2014 Annual Geotechnical Inspection
Doris North Project
Hope Bay, Nunavut

Prepared for

TMAC Resources Inc.

Prepared by

SRK Consulting (Canada) Inc.
1CT022.001
January 2015

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Executive Summary

The Doris North Project (Project) is a mining and milling undertaking of TMAC Resources Inc. The site is located in the Kitikmeot Region of Nunavut, about 170 km southwest of Cambridge Bay. The Project is licensed to conduct mining, milling and associated activities. Construction of the Project started in 2007, and was expected to continue through to 2013. Mine development started in the summer of 2010; however, ore processing was not scheduled until 2013 at the earliest. In addition to supporting ongoing construction activities, the site was used to carry out regional exploration. In February 2012, Hope Bay Mining Limited (HBML) announced the Project had been placed into Care and Maintenance. In March 2013, the Hope Bay Belt Property was sold to TMAC and the Doris North Camp was re-opened to a limited extent to permit regional exploration activities and exploration localized to the Doris North Project.

Site operations are conducted under a Type “A” Nunavut Water Board (NWB) License 2AM-DOH1323 (the License), dated August 16, 2013, which entitles TMAC (the Licensee) to use water and dispose of waste associated with their operations. TMAC contracted SRK Consulting (Canada) Inc. to conduct the annual geotechnical site inspection of the Project in accordance with stipulated License conditions. This annual investigation was carried out from July 15 to 22, 2014.

Table A below provides a summary of the inspection components and the primary recommendations stemming from the inspection. The recommendations take into consideration the fact that the site is currently still under Care and Maintenance, with limited exploration activity, as opposed to being under active construction. This includes recognition of a reduced site staff complement.

Table A: Summary of the Inspection Items and Associated Inspection Recommendations

Inspection Item	2013 Recommendations	2014 Recommendations
Thermistors	• Re-evaluate thermistor requirements taking into considering the surface infrastructure elements currently on site. Where appropriate, inactive thermistors should be inspected and where practical they should be repaired and re-commissioned for the collection of baseline data. • Inspect and evaluate if the thermistors marked as "Status Unknown" are active. • Include Westbay Well thermistors in monitoring program. • The thermistor monitoring frequency was reduced under Care and Maintenance with a couple sets of readings taken around the maximum thermal activity expected in the area, i.e. in July or August (maximum thaw depth). This should continue until the project is started up again. • North Dam thermistor data must continue to be collected in accordance with the monitoring recommendations provided in Section 7 of the North Dam As-Built Report (SRK 2012b) and Section 3 of the North Dam Monitoring Standard Operating Procedures Report (2013b).	• Repair thermistor installations identified in Appendix E. • Include the Westbay Well thermistors as part of the monitoring program. • The thermistor string monitoring frequency was reduced under Care and Maintenance with readings of a couple sets taken around the maximum thermal activity expected in the area, i.e., in July or August (maximum thaw depth). This should continue until the Project is started up again.
Old Beach Laydown Area	• Relocate two of the explosives magazines to an area where they are on the sandy beach as opposed to partially on the tundra vegetation.	• No action required.
Roberts Bay Jetty	• Continue monitoring the jetty thermistor in accordance with the protocols stipulated in Section 3.2. • If the Project moves beyond Care and Maintenance, repair or replace the damaged thermistor SRK-JT2-12. • Follow the recommendations for construction and monitoring provided by PND (2013).	• Continue to collect monthly thermistor string data as a minimum (July to August). • Follow the recommendations for settlement monitoring provided in Section 7.0 of PND (2013). • Remind operational staff annually about the operational limitations of the jetty as provided in Section 4.0 of PND (2013).
Shoreline Laydown Area	• Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion.	• No action required.
5 ML Roberts Bay Tank Farm	• Backfill the trenches excavated to confirm liner elevation. • Should the facility be re-commissioned, the liner repairs should be completed to ensure design capacity and consider the installation of settlement beacons along the fuel transfer station and on sections of the secondary containment facility not constructed on bedrock.	• Backfill the trenches excavated to confirm liner elevation. • Should the facility be re-commissioned, the extension of the liner should be completed to ensure design capacity and consider the installation of settlement beacons along the fuel transfer station and on sections of the secondary containment facility not constructed on bedrock.

Inspection Item	2013 Recommendations	2014 Recommendations
20 ML Roberts Bay Tank Farm	• In the areas were there has been potential for the liner to be compromised, it should be exposed and evaluated by a qualified person to confirm the integrity of the bunded area before the facility is refilled. • Prior to refilling the fuel tanks the pedestals and area of the bunded area need to be reconstructed. Under Care and Maintenance, no action is required (unless further erosion continues). • Maintain improved water management practices to prevent the ponding of water and further erosion of the interior on the containment facility. • Additional high wall stabilization and management practices should be considered.	• In the areas where the liner has been exposed and potentially damaged, the liner should be inspected and repaired, as required, by a qualified person to confirm the integrity of the bunded area before the facility is refilled. • The exposed grounding cable behind Fuel Tank #1 should be evaluated by a qualified person to confirm it is still functioning as designed. • Prior to refilling the fuel tanks the pedestals and areas of the bunded area need to be reconstructed. Under Care and Maintenance no action is required (unless further erosion continues). • Maintain improved water management practices to prevent the ponding of water and further erosion of the interior of the containment facility. • A review of the high wall by a qualified rock mechanics expert is recommended to confirm whether additional stabilization is required.
Roberts Bay Laydown Area	• Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion. • Monitor flow from drainage channels beneath pad. If flow stops, the blockage must be traced to prevent onset of thermal erosion. • Monitor areas where rock was relocated from the tundra for signs of thermal erosion.	• Monitor areas where rock was relocated from the tundra for signs of thermal erosion.
Quarry #1 Overburden Dump	• Monitor surface runoff and consider requirement for alternate sedimentation control measures. • If the surface is used as a laydown area appropriate management protocols must be put in place taking into consideration the propensity for sinkhole development and overall differential settlement.	• Monitor surface runoff and consider requirement for alternate sedimentation control measures.
Airstrip	• Monitor areas where rock was relocated from the tundra for signs of thermal erosion. • Maintain practice of inspecting the runway toe line during freshet and after significant or prolonged rainfall events. Pump ponded water to prevent onset of thermal erosion. • Conduct inspections of the airstrip shoulder and aprons to monitor the tension cracks prior to each use.	• Monitor areas where rock was relocated from the tundra for signs of thermal erosion. • Repair the tension cracks and erosion gullies on the north apron behind the control tower.

Inspection Item	2013 Recommendations	2014 Recommendations
All Weather Roads (Doris Site)	• Inspect road toe lines during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion. • Monitor areas where rock was relocated from the tundra for signs of thermal erosion. • The buttress recommended for the Secondary Road should be constructed, and until such time as the buttress is constructed a visual monitoring system should be put in place and warning signs posted along the section in question.	• Monitor areas where rock was relocated from the tundra for signs of thermal erosion. • The buttress recommended for the Secondary Road should be constructed; and until such time, a visual monitoring system should be put in place and warning signs posted along the section in question.
Doris Creek Bridge	• Ensure the correct thermistor reader, set to the correct thermistor bead resistivity, is used for each thermistor cable as listed on the Doris Thermistor Data Field Sheet. • Continue monitoring the thermistor strings with the recommendations set out in Section 3.2. • Monitor and ultimately replace the rock gabions.	• Ensure the correct thermistor reader, set to the correct thermistor bead resistivity, is used for each thermistor cable as listed on the Doris Thermistor Data Field Sheet. • Monitor and ultimately replace the rock gabions.
Wash Bay/Explosives Mixing Plant	• Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion.	• No action required.
Upper and Lower Reagent Pads	• Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Ponded water should be pumped to prevent onset of thermal erosion.	• No action required.
Quarry #2 and Crusher Area	• Continue to follow the Quarry Management Plan. • A barricade at the Quarry entrance is recommended.	• A barricade at the Quarry #2 entrance is recommended.
Batch Plant Pad (Previously Crusher Pad)	• Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion.	• No action required.
Upper Reagent Pad AN Storage	• Should the facility be used to provide secondary containment, the design criteria must be confirmed and appropriate remedial measures must be implemented. Under Care and Maintenance no action is required.	• Should the facility be used to provide secondary containment, the design criteria must be confirmed and appropriate remedial measures must be implemented. Under Care and Maintenance no action is required.
Landfarm	• TMAC to continue to follow the designated Landfarm Management Plan. • Conduct regular visual inspections to monitor for signs of settlement. • Repair the sinkhole along the outside berm face of the Soil Containment Pond and the pothole in the access ramp into Snow Containment Pond.	• Conduct regular visual inspections to monitor for signs of differential settlement. • Repair the sinkhole along the outside berm face of the Soil Containment Pond. • Repair the pothole and depressions in the access ramp into Snow Containment Pond. • Discharges into the Snow Containment Pond should be onto a protective barrier to prevent erosion.
Sewage Treatment Plant Outfall	• Monitor for permafrost degradation at old outfall location. • No action required at new outfall location.	• Monitor for permafrost degradation at old outfall location. • No action is required for the new diffuser system, at this time.

Inspection Item	2013 Recommendations	2014 Recommendations
Quarry # 2 Overburden Dump	• No action required.	• No action required.
Doris North Camp Pads	• Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion. • Construct a catch berm at the toe of the high wall, along Pad D and install appropriate signage and barricades to warn people of the danger. • High wall stabilization measures designed for the mill pad should be installed as planned if the project moves beyond Care and Maintenance. • Develop and implement a differential settlement monitoring protocol for heated buildings constructed directly onto the thermal rock fill pads.	• Install appropriate signage and barricades to warn people of the high wall danger on Pads D and X. • High wall stabilization measures designed for the mill pad should be installed as planned if the project moves beyond Care and Maintenance. • Develop and implement a differential settlement monitoring protocol for the heated buildings (the geotechnical core cutting building and the warehouse building (on Pad Y) as well as the old underground maintenance shop (on Pad E/P)) constructed directly onto the thermal rock fill pads.
7.5 ML Doris North Camp Tank Farm	• High wall stabilization measures designed for the 7.5 ML Tank Farm should be installed as planned (SRK 2011d).	• High wall stabilization measures designed for the 7.5 ML Tank Farm should be installed as planned (SRK 2011d).
Power Generation Station (Pad B)	• Monitor the survey monuments on Pad B to allow for tracking and advance notice of any deformations as part of the annual survey.	• Monitor the survey monuments on Pad B to allow for tracking and advance notice of any deformations as part of the annual survey.
Other Site Wide Fuel Storage	• No action required.	• No action required.
Sedimentation and Pollution Control Ponds	• The Sedimentation and Pollution Control ponds should be kept free of standing water, as this will lead to permafrost degradation. • Remove the large rocks and over liner material from the exposed liner within the Sedimentation Pond. • Keep a close watch on the Pollution Control Pond thermistor data as well as the sump water quality and flow. • Carry out a comprehensive review of the ground conditions below the ponds to evaluate whether there is a further evidence of leakage.	• Remove the large rocks and over liner material from the exposed liner within the Sedimentation Control Pond. • Conduct regular monitoring of the thermal data for the Pollution Control Pond.
Sumps #1 and #2	• Both sumps should be kept free of standing water as this will lead to permafrost degradation. • Inspect sump perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion. • The depression around Sump #1 must be backfilled with overburden to prevent further permafrost degradation.	• Backfill the depression around Sump #1 with overburden to prevent further permafrost degradation.
Doris North Portal	• No action required.	• No action required.
Waste Rock Pile	• Once underground development resumes, TMAC should continue to follow the designated Waste Rock Management Plan.	• Once underground development resumes, TMAC should continue to follow the designated Waste Rock Management Plan (SRK 2014f).
Temporary Pond	• No action required.	• No action required.

