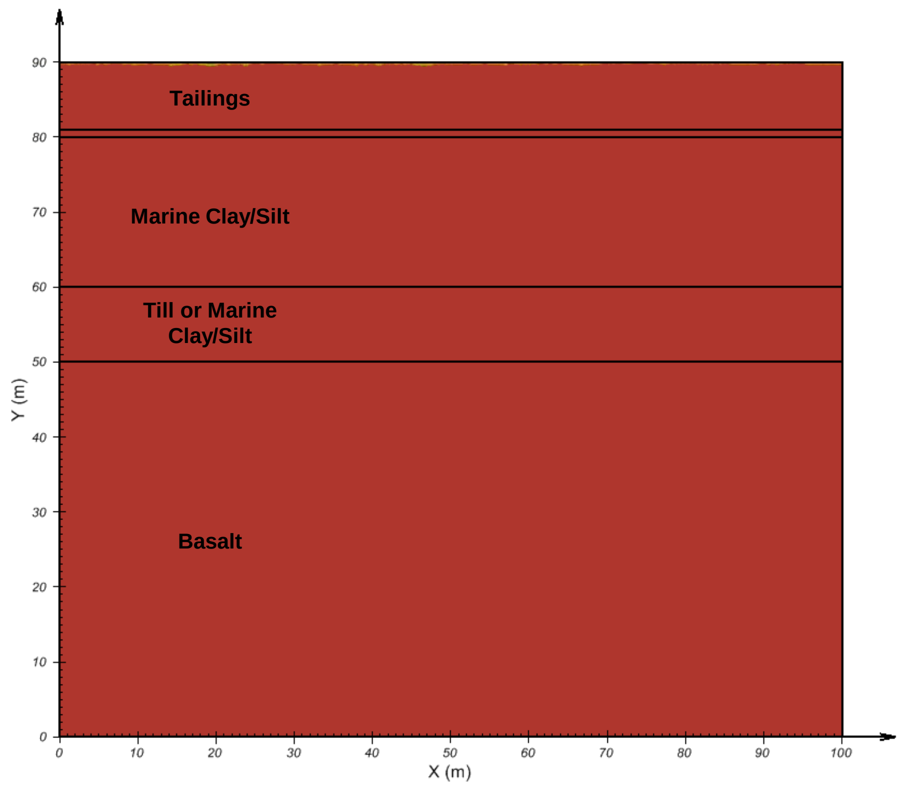
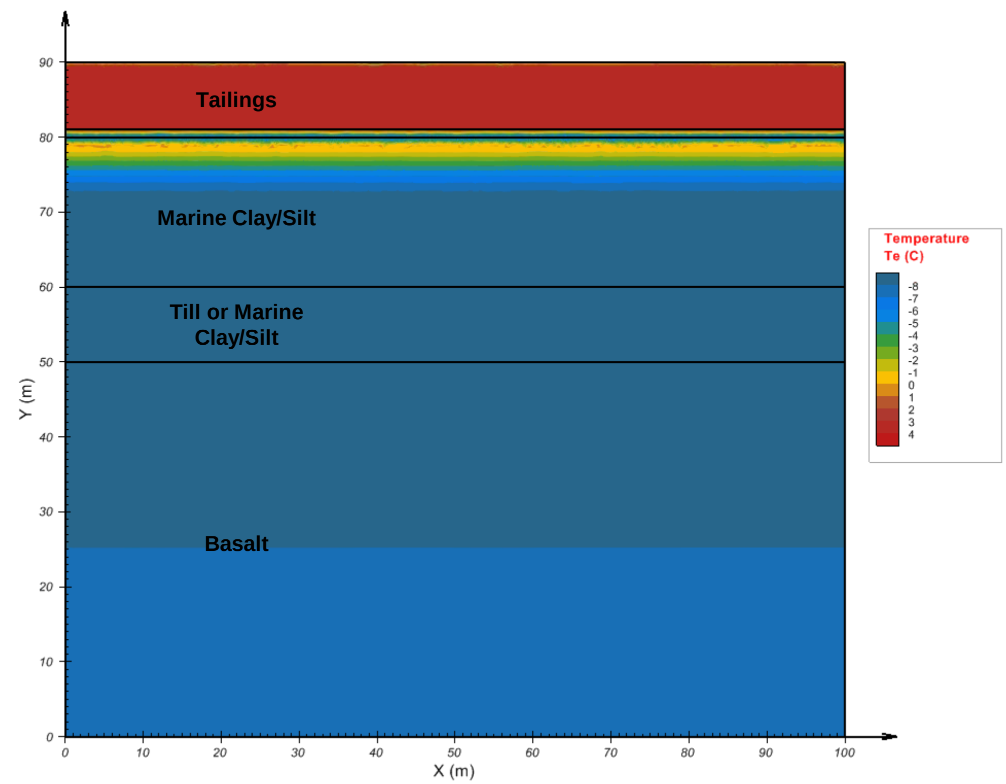


Case A – Constant temperature 4°C



Case B – Conditioned Ground Profile

srk consulting

MAC RESOURCES

TAILINGS THERMAL ASSESSMENT

Tailings Freezeback - Initial Model Conditions

Job No: 1CT022.002.200.500

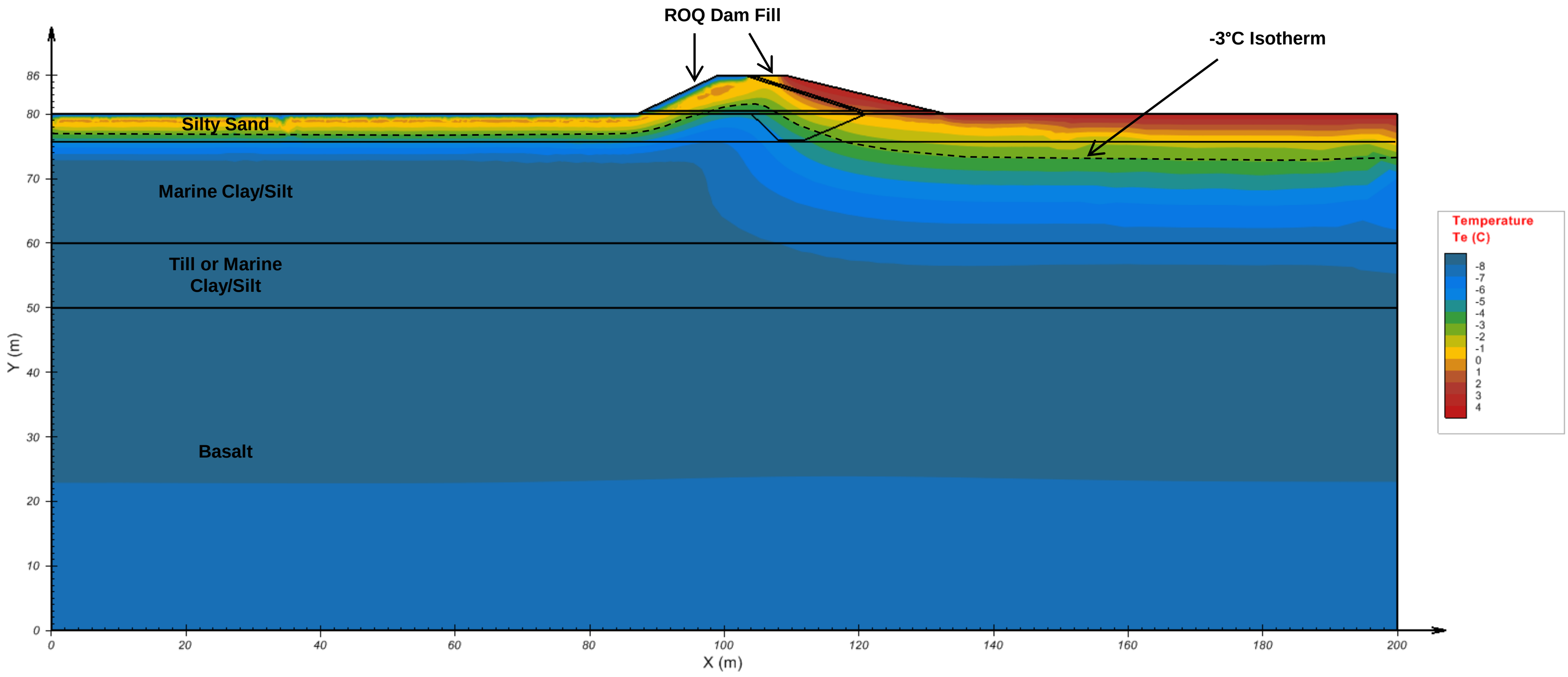
Filename: Thermal_Figures_3-7_1CT022.002.200.500_rev2_mjm_bc

