Baffinland Iron Mines LP
Mary River Expansion Stage 3

Definitive Study Report

Section 8 – Project Layout

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HATCH						

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8. Project Layout

8.1 Introduction

Layouts for the Mine, Rail and Port sites developed during the previous Stage 2 Study were further optimized during the Stage 3 Definitive Study to achieve the most efficient and cost effective solution.

This document defines the background to the layout developed during the Stage 2 Study and explains further enhancements made during the Stage 3 Study.

8.2 Mine Site Layout

8.2.1 Overview

The proposed mine site layout is shown in Appendix A8-1.

Expansion Project layout of the Mine Site is primarily based on optimization of the rail earthworks, particularly due to the flat gradient required along the loading track. Following from the optimized rail alignment:

- Rail loading zone selected with optimization of the rail
- Primary crushers located at the loading zone as per approved process design
- Roads and utilities modified as required to facilitate construction of the optimized rail

Optimization of the rail alignment is discussed in Section 8.3.

Locating the primary crushers on a new pad at the rail loading area facilitated the use of the existing crushing pad for a new ROM stockpile area. The new mine truck workshop was located with direct access to the ROM stockpile area which provided:

- Segregation of heavy mining equipment (HME) from general traffic. HME will generally be limited to the mine haul road, ROM stockpile, primary crusher area and new truck workshop apron. Only mine operations light vehicles are expected to share these areas with the HME.
- Direct access for light vehicles and pedestrians between maintenance facilities.

Following from optimization of the operating facilities the construction camp was located to on existing Laydown #1, extended as required to suit the camp installation.

8.2.2 Explosives Facilities Clearances

The proximity that infrastructure can be in relation to explosives magazines and explosives plants within Canada is set out by Natural Resources Canada (NRCan) in the Quantity-Distance (Q-D) tables. An assessment of the Expansion Project facilities was completed based on the emulsion plant parameters set out in the ERP Project Explosives storage clearances drawing (refer to Appendix A8-2), and on the basis that the magazine location near the emulsion plant is not used for explosives magazines (therefore, only the distance from the emulsion plant is considered).

The primary crusher control room is considered an “inhabited building” and the primary crusher pad is considered as equivalent to a “heavy traffic public route”, which both require a D7 distance. The primary crusher pad is entirely located outside the D7 limit and, therefore, complies.

The rail track is considered equivalent to a “light traffic public route” based on the fact that a loco with a driver will only pass into the area 5-6 times per day with a similar number of entries of a service vehicle to pick up the loco driver. This same classification was previously used for the treated effluent road. This requires a D4 distance. The rail track and modified treated effluent road are outside this limit and therefore comply.

It is worth noting that to further mitigate risk, the rail operating procedures should minimize the time a loco driver is within the D7 zone. This is readily achieved by running the train through to the end of the track when it first arrives and immediately picking up the driver(s) and transferring them to the North end of the train.

8.2.3 Primary Crushing, Stockpiling and Train Loading

Layout of the three jaw crushers was developed to match the operating clearances required for crusher feed and maintenance, and to spread the product stockpile(s) along the length of the rail loading zone. The proposed layout is shown in Figure 8-1.

Each crusher will be fed with ROM by a CAT 988 FEL. The crushers are laid out in a staggered position with 35 meters between centers. The FEL’s will access the crushers by ramps created with pre-cast concrete blocks.

ROM will be delivered by haul trucks to the new crusher pad. The trucks will access the crusher area via the extended haul road and dump the ROM ore before leaving via the same road. The dumped ROM will be spread by the front end loaders (FEL’s) between train loading.

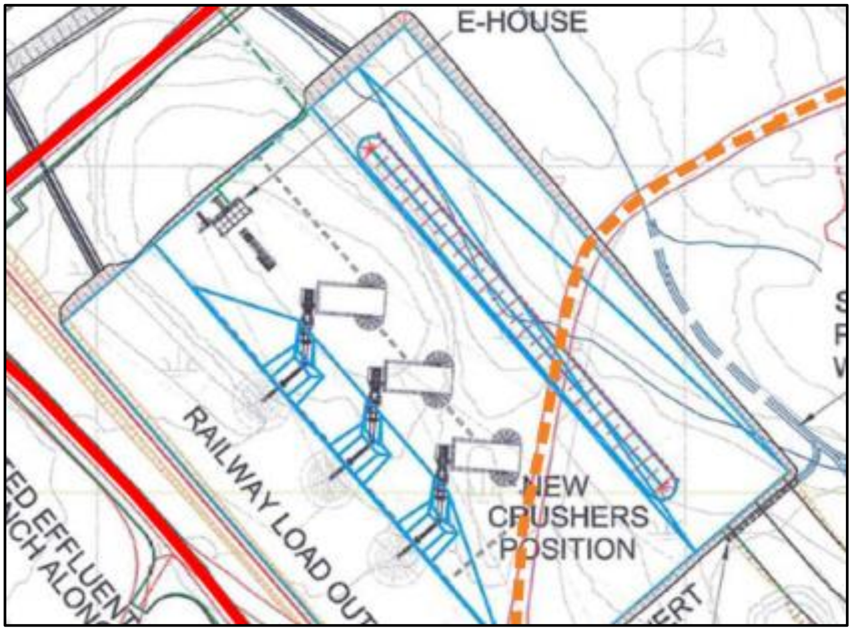

Figure 8-1: Primary Crushing Layout

8.2.4 Mine Truck Workshop

A new Mine Vehicle Workshop is included for the Mine. The workshop building will consist of two bays, 16.5 by 32 meters long. The workshop is located to:

- Provide direct access from the ROM stockpile where the equipment will be operating.
- Provide relatively direct and safe access for light vehicles and personnel between the new workshop and existing.
- Allow future expansion of the building (with associated expansion of the earthworks / pad).
- Minimize earthworks required to construct the pad.

8.2.5 Mine Camp

New 800 man hard-walled camp will be built at the mine to accommodate the operations and construction personnel.

The camp location was selected based on minimization of the associated earthworks to construct a nominally flat pad. Other considerations related to the camp location include:

- Clearance to the CMR2 runway approach was verified for non-instrument approaches as documented on drawing H349000-4400-10-041-0009 (refer to Appendix A8-3).
- An significant ice lens underlays much of the pad however using a raised building with free air flow under should minimize the risk of significant changes to the permafrost heat balance.

- The camp is located adjacent to the rail loading track which may result in excessive shunting noise in rooms along the east side of the camp.
- Operations and maintenance personnel will require bussing to their work location.

8.2.6 Roads

The tote road will be deviated in order to cross the new rail line before the mine camp site, this is shown in Figure 8-2

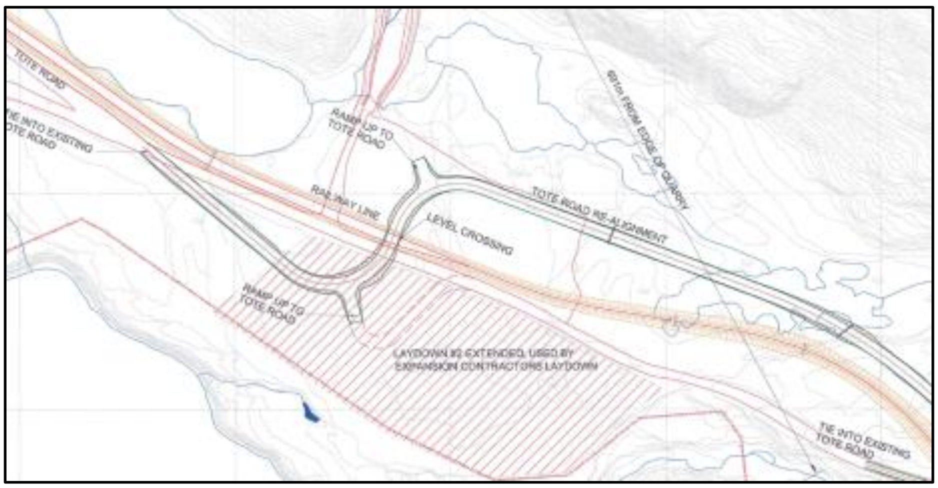

Figure 8-2: Tote Road Rail Crossing

The mine haul will be extended to allow the mine haul trucks to dump ore at the new primary crushing area. This road will be 24m wide to allow two-way traffic of the mine haul trucks; refer to Figure 8-3.

