REPORT

Nalunaq Gold Mine, Greenland

Preliminary Geotechnical Report - Mine Surface Infrastructure

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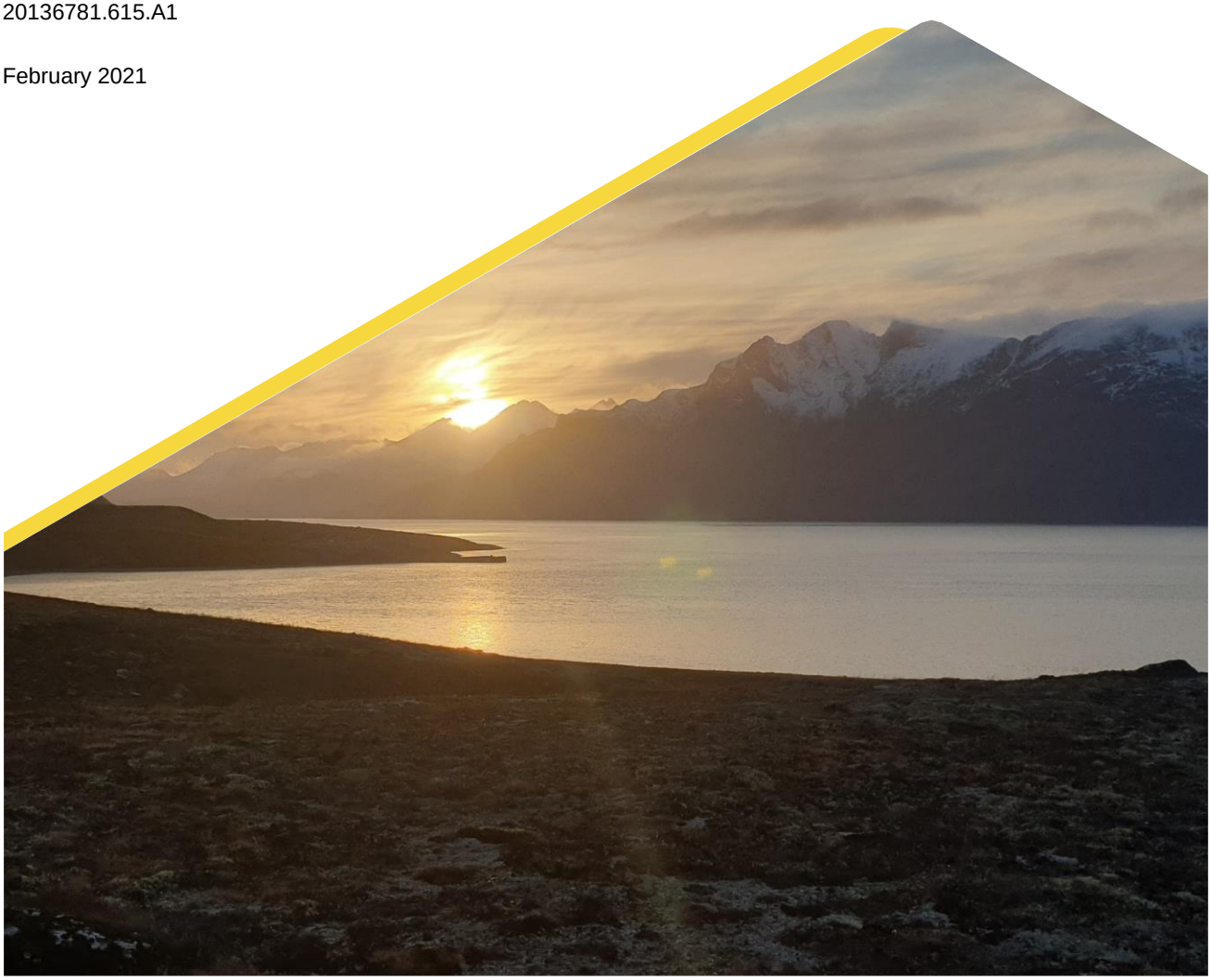
February 2021



Distribution List

Nalunaq A/S - 1 x pdf

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Table of Contents

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 Context

Nalunaq A/S ("the Company") has engaged Golder Associates (UK) Ltd ("Golder") to provide support for the surface geotechnical engineering at its Nalunaq Mine in southern Greenland (Figure 1).

As part of the scope of work, a site visit to the Nalunaq Mine was undertaken in October 2020 to benchmark information collated prior to the site visit; and to collect additional data. This report presents the results of a preliminary assessment of geotechnical ground conditions across the Nalunaq Mine area based on the results of the October 2020 site visit and other information made available to Golder.

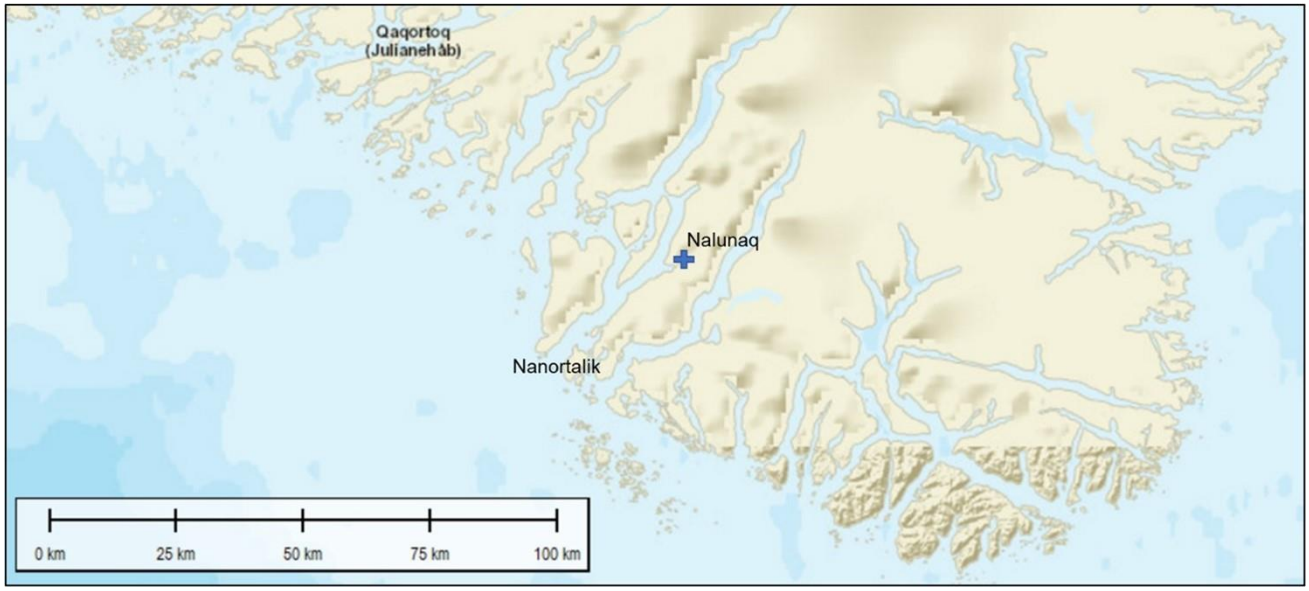

Figure 1: Approximate location of the Nalunaq Mine, Greenland

1.2 Background

Following discovery in the early 1990s and development and operation by Crew Gold Corporation ("Crew Gold"), development was continued by Angus & Ross plc and Angel Mining (Gold) A/S, between 2004 and 2013. Subsequently additional exploration work has been undertaken in the Nalunaq area. It is understood that Nalunaq A/S, which is a wholly owned subsidiary of AEX Gold Inc., is aiming to restart mining operations in 2021.

Golder was engaged by the previous owners to provide support on the project with regards to tailings disposal, geotechnical engineering, underground rock mechanics and water management between 2002 and 2009. The key reports prepared by Golder at the time are as follows:

- Review of Surface Tailings Options – 2002 – Kvaerner Engineering & Construction UK Ltd;
- Geotechnical Review – 2003 – McIntosh Engineering on behalf of Crew Developments;
- Waste Management and Mineral Processing – 2009 - Angus Ross PLC;
- Geotechnical Assessment of Proposed Mineral Processing Chamber – 2009 - Angus Ross plc;
- Geotechnical Assessment of Proposed Mineral Processing – 2009 – Angel Mining (Gold) A/S;
- Conceptual plug design for the Nalunaq Mine. Draft Technical Memorandum dated 10 July 2009; and,
- Site Visit – 2009 - Angel Mining (Gold) A/S.

The approximate layout of the proposed mine infrastructure, as of October 2020, is shown in Figure 2 and APPENDIX A.

Figure 2: Nalunaq Mine, Kirkespirdalen, Greenland

2.0 ENVIRONMENTAL AND GEOLOGICAL SETTING

2.1 Climate

The Nalunaq Mine site is located in southern Greenland, 35 kilometres (km) northeast of the town of Nanortalik, in the Municipality of Kujalleq. The mine lies on the northern slopes of the Kirkespirdalen Valley (Kirkespirdalen) around 9 km from the eastern side of the Sarqå Fjord. It has a tundra climate with strong oceanic and polar influences (SRK, 2002). Precipitation (including both rainfall and snowfall) is moderate with an annual average of 602 mm and snow cover is relatively limited with an annual average snowpack depth of 194 mm, although extremes have been observed, causing flooding within the valley. Temperatures show little variation between seasons. July is the hottest month with a mean temperature of 10.7°C and February is the coldest month with a mean temperature of -7.9°C.

2.2 Physiography

The Nalunaq Mine site is situated in a mountainous periglacial area in southern Greenland. Kirkespirdalen in which the mine is situated is typical of a glacially eroded valley with steep sides into which feed a number of previously glaciated cirques. A lake is situated in the upper reaches of the valley that is drained by the Kirkespir River to the Sarqå Fjord. The proposed mine camp area is located on a raised beach to the south of where the Kirkespir River enters the fjord (Figure 3). An unsurfaced road, approximately nine km long, connects a jetty (Figure 2) with the camp area and onwards up the valley to the proposed process plant, dry stack tailings storage facility (DTSF) and mine site.

Figure 3: View from the temporary (2020) site office north across the proposed camp area on a raised beach above the Sarqå Fjord

The valley may be broadly divided into two areas: a lower section below the Repeater Station (Figure 2) where the river descends approximately 70 metres (m) over a distance of approximately 500 m via a series of small rapids; and an upper section east of the Repeater Station where the area for the proposed DTSF and process plant is situated in the braided channel of the Kirkespir River (Figure 4 and Figure 5).

The valley slopes are covered with talus from the exposed rocks above and a number of talus-derived rock glaciers are present (Figure 4). A number of gullies are associated with debris flows, some of which have extended out onto the valley floor (Figure 6).

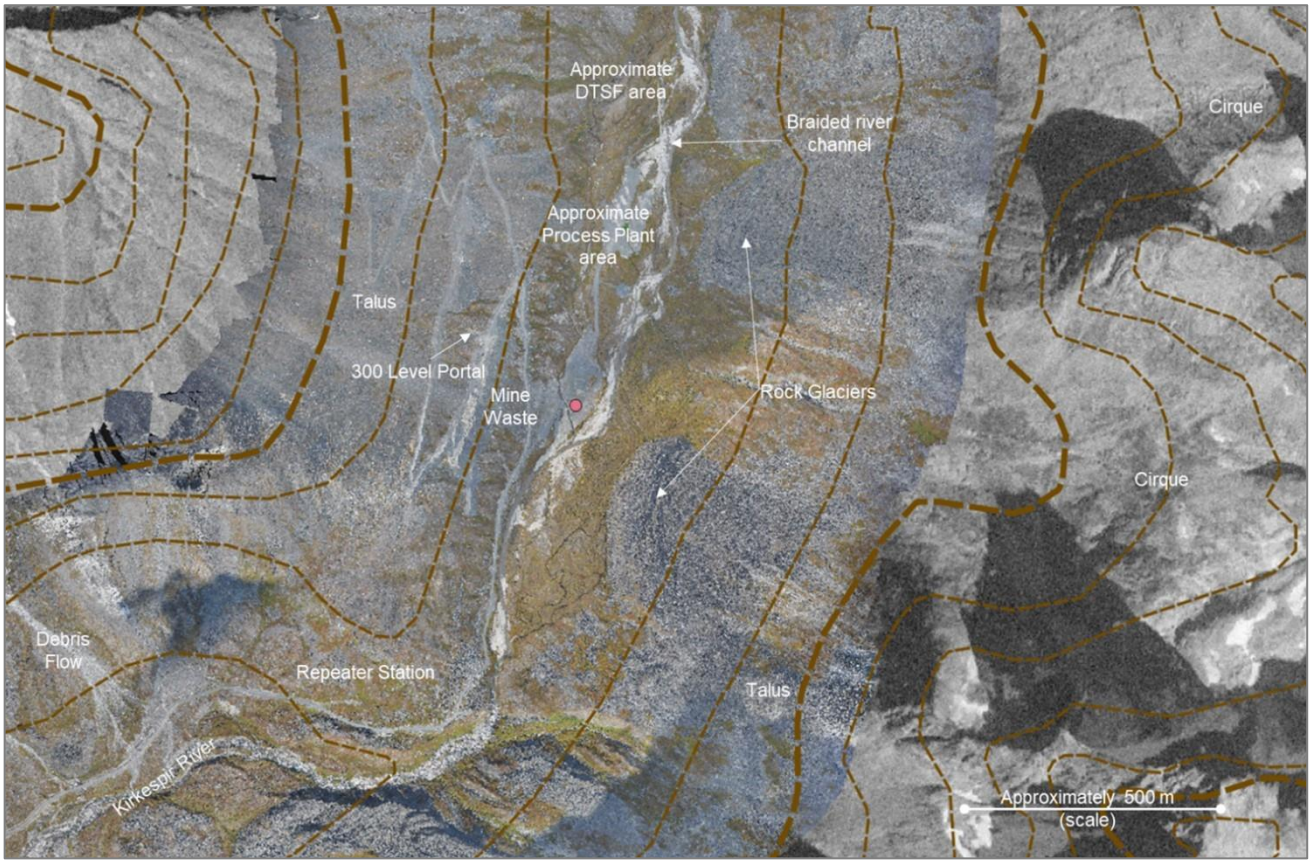

Figure 4: Principal geomorphic features in the vicinity of the Nalunaq Mine

Figure 5: View of the proposed DTSF and process plant areas from the 300 m Level portal, showing the braided channel of the Kirkespir River