Inspection Item	2013 Recommendations	2014 Recommendations
Doris Fresh Water Intake	• Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion.	• No action required.
Doris Primary Vent Raise Pad	• Install catch berm and appropriate signage along high wall. • Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion. • Remove metal debris from fuel transfer station.	• Install catch berm and appropriate signage along high wall.
Frozen Core Plant Pad	• Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion.	• No action required.
North Dam	• Increase frequency of surveying North Dam monitoring points in accordance with the recommendations by the Engineer-of-Record in Section 7 of the North Dam As-built Report (SRK 2012b) and Section 3 of the North Dam Monitoring Standard Operating Procedures Report (SRK 2013b). This needs to be implemented immediately. • Survey and monitor the two depressions on the upstream face of the dam in conjunction with the instrumentation monitoring program. • Backfill the erosion around Deep Settling Monitoring Point ND-DSP-100. • Repair the contact thermistor bead on the North #2 thermosyphon and test the functionality of the thermosyphon and re-charge the thermosyphon if required.	• North Dam recommendations are reported separately. See SRK (2014c).
Shoreline Erosion	• Continue to implement measures to maintain the water level in Tail Lake at 28.2 masl to prevent onset of permafrost degradation.	• North Dam recommendations are reported separately. See SRK (2014c).
Doris North Diversion Berm	• Repair area of exposed liner next to where the water line passes over the berm.	• Repair area of exposed liner next to where the water line passes over the berm.
Doris-Windy All Weather Road	• Inspect road toe lines during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion. • Monitor areas where rock was relocated from the tundra for signs of thermal erosion. • Implement inspection protocol to monitor shoulder cracks and potholes. • Backfill the dip in the road by the helipad.	• Monitor areas where rock was relocated from the tundra for signs of thermal erosion.

Inspection Item	2013 Recommendations	2014 Recommendations
Doris-Windy All Weather Road Stream Crossings	• Ensure the correct thermistor reader is used for each thermistor cable as listed on the Doris Thermistor Data Field Sheet. • Continue monitoring the thermistor strings in accordance with recommendations in Section 3.2. • Install additional railings between the two bridge superstructures. • The depressions and ponded water against the thermal pad abutments should be covered with rock fill to prevent thermal degradation of the permafrost.	• Ensure the correct thermistor reader, set to the correct thermistor bead resistivity, is used for each thermistor cable as listed on the Doris Thermistor Data Field Sheet. • Install additional railings between the two bridge superstructures at Stream Crossings #2 and #3. • The depressions and ponded water against the thermal pad abutments at Stream Crossing #3 should be covered with rock fill to prevent thermal degradation of the permafrost. • Inspection of the bridge over Stream Crossing #3, by a qualified structural engineer should be conducted. Any repairs/remediation to the bridge should be completed under the supervision of a qualified person.
Quarry A	• Continue to follow the Quarry Management Plan.	• No action required.
Quarry B	• Continue to follow the Quarry Management Plan.	• No action required.
Quarry D	• Continue to follow the Quarry Management Plan.	• Should the bunded and lined facility, within Quarry D, be used to provide secondary containment, the design criteria must be confirmed and appropriate remedial measures must be implemented. Under Care and Maintenance no action is required.

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1 Introduction

1.1 Inspection Requirements

The Doris North Project (Project) is a mining and milling undertaking of TMAC Resources Inc. TMAC acquired the property from Newmont Mining Corporation (NMC) in 2013. The site is located in the Kitikmeot Region of Nunavut, about 170 km southwest of Cambridge Bay (with general coordinates of latitude 68°09'N and longitude 106°40'W, as shown in Figure 1).

The Project is licensed to conduct mining, milling and associated activities. In 2012, Hope Bay Mining Limited (HBML), a wholly owned subsidiary of Newmont Mining Corporation (NMC), temporarily delayed mine development pending re-evaluation of project economics and therefore much of the licensed infrastructure components have not been constructed, as illustrated in Figures 2 and 3. Construction of the Project started in 2007, and was expected to continue through to 2013. Mine development started in the summer of 2010; however, ore processing was not scheduled until 2013 at the earliest. In addition to supporting construction activities (Figure 4), the site was used to carry out regional exploration. In February 2012, HBML announced the Project was placed under Care and Maintenance. In March 2013, the Project was sold to TMAC. The Doris North camp was re-opened, to a limited extent, to permit exploration activities.

Site operations are conducted under the Type "A" Nunavut Water Board (NWB) License 2AM-DOH1323 (the License), dated August 16, 2013, which entitles TMAC (the Licensee) to use water and dispose of waste associated with their operations. Part J, Items 18 and 19 of the License states the following:

> *"18. The Licensee shall ensure that a geotechnical inspection is carried out annually between July and September by a Geotechnical Engineer. The inspection shall be conducted in accordance with the Canadian Dam Safety Guidelines where applicable and take into account all major earthworks, including the following:*
>
> *a. North and South Dams;*
> *b. Geotechnical instrumentation and associated monitoring data;*
> *c. A description of geophysical and permafrost conditions at the Project site;*
> *d. Tailings Impoundment Area shoreline and erosion strip survey monitoring results;*
> *e. Emergency Dump Catch Basins;*
> *f. All weather access roads;*
> *g. Roberts Bay Jetty;*
> *h. Landfill;*
> *i. Landfarm;*
> *j. Fuel Storage and Containment Facilities at the Plant Site and Roberts Bay site;*
> *k. Sedimentation Pond;*
> *l. Pollution Control Pond;*
> *m. Sumps;*
> *n. Underground mine openings;*
> *o. Groundwater conditions underground;*
> *p. Rock temperature measurements and groundwater inflow in the underground mine workings;*
> *q. Sedimentation control berm at the overburden dump; and*
> *r. Doris North Camp Area Diversion Berm.*

19. The Licensee shall submit to the Board, within sixty (60) days of completion of the geotechnical inspection, the Geotechnical Engineer's inspection report. The report shall include a cover letter from the Licensee outlining an implementation plan addressing each of the Geotechnical Engineer's recommendations."

In fulfillment of these regulatory requirements, TMAC requested that SRK conduct the 2014 geotechnical site inspection. This report provides a summary of the conditions observed and the resulting mitigation recommendations. This is the sixth formal annual geotechnical inspection carried out for this site in fulfillment of the stipulated Water License Condition. Inspections completed in 2009, 2010, 2011, 2012, and 2013 were also completed by SRK (SRK 2009e, SRK 2011a, SRK 2012a, SRK 2013a, and SRK 2014a).

In 2012, construction was completed of a 10 km all-weather road linking the Doris Camp and the Windy Camp. This road does not fall under the Doris North Water License; however, the water management plan for the three rock quarries (Quarry A, B, and D) along the road is administered through the NWB. TMAC therefore requested that the geotechnical inspection include the all-weather road.

The Doris North Project: 2014 Annual Roberts Bay Jetty Inspection Technical Memorandum (SRK 2014b) as well as the 2014 Annual Geotechnical Inspection, Tailings Impoundment Area, Report, (SRK 2014c), are submitted under separate covers to the Nunavut Impact Review Board (NIRB) and NWB respectively and will not be discussed in this report.

It should be noted that up until February 2012, most of the site was still under construction, and as a result, many of the elements listed for inspection under the Water License had not yet been constructed and are therefore not reported on. This is illustrated in Figures 2 and 3. In February 2012, HBML announced the Project would be placed under Care and Maintenance and, as such, all site activity was stopped and HBML embarked on a major demobilization campaign of all salvageable equipment and supplies. With TMAC taking over the Project in March 2013, the Doris North camp was re-opened with limited site operations, to support exploration activities but no construction activities.

1.2 Report Structure

Section 2 of this report provides a brief summary of the site history and physical conditions to provide context for the report content. Inspection conditions are described in Section 3 and an overall summary of recommendations is provided in Section 4. All elements of the site discussed in this report are presented with the enclosed figures, which includes detailed site photographs. Details pertaining to the site wide ground temperature cables (*aka* thermistor strings) are presented in the appendices.

2 Site Conditions

2.1 Site History

A brief summary of the site history is listed in Table 1.

Table 1: Summary of Pertinent Site Ownership History

Period	Comment
1964	Sporadic exploration in the Hope Bay area begins, resulting in several gold and silver showings including Ida Point, Ida Bay and Roberts Lake.
1970	Roberts Bay Mining explores the area for about a decade up to 1980.
1977	Noranda begins exploring for volcanogenic massive sulphide deposits. They leave the belt in 1990.
1987	Abermin Corporation stake claims in the vicinity of Aimaokatalok and Doris Lakes. After completing some exploration, they allow their claims to expire.
1988	BHP Minerals Canada Inc. (BHP) explores the southern portion of Hope Bay Volcanic Belt.
1991	BHP acquires a contiguous block of claims covering about 1,106 km^2 from Abermin Corporation.
1992	BHP commences exploration drilling at the Boston property.
1996 and 1997	BHP complete 2,300 m of underground development, underground exploration (drilling and sampling) and bulk sampling of the Boston deposit.
1999	BHP sells all its interests in the Hope Bay Belt to Hope Bay Joint Venture (HBJV), a 50:50 joint venture between Hope Bay Gold Corporation Inc. (formerly Cambiex Exploration Inc.), and Miramar Hope Bay Limited (MHBL), a wholly owned subsidiary of Miramar Mining Corporation (MMC).
2002	Hope Bay Gold Corporation Inc. formerly merges with MMC, and the Hope Bay site is operated under MHBL.
2003	MHBL completes a feasibility study to develop the Doris North Project as a small high grade underground mine.
2005	MHBL completes an Environmental Assessment (EA) for the Doris North Project.
2006	MHBL receives an approved and signed Project Certificate for the Doris North Project.
2007	The Doris North Project Water License is issued, and construction of the Doris North Project commences.
2008	Hope Bay Mining Limited (HBML), a wholly owned subsidiary of Newmont Mining Corporation (NMC) buys out all interests in the Hope Bay Belt from MMC. HBML announces a delay in the construction of the Doris North Project. Construction of select surface infrastructure continues, but mine development is not started.
2009 to 2011	Construction of select surface infrastructure elements of the Doris North Project continues. Mine development is started in the summer of 2010.
2012	In February 2012 the Doris North Project is placed under Care and Maintenance. Salvageable equipment and supplies were demobilized in the summer of 2012. By mid-October the camp was temporarily shut down.
2013	In March TMAC acquires the Hope Bay Gold Project. The Doris North Camp is re-opened with limited site presence to support exploration activities.

2.2 Site Infrastructure

The Project area trends north to south and is approximately 8 km long and 3 km wide from Roberts Bay, in the north, to the southern end of Tail Lake, in the south. Outside of this area, immediately to the northwest along the Roberts Bay shoreline, there is a beach which has historically been used as a barge landing site and laydown area. This beach is not permanently connected to the Project since its only link to the greater site is a seasonal ice-road constructed over the Roberts Bay sea ice.

At the north end of the Project there is a jetty and shoreline laydown area. An all-weather road (*aka* Jetty Road) connects these facilities to the Roberts Bay laydown area and the two tank farms (the 5 Million Litre (ML) fuel tank farm constructed at the disused Quarry #1, and the 20 ML fuel tank farm which has been constructed in a bedrock outcrop to the southeast of Quarry #1). To the east of Quarry #1 is an Overburden Stockpile which is contained by an all-weather road known as the Roberts Bay Access Road.

From the Roberts Bay Laydown, an all-weather road continues south (*aka* Primary Road), for about 4 km, towards the Doris North Camp. Part of this road has been widened for use as an all-weather airstrip (with a partially constructed expanded airstrip). Between the camp and the airstrip, there is a spur road heading east towards a pad housing the wash bay and explosives mixing plant. Further along the road heading towards the camp, there is a large laydown area (*aka* the Upper and Lower Reagent Pads) which was used as the operational base for the exploration drilling contractor, as well as general equipment and supply storage.

Beyond the Upper and Lower Reagent Pads, there is another spur road servicing a rock quarry used for a source of construction material (Quarry #2). This spur road also serves as an access to the construction crusher complex and stockpile area, the Quarry #2 overburden stockpile, the landfarm, and core storage area.

