Attachment 8.11

Milne Port Stacker/Reclaimer Berm Foundation Geotechnical Recommendations

(72 Pages)

Baffinland Iron Mines Corporation
Mary River Expansion Project

Geotechnical Recommendations for Stacker/Reclaimer Berm Foundation

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Dated: [***insert current date***]

[INSERT NAME OF REPORT RECIPIENT]

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1. Introduction

Hatch has been retained by Baffinland Iron Mines Ltd. (BIM) to assist on the design of a Bulk Material Handling (BMH) system at the Milne Inlet Port for the Mary River Expansion Project.

The BMH system consists of a rail car tippler located at the terminus of the mine-to-port railway, an indexer to push the rail car in the tippler, a loadout tunnel connecting with the tippler, a raw ore stockpile with embedded loadout tunnel, crushing and screening plants, and conveyor systems to transfer materials from the tippler through the crushing and screening plants to a longitudinal bucket-wheel Stacker/Reclaimer.

The Stacker/Reclaimer and the associated conveyor system will be operated on the rail tracks found on a Stacker/Reclaimer berm.

This memo provides geotechnical recommendations for the Stacker/Reclaimer berm foundation, evaluate the berm stability, the thermal regime in foundations, and the settlement. The analyses are based on the preliminary berm configuration shown in the drawings in Appendix B (Drawing H353004-CM001-400-465-0045) provided by Thyssenkrupp Industrial Solutions (tkIS) and the data from the geotechnical investigation program (H353004-40000-229-230-0009).

The requirements of the project include keeping the elevation of the rail track of the Stacker/Reclaimer, excluding any option to raise the berm or change the longitudinal grade of the berm, and the width and slope of the berm.

1. Geotechnical Site Information

The geotechnical site investigation plan and borehole profiles are illustrated in Appendix A1.

1.1 General

Six boreholes (BH 16-M001, BH 16-M004. BH 16-M005, BH 16-M006, BH 16-M014, BH 16-M015) were drilled along the longitudinal alignment of the berm from north (near shoreline) to south. The overall site is relatively flat over the footprint of the berm.

The subsurface conditions encountered at the site are highlighted as follows:

- Near the south end of the berm, the deposit consists of a sandy layer with a thickness of 6 m to 9 m, overlying a silt deposit extending to the borehole termination depths of about 15.2 m (BH 16-M006, BH 16-M014 and BH 16 -M015).
- In the middle of the berm, the sandy deposit dominates the encountered overburden (BH 16-M004 and BH 16-M005). A 1.5 m silt layer was encountered in BH 16-M004 from a depth of 10.6 m to 12.1 m.
- Near the north end of the berm, a sandy deposit (sand to sand and gravel) was encountered in BH 16-M001 down to the termination of the borehole (at about 15 m depth). No silt layer was found in this borehole.

- No bedrock was encountered during the investigation.

1.2 Subsurface Interpretation

Appendix A1 shows the site overall layout and a geological profile along the berm. Sketch 1 in Appendix A1 shows the interpreted soil profile below the berm.

Near the south end of the berm, the subsurface soil profile consists of a sandy layer, overlying a silty deposit, and an inferred till layer. The till layer, assumed at 65 m depth, was extrapolated from the till encountered in BH 17-008 and BH 17-M010 (see Sketch 2 in Appendix A1). The 65 m depth was adopted as the base case for settlement calculations; a sensitivity study was performed to evaluate the impact of the till layer on the results.

Near the north end of the berm, the subsurface soil profile consists of a sandy deposit (sand to sand and gravel) overlying an inferred till layer. The till layer depth was assumed to be same as at the south end.

There appears to be some localized water ponding along the berm alignment.

The following summarizes the key soil properties:

- The sandy deposit contains sand, with a varying amount of gravel and silt as per the assessment of the geotechnical investigation data (Hatch, 2017, H352034-1000-229-230-0002, Rev.2) at the Milne Inlet Site. This layer contains an ice content typically ranging from 10% to 20% by weight. This deposit can be classified as low to medium frost susceptible.
- The silty layer contains predominantly silt, with trace to some sand, trace gravel, trace organics and is thought to be a delta deposit. The silt is general frozen and well bonded and contains thin ice lenses with a typical ice content ranging from 20% to 40% by weight. This deposit can be classified as medium to high frost susceptible.
- Till: A possible till layer has been inferred at 65m depth as per the findings of BH 17-M010 and BH 16-M008 (see Sketch 2 in Appendix A1). The till is well graded and has a relatively low ice content of generally less than 10%. This deposit can be classified as low to medium frost susceptible.
- Ground ice was not encountered in the boreholes shown in the profile in Appendix A1. However, based on experience at other project locations, the presence of occasional ground ice is common for the Milne Inlet Port area, particularly within or close to the depth of the active zone.

There will be a SPMT (Self Propelled Modular Transporter) service road, which comprises approximately 600 mm thick crusher-run rockfill constructed from the station 1+800 to 1+100 prior to the Stacker/Reclaimer berm.

2. Climate Conditions

The site is in a continuous permafrost zone with a mean annual air temperature of about -12°C, based on the response document drafted by RWDI to Crown-Indigenous Relations and Northern Affairs Canada inquiry (RWDI, 2019). The global warming effect was taken into account according to the Intergovernmental Panel on Climate Change (IPCC) long term climate change studies (IPCC, 2014). A temperature adjustment was applied considering to global warming for the period spanning from 2010 to 2039, summarized in the Hatch Geotechnical Design Basis (H353004-00000-229-210-0001).

3. Structure

As per the preliminary design drawings provided (drawing no. A05212A04, dated on 09/12/2017, drawing no. 4832571, Rev.4, dated on 07/12/2017), the Stacker/Reclaimer berm is about 2.7 m high from the base to the top of berm, i.e., 3 m high from the berm base to the top of rail, and about 22 m wide at the crest with a side slope of 1.5H:1V. The Stacker/Reclaimer berm will be constructed using by compacted Type 8 rockfill. The preliminary design drawings have been updated by Hatch to be issued for construction (H353004-40000-221-272-0004-0001). The preliminary drawings are referenced for better illustration of the Stacker/Reclaimer berm details (See Appendix B).

The rail track over the berm is about 1.5 km long in the longitudinal direction. There are two large live ore stockpiles (about 20 m high, 30 m wide at the crest and 90 m wide at the base) on either side of the berm. The ore will be transferred to the ship-loader during the shipping season window in summer and will be stockpiled during the rest of the year.

3.1 Rail Surcharge Loads

The surcharge pressures on the berm are summarized as below:

- Rail surcharge pressure in **Long-term Operation** conditions (load case II) = 228 kPa (unfactored)
- Rail surcharge pressure in **Maintenance** conditions (load case III) = 280 kPa (unfactored).

The rail surcharge was calculated using the following formula as per the load data from the tkIS drawing No.4934009, dated 25 September 2017. The calculated surcharge load pressures were reviewed and confirmed by tkIS as per the email from Mr. Laurent, dated 21 February 2018. The surcharge pressure from the conveyor is 200 kPa as per the drawing provided by tkIS (BSCY-S-560, dated on 2017-11-27).

$$Surcharge\ Load = \frac{Max\ Wheel\ Load\ for\ load\ case}{Area} = \frac{F_1{+}F_2}{S \times L} * Load\ Coeffieicnt$$

Where:

$\boldsymbol{F_1}$ and $\boldsymbol{F_2}$ are the maximum wheel loads (kN);

S is the average spacing between the point loads;

L is the width of the track loading zone (m);

Rail Surcharge in Operational Cases (Load **II**)

$$Surcharge\ due\ to\ Load\ II = \frac{350kN + 350kN}{\frac{1}{2} * (1.2 + 1.5)m * 2.5m} * 1.1 \cong 228\ kPa$$

Rail Surcharge in Maintenance Case (Load **III**)

$$Surcharge\ due\ to\ Load\ III = \frac{450kN + 450kN}{\frac{1}{2} * (1.2 + 1.5)m * 2.5m} * 1.1 \cong 280\ kPa$$

4. Stability Analyses

4.1 Design Criteria

The preliminary design criteria for the slope stability of the Stacker/Reclaimer berm is summarized in Table 4-1 corresponding to loading cases. The design criteria (see Table 4-1) adopted a factor of safety of 1.4 and 1.3 for the Long-term Operation Case (Static Loading Case) and High Ground Water Level Case (Summer Seasons) cases respectively, due to the narrow timeframe which each of the two cases will occur. The side slopes of Stacker/Reclaimer Berm will be covered by iron ore during the stacking seasons, with full side slope exposure and loading from the Stacker/Reclaimer occurring infrequently during the ship loading seasons (~ 2 months). High ground water levels can only occur during the months with above zero temperatures, which ranges from June to August and June to September for the 2010 average Milne Port temperatures and estimated 2039 Milne Port temperatures, respectively.

Table 4-2 summarized the geotechnical parameters used in the analysis, sourced from the Geotechnical Design Basis (H353004-00000-229-210-0001). For pseudo-static analysis, a value of 2/3 of peak ground acceleration (PGA) 0.028 g was used. The PGA of 0.042 g was used for the design, consisting with that adopted for the design of the ore dock (BESIX, 2017), as per the 475-year return period.

Table 4-1: Preliminary Design Criteria for Stacker/Reclaimer Berm

Loading Case	Minimum Factor of Safety
Long-term Operation Case (Static Loading Case)	1.4
Short-term Maintenance Case (Static Loading Case)	1.3
Pseudo-static Condition (Earthquake Case)	1.1
High Ground Water Level Case (Summer Seasons)	1.3

Table 4-2: Material Properties in Slope Stability Analysis

Material	Cohesion, c (kpa)	Internal Friction Angle, Φ,(Degree)	Unit Weight, γ, (kN/m^3)
Type 5 Rockfill	0	40	22
Type 8 or 12 Rockfill	0	40	20
Ballast	0	40	20
Sub-ballast	0	40	22
Native Sand	0	32	18

4.2 Results

The factor of safety for slope stability analyses were calculated using Geo-Studio software 2016. A series of limit equilibrium analyses were performed using the Morgenstern-Price method of slices.

Table 4-3 presents the calculated factor of safeties for both original berm configurations.

1. The original berm configuration, as shown in Figure 4-1, doesn’t satisfy the stability requirement, i.e., insufficient factor of safety as per the slope stability criteria in Table 4-3.
2. To keep the berm geometry unchanged, two rockfill trenches beneath the two sides of the Stacker/Reclaimer berm are being proposed. The rockfill trenches will run parallel to the Stacker/Reclaimer Berm for its entire length. The geometry of the trenches includes a top width of 15 m, a depth of 1.5 m, and side slopes of 1.5H:1V. The trench will be composed of 300 mm top layer of compacted Type 5 Rockfill, followed by 1200 mm of compacted Type 8 Rockfill. Details of the Rockfill Trench can be found in Figure 4-2. The additional Rockfill Trench improves the slope stability and satisfy the stability requirement as shown in Table 4-3.

At centre, the rockfill berm consists of minimum 100 mm road topping (compacted Type 5, 32 mm minus) overlying compacted Type 8 rockfill (150 mm minus, jaw run). Below the track is the ballast and sub-ballast overlying a “Combigrid” Type 40/40 Q1 151 GRK3 or similarly approved geo-composite on top of compacted Type 8 rockfill to form the berm. At the contact between the Type 8 rockfill and native soil material, an optional Combigrid” Type 40/40 Q1 151 GRK3 or similarly approved geo-composite is required as per the direction of the BIM’s site representative/Field Engineer or his/her designate, where fine-grained or soft deposit is encountered at ground.

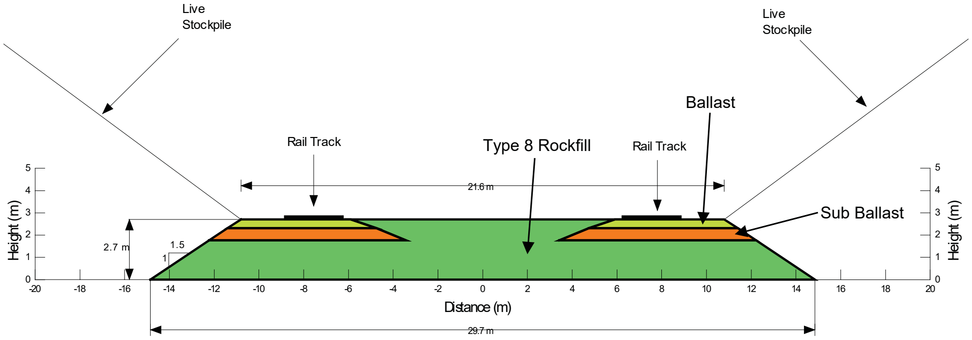


Figure 4-1: Sketch of Stacker/Reclaimer Berm Configuration (Original)

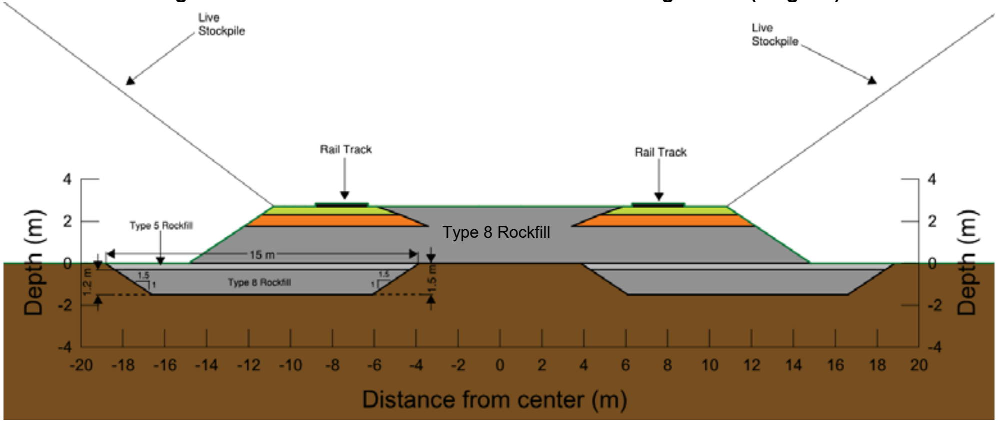


Figure 4-2: Sketch of Stacker/Reclaimer Berm Configuration with Rockfill Trench

Table 4-3: Summary of the Results of Slope Stability Analyses

Berm Configuration	Loading Case	Calculated Factor of Safety / Figure	Minimum Factor of Safety	Note
Original Berm Configuration	Long-term Operation Case	1.2 Figure C1B	1.4	Not Acceptable
	Short-term Maintenance Case	1.2 Figure C2B	1.3	Not Acceptable
Original Berm Configuration with Rockfill Trench	Long-term Operation Case	1.4 Figure C3	1.4	Acceptable
	Short-term Maintenance Case	1.3 Figure C4	1.3	Acceptable
	Pseudo-static Condition (Earthquake Case)	1.1 Figure C5	1.1	Acceptable
	High Ground Water Case (Summer Season round)	1.3 Figure C6	1.3	Acceptable

5. Ultimate Bearing Capacity

The ultimate bearing capacity of the rail track is estimated based on the following assumptions:

- The rail track is 2.5 m width.
- The friction angle of the compacted rockfill berm is 40 degrees.
- The groundwater is at the rockfill berm surface.

The factored geotechnical resistance below the rail track is 430 kPa using Geotechnical Resistance Factor of 0.5 for ultimate limit state design.

6. Thermal Analyses

The thermal analyses were performed to investigate the temperature regime in the foundation. Appendix A3 summarizes the methodologies and details of the thermal analyses. Figure D1 and D4 presents the thermal model results.

The temperature of the soil below rockfill pad is shown in Appendix D. The following summarizes the results:

- The active zone below the Stacker/Reclaimer rail track is generally located within the non-frost susceptible Rockfill Trench.

- The active zone beneath the center of the Stacker/Reclaimer Berm reaches a maximum depth of approximately 0.5 m over the 20-year operation life. This depth is much shallower than the natural depth of the active zone (~ 1.5 m) without the Stacker/Reclaimer Berm.
- The active zone crosses beneath the Rockfill trenches into the Native Sand horizontally at the start of the side slopes of the Stacker/Reclaimer Berm.
- It is noted that the airstrip at the Mary River site and the fuel tank at Milne Inlet site have a 2 m to 2.2 m thick granular pad and no freeze heave or thaw settlement actions were observed for these structures.
- As a result, the thaw settlement risk is considered low for the underlying permafrost. The salinity measurements for the samples near ground surface are 3 ppt and 5 ppt as per the BH 17-M010 and BH 17-M012 at 0.9 m and 4 m deep, corresponding to a freezing point of about -0.2°C and -0.3°C, respectively (note: assuming the freezing point decreases by 0.28 degrees Celsius for every 5 ppt increase in salinity). In addition, the native soil below the berm mainly consists of coarse-grain deposit (silty sand, sand, sand and gravel, and sandy gravel) with relatively low susceptibility to thaw settlement.
- The native soil (sand to sand and gravel) under/outside the side slope and trenches of the rockfill berm may experience the freeze and thaw action. However, the freeze and thaw actions are local and is not expected to cause a global stability issue to impact the rail-track on the rockfill berm.

7. Settlement Analyses

The loads of lump ore stockpiles and the berm will produce compression of the foundations and cause settlement including long-term creep. Deformation analyses were conducted to assess the settlement impact to the rail track. Appendix A4 summarizes the methodologies and the key parameters. The settlement analyses were conducted using the modified berm configuration.

Table 7-1 summarizes the cases analyzed in this study.

1. Two cross sections were selected for the typical subsurface soil deposits below the berm, as shown in the Sketch 1 in Appendix A1.
    a. The South Section represents the soil profile at the south portion of the berm, consisting of a sandy layer, an underlying silty deposit, and an inferred till layer. The soil profile is likely representative from Station 1+000 to 1+280. Figure E1-1 in Appendix E shows the typical soil configuration in the finite element model.

   b. The North Section represents the soil profile at the north portion of the berm consisting of a sandy deposit overlying an inferred till layer. The soil profile is likely representative from Station 1+850 to 2+270. Figure E1-2 in Appendix E shows the configuration in the finite element model.

2. The base-case depth of the underlying till was 65 m, as extrapolated from the boreholes advanced well outside of the footprint of the berm.

7.1 Settlement Results

Table 7-1 summarizes the results of the settlement analyses. The base-case settlement is considered as the best estimated settlement for the berm in the current design stage. It should be noted that the calculated settlement is the best-estimated settlement without applying a safety factor. Considering the uncertainty of the till layer depth and the complexity of the permafrost creep, the possible settlement or differential settlement may range from -50% to +100% of the best-estimated value.

The following summarizes the main findings of the settlement analyses:

1. The calculated total settlements are 270 mm and 80 mm at the South Section and the North Section (near the shoreline) respectively, as shown in Figure E2-1. As shown, the south section of the berm has a larger settlement due to the presence of silt permafrost. The settlement components for the lump ore stockpiles and the berm & surcharge are summarized in Table 7-1.
2. The differential settlement along the berm will occur where either the load or the foundation soil properties vary. In general, the estimated differential settlement is approximately 0.5% near the south end of the lump stockpile, as per a preliminary assessment, as shown in Table 7-3. It is noted that large differential settlement may also occur locally along the berm if large load/soil variation is encountered.
3. The creep settlement takes place after construction in a slow rate, as shown in Figure E3-1 in Appendix E.
4. The lump stockpile contributes significantly to the settlement of the berm due to their high loading pressure and large footprints resulting in deep stress influence zones.
5. The instantaneous/elastic compression of the rockfill berm is small (less than 10 mm), as per the comparison of the settlement at the berm top and the berm base in Figure E2-2.

Table 7-1: Summary for Settlement Analyses

Case	Cross Section	Bottom Boundary	Settlement Contour Figure	Total long-term Settlement of Rail Track, mm (over 20 year design life)
Case A1 (Base-case)	South Section	Base-case (Till Depth 65 m)	Figure E1-1	270
Case A2 (Base-case)	North Section	Same as above	Figure E1-2	80

Table 7-2: Summary for Settlement Components for Base-Case

Case	Cross Section	Settlement Component Due to Berm +Surcharge	Settlement Component Due to Lump Stockpile	Total Settlement of Rail Track, mm (over 20 year design life)
Case A1 (Base-case)	South Section	80 mm	190 mm	270 mm
Case A2 (Base-case)	North Section	30 mm	50 mm	80 mm

Table 7-3: Summary for Preliminary Differential Settlement Assessment**

Soil Profile Case	Geometry	Total Settlement of Rail Track, mm	Differential Settlement, mm	Differential Settlement Ratio** (Order of Magnitude Estimate)
Case A1 (Base-case)	Section 1 (S1) South Section Berm only	80	190 between S1 and S2	0.5% in average (=190 mm / 40 m*) *Assuming S1-S2 distance is about 40 m at the end of the lump stockpile
Case A1	Section 2 (S2) South Section Berm+Stockpile	270		

Note: * *The soil layer was interpreted and inferred as per the currently available information. The soil profile between boreholes may be different from the assumed and ground ice may be present. The borehole locations were shown in Appendix A1.

7.2 Assumptions and Limitations

The following presents the assumptions and limitations for the settlement analyses:

(1) The creep parameters for permafrost were estimated from literature test data on soil with a similar soil type, ice content, loading range, and temperature range. Site-specific laboratory/field creep tests are required to verify and confirm these design parameters and to remove uncertainty associated with using the literature values.

(2) The primary limitation is the lack of subsurface drilling to confirm or identify the depth of the till layer. As a result, the calculated settlements have a high degree of uncertainty. The depth to the till layer was extrapolated from the boreholes advanced well outside of the footprint of the berm.

(3) The soil profile between the boreholes was inferred as per the borehole data. Although not encountered, ground ice may exist in-between borehole locations.

(4) The live lump ore stockpiles were assumed to be constant static loads in the analyses.