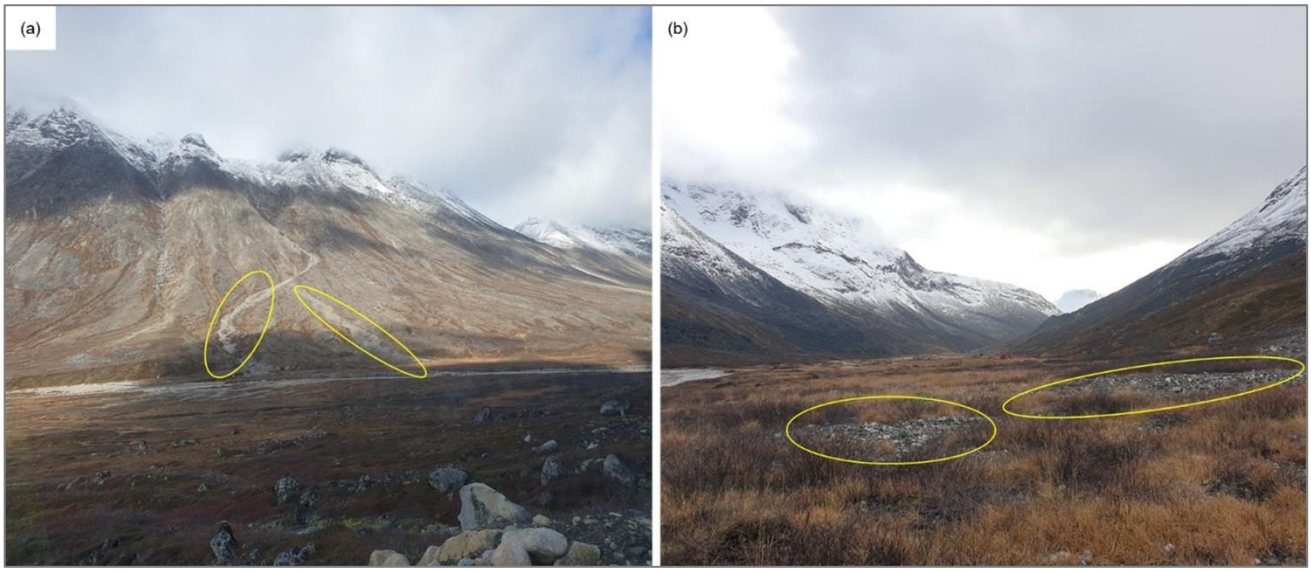

Figure 6: Debris flow deposits (circled in yellow) from the northern side of Kirkespirdalen: (a) at the lower end of the valley approximately 1 km east of the Sargå Fjord; (b) at the northern edge of the proposed DTSF area (view west down valley)

2.3 Geology

The mine is situated in the basement rocks of southern Greenland. According to Dominey *et al*. (2006) Nalunaq is situated within the Ketilidian Mobile Belt, which is related to the accretion of a Palaeoproterozoic continental margin against the Archaean Core of South Greenland. Dominey *et al*. (2006) report that the site lies in the Psammite Zone which is a supracrustal succession of psammites with pelites and interstratified mafic volcanic rocks with gold mineralisation at Nalunaq hosted by a meta-volcanic unit composed of basaltic pillow lavas and pyroclastics intruded by dolerite sills. The volcanic rocks are reported (Dominey *et al*., 2006) to be metamorphosed to amphibolites and the area is intruded by late- and post-tectonic granitoid plutons. It is also reported by Dominey *et al*. (2006) that at Nalunaq granitoid rocks surround three sides of the meta-volcanic mass hosting the vein. A geological map of the area is presented at Figure 7.

The bedrock in the area is variably weathered at surface but becomes fresh at shallow depth, typically 20 m to 30 m from surface.

Fluvioglacial deposits, commonly overlain and interbedded by talus and debris flow deposits, fill the glacially eroded Kirkespirdalen. The talus and debris flow deposits observed are poorly sorted comprising sand to boulders. The main valley infill comprises fluvioglacial alluvium of sand, gravel and cobbles associated with the braided Kirkespir River.

In the proposed camp and beach landing area (Figure 3) the deposits form a raised beach, the composition of which is dominated by sand with some gravels. No clay deposits of significance were identified within the surficial deposits.

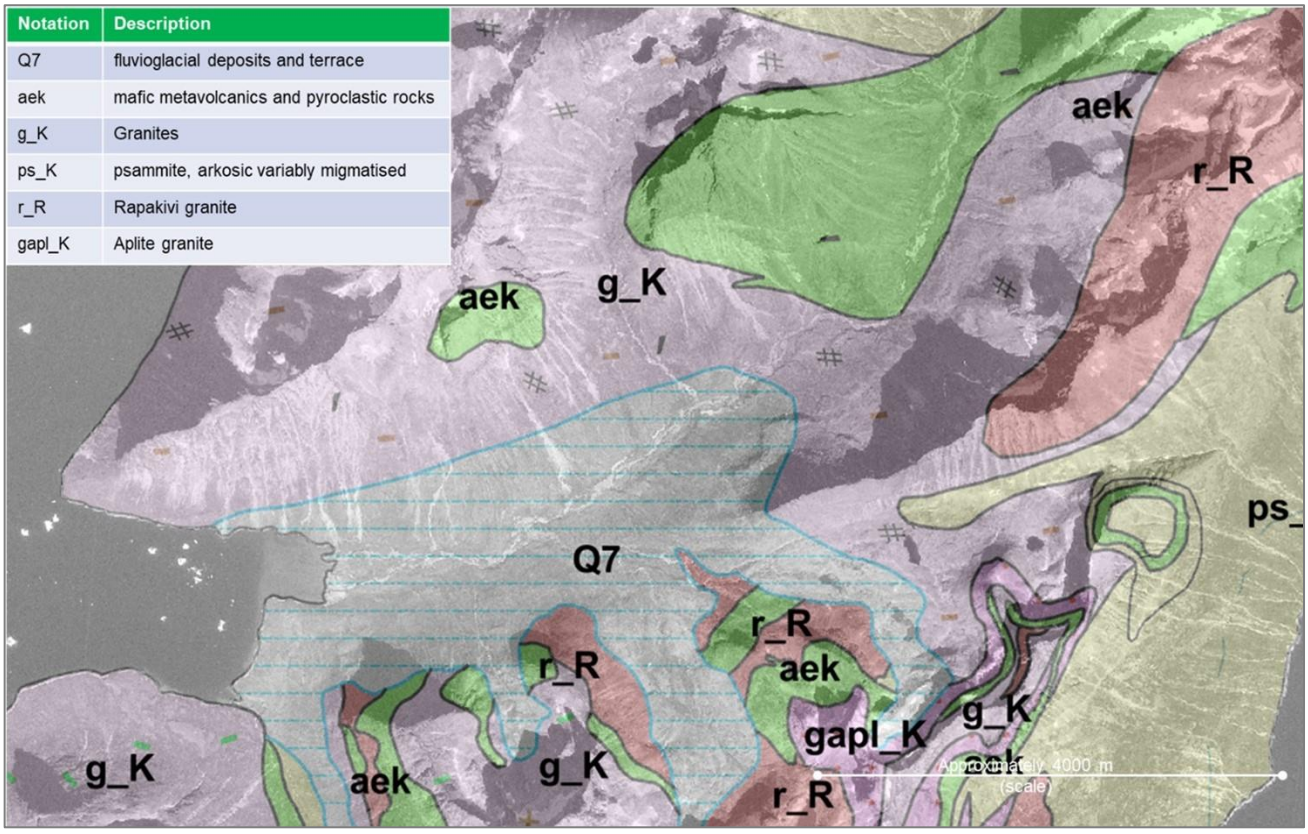

Figure 7: Geological map of Kirkespirdalen and the area in the vicinity of the Nalunaq Mine (Geus, 2019)

2.4 Seismicity

2.4.1 Tectonic Setting

Greenland is dominated by crystalline crustal rocks of the Precambrian shield which were formed during a succession of Archean and early Proterozoic orogenic events which stabilised as a part of the Laurentian shield about 1600Ma. The marginal parts of Greenland are under extensional tectonic stress between the adjacent areas after mid-Mesozoic age, with a transitional continent-ocean structure indicating a passive margin. As a consequence, tectonic activities such as the occurrence of earthquakes are very few compared to active regions (Kanao *et al*., 2015).

The tectonic features of south-western Greenland are dominated by the rifting and extension of the Labrador Sea. Various models of the continental and oceanic crust boundaries have been proposed (Hosseinpour *et al*., 2013) and are shown in Figure 8.

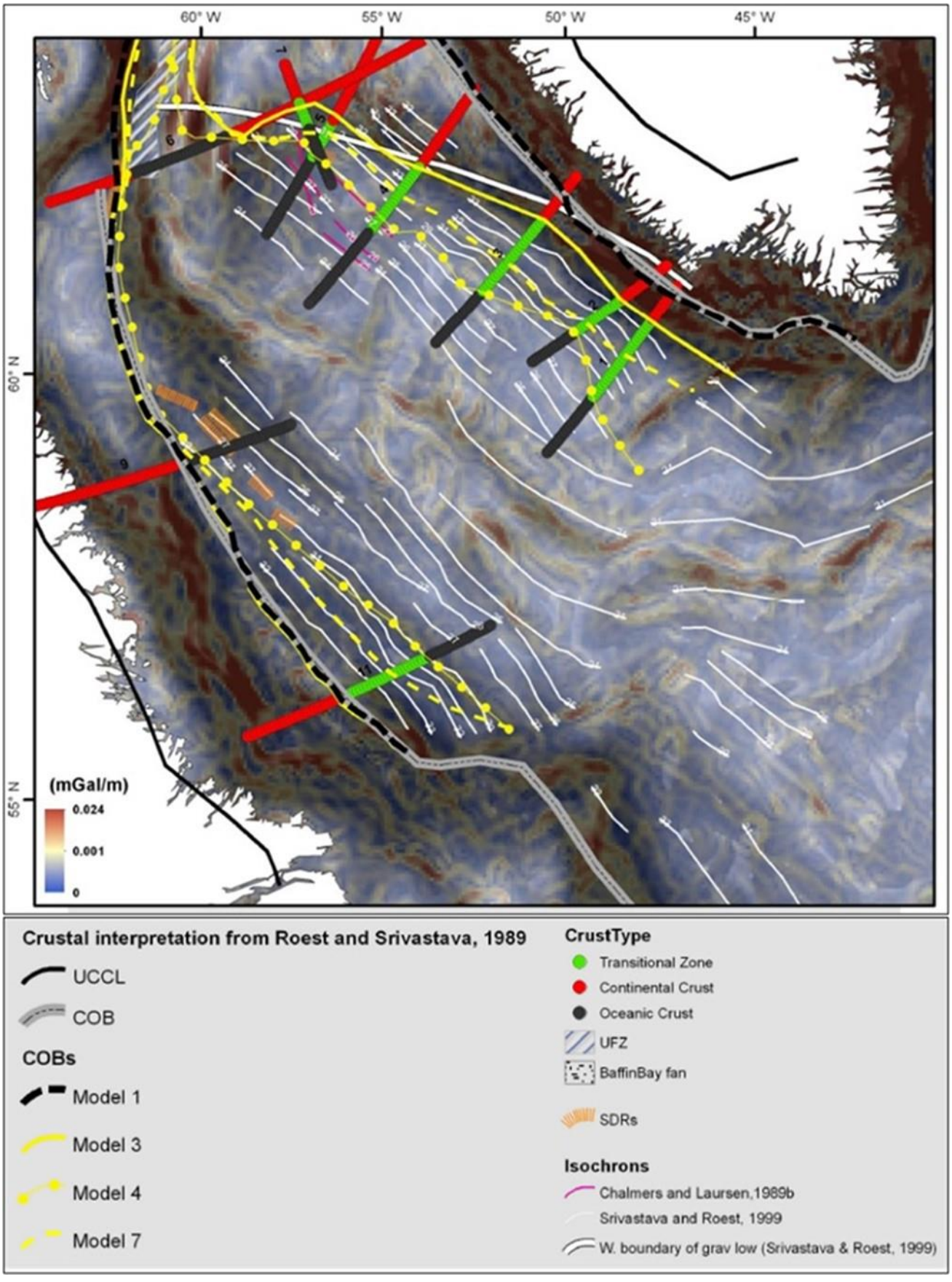

Figure 8: Continental and Oceanic Crust boundary (COB) Models in the Labrador Sea (Hosseinpour *et al.*, 2013)

2.4.2 Recorded Earthquakes

Magnitude 4 earthquakes are typically the threshold usually adopted for engineering purposes, as damages can occur above this magnitude subject to distance, soil foundation conditions and type of engineered structures. The United States Geological Survey (USGS) Earthquake Centre online database (USGS, 2020) was consequently searched for seismic events of magnitude M>4, within the time period 1900 to 2020 and a radius spanning 300 km around the Nalunaq Mine site (Figure 9).