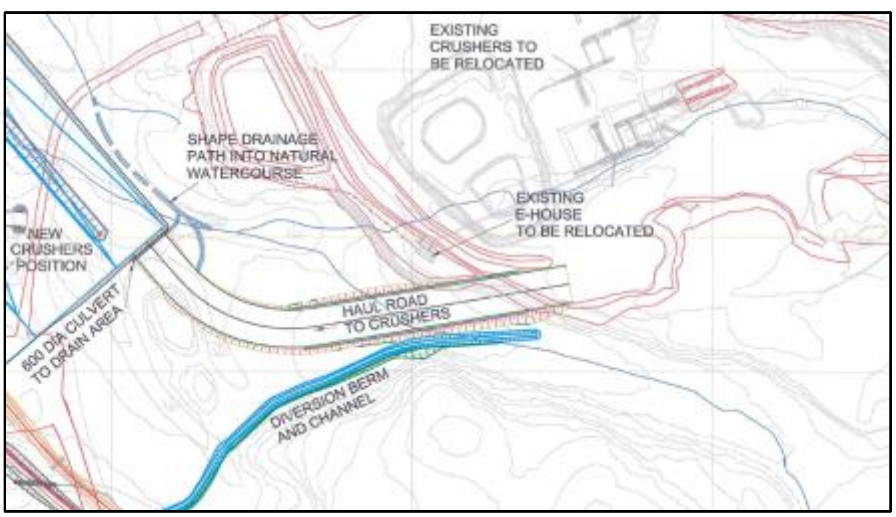

Figure 8-3: Mine Haul Road Extension to new Crushing Pad

The service road leading to the treated effluent discharge point will be realigned to be next to the rail line.

An access point for the train drivers swop out will be provided adjacent to the Tote road and the new construction camp.

8.2.7 Utility Systems

8.2.7.1 Power Supply and Distribution

At the Mine Site the present power generation facility will remain unchanged. The medium voltage reticulation network arrangement will not change, except for the re-routing of cables to avoid new facilities:

- Re-route 5kV power feed to E-House #8 to avoid new mine truck workshop.
- Re-route 5kV power feed to the runway area to avoid new construction camp.

E-house #11 currently feeds Crusher C and will be relocated to feed the three modified crushers installed in their new position as shown in Figure 8-4.

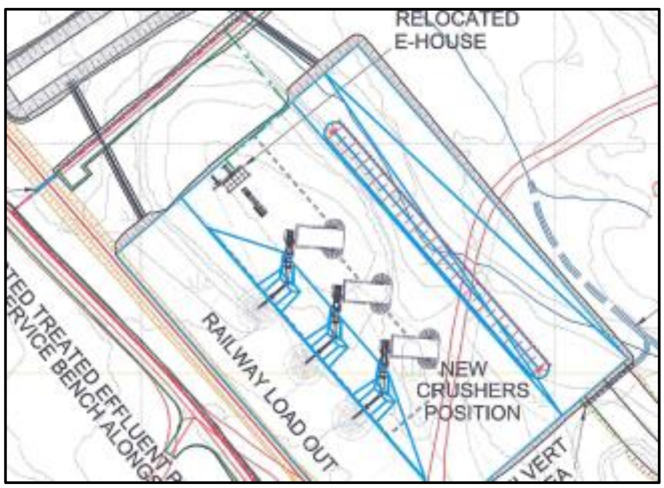

Figure 8-4: New Crusher Arrangement

8.2.7.2 Water Supply

The water supply to the mine water treatment plant is currently via a heated HDPE pipeline from the water pump station to the east of the aerodrome. This pipeline will be rerouted as the construction camp pad will encroach over the existing pipe. The water pipe will be rerouted to run along the south edge of the construction camp pad; see Figure 8-5.

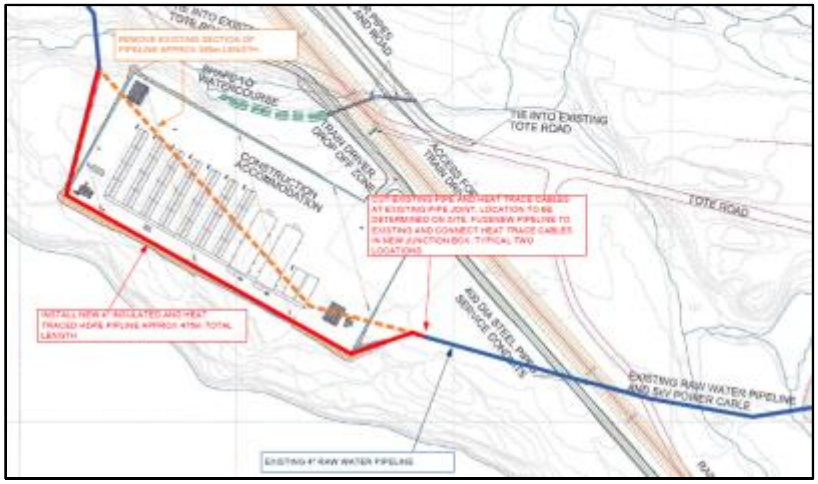

Figure 8-5: Rerouting of services around the Construction Camp Pad

8.2.7.3 *Communications and IT Infrastructure*

New fiber optic cables are to be installed from the communications hub to the relocated E-house #11 and the new Mine Vehicle Workshop, refer to Figure 8-6. The Fiber will be installed on berms constructed for the routing of utilities.

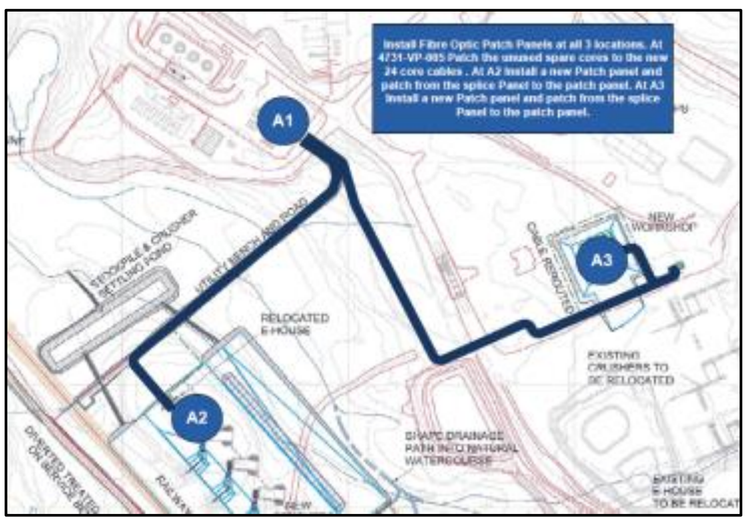

Figure 8-6: Mine Fiber Optic Cable

8.3 Rail Layout

8.3.1 Overview

Rail layout was mutually developed during the Stage 2 study and further optimised during Stage 3. The proposed rail track diagrammatic layout is shown on Appendix A8-8 and the plan/long section is shown on Appendix A8-9.

8.3.2 *Mine Terminal*

The Mine track facilities are represented in Figure 8-7.

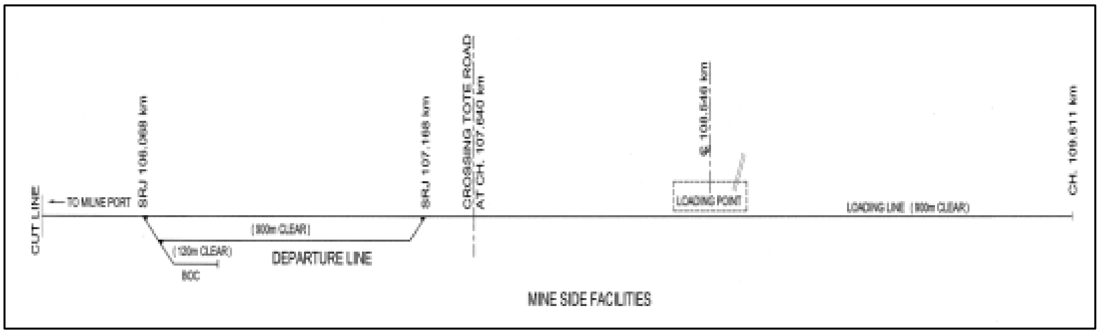

Figure 8-7: Mine Track Diagram

- Loading staging line for empty train — 900 m. (mainline chainage)
- Loading pull through line to stop block — 900 m. (mainline chainage)
- Departure Siding — 900 m.