DORIS NORTH PROJECT

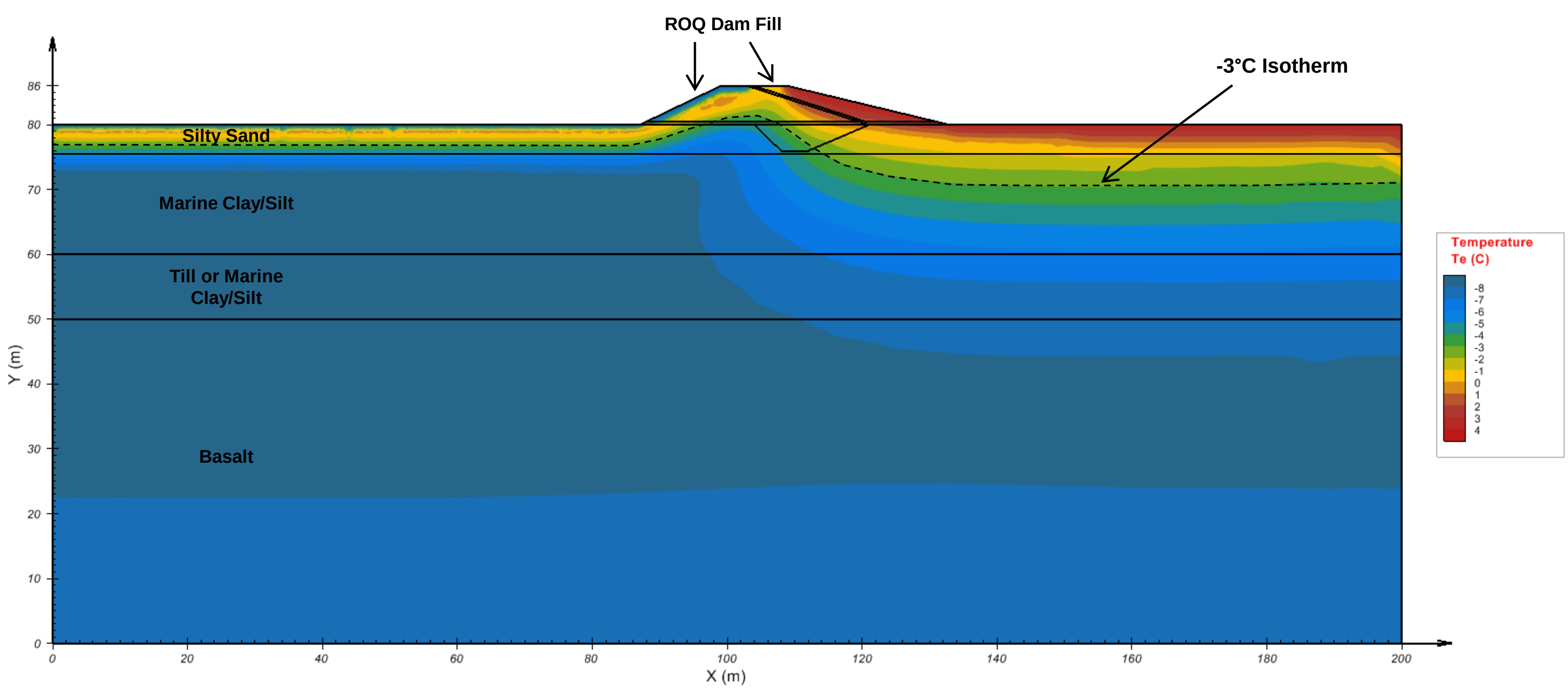
Date: 2015/04/15

Approved: EMR

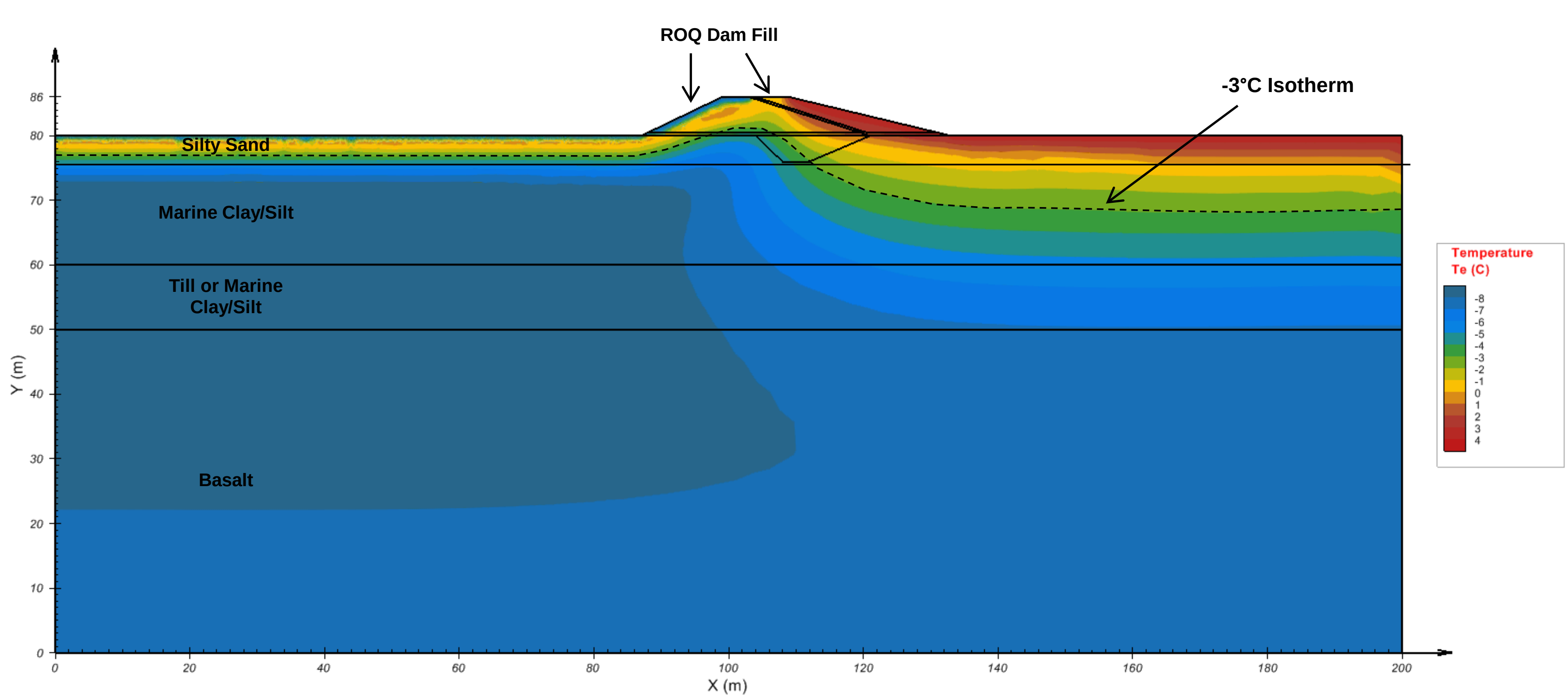
Figure: 7



Time – year 2



Time – year 4



Time – year 6

srk consulting

MAC RESOURCES

TAILINGS THERMAL ASSESSMENT

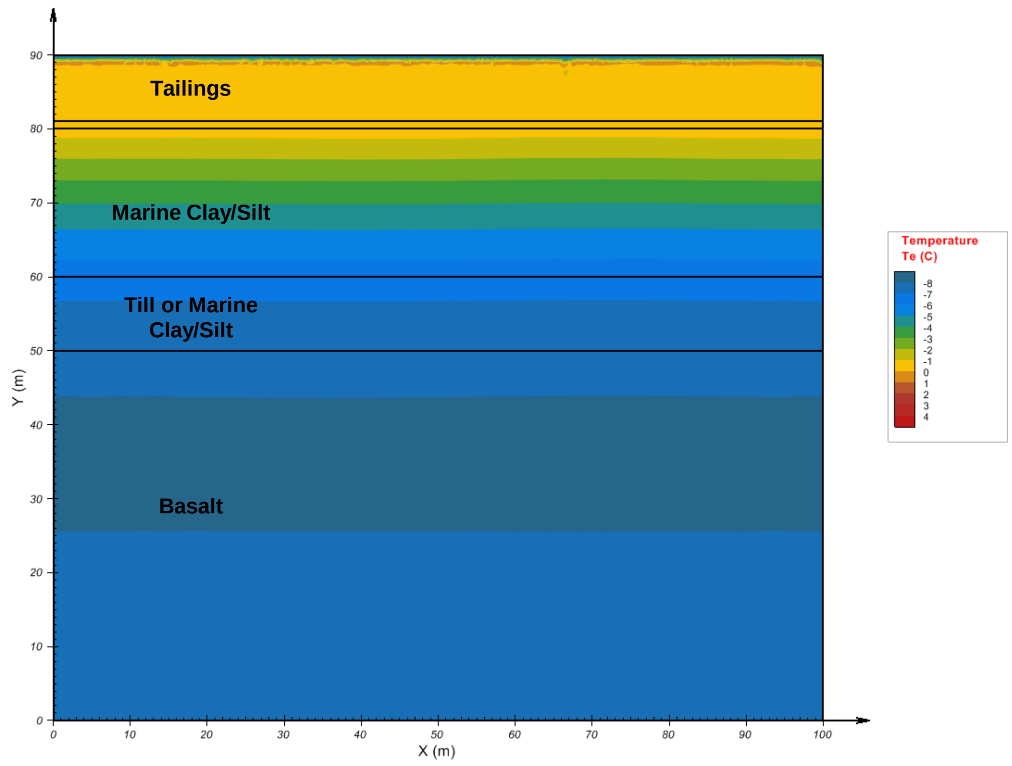