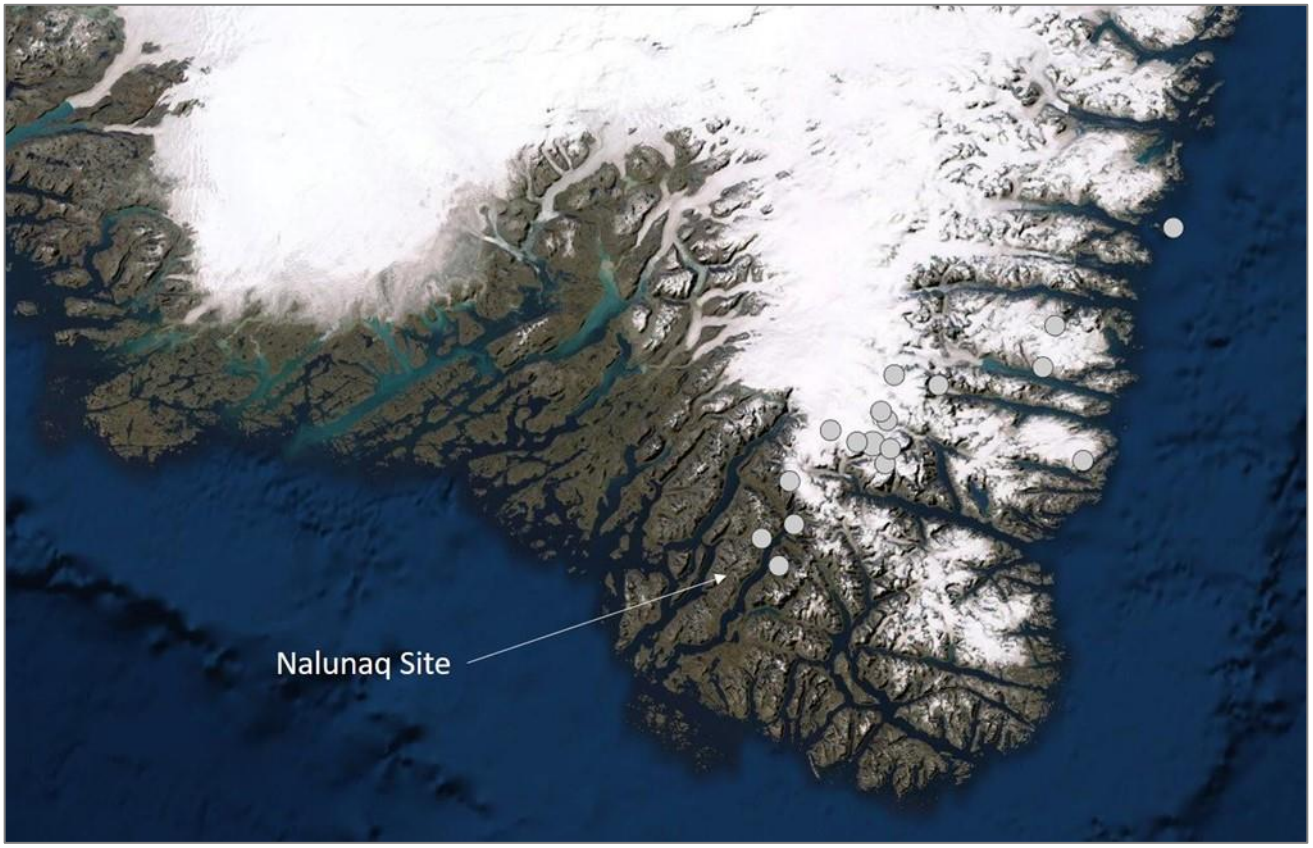

Figure 9: Recorded seismic events of magnitude M>4 (USGS, 2020)

2.4.3 Global and Regional Seismic Hazard Study

A fully probabilistic seismic hazard analysis at global level was developed as part of the Global Awareness Report Risk (GAR) Atlas (Global Facility Disaster Reduction Recovery (GFDRR) Innovation Lab, 2020). The GAR Atlas includes data from the GAR17 hazard model.

Based on available online maps from the GAR17 hazard model the estimated peak ground acceleration (PGA) for the Nalunaq Mine area is approximately 105 gal (0.1 g) and 200 gal (0.2 g). for the 475-year and 2,475-year return event, respectively (Figure 10 and Figure 11)

A seismic hazard study of Greenland was undertaken by the Geological Survey of Denmark and Greenland (GEUS) (Voss *et al*., 2007) based on available earthquake catalogues. Based on the results of the study Voss *et al* (2007) conclude that the seismic hazard in Greenland is low. The Nalunaq Mine area is within a seismic source zone with an estimated PGA of 0.048 g for the 475-year return event (Figure 12).

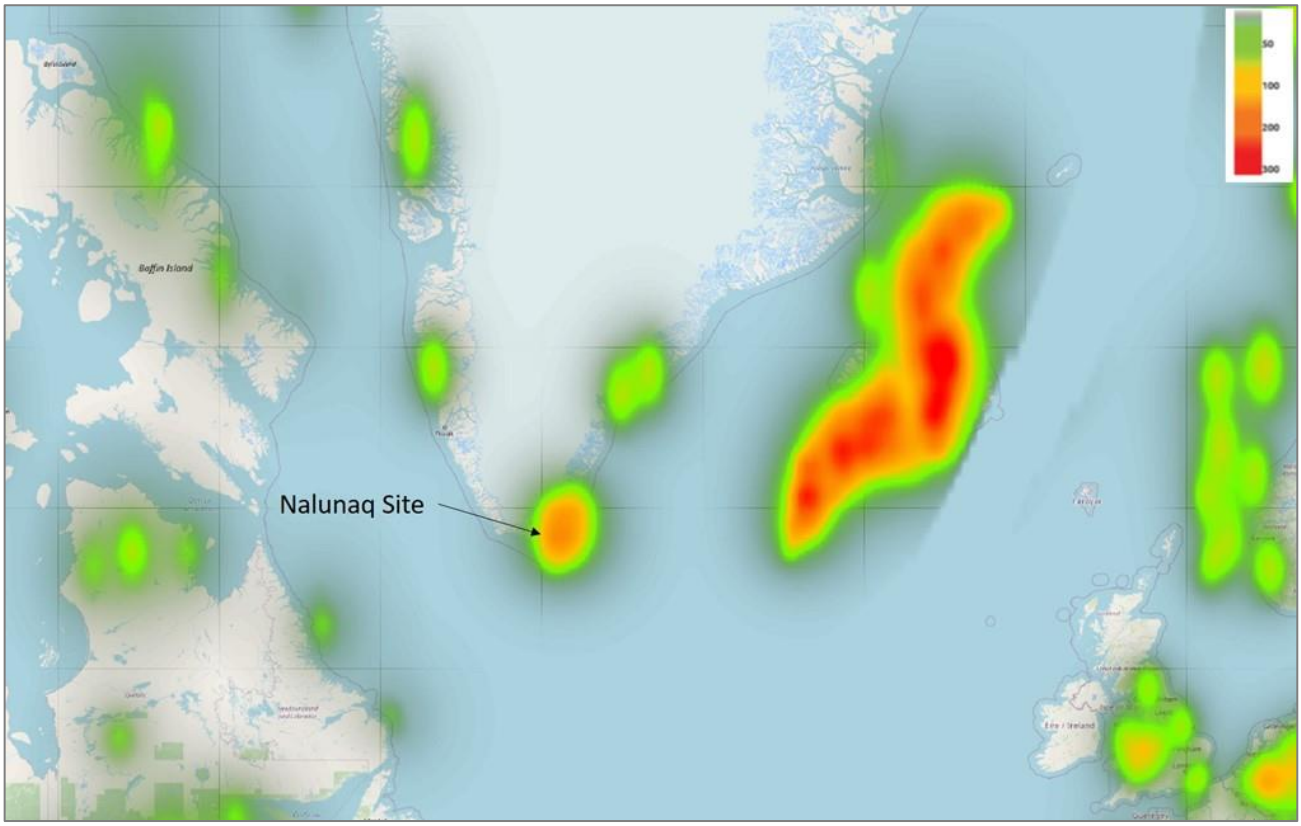

Figure 10: PGA values in gal for 475-year return period (GFDRR Innovation Lab, 2020)

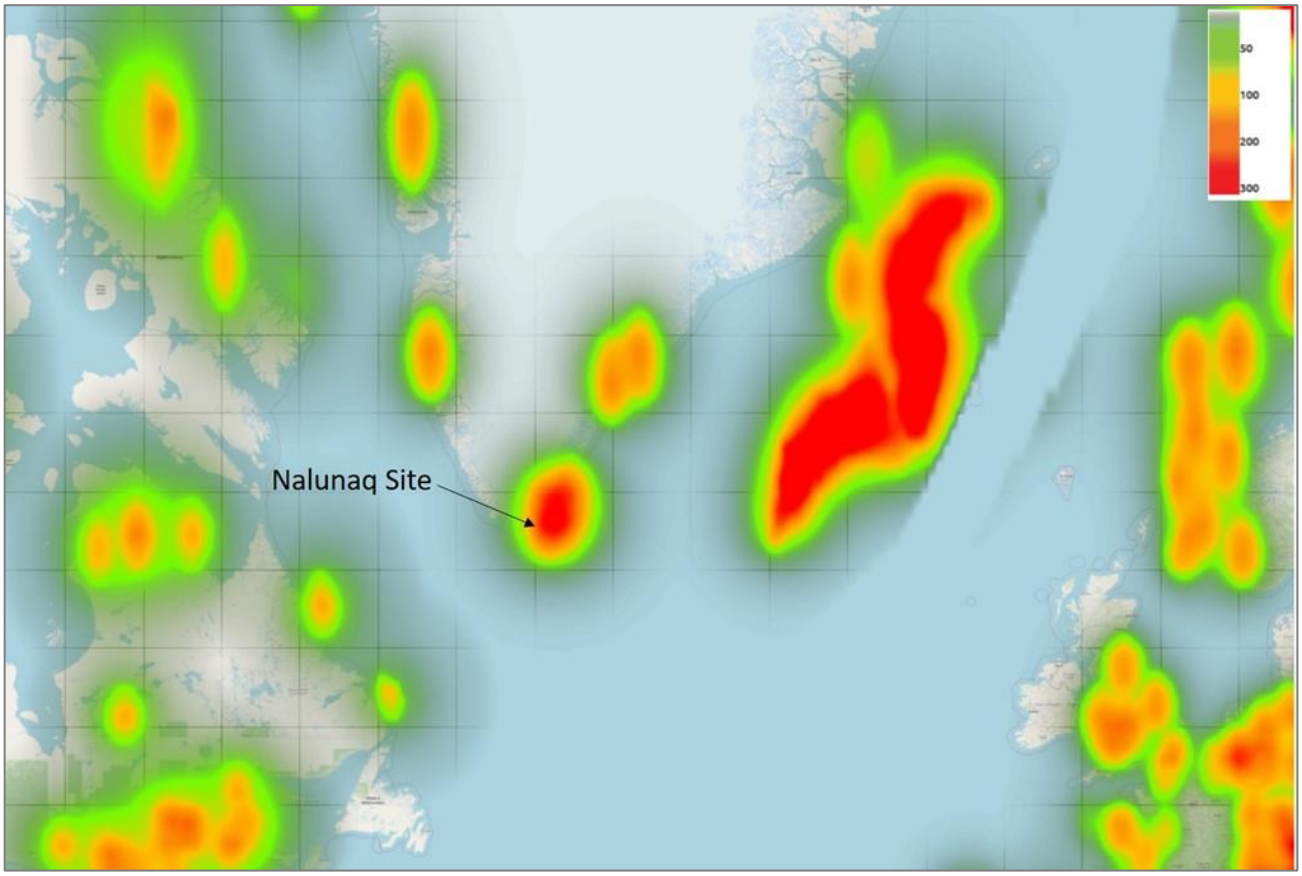

Figure 11: PGA Values in gal for 2,475-year return period (GFDRR Innovation Lab, 2020)

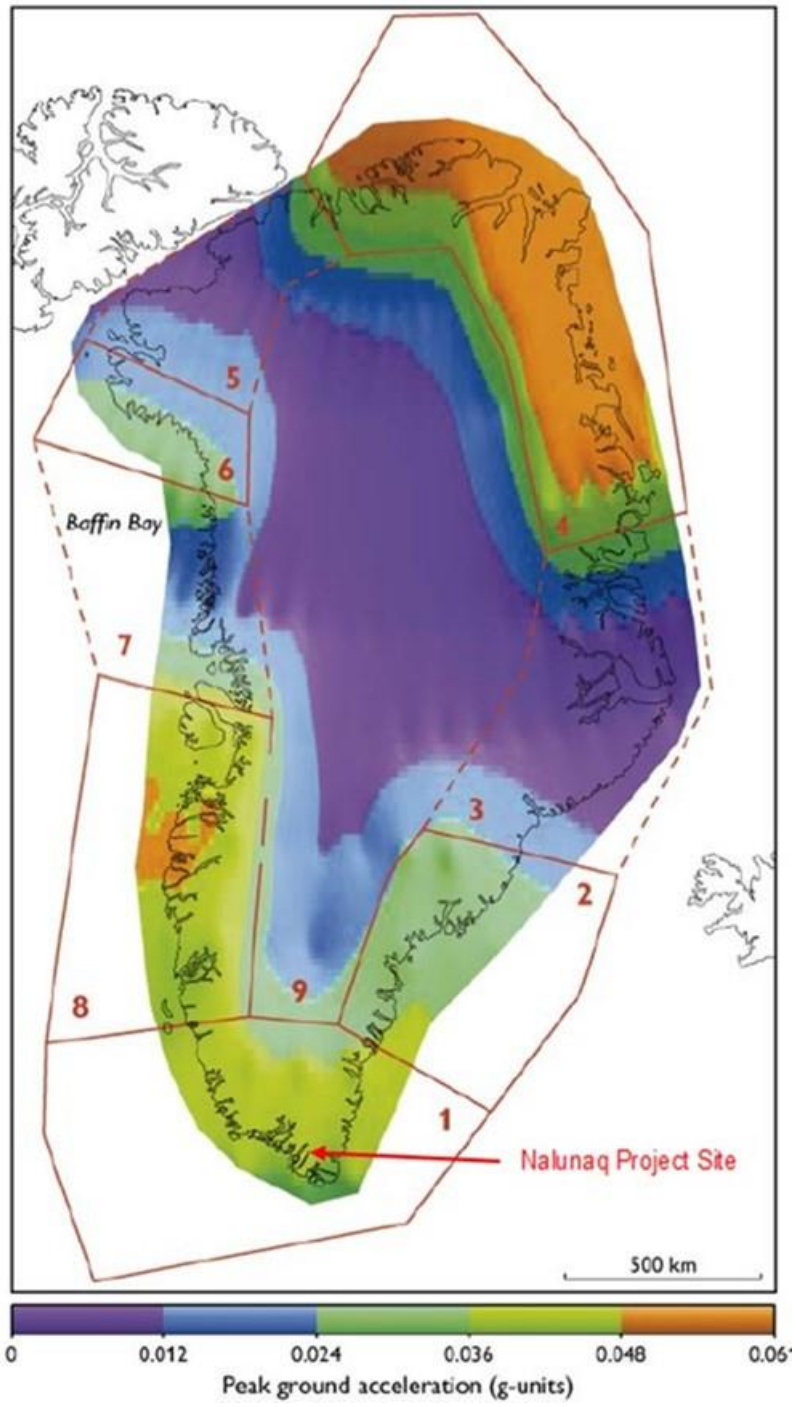

Figure 12: Seismic Sources and PGA Values for the 475-year return period (Voss *et al.*, 2007)

2.4.4 Conclusions

In absence of site-specific studies, it is recommended that a PGA of 0.2 g is adopted for the current design based on GAR17 seismic hazard model. However, it should be noted that the objective of the GAR17 hazard model, as for other global studies, is to provide input for high level risk analyses for large regions rather than present absolute values for a specific location. Seismic input parameters and analysis are smoothed over large areas and may not be representative of seismic hazard for specific locations. It is consequently recommended that for future design phases a site-specific seismic risk assessment be undertaken for the Project site to confirm PGA values for various return period events.