8.3.3 *Port Terminal*

The port terminal and yard layout is presented in Figure 8-8

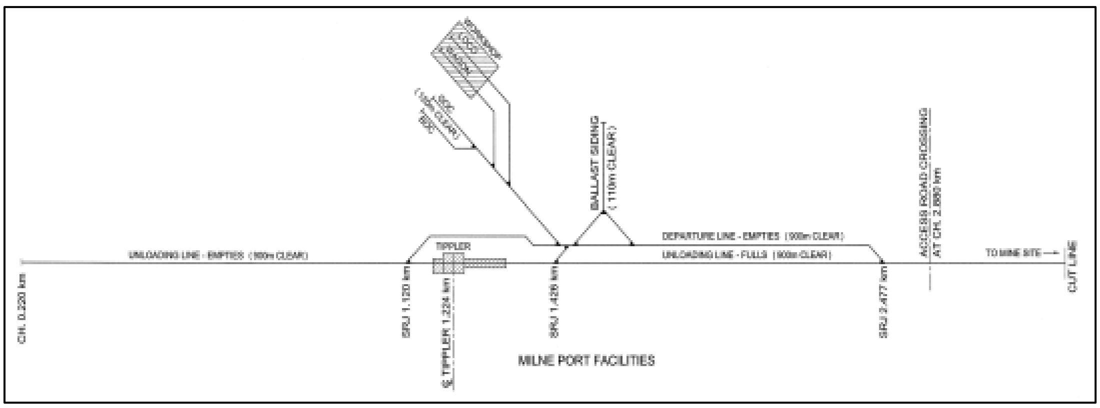

Figure 8-8: Port Side Track Diagram

- Unloading lines — 2800 m (mainline chainage)
- Departure Siding — 900 m
- Locomotive Run-around loop — 347 m
- Locomotive Workshop Spur — 390 m
- Ore Car Workshop Spur — 215 m
- Bad Order Car Spur — 205 m

- Good Order Car Spur 160 m
- Ballast Spur 400 m
- Triangle Link 375 m
- Cross Over 120 m.

8.3.4 Mainline CH 2.80km to CH 106.00 km

The mainline chainage starts at zero at the stop block of the push through line for unloaded trains at the Milne Port tippler and terminates at CH 110.661 km at the stop block beyond the Mary River Mine loading bank. For train operations and track maintenance purposes the mainline is defined as starting at CH 2.8 km and ending at CH 106.00 km. This is from just south of the mainline switch entering the Milne Port facilities to just north of the mainline switch entering the Mine Terminal.

The mid-way passing loop is located between CH 55.883 km and CH 56,936 km, providing a clearance of 900 m, fit for maximum 80 car train length.

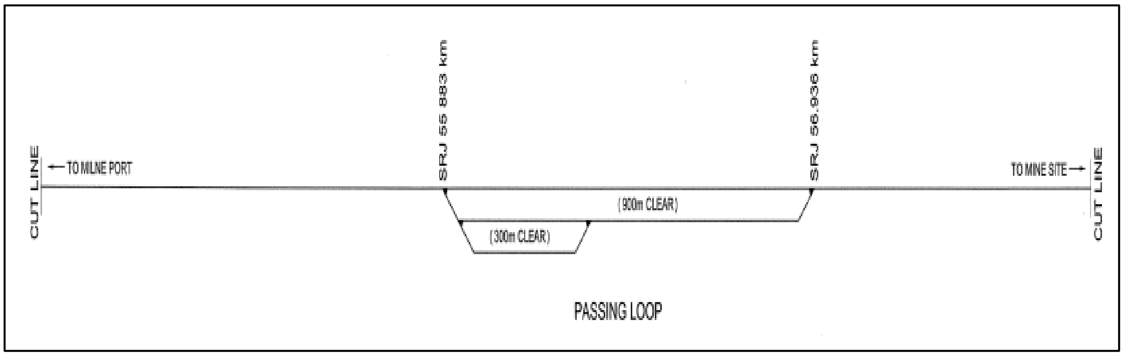

Figure 8-9: Midway Passing Loop and Backtrack

Routing of the main rail line between the Mine and the Port is a critical project activity due to rail operational constraints, the interface with project permitting and the impact on earthworks volumes (and therefore project capex).

Track and gradient design criteria are discussed in detail in Section 10 of this Report (Site Development and Infrastructure) and have been applied to the rail alignment development.

Routing criteria used during the Stage 2 Study included:

- Rail alignment to remain within existing commercial lease and impact area boundaries as far as possible (nominally within 100 m of the existing Tote Road centerline);
- Deviations required outside the existing boundaries to be constrained as close to the existing road as practical (with a target of being within 1km of the road)
- The permitting criteria was carried forward to this study however to optimize the rail design the number and length of deviations outside the existing boundary and the

maximum distance from the existing road were increased compared to the original High Level Option Study routing, particularly for the deviation at “km67 hill” as discussed below

- Detail design of the rail alignment has a significant impact on the earthworks volumes to construct the rail substructure (embankment) particularly in areas of varying sub-grade (permafrost and rock). Routing criteria was applied to minimize project capex and provide a stable substructure include:
  - Route rail on/through areas of rock sub grade where available. Utilize rock cuts to level track and as a quarry source for areas where rock fill is required
  - Avoid ice-rich permafrost where practical
  - Utilize permafrost excavation sparingly but as required to minimize overall capital cost
  - Align rail to minimize fill volumes. Utilize deviations outside the permitting boundary where significant benefit can be realized.

8.3.5 Routing Optimization

8.3.5.1 General Optimization

Development of the rail alignment during the Stage 2 study was completed using 3D engineering design tools applying the developed geometric criteria and external constraints. Where available LiDAR data obtained by Baffinland in 2008 was used for the existing terrain; where the rail was routed outside the available LiDAR data, GIS information publically available from Natural Resources Canada (NRCan) was utilized. Design was further supported by field inspection of the initial alignment.

During the Stage 2 study a new LiDAR survey was commissioned and completed after the High Level Option Study alignment was further developed and optimized. This LIDAR survey was incorporated into the 3D engineering design. Minor adjustments were made to the optimized alignment as the updated LIDAR included the current Tote road alignment, including Tote road modifications that were made since 2008. The section where the Tote road and rail alignment clashed were eliminated as far as practically possible. However, a total of 11 grade crossings remained after the optimization process. A total of 9 of these grade crossings will require minor Tote road realignments so as to ensure compliance with Transport Canada grade crossing specifications for grade crossings that only have visual warning systems in the form of road and rail signage. The design currently allows no advance warning system with either flashing lights or gates as these are not required for future operations based on the number of trains and road vehicles which will make use of the grade crossings.

8.3.5.2 Geotechnical Optimization

Early study alignment development assumed permafrost for the full length of the rail route with significant distances of moderately to highly frost susceptible soils (refer to Knight

Piesold report NB-102-0018/10-1 Road Upgrade Design Summary). However, during the study a site visit by Hatch's lead Geotechnical engineer identified substantial opportunities to realign the rail into adjacent areas of rock sub grade and to optimize the vertical profile to construct the rail substructure on rock beds that exist as sedimentary layers in the permafrost along the km 67 hill deviation (refer to Appendix A8-11)

Based on field observations, the following geotechnical optimizations were incorporated into the rail design:

- From Milne Port to CH 8.000 km the rail has been routed through granitic rock to the north-east of the existing Tote Road. Elevation of the rail has been set to below grade. The resulting excavated rock will be used as a quarry source for bulk fill required toward the south (rock fill embankment constructed over permafrost)
- Alignment from CH 10.000 km to CH 11.500 km adjusted to avoid ice rich permafrost (and excess fill required)
- Alignment from CH 60.000 km to CH 80.000 km adjusted to align, where practical, on sedimentary rock shelf and utilize local cut-to-fill construction methodology at gully's
- Alignment at CH 77.000 km adjusted to minimize crossing over ice rich permafrost.
- Alignment at CH 88.000 km to 92.000 km adjusted to avoid ice rich permafrost and maximize construction over rock sub grade
- Realign CH 99.000 km to CH 104.000 km through rock sub grade.

