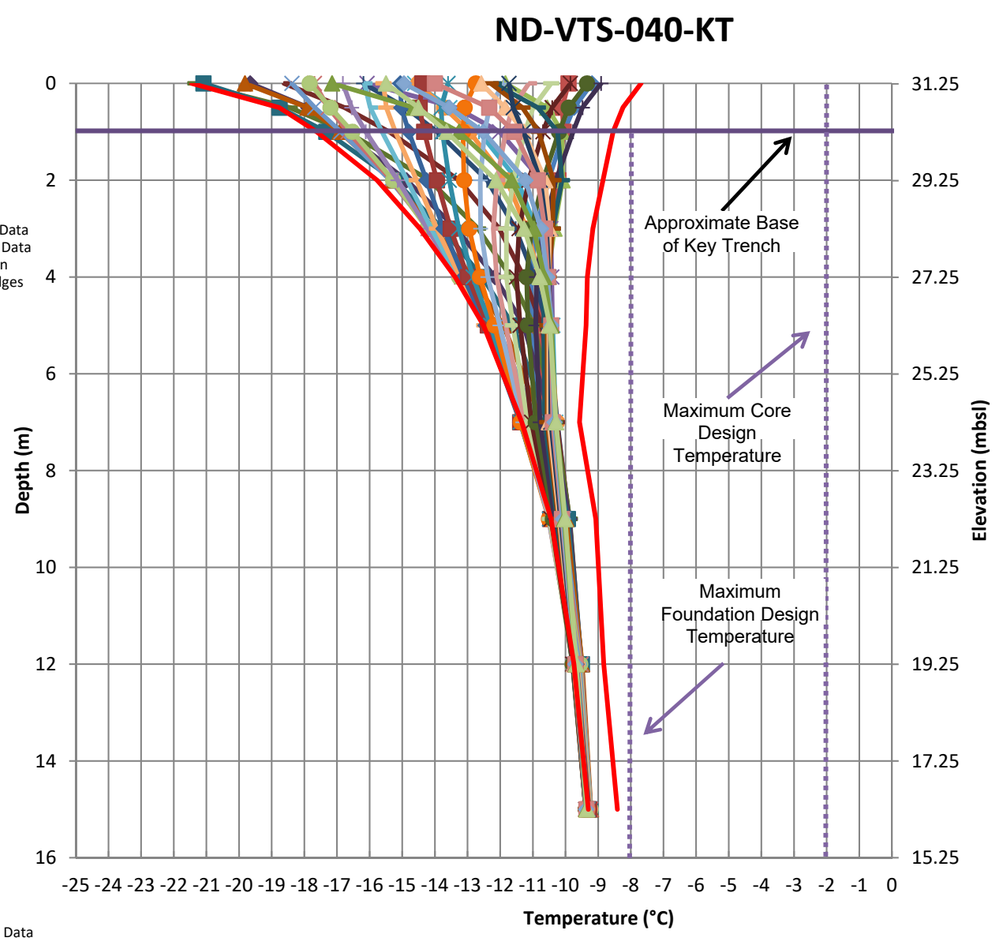


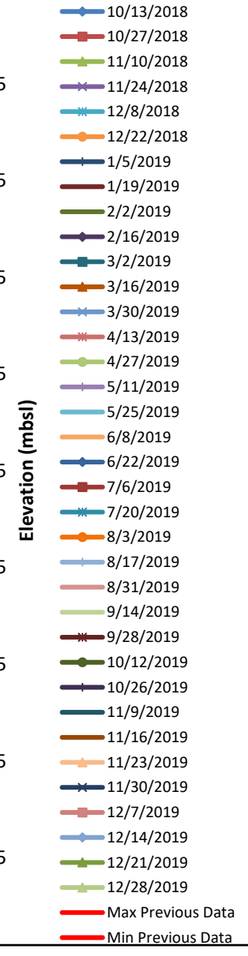


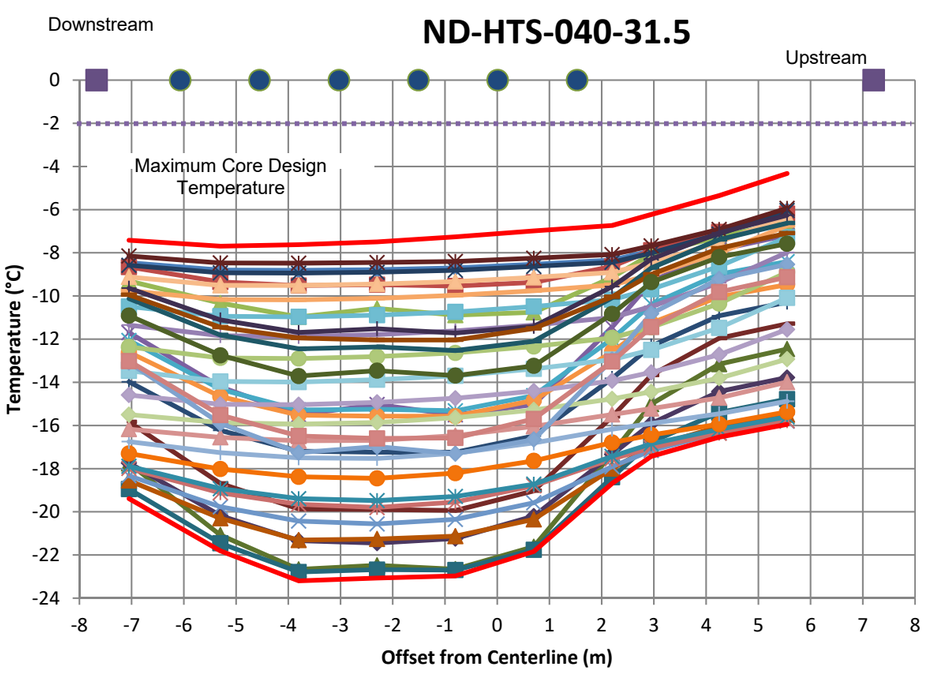


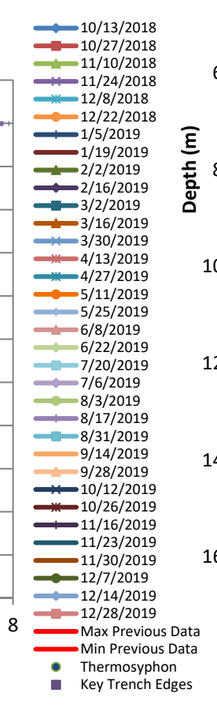
Legend:

- GTC Status: Cable irreparably damaged
- GTC Status: Bead damaged or data missing
- Design Thermal Block





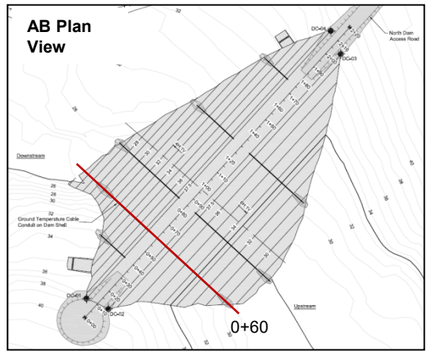


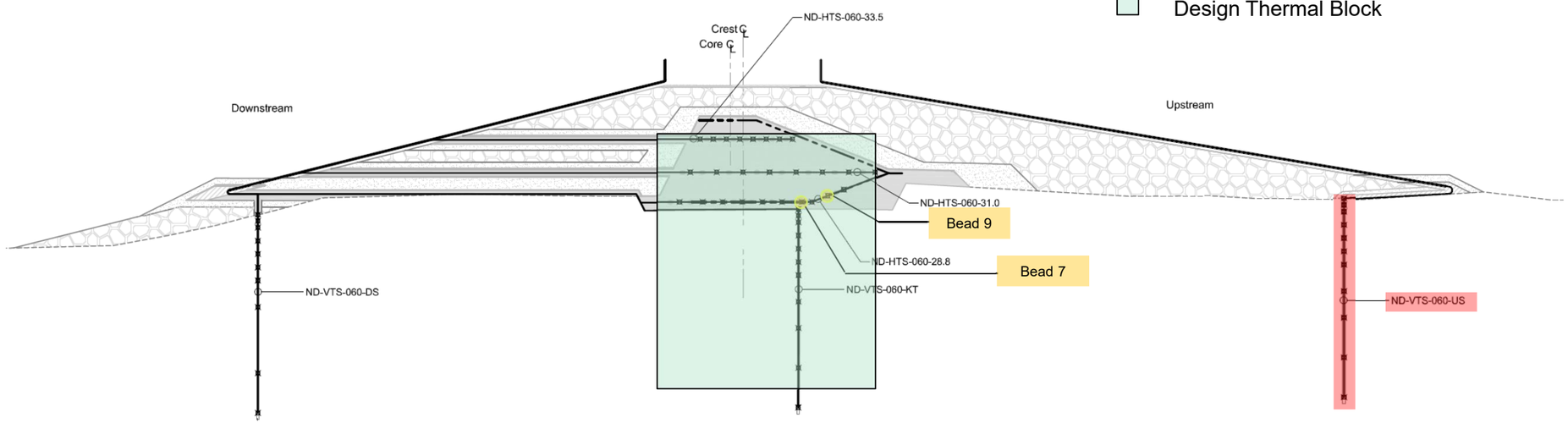


Note:

- Previous Data was recorded between August 2012 and September 2018

srk consulting	MAC RESOURCES	2019 AGI - North Dam
		Station 0+40 Ground Temperature Cable Readings by Location
Job No: 1CT022.038 Filename: AppB_1CT057.038_ND_GTC	**DORIS TIA**	Date: Feb. 2020 / Approved: PL / Figure: **B.2**