3.0 GEOTECHNICAL SITE INVESTIGATIONS

Two geotechnical site investigations have been undertaken on the sites of the proposed camp, process plant and DTSF. Figure 13 shows the location of one borehole drilled as part of the 2001 site investigation and two trial pits excavated as part of the 2020 site investigation in the area of the proposed camp.

Figure 14 shows the location of five boreholes drilled as part of the 2001 site investigation and six trial pits excavated as part of the 2020 site investigation in the area of the proposed process plant and DTSF.

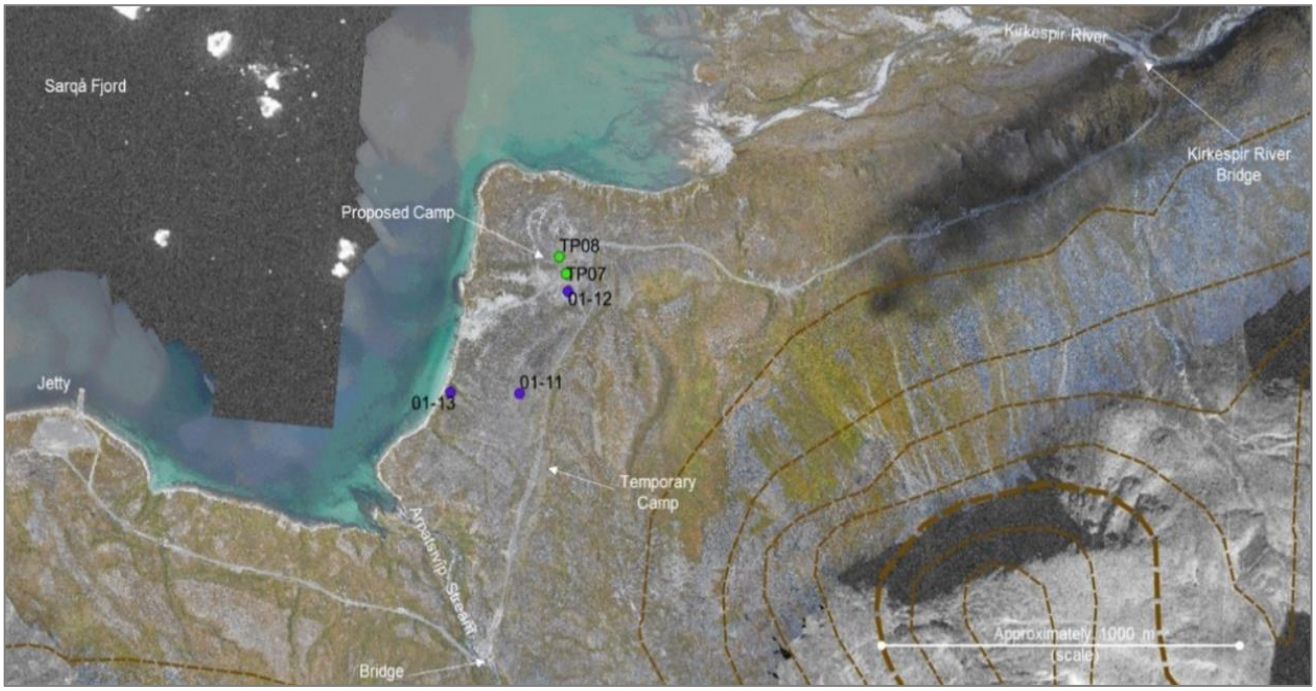

Figure 13: Location of Trial Pits (TP07 and TP08) and Boreholes (BH01-12) in the area of the proposed camp

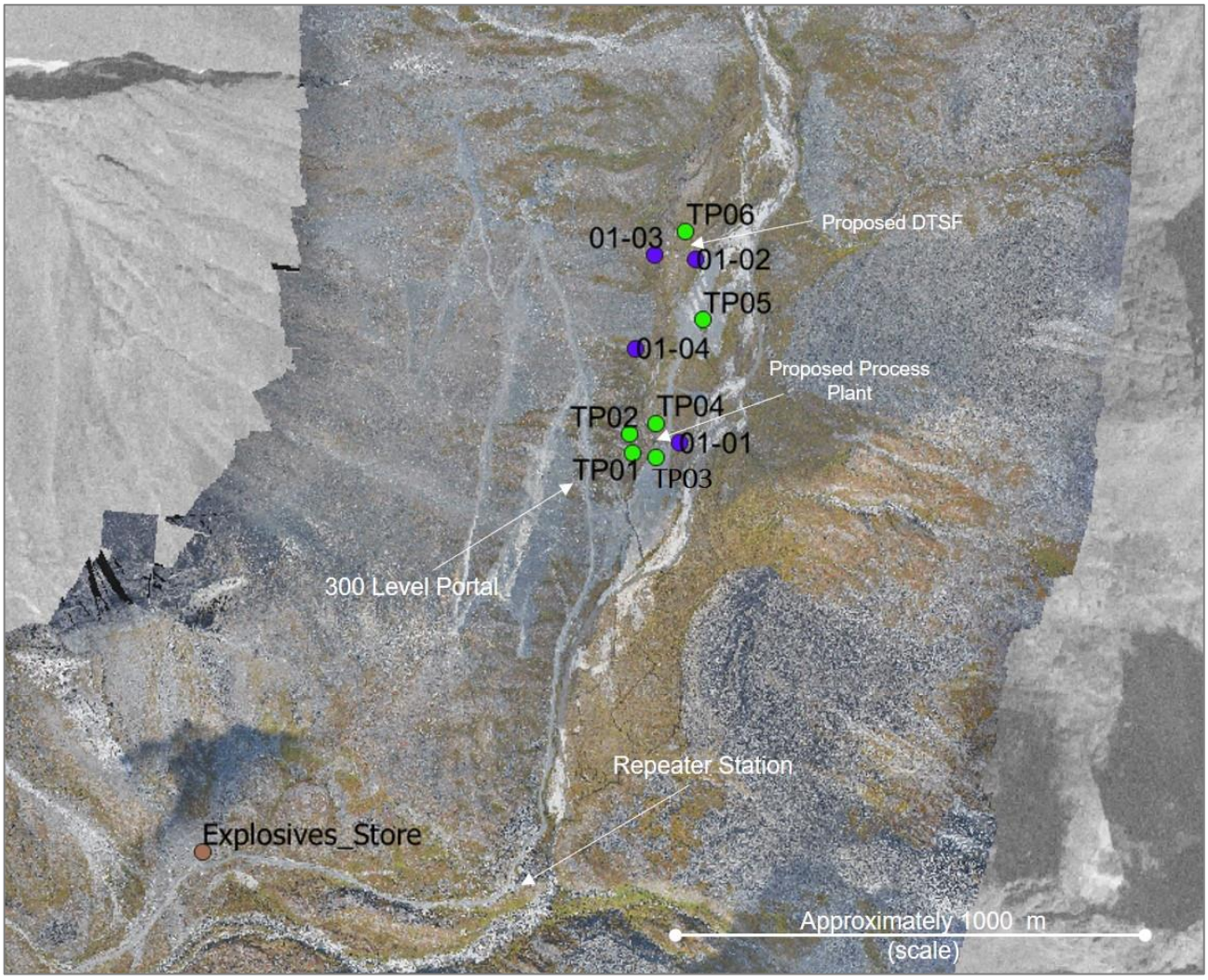

Figure 14: Location of Trial Pits (TP01 and TP06) and Boreholes (BH01-01 to BH01-05) in the area of the proposed plant and DTSF

3.1 2001 Site Investigation

A geotechnical investigation was undertaken as part of a Bankable Feasibility Study (BFS) for the Nalunaq Gold Project by Golder in 2001 (Golder, 2002). The purpose of the investigation was to determine the subsurface conditions by means of borehole drilling, sampling and in situ testing. The investigation focussed on the near shore structures, the process plant location and potential locations for a proposed tailings disposal facility.

Fifteen boreholes were drilled at selected locations with one borehole located in the area of the proposed camp site (BH01-12, see Figure 13) and five boreholes located in the area currently proposed for the process plant and the DTSF (BH01-01 to BH01-05, see Figure 14). The boreholes were drilled to depths ranging from 3.2 m below ground level (mbgl) to 27.4 mbgl. The boreholes were logged, and Standard Penetration Tests (SPT) were undertaken to provide information on the geotechnical engineering properties of the materials encountered. Laboratory tests were completed on selected samples to determine water content and particle size distribution. The borehole logs and laboratory test reports are presented in APPENDIX B.

Based on the ground conditions encountered and the geotechnical testing undertaken preliminary recommendations were made by Golder (2002) for the characteristics of the administrative building foundations in the vicinity of the plant site (Figure 13). Additional recommendations were made to address the shallow

groundwater table and the potential for frost heave or thaw consolidation in the design of the foundation. In the report the need for further climate and hydrology studies was noted.

3.2 2020 Site Investigation

In October 2020, a Golder geotechnical engineer visited Nalunaq Mine to gain an understanding of site conditions, oversee trial pitting and undertake sampling. Six trial pits were excavated to investigate the shallow subsurface conditions in the vicinity of the proposed process plant and DTSF area with two additional trial pits excavated in the area of the proposed camp. The locations of the six trial pits (TP01 to TP06) excavated in the area of the proposed process plant and DTSF are shown on Figure 14 and the locations of the two trial pits in the area of the proposed camp are shown on Figure 13. Representative samples were excavated from two potential borrow pit areas (Figure 15) to assess the suitability as aggregate material for concrete mix production, engineered backfill and for use in access road construction.

The positions of the excavated trial pits, their depth, descriptions of the strata encountered and the groundwater conditions encountered are included in logs presented in APPENDIX C. Materials from the trial pits in the 2020 site investigation are described as per ASTM D2488. Trial pit logs and a laboratory test results are presented in APPENDIX C.

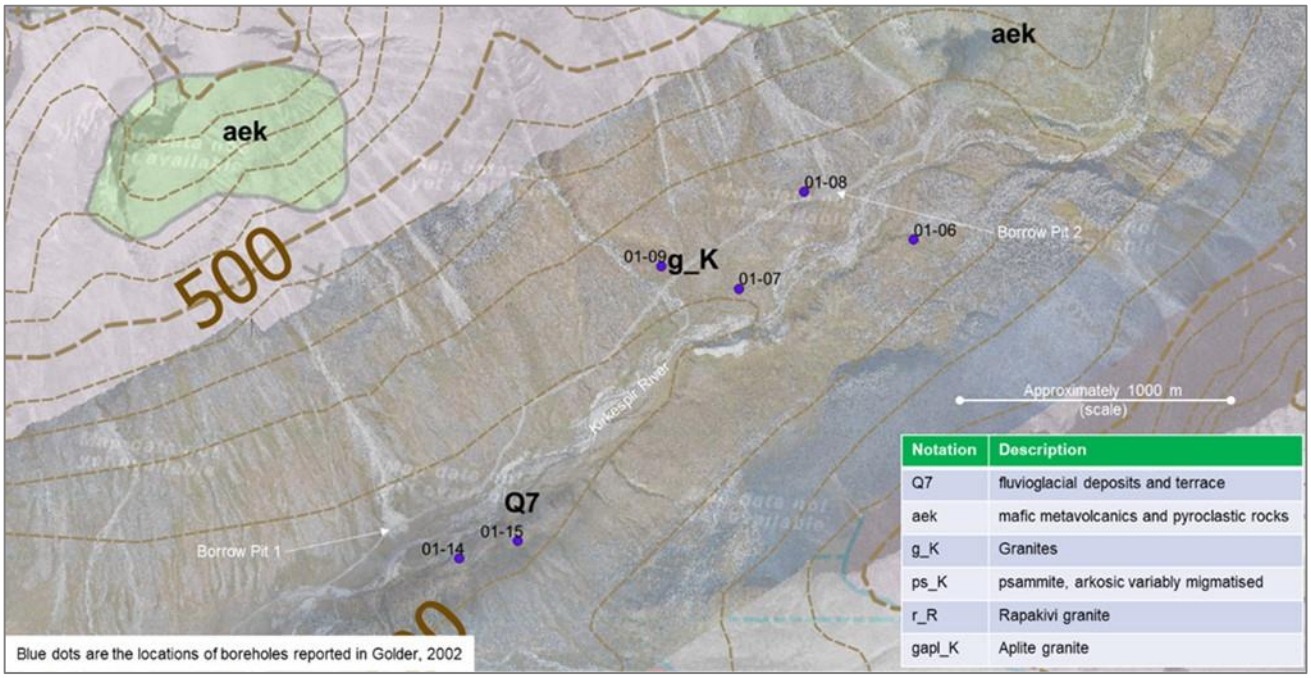

Figure 15: Borrow Pit Locations (Geology from GEUS, 2019)

4.0 GEOTECHNICAL ASSESSMENT

Fluvioglacial deposits, commonly overlain and interbedded by talus and debris flow deposits, fill the glacially eroded Kirkespirdalen. The talus and debris flow deposits observed are poorly sorted comprising sand to boulders. The main valley infill comprises alluvium of sand, gravel and cobbles associated with the braided Kirkespir River. In the proposed camp and beach landing area the deposits form a raised beach, the composition of which is dominated by sand with some gravels. No clay deposits of significance were identified within the surficial deposits

As stated in Section 2.3 the bedrock predominantly comprises metavolcanics that vary from fresh to variably weathered. The bedrock in the area is variably weathered at surface but becomes fresh at shallow depth, typically 20 m to 30 m from surface.