Thermal Performance of South Dam at years 2,4 and 6

Job No: 1CT022.002.200.500

Filename: ThermalMemo_Figures_7-9_1CS020.006_rev03_mjm_im_bc

DORIS NORTH PROJECT

Date:	Approved:	Figure:
2015/04/15	EMR	8



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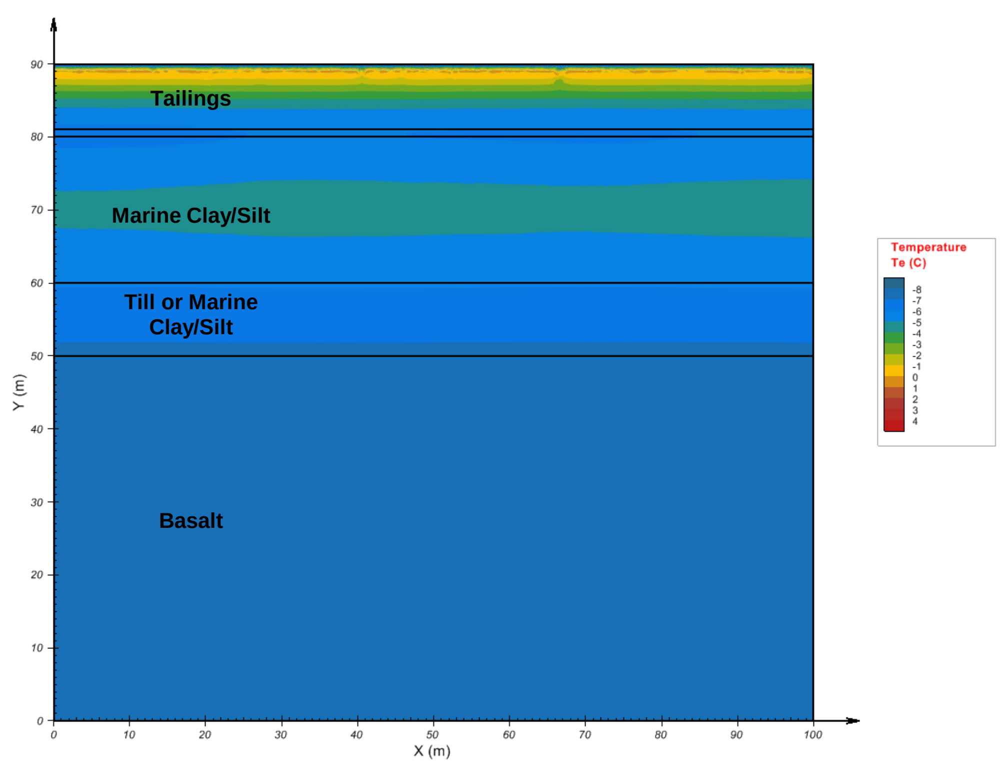