The Doris Camp area, also known as Quarry #4, consists of multiple tiered foundation pads, cut partially into bedrock. The western most pad (Pad X) contains the camp, sewage treatment plant, fire water tank and temporary site power plant. The lower west pads (Pads E/P and Y) houses the old underground equipment maintenance shop (presently used as a shop to support surface equipment maintenance), warehousing, exploration support facilities, and other miscellaneous camp services.

The 7.5 ML Doris North Camp Fuel Tank Farm is located immediately northeast of the camp, on bedrock outcrop (Pad R) and the pad immediately south (Pad B) houses the permanent power station. Immediately to the east of the permanent power station pad is the mill pad (Pad D) which has been blasted into a bedrock. Pad D previously hosted the lined Temporary Pond which was removed late in 2013. Moving further east the ore stockpile pad (Pads Q and H/J) is located between the mill pad (Pad D) and the portal (Pad L). Immediately downslope of these facilities are additional mine area laydown pads (Pads F and G) and to the west of these pads is the waste rock pile (Pad I).

All of the site water management is facilitated by the North Diversion Berm, which routes clean (non-contact) surface runoff around the camp, mine and mill site pads and infrastructure, and the

Sedimentation and Pollution Control ponds, located downslope and to the south of camp, mine and future mill infrastructure. The Sedimentation Control Pond collects non-contact surface water runoff from Pads X, Y, E/P, R, B, and C. The Pollution Control Pond collects contact surface water runoff from Pads D, I, Q, H/J, and L. The all-weather road running along the south of the site (*aka* Float Plane Dock Access Road) acts as the downstream walls of the Sedimentation and Pollution Control ponds. This road links the camp area to Doris Lake, where the fresh water intake is located.

An all-weather road (*aka* Secondary Road) connects to the Float Plane Access Road, along the east side of Pad G, and follows the western shore of Doris Lake before crossing Doris Creek and on to the Frozen Core Plant pad and the North Dam on Tail Lake. The primary vent raise pad is located along this road just before the Doris Creek Bridge. A small spur road extends from the Frozen Core Plant pad to Tail Lake (*aka* Tail Lake Access Road). The Frozen Core Plant building was dismantled and removed in 2012 after completion of the North Dam.

A helicopter support base is located due south of Pads Y and E/P, at the junction of the Primary Road, the Float Plane Dock Access Road, and the Doris-Windy All-Weather Road. The Doris-Windy All-Weather Road meanders due south along high ground, passing by three construction quarries (Quarry A, B, and D) as illustrated in Figure 3, and provides an all-weather link between Doris North Camp and the old Windy Camp.

2.3 Climate

The Project area has a low arctic eco-climate with a mean annual temperature of -12°C with winter (October to May) and summer (June to September) mean daily temperatures ranging from -50°C to +11°C and -14°C to +30°C, respectively. The mean annual precipitation is about 207 mm, with just over one third of that falling as snow. Significant and persistent site winds results in substantial snow redistribution throughout the winter season, which often leads to protected slopes having almost year round snow cover. The annual lake evaporation (typically occurring between June and September) is estimated at about 220 mm.

2.4 Regional Geomorphology

During the Quaternary period, the region was subjected to multiple glaciations. The northwestern sector of the vast Laurentide Ice Sheet covered the area during each glaciation, and the present day landscape provides clear evidence of the most recent (Late Wisconsin) glaciation. Striations, orientation of eskers, grooves and drumlins indicate that the predominant glacial ice movement was north-northwest (EBA 1996).

The ice disappeared about 8,800 years ago leaving a blanket of basal till. The sea level was about 200 m higher than present immediately following de-glaciation. At that time, the Project area was submerged and the edge of the ice sheet abutted the open sea. Melt water streams from the ice carried fine grained sediments towards the sea, resulting in the accumulation of marine sediments on top of the till, with the greatest accumulation in deeper water zones, which now form the valley bottoms (EBA 1996).

Isostatic rebound after de-glaciation resulted in emergent landforms, and during this process all parts of the land were subjected to coastal processes. The easily erodible marine sediments, till and glacio-fluvial sands and gravels were subsequently reworked by waves, currents and sea ice. This has resulted in the present day outcrops where thin soil veneers were washed off the uplands and deposited in the valley bottoms. Since emergence, the natural effects of weathering, frost action and permafrost have transformed the landscape to its present day shape (EBA 1996).

2.5 Permafrost and Geotechnical Conditions

There have been numerous subsurface geotechnical investigations in the area, and SRK (2009a) and SRK (2011b) provide a comprehensive summary of this information. The area is characterized by extensive areas of bedrock outcrop zones transitioning to deep overburden soils at the contact zones. Geotechnical laboratory testing (moisture contents, Atterberg Limits, grain size distribution, pore water salinity, strength, permeability, mineralogy, thermal conductivity, bulk density, Proctor density and consolidation) on disturbed and intact samples collected during the various field campaigns confirms that overburden soils are comprised mainly of ice-rich, saline marine silt and clay ranging in thickness from 5 to 35 m. Isolated historic beach deposits containing small amounts of sand are present. Bedrock generally consists of competent basalt, and the interface zone between overburden and bedrock are typically associated with a relatively small rubble zone.

The area is completely within the cold continuous permafrost region of Canada, and site specific thermistor data, dating back to 2003 confirms the average surface ground temperature is about -9°C. The active layer is somewhat variable, but is typically about 1 m thick, and the depth of zero annual amplitude is about 10 m. Based on data from a deep thermistor string installed in 2003, total permafrost depth is estimated to be about 570 m.

3 Inspection Conditions

3.1 General

Mr. Lowell Wade, a Senior Consultant with SRK, conducted the geotechnical inspection from July 15 to 22, 2014. The detailed site inspection was carried out using a pickup truck with frequent stops for actual physical inspections, followed by a reconnaissance fly-over of the site via helicopter. Ms. Sarah Warnock, TMAC's On-site Environmental Coordinator and Mr. John Roberts, TMAC's Vice President Environmental Affairs were on site but neither accompanied SRK on the inspection.

Weather conditions during the inspection were cool, overcast with light wind, and occasional precipitation. A photo log of the inspection is presented in Figures 5 through 20, accompanying this report.

3.2 Thermistor Strings

Figures 3 and 5 present location maps of all 74 Project area thermistors installed between 2002 and 2012. Forty-three (43) of these strings are still active (Appendix A and SRK 2014b), twenty seven (27) are inactive (Appendix B), and ones that have not been recorded since 2010 are listed as their status being unknown (Appendix C and D). Appendix E provides a complete summary listing reconciling these strings to 2AM-DOH1323 Water License conditions and to the requirements under Care and Maintenance. In addition to the listed thermistor strings, there are also a number of historic thermistor installations dating back to the 1990s (SRK 2009a); however, data from these cables are not reported in this document. As part of the 2014 inspection, the physical condition of all the site wide thermistor strings was confirmed, but no data was acquired to confirm if they were functioning.

In the Project area, the bulk of the thermistor strings are less than 20 m deep, with the exception of five thermistor strings at an approximate depth of 50 m (SRK-38, SRK-39, SRK-40, SRK-42 and SRK-43), and three deeper thermistor strings (SRK-50 at 200 m, 08TDD632 at 350 m and TDD-242 at 70 m).

Based on approximately five years of data from the thermistor string SRK-50, the geothermal gradient below a depth of 90 m is about 10.9°C/km, which in turn implies a depth of permafrost of about 570 m in the area of this drillhole. Using one year of data from the thermistor string 08TDD632, and the geothermal gradient below a depth of approximately 90 m is about 17.9°C/km, which in turn implies a depth of permafrost of about 435 m in the area of this drillhole. Another deep thermistor string (about 70 m long) was installed in drillhole TDD-242 in 2000. Golder (2001) presents data from this string, but reports that this data is likely unreliable due to an unidentified malfunction, and has thus not been used in any assessments of the deep thermal gradient.

The numerous shallow thermistor strings (5 to 20 m deep), some with data spanning more than nine years, consistently show an active layer of about 1 m thick and a depth of zero annual amplitude of about 10 m below ground surface. The surface permafrost temperature is consistently about -9°C.

Two thermistor strings were installed through the Roberts Bay Jetty into submarine permafrost in 2009 (SRK 2009b). One of the thermistor strings, SRK-JT2-09, was damaged and had to be replaced in 2012 (SRK-JT2-12) and again in 2013. Data from these strings support an observation that the submarine permafrost has similar trends to onshore conditions.

The thermistor strings installed within the North Dam suggest the temperatures are trending towards the design temperatures. A complete discussion of the North Dam is provided in SRK (2014b).

Except for the data loggers installed at the North Dam, there are no data loggers connected to any of the Project thermistor strings. TMAC's ESR or Operations staff collects manual readings at roughly monthly intervals. This data is forwarded to SRK, who maintains a database with the relevant information.

Recommendations

- Repair thermistor installations identified in Appendix E.
- Include the Westbay Well thermistors as part of the monitoring program.
- The thermistor string monitoring frequency was reduced under Care and Maintenance with readings of a couple sets taken around the maximum thermal activity expected in the area, i.e., in July or August (maximum thaw depth). This should continue until the Project is started up again.

3.3 Old Beach Laydown Area

Prior to construction of the Roberts Bay Jetty, barges resupplying the site were beached at a location along the western shore of Roberts Bay (Figures 2 and 4). This area has sufficient deep water to allow barges to be pushed up onto the shore for safe offloading. Once offloaded, supplies and equipment were stored on the beach until such time that there was sufficient sea-ice and snow to construct an ice road to allow transport of the supplies and equipment to their final destination along the belt.

HBML used this facility during early construction stages of the Project. This facility is useful for the offloading of heavier items which exceed the design capacity of the Roberts Bay Jetty for any future plans for the Project.

During the 2007 to 2012 construction seasons, this site was primarily used for storage of construction explosives, in five self-contained Type-4 magazines. During the winter time, explosives were transported to their intended areas of use via an explosives truck on an ice road, and during the summer period, explosives were transported via helicopter. These magazines had been relocated to Quarry A and B, along the Doris-Windy All-Weather Road (Figures 3 and 20) late in 2013.

The beach landing site is a large un-vegetated sandy area, and there have been no surface improvements to the site since it was first used in the 1990s.

The beach is covered in wheel tracks; however, given the sandy nature of the beach, and the fact that there have been no signs of physical and/or thermal erosion, there are no concerns associated with these ruts.

Recommendations

- No action required.

3.4 Roberts Bay Jetty

The Roberts Bay Jetty was constructed in the summer of 2007, and was put in use for the first time in August 2007. It is used as a berthing facility from which to offload barges during the annual resupply sealift. This jetty is designed to replace the use of the Old Beach Laydown Area for normal resupply operations of the Project.

Foundation conditions beneath the jetty are very weak, and as a result the jetty is subject to extensive consolidation settlement (SRK 2004, 2005a, b, and 2006). This settlement was expected, and to facilitate more controlled settlement, the rock fill structure was underlain by a double layer of geogrid placed directly onto the seabed. The jetty was originally designed to extend a total length of 103 m from the shoreline, such that the barges could berth in 5 m deep water. During construction, the front section of the jetty slumped due to very weak foundation conditions in the deep water. The design was subsequently modified to allow berthing in shallower water (about 2 m deep), which resulted in a slightly shorter overall jetty length (SRK 2009c and d).

Extensive settlement monitoring of the berthing face of the jetty was undertaken in 2007, and by the summer of 2008, the jetty was observed to have settled about 0.5 m, in accordance with original design expectations (SRK 2005a). Subsequently the jetty was raised in the summer of 2008 to ready the facility for the 2008 sealift. No further settlement monitoring was undertaken after this, and no further raising of the jetty was required prior to the 2009 sealift. Further levelling and raising of the jetty was done prior to the 2010 sealift; however, no surveys were available to confirm how much settlement had occurred. No further work was done on the jetty prior to the 2011 sealift. In preparation for the 2012 sealift, the jetty was raised and extended by a few metres, and an earthen ramp was constructed to facilitate demobilization activities that were underway during the time of inspection. No surveys or quantities of fill used were available.