A summary of the geotechnical units at the proposed plant, DTSF and camp site based on available boreholes and trial pits geotechnical logs is presented in Table 1 below. It should be noted that the soil conditions encountered in the trial pits vary significantly from the borehole logs in terms of the apparent quantity of cobbles and boulders. As such there can be an apparent difference in the description of particle size distribution as it is considered that trial pits are typically more effective at providing information on bulk material properties than boreholes as the use of drilling flush is likely to wash out the fine fraction leading to a sampling bias.

Table 1: Nalunaq Site Typical Geotechnical Units

Geotechnical Units	Typical Thickness (m)	Description
Topsoil	0.15	Well Graded Sand with Gravel and Cobbles (SW) - Medium to coarse sand, fine to coarse sub-rounded gravel and cobbles; moist, brown
Colluvium (Talus)	0 - 9	Well Graded Gravel and Sand (GW) - Coarse to fine subangular gravel, fine to coarse sand, with large subangular cobbles and boulders; dry to moist, grey
Alluvium	4 - 8	Well Graded Gravel and Sand, Cobbles and Boulders (GW) - Coarse to fine sub-rounded hard gravel; fine to coarse sand, with hard, sub-rounded cobbles and boulders with a maximum dimension of 500 mm; dry to moist, grey or brown
Glacial Till	2	Well Graded Gavel with Sand (GW) – Sand and gravel, with cobbles and boulders with a maximum dimension of 700mm; moist, grey
Bedrock	-	Weathered to fresh, foliated, weak to very strong, fine grained mafic rock

4.1 Ground Conditions

A summary of general ground conditions for each area is presented in the following sections. The overall site layout, as of October 2020, with location of each proposed facility is presented in Figure 2 and APPENDIX A.

4.1.1 Proposed Camp Site Area

Logs of the trial pits excavated (TP07 and TP08) are presented in APPENDIX C and their locations are shown on Figure 16. Photographs of each trial pit are presented as Figure 17 and Figure 18.

The materials encountered comprised of topsoil down to 0.15 mbgl and grey gravelly sand to sand with cobbles and boulders for the remainder of the pits in both cases.

Samples of the grey gravelly sand were taken for geotechnical testing and the proposed testing schedule is presented in APPENDIX C.

Based on the results of the trial pitting and the logs of boreholes previously drilled in the area the foundation soil at the proposed camp area predominantly comprises gravelly sand with occasional cobbles and boulders. No water was observed during borehole drilling (Golder, 2002) or trial pit excavation suggesting that the groundwater table in the vicinity of the proposed camp area is likely to be at least 8.5 mbgl.

It is understood that low load bearing modular buildings will be installed on top of adjustable steel triangle support at the camp. From site visual inspection and data available, ground conditions should be favourable for construction of the camp.

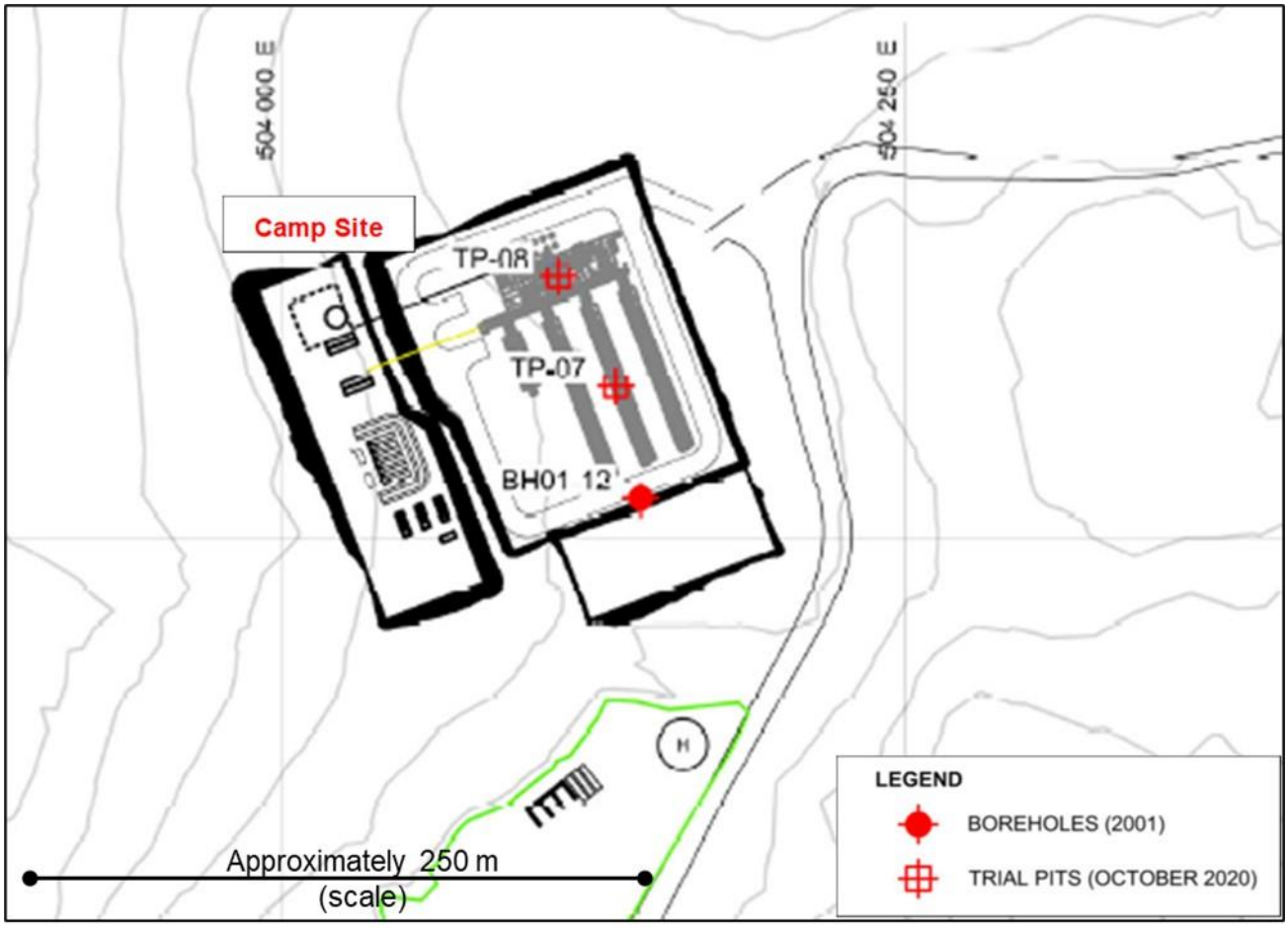

Figure 16: Proposed camp area investigation locations overlain with the October 2020 camp design layout

Figure 17: Trial Pit TP-07 at the proposed camp

Figure 18: Trial Pit TP-08 at the proposed camp

4.1.2 Near Shore Areas

It is understood that various options are being considered for shipment of containers and construction equipment to site including upgrading the exiting jetty/pier and access road and or development of a beach landing area to the south west of the camp site. No additional information was made available to Golder on the proposed design for the near shore structures. The location of the pier, beach landing site and the proposed camp site are shown on Figure 19.

No additional trial pits were completed in the area of the proposed beach landing although the materials are likely to be similar grey gravelly sand, becoming finer in granularity close to the current beach. As no geotechnical data is available for these areas further studies are necessary to confirm offshore and onshore ground properties for the design of the near shore structures.

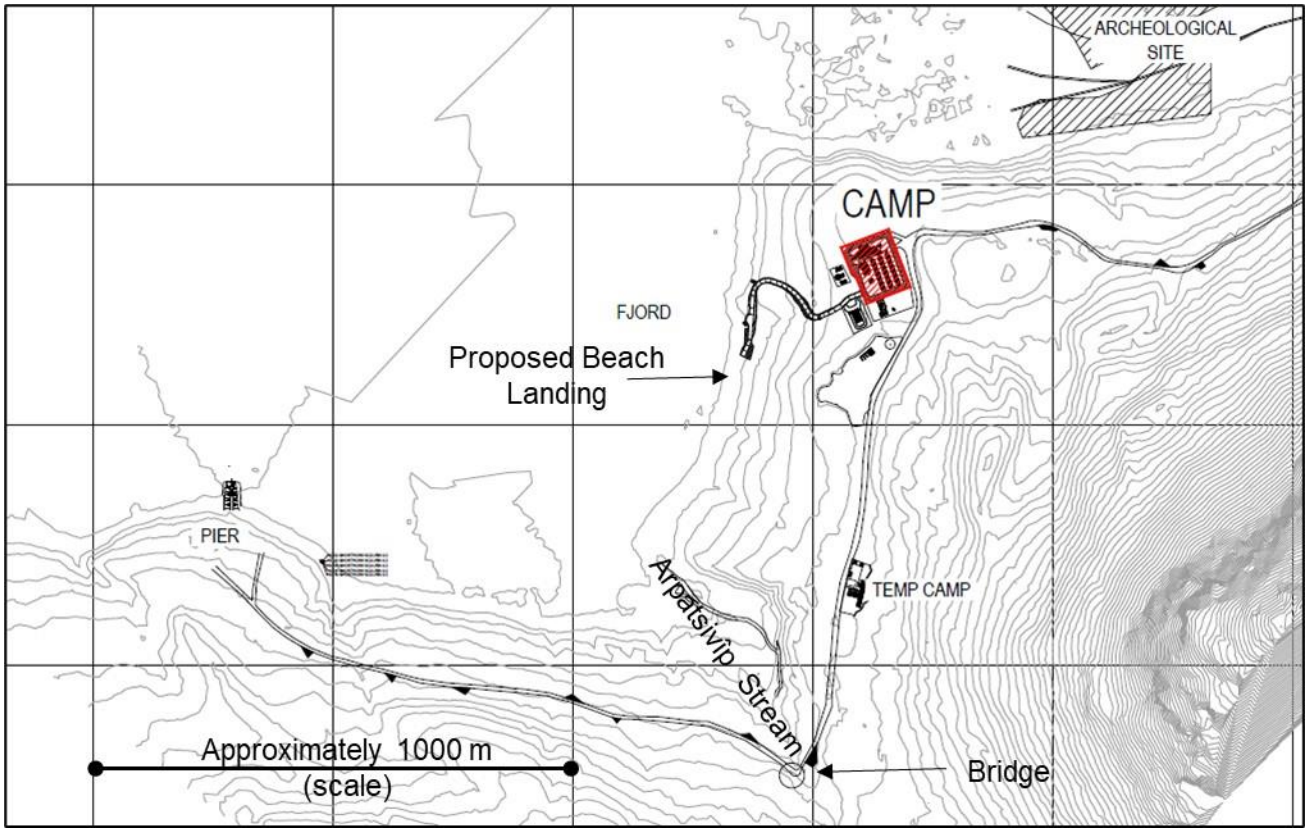

Figure 19: Existing pier and proposed camp and beach landing area

4.1.3 Access Road

The existing gravel road constructed during previous mining operation connecting the pier to the proposed process plant an DTSF area is currently (October 2020) used to access the Nalunaq Mine site for exploration activities. An aerial view of the access road is presented in Figure 20 with a typical section shown in Figure 21.

Based on field observations in October 2020 the ground conditions along the access road route are dominated by alluvium within the Kirkespirdalen floor and talus and debris flow deposits on the slopes. No intrusive (drilling or trial pitting) investigations have been undertaken specifically along the road. Two boreholes drilled as part of the investigation of Borrow Pit 2 (BH01-08 and BH01-09) were drilled in the vicinity of the road during the 2001 site investigation. BH01-08 was drilled to a depth of 9.2 mbgl encountering talus to its full length, described as boulders, cobbles, gravel, sand and trace silt. BH01-09 was drilled to a depth of 6.6 mbgl (refusal) also encountering talus, described as very dense, moist and brown becoming grey at 3 mbgl with boulders, cobbles, gravel, sand and trace silt.

The information from these boreholes is too localised to enable a general assessment for the entire length of the road. The depth of surficial soils will need to be confirmed to inform an assessment of the potential for realignment of the road (to decrease the slope in steep sections) including the need for cut and fill.

The existing gravel road appears to be in fair condition for most of its length although it is considered that maintenance will be required to minimise damage due to freeze-thaw cycles and heavy rain. The use of well-graded material for the rehabilitation of sections of the road that are in poor condition, the improvement of the drainage system and adequate crossfall in those areas will need to be considered in the design.

Operational risks (driving risks particularly in winter) associated with the section of the road with a grade in excess of 10% should be addressed and where possible, consideration given to alternative road alignments.

Avalanche, rockfall (Golder, 2020a) and debris flow hazards should be considered in the design as well as drainage to avoid erosion of the road surface.

Figure 20: Nalunaq Mine access road (Photo Source: AEX Gold)

Figure 21: Mine access road near the proposed process plant

Two river crossings (bridges) exist along the access road from the pier area to the proposed process plant site (Figure 22). The bridge over the Arpatsivîp stream crossing between the pier area and the proposed camp site is shown on Figure 23 and the container bridge over the Kirkespir River is shown on Figure 24.