8. Recommendations

8.1 General

The Stacker/Reclaimer berm should be minimum 2.7 m in thickness below the rail track. The berm should have a minimum 21.6 m wide crest with a side slope of 1.5H:1V or flatter. The construction material shall consist of compacted crusher-run rockfill and granular fill.

8.2 Rockfill Trench

The top width of the Rockfill Trench was calculated such that the full thickness of the 1.5 trench lies underneath the Stacker/Reclaimer rail tracks to stabilize the slope of the berm and to minimize differential settlement. The width of the trench should be adjusted to maintain this thickness if the spacing between the Stacker/Reclaimer rail trackers are to be changed. The geometry of the trenches include a top width of 15 m, a depth of 1.5 m, and side slopes of 1.5H:1V. The trench should be composed of 300 mm top layer of compacted Type 5 Rockfill, followed by 1200 mm of compacted Type 8 Rockfill. The rockfill should be compacted by at least 5 passes of a 10-ton (or larger) vibratory roller with vibrations in the range of 1200 to 1500 vpm and the roller speed of about 2 mph (3.2 km/h).

8.3 Construction Schedule

It should be noted that the subgrade soils are classified as low to high frost susceptible indicating that the subgrade is sensitive to frost heave and thaw settlement characteristics.

It is recommended to construct the berm and rockfill trench during the thaw season. In this way, the thaw depth below ground surface is at maximum during construction and the thermal regime can stabilize for the following winter-thaw season cycle prior to placing the rail track. This approach will minimize the risk of thaw settlement after the rail-track has been installed. Prior to the placement of the rockfill, any topsoil, soft materials, detrimental materials, frozen soil, ice and water ponding should be removed. The subgrade soil of the berm and trench should be proof rolled by a 10-ton (or larger) roller. The rockfill should be placed and compacted in accordance with the latest revision of the project specification (ref. H353004-00000-221-078-001, Standard Specification, Placement of Fill). The rockfill should be compacted by at least 5 passes of a 10-ton (or larger) vibratory roller with vibrations in the range of 1200 to 1500 vpm and the roller speed of about 2 mph (3.2 km/h). Adequate drainage should be provided to divert surface run-off away from the berm footprint and prevent water ponding on the subgrade.

If the rockfill materials have to be placed in winter season, the Stacker Reclaimer Berm must be constructed with compacted rockfill (Type 8) to at least 1.5 m high above the existing grade (i.e. minimum thickness of the rockfill berm is 1.5 m) prior to the coming thaw season. If sub-excavation is to be conducted during the berm construction, the 1.5 m height for the compacted rockfill will be measured from the top of the sub-excavated surface. This approach is to minimize thawing and preserve the frozen ground condition of the subgrade and to minimize the risk of thaw settlement. The rockfill should be unfrozen and free from any detrimental materials, ice and snow. The rockfill should be placed and compacted in accordance with the latest revision of the project specification (ref. H353004-00000-221-078-001, Standard Specification, Placement of Fill). The rockfill should be compacted by at least 5 passes of a 10-ton (or larger) vibratory roller with vibrations in the range of 1200 to 1500 vpm and the roller speed of about 2 mph (3.2 km/h). The proposed method of compaction should be proven to achieve satisfactory compaction of this type of rockfill in winter season. Adequate drainage should be provided to divert surface run-off away from the berm footprint and prevent water ponding on the subgrade during thaw seasons.

For the portions of the berm that are constructed in winter but cannot achieve the 1.5 m minimum thickness requirement before the coming thaw season, the rockfill of these portions of the berm should be removed to expose the subgrade and to proof roll the subgrade following the same procedures as for the thaw season as recommended above.

It should be noted that construction of berm during the winter season may result in excessive settlement. Consequently, additional remedial work may be necessary in the following thaw seasons to keep the settlement under control or under acceptable levels. If the final grade requires fill over 1.5 m thickness, the Contractor may also choose to carry out the work in the winter to build the minimum 1.5 m fills and come back in the following summer to continue the fill construction to the final grade levels.

The berm construction work should be supervised by an BIM’s site representative/Field Engineer or his/her designate. The settlement of the berm should be monitored during construction and operation. The degree of remedial work arising from settlement during construction can be determined during from this monitoring program. Any issue of settlements should be remediated by complete or partial removal of the affected fills, proof rolling of the native subgrade, and backfilling with compacted rockfill. Due to the potential settlement of the Stacker/Reclaimer Berm constructed in cold region, maintenance schedule should be established to re-level and/or re-align the railway track in regular interval.

It should be noted that deviation from the proposed construction scheduling and recommendations outlined in this Section carries risk of excessive settlement and consequences outside of what is presented in this report.

8.4 Field Test Stockpile

It is recommended to place a 25 m high test stockpile (approximate volume = 3,500 m^3) as soon as practical, ideally near the south end of the berm which is expected to have larger settlement due to the presence of high-ice-content silt deposit. A settlement monitoring program should be implemented to monitor the settlement of the foundation below the stockpile and the settlement adjacent to the stockpile. The data will provide a good indication of the berm settlement and also serve as a base of calibration for the creep parameters.

8.5 Subgrade Preparation

The subgrade should be proof-rolled and inspected prior to placing fill materials. The identified soft areas shall be further compacted, and/or, be excavated and replaced with compacted granular fill or rockfill as approved by BIM’s site representative/Field Engineer or his/her designate. BIM’s site representative/Field Engineer or his/her designate shall inspect and approve the subgrade.

The rockfill should not be frozen and should be free from snow, detrimental and frost susceptible materials. The rockfill should not be placed in water or on ice. Dewatering is required where ponding water is encountered. Over-excavation is required to remove ground ice if encountered.

8.6 Berm Construction

The berm construction materials should be free draining and non-frost susceptible to prevent the formation of ice lenses, which may cause frost action and significant damage to the footing and/or structure.

The rockfill materials should be Type 8 rockfills, satisfying the requirement of the project specifications and the construction notes in the drawings. Any ice or snow shall be removed during construction.

It is critical to achieve a satisfied compaction for the performance of the berm. The rockfill materials, fill placement and compaction for the construction of the Stacker/Reclaimer berm should strictly follow the project specifications (ref. H353004-00000-221-078-001, Standard Specification, Placement of Fill). The rockfill should be compacted by at least 5 passes of a 10-ton (or larger) vibratory roller with vibrations in the range of 1200 to 1500 vpm and the roller speed of about 2 mph (3.2 km/h).

The berm placement and compaction should be supervised by BIM’s site representative/Field Engineer or his/her designate and the construction QA/QC program should be carried out.

8.7 Maintenance / Monitoring Program

A monitoring program should be implemented during the construction of the Stacker/Reclaimer Berm to remediate areas with excess settlement. Remediation will consist of complete or partial removal of the affected fills, proof rolling of the native subgrade, and backfilling with compacted rockfill. This monitoring program, along with a maintenance program, should conducted during the lifetime of the Stacker/Reclaimer to address the long-term total and differential settlement of the Stacker/Reclaimer berm. The rail track may need to be re-leveled and/or re-aligned periodically by railway technologies/ machines, where the settlement exceeds the tolerance in the design life. The unfavorite differential settlement is likely to occur near the ends of the lump ore stockpiles. The reclaiming and stockpiling operation may be used to adjust the layout of the stockpile to smooth out the differential settlement if needed.

A monitoring program is recommended to survey the track settlement on a regular basis and provide information for the maintenance program.

Salt should not be used for the snow removal purpose over the berm, as it may increase the salinity of the underlying permafrost and cause thaw settlement.

8.8 Drainage

Proper drainage is an important component to ensure a satisfactory performance of the structure. Water that is ponding or seeping into the soils around the berm may cause permafrost degradation resulting in instabilities and excessive settlement.

(1) External drainage crossing the berm from the stockyard should not be intercepted or diverted by the berm or stockpiles. Water should be intercepted well before reaching the berm. Water may be passed under the berm using culverts, but this should also be avoided where possible. If required, ditches should be constructed a minimum 6 m from the berm. All ditches should be protected from erosion. Water should never be left to pond on or at the toe of the berm or inside the rockfill trench.

(2) A proper drainage system should be provided on the berm crest to avoid any ponding water or ice accumulation near the rail track during warm and cold seasons correspondingly. Any concentrated water flow in the drainage system shall be lined to avoid negative thermal impact to the foundation. If sump and pump drainage system is to be used, the sump shall be lined.

8.9 Operation of Reclaiming and Stacking

The following is recommended to be considered for the operation of reclaiming and stacking.

(1) Inspect the berm during every thaw season, particularly in the first two thaw seasons for settlement and side slope slumping.

(2) Maintain the two lump ore stockpiles symmetric to the berm during operation, as much as possible, to minimize the potential differential settlement at the cross-section direction.

(3) The stockpile operation may be optimized to mitigate the expected large differential settlement near the end of stockpile by flattening the stockpile longitudinal slope or shifting the locations of the stockpile end annually.

(4) Snow should be removed timely from the berm between the two lump stockpiles to avoid impacting the operation.

(5) Reclaiming operation for the lump stockpile should be carried out in a way to improve the drainage of run-off water collected from the berm.

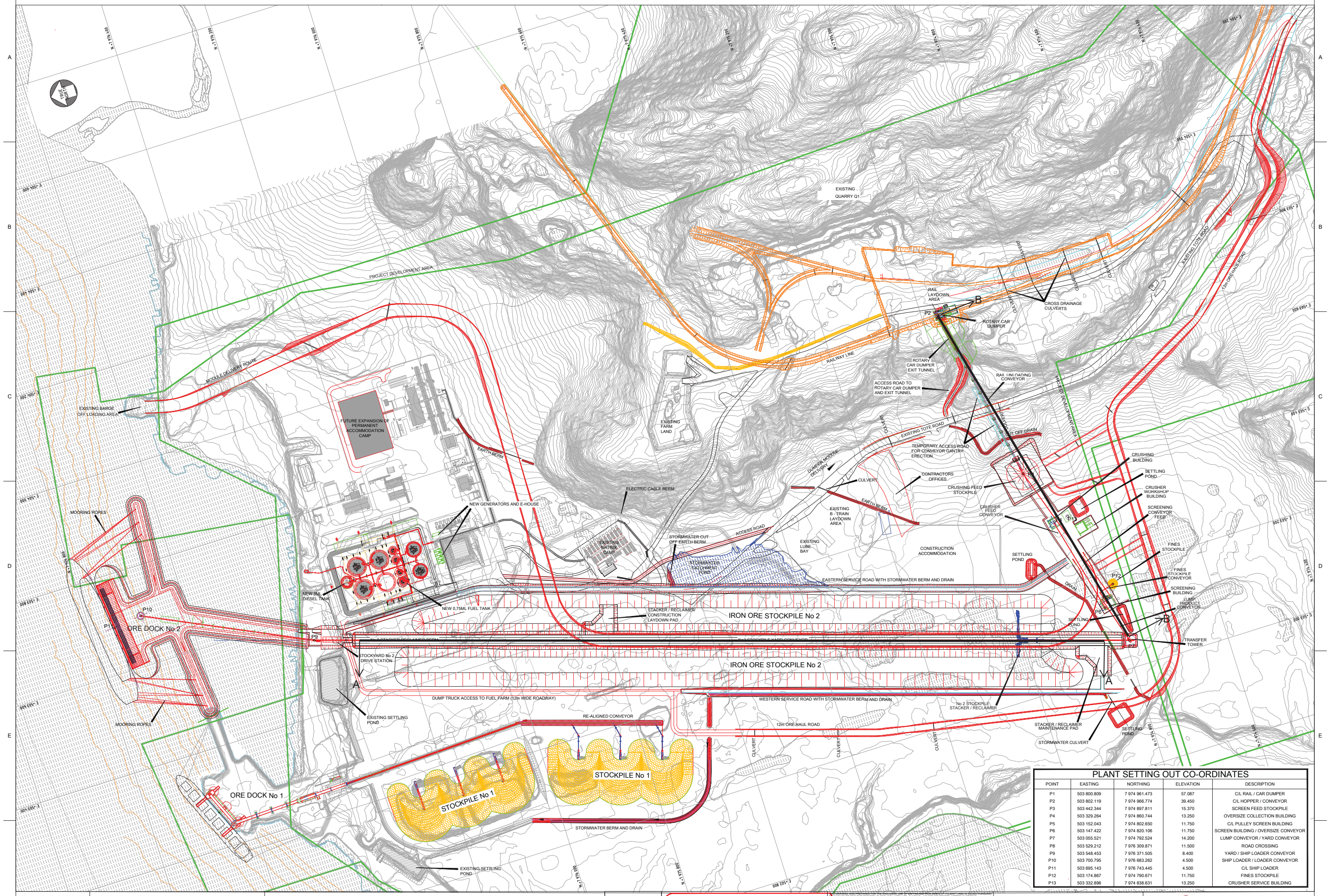
(6) During thaw seasons, the sloughing along the live stockpile slope may occur and should be considered in the maintenance program.

9. References

1. B*ESIX VanPile JV, 18-Oct-2017, Seismic Criteria - PGA value for Ore Dock, Mary River Project, CG001. Letter No. BIM-BV-GE-Ge-LE-00023.*
2. *Hatch, 2012, "Geotechnical Data Report -Infrastructure" (ref H337697-0000-15-1240004, Rev. C), April 05, 2012.*
3. *Hatch, 2016, "Geotechnical Criteria for Building Foundations at Milne Inlet", H352004-0000-229-078-0001, Rev.0, Dec. 15, 2016.*
4. *Hatch, 2016, "Preliminary Geotechnical Recommendation for Infrastructures at Milne Inlet", H352004-0000-229-230-0002, Rev.0, Sept. 01, 2016.*
5. *Hatch, 2017, "2016 Milne Port Geotechnical Investigation Factual Data Report", (ref H352034-1000-229-230-0002), Rev.2.*
6. *Hatch, 2018, "Hatch Geotechnical Design Basis", Rev. 0.*
7. *Hatch, 2016, “Bridge Design Parameter Requirements”, H353004-CC003-230-078-0001, Rev 0, Dec. 13, 2016*
8. *IPCC, Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change., 2014. Climate Change 2014: Synthesis Report. IPCC, Geneva, Switzerland: Cambridge University Press.*
9. *RWDI, 181234 CIRNAC IR 14., 2019.*

Appendix A1
Borehole Plan and Soil Profiles

DWG. No.
H353004-00000-220-272-0001-0001



PLANT SETTING OUT CO-ORDINATES

POINT	EASTING	NORTHING	ELEVATION	DESCRIPTION
P1	503 800.809	7 974 961.473	57.087	C/L RAIL / CAR DUMPER
P2	503 802.119	7 974 966.774	39.450	C/L HOPPER / CONVEYOR
P3	503 442.344	7 974 897.811	15.370	SCREEN FEED STOCKPILE
P4	503 329.264	7 974 860.744	13.250	OVERSIZE COLLECTION BUILDING
P5	503 152.043	7 974 802.650	11.750	C/L PULLEY SCREEN BUILDING
P6	503 147.422	7 974 820.106	11.750	SCREEN BUILDING / OVERSIZE CONVEYOR
P7	503 055.521	7 974 792.524	14.200	LUMP CONVEYOR / YARD CONVEYOR
P8	503 529.212	7 976 309.871	11.500	ROAD CROSSING
P9	503 548.453	7 976 371.505	8.400	YARD / SHIP LOADER CONVEYOR
P10	503 700.795	7 976 683.262	4.500	SHIP LOADER / LOADER CONVEYOR
P11	503 695.143	7 976 743.445	4.500	C/L SHIP LOADER
P12	503 174.867	7 974 790.671	11.750	FINES STOCKPILE
P13	503 332.896	7 974 838.631	13.250	CRUSHER SERVICE BUILDING

DRAWING No.	DRAWING TITLE
REFERENCE DRAWINGS	

NAME
SIGNATURE
ENG REG NUMBER
REVISION DATE
ORIGINAL DATE
REG. PROFESSIONAL

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0	APPROVED FOR FEASIBILITY STUDY	MPB		16/03/2017

REVISIONS

HATCH

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	I BARNARD	NR	07/09/2017
DESIGNER	I BARNARD	NR	07/09/2017
CHECKER	F HUGO		22/09/2017
DESIGN COORD.	R GOOSEN		22/09/2017
RESP. ENG.	R HALIM		22/09/2017
LEAD DISC. ENG.	A GROBBELAAR		22/09/2017
AREA MANAGER	N MASON		22/09/2017
PROJ. MANAGER	S HEINER		22/09/2017
CLIENT			

DRAWING APPROVAL STATUS: CLIENT REVIEW

Baffinland

BAFFINLAND IRON MINES LP
MARY RIVER PROJECT

PORT SITE
BLOCK PLAN
OVERALL LAYOUT

SCALE 1:2500 OR AS NOTED
DWG. No. H353004-00000-220-272-0001-0001
REV 1

SHEET SIZE: E

$USERNAME$ $TIME$
$DATE$
$FILE$

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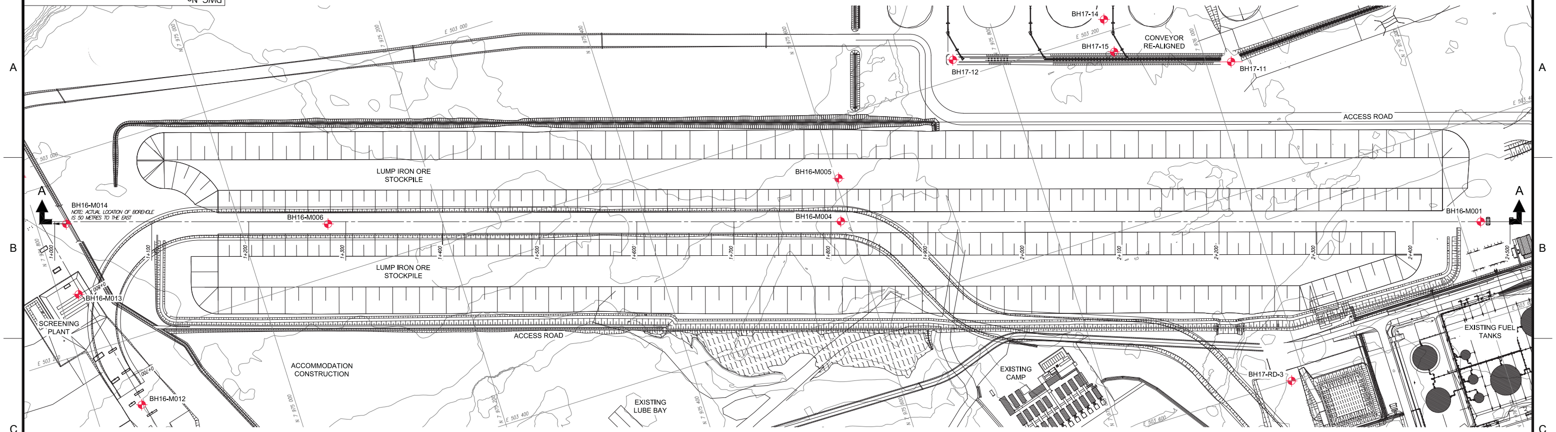


PLAN

0 50 100 150 200 METRES

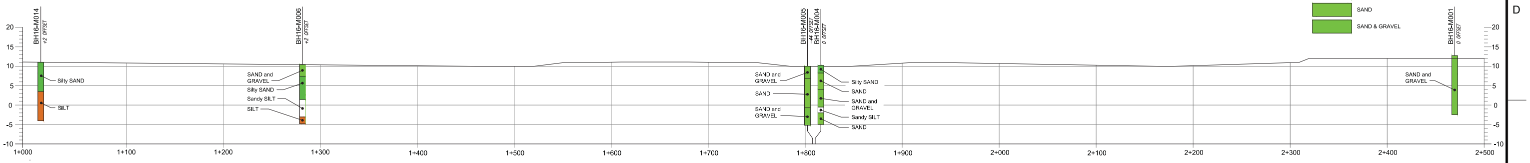
SCALE: 1:2000

NOTE

PROCESSING LINE LAYOUT UPDATED LAST ON FEBRUARY 6TH,, 2018

LEGEND

🟧	SILT
☐	Sandy SILT
🟩	Silty SAND
🟩	SAND
🟩	SAND & GRAVEL



SECTION A-A

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DRAWING No.	DRAWING TITLE

REFERENCE DRAWINGS

NAME

SIGNATURE

ENG REG NUMBER

REVISION DATE

ORIGINAL DATE

REGISTERED PROFESSIONAL

No.	DESCRIPTION	BY	CHK'D	DATE

REVISIONS

HATCH

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	T BEREKOWSKI	NR	26/01/2018
DESIGNER		NR	
CHECKER			2018-02-07
DESIGN COORD.			
RESP. ENG.	G QU		
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER			