8.3.5.3 Deviation at km 67 Hill

The existing Tote Road climbs over a hill between the CH 62.000 km and CH 80.000 km, with its crest at approximately CH 67 km. The total elevation gain/loss and associated gradient profile is not suitable for a rail track following the road. The locomotives would be unable to climb the hill in the loaded direction and braking requirements down the hill loaded would be excessive.

During the High Level Option Study a concept alignment was developed deviating away from the road and bypassing the peak of the hill, but still generally climbing up and over the hill. Following field inspection of the terrain along the proposed route, particularly deep gully's on the west side of the hill, and considering the operational impacts of a long uphill climb / downhill decent, alternative deviations were investigated. The Tote Road, initial concept alignment and alternatives routes assessed are illustrated in Figure 8-10.

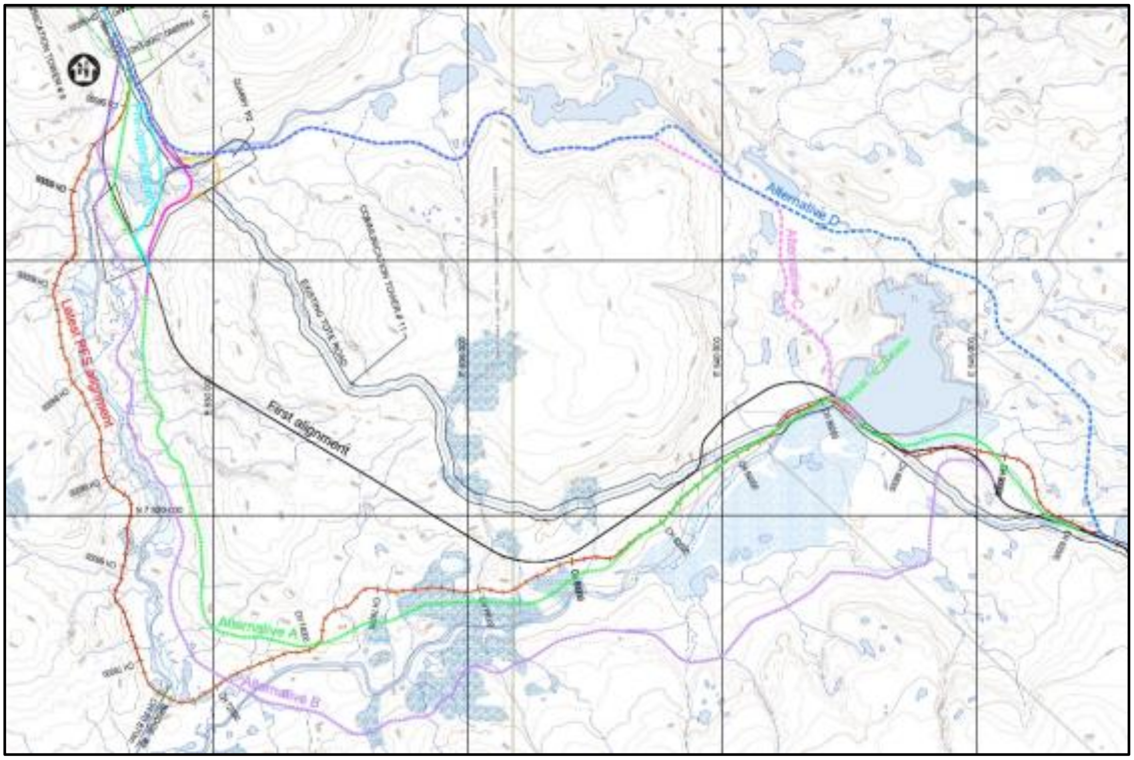

Figure 8-10: Potential Alternative Deviations Around km 67 Hill

Considering the terrain (and resulting fill requirements), gradients and potential for a rock cut ledge rail embankment, alternative A was initially selected, however, a suitable location for a rail over river bridge, with reasonable earthworks volumes and bridge structural requirements, could not be identified.

Final optimization of the alignment in the area of km 67 Hill was to relocate the rail bridge approximately 12 km downstream from the existing road bridge resulting in the final layout.

8.3.5.4 Final Alignment Summary

The final alignment developed for the study is shown on the rail plan and long section drawings, included in Appendix A8-9, and the formation cross section drawings included in Appendix A8-10.

Figure 8-11 Figure 8-12, Figure 8-13 indicate the track alignment as developed during the feasibility study.