It is noted that it is likely that flooding will occur seasonally in the active drainages and on the adjacent floodplains during high rainfall or snow melt events. It is considered that specific drainage and crossing designs will be required to prevent inundation and to ensure access is maintained. Additionally, during river high flows, the bed load of active drainages can be expected to become mobile and this will need to be considered as part of the river crossing designs. An assessment of the flow capacity requirements for the container bridge over the Kirkespir River during a 1 in 2-year flow event is presented in Golder (2020c)

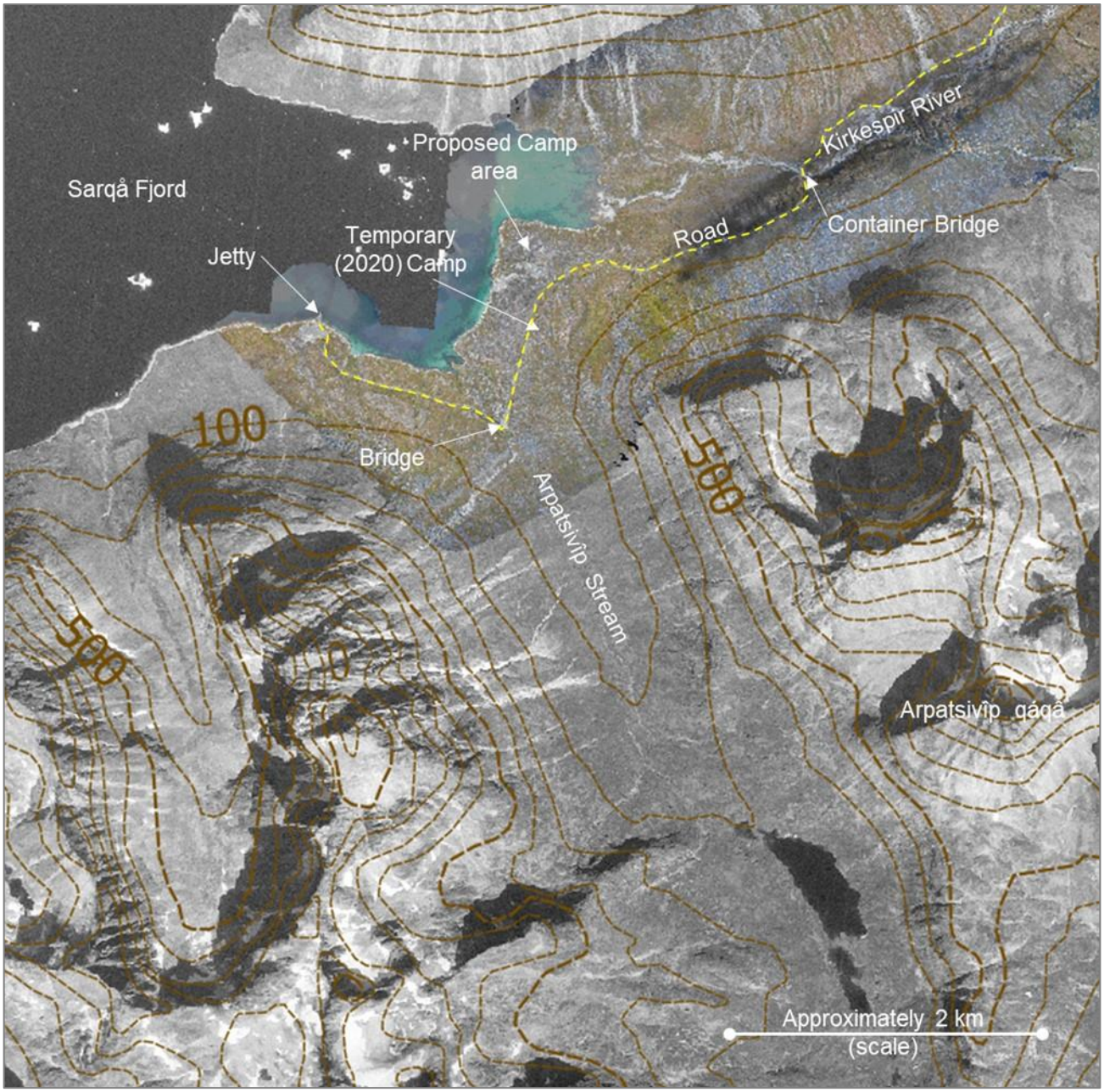

Figure 22: Access road with the two river crossing locations identified

Figure 23: Access Road river crossing between the pier and the proposed camp

Figure 24: Container bridge over the Kirkespir River

4.1.4 Borrow Pits Area

During the 2020 site investigation one sample was obtained from each of the two areas used as borrow pits during the previous operating period and sent for analysis to assess for suitability as aggregate material for concrete mix, engineered backfill and for use in access road construction.

The borrow pit areas are shown in Figure 15. The test results are presented at APPENDIX C.

4.1.5 DTSF and Process Plant Site

The proposed DTSF and process plant sites are located in the upper Kirkespirdalen and are accessed by the access gravel road (Figure 2, Figure 4 and APPENDIX A). A conceptual layout (as of December 2020) for the DTSF (five years tailings storage capacity) and the process plant are presented in Figure 25 and APPENDIX A. The site is dominated by a U-shaped valley formed by glacial processes. The upper parts of the ridges and the adjacent hills are characterised by extensive rock outcrops and thin surficial deposits comprising talus (cobble and boulder size).

The Kirkespir River is a braided river characterised by a network of active drainage channels. It is considered likely that the drainage channels migrate regularly during high rainfall/run off events such as during storm events and spring snow melt. Alluvial deposits comprising cobbles and boulders with sand and gravel (alluvium) overlying glacial till and bedrock have been encountered within the area of the proposed process plant site and DTSF. The thickness of alluvial deposits recorded in boreholes BH01-01 to BH01-04 (Golder, 2002 and APPENDIX B) ranged from 4.32 m (BH01-03) to 8.1 m (BH01-01). Superficial soils and till deposits were encountered in some boreholes and the total thickness of overburden deposits reported ranged from 4.6 m (BH01-03) to 8.5 m (BH01-02). Bedrock was not encountered in any of the boreholes.

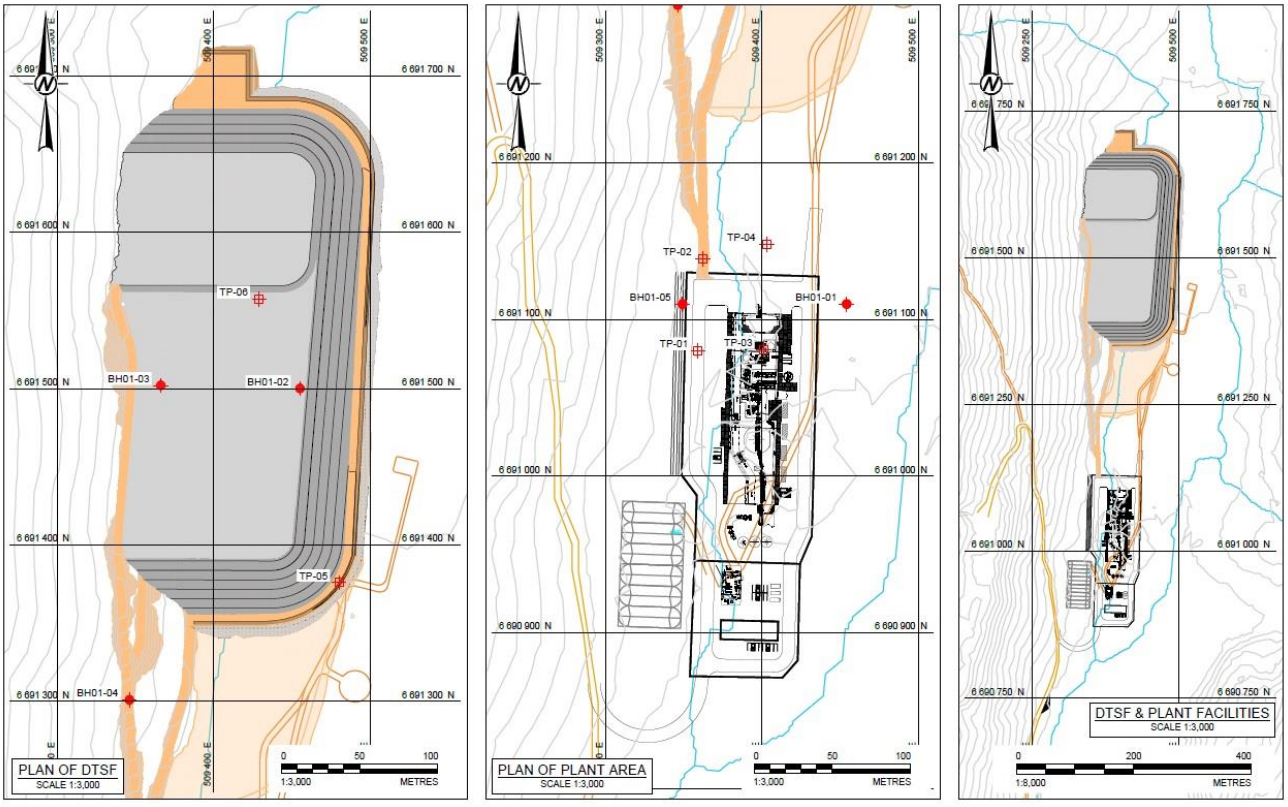

Figure 25: Plan of the proposed process plant site and DTSF site showing investigation points

Two trial pits were excavated in the proposed area for the DTSF denominated as TP-05 and TP-06 (Figure 26 and Figure 27). The pits were excavated to a total depth of 1.8 m and 3.0 m respectively. Logs for the trial pits are presented at APPENDIX C.

The material encountered in TP-05 comprised 0.2 m of well graded sand with gravel (GW as per ASTM 2488) considered as fill placed during previous Mine operation and well graded sand with gravel, cobbles and boulders (SW as per ATM2488) (Figure 26) to a maximum excavated depth of 1.8 mbgl. Groundwater was intercepted at 1.8 mbgl. A sample of alluvium from a depth of 1.7 mbgl was selected for testing (test schedule and results are presented at APPENDIX C).

Figure 26: Excavated materials from TP-05 in the proposed DTSF area

The material encountered in TP-06 (Figure 27) comprised 0.15 m of loose brown gravel with sand, cobbles and organic matter (TOPSOIL) underlain by brown boulders, cobbles and gravel with sand (ALLUVIUM) to a maximum excavated depth of 3.0 m. Groundwater was intercepted at 1 mbgl.

Figure 27: Excavated material from TP-06 in the proposed DTSF area

Four trial pits (TP01 – TP04) were excavated in the proposed process plant site area.

In TP01, TP02 and TP04 TOPSOIL comprising loose brown coarse gravel with sand, cobbles and organic matter was encountered to a maximum depth of 0.15 mbgl. MADE GROUND comprising dry, loose grey gravel and cobbles was present to a depth of 0.3 mbgl in TP03.

Trial Pit TP-01 was excavated to a depth of 2.7 mbgl with ALLUVIUM comprising grey boulders, cobbles and gravel with sand being present from 0.15 mbgl to the maximum excavated depth of 2.7 bgl. Groundwater was intercepted at 2 mbgl.

Trial Pits TP-02, TP-03 and TP-04 were excavated to 2.1 mbgl, 1.8 mbgl and 1.6 mbgl respectively through ALLUVIUM comprising brown boulders, cobbles and gravel with sand. No groundwater was intercepted in TP02, however groundwater was intercepted at 1.6 mbgl and 1.5 mbgl in TP03 and TP04 respectively.

Photographs of the trial pits and the soils excavated are presented in Figure 28. Samples of alluvium from TP01 and TP04 were selected for laboratory testing (a test schedule and results are presented at APPENDIX C).

Figure 28: Trial Pits TP-01, TP-02, TP-03 and TP-04 excavated in the proposed process plant area

The depth to groundwater recorded during borehole drilling (Golder, 2002) and during trial pit excavation varied from 0.4 mbgl to 2.4 mbgl. Groundwater observations in standpipes installed within trial pits are provided in Golder 2020a.

The critical elements to be addressed during the design of foundations for the process plant structures and the assessment of stability for the DTSF are shallow groundwater levels, flood risk and potential for freeze-thaw cycles in winter. It is recommended that this is given careful consideration in the next stage of the project.

As the proposed process plant area is within the braided channel of the Kirkespir River foundation preparation works should include construction of a fill pad. Erosion protection will need to be provided in the design of the

pad to protect exposed banks from material mobilisation in the event of flooding or high flows during storms or snow melt.

There is the potential for localised rock falls that are likely to be triggered by rainfall and or freeze thaw conditions from the steeper upper slopes of the ridges bounding Kirkespirdalen. Detailed field mapping is recommended to assess rock fall potential within areas with adjacent steep rock slopes (Golder, 2020a).

Debris flows may originate from steeper parts of the scree slopes and fan deposits during high rainfall or run-off events and loose surficial deposits may become mobile and flow downslope.

4.1.6 300 Level Mine Portal Platform and Haul Road

The existing 300 Level Mine portal platform was constructed during previous operation of the mine using waste rock (Figure 29). It is understood that the original ground slope beneath the waste rock platform varied between 19^{o} and 26^{o} and comprised overburden of sand, gravel, cobbles and boulders of various thicknesses (Golder, 2003), interpreted to be talus deposits.

Figure 29: Existing waste rock platform at the 300 Level portal dumps showing slopes (view from the proposed process plant area)

The upper layer of the waste rock material within the 300 Level portal platform appears to have been compacted through the traffic of vehicles that occurred during the past operation of the mine. However, waste rock discharged along the slope south of the Mine portal platform seemed to comprise more loose material on the upper layer (Figure 30 and Figure 31).