DRAWING APPROVAL STATUS: INTERNAL REVIEW

Baffinland

BAFFINLAND EXPANSION 12 MTPA MINE OPTION
PRE FEASIBILITY STUDY

PORT SITE
LUMP IRON ORE STOCKPILE
GEOLOGICAL PROFILE

SCALE 1:2000 OR AS NOTED

DWG. No. H352034-GEOSKT-229-292-0012

REV A

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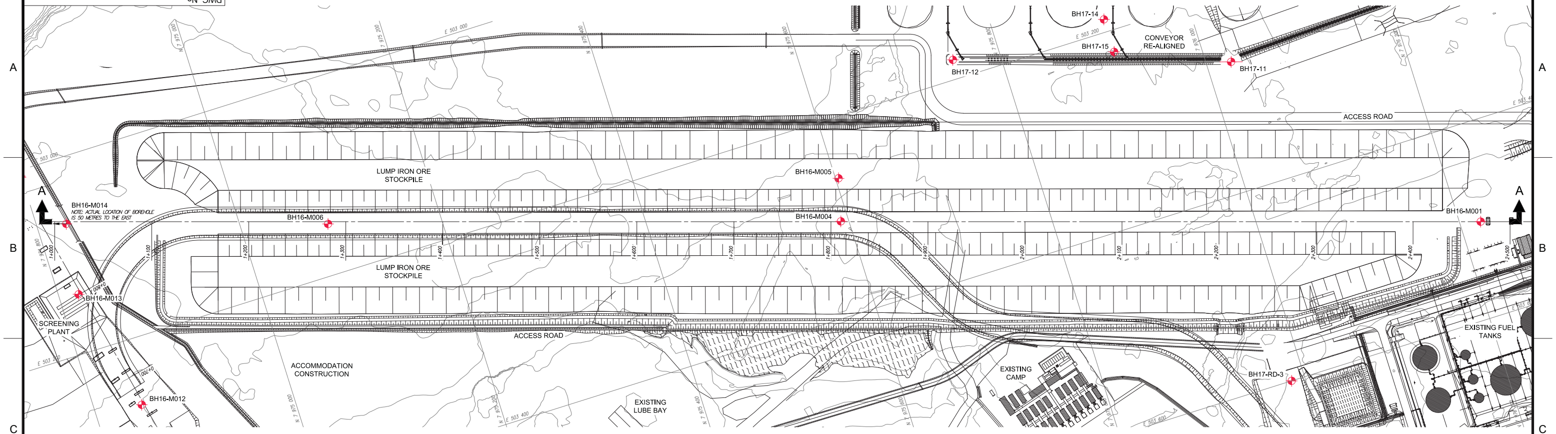


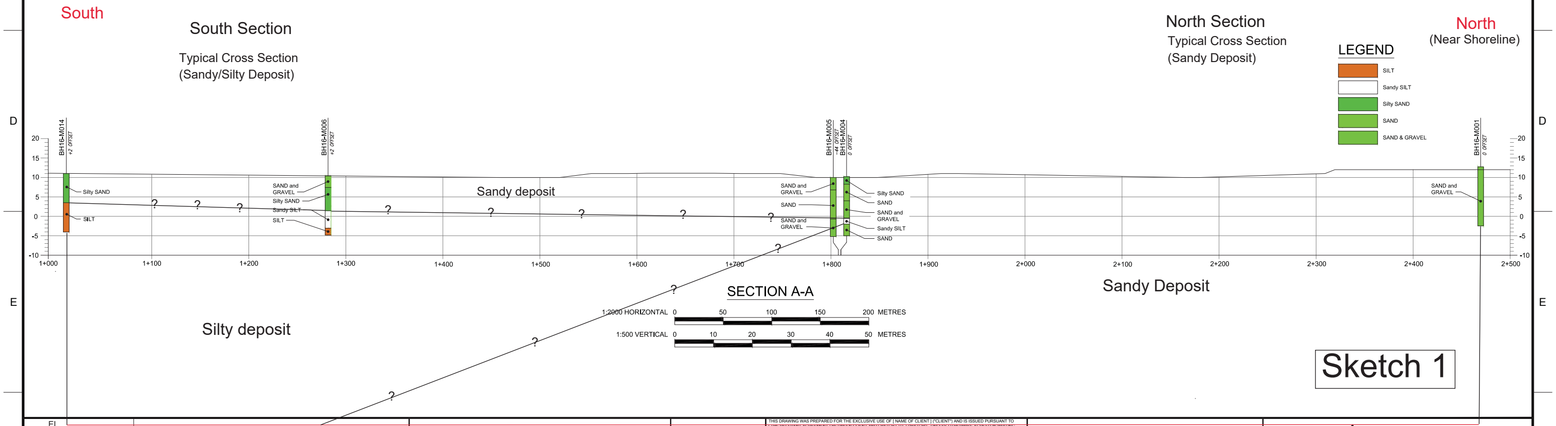
PLAN

0 50 100 150 200 METRES

SCALE: 1:2000

NOTE

PROCESSING LINE LAYOUT UPDATED LAST ON FEBRUARY 6TH., 2018



LEGEND

🟧	SILT
⬜	Sandy SILT
🟩	Silty SAND
🟩	SAND
🟩	SAND & GRAVEL

SECTION A-A

1:2000 HORIZONTAL 0 50 100 150 200 METRES

1:500 VERTICAL 0 10 20 30 40 50 METRES

DRAWING No.	DRAWING TITLE

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DESIGNER		NR	
CHECKER			2018-02-07
DESIGN COORD.			
RESP. ENG.	G QU		
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER			

DRAWING APPROVAL STATUS: INTERNAL REVIEW

Baffinland

BAFFINLAND EXPANSION 12 MTPA MINE OPTION
PRE FEASIBILITY STUDY

PORT SITE
LUMP IRON ORE STOCKPILE
GEOLOGICAL PROFILE

SCALE	DWG. No.	REV
1:2000 OR AS NOTED	H352034-GEOSKT-229-292-0012	A

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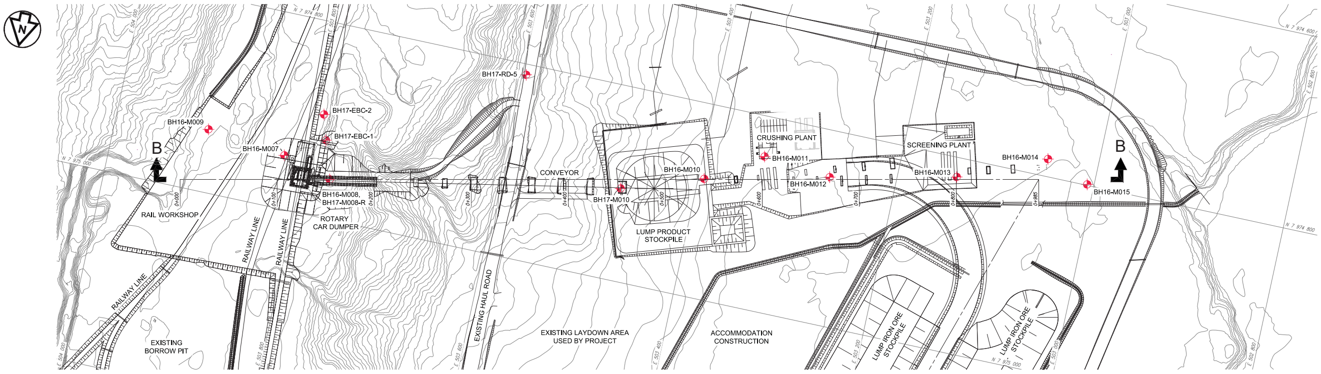

PLAN

0 50 100 150 200 METRES
SCALE: 1:2000

NOTE

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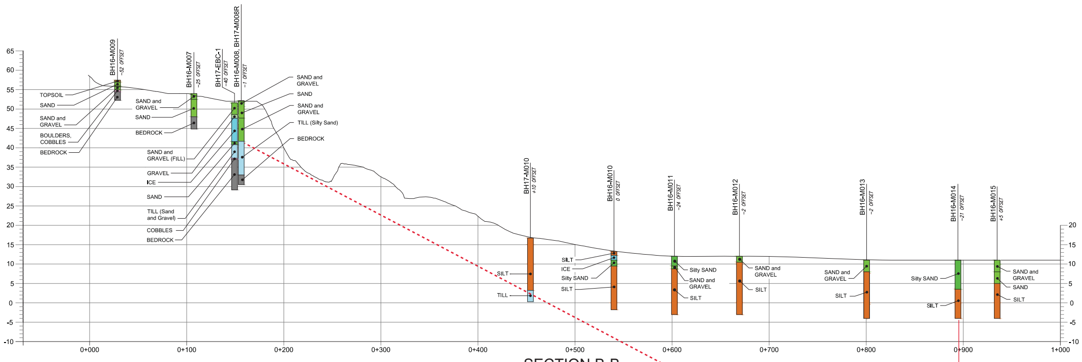

SECTION B-B

Silty Deposit

1:2000 HORIZONTAL 0 50 100 150 200 METRES

1:500 VERTICAL 0 10 20 30 40 50 METRES

Inferred Till Interface

Inferred Till Elevation @ BH 16-M014: ~ 55 m

LEGEND

🟫	TOPSOIL
🟧	SILT
🟩	Silty SAND
🟩	SAND
🟩	SAND & GRAVEL
🟦	TILL
🟦	ICE
🟪	BOULDERS, COBBLES
⬛	BEDROCK

Sketch 2

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DESIGNER		NR	
CHECKER			2018-02-07
DESIGN COORD.			
RESP. ENG.	G QU		
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER			

DRAWING APPROVAL STATUS: INTERNAL REVIEW

Baffinland

BAFFINLAND EXPANSION 12 MTPA MINE OPTION
PRE FEASIBILITY STUDY

PORT SITE
PROCESSING LINE
GEOLOGICAL PROFILE

SCALE	DWG. No.	REV
1:2000 OR AS NOTED	H352034-GEOSKT-229-292-0011	A1

$USERNAME$
$DATE$
$FILE$
$TIME$

Appendix A2
Borehole Data

HATCH

BOREHOLE REPORT

BH16-M001

Sheet 1 of 1

Client: Baffinland Iron Mines
Project: Mary River Expansion Study Stage 2
Location: Milne Inlet (Reclaimer Berm)
Project No.: H352034
Datum: NAD83
Platform: Ground

Easting:	503,504.0 m
Northing:	7,976,237.0 m
Surface Elevation:	12.75 m
Bottom Elevation:	-2.45 m
Total Depth:	15.2 m
Logged By:	MR
Reviewed By:	SH/WH

Contractor: Boart Longyear
Rig Type/ Mounting: MiniSonic Rig
Date Logged: 12/8/2016
Driller: Michael Scott
Hole Diameter (mm): 96
Date Reviewed: 2/10/2017

Water: Unobserved due to Permafrost
Method: Vibracore
Casing: H-Casing [15.2]

Elevation (m)	Depth (m)	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
		GRAVELLY SAND, trace COBBLES: Light brown to grey, fine to medium grained sand, rounded to subangular gravel	Nf							
		1.50 m to 2.00 m: Trace gravel and silt, rounded gravel	Vx							
10.8	2.0		Nbe							
				18						
			Vc							
8.8	4.0			18						
		4.60 m to 6.10 m: Trace silt	Vc							
6.8	6.0			19	0	82	17			
		6.10 m to 9.10 m: Some silt, fine to coarse grained sand	Nbe							
				16						
4.8	8.0			16						
		9.10 m to 10.60 m: Some gravel								
2.8	10.0			16						
		10.60 m to 12.10 m: With gravel, trace excess ice	Nbe							
				16						
0.8	12.0									
		12.10 m to 13.70 m: Trace gravel and silt, rounded to subangular gravel	Nbe	18						
-1.3	14.0	13.70 m to 15.20 m: Some silt, some gravel	Nbe							
				16						
		To Target Depth. **Drillhole BH16-M001 terminated at 15.2m.**								
-3.3	16.0									
-5.3	18.0									
-7.3	20.0									

Notes:

HATCH BOREHOLE REPORT

BH16-M004

Sheet 1 of 1

Client: Baffinland Iron Mines
Project: Mary River Expansion Study Stage 2
Location: Milne Port Reclaimer Berm

Project No.: H352034
Datum: NAD83
Platform: Ground

Easting: 503,302.0 m
Northing: 7,975,591.0 m
Surface Elevation: 10.20 m
Bottom Elevation: -5.00 m
Total Depth: 15.2 m
Logged By: UK
Reviewed By: SH/WH

Contractor: Boart Longyear
Rig Type/ Mounting: MiniSonic Rig
Date Logged: 12/8/2016
Driller: E.Beachamp
Hole Diameter (mm): 96
Date Reviewed: 2/10/2017

Water	Method	Casing	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
Unobserved due to Permafrost	Vibracore	H-Casing	SILTY SAND with GRAVEL: Grey, coarse grained sand, angular gravel	Nf	19						
			SAND, trace SILT: Coarse grained sand	Nbe		0	95	4			
			5.50 m to 6.10 m: Trace to some SILT	Nf							
			SAND and GRAVEL, some SILT: Grey, coarse grained sand, angular gravel	Nf	14						
			SANDY SILT: Dark grey, mottled black, fine organic material	Nf Vc							
		[15.2]	SAND, some SILT: Grey, coarse grained sand	Vc							
			To Target Depth. **Drillhole BH16-M004 terminated at 15.2m.**								

Elevation (m)	Depth (m)
8.2	2.0
6.2	4.0
4.2	6.0
2.2	8.0
0.2	10.0
-1.8	12.0
-3.8	14.0
-5.8	16.0
-7.8	18.0
-9.8	20.0

Graphic Log | Recovery | Sample Type | Moisture Content Profile 0

Notes:

HATCH BOREHOLE REPORT

BH16-M005

Sheet 1 of 1

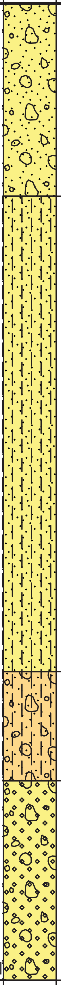
Client: Baffinland Iron Mines
Project: Mary River Expansion Study Stage 2
Location: Milne Port Reclaimer Berm

Project No.: H352034
Datum: NAD83
Platform: Ground

Easting: 503,270.0 m
Northing: 7,975,696.0 m
Surface Elevation: 10.00 m
Bottom Elevation: -5.20 m
Total Depth: 15.2 m
Logged By: UK
Reviewed By: SH/WH

Contractor: Boart Longyear
Driller: E.Beachamp
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 96
Date Logged: 12/8/2016
Date Reviewed: 2/10/2017

Water: Unobserved due to permafrost
Method: Vibracore
Casing: H-Casing [15.2]



Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
SAND and GRAVEL, Some SILT: Grey, angular to rounded gravel	Nf	13	35	53	12			
SAND, some SILT: Grey, fine to coarse grained sand	Nf	20 16						
GRAVELLY SAND, Trace SILT: Grey, subangular gravel, coarse grained sand	Nf							
SANDY GRAVEL: Grey, angular to sub-angular and well graded gravel	Nf							
To Target Depth. **Drillhole BH16-M005 terminated at 15.2m.**								

Moisture Content Profile: 0

Elevation (m)	Depth (m)
8.0	2.0
6.0	4.0
4.0	6.0
2.0	8.0
0.0	10.0
-2.0	12.0
-4.0	14.0
-6.0	16.0
-8.0	18.0
-10.0	20.0

Notes:

BOREHOLE REPORT

BH16-M006

Sheet 1 of 1

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Milne Port Reclaimer Berm

Project No.: H352034

Datum: NAD83

Platform: Ground

Easting: 503,136.0 m

Northing: 7,975,081.0 m

Surface Elevation: 10.00 m

Bottom Elevation: -5.20 m

Total Depth: 15.2 m

Logged By: MR

Reviewed By: SH/WH

Contractor: Boart Longyear

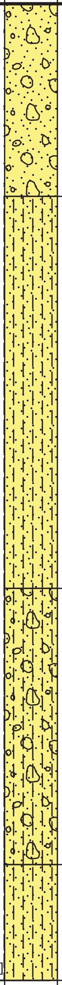
Rig Type/ Mounting: MiniSonic Rig

Date Logged: 12/8/2016

Driller: Michael Scott

Hole Diameter (mm): 96

Date Reviewed: 2/10/2017



Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile 0	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
			Vibracore	H-Casing		GRAVELLY SAND, some SILT, some COBBLES: Grey to light brown, subangluar to rounded gravel	Nf				9	32	55	13			
	8.0	2.0															
						SILTY SAND: Brown, coarse grained	Vc										
	6.0	4.0															
											18						
	4.0	6.0															
						4.90 m to 5.80 m: Some GRAVEL	Nf										
	2.0	8.0															
						SILT, some SAND, trace GRAVEL: Grey, coarse grained and angular gravel	Nbn										
	0.0	10.0															
	-2.0	12.0															
						SILT, trace to some SAND	Nbn										
	-4.0	14.0															
				[15.2]													
						To Target Depth. **Drillhole BH16-M006 terminated at 15.2m.**											
	-6.0	16.0															
	-8.0	18.0															
	-10.0	20.0															

Notes:

HATCH

BOREHOLE REPORT

BH16-M007

Sheet 1 of 2

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Milne Port Train Unloading

Project No.: H352034

Datum: NAD83

Platform: Ground

Easting: 503,822.0 m

Northing: 7,974,945.0 m

Surface Elevation: 54.00 m

Bottom Elevation: 44.86 m

Total Depth: 9.1 m

Logged By: UK

Reviewed By: SH/WH

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 10/3/2016

Driller: E.Beachamp

Hole Diameter (mm): 96

Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	**Soil Description** TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile 0	Other Tests
Unobserved due to Permafrost			Vibracore	H-Casing		SAND and GRAVEL: Grey, coarse grained sand, angular to sub-angular gravel	Nf		☒		
						SAND: Grey, coarse grained	Nbn		☒		
	52.0	2.0									
							Nf		☒		
	50.0	4.0							☒		
						4.70 m to 6.10 m: Some GRAVEL					
	48.0	6.0		[6.1]							
						Start of Coring at 6.1m. ***Continued on Rock Core Log sheet.***					
	46.0	8.0									
	44.0	10.0									
	42.0	12.0									
	40.0	14.0									
	38.0	16.0									
	36.0	18.0									
	34.0	20.0									

Notes:

HATCH

BOREHOLE REPORT

BH16-M008

Sheet 1 of 3

Client: Baffinland Iron Mines
Project: Mary River Expansion Study Stage 2
Location: Milne Port Train Unloading

Project No.: H352034
Datum: NAD83
Platform: Ground

Contractor: Boart Longyear
Rig Type/ Mounting: MiniSonic Rig
Date Logged: 10/4/2016
Driller: E.Beachamp
Hole Diameter (mm): 96
Date Reviewed: 2/10/2017

Easting:	503,771.0 m
Northing:	7,974,959.0 m
Surface Elevation:	52.00 m
Bottom Elevation:	30.66 m
Total Depth:	21.3 m
Logged By:	UK
Reviewed By:	SH/WH

Water | Elevation (m) | Depth (m) | Method | Casing | Graphic Log | Recovery | Sample Type | Moisture Content Profile 0 | Other Tests

Water: Unobserved due to Permafrost

Method: Vibracore

Casing: H-Casing [18.8]

Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description
SANDY GRAVEL: Rounded to sub angular gravel, coarse grained sand, well graded	Nf
SAND: Coarse to fine grained	Nf
3.00 m to 4.60 m: Some SILT	Nbn
SAND and GRAVEL: Coarse grained sand	Nf
6.90 m to 7.60 m: Zone of inferred cobbles	
SILTY SAND, some GRAVEL: Fine to coarse, subangular gravel	Nbn
12.20 m to 12.60 m: GRAVELLY SILTY SAND	
13.80 m to 15.40 m: SILTY SAND	

Start of Coring at 18.8m.
Continued on Rock Core Log sheet.

Elevation (m)	Depth (m)
50.0	2.0
48.0	4.0
46.0	6.0
44.0	8.0
42.0	10.0
40.0	12.0
38.0	14.0
36.0	16.0
34.0	18.0
32.0	20.0

Notes:

BOREHOLE REPORT

BH16-M009

Sheet 1 of 2

Client:	Baffinland Iron Mines
Project:	Mary River Expansion Study Stage 2
Location:	Milne Port Train Unloading
Project No.:	H352034
Datum:	NAD83
Platform:	Ground
Easting:	503,904.0 m
Northing:	7,974,935.0 m
Surface Elevation:	57.50 m
Bottom Elevation:	52.32 m
Total Depth:	5.2 m
Contractor:	Boart Longyear
Driller:	Samuel Flynn
Rig Type/ Mounting:	MiniSonic Rig
Hole Diameter (mm):	96
Date Logged:	10/4/2016
Date Reviewed:	2/10/2017
Logged By:	MR
Reviewed By:	SH/WH

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile 0	Other Tests
Unobserved due to Permafrost			Vibracore	H-Casing		ORGANICS: Organic soil					
						GRAVELLY SAND: Light brown to grey, angular to subgranular gravel, medium to coarse grained sand	Nf				
	55.5	2.0				SAND and GRAVEL: Grey to light brown, Fine to coarse grained sand, angular to subangular gravel	Nbn				
				[3.7]		Inferred BOULDERS with SAND: Coarse to fine grained sand					
	53.5	4.0				***Start of Coring at 3.7m.*** ***Continued on Rock Core Log sheet.***					
	51.5	6.0									
	49.5	8.0									
	47.5	10.0									
	45.5	12.0									
	43.5	14.0									
	41.5	16.0									
	39.5	18.0									
	37.5	20.0									

Notes:

HATCH

BOREHOLE REPORT

BH16-M010

Sheet 1 of 1

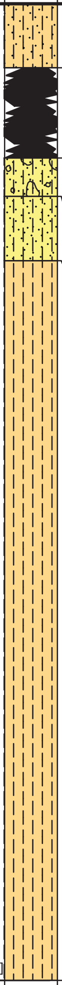
Client: Baffinland Iron Mines
Project: Mary River Expansion Study Stage 2
Location: Milne Port Crusher
Project No.: H352034
Datum: NAD83
Platform: Ground
Easting: 503,394.0 m
Northing: 7,974,877.0 m
Surface Elevation: 13.30 m
Bottom Elevation: -1.90 m
Total Depth: 15.2 m
Contractor: Boart Longyear
Rig Type/ Mounting: MiniSonic Rig
Date Logged: 12/9/2016
Logged By: MR
Driller: Michael Scott
Hole Diameter (mm): 96
Date Reviewed: 2/10/2017
Reviewed By: SH/WH

Elevation (m)	Depth (m)
11.3	2.0
9.3	4.0
7.3	6.0
5.3	8.0
3.3	10.0
1.3	12.0
-0.7	14.0
-2.7	16.0
-4.7	18.0
-6.7	20.0

Method: Vibrocore

Casing: H-Casing [15.2]

Graphic Log



Moisture Content Profile: 0

Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Field Water Content	Percent Gravel	Percent Sand	Percent Fines
SILT, some SAND: Brown, moist	Vc				
ICE: Soft, white, cloudy texture	ICE	28	0	16	84
GRAVELLY SILTY SAND: Light brown and grey	Nf				
SILT and SAND: Organic silt, brown, moist	Vx				
SILT, trace SAND: Organic, dark grey to brown, moist	Vx	100	0	4	96
		32			
	Nbn				
	Nf				
	Vx				
	Nf				
	Nbn				
	Nf				
To Target Depth. **Drillhole BH16-M010 terminated at 15.2m.**					

Other Tests

Notes:

BOREHOLE REPORT

BH16-M011

Sheet 1 of 1

Client: Baffinland Iron Mines
Project: Mary River Expansion Study Stage 2
Location: Milne Port Crusher

Project No.: H352034
Datum: NAD83
Platform: Ground

Easting: 503,339.0 m
Northing: 7,974,868.0 m
Surface Elevation: 12.00 m
Bottom Elevation: -3.20 m
Total Depth: 15.2 m
Logged By: MR
Reviewed By: SH/WH

Contractor: Boart Longyear
Rig Type/ Mounting: MiniSonic Rig
Date Logged: 12/4/2016
Driller: Michael Scott
Hole Diameter (mm): 96
Date Reviewed: 2/10/2017

Method: Vibrocore
Casing: H-Casing [15.2]

Elevation (m)	Depth (m)
10.0	2.0
8.0	4.0
6.0	6.0
4.0	8.0
2.0	10.0
0.0	12.0
-2.0	14.0
-4.0	16.0
-6.0	18.0
-8.0	20.0

Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
SILTY SAND: Light brown, moist	Nf							
	Nbn	16	0	68	32			
	Nf							
	Nbn							
SAND and GRAVEL: Light brown, moist, subangular gravel	Vx	10						
SILT, trace SAND: Dark grey, moist	Nbe							
	Vc							
	Nf							
	Nf							
	Nf							
	Nbn							
	Nbn							
	Nbn							

Moisture Content Profile 0

To Target Depth.