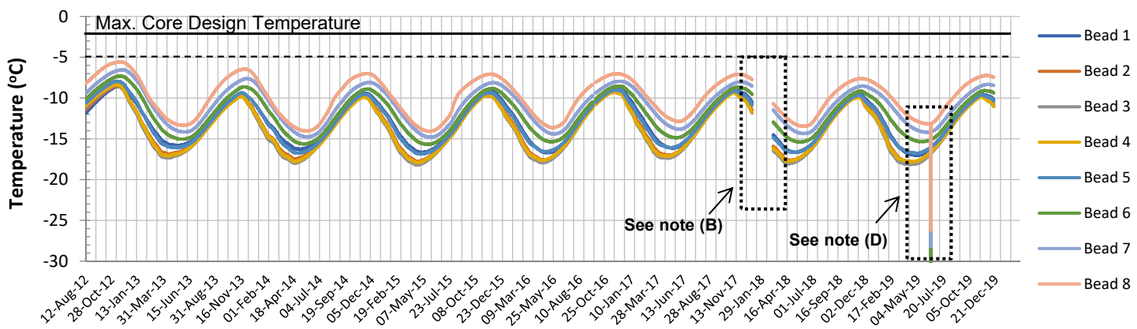




ND-HTS-060-33.5

ND-HTS-060-28.8

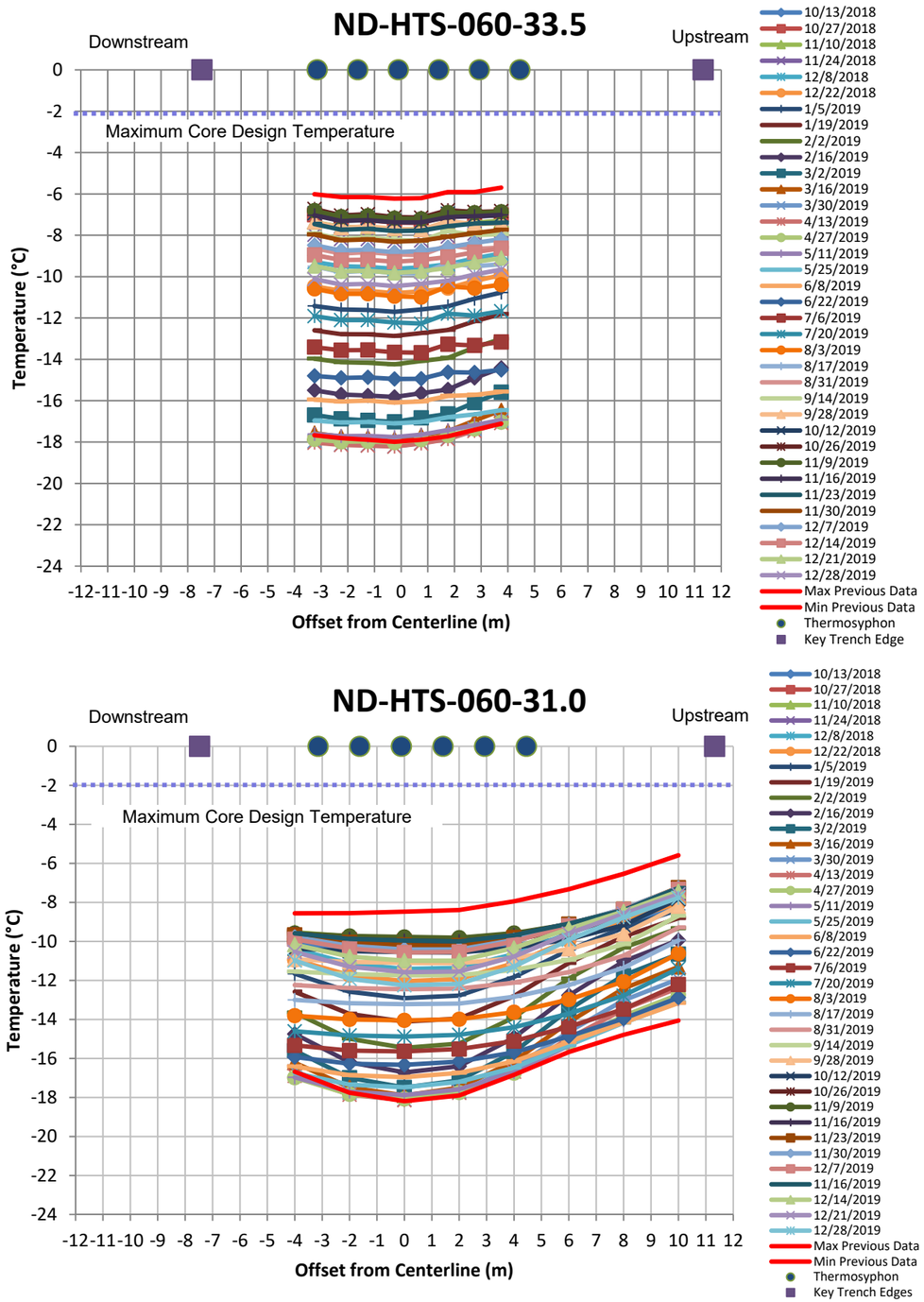
ND-HTS-060-31.0

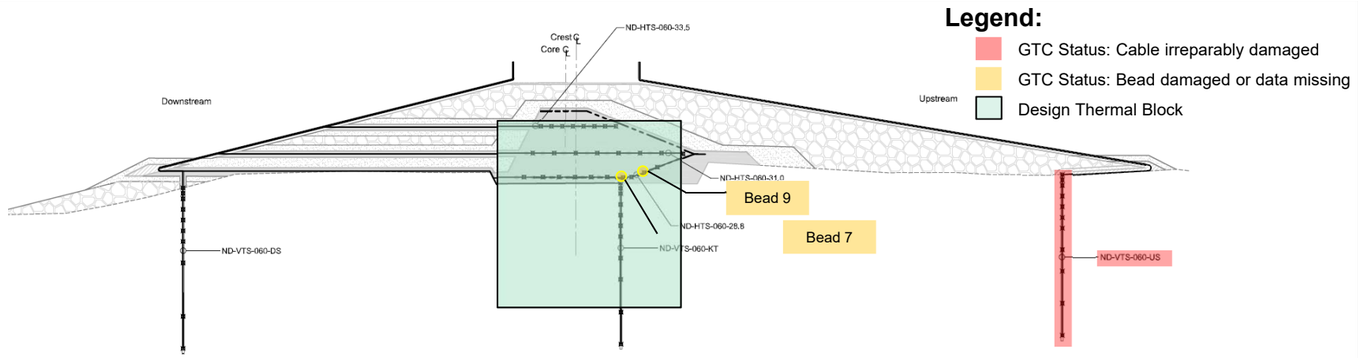


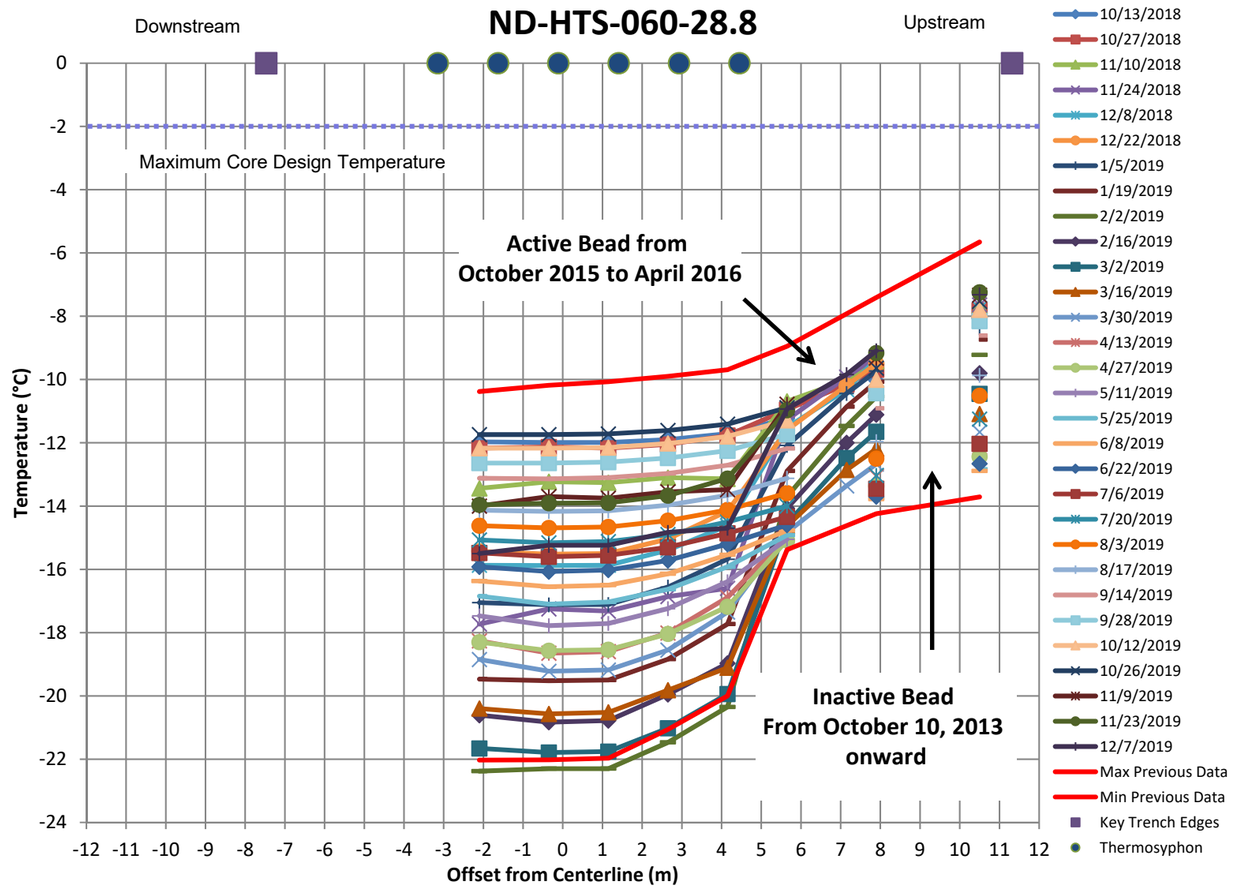
Notes:

- Bead numbers increase from downstream to upstream (horizontal) and top to bottom (vertical)
- **(A)** Variation in Ground Temperature Cable readings during winter months due to close proximity of Ground Temperature Cable beads to thermosyphon pipes.
- **(B)** Data logger was disconnected from January 1, 2018 to March 3, 2018 for recalibration