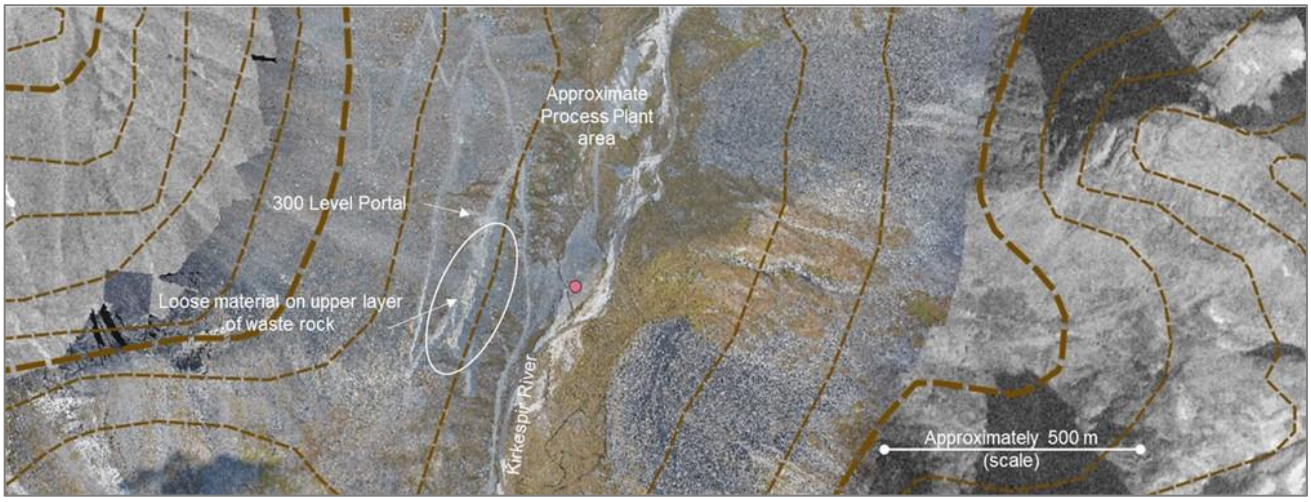

Figure 30: Location of loose material on upper layer of waste rock dumps south of the 300 Level portal

Figure 31: Waste dumps south of the 300 Level portal (view due south)

Based on the available topographical data provided by the Company the slope of waste rock platforms is approximately 36^{o} at the 300 Level portal and approximately 38^{o} along the waste dump area to the south. Although it is considered that the angle of internal friction of waste rock is likely to exceed the existing slope angle as these slopes have been in place for a number of years and appear to be generally stable, parts of the platform area are poorly drained and any changes in material saturation and the phreatic surface in the ground are considered likely to have an impact on the overall slope stability. As a consequence of the observed poor drainage it is considered that runoff control measures will be needed to enhance the stability of the existing 300 Level Mine portal platform.

It is considered that the haul road connecting the proposed process plant area with the 300 Level portal platform has an excessive gradient for the safe transportation of ore (up to 19% in some sections). It is understood from AEX personnel that a one-way system will be adopted for the existing road (Figure 32). As per the access road, the depth of surficial soils will need to be confirmed if an assessment of the potential for realignment of the road (to decrease the slope in steep sections) is undertaken to inform the design of the road including the requirement for cut and fill.

Figure 32: View south of the existing haul road from the proposed process plant area to the 300 Level platform.

4.2 Preliminary Geotechnical Assessment

Laboratory tests were undertaken on samples obtained from trial pits and borrow area. Tests included:

- Classification (Particle Size Distribution, Particle density and Atterberg limits);
- Moisture Content;
- Compaction (Standard and Modified Proctor); and
- Chemical Tests (Water and acid soluble sulphate, total sulphur, chloride, organic content).

Laboratory test results are presented in APPENDIX C.

Particle Size Distribution (PSD) curves for various material are presented in figures below. Based on the results, the samples from the DTSF and process plant area and from the borrow areas can be classified as well graded gravel and sand (GW) in accordance with ASTM D2488. The sample from the trial pit at the camp site can be classified as well graded sand with gravel (SW). All samples are non-plastic. The reported Standard Proctor Maximum Dry Density (SPMDD) varies from 2.0 to 2.2 t/m^3 for the DTSF and process plant samples; and was 1.8 t/m^3 for the sample from the camp area. The SPMDD values for borrow material are between 2.1 and 2.3 t/m^3.

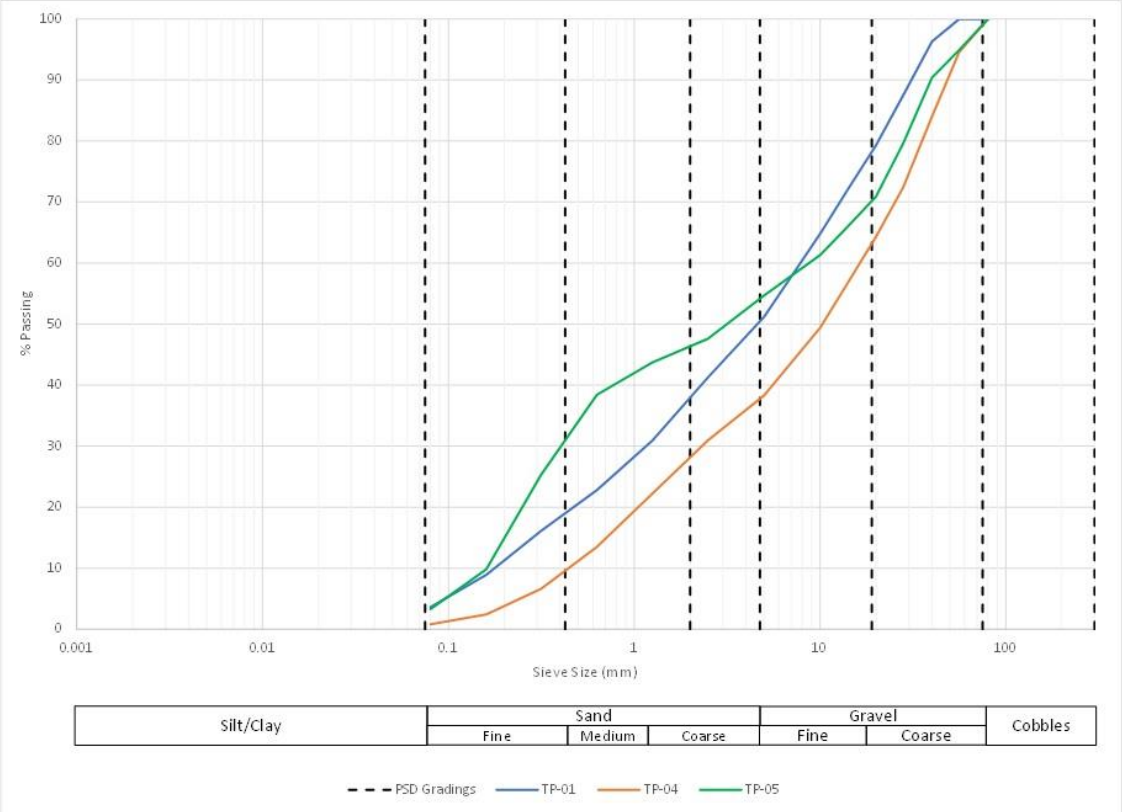

Figure 33: DTSF and process plant area samples - PSD Curve

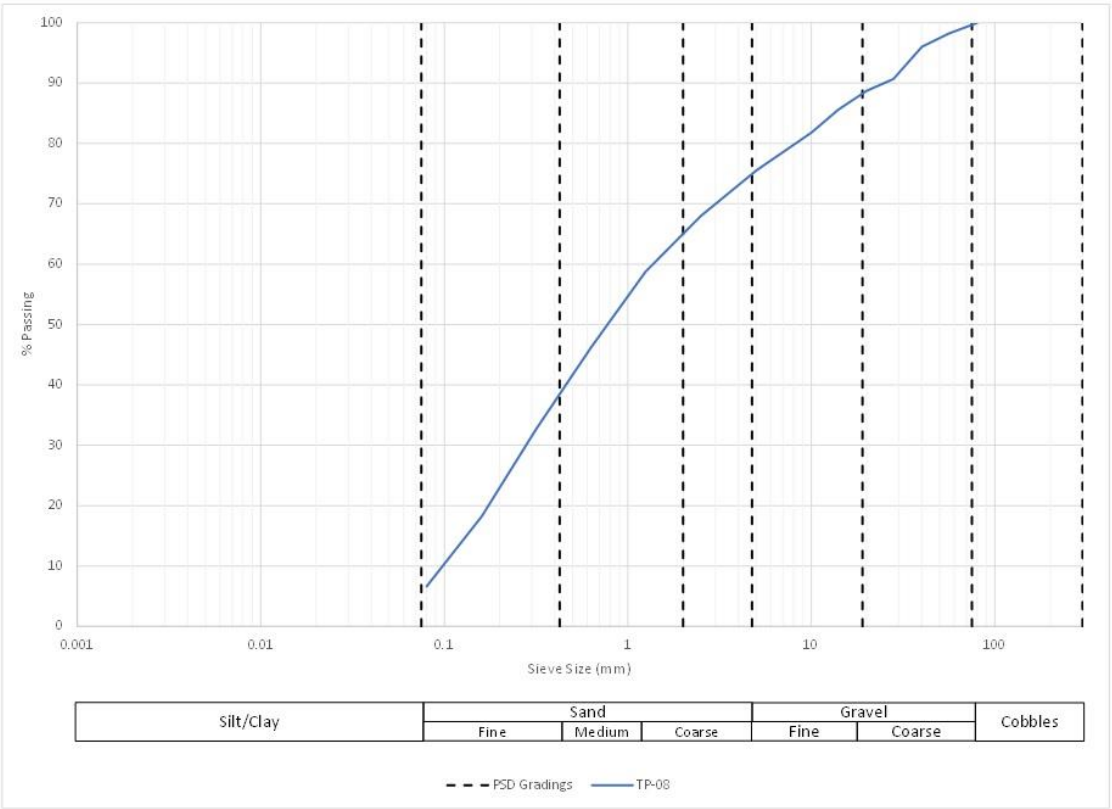

Figure 34: Camp site sample - PSD Curve

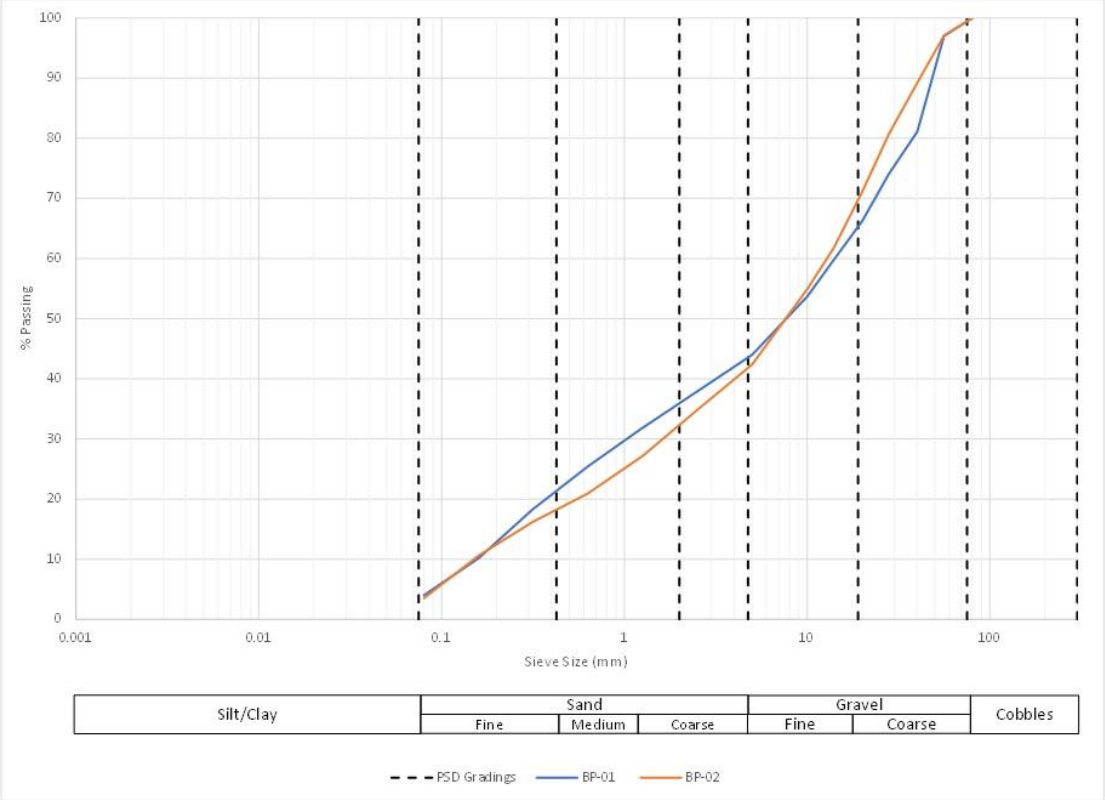

Figure 35: Borrow areas samples - PSD Curve

Organic content is generally low for all samples with the exception of the material obtained from borrow areas. As no test pits were excavated at the proposed borrow areas, the higher reported organic content is likely due to surficial material.

It is recommended that additional targeted site investigation (trial pitting, sampling and laboratory testing) will be undertaken to confirm availability of material for road surface and concrete. However, based on the preliminary assessment the proposed borrow areas are considered appropriate to be used for sourcing aggregate for road construction and concrete.

4.2.1 Foundation Soil

During the drilling of boreholes in 2001 (Golder, 2002) SPTs were undertaken in eleven boreholes with three of the boreholes corresponding to areas of current interest. SPTs in BH01-02 and BH01-05 were completed in the area of the proposed process plant; and SPTs in BH01-12 were completed in the area of the proposed camp to obtain in-situ soil strength properties. A 60° solid cone was driven into the soil at the base of the advanced borehole using a 63.5 kg hydraulic hammer and then the number of blows (SPT N-value) required to drive the drill rod recorded.

In BH01-02 one SPT test was undertaken within a till horizon at approximately 7 mbgl, in the proposed process plant area. The test recorded N values of 71 blows per 0.15 m of penetration.

In BH01-05, the SPT test was undertaken in an alluvial horizon 1 mbgl recording N Value of 35 per 0.05 m of penetration.

In BH01-12 five SPT tests were completed at surface, 2 mbgl, 3.4 mbgl, 4.4 mbgl and 6.2 mbgl respectively. The first test on organic silty sand recorded 32 blows per 0.15 m penetration. The second to fourth tests were completed on a gravelly sand to sand type material recording 53 blows per 0.3 m penetration, 35 blows per 0.18

m penetration and 34 blows per 0.3 m penetration. The last SPT on alluvial material recorded 50 blows per 0.1 m penetration.