Drillhole BH16-M011 terminated at 15.2m.

Notes:

HATCH

BOREHOLE REPORT

BH16-M012

Sheet 1 of 1

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Milne Port Generator

Project No.: H352034

Datum: NAD83

Platform: Ground

Easting: 503,268.0 m

Northing: 7,974,848.0 m

Surface Elevation: 12.00 m

Bottom Elevation: -3.20 m

Total Depth: 15.2 m

Logged By: MR

Reviewed By: SH/WH

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 12/8/2016

Driller: Michael Scott

Hole Diameter (mm): 96

Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	**Soil Description** TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile 0	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
						SAND and GRAVEL, some SILT, trace COBBLES: Light brown, rounded	Nf										
											6	39	45	17			
						SILT, some SAND: Dark grey	Vx										
	10.0	2.0															
							Nbn										
	8.0	4.0															
											21	0	16	84			
							Vx										
	6.0	6.0															
							Nbn										
	4.0	8.0	Vibrocore	H-Casing													
							Nf										
	2.0	10.0															
	0.0	12.0															
	-2.0	14.0															
				[15.2]		To Target Depth. **Drillhole BH16-M012 terminated at 15.2m.**											
	-4.0	16.0															
	-6.0	18.0															
	-8.0	20.0															

Notes:

BOREHOLE REPORT

BH16-M013

Sheet 1 of 1

Client: Baffinland Iron Mines
Project: Mary River Expansion Study Stage 2
Location: Milne Port Screening

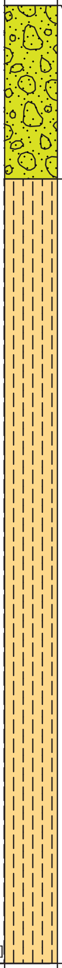
Project No.: H352034
Datum: NAD83
Platform: Ground

Easting: 503,140.0 m
Northing: 7,974,820.0 m
Surface Elevation: 11.00 m
Bottom Elevation: -4.20 m
Total Depth: 15.2 m
Logged By: MR
Reviewed By: SH/WH

Contractor: Boart Longyear
Rig Type/ Mounting: MiniSonic Rig
Date Logged: 12/5/2016
Driller: Michael Scott
Hole Diameter (mm): 96
Date Reviewed: 2/10/2017

Elevation (m)	Depth (m)
9.0	2.0
7.0	4.0
5.0	6.0
3.0	8.0
1.0	10.0
-1.0	12.0
-3.0	14.0
-5.0	16.0
-7.0	18.0
-9.0	20.0

Method: Vibrocore
Casing: H-Casing [15.2]



Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
Organic soil and GRAVEL								
GRAVELLY SAND, some SILT: Light brown, medium to coarse grained sand, rounded to subangular gravel	Vx	25	32	48	20			
SILT, some SAND: Dark grey	Vc	21	5	33	61			
	Nf							
	Nbn							
	Nf							
	Nbn							
	Nf							
	Nbn							
	Nf							
	Nbn							
To Target Depth. **Drillhole BH16-M013 terminated at 15.2m.**								

Moisture Content Profile: 0

Notes:

HATCH

BOREHOLE REPORT

BH16-M014

Sheet 1 of 1

Client:	Baffinland Iron Mines	**Project No.:**	H352034
Project:	Mary River Expansion Study Stage 2	**Datum:**	NAD83
Location:	Milne Port Tail Pulley	**Platform:**	Ground
Contractor:	Boart Longyear	**Rig Type/ Mounting:**	MiniSonic Rig
Driller:	Michael Scott	**Hole Diameter (mm):**	96
Date Logged:	12/5/2016	**Date Reviewed:**	2/10/2017

Easting:	503,052.0 m
Northing:	7,974,782.0 m
Surface Elevation:	11.00 m
Bottom Elevation:	-4.20 m
Total Depth:	15.2 m
Logged By:	MR
Reviewed By:	SH/WH

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile 0	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
			Vibrocore	H-Casing		GRAVELLY SILTY SAND: Grey to brown, angular to subangular gravel	Nf				6	22	52	26			
	9.0	2.0															
						SILTY SAND: Grey	Nbn										
	7.0	4.0									21	0	78	22			
	5.0	6.0					Nf Nbn										
						SILT, some SAND: Dark grey, fine grained sand	Nf Nbn Nf										
	3.0	8.0															
	1.0	10.0															
	-1.0	12.0															
	-3.0	14.0					Nbn										
				[15.2]		To Target Depth. **Drillhole BH16-M014 terminated at 15.2m.**											
	-5.0	16.0															
	-7.0	18.0															
	-9.0	20.0															

Notes:

HATCH BOREHOLE REPORT

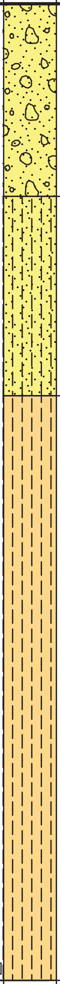
BH16-M015

Sheet 1 of 1

Client: Baffinland Iron Mines
Project: Mary River Expansion Study Stage 2
Location: Milne Port Tail Pulley Alt.
Project No.: H352034
Datum: NAD83
Platform: Ground
Contractor: Boart Longyear
Driller: Michael Scott
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 96
Date Logged:
Date Reviewed: 2/10/2017

Easting:	503,007.0 m
Northing:	7,974,799.0 m
Surface Elevation:	11.00 m
Bottom Elevation:	-4.20 m
Total Depth:	15.2 m
Logged By:	MR
Reviewed By:	SH/WH

Method: Vibrocore
Casing: H-Casing [15.2]



Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Field Water Content	Percent Gravel	Percent Sand	Percent Fines
SAND and GRAVEL, trace SILT, trace COBBLES: Light brown to grey, fine to coarse grained sand, rounded gravel	Nf	1	32	59	10
SAND, trace SILT: Light brown, fine to coarse grained sand,	Nf	14	15	71	14
SILT, some SAND: Dark grey to brown	Nbn Nf	24 27			
To Target Depth. **Drillhole BH16-M015 terminated at 15.2m.**					

Elevation (m)	Depth (m)
9.0	2.0
7.0	4.0
5.0	6.0
3.0	8.0
1.0	10.0
-1.0	12.0
-3.0	14.0
-5.0	16.0
-7.0	18.0
-9.0	20.0

Moisture Content Profile
0

Notes:

Appendix A3
Thermal Analyses Methodology

Appendix A3

Thermal Analyses

Two-dimensional finite element modelling, with commercially available software (Temp/W), was used to predict the thermal regime for the tunnel foundation.

The air temperature is based on the mean monthly air temperature from Milne Inlet Port, NU (2006-2015) extracted from RWDI's response document to Crown-Indigenous Relations and Northern Affairs Canada titled "181234 CIRNAC IR 14" (RWDI, 2019), see Table A-3-1.

The global warming effect was taken into account according to the Intergovernmental Panel on Climate Change (IPCC) long term climate change studies. A temperature adjustment was applied considering to global warming for the period spanning from 2010 to 2039 (Hatch 2018).

Table A-3-1: Mean Monthly Temperatures for Milne Inlet Port, NU (2006-2015)

Month	Temperature
January	-29.5
February	-30.8
March	-28.9
April	-19.6
May	-6.9
June	3.5
July	10.2
August	7.4
September	-0.9
October	-7.7
November	-17.9
December	-25.1

Surface boundary conditions at the site were obtained based on the n-factors which was used to correlate air temperatures to ground surface temperatures during cold seasons (n_f) and thaw seasons (n_t). Values of n_t and n_f used in the analysis were summarized in Table A-3-2 Typically, n_f is less than 1 considering the impact of snow accumulation/insulation over ground surface during winter while n_t is more than 1 considering the impact of radiation.

Inside the tunnel, the n factor of 1 was used assuming that the ground surface temperature is same as the air temperature. It is noted that in summer the air temperature in the tunnel could be colder than the air temperature outside while in winter, the inside air temperature in the tunnel becomes is likely warmer than the outside air temperature. There is no sufficient data/study to quantify the two opposite effects. As such, this study assumed that the air temperature in tunnel is same.

The available thermistor data from the Mary River site (Hatch, 2012) indicate that ground temperature reaches equilibrium (at -10° C) below 15m depth, thus the bottom boundary was assumed to be 15m below the ground surface, with a constant temperature of -10° C.

The results are shown in the figures in this appendix.

Table A-3-2: N-factors to be Used in Modelling

Material	N – factors	
	Freezing (n_f)	Thawing (n_t)
Native Sand	0.7	1.2
Native Silt	0.5	1.2
Rockfill / Granular Backfill	0.8	1.5

Appendix A4
Settlement Analyses Methodology

Appendix A4

Settlement Analyses

Two-dimensional finite element modelling, with commercially available software (Sigma/W), was used to predict the displacement.

Figure A-4-1 and Table A-4-2 shows the engineering parameters for unfrozen soil, frozen silt and frozen till used in the analyses.

In the model, the creep deformation was modeled using a long-term strength envelope and equivalent long-term deformation modulus (see details in Hatch 2018).

For the soil beyond structures/facilities, the following simplified soil profile was used as per the warmest envelope from the thermistor monitoring data (see the figure below).

a. 0 m to 3 m depth: Soil in Active Zone*

b. 3 m to 7 m depth: Frozen Soil (above - 7° C)

c. Below 7 m depth: Frozen Soil (below - 7° C)

Note: * The properties of the unfrozen soil was used for the soil between 2 m to 3 m depth as a conservative assumption.

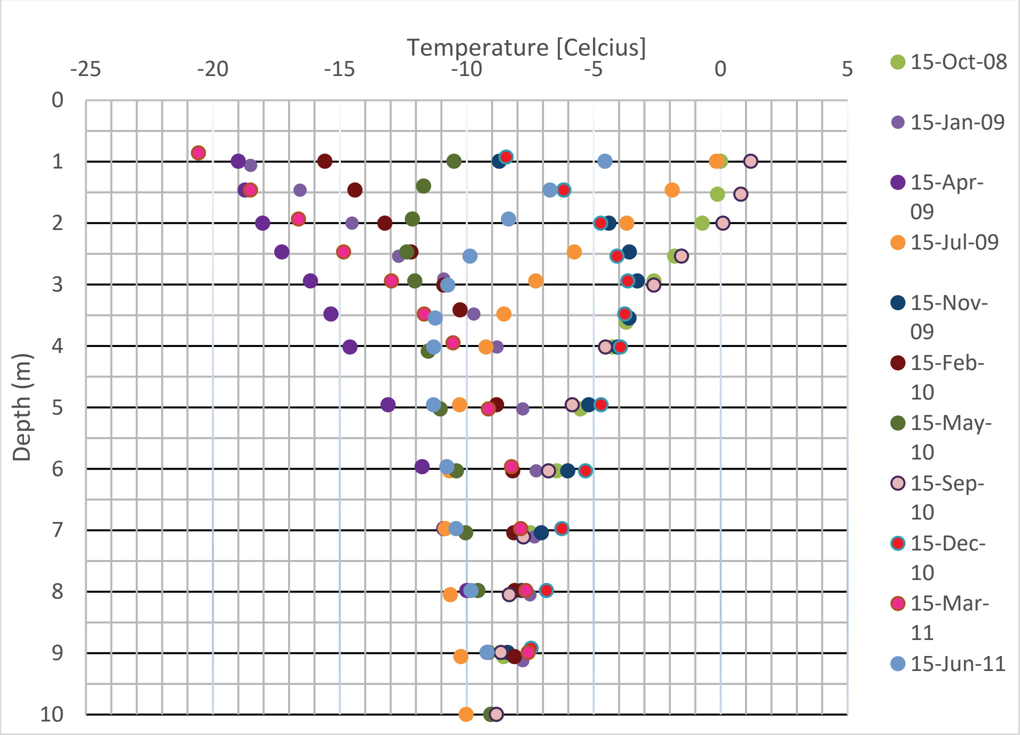


Figure: A-1: Temperature Profiles containing Numerical and Recorded Data Overlain

(Thermistor data from BH2007-10, reported by Knight Piesold, 2008)

Table A-4-1: General Design Parameters

Materials	**Elastic Young's Modulus**	**Poisson's Ratio**	**Unit Weight**	**Strength Parameters**	
	Es, (MPa)		**kN/m^3**	c' **(kPa)**	ϕ' **(Degrees)**
Ore	30	0.33	26	0	40°
Engineered Fill (compacted crushed rockfill)	70	0.33	22	0	40°
Rockfill	70	0.33	22	0	40°
Native Silt	8 (unfrozen condition)	0.33	18	0	30°
Native Sand	15 (unfrozen condition)	0.33	18	0	32°

Table A-4-2: Design Parameters for Frozen Silty Permafrost

Temperature	**Long-term Deformation Modulus**	**Poisson's Ratio**	**Unit Weight**	**Strength Parameters For Creep Analyses (20-year design life)**	
	Ec, (MPa)		**kN/m^3**	c'_{LT} **(kPa)**	ϕ'_{LT}
Above - 7° C	22	0.33	18	0	30°
Below -7° C	44	0.33	18	0	30°

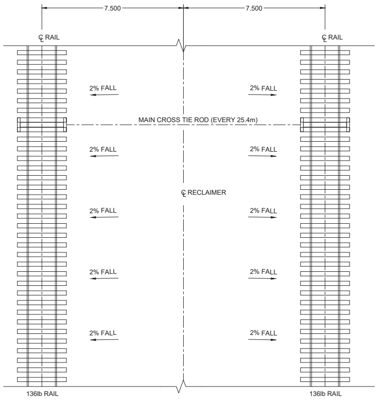
Note: The underlying till material is considered very stiff in its hard frozen state (< - 7°C) with a high deformation modulus of 1,000 MPa.

Table A-4-3: Design Parameters for Frozen Sandy Permafrost

Temperature	**Long-term Deformation Modulus**	**Poisson's Ratio**	**Unit Weight**	**Strength Parameters For Creep Analyses (20-year design life)**	
	Ec, (MPa)		**kN/m^3**	c'_{LT} **(kPa)**	ϕ'_{LT}
Above - 7° C	80	0.33	18	0	32°
Below -7° C	160	0.33	18	0	32°

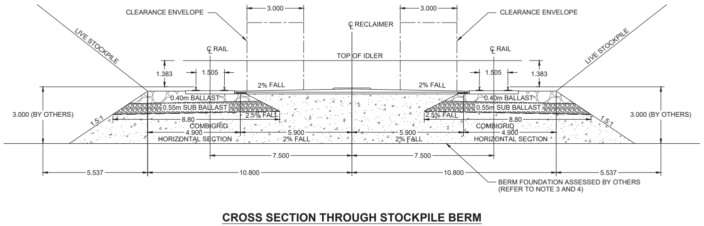
Note: The underlying till material is considered very stiff in its hard frozen state (< - 7°C) with a high deformation modulus of 1,000 MPa.

Appendix B
Reclaimer/Stacker Drawings



STOCKPILE BERM PLAN

SCALE: 1:100 m
2 0 2



CROSS SECTION THROUGH STOCKPILE BERM

SCALE: 1:100 m
2 0 2

BERM FILL

PROOF ROLL WITH A MINIMUM OF FOUR PASSES (2 IN EACH IN PERPENDICULAR DIRECTIONS) WITH A MINIMUM 8 TONNE VIBRATING SMOOTH DRUM ROLLER TO THE SATISFACTION OF THE GEOTECHNICAL ENGINEER. REPLACE SOFT, WET OR HEAVING AREAS WITH GRANULAR FILL TO PROVIDE A STABLE PLATFORM.

CRUSHED GRAVEL BALLAST

1. GRADATIONS TO BE WITHIN LIMITS SPECIFIED (IRRICANA PIT).
   (SPEC NOTE: SEEK APPROVAL OF GEOTECHNICAL ENGINEER FOR ALL GRADATIONS)

SIEVE SIZE	PERCENT PASSING
45.3 mm (1 - 3/4")	100
32.0 mm (1 - 1/4")	70 - 95
25.4 mm (1")	50 - 80
19.0 mm (3/4")	30 - 60
12.7 mm (1/2")	10 - 30
4.76 mm (No. 4)	0 - 3
74 micron (No. 200)	0 - 1

2. PERCENTAGE OF CRUSHED PARTICLES IN SIZE RANGE SHALL NOT BE LESS THAN 70% BY WEIGHT OF ALL PARTICLES IN THAT SIZE RANGE. PARTICLES HAVING ONE OR MORE FRACTURED FACES WILL BE USED IN CALCULATING THIS PERCENTAGE.
3. MATERIAL IN SAMPLE FINER THAN NO. 4 (4.76 MICRON) SIEVE WILL NOT BE CONSIDERED IN DETERMINING THE PERCENTAGE OF FRACTURED FACES.
4. GRADING OF CRUSHED GRAVEL BALLAST SHALL BE DETERMINED BY ASTM C316, LATEST EDITION.
5. AMOUNT OF MATERIAL FINER THAN NO. 200 (74 MICRON) SHALL BE DETERMINED BY ASTM C117, LATEST EDITION.

SUB-BALLAST

1. COMPACT TO 98% OF STANDARD PROCTOR MAXIMUM DENSITY.
2. MATERIAL TO BE CRUSHED OR SCREENED PIT RUN GRAVEL, CONTAINING NO MORE THAN THREE PERCENT (3%) ORGANICS BY WEIGHT AS DETERMINED BY ASTM C-123.
3. MATERIAL GREATER THAN 5 mm TO CONTAIN A MINIMUM OF FIFTY PERCENT (50%) BY WEIGHT FRACTURED MAERIAL (TWO (2) FRACTURED FACES).
4. GRADATIONS TO BE WITHIN LIMITS SPECIFIED.

SIEVE SIZE	PERCENT PASSING
75 mm (3")	100
25 mm (1")	60 - 90
4.75 mm (#4)	35 - 60
425 micro m (#40)	10 - 40
80 micro m (#200)	0 - 5

COMBIGRID

1. COMBIGRID TO BE COMBIGRID 40/40 Q1 151 GRK3 (OR APPROVED EQUIVALENT).
2. TO BE INSTALLED IN THE INTERFACE BETWEEN THE BERM AND SUB-BALLAST. PER PRODUCT SPECIFICATION.

NOTES:

1. DIMENSIONS ARE IN METERS, ELEVATIONS AND STATIONS ARE IN METERS, UNLESS NOTED OTHERWISE.
2. THIS DESIGN DOES NOT ACCOUNT FOR ANY JACKING OR SETTLEMENT DUE TO PERMAFROST IN THE FOUNDATION. DESIGN THICKNESS OF THE BERM BY OTHERS.
3. THIS DESIGN ASSUMES THE BALLAST STRUCTURE IS OVERLYING A BERM (DESIGN BY OTHERS) WHICH IS DESIGNED WITH A MINIMUM CBR OF 10.
4. THE DESIGN LOADING AT THE BASE OF THE SUB-BALLAST IS 350 KPa.
5. FOR WHEEL LOAD DETAILS REFER TO THE PRELIMINARY WHEEL LOADS DRAWING NUMBER 4934009. PER LOAD CASE III :
   - MAX VERTICAL LOAD IS 445KN (+/- 10%)
   - MAX HORIZONTAL LOAD IS 45KN (+/- 10%)
6. FOR RAIL TRACK MAIN CROSS TIE SEE DRAWING A05212A04 DRAWING 102 ON DOCUMENT 4500001466-B05-0002-002.

DOCUMENT NUMBER : 4500001466-B07-0001-001

THIS SEAL IS ONLY FOR DESIGN OF STRUCTURAL FILL (SUB-BALLAST + BALLAST) ABOVE THE BERM.
Aug 29/2017

TO COME

KCB APPLIED FOR A NWT STAMP AND ONCE RECEIVED PROPOSE TO RE SUBMIT THE STAMPED DRAWINGS.