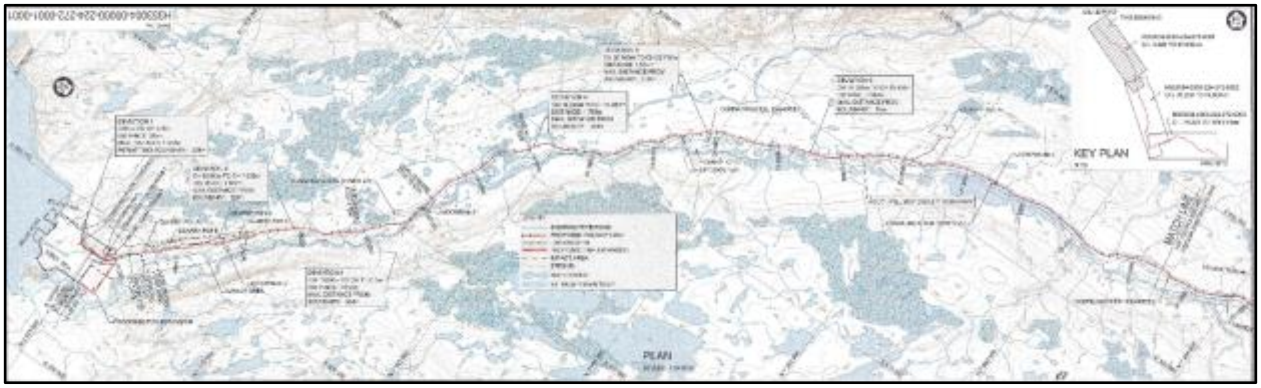

Figure 8-11: Layout Section CH 0.220 km to CH 37.250 km

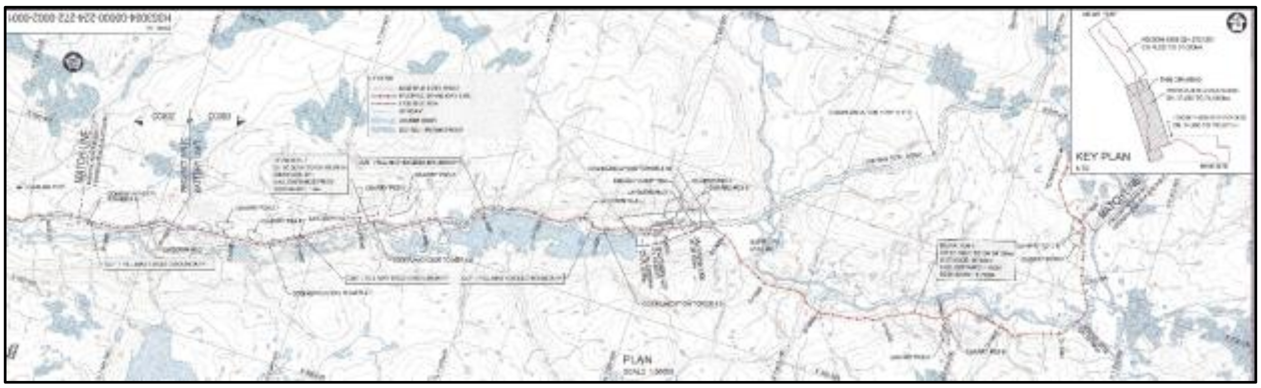

Figure 8-12: Layout Section CH 37.250 km to CH 74.250 km

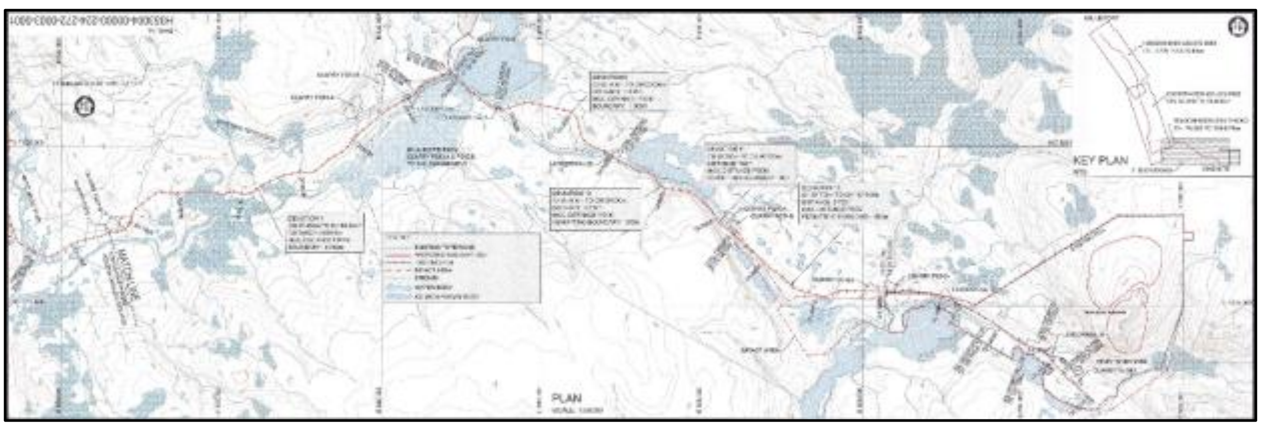

Figure 8-13: Layout Section CH 74.250 km to CH 110.611 km

Key parameters are summarized in Table 8-1. A summary of deviations outside the current permit boundary is provided in Table 8-2.

In addition to the listed deviations, some sections of the rail line are very close to the existing permit boundary and the toe of fill/crest of cut may extend beyond the boundary.

Table 8-1: Rail Alignment Parameters

Item	Value	Comment
Total main line length	110.6 km	
Maximum gradient – loaded uphill	1.5%	
Maximum gradient – loaded downhill	3.0%	
Number of deviations outside permit boundary	10	
Total distance of deviations outside permit boundary	46.6 km	A total of 12 deviations have been identified
Total length constructed on rock sub grade	23 km	Approximate, pending final geotechnical verification
Total length constructed on ice-rich permafrost	4 km	
Number of bridges	4	
Number of level crossings	11	Excluding yard track

Table 8-2: Summary of Deviations Outside Existing Permit Boundary

Deviation Number	Rail Chainage		Distance of deviation* (m)	Max distance from existing permit boundary* (m)	Reason for Deviation
	Start (km)	End (km)			
1	-	315	315	339	Unloading track alignment
2	6,250	7,932	1,682	229	Rock cut foundation
3	10,080	11,912	1,832	254	Gradient
4	15,238	16,943	1,705	359	Horizontal alignment
5	20,946	22,760	1,814	128	Gradient
6	24,791	25,090	309	19	Gradient
7	46,304	46,391	87	17	Gradient
8	57,490	84,334	26,884	7,042	Gradient and bridge location
9	87,800	92,006	4,206	1,284	Gradient
10	93,800	95,000	1,200	390	Gradient
11	95,780	96,525	745	168	Gradient
12	97,750	103,542	5,792	903	Rock cut foundation

* Distances based on rail centerline. Toe of fill / crest of cut will exceed values listed.

8.3.6 Sidings

One siding was identified during the prefeasibility phase of the study. To allow loaded and empty trains travelling north and south respectively to cross one another the design identified the requirement for “midway siding”. The location of the “midway siding” was between CH 55.883 km and CH 56.936 km from stock rail joint to stock rail joint. The siding was positioned on the West of the mainline alignment during the previous phase of the study. However, during the final rail alignment optimization it was noted that an existing operational building was located on the Western side of the rail alignment in the same location as the proposed rail siding location.

Thus, it was decided to move the “midway siding” and to locate it to the East of the mainline. The siding is able to accommodate 80 ore railcar trains with two locomotives and has a clearance distance of 900m. The siding also includes a 300m maintenance and staging siding where on-track maintenance equipment can be staged and bad order wagons can be shunted off the main train consist in emergency cases. Refer to Figure 8-16 for the diagrammatic layout.

8.3.7 Bridges

The number of rail over river bridges have remained unchanged from that which, was identified in the Stage 2 phase. A total of 4 rail over river bridges are required along the entire rail alignment to cross major water crossings. During the Stage 2 study these rail over river bridges were located at the following locations:

- 4 span crossing 15.100m per span, located at CH 15.839 km
- 2 span crossing 20.235m per span, located at CH 70.869 km
- 2 span crossing 20.235m per span, located at CH 86.355 km
- 4 span crossing 15.200m per span, located at CH 92.255 km.

With the integration of the final LIDAR topographical survey information and making adjustments to optimize the rail alignment as set out elsewhere in this section of the report. The final rail over river bridge locations have been determined to be located at:

- 4 span crossing 15.100m per span, located at km 15.839 (H353004-3330-230-270-0001-0001)
- 2 span crossing 20.235m per span, located at km 70.690 (H353004-3330-230-270-0001-0002), this bridge moved northeast from the previous study location
- 2 span crossing 20.235m per span, located at km 86.355 (H353004-3330-230-270-0001-0003)
- 3 span crossing with one centre span of 20.100m and two outside spans of 20.235m per span, located at km 102.217 (H353004-3330-230-270-0001-0004), this bridge moved north from the previous study location.

The final extent of the rail over river bridges is such that there was no reduction in the overall length of bridges required along the rail alignment after making the final adjustments to incorporate the alignment changes that were implemented. Bridge spans have been based on the existing normal flow river bank and the adjacent Tote road bridges. Detailed hydrological design will be carried out by the successful contractor as part of the overall bridge design of the project.

8.4 Port Layout Development

8.4.1 Overview

The proposed port site layout is shown on Appendix A8-4.

Expansion Project layout for the Port Site was primarily driven by optimization of the bulk materials handling equipment within the existing Project Development Area (PDA) boundary, and with consideration of the associated rail track infrastructure. Facilities were generally constrained to the existing PDA to remove any schedule risk associated with timeline for approval of the proposed PDA expansion.

Key aspects of the selected bulk materials handling and rail layout include:

- Locating the rail unloading system on the natural bench adjacent to quarry Q1 in a natural depression. This location optimized the design of the unloading system and the rail track:
  - Unloading system founded on rock (valley floor at Milne is deep permafrost)
  - Excavation for unloading basement is reduced (relative to typical deep pit excavation for an unloading system)
  - Unloading basement can be “day-lighted” with vehicle (small equipment) access through the conveyor tunnel into the basement.
  - Unloading conveyor is nominally horizontal through to discharge onto primary crushing stockpile.
  - Rail track is maintained at a higher elevation and does not need to decent to the Milne valley floor elevation.
- Locating the new ore dock east of the existing to optimize it’s position for efficient ship access and potential future ice breaker access.
- Aligning the new yard conveyor and stockpile to:
  - Maximize length within the existing PDA (therefore maximizing stockpile capacity)
  - Directly feed the new ship loader without intermediate conveyor (for proposed dual quadrant ship loading utilizing a flow splitter and single link conveyor)
  - Construct the stockpile on the flat river delta plain which minimized associated earthworks.
- Aligning the crushing and screening system to link the rail unloading and stockpile systems with the minimum possible conveyor lengths.

Other facilities required at Milne were positioned after the above optimization was complete and were generally located:

- Facilities to support rail operations and maintenance were grouped adjacent to the rail unloading system and arranged to minimize associated rail track lengths. Rail workshop was also able to be founded on rock.
- Facilities to support crushing and screening operations and maintenance were located adjacent to the crusher building.
- Operations camp and utility system were optimized to be expansions of existing systems and located to facilitate expansion rather than constructing new independent facilities.
- Construction camp was located centrally to the construction work and to minimize earthworks.

8.4.2 Bulk Materials Handling

8.4.2.1 Introduction

Layout of the bulk materials handling system was developed during the Stage 2 study. Further optimization of the layout during Stage 3 was delegated to the CM001 Bulk Materials Handling and Processing Contractors to consider with their bids. A battery limit drawing (included in Appendix A8-7) was issued with the package to define the available footprint for optimization. All bids received effectively aligned with the Stage 2 layout and this was carried forward as the basis for the Stage 3 study.