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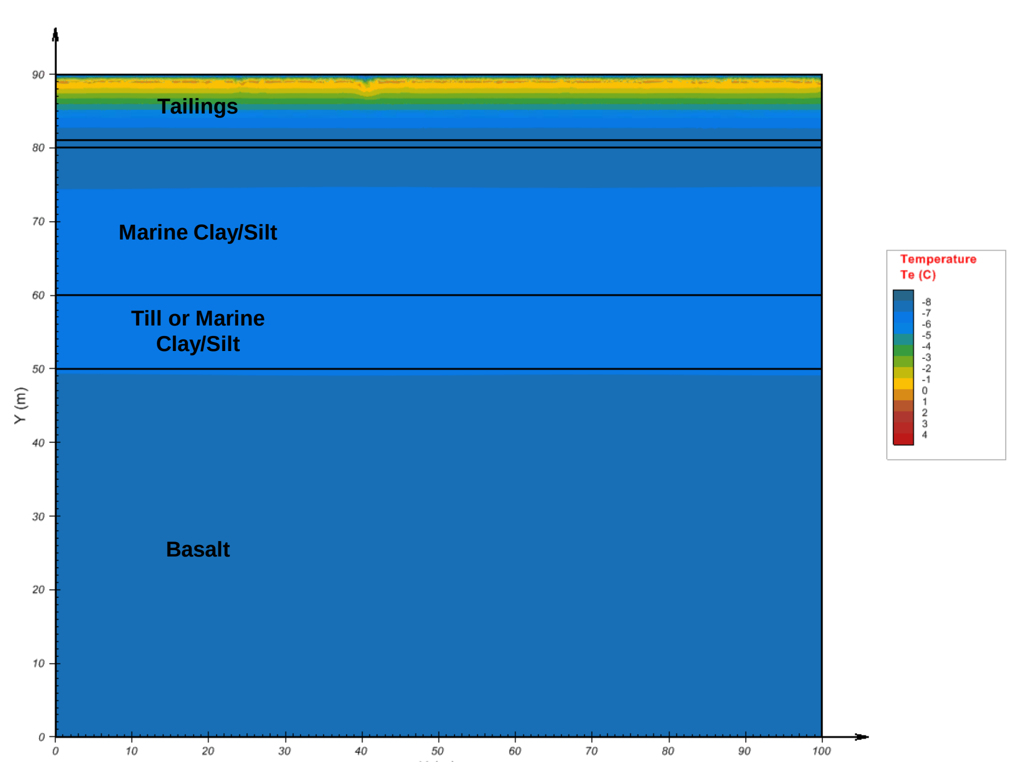
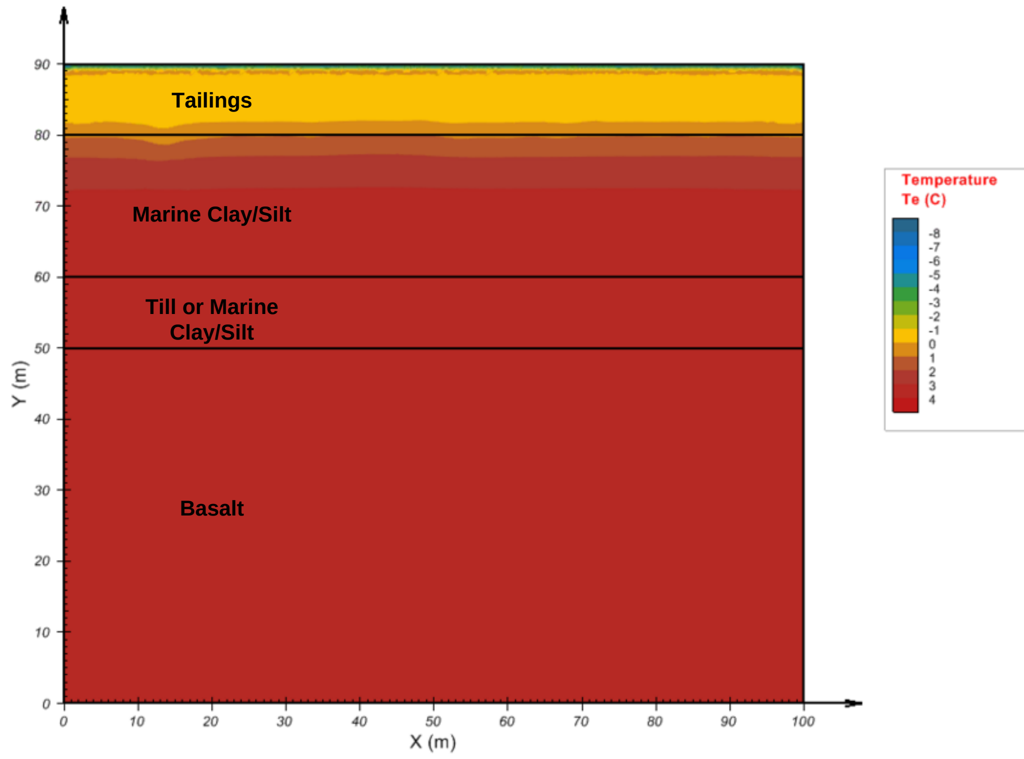
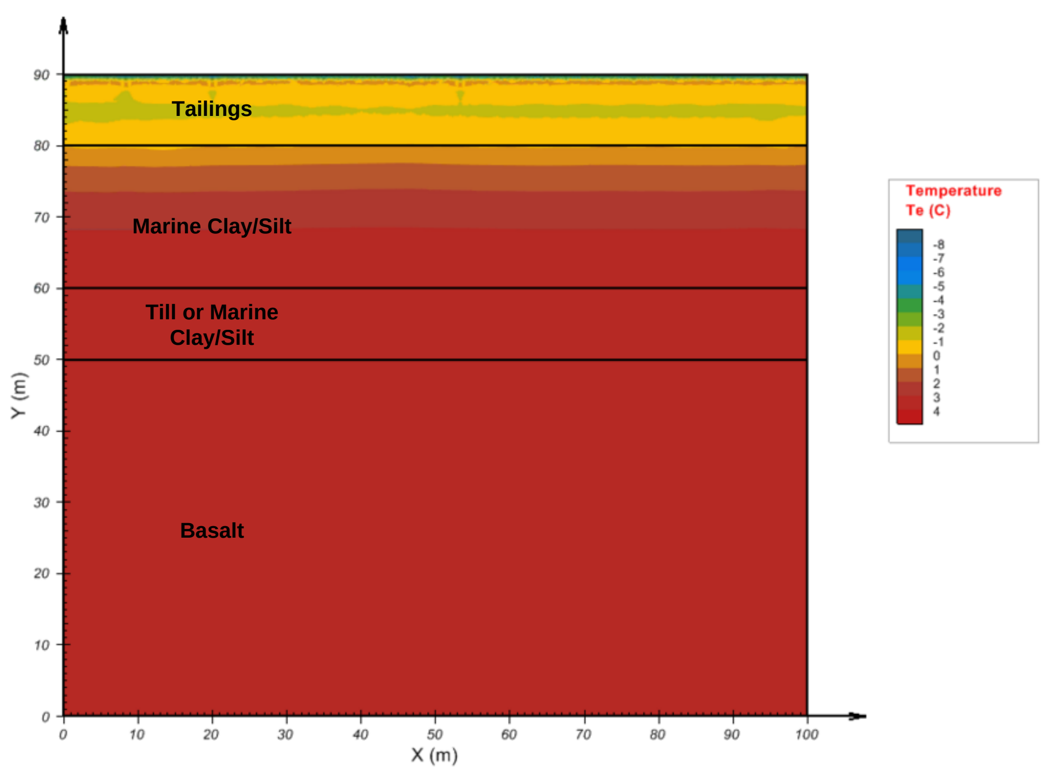