DRAWING REVISIONS

REVISION	DESCRIPTION OF REVISION	DATE (YYYY-MM-DD)	DRAWN	DESIGNED	CHECKED	APPROVED
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
1	RE-ISSUED FOR CONSTRUCTION	2017-09-12	RM	KC/AB	PF	TK
0	ISSUED FOR CONSTRUCTION	2017-08-29	RM	KC/AB	PF	TK

ORIGINAL ISSUE

DRAWN:	RM
DESIGNED:	KC
CHECKED:	PF
APPROVED:	TK
DATE:	2017-08-18

CLIENT
thyssenkrupp
A&B RAIL SERVICES LTD.

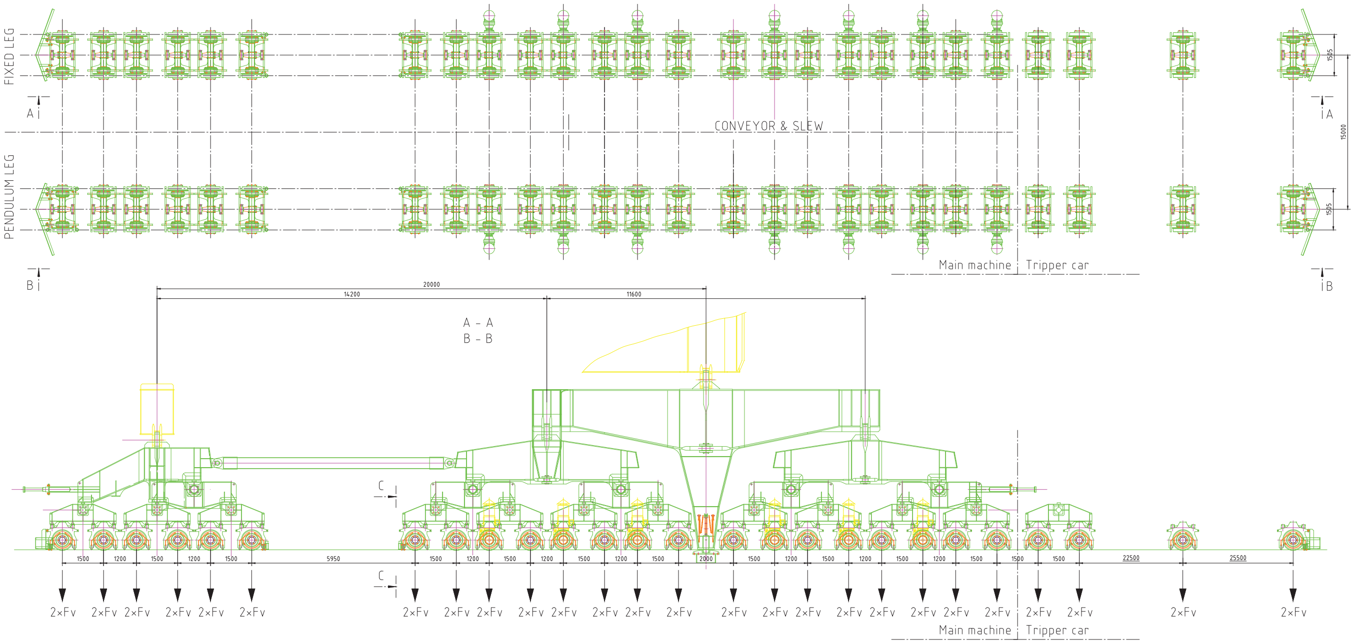
Klohn Crippen Berger

PROJECT
BAFFINLAND IRON MINES LP
MARY RIVER EXPANSION STAGE 3

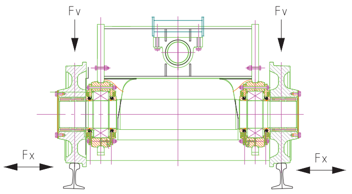
TITLE
STACKER, RECLAIMER AND CONVEYOR
BALLAST AND SUB BALLAST DETAILS

SCALE	PROJECT No.	DWG. No.	REV.
1:100	A05212A04	101	1

REFERENCE DRAWING	
DRAWING NO.	TITLE



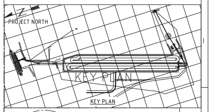
C - C
Two-wheel bogie
Fixed side



Max. Wheel Loads (±10% Tolerance)		Fixed Leg	Pendulum Leg
No.of Wheels		12 + 32 + 4 + 2 + 2	12 + 32 + 4 + 2 + 2
LOAD CASE I: in operation, main loads Vertical wheel load Horizontal load	Fv Fx	322 KN 32 KN	322 KN
LOAD CASE II: in operation, main loads with additional loads Vertical wheel load Horizontal load	Fv Fx	350 KN 35 KN	350 KN
LOAD CASE III: in- and out of operation, main-, additional- and special loads Vertical wheel load Horizontal load	Fv Fx	445 KN 45 KN	445 KN

DRAWING NOTES

Preliminary



ENG STAMP

PERMIT STAMP

CLIENT INFO

STATUS IFC

thyssenkrupp Industrial Solutions
St. Ingbert, Germany

Tolerances for welded constructions	DIN EN ISO 13920 Tolerance classification	B / F	
Tolerances for machined surfaces	DIN ISO 2768 part 1/2 Tolerance classification	m / k	
		E KN 912235.11	Surface EN ISO 1302
List of Material		No. of marks	

	Date	Name	Dep.
Drawn	02.06.17	ZITTM	
Checked	01.08.17	KILIANJ	
Static			
Approved			

Index	Revision	Date	Name	Checked
02	STATUS	25.09.17	ZITTM	KILIANJ
01	Hatch No.	14.09.17	ZITTM	KILIANJ

Origine

thyssenkrupp

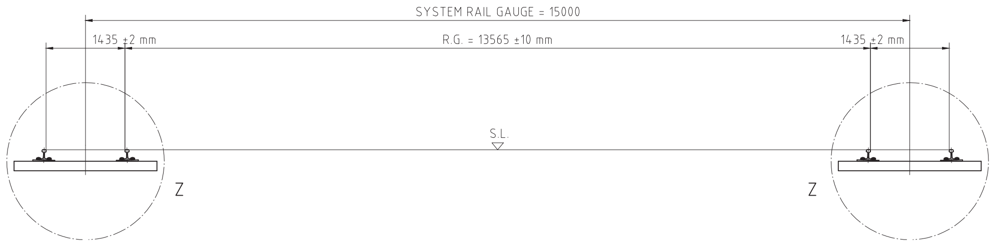
Weld seams
external state DIN EN ISO 5817 — Group of valuation B|C
NDT - ISO 17640"B", ISO 11666"2" — Valuation group B 2
Tolerance setting ISO 8015
Scale 1:50
Weight kg
Hatch No. E353004-CM001-240-272-4006
Material WB

PRELIMINARY WHEEL LOADS

BUCKET WHEEL RECLAIMER
12848 BAFFINLAND

Drawing-Ident No.	Ch.	Key-No.	F	
4934009	CAD		0	Sheet 1 Sheets

Used instead of:
Replaced by:

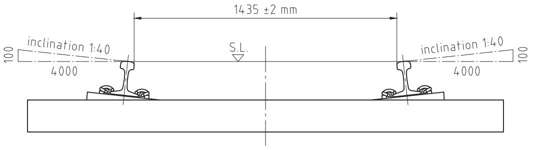


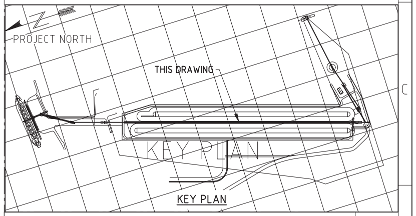
REFERENCE DRAWING

DRAWING NO.	TITLE

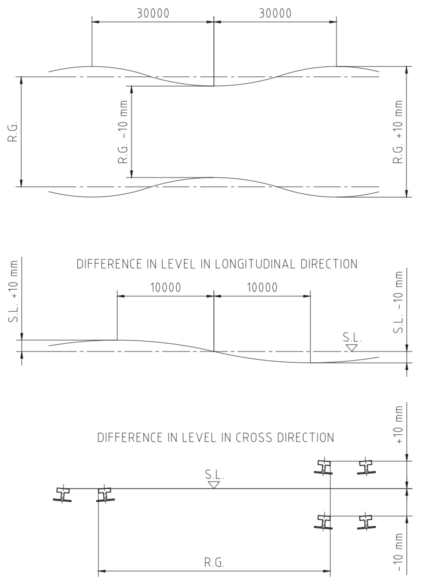
DRAWING NOTES

Detail Z (1:15)





ADMISSIBLE TOLERANCES FOR RAIL LAYING



R.G. = RAIL GAUGE = 13565
S.L. = STANDARD LEVEL

ENG
STAMP

PERMIT
STAMP

CLIENT INFO

thyssenkrupp Industrial Solutions
St. Ingbert, Germany

Tolerances for welded constructions — DIN EN ISO 13920 Tolerance classification — B / F
Tolerances for machined surfaces — DIN ISO 2768 part 1/2 Tolerance classification — m / k

E
KN 912235.11
No. of marks
Surface
EN ISO 1302

list of Material

	Date	Name	Dep.
Drawn	11.07.17	KELKEL	
Checked	14.07.17	KILIANJ	
Static			
Approved			

Index	Revision	Date	Name	Checked
01	LONGITUDINAL TOLERANCE	14.07.17	KELKEL	KILIANJ

Origine

thyssenkrupp

Weld seams
external state DIN EN ISO 5817 — Group of valuation — B|C
NDT - ISO 17640:"B", ISO 11666:"2" — Valuation group — B 2

Tolerance setting ISO 8015

Scale 1:50
Weight kg
Hatch No.
Material WB

RAIL TOLERANCES

STACKER/RECLAIMER
BAFFINLAND

Drawing-Ident No.	CH.	Key-No.	F	
4935166	CAD		2	Sheet 1 1 Sheets

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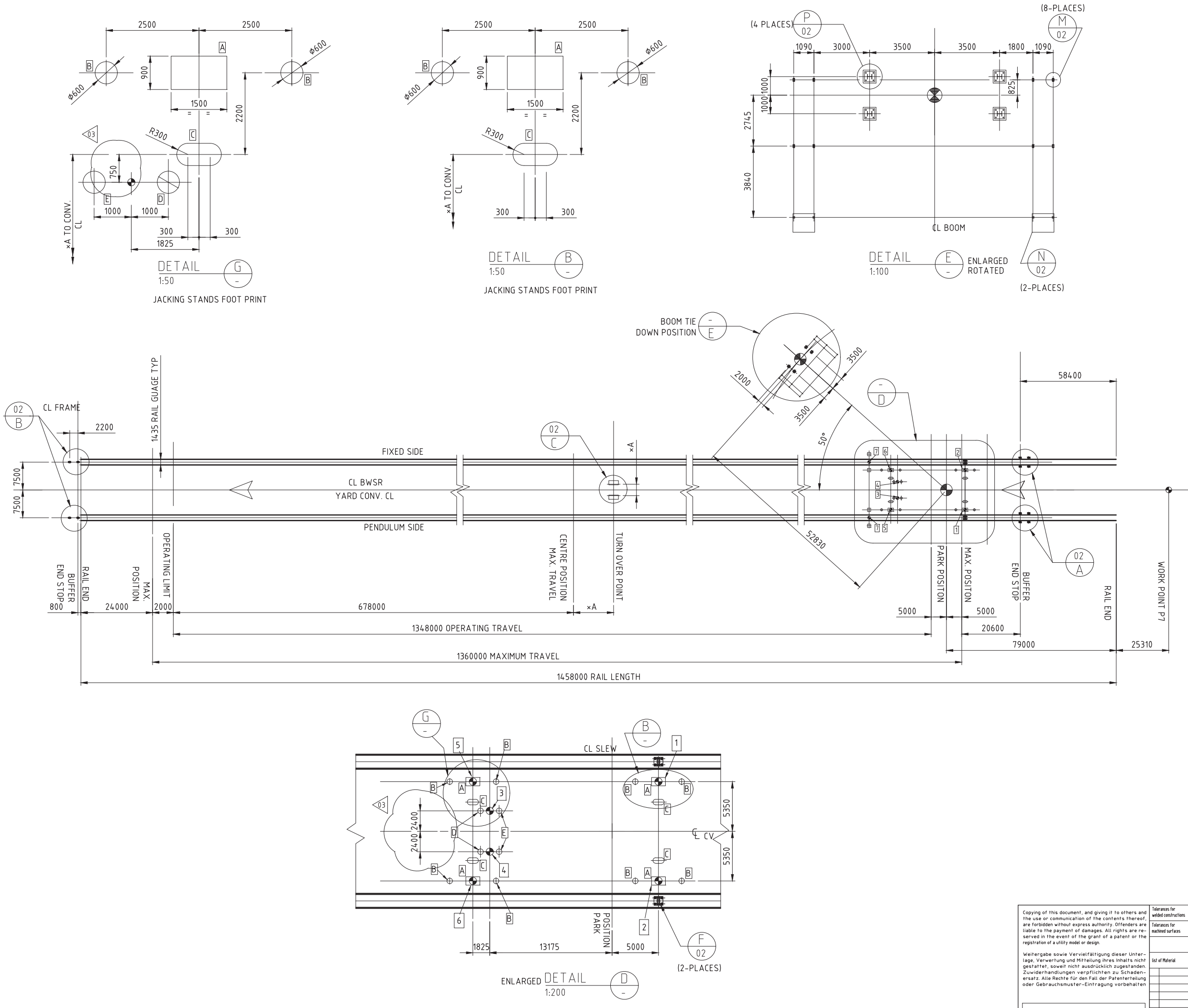
Replaced by:



REFERENCE DRAWING	
DRAWING NO.	TITLE

NOTE:
1. MAXIMUM TRAVEL DISTANCE IS WITH BUFFER BUFFER COMPRESSED.

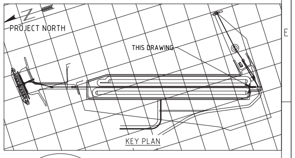
JACKING POSITION RECLAIMER	VERTICAL LOADS (kN)				
	A	B	C	D	E
1	10400	710	±710		
2	12100	825	±825		
3				1300 ±185	1300 ±185
4				1300 ±185	1300 ±185
5	3500	240	±240		
6	3500	240	±240		

ALL GIVEN LOADS ARE FOR MACHINE WITH THE BOOM AT 50° (TIE DOWN ANGLE)

TOP OF CONCRETE TO BE -200mm FROM TOP OF RAIL FOR JACKING PADS

×A
to be informed later

Preliminary
not for construction



STATUS IFC

thyssenkrupp Industrial Solutions
St. Ingbert, Germany

Tolerances for welded constructions DIN EN ISO 13920 Tolerance classification B / F
Tolerances for machined surfaces DIN ISO 2768 part 1/2 Tolerance classification m / k
Weld seams external state DIN EN ISO 5817 Group of valuation B|C
NDT - ISO 17640:"B", ISO 11666:"2" Valuation group B 2
Tolerance setting ISO 8015
E KN 912235.11
No. of marks
Surface EN ISO 1302
Scale 1:20
Weight kg
Hatch No. E353004-CM001-230-272-4007-0001
list of Material
Material WB
Date Name Dep.
Drawn
Checked
Static
Approved

Index	Revision	Date	Name	Checked
03	STATUS	21.07.17	ZITTM	KILIANJ
02	Hatch No.	17.07.17	ZITTM	KILIANJ
01		27.06.17	ZITTM	KILIANJ

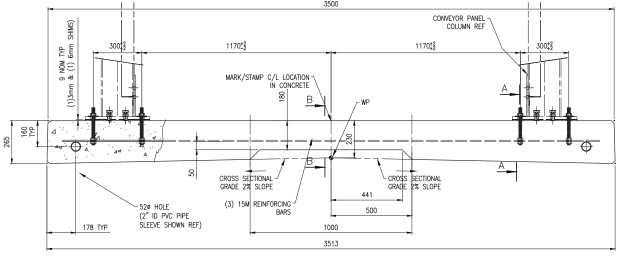
TRACK INSTALLATION

PRELIMINARY

12848 BAFFINLAND

thyssenkrupp

Drawing-Ident No. 4934437
CH.
Key-No.
F 1
Sheet 1
CAD
Sheets
Origine
Used instead of:
Replaced by:



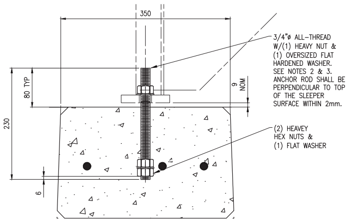
ELEVATION – SLEEPER

2% SLOPE BOTH SIDES
1:12
(QTY REQUIRED 532)

REFERENCE DRAWING	
DRAWING NO.	TITLE
BCSY-A-500	STOCKPILE #2 YARD CONVEYOR 4122-CV-001 – GENERAL ARRGN'T SHT 1
BCSY-S-520	STOCKPILE #2 YARD CONVEYOR 4122-CV-001 – CONVEYOR TABLE
	STANDARD YARD CONVEYOR TABLE – STRUCTURAL ARRGN'T
BCSY-S-520	STOCKPILE #2 YARD CONVEYOR 4122-CV-001 – CONVEYOR TABLE
	STANDARD YARD CONVEYOR TABLE – DETAILS

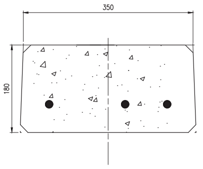
NOTES:

1. REINFORCING STEEL AND ANCHORING BARS SHALL BE DEFORMED BARS CONFORMING TO CAN/CSA G30.18 BILLET STEEL BARS, GRADE 400 HOT DIPPED GALVANIZED TO ASTM A767.
2. ANCHOR RODS SHALL BE ASTM A302 L7, HOT DIPPED GALVANIZED.
3. HARDENED WASHERS SHALL BE ACCORDING TO ASTM F436 & HEAVY HEX NUTS SHALL BE ACCORDING TO ASTM A563. ALL SHALL BE HOT DIPPED GALVANIZED.
4. MINIMUM CONCRETE COVER SHALL BE 50mm.
5. MINIMUM CONCRETE STRENGTH, 30 MPa AT 28 DAYS.
6. PROVIDE 15mm CHAMFER FOR ALL EDGES.
7. SLEEPERS SHALL BE MANUFACTURED IN ACCORDANCE WITH CSA A 23.4. A CLASS OF EXPOSURE OF F-2 SHALL BE IMPLEMENTED IN DETAILING AND FABRICATION.
8. DO NOT COMMENCE FABRICATION BEFORE SHOP DRAWINGS ARE REVIEWED AND RELEASED FOR CONSTRUCTION.
9. FABRICATOR TO SUPPLY THE SLEEPER W/ THE TOP NUTS & WASHERS NOT INSTALLED. THOSE SHALL BE SUPPLIED IN SEPARATE PALLETS.
10. ALL ANCHOR RODS SHALL BE ALIGNED ALONG THE SLEEPER CENTRE LINE WITHIN 2mm.
11. SLEEPER DETAILS ARE BASED ON CROSS SECTIONAL GRADE SLOPE SURFACE OF 2% EACH SIDE OF CONVEYOR CENTER.
12. ALL DIMENSIONS ARE IN MILLIMETERS.
13. DESIGN IS BASED ON A FACTORED BEARING RESISTANCE OF 200 kPa.



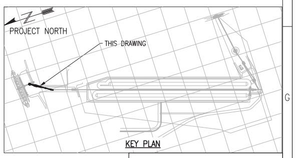
SECTION: A–A

ANCHOR ROD
1:4



SECTION: B–B

1:4



KEY PLAN

CLIENT DRAWING NUMBER:
E353004-CM001-230-260-0062

tkIS (Canada) Inc.

Tolerances for machined surfaces ISO 2768 part 1/2 Tolerance classification m/K
Tolerances for welded constructions ISO 13920 Tolerance classification B/F
Surface ISO 1302
Scale
Weight 605 kg
Bill of Material
Material

	Date (YY-MM-DD)	Name
Drawn	17-09-06	DCM
Checked	17-09-12	
Designed	17-09-06	N. RIZKALLA
Approved	17-09-13	N. RIZKALLA

BAFFINLAND IRON MINES – MARY RIVER EXPANSION PROJECT
STOCKPILE #2 YARD CONVEYOR 4211-CV-001
SLEEPER DETAILS

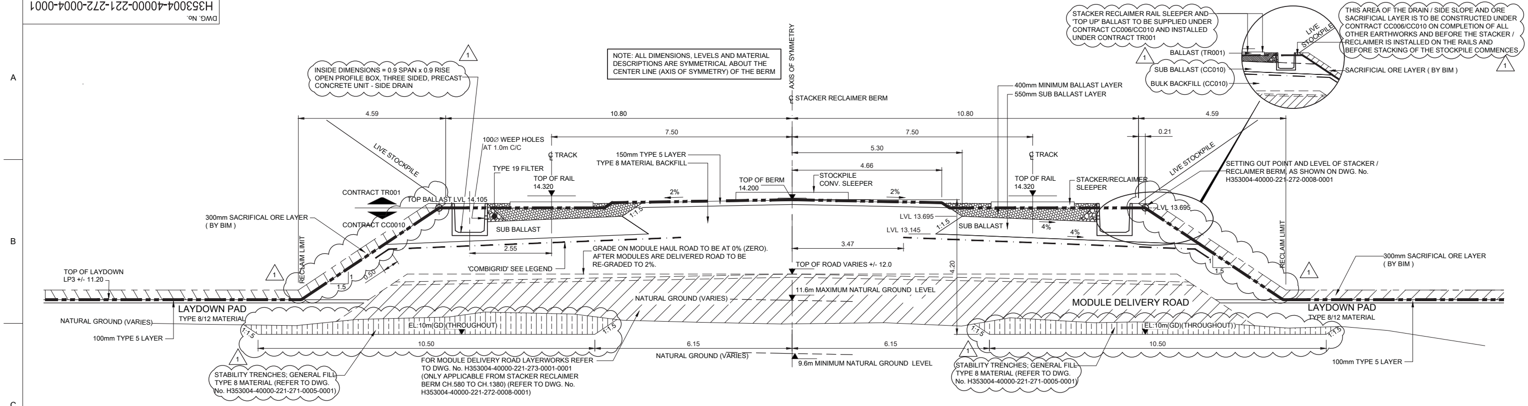
Index	Revision	Date (YY-MM-DD)	Name	Checked
B	ISSUED FOR QUOTATION	17-11-27	DCM	NR
A	ISSUED FOR QUOTATION	17-09-13	DCM	NR

thyssenkrupp

Drawing-Ident No. BSCY-S-560
CH.
Key-No.
Size A1
Sheet
Sheets
CAD
Origin:
Supercedes:
Superceded by:

PLOT DATE: 27 November 2017 FILE: G:\BAF\BCSY\DRAWINGS\TEMPORARY ARCHIVE\BCSY-S-560_B.DWG

DWG. No. H353004-40000-221-272-0004-0001



BALLAST AND SUB BALLAST MATERIALS SPECIFICATION:

CRUSHED GRAVEL BALLAST:

GRADATIONS TO BE WITHIN LIMITS SPECIFIED, APPROVAL TO BE PROVIDED BY GEOTECHNICAL ENGINEER FOR ALL GRADATIONS.