- **(C)** No readings from Bead 7
- **(D)** A low temperature spike for all beads was observed for a single reading on June 12, 2019 and is attributed to an instrumentation error.

srk consulting	TMAC RESOURCES	2019 AGI - North Dam
Job No: 1CT022.038 Filename: AppB_1CT022.038_ND_GTC	DORIS TIA	**Station 0+60** **Horizontal Ground Temperature Cable Temperature Vs. Time**
		Date: Feb. 2020 / Approved: AB / Figure: **B.3**



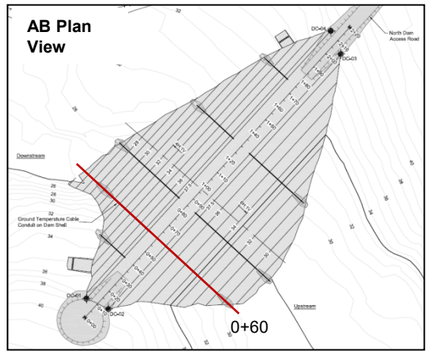


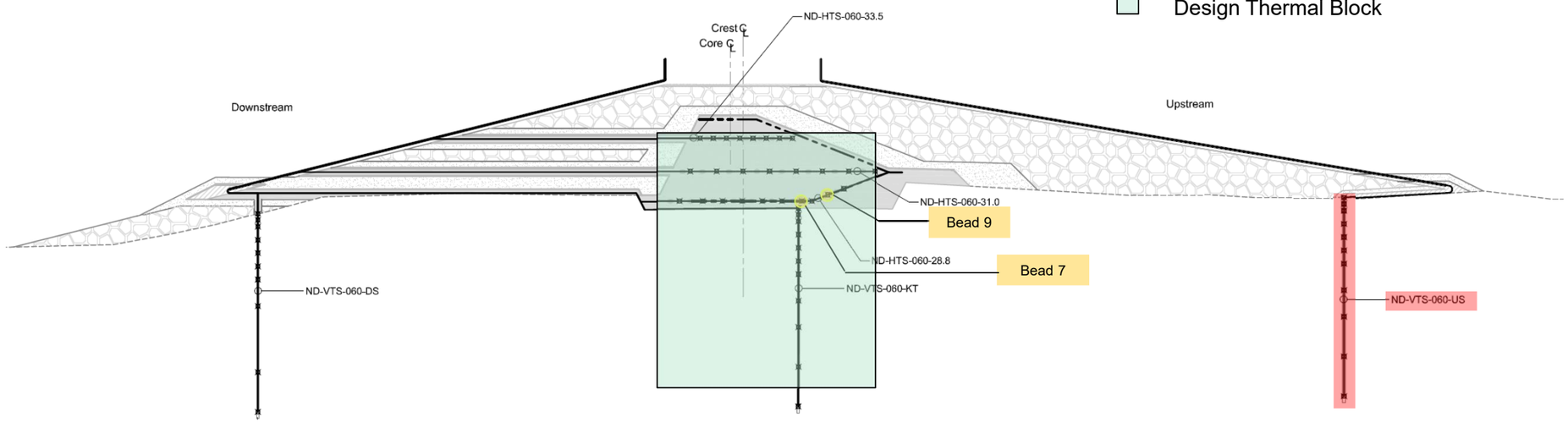


Note:

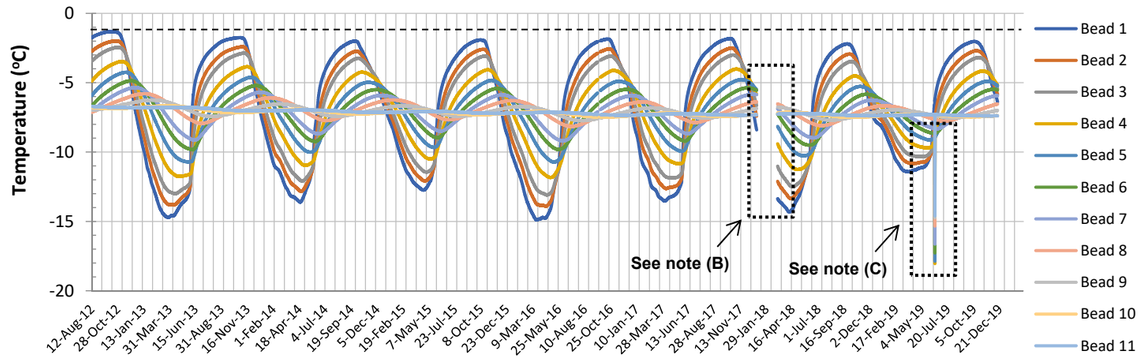
- Previous Data was recorded between August 2012 and September 2018

srk consulting	MAC RESOURCES	2019 AGI - North Dam
		Station 0+60 Horizontal Ground Temperature Cable Readings by Location
Job No: 1CT022.038 Filename: AppB_1CT057.038_ND_GTC	**DORIS TIA**	Date: Feb. 2020 · Approved: PL · Figure: **B.4**