In 2013, the jetty was damaged due to a severe storm at the beginning of August. Large waves washed the rock fill at the end of the jetty out into Roberts Bay. PND Engineers Canada Inc. supervised the jetty reconstruction with large rock fill armouring covered with surfacing material and became the Engineers of Record for the Jetty (PND 2013). As part of the reconstruction activities, two survey monitoring points were installed at the end of the jetty (Figure 6).

A significant portion of the jetty has been constructed on submarine permafrost, and HBML installed two thermistor strings to confirm the presence of this condition. These thermistor strings were installed by HBML in March 2009 under the supervision of SRK (SRK 2009b). During snow clearing operations in late 2011, the thermistor string SRK-JT2-09 was severed. A replacement thermistor string was installed early in 2012 (SRK-JT2-12) (SRK 2013c). This replacement thermistor string was damaged again, in August 2013, during reconstruction activities.

The 2014 geotechnical inspection of this structure revealed no cause for concern (Figure 6). There were no obvious signs of distress anywhere on the structure. SRK's design and operational limitations for the jetty are now superseded by the new requirements stipulated by PND (2013).

A more comprehensive stand-alone summary of the jetty inspection was submitted under a separate cover to the NIRB (SRK 2014c).

Recommendations

- Continue to collect monthly thermistor string data as a minimum (July to August).
- Follow the recommendations for settlement monitoring provided in Section 7.0 of PND (2013).
- Remind operational staff annually about the operational limitations of the jetty as provided in Section 4.0 of PND (2013).

3.5 Shoreline Laydown Area

A small laydown area has been constructed adjacent to the jetty as illustrated in Figure 6. This area was initially used for the construction of office facilities, but is currently used to stage equipment, supplies and waste to be backhauled via the annual sealift return barges. The area consists of one large triangle shaped pad, connected via a short all-weather road to the construction phase helipad (now used as laydown area), and a short spur road further west (intended to join up with a mooring bollard, which has not been constructed). All of these elements are thermal rock fill pads between 1 and 2 m thick placed directly on the tundra. The main laydown pad was constructed in 2008 to final design grade; however, the road spurs were only constructed as tote roads at that time. The roads were completed to design grade, and the helipad constructed during the summer of 2008. The access road between the jetty and the Roberts Bay laydown area was widened during the 2010 construction season to facilitate barge off-loading activities.

Although this seasonal construction technique is not desirable, visual inspections show no sign of permafrost degradation, or undue settlement of any of the shoreline laydown area pads. Some natural surface overland flow is blocked by the shoreline laydown area pad, and no culverts or rock drains have been installed. There are; however, no signs of ponding upstream of the pads, suggesting that the run-of-quarry (ROQ) fill used in pad construction is sufficiently coarse to not impede drainage.

Recommendations

- No action required.

3.6 5 ML Roberts Bay Tank Farm

The Project's primary fuel storage is at three on-site locations. The purpose built, single 5 ML steel tank located in the disused Quarry #1 at Roberts Bay (Figure 7) is one of these facilities. The steel tank is placed in an engineered secondary containment facility designed and constructed by SNC Lavalin Engineers and Contractors (SLEC) in 2008. Secondary containment is provided with a double-lined system consisting of an HDPE liner overlying a geosynthetic clay liner. This liner system is protected with a gravel topping. Quality control and quality assurance were carried out during construction of the secondary containment facility (SRK 2009c and d).

The tank sits on a competent bedrock foundation, but the eastern section of the secondary containment and the fuel transfer station sit on engineered fill (compacted quarry rock) overlying a permafrost overburden foundation. Rock high walls are present along approximately 30% of the perimeter of the secondary containment. These high walls have been scaled and there are no concerns about their general condition.

Immediately north of the secondary containment area, a large deep pocket of frozen overburden soil was encountered overlying the quarry rock. During quarry development much of this overburden was relocated to a stockpile northeast of the tank farm (Quarry #1 Overburden Dump, Figure 10); however, this has resulted in areas of ponding above the north high wall of the secondary containment area. To alleviate any risk of overtopping and spilling of water into the secondary containment area, a drainage channel was constructed to convey this water away from the high wall towards the tundra, east of Quarry #1. Thaw settlement of this drainage channel has occurred, and as a result the amount of ponding increased. HBML subsequently in-filled this area with rock to construct road access to the radio tower at the apex of Quarry #1 which completely remediated this area of concern.

At the time of the inspection there was minimal ponded water inside the southeast corner of the containment area, and SRK understands that the low spots observed in previous years had been remediated through re-grading.

HBML reviewed as-built data for the secondary containment in 2011 and concluded that the required capacity to allow the fuel tank to be filled to capacity was not met. Subsequently, the fuel level in the tank was lowered to ensure compliance with appropriate regulations pending the extension of the liner to meet design capacity. At the time of the inspection, the containment area had still not been repaired but the 5 ML fuel tank had been emptied, the piping removed, and the Fuel Transfer Station had been decommissioned.

As part of the investigation to confirm the secondary containment volume, the liner was exposed along the west side of the bunded facility through careful hand excavation. These trenches have not been backfilled.

Since the fuel transfer station and part of the secondary containment are only partially constructed on bedrock, the area should be carefully monitored for any signs of settlement if the facility is re-commissioned to contain fuel.

Recommendations

- Backfill the trenches excavated to confirm liner elevation.
- Should the facility be re-commissioned, the extension of the liner should be completed to ensure design capacity and consider the installation of settlement beacons along the fuel

transfer station and on sections of the secondary containment facility not constructed on bedrock.

3.7 20 ML Roberts Bay Tank Farm

A 20 ML fuel tank farm was completed in late 2011 (Figure 8). The facility is constructed on a rock foundation which was created through drilling and blasting of a rock outcrop due south of the Roberts Bay laydown area. The high wall created is up to 17 m in height and has one catch bench. The high wall had been scaled and in areas, permanent slope stabilization had been installed in accordance with design recommendations. During the 2014 inspection, it was noted the grout around some of the rock bolts had crumbled. The IFC (SRK 2011c) drawings show 2.4 m long rock-bolts were to be installed, but no as-built drawings were produced to confirm this. A rock mechanics expert should inspect the high wall to confirm whether additional remediation is required. Rock debris within the containment area should be removed.

There are indications that runoff from the high wall is being concentrated and running into the containment area at the south end of the facility. The containment facility was designed for this, but erosion has caused silt loading which is concentrated around the sump (Figure 8) and may wash gravel off the liner. It is recommended to monitor and take remedial measures should this become worse.

The presence of high water marks along the interior slopes of the secondary containment area was observed during the 2012 inspection. The high standing water level has also resulted in erosion of the crushed rock tank pedestals and containment perimeter. This suggested that appropriate snow and water management practices were not in place for the facility leading to prolonged periods of ponding. Ponded water within the facility must be prevented. Although the ponded water does not impact the facility design capacity (due to the fact that all the tanks have not yet been constructed), it is not considered best practice and TMAC has implemented proper water management protocols. Prior to refilling the fuel tanks, the pedestals should be repaired.

In 2012, wheel and grader damage was observed along the interior slopes of the secondary containment area suggesting that due care was not taken during snow clearing activities. During the 2014 inspection, wheel damage to the interior slopes was observed behind Fuel Tank #3. The granular fill over the liner on the interior slope behind Fuel Tank #1 has slumped and the liner is exposed in several locations. In addition, the grounding cable has been lifted (Figure 8). The damaged areas should be carefully excavated, the integrity of the liner and the grounding cable confirmed, prior to storing fuel in this fuel tank farm.

Recommendations

- In the areas where the liner has been exposed and potentially damaged, the liner should be inspected and repaired, as required, by a qualified person to confirm the integrity of the bunded area before the facility is refilled.
- The exposed grounding cable behind Fuel Tank #1 should be evaluated by a qualified person to confirm it is still functioning as designed.

- Prior to refilling the fuel tanks, the pedestals and areas of the bunded area need to be reconstructed. Under Care and Maintenance no action is required (unless further erosion continues).
- Maintain improved water management practices to prevent the ponding of water and further erosion of the interior of the containment facility.
- A review of the high wall by a qualified rock mechanics expert is recommended to confirm whether additional stabilization is required.

3.8 Roberts Bay Laydown Area

The laydown area at Roberts Bay (Figure 9) is a thermal rock fill pad approximately 1 to 2 m thick, placed directly on the tundra. The pad essentially follows the natural topography in the area; however, there are some levelling tiers included. This laydown pad is intended to serve as the staging area for receipt of supplies and equipment from the annual sealift. Prior to being placed under Care and Maintenance this site was also used to house the workshop and warehousing facilities (including power generation) for the site services contractors as well as the construction fleet and spare inventory (all of which was removed in 2012). During the time of the 2014 inspection, the Roberts Bay Laydown Area hosted the incineration facilities and waste management sorting and staging areas, and other general warehousing in the form of sea cans.

The incinerator has been installed within a fully lined facility (HDPE liner), and all other fuel storage on the pad is in double-lined tanks, placed within secondary lined fuel containment berms.

The laydown pad shows no obvious signs of distress in the form of thaw settlement, and there was no evidence of ponding water on the pad. The southeastern section of the pad was constructed over a couple of drainage channels which were used to direct overland surface runoff towards Roberts Bay. There was no special care taken to place rock drains over these areas; however, a reconnaissance investigation along the perimeter toe of the pad showed no signs of standing or ponding water, suggesting that the pad is coarse enough to allow subsurface drainage. This observation is supported by the fact that where the drainage channels emerge from the pad, water was visibly flowing unimpeded from the pad. Within this general area, a large quantity of quarry rock was temporarily stored on the tundra, but this has subsequently been relocated. The contractor took great care to not damage the tundra whilst removing the quarry rock; however, the net effect is that there is a thin veneer of gravel covering the tundra vegetation. This will affect the thermal response and most likely result in a localized increase in the active layer thickness. Significant long-term thermal erosion is not expected; however, these areas should be monitored.

Recommendations

- Monitor areas where rock was relocated from the tundra for signs of thermal erosion.

3.9 Quarry #1 Overburden Dump

A temporary Overburden Dump was constructed north of Quarry #1 during its initial development (Figure 10); however, there was no sedimentation control in place at the time. A sedimentation control berm was subsequently constructed in 2011 and overburden, organics, snow and ice as well as oversize material from the quarry development for the 20 ML Fuel Tank Farm was deposited in this Overburden Dump as shown in Figure 10. Poor dumping practices resulted in no separation between the sedimentation control berm and the toe of the Overburden Dump and therefore surface runoff can flow unimpeded directly over the sedimentation control berm and onto the tundra. The sedimentation control berm was later extended in 2011, and turned into the Roberts Bay Access Road.

Following completion of dumping, the surface of the pile was levelled and covered with a layer of surfacing material to allow the pile to be used as a general laydown area. During the 2011 inspection, the surface had several large sinkholes, located at the entrance, which are simply a function of the fact that the pile contains large voids and the fine grained surfacing material is falling through as the pile undergoes settlement and snow and ice lenses melt. At the time of the 2014 inspection, surfacing material had been placed over the sinkholes so that only a couple remain. The entire laydown had been cleaned up and only the waste bin remains in the laydown area. Should the Overburden Dump be used as a laydown and storage area in the future, appropriate management protocols will be required to monitor sinkhole development and overall differential settlement along with regular maintenance.

Recommendations

- Monitor surface runoff and consider requirement for alternate sedimentation control measures.

3.10 Airstrip

The all-weather airstrip (runway) is 900 m long, 23 m wide and is a 2 m thick thermal rock fill pad constructed directly on the tundra (Figure 11). At each end of the runway there is an apron which measures about 80 m x 50 m. The base course of the airstrip consists of ROQ material, followed by a layer of 2-inch crush. The surfacing material is a ¾-inch gravel topping layer. The north end of the airstrip, up to the first drainage crossing was constructed in 2007, and the remainder was completed in 2008. An airstrip expansion was partially completed in 2011 which would increase the airstrip length to 1,900 m and its width to 45 m. The north airstrip apron extension was also completed in 2011.