SIEVE SIZE	PERCENT PASSING
45.3mm (1 - 3/4")	100
32.0mm (1 - 1/4")	70 - 95
25.4mm (1")	50 - 80
19.0mm (3/4")	30 - 60
12.7mm (1/2")	10 - 30
4.75mm (No. 4)	0 - 3
75 micron (No. 200)	0 - 1

PERCENTAGE OF CRUSHED PARTICLES IN SIZE RANGE SHALL NOT BE LESS THAN 70% BY WEIGHT OF ALL PARTICLES IN THAT SIZE RANGE. PARTICLES HAVING ONE OR MORE FRACTURED FACES WILL BE USED IN CALCULATING THIS PERCENTAGE.

MATERIAL IN SAMPLE FINER THAN No. 4 (4.76 MICRON) SIEVE WILL NOT BE CONSIDERED IN DETERMINING THE PERCENTAGE OF FRACTURED FACES.

GRADING OF CRUSHED GRAVEL BALLAST SHALL BE DETERMINED BY ASTM C316, LATEST EDITION.

AMOUNT OF MATERIAL FINER THAN No. 200 (74 MICRON) SHALL BE DETERMINED BY ASTM C117, LATEST EDITION.

SUB BALLAST:

COMPACT TO 98% OF STANDARD PROCTOR MAXIMUM DENSITY.

MATERIAL TO BE CRUSHED OR SCREENED PIT RUN GRAVEL, CONTAINING NO MORE THAN THREE PERCENT (3%) ORGANICS BY WEIGHT AS DETERMINED BY ASTM C123.

MATERIAL GREATER THAN 5mm TO CONTAIN A MINIMUM OF FIFTY PERCENT (50%) BY WEIGHT FRACTURED MATERIAL [TWO (2) FRACTURED FACES]

SIEVE SIZE	PERCENT PASSING
75mm (3")	100
25mm (1")	60 - 90
4.75mm (No. 4)	35 - 60
425 micron (No. 40)	10 - 40
75 micron (No. 200)	0 - 5

NOTES ON OPERATION OF STACKING AND RECLAIMING:

THE FOLLOWING IS RECOMMENDED TO BE CONSIDERED FOR THE OPERATION OF STACKING AND RECLAIMING:

- INSPECT THE BERM EVERY SEASON DURING EVERY THAW, PARTICULARLY IN THE FIRST TWO SEASONS, FOR SETTLEMENT AND SIDE SLOPE SLUMPING.
- MAINTAIN SYMMETRY OF THE TWO LUMP ORE STOCKPILES TO THE BERM DURING OPERATION, TO MINIMIZE THE POTENTIAL DIFFERENTIAL SETTLEMENT IN THE CROSS SECTIONAL PLANE.
- TOP OF STABILITY LAYER TO BE CLEANED BEFORE FRESHET AND RAINY SEASON, ANY PONDING WATER ON THE BERM TO BE PUMPED OUT.
- SNOW TO BE REMOVED TO AVOID ACCUMULATION.
- SIDE DRAIN TO BE KEPT CLEAN OF IRON ORE AND OTHER DEBRIS, PARTICULARLY BEFORE FRESHET AND RAINY SEASON.

NOTES ON BERM STABILITY TRENCH:

1

- OVER EXCAVATION TO BE AT ELEVATION OF 10m GD AND BACKFILLED WITH TYPE 8 MATERIAL PRIOR TO CONSTRUCTION OF LP3 LAYDOWN AREA.

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.

NOTES ON LAYERWORKS:

1. THE PROPERTIES OF ALL FILL MATERIALS TO SATISFY THE REQUIREMENTS IN THE HATCH SPECIFICATION H353004-00000-280-078-0002 UNLESS OTHERWISE NOTED.
2. ALL MATERIALS TO BE PLACED AND COMPACTED IN STRICT ACCORDANCE WITH HATCH SPECIFICATION H353004-00000-221-078-0001 AND THE GEOTECHNICAL RECOMMENDATIONS IN DOCUMENT H353004-00000-229-230-0004,
3. EXISTING GROUND BENEATH THE BERM TO BE SHAPED TO ENSURE A MINIMUM DEPTH OF 2.88m OF ROCKFILL IS ACHIEVED PLUS 1.5m OF STABILITY TRENCH AS INDICATED ON THE SECTION. △1
4. SUB BALLAST LAYER = 0.55m,
5. BALLAST LAYER = 0.40m MINIMUM,
6. ROADWAY = MINIMUM 0.40m .

CONSTRUCTION SEQUENCE:

1. FOUNDATION PREPARATION TO BE DONE IN ACCORDANCE WITH HATCH SPECIFICATIONS H353004-00000-221-028-0001 AND H353004-00000-280-078-0002,
2. CONSTRUCT STABILITY TRENCHES, △1
3. CONSTRUCT MODULE ROAD WITH TYPE 8 AND TYPE 5 MATERIAL,
4. CONSTRUCT LAYDOWN PADS,
5. PLACE AND COMPACT TYPE 8 FILL UP TO BOTTOM OF SUB BALLAST LEVEL, 4% CROSS SLOPE,
6. INSTALL 'COMBIGRID' TYPE 40/40 Q1 151 GRK3 OR SIMILAR APPROVED BELOW SUB BALLAST,
7. PLACE AND COMPACT SUB BALLAST,
8. PLACE AND COMPACT 0.55m INFILL BETWEEN SUB BALLAST LAYERS AT BERM CENTRE,
9. PLACE BALLAST,
10. PLACE AND COMPACT BERM MATERIAL IN CENTRE TO LEVEL 13.65 AT CENTRELINE,
11. INSTALL RAIL TIES,
12. ADD FINAL BALLAST,
13. COMPLETE TOP OF BERM, 2% CROSS SLOPE.

LEGEND:

— · — · — - 'COMBIGRID' TYPE 40/40 Q1 151 GRK3 OR SIMILAR APPROVED

CONTRACT TR001

CONTRACT CC006/CC010 - BATTERY LIMIT

△1 GD - GEODETIC DATUM

PERMIT TO PRACTICE
HATCH LTD.
Signature ______
Date ______
PERMIT NUMBER: P 512
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

DRAWING No.	DRAWING TITLE
H353004-40000-221-271-0005-0001	LAYDOWN AREA LP3 - PLAN AND PROFILES
H353004-00000-280-078-0002	QUARRIED FILL MATERIALS REQUIREMENTS
H353004-00000-221-078-0001	PLACEMENT OF FILL
H353004-40000-221-272-0008-0001	STOCKPILE 2 STACKER RECLAIMER BERM - SECTIONS
4500001466-B07-0001-001	KRUPP / KLOHN CRIPPEN BERGER - BALLAST AND SUB BALLAST DETAILS
H353004-00000-229-230-0004	GEOTECHNICAL RECOMMENDATIONS FOR STACKER RECLAIMER BERM
H353004-40000-223-271-0007-0004	MODULE DELIVERY ROAD - PLAN AND PROFILE SHEET 4 OF 4
H353004-40000-223-271-0007-0003	MODULE DELIVERY ROAD - PLAN AND PROFILE SHEET 3 OF 4
H353004-40000-223-271-0007-0002	MODULE DELIVERY ROAD - PLAN AND PROFILE SHEET 2 OF 4
H353004-40000-223-271-0007-0001	MODULE DELIVERY ROAD - PLAN AND PROFILE SHEET 1 OF 4
H353004-40000-221-273-0001-0001	MODULE, PRIMARY AND SECONDARY ROADS - TYPICAL CROSS SECTIONS

REFERENCE DRAWINGS

REG. PROFESSIONAL

FOR CONSTRUCTION

No.	DESCRIPTION	BY	CHK'D	DATE
1	STABILITY TRENCH ADDED AND GEOMETRY UPDATED	JM	FH	13/02/2019
0	APPROVED FOR CONSTRUCTION	IHB	FH	28/06/2018

REVISIONS

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	I BARNARD	NR	07/06/2018
DESIGNER	I BARNARD	NR	07/06/2018
CHECKER	F HUGO		
DESIGN COORD.	R GOOSEN		
RESP. ENG.	R HALIM		
LEAD DISC. ENG.	A GROBBELAAR		
AREA LEAD	V LAVRIC		
ENG. MANAGER	R GOOSEN		
AREA MANAGER	T ATIBA		

DRAWING APPROVAL STATUS: Approved for Construction

BAFFINLAND IRON MINES LP
MARY RIVER EXPANSION PROJECT

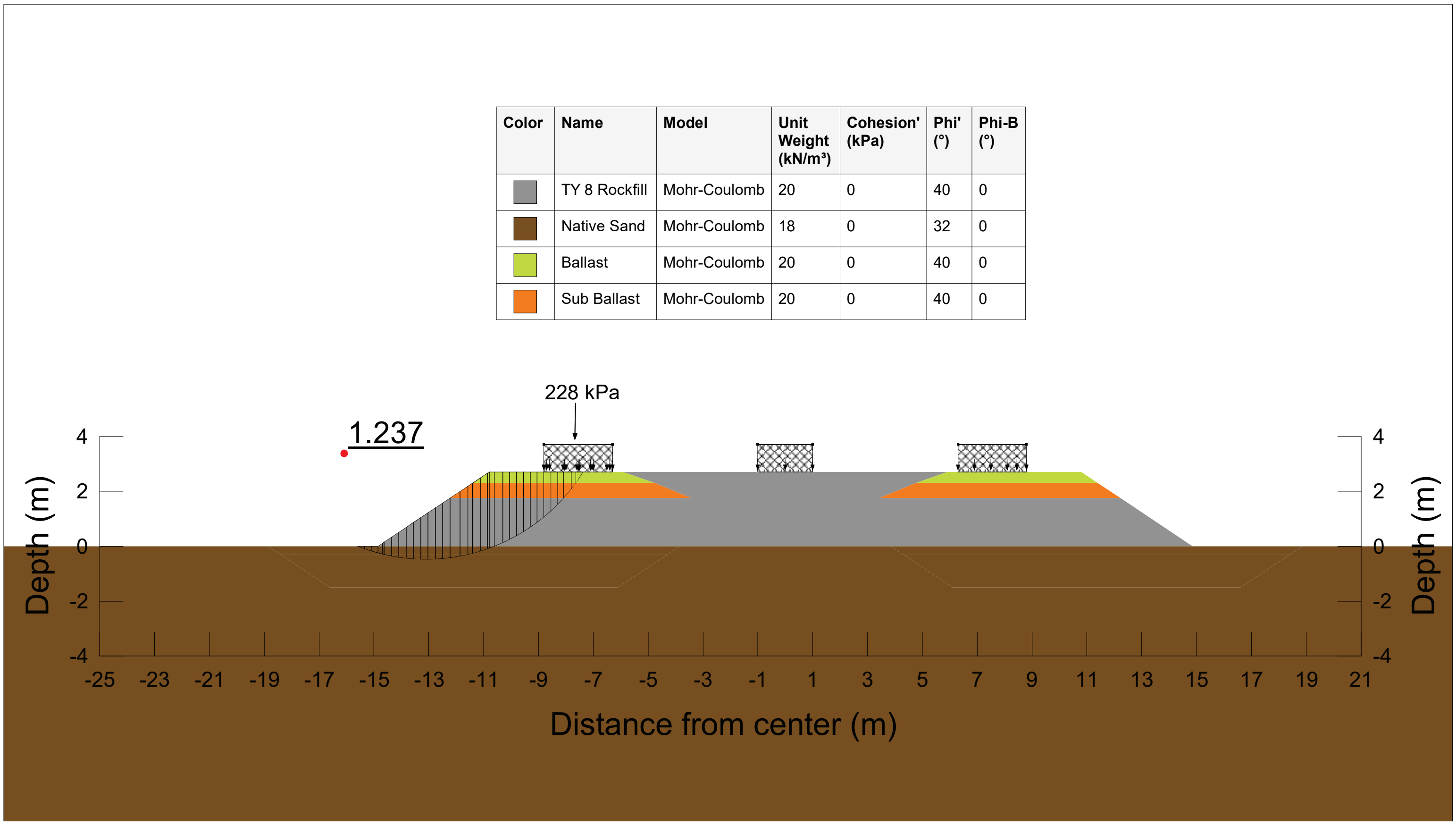
PORT SITE
STACKER RECLAIMER BERM
TYPICAL SECTION

SCALE	DWG. No.	REV
NTS OR AS NOTED	H353004-40000-221-272-0004-0001	1

SHEET SIZE: D

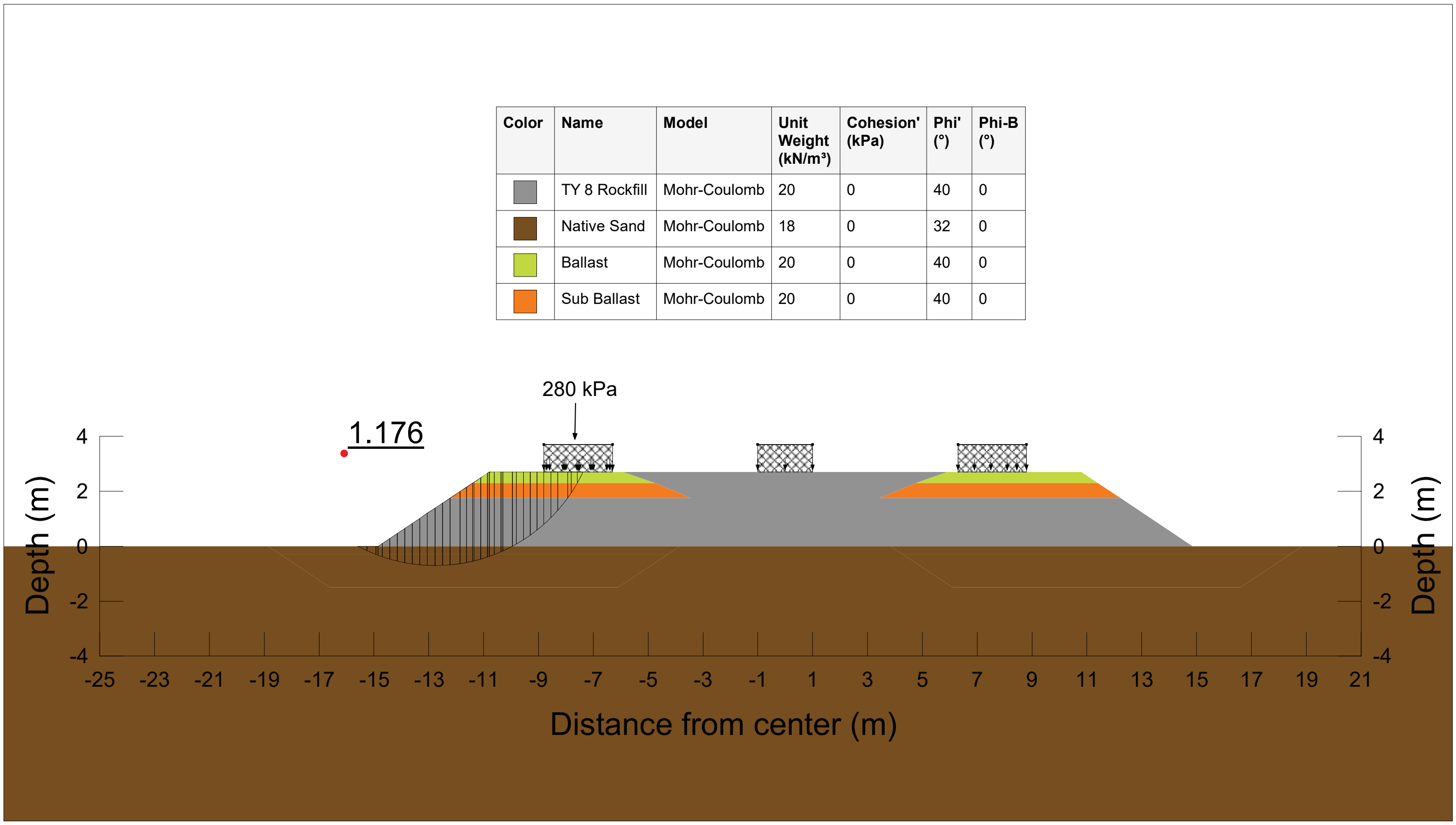
$USERNAME$ $DATE$ $FILE$ $TIME$

Appendix C
Stability Analyses Results



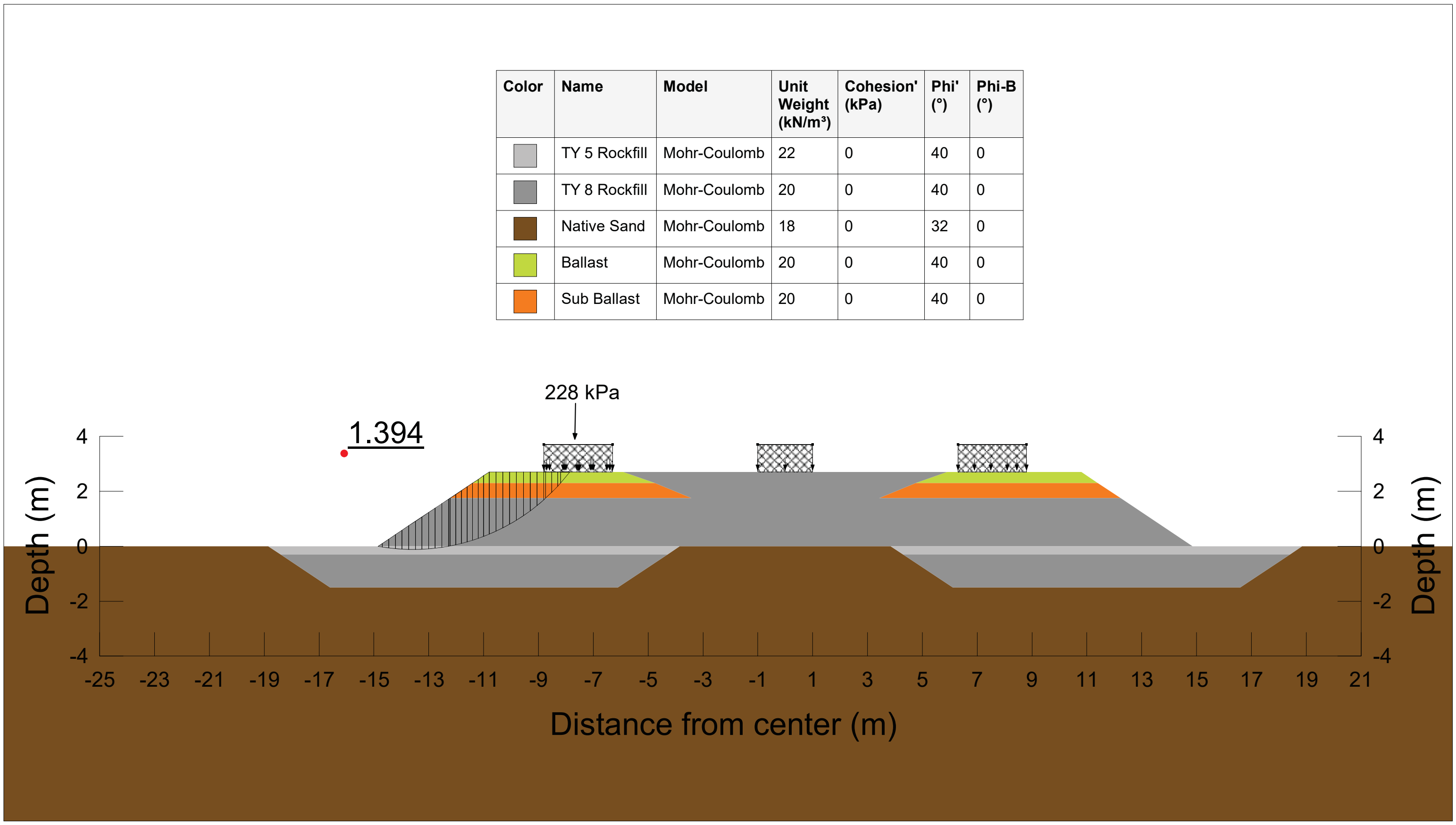
Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)
⬛	TY 8 Rockfill	Mohr-Coulomb	20	0	40	0
🟫	Native Sand	Mohr-Coulomb	18	0	32	0
🟩	Ballast	Mohr-Coulomb	20	0	40	0
🟧	Sub Ballast	Mohr-Coulomb	20	0	40	0