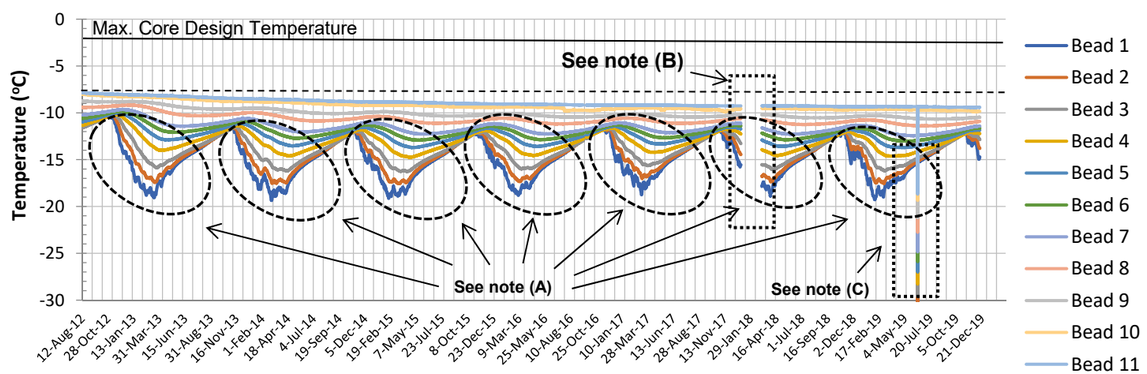




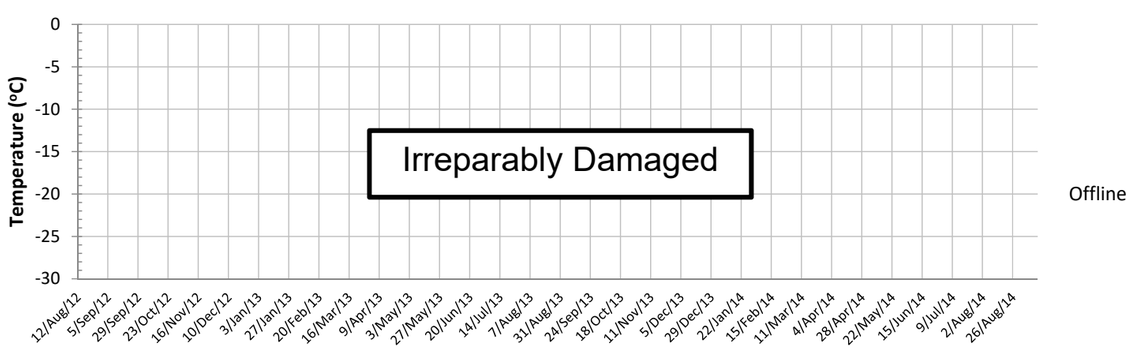
ND-VTS-060-DS



ND-VTS-060-KT



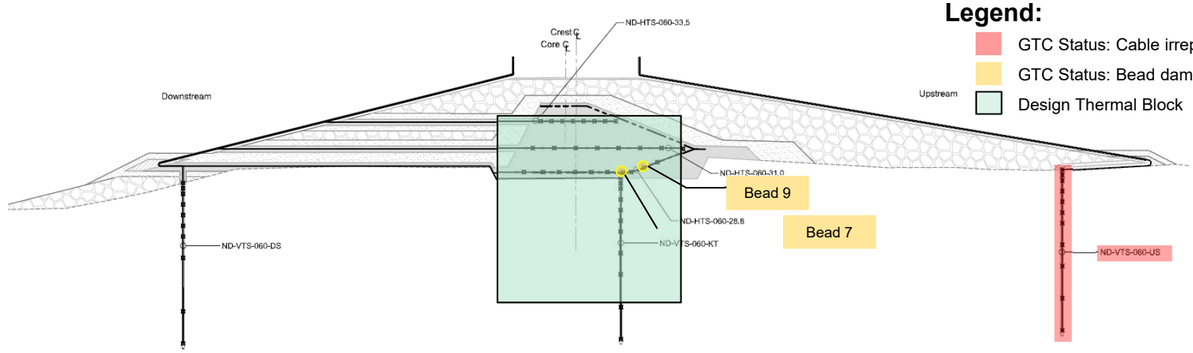
ND-VTS-060-US

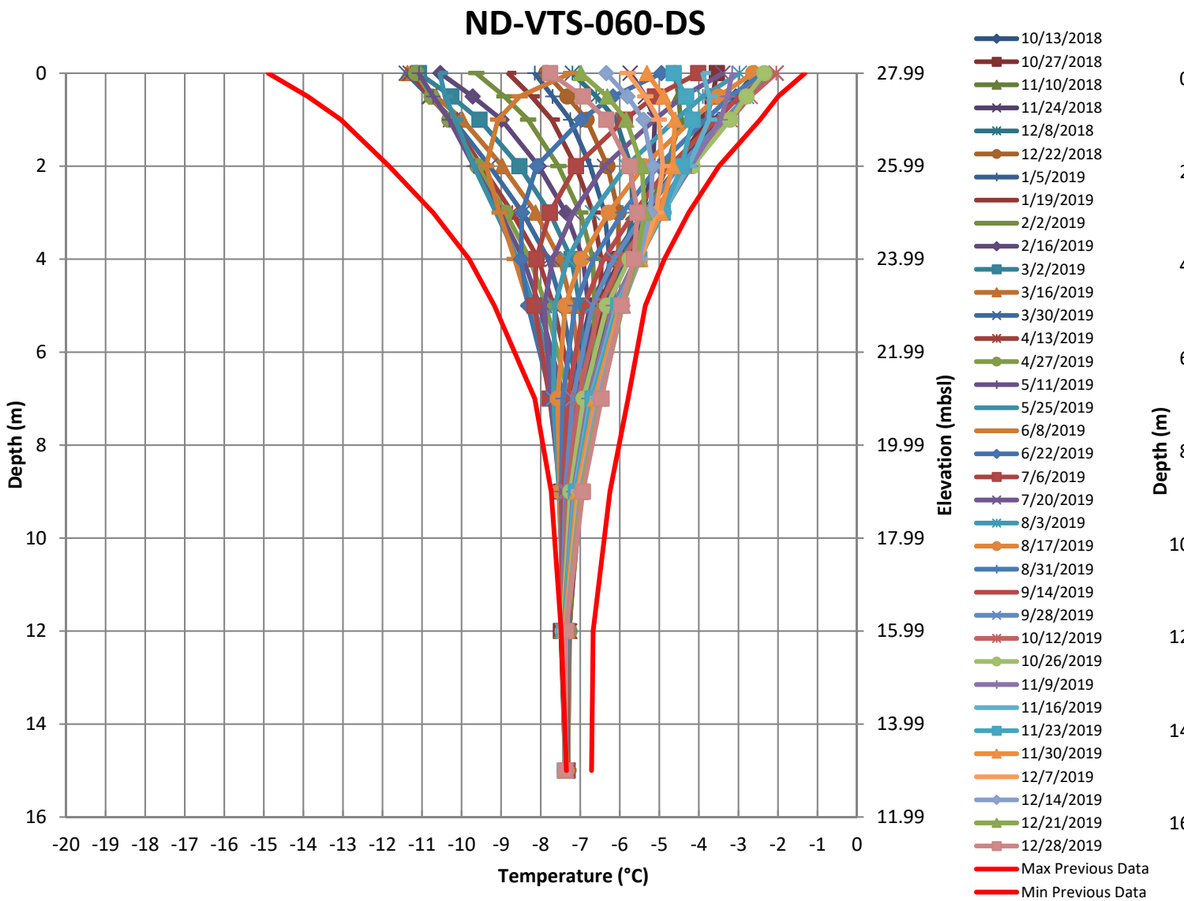


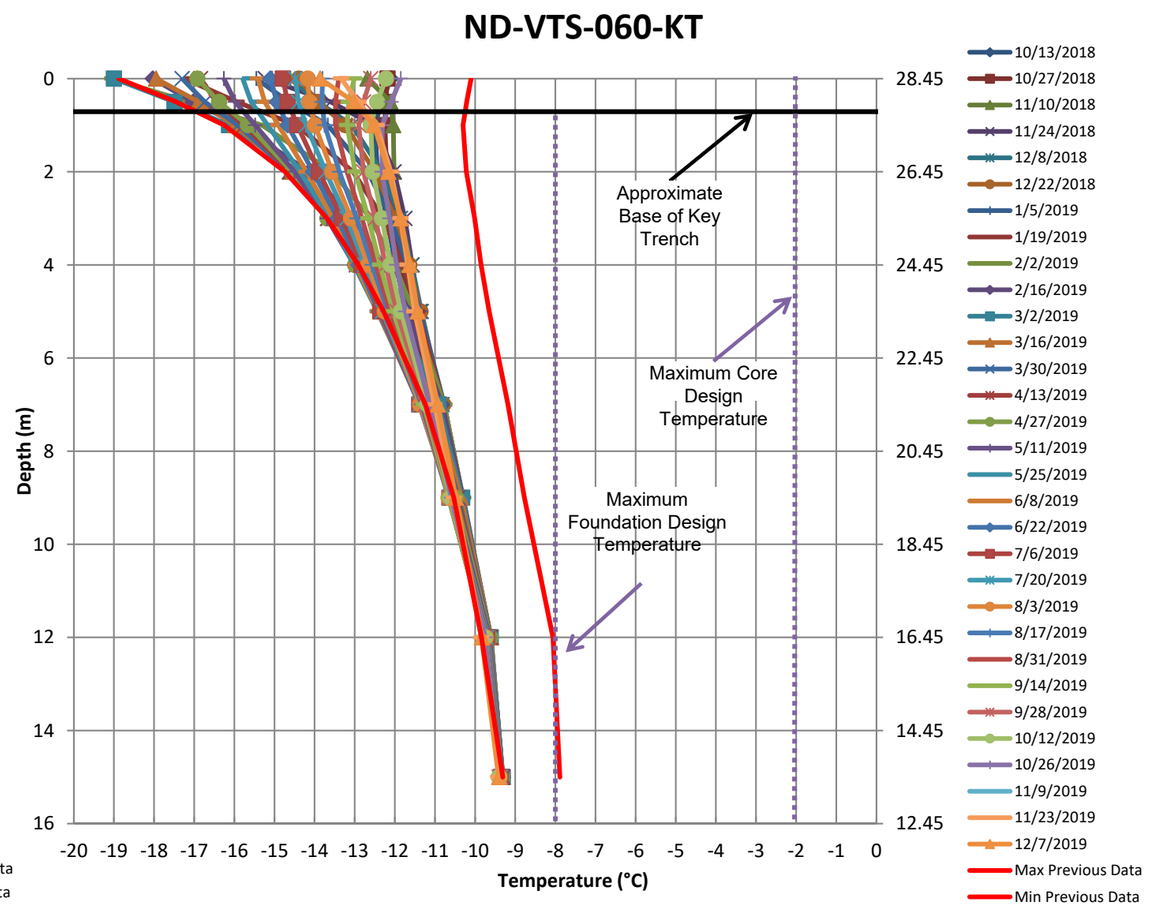
Notes:

- Bead numbers increase from downstream to upstream (horizontal) and top to bottom (vertical)
- **(A)** Variation in Ground Temperature Cable readings during winter months due to close proximity of Ground Temperature Cable beads to thermosyphon pipes.