This airstrip doubles as the main access road between Roberts Bay and the Doris North Camp, and traffic control is managed via access control booms at each end of the runway. A permanent aircraft control tower is located on the north apron, complete with a portable wash station and power supply. Fuel for the generator is stored in a double-walled fuel tank housed in a portable secondary containment berm. Drummed jet fuel is also housed in a portable secondary containment berm. Both of these facilities are located right on the shoulder of the apron.

The airstrip is equipped with permanent runway lights (power supplied by the generator at the control tower), Global Positioning System (GPS) approach instrumentation, and a standard windsock. During installation of the runway lighting and windsock, temporary rock fill roads were pushed out onto the tundra. During the removal of these roads, care was taken not to damage the tundra; however, that meant that a thin veneer of gravel was left behind. This will likely affect the thermal response of the active layer and these areas should be monitored for signs of thermal erosion.

There are two ephemeral drainage channels passing under the airstrip, and at each of these locations rock drains were installed to allow unimpeded flow of water. At the location of the two rock drains, flow appears to be unimpeded suggesting that they are functioning as intended.

The airstrip has required a significant amount of maintenance since its completion in 2008, which according to the staff was mostly a result of frequent construction traffic passing over the runway. Some of the maintenance can also be ascribed to ongoing settlement. The settlement is to be expected, since the airstrip was not completely constructed to design grade during the winter, and as such, the active layer was suppressed which would result in consolidation settlement within the active layer. There were small tension cracks along the west side of the airstrip while no tension cracks were observed along the east side at the time of the inspection, which supports the observation that minor settlement is still occurring; however, the manifestation of these cracks are also partially as a result of the over-steepened shoulders. Based on site feedback, the level of maintenance was decreased in 2011 and minimal maintenance was carried out since, suggesting a steady state condition is being approached.

Although no water was present during the inspection, there was clear evidence of significant ponding of water against the airstrip, which would result in thermal erosion, in turn leading to increased runway settlement. It is understood that there is a management protocol in place whereby ponding is pumped out; therefore, this is likely not a significant contributing factor to runway settlement.

Significant tension cracks along the edges of the north apron, behind the control tower, were observed. The tension cracks behind the control tower and jet fuel drums should be repaired as these tension cracks could undermine the control tower and jet fuel drums which could lead to the collapse of the control tower or create a fuel spill from the jet fuel drums.

Recommendations

- Monitor areas where rock was relocated from the tundra for signs of thermal erosion.
- Repair the tension cracks and erosion gullies on the north apron behind the control tower.

3.11 All-Weather Roads (Doris Site)

The following all-weather roads have been constructed on site, as illustrated in Figures 2 and 3:

- The Roberts Bay Access Road, a 120 m long, 8.3 m wide single lane link between Quarry #1 Overburden Dump and shoreline in support of the fuel offloading barges;
- The Jetty Road, a 250 m long, 10 m wide single lane link between the Jetty and Roberts Bay laydown area;
- The North Primary Road, a 600 m long, 8.3 m wide single lane link between Roberts Bay laydown area and the north airstrip apron;

- The South Primary Road, a 2.6 km long, 8.3 m wide single lane link between the south airstrip apron and Doris North Camp;
- The ANFO Mixing Plant, a 75 m long, 8.3 m wide single lane spur from the South Primary Road to the wash bay;
- The Quarry #2 Access Road, a 300 m long, 8.3 m wide single lane spur from the South Primary Road to Quarry #2;
- The Float Plane Dock Access Road, an 870 m long, 8.3 m wide single lane link between Doris North Camp and Doris Lake;
- The Secondary Road, a 1,570 m long, 8.3 m wide single lane link between Doris North Camp and North Dam and Frozen Core Plant pad (also called the Tail Lake Road); and
- The Tail Lake Access Road, a 260 m long 8.3 m wide single lane link between the Frozen Core Plant pad and the Tail Lake fish-out pad.

The roads are above grade thermal rock fill pads constructed directly on the tundra. Road fill thickness is variable between 1 m up to 3 m. The roads have been constructed with ROQ material with a surfacing layer of 1 ½” minus crush rock. All roads are single lane roads with turnouts. There are no culverts or rock drains under the roads to allow drainage of overland surface runoff flow. Visual inspection revealed that there are only a few isolated areas where ponding exists along the toe of the roads, suggesting that the fill material is generally sufficiently coarse to not impede flow. Where ponding does occur, it appears to be associated with areas of the tundra where construction damage occurred. There were no signs of thermal erosion, but these ponded areas should be monitored and pumped out during freshet and after significant or prolonged rainfall events.

As per the *Mines Act*, road turnouts were constructed every four truck-lengths to facilitate road construction. Many of these have been picked up, and since care was taken not to damage the tundra, a thin veneer of gravel remains present at these locations. This gravel will change the thermal response of the underlying soils and these areas should be monitored for signs of thermal erosion.

A surficial slope failure occurred in August 2010 during construction of the Secondary Road at approximately chainage 0+550 (Figure 21). At the time, construction in this area was stopped and a temporary bypass was constructed. The ground was allowed to freeze during the subsequent winter season and road construction commenced completing this section of road in April 2011. SRK recommended that a buttress be constructed at the same time to ensure that the failure not remobilize. This buttress was not constructed; however, no further movement in the road shoulder was observed during the subsequent annual geotechnical inspections.

Recommendations

- Monitor areas where rock was relocated from the tundra for signs of thermal erosion.
- The buttress recommended for the Secondary Road should be constructed; and until such time, a visual monitoring system should be put in place and warning signs posted along the section in question.

3.12 Doris Creek Bridge

The Secondary Road crosses Doris Creek via a single span prefabricated bridge constructed on two thermal pad abutments (Figure 21). The bridge was constructed in 2010. Two thermistor strings were installed in 2011 (one in each abutment) to monitor the integrity of permafrost conditions. In 2013, readings from these thermistor cables were taken at the end of July and August. Although the correct instrument was used to collect the readings, it appears the instrument was set to the wrong thermistor bead resistivity as the recorded temperature values are not consistent with the previous sets of data. As a result, the 2013 readings have not been included with the data provided in Appendix A.

Visual inspection revealed no issues of concern other than the poorly constructed rock gabions. The deformation of the gabions does not appear to have become worse since the 2012 inspection, but the gabions should be monitored and replaced when appropriate.

Recommendations

- Ensure the correct thermistor reader, set to the correct thermistor bead resistivity, is used for each thermistor cable as listed on the Doris Thermistor Data Field Sheet.
- Monitor and ultimately replace the rock gabions.

3.13 Wash Bay/Explosives Mixing Plant

The wash bay pad housed a large modular building with a smaller adjoining modular building; a wooden shack, stored behind the large modular building; and a Weatherhaven, with an associated double walled fuel tank, located on the other side of the pad. The Weatherhaven and the double walled fuel tank have been removed. The large modular building was used for the ANFO emulsion plant. The ANFO emulsion plant has been removed so only the bunded area on the ground and electrical panels remain. The pad is a thermal rock fill pad about 1 m thick. There are small tension cracks, along the east side of the rockfill pad. Visual inspection showed no signs of ponding at the toe of the pad (Figure 11).

Recommendations

- No action required.

3.14 Upper and Lower Reagent Pads

Between the airstrip and the Doris North Camp, two large laydown areas have been constructed (Figure 12). These areas, which are at two different elevations, are called the Upper and Lower Reagent pads. Prior to the site being placed under Care and Maintenance the Lower Pad was used as the primary sea can storage and warehousing area. The Upper Reagent Pad was used for sea can storage as well as a general laydown yard for equipment and construction supplies. These pads became the general staging area for demobilization during the 2012 sealift. These pads were constructed to cover and mitigate an area of permafrost degradation which was inadvertently caused as part of the 2008 construction activities. The pads range between 1 to 3 m thick, and there are no concerns associated with them based on the visual inspection.

Recommendations

- No action required.

3.15 Quarry #2 and Crusher Area

At the time of the inspection Quarry #2 was inactive. This quarry was continuously used as the primary source of construction materials for the Project. The quarry was developed using two benches, each about 6 m high, as illustrated in Figure 13. There were no signs of standing water on either of the quarry benches, and no evidence of overland surface runoff flowing uncontrolled onto the tundra. There are no significant natural water bodies near the quarry site and therefore no risk of an uncontrolled sediment release into a water body. The area is managed under an approved Quarry Management Plan (SRK 2014).

Prior to development of the quarry, a significant amount of overburden (frozen silt and clay) was stripped and stockpiled on the tundra in an area immediately east of the quarry. Some of this overburden was relocated to an area northeast of the quarry, spread out and levelled, covered with crushed rock, and is used as a core storage area, the burn pit for approved combustible construction materials, and the landfarm site (Figure 13). During the 2013 inspection it was noted, at the north end of Quarry #2 and across from the landfarm next to the gate, drill cuttings had been dumped along the side of the access road. SRK understands that no further drill cuttings have been dumped in this area.

The construction crusher was relocated from the old Crusher Pad (new Batch Plant Pad) to a disused part in the north end of the quarry in late 2010, but had been dismantled and removed from the site in 2012. At the time of the 2014 inspection, multiple stockpiles of various crusher products had been stockpiled in this area of Quarry #2.

Recommendations

- A barricade at the Quarry #2 entrance is recommended.

3.16 Batch Plant Pad (Previously Crusher Pad)

At the junction between the South Primary Road to the camp and the Quarry #2 Access Road (Figure 2), a 1 m thick ROQ pad measuring about 125 m x 125 m has been constructed (Figure 12), linking up with the Lower Reagent Pad. This thermal pad originally housed the construction crusher plant, crusher power and fuel supply, as well as stockpiles of crushed rock; however, it now houses a prefabricated building which contained the concrete batch mixing plant. Fuel supply for the plant is a double-walled steel tank placed in a secondary containment facility immediately outside the building. A stockpile of 6-inch crush product remains on part of the pad along with some sea cans.

Visual inspection of the pad perimeter showed no signs of standing water, and given the fact that this pad has been constructed on the natural watershed divide, surface overland flow is limited.

Recommendations

- No action is required.

3.17 Upper Reagent Pad AN Storage

At the south end of the Upper Reagent Pad (Figure 12) a lined bulk ammonium nitrate (AN) storage area was constructed by HBML in 2012. No formal design for this facility was prepared and construction was carried out with no designated design, quality control or quality assurance. No as-built drawings exist. Without knowing the appropriate design data, it is not apparent whether there is appropriate containment capacity and whether there is sufficient liner protection material. During the 2014 inspection, there was no AM stored in the facility and sections of liner are exposed along the crest of the bunded area.

Recommendations

- Should the facility be used to provide secondary containment, the design criteria must be confirmed and appropriate remedial measures must be implemented. Under Care and Maintenance no action is required.

3.18 Landfarm

A landfarm has been constructed immediately northeast of Quarry #2 as shown in Figure 13. The fully lined facility consists of three cells: a clean water pond which only contains water that is suitable for discharge to the tundra; a snow pond which contains contaminated snow in winter, effluent consolidated from smaller fuel storage secondary containment berms around site, or treated water from the soil pond prior to being discharged onto the tundra once it meets discharge criteria; and one for remediating lighter hydrocarbon fraction contaminated soils. Contaminated soils that cannot be remediated within the landfarm are shipped off site. The Landfarm Management Plan (SRK 2014d) governs the management of this facility and describes the proper use of each cell.

The landfarm has been constructed on a levelled pad consisting of a random mix of overburden, organics, snow and ice, and oversize material from early Quarry #2 development. To minimize the risk of differential settlement the landfarm foundation was designed to include a layer of woven geotextile; however, this facility should be monitored for signs of differential settlement. During the 2014 inspection, the Soil Containment Pond's outside berm face, closest to the Primary Road, had a small sinkhole which shows evidence of healing over. The sinkhole is simply due to fines migrating through to the coarse underlying ROQ material. There are several large rocks within the Soil Containment Pond that should be removed to prevent damage to the liner. The Snow Containment Pond showed signs of significant ponding of water and silt accumulation in the bottom. There is a large pothole at the bottom of the access ramp as water has been allowed to be discharged at this location. There are also two depressions, in the access ramp, from tires spinning because of the loss of traction.