Time – year 8

srk consulting	MAC RESOURCES	TAILINGS THERMAL ASSESSMENT **Tailings Freeze-Back in Areas without Talik in Years 4, 6, and 8**
Job No: 1CT022.002.200.500 Filename: ThermalMemo_Figures_7-9_1CS020.006_rev03_mjm_im_bc	DORIS NORTH PROJECT	Date: 2015/04/15 · Approved: EMR · Figure: **9**



Time – year 4



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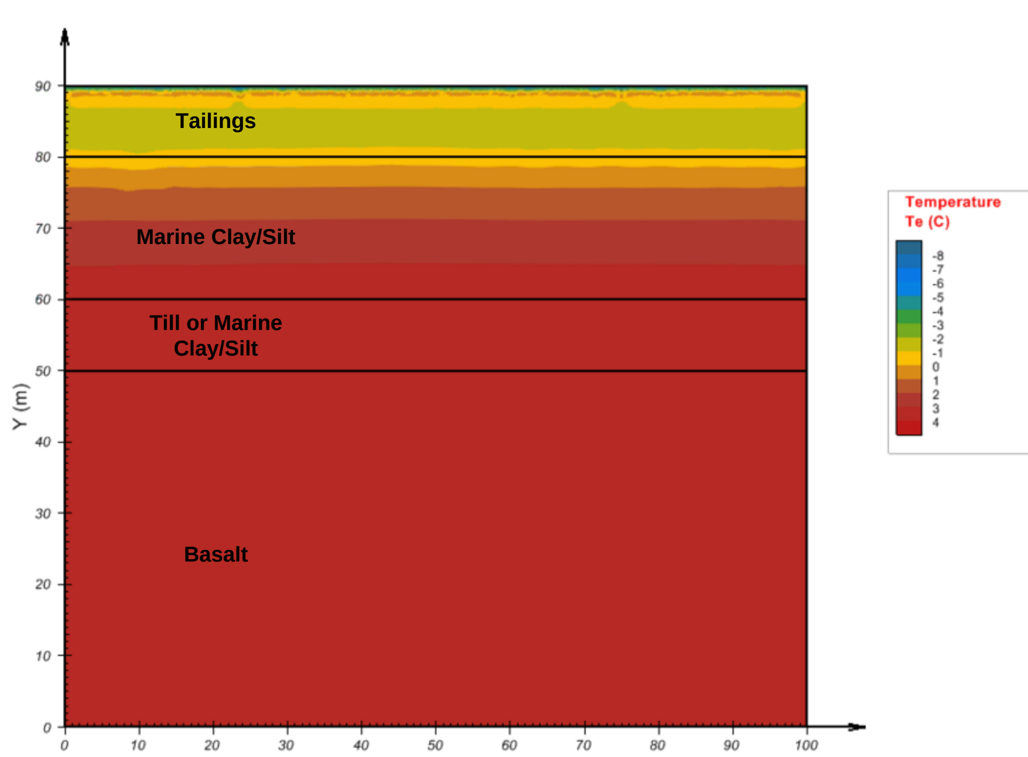

Time – year 8

srk consulting	MAC RESOURCES	TAILINGS THERMAL ASSESSMENT **Tailings Freeze-Back in Areas withTalik in Years 4, 6, and 8**
Job No: 1CT022.002.200.500 Filename: ThermalMemo_Figures_7-9_1CS020.006_rev03_mjm_im_bc	DORIS NORTH PROJECT	Date: 2015/04/15 — Approved: EMR — Figure: **10**

Appendix G – South Dam, Interim Dike and Tailings Consolidation Evaluation

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Memo

To:	Project File	**Client:**	TMAC Resources Ltd.
From:	Murray McGregor, EIT	**Project No:**	1CT022.002.200.520
Reviewed By:	Maritz Rykaart, PhD, PEng	**Date:**	May 29, 2015
Subject:	Doris North Project: South Dam, Interim Dike and Tailings Consolidation Evaluation		

1 Introduction

1.1 Tailings Management Concept

TMAC Resources Ltd. plan to revise their tailings management plan to accommodate a greater volume of tailings at the Doris North Project, located in Nunavut, approximately 160 km southwest of Cambridge Bay. The revised volume of tailings exceeds the amount that can sub-aqueously be deposited in the Tailings Impoundment Area (TIA) with a permanent water cover after the North Dam gets breached.

The tailings management plan has subsequently been redesigned to incorporate a sub-aerial deposition strategy starting at the south end of the TIA. Approximately 2.5 Mt of tailings will be deposited along the southern end of the TIA and will be contained by a new Interim Dike about 1,500 m north of the South Dam. The remaining portion of the TIA, between the Interim Dike and the existing North Dam, will not contain any tailings and will act as a Reclaim Pond. Tailings will be spigotted from a number of points along the eastern perimeter of the TIA and from the South Dam creating a landscape that drains towards the Interim Dike at an average slope of about 1%.

The South Dam was originally designed as a frozen core dam (SRK 2007), as it was intended to retain water for a period of up to 20 years. With the proposed revised tailings deposition strategy, the South Dam is not required to retain water since the tailings will be beached from the face of the dam from the start of operations. As a result, the South Dam design has been changed to a frozen foundation dam consisting of a compacted rock fill dam with a geosynthetic clay liner (GCL) keyed into the permafrost overburden foundation.

Upon closure, the tailings surface will be covered with a nominal waste rock cover of 0.3 m thickness. The function of the cover is to prevent dust and to minimize direct contact by terrestrial animals. The cover will terminate at the Interim Dike, and the Interim Dike will be levelled to match the elevation of the cover. Once the water quality in the Reclaim Pond has reached the required discharge criteria, the North Dam will be breached as originally intended.

1.2 Consolidation Evaluation Objective

The South Dam will be constructed on frozen soils and is designed as a frozen foundation dam. Thermal modeling has confirmed that these conditions would readily be met (SRK 2015) therefore no settlement evaluation is required.

The Interim Dike will be constructed over unconsolidated lake bed sediments so consolidation settlement will be expected. Similarly, the hydraulic deposition of tailings will result in the tailings itself being subject to consolidation.

This technical memorandum provides details of the magnitude and time estimates for these settlements to ensure that the necessary design mitigation measures can be developed.