Figure C1B - Long-term Operating Case (Original Berm Configuration)



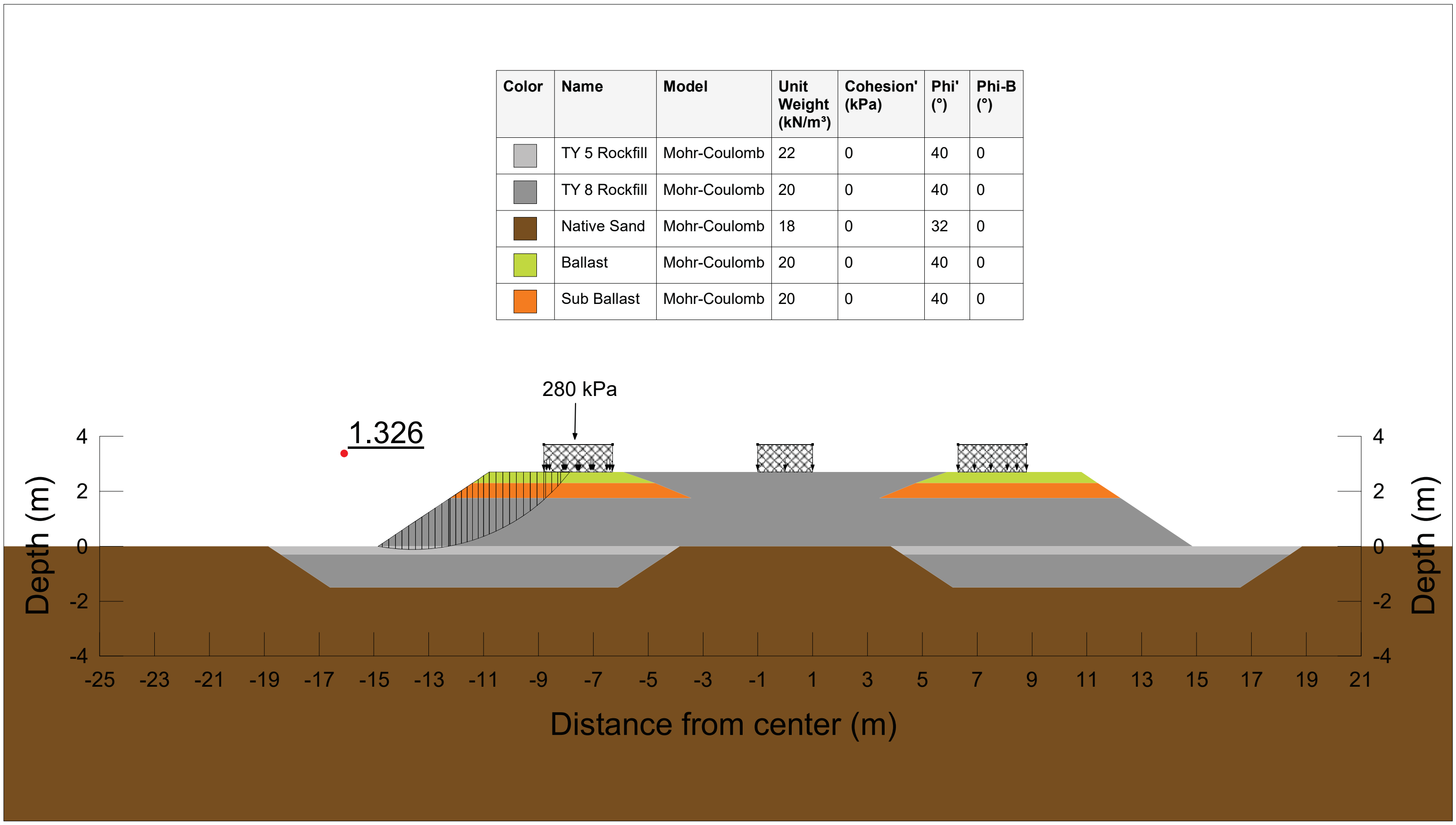
Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)
⬛	TY 8 Rockfill	Mohr-Coulomb	20	0	40	0
🟫	Native Sand	Mohr-Coulomb	18	0	32	0
🟩	Ballast	Mohr-Coulomb	20	0	40	0
🟧	Sub Ballast	Mohr-Coulomb	20	0	40	0

Figure C2B - Short-term Maintenance Case (Original Berm Configuration)



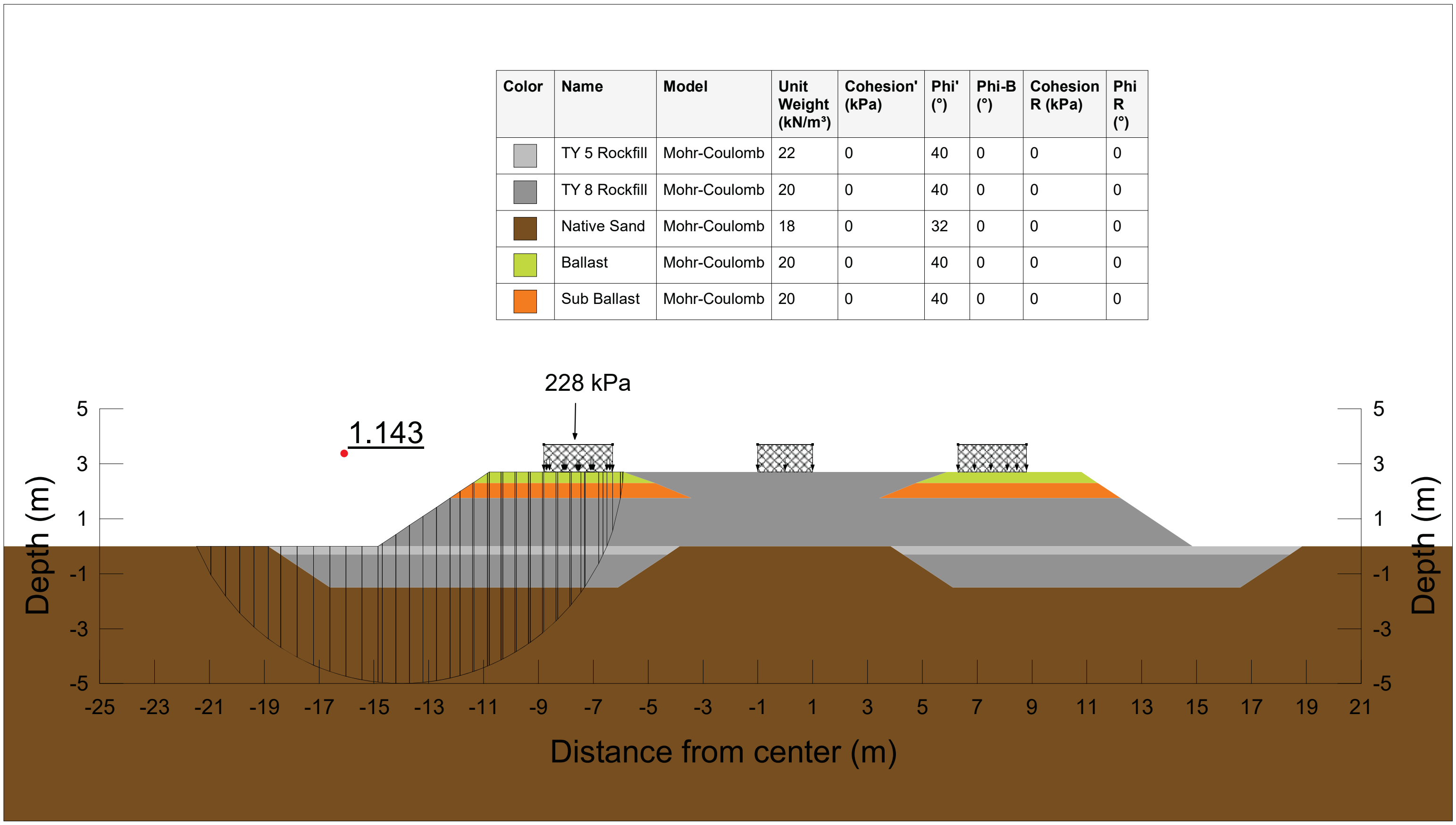
Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)
⬜	TY 5 Rockfill	Mohr-Coulomb	22	0	40	0
⬛	TY 8 Rockfill	Mohr-Coulomb	20	0	40	0
🟫	Native Sand	Mohr-Coulomb	18	0	32	0
🟩	Ballast	Mohr-Coulomb	20	0	40	0
🟧	Sub Ballast	Mohr-Coulomb	20	0	40	0

Figure C3 - Long-term Operation Case (with Rockfill Trench)



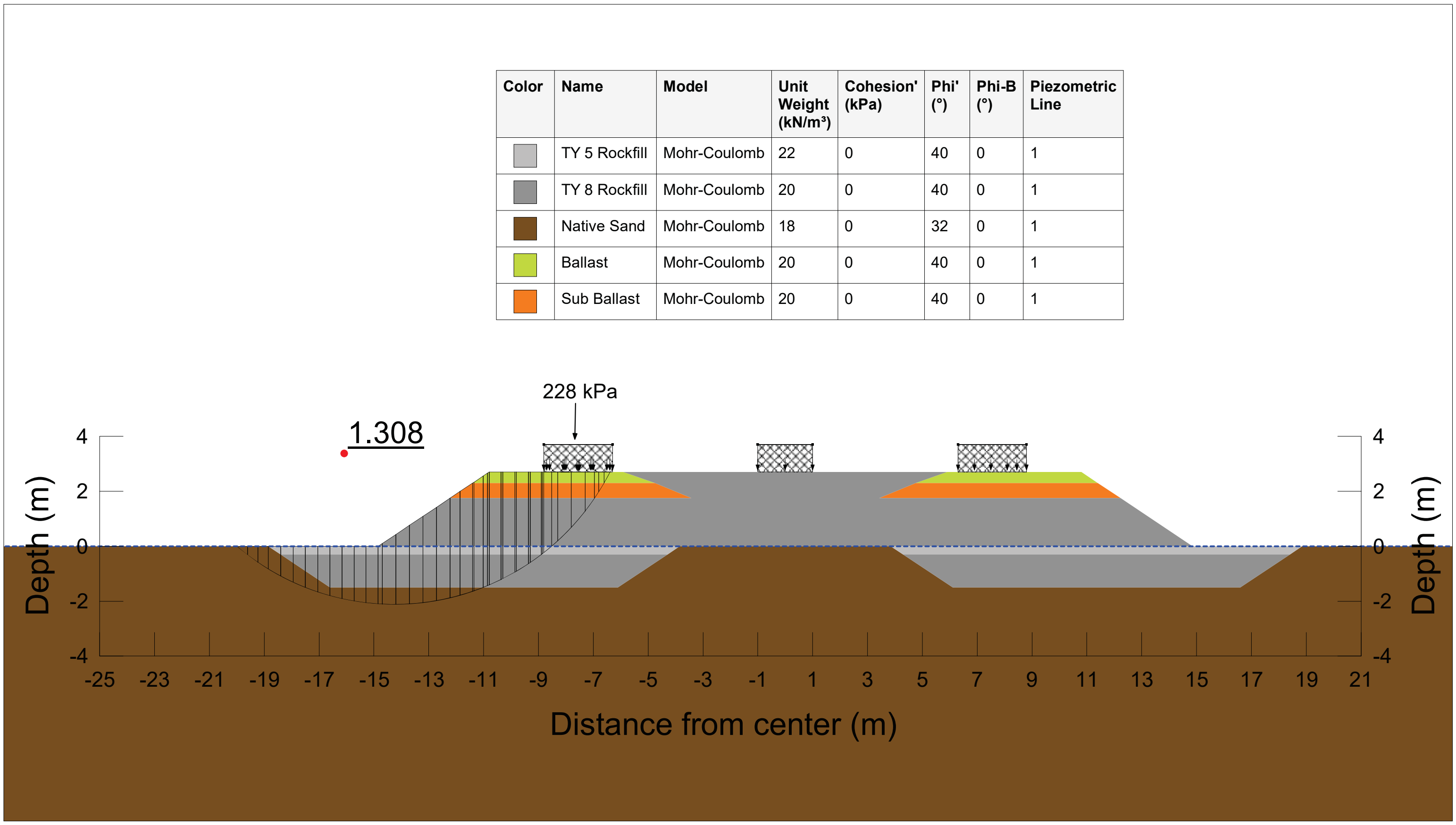
Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)
⬜	TY 5 Rockfill	Mohr-Coulomb	22	0	40	0
⬛	TY 8 Rockfill	Mohr-Coulomb	20	0	40	0
🟫	Native Sand	Mohr-Coulomb	18	0	32	0
🟩	Ballast	Mohr-Coulomb	20	0	40	0
🟧	Sub Ballast	Mohr-Coulomb	20	0	40	0

Figure C4 - Short-Term Maintenance Case (with Rockfill Trench)



Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)	Cohesion R (kPa)	Phi R (°)
░	TY 5 Rockfill	Mohr-Coulomb	22	0	40	0	0	0
▓	TY 8 Rockfill	Mohr-Coulomb	20	0	40	0	0	0
🟫	Native Sand	Mohr-Coulomb	18	0	32	0	0	0
🟩	Ballast	Mohr-Coulomb	20	0	40	0	0	0
🟧	Sub Ballast	Mohr-Coulomb	20	0	40	0	0	0

Figure C5 - Pseudo-static Condition (with Rockfill Trench)



Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)	Piezometric Line
⬜	TY 5 Rockfill	Mohr-Coulomb	22	0	40	0	1
⬛	TY 8 Rockfill	Mohr-Coulomb	20	0	40	0	1
🟫	Native Sand	Mohr-Coulomb	18	0	32	0	1
🟩	Ballast	Mohr-Coulomb	20	0	40	0	1
🟧	Sub Ballast	Mohr-Coulomb	20	0	40	0	1

Figure C6 - High Groundwater Case (with Rockfill Trench)

Appendix D
Thermal Analyses Results

Color	Name	Model	Unfrozen Thermal Conductivity (J/sec/m/°C)	Frozen Thermal Conductivity (J/sec/m/°C)	Unfrozen Volumetric Heat Capacity (J/m³/°C)	Frozen Volumetric Heat Capacity (J/m³/°C)	Vol W/C (m³/m³)	Initial Temperature (°C)
🟨	Sand	Simplified Thermal	2	3	2,600,000	2,600,000	0.255	
⬜	Rockfill	Simplified Thermal	3	4.5	3,000,000	2,400,000	0.036	0

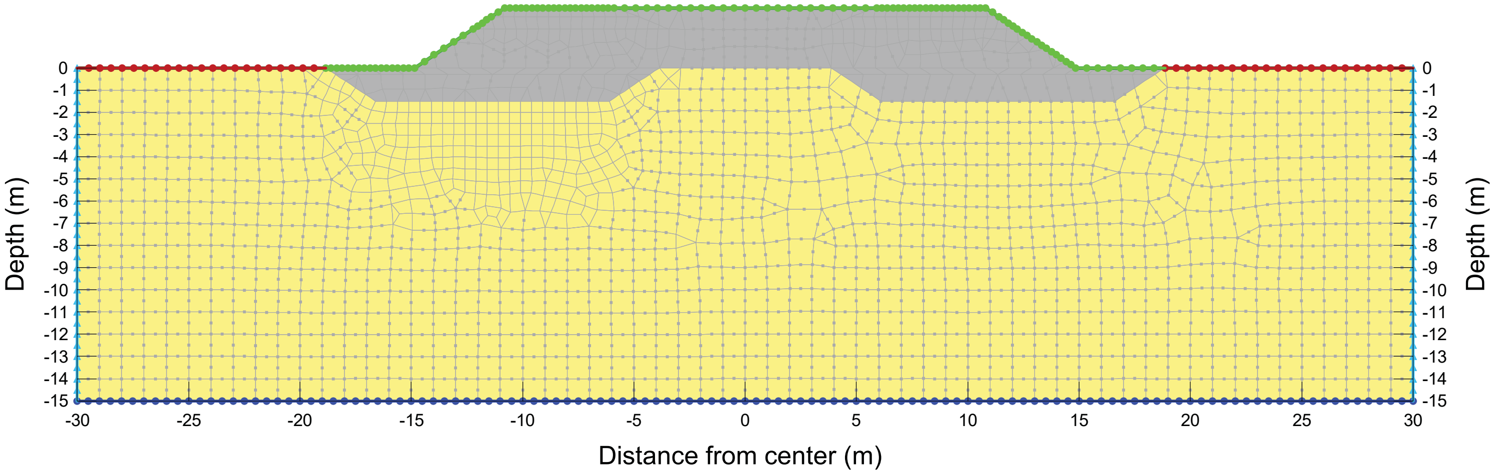


Figure D1 - Thermal Model Geometry

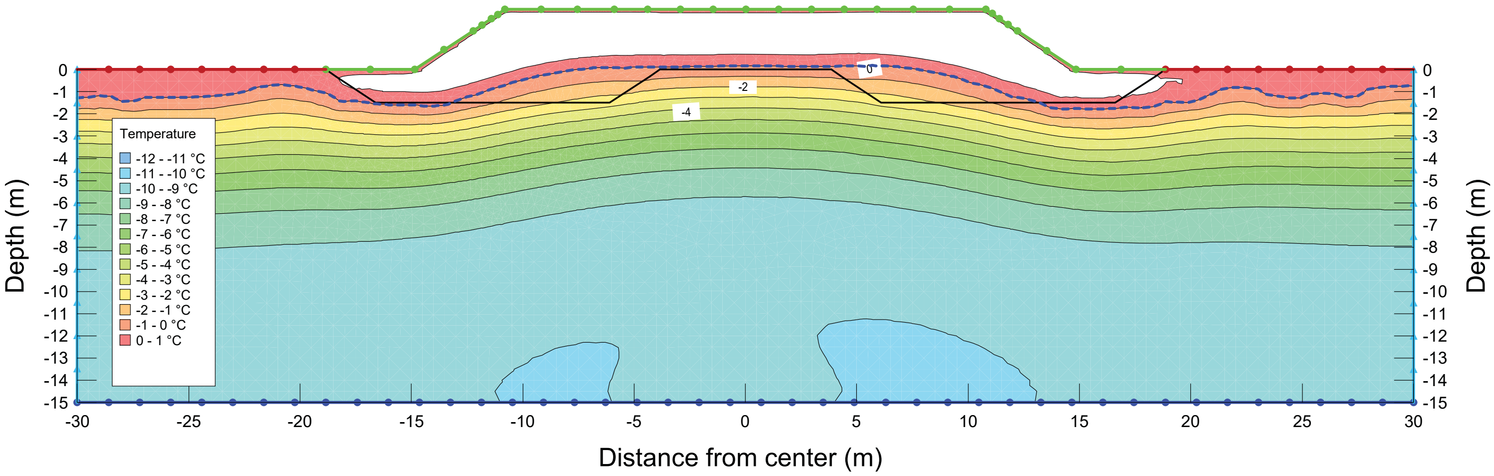


Figure D2 - Summer Temperature Contours (2 years after construction)

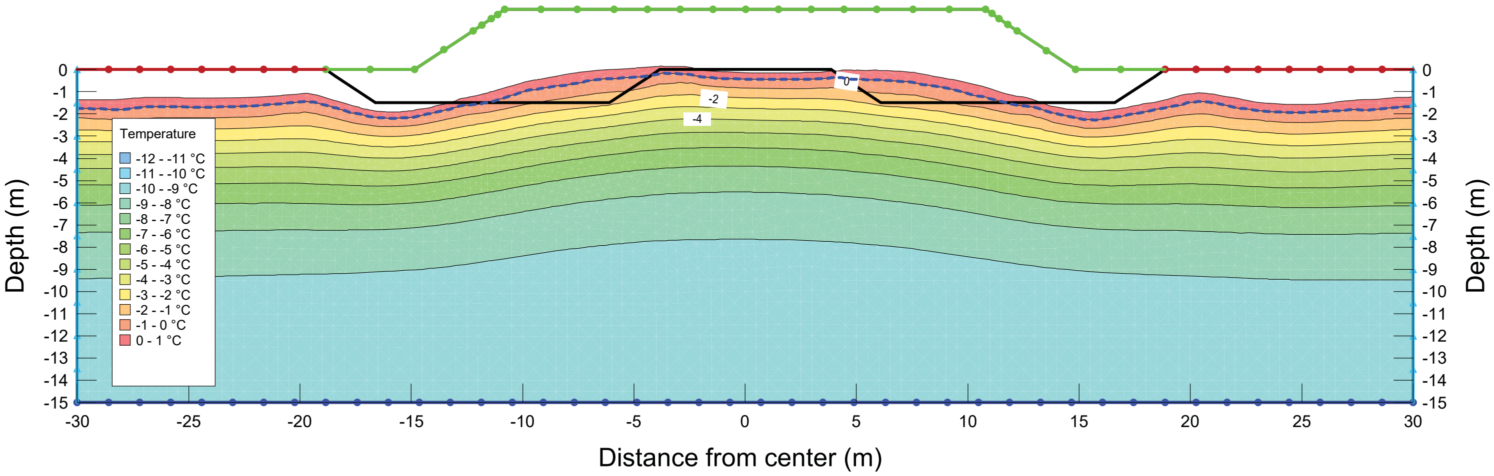
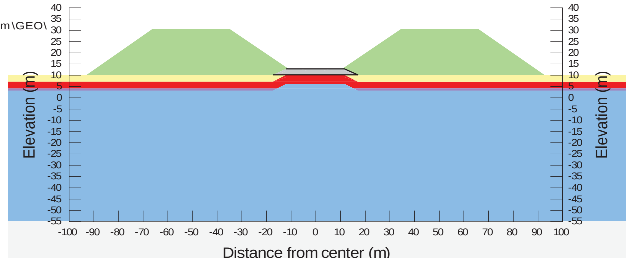