Recommendations

- Conduct regular visual inspections to monitor for signs of differential settlement.
- Repair the sinkhole along the outside berm face of the Soil Containment Pond.
- Repair the pothole and depressions in the access ramp into Snow Containment Pond.
- Discharges into the Snow Containment Pond should be onto a protective barrier to prevent erosion.

3.19 Sewage Treatment Plant Outfall

The Sewage Treatment Plant outfall used to discharge treated effluent directly onto the tundra is immediately south of the Crusher Pad (Figure 13). Visual inspection during 2010 and 2011 confirmed there was significant ponding of water; and tundra vegetation die back had started with associated erosion damage. In 2012, fill was placed within the depressions to prevent additional erosion and a new diffuser system was constructed and put into operation with a discharge location further to the west with the diffuser located on a bedrock outcrop. In 2013 permission was given to use the old outfall location when there are limited numbers of people on site. The new diffuser system has not been used since 2012 and requires repairs.

Recommendations

- Monitor for permafrost degradation at old outfall location.
- No action is required for the new diffuser system, at this time.

3.20 Quarry #2 Overburden Dump

A permanent overburden dump has been constructed east of Quarry #2 as shown in Figure 13. Overburden stripped from Quarries # 2 and #4, and oversized quarry rock that was not suitable for construction is hauled to this location. Material was end dumped and then spread with a dozer. The overall dump construction consists of a series of cells, primarily to facilitate constructability. The material is therefore a random mix of organics, marine silts and clays, and quarry rock. A sedimentation berm has been constructed downstream of the overburden dump to ensure that no sediment is released from the dump area. At the time of inspection the area was dry.

Recommendations

- No action required.

3.21 Doris North Camp Pads

The Doris North Camp area is also the designated Quarry #4 area as illustrated in Figures 14 through 17. The permanent camp has been constructed on a bedrock foundation which was achieved through a benched cut with a high wall at the north side of the camp (Pad X). This pad is increased in size via a fill zone extended to the south placed directly on tundra. This pad is variable in thickness but generally at least 1 m thick. Two lower fill pads (Pads E/P and Y) are about 2 m lower than the upper pad which provides additional space for camp facilities.

The upper camp pad (Pad X) houses the camp, temporary power generation station, equipment storage shed, the sewage treatment plant, fire water tank and pump house, and a muster station.

The lower camp pads (Pads E/P and Y) houses the old underground equipment maintenance shop (presently used as the surface equipment maintenance shop), warehousing, exploration support facilities, and other miscellaneous camp services.

Immediately south of the lower camp pads is the helipad, which houses four helicopter pads, a helicopter base station as well as other related support facilities. Towards the east, immediately below the portal, are two pads that were to serve as primary support for the mining activities (Pads F and G). At the time of the inspection, the underground drilling contractor’s shop and warehousing facilities, as well as general mining supplies had been removed with only a few sea cans and underground construction supplies remaining on Pad G. The empty contractor’s shop and warehousing facilities are located on Pad F. On Pad L, there remains the underground air-supply, power generators, brine mixing facility and a few sea cans.

Immediately northeast of the camp, a rock excavation was completed which now houses the primary 7.5 ML Doris North Camp Fuel Tank Farm (Pad R). South of this facility, the permanent power house for the site has been constructed on a levelled rock fill pad (Pad B). Between these facilities and the portal is another rock excavation which will form the foundation of the mill building (Pad D). A temporary lined facility, which was used as part of the interim site water management plan was removed from this location at the end of 2013.

Between the mill pad (Pad D) and the portal (Pad L) is an elevated ore storage pad (Pad Q/H/J), and immediately below the mill pad (Pad D) is the waste rock pile (Pad I). Downslope of the facilities, at the natural collection point for the site, are the Sedimentation and Pollution Control ponds.

All of the pads mentioned above, range in thickness between at least 1 m and up to 6 m thick. All of the pads have been designed as thermal pads to preserve the underlying permafrost. By design, no permanent heated buildings are to be constructed directly onto these pads; however, at the time of the inspection the geotechnical core cutting building and warehouse building (on Pad Y) as well as the old underground maintenance shop (on Pad E/P) did not comply. These heat sources may lead to permafrost degradation, which in turn would lead to foundation settlement. There would be no short-term concerns; however, TMAC should closely monitor for signs of settlement and take appropriate remedial measures, if required.

Visual inspection of the camp pad perimeter showed no signs of ponding water, and there was no ponding water visible anywhere on any of the pad surfaces. The high wall behind the camp, on Pad X, has been scaled clean, and a catch berm has been constructed behind wooden cabins, immediately beneath the wall and along the base of the entire length of the high wall in case rocks loosen and fall from the highly fractured face. Appropriate barricades and signage have not been put in-place to keep people and equipment at a safe distance from the wall.

The high walls behind the 7.5 ML Doris North Camp Fuel Tank Farm (Pad R) and the mill pad (Pad D) were scaled clean, and were generally in good condition. Recommendations for permanent stabilization of these walls were provided in 2011, but have not been implemented (SRK 2011d). As a result, rocks have fallen from the high walls onto the pad surfaces.

Recommendations

- Install appropriate signage and barricades to warn people of the high wall danger on Pads D and X.
- High wall stabilization measures designed for the mill pad should be installed as planned if the Project moves beyond Care and Maintenance.
- Develop and implement a differential settlement monitoring protocol for the heated buildings (the geotechnical core cutting building and the warehouse building (on Pad Y) as well as the old underground maintenance shop (on Pad E/P)) constructed directly onto the thermal rock fill pads.

3.22 7.5 ML Doris North Camp Tank Farm

The primary camp fuel supply is contained within the 7.5 ML Doris North Fuel Tank Farm constructed on a blasted rock foundation immediately north of the camp (Pad R, Figure 14). This facility was completed in 2010. At the time of the inspection there was no visible ponding, but there are clear signs of ponding which drains towards the engineered sump. This water is pumped from the facility in accordance with the site Interim Water Management Plan (SRK 2012c). Crushed rock pedestals have been constructed to support the piping between the fuel tanks. From the 2011 as-built drawings, the total minimum containment design requirement is 2,339 m^3 and there is an additional containment of 569 m^3 (SRK 2011e).

The high wall behind the tank farm was scaled and is in good condition; however, long term stabilization measures, which have been designed, should be implemented as rock debris has fallen from the high wall into the bunded area (SRK 2011d).

Recommendations

- High wall stabilization measures designed for the 7.5 ML Tank Farm should be installed as planned (SRK 2011d).

3.23 Power Generation Station (Pad B)

The main camp power plant has been constructed on Pad B immediately south of the 7.5 ML Doris North Camp Fuel Tank Farm (Figure 14). This thick pad (up to 6 m in places) is founded on ice rich permafrost marine silts and clays, and is therefore subject to differential settlement. This pad houses the power plant which is a heated, large and heavy structure constructed on concrete footings located close to steep angle of repose rock fill slopes. This structure generates heat and vibrations and a failure could result in loss of life. There are also two 30 m tall exhaust stacks constructed on a concrete spread footing with no additional stabilization. Two monitoring points were installed in 2013. A monitoring system needs to be put in place to provide advance warming of any deformation.

Recommendations

- Monitor the survey monuments on Pad B to allow for tracking and advance notice of any deformations as part of the annual survey.

3.24 Other Site Wide Fuel Storage

A number of other double-lined fuel tanks were scattered throughout the site during construction activities. All of these tanks had been placed in lined secondary containment or lined spill containment trays. These double lined fuel tanks have been emptied and demobilized from site.

Recommendations

- No action required.

3.25 Sedimentation and Pollution Control Ponds

All non-contact and contact water from the Doris North camp pads flows to the Sedimentation and Pollution Control ponds respectively (Figure 17). Both ponds were designed with downstream liners keyed and frozen into the permafrost, but without bottom liners. The ponds were constructed and commissioned in the late spring of 2011, but it was noted the Sedimentation and Pollution Control ponds were not retaining water. The primary mode of leakage was water bypassing the liner that was supposed to be keyed into the permafrost. The most likely cause of this was due to the late season construction of the ponds, in May of 2011, which meant there was no time for the liner to freeze-back into the permafrost prior to spring freshet. In the fall of 2011, a decision was subsequently made to reconstruct both ponds; the Sedimentation Control Pond was completely lined and the Pollution Control Pond had its key trench and liner extended down into the permafrost. In addition, two downstream sumps (Section 3.26) were constructed to allow collection of any water that does manage to bypass any of the reconstructed ponds.

To monitor performance of the Pollution Control Pond three ground temperature cables were installed in the spring of 2012. To date, all monitoring data confirms frozen ground conditions, which suggests the Pollution Control Pond is performing as designed and is not leaking (Appendix A). Notwithstanding this, the Pollution Control Pond is operated as normally empty, meaning that water is not allowed to accumulate for prolonged periods to prevent any chance of the foundation thawing.

The 2012 inspection revealed the interior benches of the Pollution Control Pond showed signs of differential settlement as observed by the tension cracks. During the 2013 and 2014 inspections, these tension cracks had not increased in size suggesting steady state conditions have developed. A pump located within the Pollution Control Pond has been used to actively keep the water levels low. At the time of the 2014 inspection, only a minor amount of standing water was observed in the southeast corner of the Pollution Control Pond. The interior surface of the Pollution Control Pond shows signs of permafrost degradation due to ground disturbance during construction activities and increased surface water runoff but, as mentioned above, the monitoring data confirms the Pollution Control Pond is performing as designed.

At the time of the 2014 inspection, there was water in the base of the Sedimentation Control Pond. The liner in the upper northeast corner of the Sedimentation Control Pond appears to have been cut at regular intervals, possibly due to handling. The overlap between two liners, at the north end of the Separator/Divider Berm, has not been sealed. Over liner material and a large rock from the Separator/Diversion Berm have washed down over the liner into the Sedimentation Control Pond. This is causing the liner to sag. Another large rock has fallen into the base of the Sedimentation Control Pond in the west corner.

Recommendations

- Remove the large rocks and over liner material from the exposed liner within the Sedimentation Control Pond.
- Conduct regular monitoring of the thermal data for the Pollution Control Pond.

3.26 Sumps #1 and #2

Two sumps (Figure 17) were constructed within the tundra to capture the water that may bypass the reconstructed Sedimentation and Pollution Control ponds. Sump #1 was full of water while Sump #2 was empty during the time of the inspection. Perimeter permafrost degradation was observed around Sump #1. This was to be expected and the depression around the steel sump should be backfilled with the saved and stockpiled overburden material, and covered with coconut matting. Sump #2 appeared to be in good condition. It was confirmed with site staff that both sumps are being pumped on an ongoing basis.

Recommendation

- Backfill the depression around Sump #1 with overburden to prevent further permafrost degradation.

3.27 Doris North Portal

Mine development started in 2010 and at the time of the inspection the portal had been backfilled with waste rock and covered with wire mesh bolted to the ceiling. A steel and wire gate with warning signs had been placed close to the portal entrance. The high wall above the collar had been scaled and meshed in accordance with recommendations of a specialist. The collar had been properly supported in accordance with recommendations of a specialist (Figure 15).

Recommendations

- No action required.

3.28 Waste Rock Pile

In 2010, waste rock from mine development was brought up via the portal and dumped on the waste rock pile on Pad I. The Waste Rock Management Plan (SRK 2010) outlines how waste was characterized, tested, and how segregated placement was carried out. During continued underground development in 2011 and 2012, discussions with site staff indicated appropriate protocols were being followed while waste rock was placed on Pad I. The majority of Pad I has been covered with waste rock. No waste rock has been place on Pad I since the Project went into Care and Maintenance in 2012. In 2014, saline drill cuttings from the exploration drill programs were being dumped at two locations on the waste rock pile. Initially saline drill cuttings were being dumped at the east side of the waste rock pile, but concern that the saline water runoff would not be captured by the Pollution Control Pond (Section 3.25) resulted in the saline drill cuttings being dumped at the west side of the waste rock pile later in the year. During the 2014 inspection, evidence of water flowing from the base of the waste rock pile and from the toe of Pad I was observed. This runoff water is being captured by the Pollution Control Pond. It was also observed that tension cracks have started to form along the edge of Pad I where it forms the upper limit of the Pollution Control Pond (Figure 17). These tension cracks are a results of permafrost degradation but do not affect the integrity of Pad I.