2 Consolidation Evaluation

2.1 Method/Theory

Empirical settlement calculations were completed using Terzaghi's one-dimensional (1D) theory of consolidation. For these calculations, laboratory data is used to construct relationships between void ratio and effective stress; where effective stress is presented as a log scale. Terzaghi's consolidation theory then predicts ultimate settlements using the relationship:

$$\delta_c = \frac{C_r}{1+e_0} H \log\left(\frac{\sigma'_{zc}}{\sigma'_{z0}}\right) + \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'_{zf}}{\sigma'_{zc}}\right)$$

Where:

δ_c = ultimate settlement due to consolidation (m)
C_r = recompression index (dimensionless)
C_c = compression index (dimensionless)
e_0 = initial void ratio (dimensionless)
H = thickness of the consolidation layer (m)
σ'_{zc} = pre-consolidation effective stress (kPa)
σ'_{z0} = initial in-situ effective stress (kPa)
σ'_{zf} = final in-situ effective stress (kPa)

It is assumed that all foundation and tailings materials are normally consolidated and therefore re-compression was not considered. This means the 1D consolidation can be estimated by the simplified empirical relationship:

$$\delta_c = \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'_{zf}}{\sigma'_{z0}}\right)$$

In applying the empirical equation above, the following assumptions were adopted:

- Secondary consolidation is negligible and was not considered as part of this assessment.

- The fine grained (tailings) soil layer was discretized into 1 m intervals for calculations. This was completed to provide a better estimate of settlement rather than treating the entire profile as one unit since settlement is dependent on effective stress.

The consolidation was completed using Terzaghi's 1D theory of consolidation time dependant analysis. The relationship is shown below:

$$T_v = \frac{C_v t}{H^2{}_{dr}}$$

Where:

T_v = Terzaghi's empirical time factor for consolidation
C_v = coefficient of consolidation
t = time
H_{dr}= thickness of the consolidation layer → (m)

2.2 Foundation Conditions

2.2.1 South Dam

Rigorous foundation characterization has been carried out at the proposed South Dam alignment (SRK 2003, 2007). The foundation conditions are variable, with the overburden thickness thinning drastically towards the abutments, as illustrated in Figure 3. Towards the center of the proposed alignment, the overburden profile is at its maximum thickness. The upper, approximately 5.5 m of the profile, consists of marine silt which transitions to marine silt and clay to a depth of about 24 m below ground surface (i.e. about 18.5 m thick). Beneath these sediments is a layer of gravelly till of about 10 m thickness overlying the host basalt bedrock. The entire profile is cold permafrost (-8˚C surface temperature), with an active layer thickness of about 1 m. The marine silts and clays are ice rich with clear ice lenses present. Salinity results from samples collected in the footprint of the South Dam foundation indicate salinity ranges from 30 to 46 parts per thousand, with an average of about 41 parts per thousand. This results in a depressed freezing point of about -2.3˚C in accordance with Velli and Grishin's empirical formulation (Andersland 2004).

2.3 Interim Dike

There has been no geotechnical characterization of the foundation conditions beneath the proposed alignment of the Interim Dike. A series of condemnation holes were drilled in Tail Lake, approximately 1,700 m north of the proposed Interim Dike location (SRK 2003). These holes suggest that the overburden thickness is likely to be in the order of 5 to 22 m thick, but provide little detail of the material. Detailed characterization of lake bed sediments in nearby Doris and Patch Lakes (SRK 2009) suggest lake bed thickness (i.e. overburden thickness), between 4.8 and 35.8 m, would not be unreasonable to expect. Foundation conditions beneath the North Dam (SRK 2007, 2012) are similar to those under the proposed South Dam alignment; however, the overall overburden thickness is shallower beneath the North Dam since there is no evidence of the gravelly till zone being present.

All of this anecdotal evidence, together with the fact that Tail Lake, the original lake forming the TIA is a much smaller lake than either the Doris or Patch Lakes, and is geomorphologically different, was used to conservatively adopt foundation conditions beneath the Interim Dike similar to those observed under the South Dam, but with the following modifications. The upper 5 m of the profile was assumed to be unconsolidated lake bed sediments overlying about 18.5 m of marine silt and clay. This once again overlies about 10 m of gravelly till over in-situ basalt bedrock. The TIA is believed to host a closed talik underneath it; however, this has not been conclusively demonstrated (SRK 2005). For the purpose of this assessment the entire profile underneath the proposed Interim Dike was assumed to be within this talik. This profile is considered very conservative.

Based on the assumed soft, unconsolidated nature of the lake bed sediments, the top 2.5 m of sediments under the Interim Dike footprint is initially assumed to have mixed with, or be displaced by the rock fill material, improving the material parameters in the zone of disturbance (i.e. mixing zone). This is later on referred to as Stage 1 construction.

2.4 Configuration

The Interim Dike is a homogeneous run of quarry (ROQ) rock fill dike placed in the TIA, directly on the existing lake bed sediments, without dewatering the TIA. The Interim Dike will have a crest elevation of 31.0 m, a crest width of 10 m, and upstream and downstream slopes of 3H:1V. The maximum height of the Interim Dike will be about 7.5 m, with the bottom 4.8 m being below the pre-existing water level in the TIA of 28.3 m. The Interim Dike is not required to hold back tailings supernatant water, but is expected to retain tailings solids.

At the time this stability assessment was completed, the Interim Dike was to be 1.5 m higher, with a resultant crest elevation of 32.5 m. Subsequently the tailings deposition plan (SRK 2015) was optimized which resulted in lowering of the crest. However, this consolidation assessment was not redone since the overall conclusion remained consistent, albeit conservative.

To simplify the consolidation analysis, two cross sections were evaluated: (1) a section assuming the maximum tailings thickness of 10 m, and (2) the maximum cross-section through the Interim Dike. The underlying foundation profile for both the Interim Dike and the tailings surface was simplified to consist of 20 m of marine silt and clay overlying 10 m of gravelly till followed by bedrock.

2.5 Material Properties

Material properties, adopted for the foundation, dam and dike material consolidation evaluation presented in this memorandum, is generally consistent with the original North and South Dam design properties (SRK 2007). Where available, these properties have been updated to reflect additional characterization data that has become available subsequent to the original design. Tables 1 summarize these properties.

Table 1: Foundation and Tailings Material Properties

Material	Dry Unit Weight (kN/m^3)	Primary Compression Index (Cv)	Coefficient of Consolidation (Cc)	Void Ratio (e)
Tailings	13	1.5×10^{-8} m^2/sec	0.1	0.85
Marine Silt and Clay	13	3.6×10^{-8} m^2/sec	0.2 – 0.5	1.10

The coefficient of consolidation for the marine clay is considered low for clay; therefore, a range of values were selected based on engineering judgement. The underlying gravelly till is expected to be very stiff and little consolidation is likely to occur; therefore, it was not considered in this analysis.

3 Results

The maximum settlements associated with consolidation are summarized in Table 2.

Table 2: Results of Consolidation Evaluation

Scenario	Description	Tailings Consolidation	Marine Clay Consolidation	Total Settlement
1	Tailings placed on Marine Silt and Clay	0.7 m	1.2 – 3.1 m	1.9 – 3.8 m
2	Interim Dike placed on Marine Silt and Clay	N/A	1.6 – 4.1 m	1.6 – 4.1 m

The time for 90% consolidation was calculated to be 170 years. This only considers the marine clay in the calculation.

4 Discussion and Conclusions

The consolidation results present an estimate of ultimate consolidation. The ranges of consolidation presented in the results only apply to the critical sections. These calculations are based on simple 1-D methods for the critical areas; therefore, settlement in other areas of the facility will be less since there is less change in effective stress where tailings and dike thickness are lower.