8.4.2.2 Rail Unloading

Ore transported from the mine by rail reports to the rail dumper at the port for offloading. The dumper consists of a single rotary dumper. The dumper is located on the incoming rail line at an elevation of approximately 57 meters. The natural ground level will be used to the advantage of the rail unloading conveyor which daylights at a lower level and thus not having to first be elevated to above ground level.

The dumper basement size is approximately 16.525 by 15.725 meters and 21 meters deep.

An access road will be constructed to allow access to the rail unloading conveyor. The rail unloading conveyor will be in a tunnel constructed from a prefabricated steel section over which the excavation would then be backfilled.

The tunnel will have an internal clearance height of approximately 2.7 metres which will be sufficient to allow forklift access for maintenance of equipment inside the dumper.

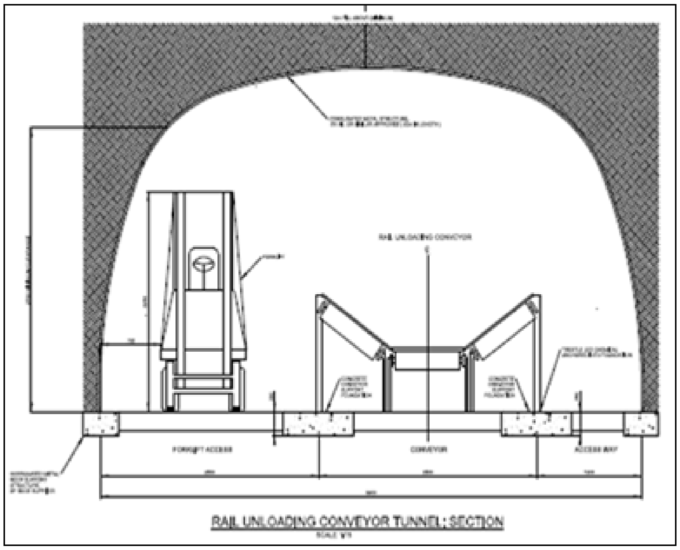

Figure 8-14: Rail Unloading Conveyor Tunnel Section

The rail unloading conveyor will discharge ore on the crusher feed stockpile.

8.4.2.3 *Secondary Crushing and Screening*

A general arrangement of the system is shown in Figure 8-15. The arrangement is proposed to optimize the associated interconnecting conveyors.

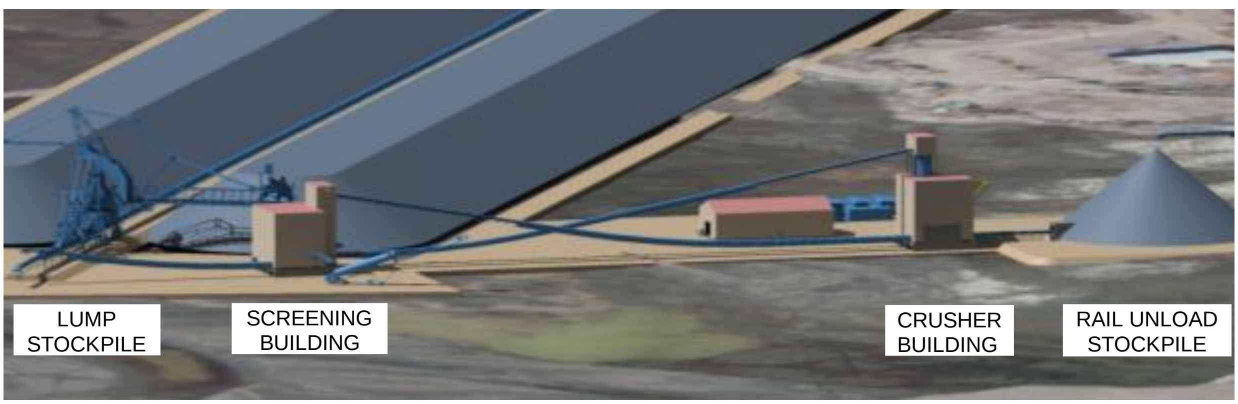

Figure 8-15: Secondary Crushing and Screening Arrangement

8.4.2.4 *Stockpile*

Lump ore from the screening plant will be conveyed direct to a new lump stockpile with dedicated reclaim and feed to Ship Loader No. 2.

Required stockpile live capacity for average year production and shipping is 7.2 Mt. The proposed reclaimer for the stockpile is a 60m boom. To achieve the required storage capacity within the topographical and permitting constraints and with a single yard conveyor (and associated stacker and reclaimer) an over-built stockpile is proposed as described in Section

6 - Process. The orientation of this stockpile was optimized to fit within the existing PDA and to feed directly to the new ship loader.

To facilitate construction of the new lump stockpile the existing reclaim conveyor will be modified as shown in the site layout drawings. The existing stockpile, used only for fine ore in the expansion project, will the modified to include the west side piles only.

Ore will be trucked to the stockpile from the intermediate pile adjacent to the screening plant and will be stacked using the existing mobile radial stackers supplied by others.

8.4.3 Marine Structures

The project requirements of shipping 12Mt of product during the prescribed open water season requires significant expansion to the wharf and marine infrastructure of the Milne Port, which includes the construction of a second ore export terminal (Ore Dock No. 2).

The introduction of Ore Dock No. 2 at the Milne Port has two primary functional objectives which consist of the following:

- Provide a safe, efficient and secure deep-water berth for a range of design vessels including Panamax and Cape Size bulk ore carriers
- Provide a means of support for the shiploaders and associated mechanical equipment used for loading the vessel
- Enable the export of lump iron ore at a rate of 16,000t/h.

The proposed ore dock layout and configuration is shown on Appendices A8-5 and A8-6.

To achieve these objectives Ore Dock No.2 consists of the following facilities:

- A new ore dock suitable for berthing Cape Size ships (up to 230,000dwt, 316m LOA and draft of 19.0m). The new dock is located east of the existing ore dock (Ore Dock No.1) at a minimum design depth below LLWD of 21m for berthing of the proposed ships. The new dock includes the following elements:
    - Symmetrical breasting and mooring points, a fender system and mooring hardware. Furthermore, the ore dock has all the necessary access and space required for the operation and maintenance of the berth and its associated infrastructure
    - The main berth face consist of structure(s) that act as combined breasting and shiploader support platform. These structure(s) accommodates fenders to absorb the energy of the berthing vessel, provide contact points for the moored vessel and mooring line points as required
    - A causeway that supports the conveyor system and provide access for pedestrians and service vehicles from the shore to the main berth face, as well as access for mechanical, conveyor and electrical systems

- Dual quadrant ship loader installed on the new dock. Each quadrant ship loader is capable of operating at up to 8,000 t/h and both loaders can operate simultaneously for a combined rate of up to 16,000 t/h.

The berth location has been selected, based on the local bathymetry, to provide the minimum depth of marine structures while still providing adequate water depth at the berth face without dredging. Furthermore, the berth location has been selected to maintain a safe distance between the existing and new berth, by allowing adequate separation during berthing and avoiding the crossing of mooring lines. The orientation of the causeway has been selected to accommodate the orientation of the reclaim conveyor feeding the shiploaders.

An underkeel clearance of 10% of the largest vessel's fully laden draft has been provided at the berth and the berth has therefore been oriented parallel to the natural bathymetry. The average elevation of the ore dock has been set at the same level as the existing ore dock, namely +5.3 m CD. In the execution phase, options for lowering this elevation will be considered to minimise capital expenditure (refer to Appendix A8-12).

8.4.4 Roads

Berms will be constructed for utility services including MV cables, fibre optic cables and HDPE pipelines. The berm on the east side of Stockpile No. 2 will allow cables to be run to feed the crushing and screening plant area and provide a redundant power and communication network. A berm will be constructed to enable the marine fuel intake pipeline to be routed to connect back to the tank farm.

An area will be prepared for receiving pre-cast foundations for the crusher and screening buildings. These building will be brought to site as complete modules and will be transported by SPMT's from the offloading dock. The final layout of the foundations will suit the preferred BMH contractors building modular design.

A new access road to the dumper is included, this road will link in from the existing tote road and be constructed with a culvert under the rail line, see Figure 8-16.