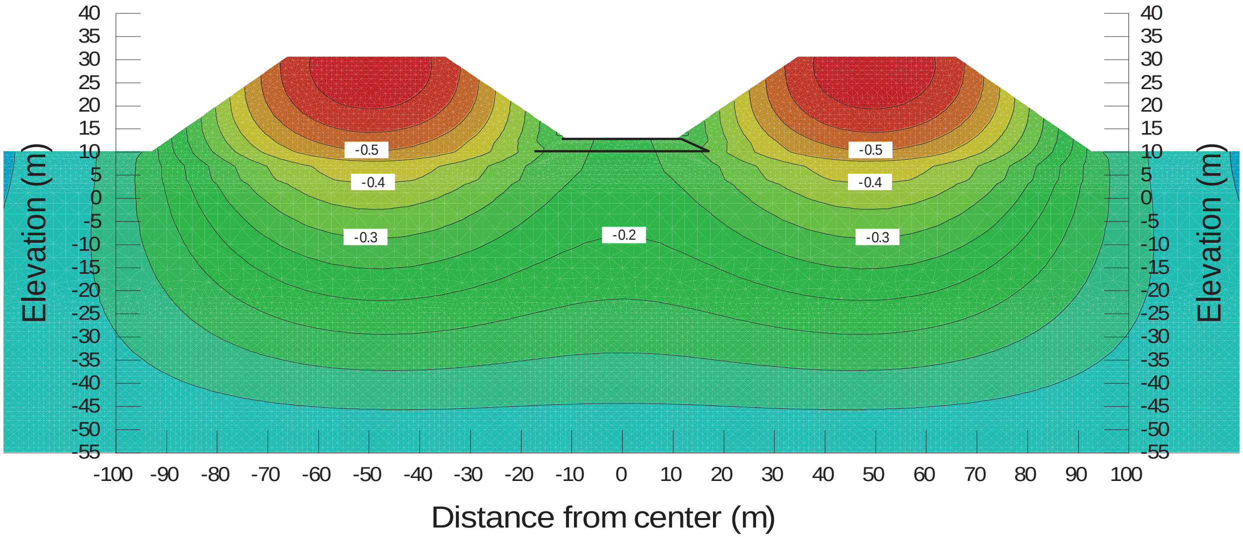
Figure D3 - Summer Temperature Contours (19 years after construction)

Appendix E
Settlement Analyses Results

File Name: Stacker-Settlement Analysis-Updated Geometry V2.gsz
Name: Berm, Lump Stockpile and Surcharge Loads - A1
Date: 3/8/2018
Directory: P:\REDLEAF\335458\SPECIALIST_APPS\02 Marry River\07 Reclaimer Berm\GEO\



Color	Name
🟩	Pre-Crushed Ore
⬜	Rockfill (Rusher-run)
🟨	Native Sand
🟥	Upper Frozen Sand (E=80 mPa)
🟦	Lower Frozen Silt (E=44 mPa)
🟪	Upper Frozen Silt (E=22 mPa)



Job number	353004		
Ref	Reclaimer Berm		
By	Lk	0	14-Mar-18
Revision		A	14-Mar-18

Mary River Expansion Project

Case A1 - Settlement Contours

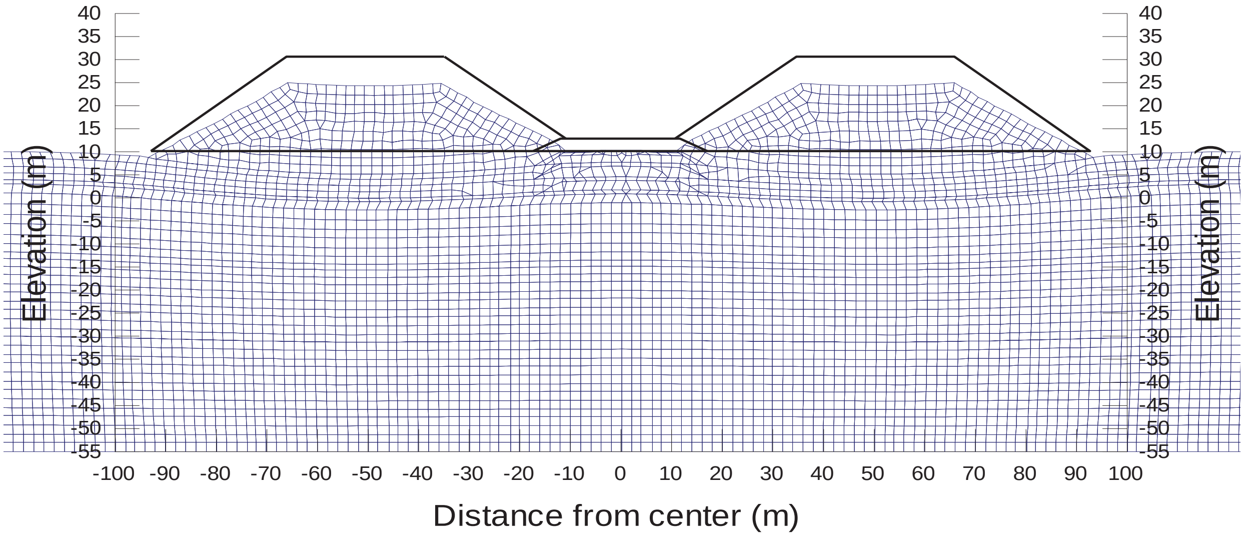
HATCH

BIM

Milne Inlet Port

FIGURE E1-1A

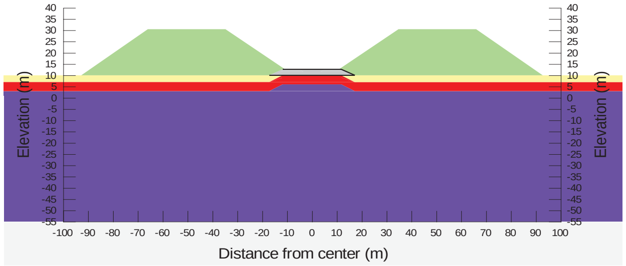
File Name: Stacker-Settlement Analysis-Updated Geometry V2.gsz
Name: Berm, Lump Stockpile and Surcharge Loads - A1
Date: 3/8/2018
Directory: P:\REDLEAF\335458\SPECIALIST_APPS\02 Marry River\07 Reclaimer Berm\GEO\



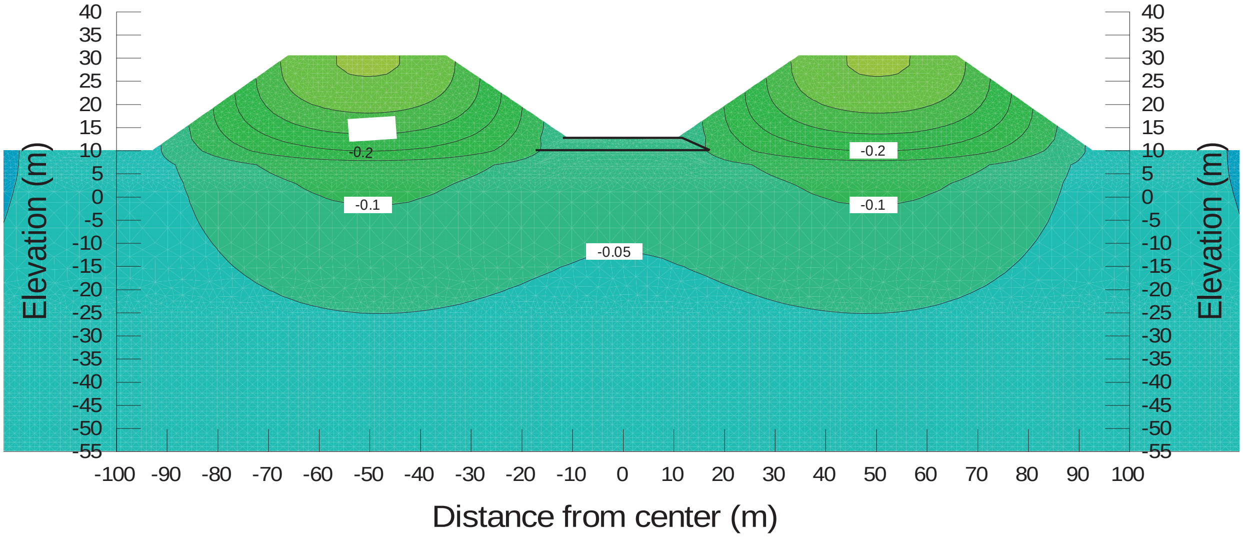
Note: Magnification factor of 10 applied to the deformed mesh

Job number	353004			**Mary River Expansion Project**	HATCH	**BIM**
Ref	Reclaimer Berm			**Case A1 - Deformed Mesh**		**Milne Inlet Port**
By	Lk	0	14-Mar-18			
Revision		A	14-Mar-18			**FIGURE E1-1B**

File Name: Stacker-Settlement Analysis-Updated Geometry V2.gsz
Name: Berm, Lump Stockpile and Surcharge Loads - A2
Date: 3/8/2018
Directory: P:\REDLEAF\335458\SPECIALIST_APPS\02 Marry River\07 Reclaimer Berm\GEO\

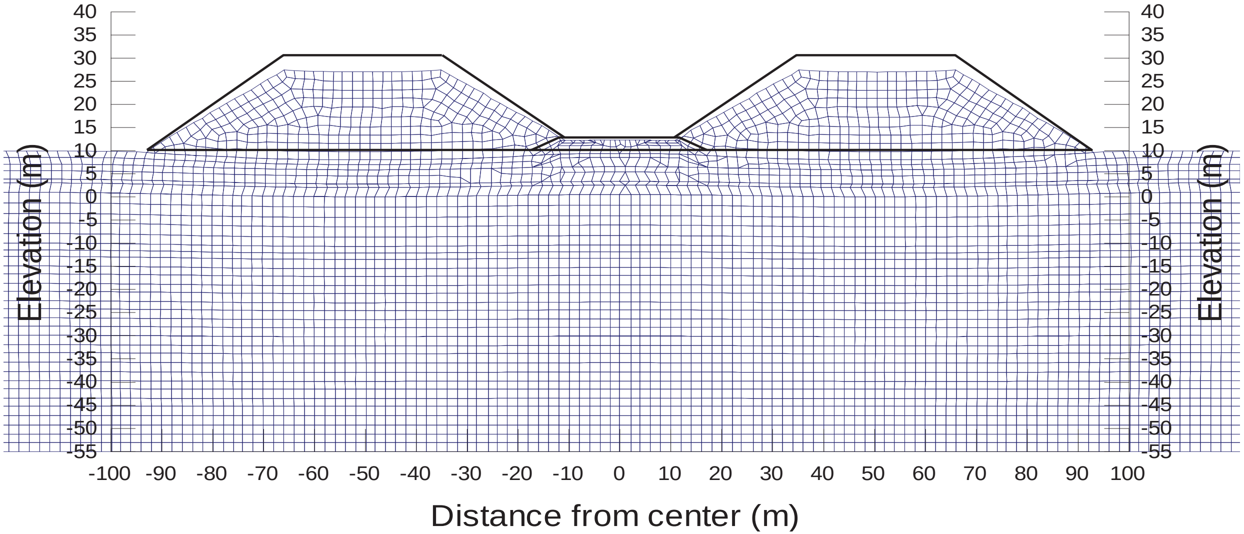


Color	Name
🟩	Pre-Crushed Ore
⬜	Rockfill (Rusher-run)
🟨	Native Sand
🟥	Upper Frozen Sand (E=80 mPa)
🟪	Lower Frozen Sand (E=160 mPa)



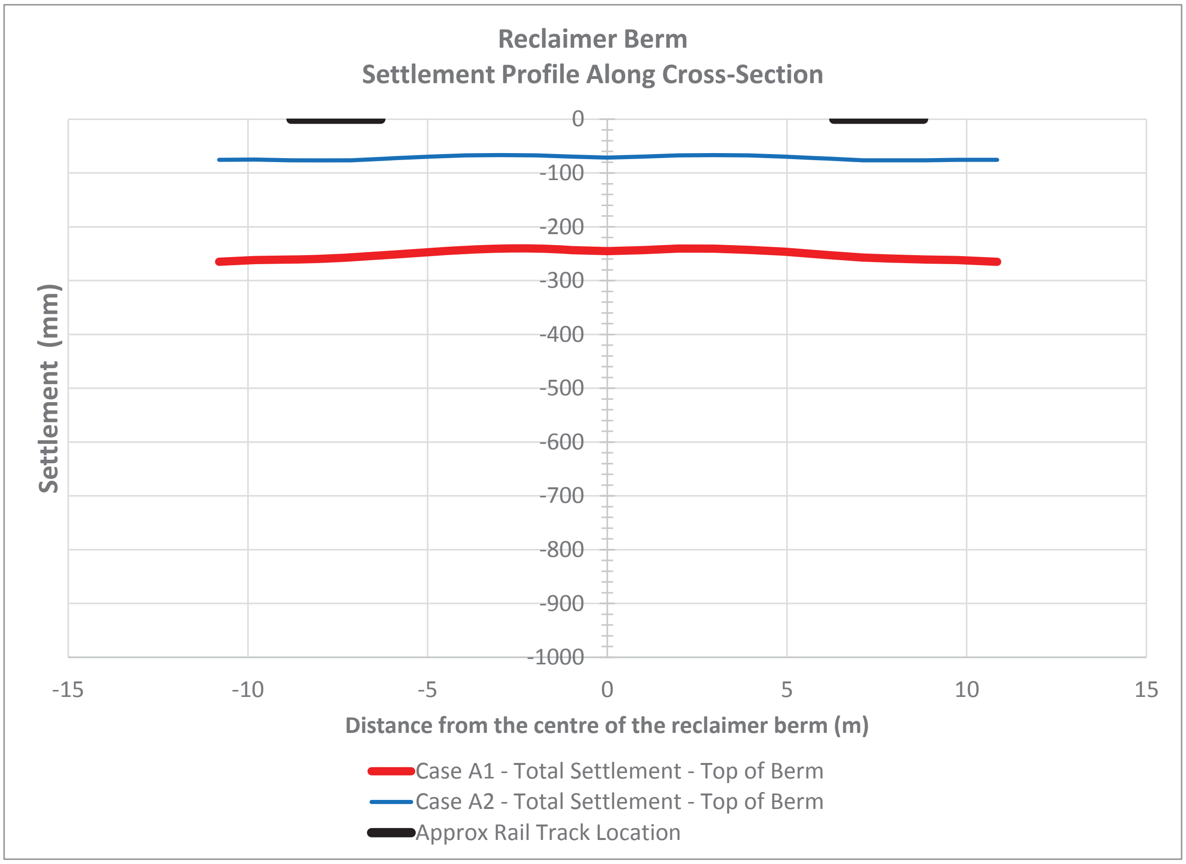
Job number	353004			**Mary River Expansion Project**		**BIM**
Ref	Reclaimer Berm			**Case A2 - Settlement Contours**	HATCH	**Milne Inlet Port**
By	Lk	0	14-Mar-18			
Revision		A	14-Mar-18			**FIGURE E1-2A**

File Name: Stacker-Settlement Analysis-Updated Geometry V2.gsz
Name: Berm, Lump Stockpile and Surcharge Loads - A2
Date: 3/8/2018
Directory: P:\REDLEAF\335458\SPECIALIST_APPS\02 Marry River\07 Reclaimer Berm\GEO\



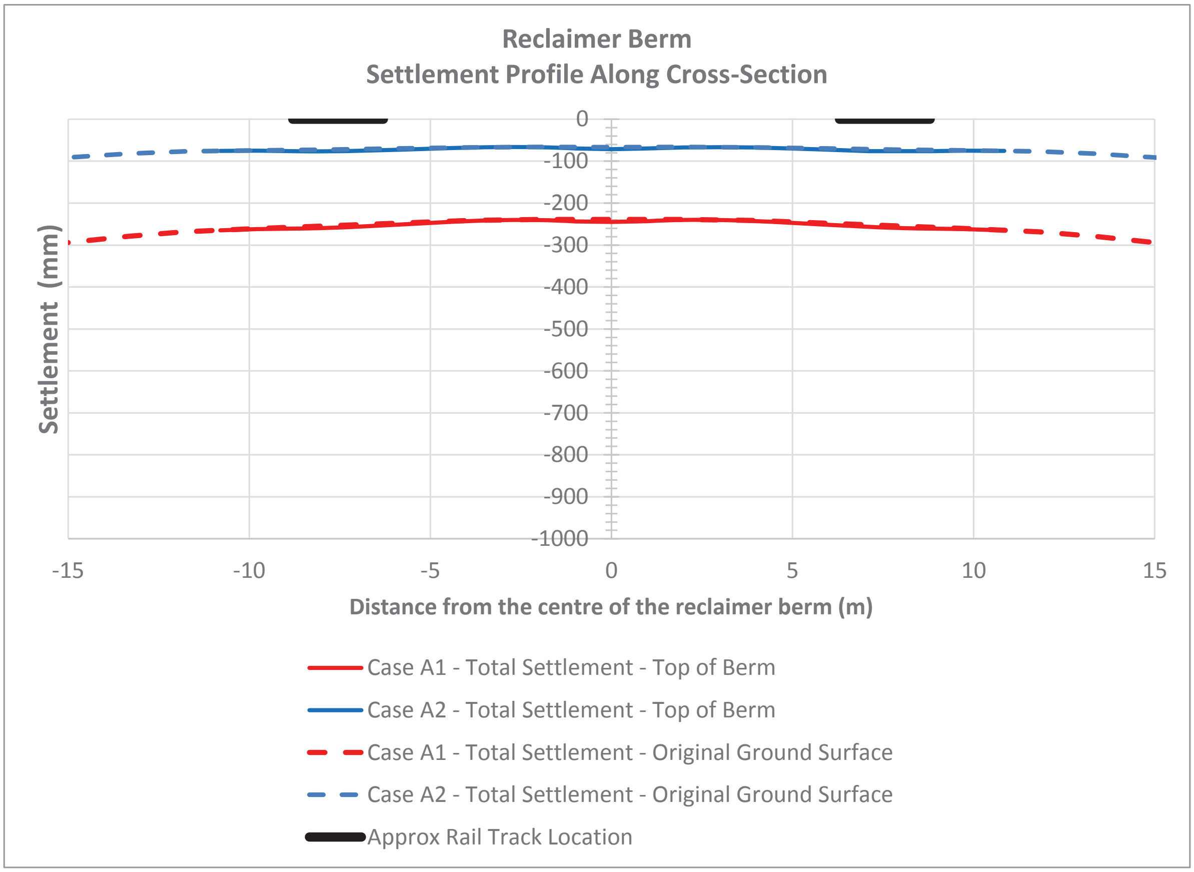
Note: Magnification factor of 10 applied to deformed mesh

Job number	353004			**Mary River Expansion Project**	HATCH	**BIM**
Ref	Reclaimer Berm			**Case A2 - Deformed Mesh**		**Milne Inlet Port**
By	Lk	0	14-Mar-18			
Revision		A	14-Mar-18			**FIGURE E1-2B**



Note: Case A1 and A2 have a model boundary depth of 60 m

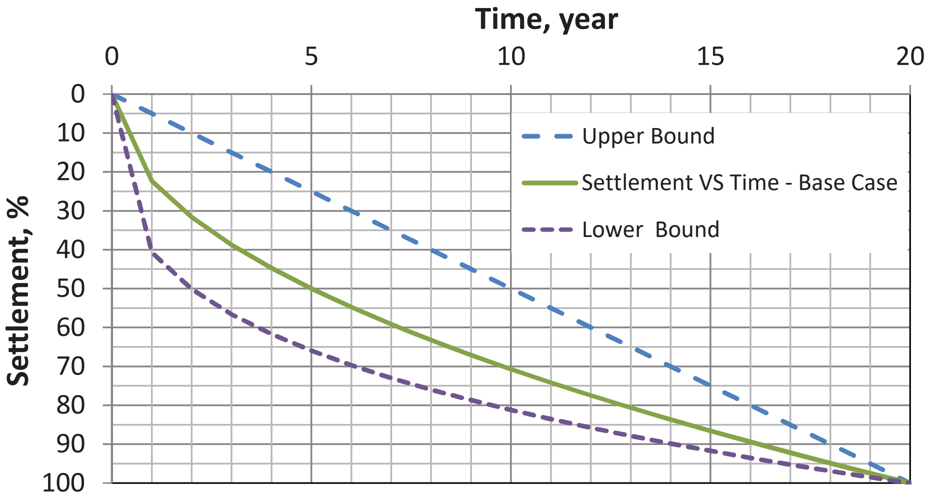
Job number		353004		**Mary River Expansion Project**	HATCH	**BIM**
Ref	Reclaimer Berm			**Total Settlement - Base Cases (Sections 1 and 2)**		**Milne Inlet Port**
By	Lk	0	14-Mar-18			
Revision		A	14-Mar-18			**FIGURE E2-1**



Reclaimer Berm
Settlement Profile Along Cross-Section

Note: Case A1 and A2 have a model boundary depth of 60 m

Job number	353004			**Mary River Expansion Project**	**BIM**
Ref	Reclaimer Berm			**Comparision of Settlement at Top of Berm and Original Ground Surface Level**	**Milne Inlet Port**
By	Lk	0	14-Mar-18		
Revision		A	14-Mar-18		**FIGURE E2-2**



Job number	353004			**Mary River Expansion Project**	**BIM**
Ref	Reclaimer Berm			**Creep Settlement - Time Dependency**	**Milne Inlet Port**
By	Lk	0	17-May-18		
Revision		A	17-May-18		**FIGURE E3-1**