The data available for consolidation of the marine clays and tailings consisted of one sample for each material type. Since the actual number of tests completed was limited, a conservative approach was completed in assessing ultimate settlement (by setting Cc of the marine clays to 0.5). The actual settlement may be much lower, but this method should provide the upper range of what could be expected.

The calculated time to consolidation was 39 years for 50% consolidation and 170 years for 90% consolidation. Since the time to consolidation is relatively long, it is not expected that continual maintenance of the interim dike would be required. The dike can be monitored throughout deposition and a lift of ROQ could be added if settlements exceed 0.5 m, which is the allowable settlement based on the design.

A thermal analysis has been completed for the maximum tailings thickness and indicates that the tailings will freeze back within 10 years for the most conservative scenario; therefore, the consolidation will be much less than the maximum calculated.

5 References

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Appendix H – South Dam and Interim Dike Seepage Assessment

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Memo

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From:	Peter Luedke, EIT Murray McGregor, EIT	Project No:	1CT022.002.515
Reviewed By:	Maritz Rykaart, PhD PEng	Date:	May 29, 2015
Subject:	Doris North Project: South Dam and Interim Dike Seepage Assessment		

1 Introduction

TMAC Resources Ltd. plan to revise their tailings management plan to accommodate a greater volume of tailings at the Doris North Project, located in Nunavut, approximately 160 km southwest of Cambridge Bay. The revised volume of tailings exceeds the amount that can sub-aqueously be deposited in the Tailings Impoundment Area (TIA) with a permanent water cover after the North Dam gets breached.

The tailings management plan has subsequently been redesigned to incorporate a sub-aerial deposition strategy starting at the south end of the TIA. Approximately 2.5 Mt of tailings will be deposited along the southern end of the TIA and will be contained by a new Interim Dike about 1,500 m north of the South Dam. The remaining portion of the TIA between the Interim Dike and the existing North Dam will not contain any tailings, and will act as a Reclaim Pond. Tailings will be spigotted from a number of points along the eastern perimeter of the TIA and from the South Dam creating a landscape that drains towards the Interim Dike at an average slope of about 1%. Figure 1 provides a general layout of the TIA.

The South Dam was originally designed as a frozen core dam (SRK 2007), as it was intended to retain water for a period of up to 20 years. With the proposed revised tailings deposition strategy, the South Dam is not required to retain water since the tailings will be beached from the face of the dam from the start of operations. As a result, the South Dam design has been changed to a frozen foundation dam consisting of a compacted rock fill dam with a geosynthetic clay liner (GCL) keyed into the permafrost overburden foundation.

Upon closure, the tailings surface will be covered with a nominal waste rock cover of 0.3 m thickness. The function of the cover is to prevent dust and to minimize direct contact by terrestrial animals. The cover will terminate at the Interim Dike, and the Interim Dike will be levelled to match the elevation of the cover. Once the water quality in the Reclaim Pond has reached the required discharge criteria, the North Dam will be breached as originally intended.

This memorandum presents the results of a seepage analysis to demonstrate the expected leakage rates through the South Dam and Interim Dike. This seepage analysis was coupled with the stability analysis documented in SRK (2015c).

2 Seepage Assessment

2.1 Methodology

Seepage analysis was carried out using the commercial RocScience Slide (Version 6) (RocScience 2014) software package. All seepage values were generated using the Steady State Groundwater Finite Element Analysis method in Slide 6.0. The water levels were applied at various elevations on the upstream and downstream side and relevant ground condition cases were also applied.

The modelling code does not handle very thin units like the GCL liner (~0.01 m) used in the South Dam. For this reason, the modelled GCL was expanded to a 0.5 m thick layer with an equivalent hydraulic conductivity that would mimic the performance of the GCL.

2.2 Configuration

Figure 2 provides a plan layout of the portion of the TIA that will be used for sub-aerial tailings deposition. Typical sections of the South Dam and Interim Dike are shown in Figures 3 and 4.

The South Dam is a frozen foundation dam which has been designed with a crest width of 10 m and an upstream slope of 4:1 H:V and downstream slope of 2:1 H:V. The crest elevation is set at 38.0 m and results in a maximum dam height of 6 m. The key trench will be about 4 m deep, have a base width of 4 m with 2H:1V, and 1H:1V upstream and downstream slopes respectively. The GCL will be placed along the entire base of the key trench, along the upstream face of the key trench and then slope back within the center of the dam at a slope of 3H:1V.

The Interim Dike is a homogeneous run of quarry (ROQ) rock fill dike placed in the TIA, directly on the existing lake bed sediments, without dewatering the TIA. The Interim Dike will have a crest elevation of 31.0 m, a crest width of 10 m, and upstream and downstream slopes of 3H:1V. The maximum height of the Interim Dike will be about 7.5 m, with the bottom 4.8 m being below the pre-existing water level in the TIA of 28.3 m. The Interim Dike is not required to hold back tailings supernatant water, but is expected to retain tailings solids.

At the time this seepage assessment was completed, the Interim Dike was to be 1.5 m higher, with a resultant crest elevation of 32.5 m as illustrated in Figure 4. Subsequently the tailings deposition plan (SRK 2015b) was optimized which resulted in lowering of the crest; however, this seepage assessment was not redone since the results as presented is deemed conservative.

2.3 Foundation Conditions

2.3.1 South Dam

Rigorous foundation characterization has been carried out at the proposed South Dam alignment (SRK 2003, 2007). The foundation conditions are variable, with the overburden thickness thinning drastically towards the abutments, as illustrated in Figure 3. Towards the center of the proposed alignment, the overburden profile is at its maximum thickness. The upper approximately 5.5 m of the profile consists of marine silt, which transitions to marine silt and clay to a depth of about 24 m below ground surface (i.e. about 18.5 m thick). Beneath these sediments is a layer of gravelly till of about 10 m thickness overlying the host basalt bedrock. The entire profile is cold permafrost (-8ºC surface temperature), with an active layer thickness of about 1 m. The marine silts and clays are ice rich, and there are clear ice lenses present. Salinity results from samples collected in the footprint of the South Dam foundation indicate salinity ranges from 30 to 46 parts per thousand, with an average of about 41 parts per thousand. This results in a depressed freezing point of about -2.3ºC in accordance with Velli and Grishin's empirical formulation (Andersland 2004).

2.3.2 Interim Dike

There has been no geotechnical characterization of the foundation conditions beneath the proposed alignment of the Interim Dike. A series of condemnation holes were drilled in Tail Lake, approximately 1,700 m north of the proposed Interim Dike location (SRK 2003). These holes suggest that the overburden thickness is likely to be in the order of 5 to 22 m thick, but provide little detail of the material. Detailed characterization of lake bed sediments in nearby Doris and Patch Lakes (SRK 2009), suggest lake bed thickness (i.e. overburden thickness) of between 4.8 and 35.8 m would not be unreasonable to expect. Foundation conditions beneath the North Dam (SRK 2007, 2012) is similar to those under the proposed South Dam alignment; however, the overall overburden thickness is shallower beneath the North Dam since there is no evidence of the gravelly till zone being present.