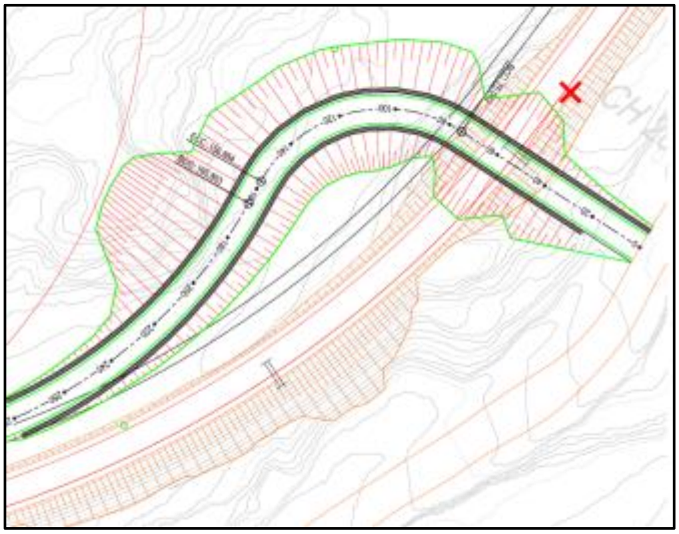

Figure 8-16: Rail Dumper Access Road

A road is included to extend the tote road where the existing road is encroached by the new stockyard No 2 on the eastern side.

A road from the temporary barge dock is included to enable large modules to be offloaded at the dock and transported up to their final positions at the crushing and screening area as well as the tippler area.

A road is included to allow the haul trucks transporting fine or to stockyard No.1 to travel between the fines stockpile and the realigned stockpile No.1.

8.4.5 Utility Systems

8.4.5.1 Power

At the Port Site, all generators will be centralised at the current generation facility. This applies to new generator additions and the main distribution E-house extension to be provided as part of the project expansion; see layout in Figure 8-17.

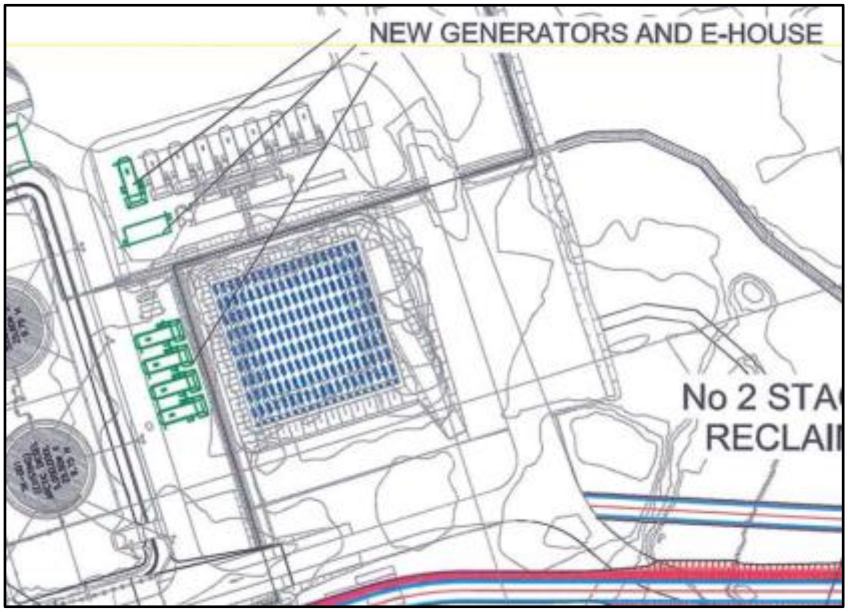

Figure 8-17: Layout of the generating Station

Power cables will be routed on top of earth berms which will be created or extended as needed to facilitate the Port power distribution network.

From the main generation distribution E-house, three Point of Supply (POS) termination points will be served. From these three termination points, the CM001 BMH Contractor will tie-in his equipment. Refer to Figure 8-18 showing the power cable layout.

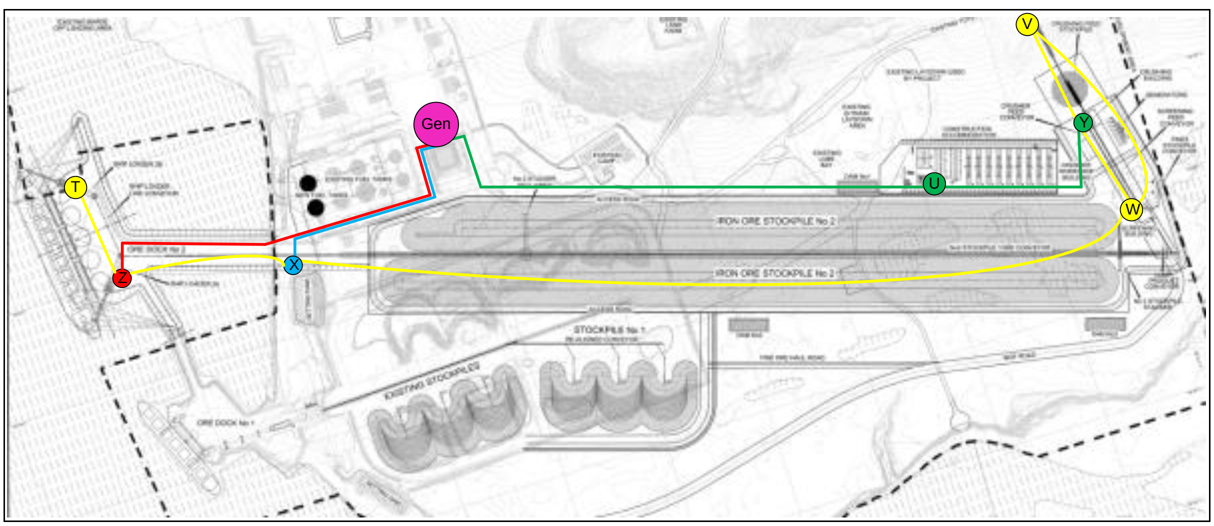

Figure 8-18: Port Electrical Power Distribution Layout Diagram

The Yard Conveyor E-House is located at position X. The blue cable route will serve the new Stockyard No. 2 yard conveyor and the stacker/reclaimer machines. This cable route will include redundant point to point cables and switchgear for the total electrical load supplied.

The Crusher Building E-house at point Y will serve the new rail unloading and yard system, screening, crushing and associated conveyors. The green cable route will include non-redundant point to point cables and switchgear for the total load at Y. The same cables will also feed the construction camp on route to the Crusher Building E-House.

The Shiploader #2A E-House at point Z and is intended to serve the new Shiploaders #2A & #2B. The red cable route will include non-redundant point to point cables and switchgear for the total load at Z.

Fully redundant power cables between the facilities would be provided by the yellow cable route. The cable supply and installation would be packaged in the BMH contractor's scope of works (CM001).

8.4.5.2 *Fuel Systems*

Three new fuel tanks will be installed in the existing fuel containment berm, including a 0.75Ml Jet-A1 tank, a 15 Ml arctic diesel tank and a 3 Ml arctic diesel tank. The tanks will be connected to the existing pipe system at the fuel tank farm.

The tank farm is supplied by floating hose connected to a marine manifold building at the north end of the tank farm. Due to interference of the new ore dock with the existing fuel ship and floating hose operating area, the marine manifold building will be relocated adjacent to the existing barge offloading area. A berm will be constructed for routing of the pipeline to the marine manifold.