Recommendations

- Once underground development resumes, TMAC should continue to follow the designated Waste Rock Management Plan (SRK 2014f).

3.29 Temporary Pond

A 6,000 m^3 total capacity lined Temporary Pond was constructed on the Mill Pad (Pad D) in early 2011 as part of the 2011 Interim Water Management Plan. The pond was constructed using compacted waste rock berms and a HDPE liner (Figure 16). The pond was founded on bedrock and the liner was bedded in ¾-in gravel. The Temporary Pond was decommissioned at the end of the season in 2013. At the time of the 2014 inspection, a section of the ROQ berm and all of the liner had been removed.

Recommendations

- No action required.

3.30 Doris Fresh Water Intake

A small thermal pad has been constructed on the shoreline of Doris Lake to support the fresh water intake facilities which consist of a pump house, emergency back-up generator and fuel supply. The fuel tank is a double-walled steel tank within a lined spill containment tray. A removable boat dock extends from the pad during the open water season.

Visual inspection of the pad toe showed no signs of ponding or thermal erosion. There appears to have been a release of water from the intake pipe sometime in the past, as there are erosion gullies leading from the pump house down to the tundra (Figure 15).

Recommendations

- No action required.

3.31 Doris Primary Vent Raise Pad

The Doris North primary vent raise is located along the Secondary Road (Figure 21). A rock fill pad had been constructed using a cut/fill method such that the vent raise could be collared on competent bedrock. The tiered pad houses the vent raise collar building on the upper platform, and a lined fuel containment area on the lower platform. A 2 to 3 m high wall exists around the collar, and is generally in good shape having been scaled during construction. Like the other rock high walls, rocks have fallen from the high wall onto the pad surfaces. A catch berm like the one behind the Doris North Camp, should be constructed immediately beneath the wall and along the base of the entire length of the high wall in case rocks loosen and fall from the highly fractured face. Appropriate barricades and signage should be put in-place to keep people and equipment at a safe distance from the wall. Visual inspection shows no signs of ponding or permafrost damage.

The Primary Vent Raise was never commissioned so the fuel transfer station located within a lined facility was never filled.

Recommendations

- Install catch berm and appropriate signage along high wall.

3.32 Frozen Core Plant Pad

A 1 to 2 m thick thermal pad was constructed due north of the North Dam alignment along the Secondary Road to support construction of the North Dam (Figure 22). A prefabricated building was located on this pad that housed the asphalt plant used for mixing the saturated core material used in dam construction. The asphalt plant and prefabricated building was removed in 2012, but there are four small stockpiles of crushed rock material on the remaining space on the pad. Visual inspection of the pad toe showed no signs of ponding or thermal erosion.

Recommendations

- No action required.

3.33 Doris North Camp Diversion Berm

The diversion berm, north of Doris Camp diverts clean surface water runoff towards the Overburden Stockpile area via two culverts that pass under the Primary Road. This reduces the volume of water reporting to the Sedimentation and Pollution Control ponds. The diversion berm is in good condition. Non-contact surface run off water is being pumped from where it ponds along the upstream edge of Pad Q/H/J over the diversion berm. The discharge of the pumped water has washed away the protective layer of the over liner crushed material exposing the liner (Figure 16). The exposed liner should be recovered with crushed material.

Recommendations

- Repair area of exposed liner next to where the water line passes over the berm.

3.34 Doris-Windy All-Weather Road

The Doris-Windy road is a 10 km all-weather road that stretches from the Doris Camp, due south to the Windy Camp (Figure 18). The road is an 8.3 m wide single lane road with turnouts designed based on lines of sight. Construction of this road started during the winter of 2009/2010 and was completed in 2011. In 2013, 2-inch crush was placed as a surfacing layer from 8+600 to the end of the alignment at 9+733. During the 2013 inspection, a large dip at the start of the Doris-Windy Road at the entrance to the helipad was observed. This was backfilled and brought back up to grade prior to the 2014 inspection; however, at the junction of the Primary Road, Float Plane Dock Access Road and Doris-Windy All-Weather Road the rock fill is only 0.5 m thick with surface water running into west side of the junction (Figure 15).

The Doris-Windy All-Weather Road is above grade thermal rock fill pad constructed directly on the tundra. Road fill thickness is variable between 1 m to over 2 m. The road has been constructed with ROQ material with a surfacing layer of 2-inch crush material. There are no culverts or rock drains under the road to allow drainage of overland surface runoff flow. Visual inspection revealed that there are only a few isolated areas where ponding exists along the toe of the road, suggesting that the fill material is generally sufficiently coarse to not impede flow. Where ponding does occur, it appears to be associated with areas of the tundra where construction damage occurred. There were no signs of thermal erosion.

Some cracking along the shoulder of the road can be observed along sections which is most likely a result of settlement of the shoulders. A few potholes were also observed at the abutments of the stream crossings, and these are likely due to the fact that the surfacing layer is infilling the larger voids of the underlying ROQ material.

As per the *Mines Act*, road turnouts were constructed every four truck-lengths to facilitate road construction. Many of these have been picked up, and since care was taken not to damage the tundra, a thin veneer of gravel remains present at these locations. This gravel will change the thermal response of the underlying soils and these areas should be monitored for signs of thermal erosion.

Two caribou crossings were constructed in 2011 along the route alignment based on locations recommended by the landowner.

Recommendations

- Monitor areas where rock was relocated from the tundra for signs of thermal erosion.

3.35 Doris-Windy All-Weather Road Stream Crossings

There are four designated Stream Crossings along the Doris-Windy All-Weather Road (Figure 19). The first Stream Crossing was installed in 2010 and consists of an arch culvert. The culvert is founded on add-freeze piles. The inspection revealed no major concerns. The web of the I-beam, on top of the fourth pile from the northwest corner of the culvert, has buckled. This deformation has not increased since it was first noticed during the 2012 inspection, but should continue to be monitored. Structural repairs would be required if this deformation increases.

The bridges with thermal pad abutments have been installed over the remaining Stream Crossings. The abutment integrity is monitored using thermistor cables. In 2013, readings from these thermistor cables were taken at the end of July and August. Although the correct instrument was used to collect the readings, it appears the instrument was set to the wrong thermistor bead resistivity as the recorded temperature values are not consistent with the previous sets of data. As a result, the 2013 readings have not been included with the data provided in Appendix A.

The two bridges at Stream Crossings #2 and #3 have gaps between the bridge superstructure railings. Additional railings should be installed as the drop-off at the opening is greater than 3 m. During the 2014 inspection, depressions and ponded water was observed against the southwest abutment of Stream Crossing #3, as well as the west side of the central abutment of the two bridges. These areas should be covered with rock fill to prevent thermal degradation of the permafrost.

It appears the bridge over Stream Crossing #3 has been shifted due to an impact. This is evident by the decking having been shifted and the wooden timber along the west side, at the north end of the bridge, has impact damage. The timber retaining wall at the southwest abutment, of the bridge, has also been shifted (Figure 19).

There are no issues with the bridge crossing at the Stream Crossing #4.

Recommendations

- Ensure the correct thermistor reader, set to the correct thermistor bead resistivity, is used for each thermistor cable as listed on the Doris Thermistor Data Field Sheet.
- Install additional railings between the two bridge superstructures at Stream Crossings #2 and #3.
- The depressions and ponded water against the thermal pad abutments at Stream Crossing #3 should be covered with rock fill to prevent thermal degradation of the permafrost.
- Inspection of the bridge over Stream Crossing #3, by a qualified structural engineer should be conducted. Any repairs/remediation to the bridge should be completed under the supervision of a qualified person.

3.36 Doris-Windy All-Weather Road Quarries (A, B, and D)

Three rock quarries were designated and used to construct the Doris-Windy All-Weather Road as illustrated in Figure 20. At the time of the inspection, none of these quarries were in use; however, all three quarries may be used at some time in future. Currently Quarry A is used as a temporary explosives storage area and it houses an access road and two Type 4 magazines.

Quarry B was used during the demobilization stage to detonate all excess explosives on site and therefore contains a very large quantity of fine rock dust laden with explosives residue. This quarry houses five Type 4 magazines, relocated from the Old Beach Laydown Area, in Roberts Bay. Ponded water was observed at the rock high wall at the south end of the quarry but the likelihood of drainage water leaving the quarry is low. A sump has been excavated in the centre of the quarry to collect any surface water run-off. This water should be closely monitored as any discharge is likely to exceed water quality criteria.

Quarry D was designed to ultimately become the new Windy Camp, but it was never fully developed. An overburden dump was constructed across the access road and is being used to store core from Windy Camp as well as contaminated soil excavated from the Patch Lake Drill Shop stored in tote bags. The 204 tote bags were subsequently moved to Roberts Bay. A bunded and lined facility has been constructed at the western edge of Quarry D next to the tote bags of drill cuttings. The bottom of the facility is covered with wooden pallets to protect the liner. SRK is not aware of any formal design for this facility and if construction was carried out with any designated quality control or quality assurance. No as-built drawings exist. Without knowing the appropriate design data, it is not apparent whether there is appropriate containment capacity.

There were no signs of standing water on either of the quarry benches, and no evidence of overland surface runoff flowing uncontrolled onto the tundra. There are no natural water bodies near any of the quarry sites, and therefore, no risk of an uncontrolled sediment release into a water body. Management of the Quarries is governed by the Quarry Management Plan (SRK 2014e).

Recommendations

- Should the bunded and lined facility, within Quarry D, be used to provide secondary containment, the design criteria must be confirmed and appropriate remedial measures must be implemented. Under Care and Maintenance no action is required.

4 Summary of Recommendations

This report provides a performance assessment of the numerous foundation pads and infrastructure at the Doris North Project site. The findings are based on a site visit and walkover survey between July 15 to 22, 2014 and subsequent consultation with site staff. This is the sixth formal annual geotechnical inspection undertaken at this site. The site is currently under Care and Maintenance, with limited exploration activities, and therefore many of the remedial recommendations identified during this geotechnical investigation are likely to be addressed as part of the Care and Maintenance operations.

Table 2 below provides a summary of the inspection components and the primary recommendations stemming from the inspection.

Table 2: Summary of Inspection Items and Associated Recommendations

Inspection Item	2013 Recommendations	2014 Recommendations
Thermistors	• Re-evaluate thermistor requirements taking into considering the surface infrastructure elements currently on site. Where appropriate, inactive thermistors should be inspected and where practical they should be repaired and re-commissioned for the collection of baseline data. • Inspect and evaluate if the thermistors marked as “Status Unknown” are active. • Include Westbay Well thermistors in monitoring program. • The thermistor monitoring frequency was reduced under Care and Maintenance with a couple sets of readings taken around the maximum thermal activity expected in the area, i.e. in July or August (maximum thaw depth). This should continue until the project is started up again. • North Dam thermistor data must continue to be collected in accordance with the monitoring recommendations provided in Section 7 of the North Dam As-Built Report (SRK 2012b) and Section 3 of the North Dam Monitoring Standard Operating Procedures Report (2013b).	• Repair thermistor installations identified in Appendix E. • Include the Westbay Well thermistors as part of the monitoring program. • The thermistor string monitoring frequency was reduced under Care and Maintenance with readings of a couple sets taken around the maximum thermal activity expected in the area, i.e., in July or August (maximum thaw depth). This should continue until the Project is started up again.
Old Beach Laydown Area	• Relocate two of the explosives magazines to an area where they are on the sandy beach as opposed to partially on the tundra vegetation.	• No action required.
Roberts Bay Jetty	• Continue monitoring the jetty thermistor in accordance with the protocols stipulated in Section 3.2. • If the project moves beyond Care and Maintenance, repair or replace the damaged thermistor SRK-JT2-12. • Follow the recommendations for construction and monitoring provided by PND (2013).	• Continue to collect monthly thermistor string data as a minimum (July to August). • Follow the recommendations for settlement monitoring provided in Section 7.0 of PND (2013). • Remind operational staff annually about the operational limitations of the jetty as provided in Section 4.0 of PND (2013).
Shoreline Laydown Area	• Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion.	• No action required.
5 ML Roberts Bay Tank Farm	• Backfill the trenches excavated to confirm liner elevation. • Should the facility be re-commissioned, the liner repairs should be completed to ensure design capacity and consider the installation of settlement beacons along the fuel transfer station and on sections of the secondary containment facility not constructed on bedrock.	• Backfill the trenches excavated to confirm liner elevation. • Should the facility be re-commissioned, the extension of the liner should be completed to ensure design capacity and consider the installation of settlement beacons along the fuel transfer station and on sections of the secondary containment facility not constructed on bedrock.