All of this anecdotal evidence, together with the fact that Tail Lake, the original lake forming the TIA is a much smaller lake than either the Doris or Patch Lakes, and is geomorphologically different, was used to conservatively adopt foundation conditions beneath the Interim Dike similar to those observed under the South Dam, but with the following modifications. The upper 5 m of the profile was assumed to be unconsolidated lake bed sediments overlying about 18.5 m of marine silt and clay. This once again overlies about 10 m of gravelly till over in-situ basalt bedrock. The TIA is believed to host a closed talik underneath it (SRK 2005); however, this has not been conclusively demonstrated (SRK 2005). For the purposes of this assessment, the entire profile underneath the proposed Interim Dike was assumed to be within this talik. This profile is considered very conservative.

Based on the assumed soft, unconsolidated nature of the lake bed sediments, the top 2.5 m of sediments under the Interim Dike footprint is initially assumed to have mixed with, or be displaced by the rock fill material, improving the material parameters in the zone of disturbance (i.e. mixing zone).

2.4 Material Properties

Hydraulic properties adopted for the foundation, dam and dike materials seepage assessment presented in this memorandum, is generally consistent with the original North and South Dam design properties (SRK 2007). Where available, these properties have been updated to reflect additional characterization data that has become available subsequent to the original design. Table 1 summarize these properties for the South Dam and Interim Dike.

Table 1: South Dam and Interim Dike Hydraulic Properties

Soil Unit	Moist Unit Weight (kN/m^3)	Thawed Hydraulic Conductivity (m/s)	Frozen Hydraulic Conductivity (m/s)	Comments/ Source
Marine Silt	18.0	5.0×10^{-9}	4.6×10^{-10}	SRK (2011)
Marine Silt and Clay	17.0	4.6×10^{-10}	4.6×10^{-10}	SRK (2011)
Lake Bed Sediments	16.0	9.0×10^{-9}	n/a	SRK (2011)
Mixing Zone	19.0	1.0×10^{-9}	n/a	Engineering Judgement
Tailings	17.5	5.4×10^{-7}	n/a	SRK (2007)
Run of Quarry Material	20.0	5.0×10^{-3}	1.0×10^{-7}	Engineering Judgement
GCL	18.0	5.0×10^{-11}	n/a	SRK (2012)

It is generally understood that under frozen conditions, the soils will not transmit seepage and as a result the hydraulic conductivity can be assumed to be infinitely low. In reality, especially when the pore water is saline, there can be a considerable unfrozen water content in frozen soils, which could constitute seepage. Since the project soils do have a high pore water salinity, allowance for such unfrozen water content has been made to assign frozen hydraulic conductivity values.

Subaerial deposition of a slurry tailings will result in physical segregation of the tailings which will subsequently result in the hydraulic conductivity being variable along the beach. Tailings closest to the deposition point will be coarser and therefore more permeable, while the finer, low hydraulic conductivity tailings will be furthest from the discharge point. Given the low sensitivity of the results to the tailings properties, only a typical average value was assessed.

Hydraulic properties for the gravelly till and bedrock was not specifically assigned. Seepage is controlled by the overlying higher hydraulic conductivity layers and therefore these lower layers does not materially affect the outcome.

2.5 Model Setup

For both the South Dam and the Interim Dike, a single typical cross-section was analysed. This critical section was conservatively assumed to be the zone where the foundation overburden soils was at its maximum thickness and the structure was at its maximum height. Figures 5 and 6 respectively present the model cross-sections for the South Dam and Interim Dike.

The South Dam stability analysis was carried out for two scenarios; partially thawed foundation conditions and fully thawed foundation conditions. Thermal modelling of the South Dam has confirmed that fully thawed foundation conditions are not likely to occur (SRK 2015a); however, the analysis represents a conservative case demonstrating the system sensitivity. For the partially thawed conditions, the -2.3 degrees Celsius isotherm as developed from thermal modelling (SRK 2015a) was adopted to define the extent of thaw as illustrated in Figure 5.

The Interim Dike was only analyzed under fully thawed conditions.

3 Results

The resultant seepage through the South Dam is presented in Table 2. The TIA full supply level is 33.5 m, and therefore the expected maximum seepage rate through the structure during the operational phase would be 0.6 m^3/day. This assumes fully thawed conditions which is not expected, and in addition, the facility would not be operated at this elevation, making the likelihood of this seepage ever occurring extremely remote. At closure, when the North Dam gets breached and the water level returns to 28.3 m there is no chance of any seepage from the South Dam, because the ground elevation of the South Dam is at elevation 32.0 m.

Three additional extreme cases were modelled to demonstrate the system sensitivity (Table 2). These cases assume the presence of a short-term perched water table at the deposition point. For the case where fully thawed foundation conditions exist, and there is a perched water table at the maximum tailings deposition elevation of 36.5 m, seepage through the South Dam could be 5.2 m^3/day. For this to happen all the free water at the deposition point must short circuit and impound immediately behind the dam. Although this is not a realistic scenario, it does demonstrate that seepage through the South Dam is controlled by the GCL.

Table 2: South Dam Seepage Assessment Results

South Dam Seepage Condition	Upstream Water Level	Downstream Water Level	Seepage Rate (l/day/lm)	Total Volume (m^3/day/200m)
Thawed Foundation	33.5	32.0	2.8	0.6
Partially Frozen	33.5	32.0	2.7	0.5
Partially Frozen	36.5	32.0	25	5.0
Partially Frozen	37.0	32.0	32	6.4
Thawed Foundation	36.5	32.0	26	5.2

Seepage through the Interim Dike is not a concern since it is not intended to retain fluids. It is however important that the Interim Dike remain highly permeable such that the tailings can drain rapidly. The results of the seepage assessment for this structure is summarized in Table 3. The results demonstrate that under all conditions, the drainage rate through the Interim Dike exceeds the volume of tailings supernatant water that will get added every day (assuming a production rate of 2,000 tonnes per day), and therefore the Interim Dike will perform as designed.

Table 3: Interim Dike Seepage Assessment Results

Interim Dike Seepage Condition	Upstream Water Level	Downstream Water Level	Seepage Rate (m^3/day/lm)	Total Volume (m^3/day/200m)
Elevated Water Level in Tailings	31.50	30.75	92	18,400
Drained to Natural Lake Level	30.75	28.30	176	35,300
Elevated Storage Levels in TCA	31.50	28.30	248	49,600
High Gradient Flow	30.75	24.00	275	55,000
Elevated Water Levels	31.50	30.50	100	20,000

4 Discussion and Conclusions

The purpose of the South Dam is to retain tailings and supernatant water. Tailings deposition will be done such that a beach will develop upstream of the dam, which will have the resultant effect of ensuring that there would never be any water in close proximity of the Dam. At closure, the beach will be the entire distance between the South Dam and the Interim Dike, of over 1.6 km. There may be short periods, while the tailings beach is being developed, where some water may be in close proximity of the South Dam. However, as it has been demonstrated by the seepage analysis, the maximum amount of seepage that might occur under the worst case scenario is about 0.6 m^3/day. This would be if the TIA is at its full supply level of 33.5 m.

The Interim Dike is designed to ensure that water can pass unhindered through the structure. The seepage analysis demonstrates that this target is easily achieved for all conceivable flow conditions.

5 References

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Figures