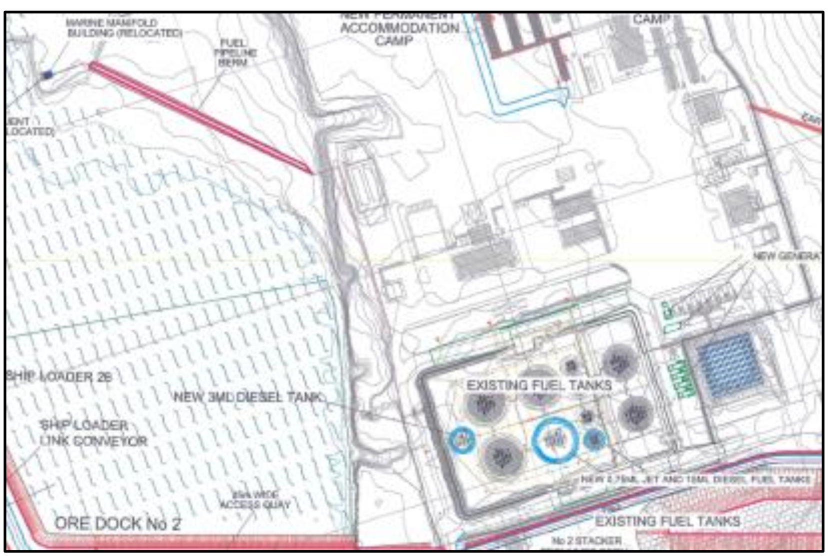

Figure 8-19: New Fuel Tanks and Relocated Marine Manifold

8.4.5.3 Treated Effluent Pipeline

Treated effluent is currently discharged near the existing marine manifold building at the north end of the fuel tank farm however construction of the new ore dock will effectively form an open bay around this location. To improve natural water flow at the point of discharge, and reduce the risk of forming a zone of brackish water, the discharge will be located adjacent to the existing barge offload ramp (alongside the relocated marine manifold building).

8.4.5.4 Communication and IT Infrastructure

Fiber optic cable will be routed as shown in Figure 8-20, to enable plant-wide communications and control. Existing fiber cable will need to be cut and spliced to allow the installation in culverts where the No2 stockpile yard conveyor intercepts the existing cable.

Redundancy in the network will be provided by a fiber optic cable that will connect from the power generation E-house to the crusher building. The BMH system installed by the contractor will connect to the fiber network at the crusher building and the No.2 stockpile yard conveyor drive house (A6 and A5 respectively in Figure 8-20).

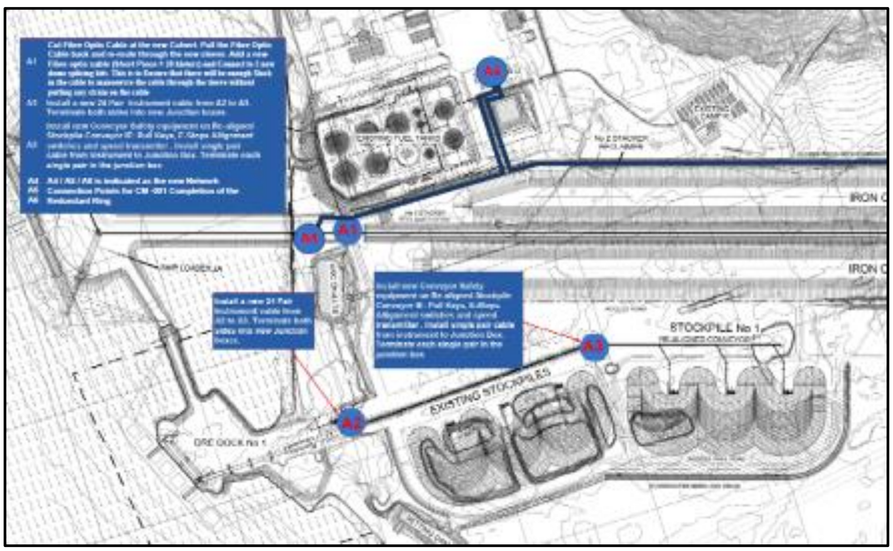

Figure 8-20: Fibre Optic routing at the Port

8.4.6 Operations and Construction Accommodation

The operations camp at the Port Site (the PSC) is to have three additional 30 bed dormitory wings (total of 90 additional beds), an extension to the existing arctic corridor and one new locker room added.

The exiting pad is sufficient for this expansion with minor grading works.

To support the expansion project a new construction camp will be built. The camp is located central to the construction works and positioned to optimize associated earthworks.

8.5 Reference Documents

Document Number	Title	Revision	Date	Appendix Number
H353004-00000-220-272-0005-0001	Mine Site – Block Plan - Layout	0	25/03/2017	A8-1
H349000-4000-00-014-0014	Mine Site Explosives Storage Clearances General Arrangement	0	13/01/2015	A8-2
H349000-4400-10-041-0009	Mine Site Aerodrome Obstacle Limitation Surfaces Non-Instrument	0	11/04/2014	A8-3
H353004-00000-220-272-0001-0001	Port Site – Block Plan – Overall Layout	0	10/03/2017	A8-4
H353004-00000-220-272-0010-0001	Port Site Ore Dock No 2 Layout	0	14/12/2016	A8-5
H353004-00000-220-272-0019-0001	Port Site Ore Dock No 2 Sections	0	15/12/2016	A8-6
H353004-00000-220-272-0017-0001	Port Site CM001 Contract Interface Overall Layout	0	15/12/2016	A8-7
H353004-00000-224-262-0001-0001	Rail Site Diagrammatic Layout Milne Port to Mine Site	0	13/12/2016	A8-8
H353004-00000-224-272-0001-0001	Rail Site Plan and Longitudinal Section Ch. 0.220km to Ch. 37.000km	1	10/02/2017	A8-9a
H353004-00000-224-272-0002-0001	Rail Site Plan and Longitudinal Section Ch. 37.250km to Ch. 74km	1	10/02/2017	A8-9b
H353004-00000-224-272-0003-0001	Rail Site Plan and Longitudinal Section Ch. 74.250km to Ch. 109.61km	1	10/02/2017	A8-9c
H353004-00000-224-260-0001-0001	Rail Site Formation Cross Sections Ch. 220m to 2500m	0	03/02/2017	A8-10a
H353004-00000-224-260-0002-0001	Rail Site Formation Cross Sections Ch. 2600m to 4100m	0	03/02/2017	A8-10b
H353004-00000-224-260-0003-0001	Rail Site Formation Cross Sections Ch. 4200m to 6600m	0	03/02/2017	A8-10c
H353004-00000-224-260-0004-0001	Rail Site Formation Cross Sections Ch. 6700m to 10300m	0	03/02/2017	A8-10d

Document Number	Title	Revision	Date	Appendix Number
H353004-00000-224-260-0005-0001	Rail Site Formation Cross Sections Ch. 1040m to 21000m	0	03/02/2017	A8-10e
H353004-00000-224-260-0006-0001	Rail Site Formation Cross Sections Ch. 25200m to 36700m	0	03/02/2017	A8-10f
H353004-00000-224-260-0007-0001	Rail Site Formation Cross Sections Ch. 36800m to 39500m	0	03/02/2017	A8-10g
H353004-00000-224-260-0008-0001	Rail Site Formation Cross Sections Ch. 39600m to 49200m	0	03/02/2017	A8-10h
H353004-00000-224-260-0009-0001	Rail Site Formation Cross Sections Ch. 49300m to 59400m	0	03/02/2017	A8-10i
H353004-00000-224-260-0010-0001	Rail Site Formation Cross Sections Ch. 59500m to 62500m	0	03/02/2017	A8-10j
H353004-00000-224-260-0011-0001	Rail Site Formation Cross Sections Ch. 62600m to 67500m	0	03/02/2017	A8-10k
H353004-00000-224-260-0012-0001	Rail Site Formation Cross Sections Ch. 67600m to 70760m	0	03/02/2017	A8-10l
H353004-00000-224-260-0013-0001	Rail Site Formation Cross Sections Ch. 70780m to 76100m	0	03/02/2017	A8-10m
H353004-00000-224-260-0014-0001	Rail Site Formation Cross Sections Ch. 76200m to 86460m	0	03/02/2017	A8-10n
H353004-00000-224-260-0015-0001	Rail Site Formation Cross Sections Ch. 86480m to 95700m	0	03/02/2017	A8-10o
H353004-00000-224-260-0016-0001	Rail Site Formation Cross Sections Ch. 95800m to 101500m	0	03/02/2017	A8-10p
H353004-00000-224-260-0017-0001	Rail Site Formation Cross Sections Ch. 101600m to 103500m	0	03/02/2017	A8-10q

Document Number	Title	Revision	Date	Appendix Number
H353004-00000-224-260-0018-0001	Rail Site Formation Cross Sections Ch. 108500m to 109500m	0	03/02/2017	A8-10r
H352034-1000-220-068-0001	Site Visit Report – Sept 7-14 2016	0	04/21/2017	A8-11
	Ore – Deck Elevation Review	A	02/14/2017	A8-12