Inspection Item	2013 Recommendations	2014 Recommendations
20 ML Roberts Bay Tank Farm	• In the areas were there has been potential for the liner to be compromised, it should be exposed and evaluated by a qualified person to confirm the integrity of the bunded area before the facility is refilled. • Prior to refilling the fuel tanks the pedestals and area of the bunded area need to be reconstructed. Under Care and Maintenance, no action is required (unless further erosion continues). • Maintain improved water management practices to prevent the ponding of water and further erosion of the interior on the containment facility. • Additional high wall stabilization and management practices should be considered.	• In the areas where the liner has been exposed and potentially damaged, the liner should be inspected and repaired, as required, by a qualified person to confirm the integrity of the bunded area before the facility is refilled. • The exposed grounding cable behind Fuel Tank #1 should be evaluated by a qualified person to confirm it is still functioning as designed. • Prior to refilling the fuel tanks the pedestals and areas of the bunded area need to be reconstructed. Under Care and Maintenance no action is required (unless further erosion continues). • Maintain improved water management practices to prevent the ponding of water and further erosion of the interior of the containment facility. • A review of the high wall by a qualified rock mechanics expert is recommended to confirm whether additional stabilization is required.
Roberts Bay Laydown Area	• Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion. • Monitor flow from drainage channels beneath pad. If flow stops, the blockage must be traced to prevent onset of thermal erosion. • Monitor areas where rock was relocated from the tundra for signs of thermal erosion.	• Monitor areas where rock was relocated from the tundra for signs of thermal erosion.
Quarry #1 Overburden Dump	• Monitor surface runoff and consider requirement for alternate sedimentation control measures. • If the surface is used as a laydown area appropriate management protocols must be put in place taking into consideration the propensity for sinkhole development and overall differential settlement.	• Monitor surface runoff and consider requirement for alternate sedimentation control measures.
Airstrip	• Monitor areas where rock was relocated from the tundra for signs of thermal erosion. • Maintain practice of inspecting the runway toe line during freshet and after significant or prolonged rainfall events. Pump ponded water to prevent onset of thermal erosion. • Conduct inspections of the airstrip shoulder and aprons to monitor the tension cracks prior to each use.	• Monitor areas where rock was relocated from the tundra for signs of thermal erosion. • Repair the tension cracks and erosion gullies on the north apron behind the control tower.

Inspection Item	2013 Recommendations	2014 Recommendations
All Weather Roads (Doris Site)	• Inspect road toe lines during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion. • Monitor areas where rock was relocated from the tundra for signs of thermal erosion. • The buttress recommended for the Secondary Road should be constructed, and until such time as the buttress is constructed a visual monitoring system should be put in place and warning signs posted along the section in question.	• Monitor areas where rock was relocated from the tundra for signs of thermal erosion. • The buttress recommended for the Secondary Road should be constructed; and until such time, a visual monitoring system should be put in place and warning signs posted along the section in question.
Doris Creek Bridge	• Ensure the correct thermistor reader, set to the correct thermistor bead resistivity, is used for each thermistor cable as listed on the Doris Thermistor Data Field Sheet. • Continue monitoring the thermistor strings with the recommendations set out in Section 3.2. • Monitor and ultimately replace the rock gabions.	• Ensure the correct thermistor reader, set to the correct thermistor bead resistivity, is used for each thermistor cable as listed on the Doris Thermistor Data Field Sheet. • Monitor and ultimately replace the rock gabions.
Wash Bay/Explosives Mixing Plant	• Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion.	• No action required.
Upper and Lower Reagent Pads	• Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Ponded water should be pumped to prevent onset of thermal erosion.	• No action required.
Quarry #2 and Crusher Area	• Continue to follow the Quarry Management Plan. • A barricade at the Quarry entrance is recommended.	• A barricade at the Quarry #2 entrance is recommended.
Batch Plant Pad (Previously Crusher Pad)	• Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion.	• No action required.
Upper Reagent Pad AN Storage	• Should the facility be used to provide secondary containment, the design criteria must be confirmed and appropriate remedial measures must be implemented. Under Care and Maintenance no action is required.	• Should the facility be used to provide secondary containment, the design criteria must be confirmed and appropriate remedial measures must be implemented. Under Care and Maintenance no action is required.
Landfarm	• TMAC to continue to follow the designated Landfarm Management Plan. • Conduct regular visual inspections to monitor for signs of settlement. • Repair the sinkhole along the outside berm face of the Soil Containment Pond and the pothole in the access ramp into snow containment pond.	• Conduct regular visual inspections to monitor for signs of differential settlement. • Repair the sinkhole along the outside berm face of the Soil Containment Pond. • Repair the pothole and depressions in the access ramp into Snow Containment Pond. • Discharges into the Snow Containment Pond should be onto a protective barrier to prevent erosion.
Sewage Treatment Plant Outfall	• Monitor for permafrost degradation at old outfall location. • No action required at new outfall location.	• Monitor for permafrost degradation at old outfall location. • No action is required for the new diffuser system, at this time.

Inspection Item	2013 Recommendations	2014 Recommendations
Quarry # 2 Overburden Dump	• No action required.	• No action required.
Doris North Camp Pads	• Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion. • Construct a catch berm at the toe of the high wall, along Pad D and install appropriate signage and barricades to warn people of the danger. • High wall stabilization measures designed for the mill pad should be installed as planned if the project moves beyond Care and Maintenance. • Develop and implement a differential settlement monitoring protocol for heated buildings constructed directly onto the thermal rock fill pads.	• Install appropriate signage and barricades to warn people of the high wall danger on Pads D and X. • High wall stabilization measures designed for the mill pad should be installed as planned if the project moves beyond Care and Maintenance. • Develop and implement a differential settlement monitoring protocol for the heated buildings (the geotechnical core cutting building and the warehouse building (on Pad Y) as well as the old underground maintenance shop (on Pad E/P)) constructed directly onto the thermal rock fill pads.
7.5 ML Doris North Camp Tank Farm	• High wall stabilization measures designed for the 7.5 ML Tank Farm should be installed as planned (SRK 2011d).	• High wall stabilization measures designed for the 7.5 ML Tank Farm should be installed as planned (SRK 2011d).
Power Generation Station (Pad B)	• Monitor the survey monuments on Pad B to allow for tracking and advance notice of any deformations as part of the annual survey.	• Monitor the survey monuments on Pad B to allow for tracking and advance notice of any deformations as part of the annual survey.
Other Site Wide Fuel Storage	• No action required.	• No action required.
Sedimentation and Pollution Control Ponds	• The Sedimentation and Pollution Control ponds should be kept free of standing water, as this will lead to permafrost degradation. • Remove the large rocks and over liner material from the exposed liner within the Sedimentation Pond. • Keep a close watch on the Pollution Control Pond thermistor data as well as the sump water quality and flow. • Carry out a comprehensive review of the ground conditions below the ponds to evaluate whether there is a further evidence of leakage.	• Remove the large rocks and over liner material from the exposed liner within the Sedimentation Control Pond. • Conduct regular monitoring of the thermal data for the Pollution Control Pond.
Sumps #1 and #2	• Both sumps should be kept free of standing water as this will lead to permafrost degradation. • Inspect sump perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion. • The depression around Sump #1 must be backfilled with overburden to prevent further permafrost degradation.	• Backfill the depression around Sump #1 with overburden to prevent further permafrost degradation.
Doris North Portal	• No action required.	• No action required.
Waste Rock Pile	• Once underground development resumes, TMAC should continue to follow the designated Waste Rock Management Plan.	• Once underground development resumes, TMAC should continue to follow the designated Waste Rock Management Plan (SRK 2014f).
Temporary Pond	• No action required.	• No action required.

Inspection Item	2013 Recommendations	2014 Recommendations
Doris Fresh Water Intake	• Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion.	• No action required.
Doris Primary Vent Raise Pad	• Install catch berm and appropriate signage along high wall. • Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion. • Remove metal debris from fuel transfer station.	• Install catch berm and appropriate signage along high wall.
Frozen Core Plant Pad	• Inspect pad perimeter during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion.	• No action required.
North Dam	• Increase frequency of surveying North Dam monitoring points in accordance with the recommendations by the Engineer-of-Record in Section 7 of the North Dam As-built Report (SRK 2012b) and Section 3 of the North Dam Monitoring Standard Operating Procedures Report (SRK 2013b). This needs to be implemented immediately. • Survey and monitor the two depressions on the upstream face of the dam in conjunction with the instrumentation monitoring program. • Backfill the erosion around Deep Settling Monitoring Point ND-DSP-100. • Repair the contact thermistor bead on the North #2 thermosyphon and test the functionality of the thermosyphon and re-charge the thermosyphon if required.	• North Dam recommendations are reported separately. See SRK (2014c).
Shoreline Erosion	• Continue to implement measures to maintain the water level in Tail Lake at 28.2 masl to prevent onset of permafrost degradation.	• North Dam recommendations are reported separately. See SRK (2014c).
Doris North Diversion Berm	• Repair area of exposed liner next to where the water line passes over the berm.	• Repair area of exposed liner next to where the water line passes over the berm.
Doris-Windy All Weather Road	• Inspect road toe lines during freshet and immediately following significant or prolonged rainfall events. Pump out ponded water to prevent onset of thermal erosion. • Monitor areas where rock was relocated from the tundra for signs of thermal erosion. • Implement inspection protocol to monitor shoulder cracks and potholes. • Backfill the dip in the road by the helipad.	• Monitor areas where rock was relocated from the tundra for signs of thermal erosion.

Inspection Item	2013 Recommendations	2014 Recommendations
Doris-Windy All Weather Road Stream Crossings	• Ensure the correct thermistor reader is used for each thermistor cable as listed on the Doris Thermistor Data Field Sheet. • Continue monitoring the thermistor strings in accordance with recommendations in Section 3.2. • Install additional railings between the two bridge superstructures. • The depressions and ponded water against the thermal pad abutments should be covered with rock fill to prevent thermal degradation of the permafrost.	• Ensure the correct thermistor reader, set to the correct thermistor bead resistivity, is used for each thermistor cable as listed on the Doris Thermistor Data Field Sheet. • Install additional railings between the two bridge superstructures at Stream Crossings #2 and #3. • The depressions and ponded water against the thermal pad abutments at Stream Crossing #3 should be covered with rock fill to prevent thermal degradation of the permafrost. • Inspection of the bridge over Stream Crossing #3, by a qualified structural engineer should be conducted. Any repairs/remediation to the bridge should be completed under the supervision of a qualified person.
Quarry A	• Continue to follow the Quarry Management Plan.	• No action required.
Quarry B	• Continue to follow the Quarry Management Plan.	• No action required.
Quarry D	• Continue to follow the Quarry Management Plan.	• Should the bunded and lined facility, within Quarry D, be used to provide secondary containment, the design criteria must be confirmed and appropriate remedial measures must be implemented. Under Care and Maintenance no action is required.

This report, ***"2014 Doris North Annual Geotechnical Inspection Report"***, was prepared by SRK Consulting (Canada) Inc.

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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