- **(B)** Data logger was disconnected from January 1, 2018 to March 3, 2018 for recalibration
- **(C)** A low temperature spike for all beads was observed for a single reading on June 12, 2019 and is attributed to an instrumentation error

srk consulting	MAC RESOURCES	2019 AGI - North Dam
Job No: 1CT022.038 Filename: AppB_1CT022.038_ND_GTC	DORIS TIA	**Station 0+60** **Vertical Ground Temperature Cable Temperature Vs. Time**
		Date: Feb. 2020 / Approved: AB / Figure: **B.5**



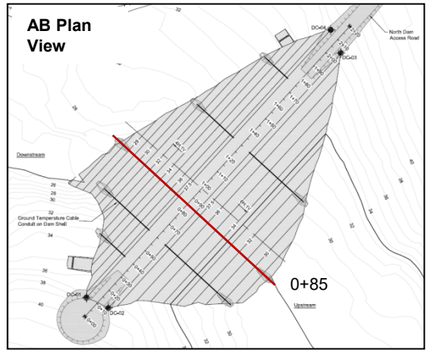


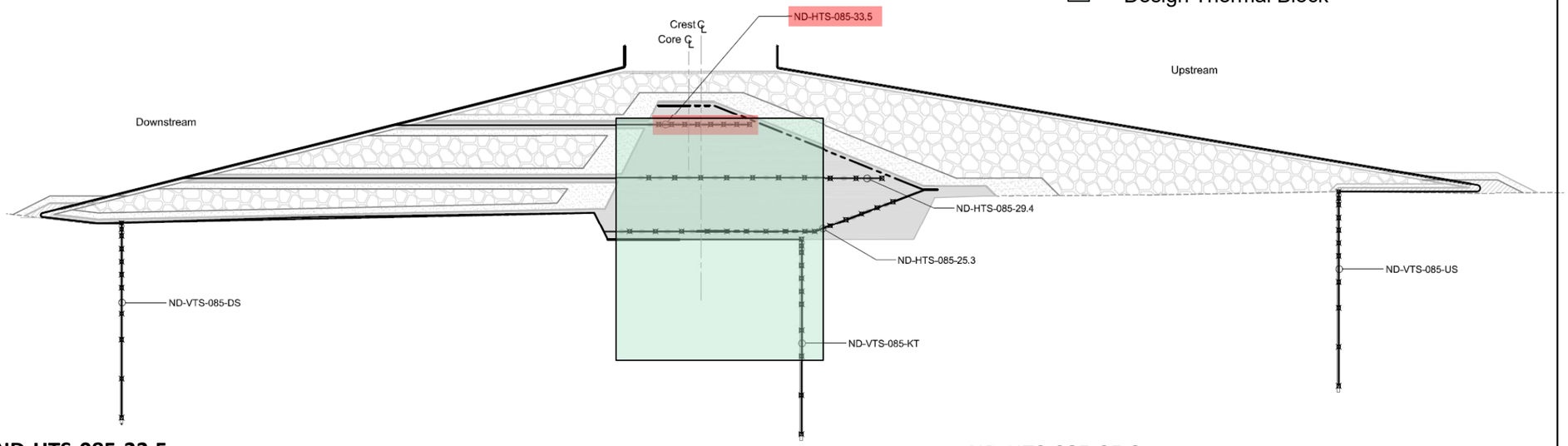


Note:

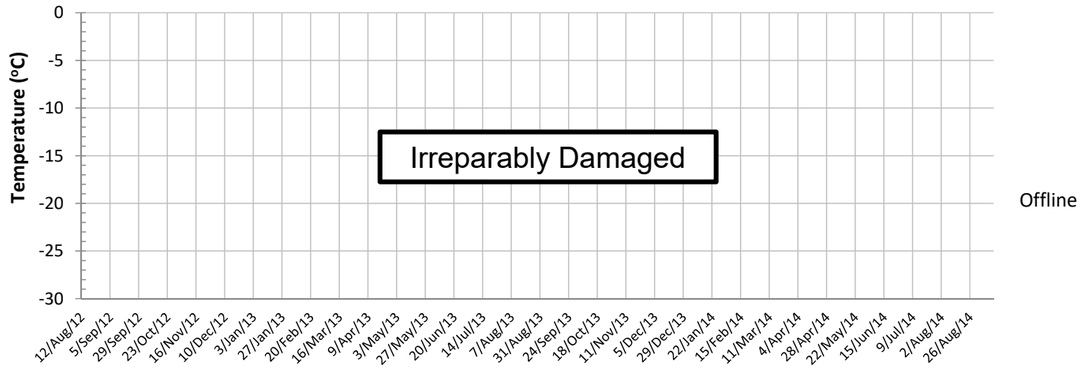
- Previous Data was recorded between August 2012 and September 2018

srk consulting	TMAC RESOURCES	2019 AGI - North Dam
		Station 0+60 Vertical Ground Temperature Cable Readings by Location
Job No: 1CT022.038 Filename: AppB_1CT057.038_ND_GTC	**DORIS TIA**	Date: Feb. 2020 / Approved: PL / Figure: **B.6**

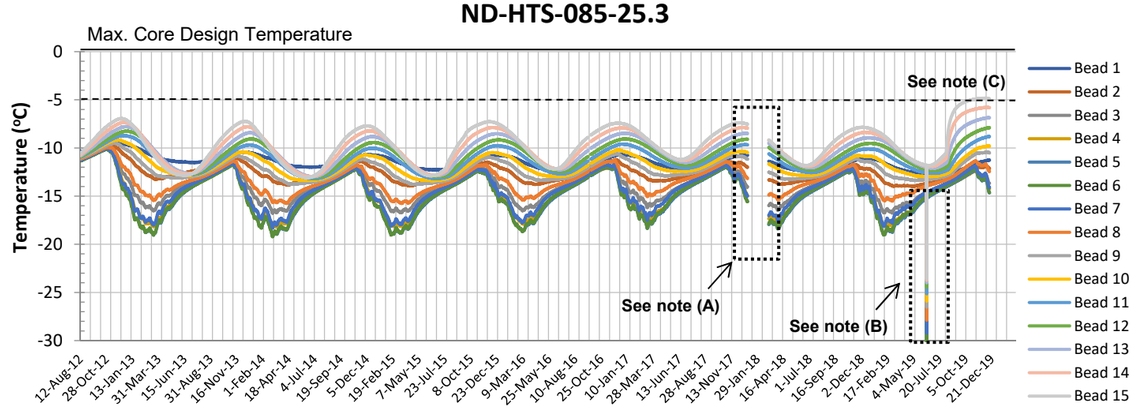




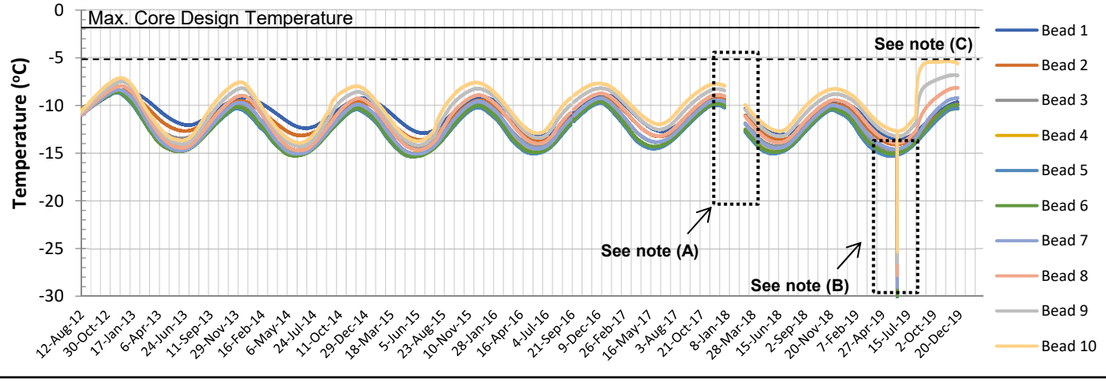
ND-HTS-085-33.5



ND-HTS-085-25.3



ND-HTS-085-29.4



Notes:

- Bead numbers increase from downstream to upstream (horizontal) and top to bottom (vertical)
- **(A)** Data logger was disconnected from January 1, 2018 to March 3, 2018 for recalibration
- **(B)** A low temperature spike for all beads was observed for a single reading on June 12, 2019 and is attributed to an instrumentation error
- **(C)** Temperature rise is expected to be a result of the rise in the reclaim pond water level.

srk consulting	MAC RESOURCES	2019 AGI - North Dam
Job No: 1CT022.038 Filename: AppB_1CT022.038_ND_GTC	DORIS TIA	**Station 0+85** **Horizontal Ground Temperature Cable Temperature Vs. Time**
		Date: Feb. 2020 / Approved: AB / Figure: **B.7**