Based on typical values for similar materials, the effective friction angle can be estimated as being in the range of 37^{o} to 39^{o} depending on particle size distribution and particles shape based on guidance in Look (2006). The unit weight for alluvial deposits is considered likely to be in the range of 21 kN/m^{3} to 22 kN/m^{3} depending on the saturation conditions based on guidance in Look, 2006. The alluvium material encountered in the area of the proposed camp were observed to contain a greater proportion of fines than those in the DTSF and process plant area. As such it is expected that the characteristics of the materials in the camp site will typically have friction angle on the lower end of the range with the alluvium in the DTSF and process plant area being on the higher end of the range.

The effective friction angle of colluvium (talus) deposits typically varies based on particle size and can be estimated as being between 34^{o} and 37^{o} with a unit weight of 17 kN/m^{3} based on guidance in Lucas *et al.* (2020) and Turner (1996). These values are indicative as a high percentage of fines may affect soil strength and result in lower friction angle.

A summary of the foundation soil estimated geotechnical parameters is presented in Table 2.

Table 2: Foundation Soil Estimated Geotechnical Parameters

Material	Description	Unit Weight (kN/m^{3})	Cohesion (kPa)	Friction Angle (deg)
Alluvium	Gravel and sand with non-plastic fines (camp area)	19 - 21	0	30 - 32
	Gravel and sand with non-plastic fines (DTSF and process plant area)	21 - 22	0	37 - 39
Colluvium (talus) and weathered rock	Cobbles and gravel with sand	17	0	34 - 37

Bearing capacities based on soil descriptions for the alluvial horizon (dense gravel and sand) are estimated to be 300 kPa (Look, 2006). The bearing capacity for foundation soil at near shore area can also be estimated as 300 kPa subject to foundation type (Golder, 2002). The allowable bearing capacity will need to be confirmed once type, depth and geometry of the foundations is defined.

Table 1 presents the typical geotechnical units encountered on site. Bedrock and Glacial till geotechnical parameters are not included in Table 2 as they are not relevant to the assessment of soils for foundation design (assessment). Topsoil if present will need to be excavated before any structures or foundations are constructed on site.

4.2.2 Engineering Fill and Construction Materials

Based on the observed ground conditions it is considered likely that general fill and selected material for foundation construction can be sourced from excavations within the area of the proposed process plant and DTSF.

Two borrow pit areas have been identified (APPENDIX A) and samples obtained for laboratory testing. Based on visual observations in October 2020 and the results of laboratory tests it is considered likely that fine and coarse aggregate for road construction and concrete mix can be obtained from the proposed borrow pit areas.

Based on observations in October 2020 it is considered unlikely that well graded fill for road maintenance purposes will occur naturally due to poor grading or excessive cobble and boulder content. It is envisaged that crushing and or screening of natural deposits will be required.

4.2.3 Cut and Fill Typical Slopes

Preliminary recommendations have been developed for cut and fill slope ratios based on typical values obtained from technical literature for similar materials (Look, 2006) and are presented in Table 3. However further detailed characterisation of soil and bedrock conditions along the cross sections of cut and/or fill area will be required in areas where shallow water table or highly fractured zone associated with faults in the bedrock (fracture rock zone where present) are encountered to validate the estimated design slopes.

Table 3: Cut and Fill Slope Ratio (based on Look, 2006)

Material type	Description	Cut Slope Ratio (V Vertical : H Horizontal)	Fill Slope Ratio (V Vertical : H Horizontal)
Alluvium	Gravel and sand with non-plastic fines (camp area)	1V:2H	1V:2.5H
	Gravel and sand with non-plastic fines (DTSF and process plant area)	1V:1.5H	1V:2H
Colluvium (scree) and weathered rock	Cobbles and gravel with sand	1V:1.2H	1V:2.5H

5.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are made based on the results of the available information:

- As previously noted the soil conditions described in the boreholes (Golder, 2002) and the trial pits (Golder, 2020) vary significantly with respect to the quantity of cobbles and boulders there can be an apparent difference in the description of particle size distribution as it is considered that trial pits are typically more effective at providing information on bulk material properties than boreholes as the use of drilling flush is likely to wash out the fine fraction leading to a sampling bias.
- Based on the available geotechnical data it is considered that the ground conditions in the proposed camp area are suitable for the construction of a camp characterised by low ground bearing accommodation and administrative buildings and storage facilities founded on level slabs with shallow foundations.
- It is considered that the ground conditions in the proposed process plant and DTSF area do not appear to present fatal flaws with respect to the construction of structures or buildings associated with the process facilities although the foundation type and design need to be confirmed.
- The bearing capacities based on soil descriptions for the alluvial deposits (dense gravel and sand) are estimated as 300 kPa, depending on the loading conditions, foundation depth and geometry.
- It is considered likely that general fill and selected material for foundation construction can be sourced from excavations within the environs of the proposed process plant and DTSF. It is considered likely that aggregate for road construction and concrete mix can be obtained from the borrow pit areas that have been identified.

- The existing access gravel road appears to be in fair condition although maintenance will be required to minimise damage due to freeze-thaw cycles and heavy rain. Flooding can occur seasonally in active drainages and on adjacent floodplains during high rainfall or snow melt events. It is considered that specific drainage and crossing designs will be required to prevent inundation and to ensure access is maintained.
- The slope of the existing waste rock platforms based on available topographical data provided by the Company is approximately 36^{o} at 300 Level portal platform and 38^{o} along the waste dump area to the south. Although the angle of internal friction of waste rock is likely to exceed existing slope angles, poor drainage, and fluctuations of phreatic surface in the ground can affect overall slope stability, hence runoff control measures are recommended to enhance stability of the existing 300 Level portal platform.
- Further investigations and test work may be required as the design of the DTSF and other structures is progressed in more detail. Where required, such investigations and test work should validate the preliminary geotechnical parameters and cut/fill slope ratios to ensure appropriate design parameters are used for the detailed design of foundations for structures and modelling of stability of the DTSF and other structures.

6.0 REFERENCES

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Signature Page

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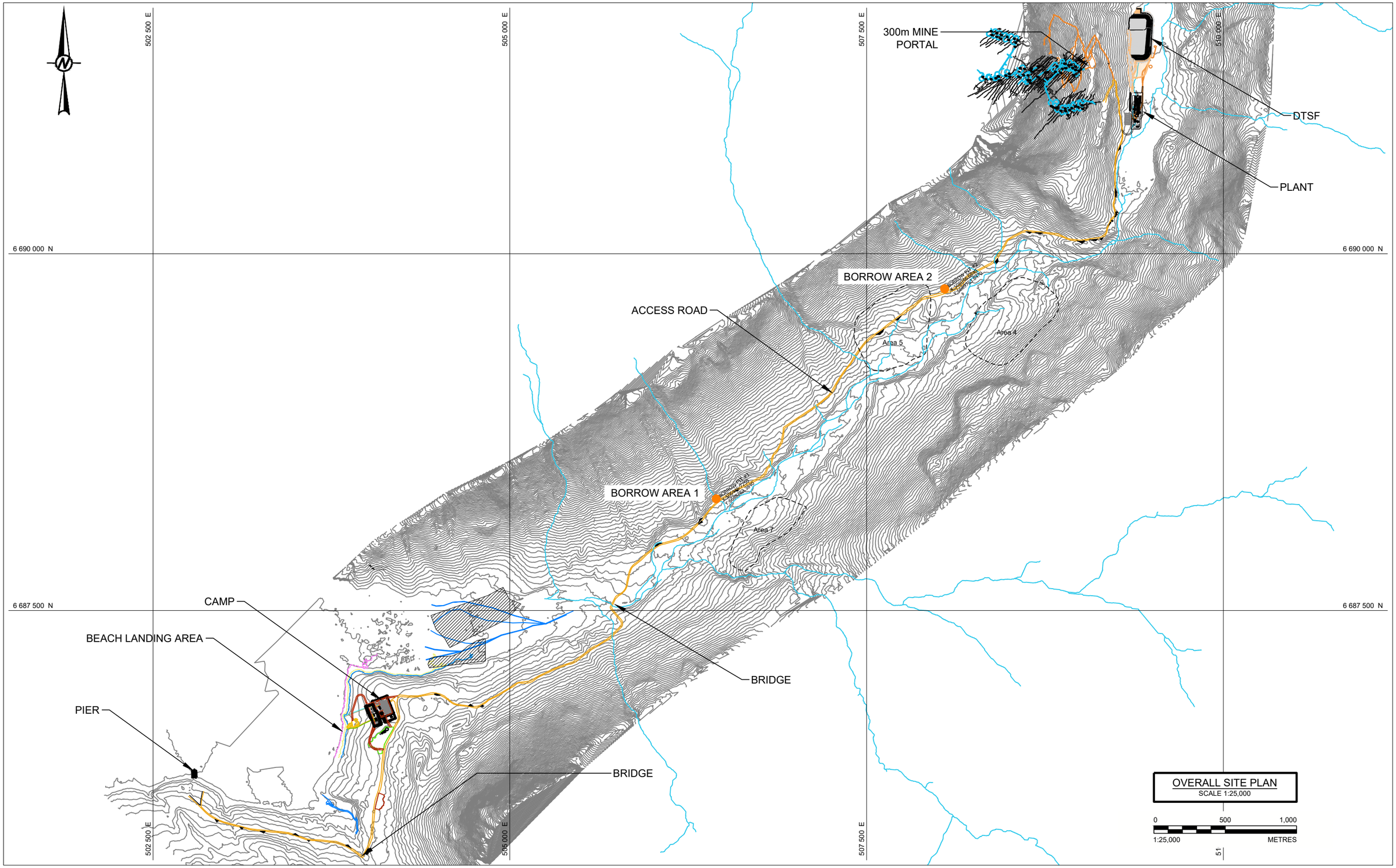
Jo Birch
Project Manager

Gareth Digges La Touche
Project Director

ES/PLC-GDLT/jlb

APPENDIX A

Overall Site Layout and Site Investigation Plan



NOTES

1. DO NOT SCALE FROM THIS DRAWING
2. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE INDICATED
3. ALL CONTOURS SHOWN AT 5 m AND 25 m INTERVALS.
4. ALL COORDINATES ARE IN METERS (UTM REFERENCE SYSTEM)

LEGEND

CLIENT
NALUNAQ A/S

PROJECT
NALUNAQ GOLD PROJECT

CONSULTANT
GOLDER

YYYY-MM-DD	2020-12-18
DESIGNED	ES
PREPARED	MR
REVIEWED	ES
APPROVED	PC

TITLE
OVERALL SITE PLAN

PROJECT NO.	CONTROL	REV.	DRAWING
20136781		A	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

25 mm

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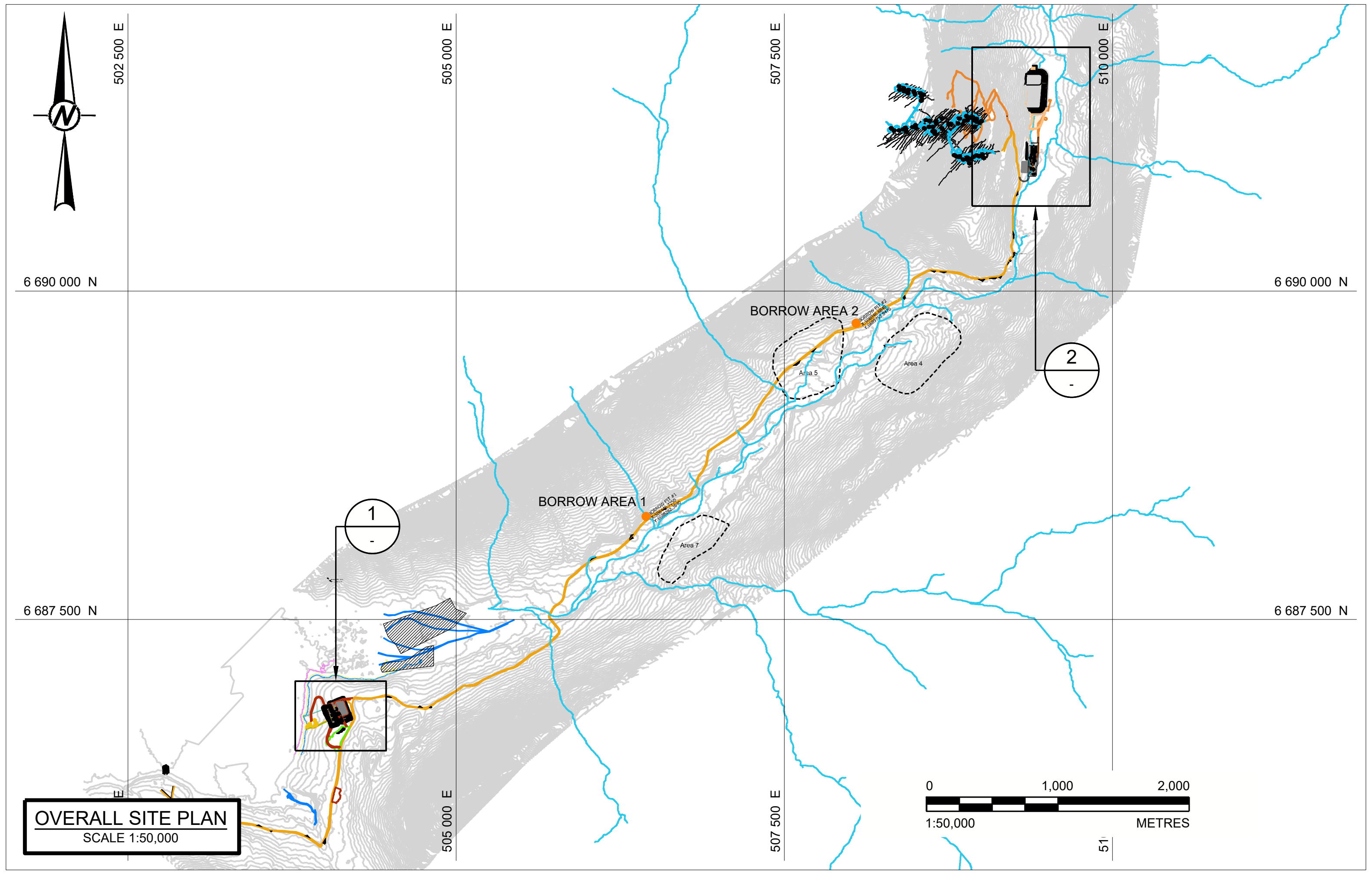
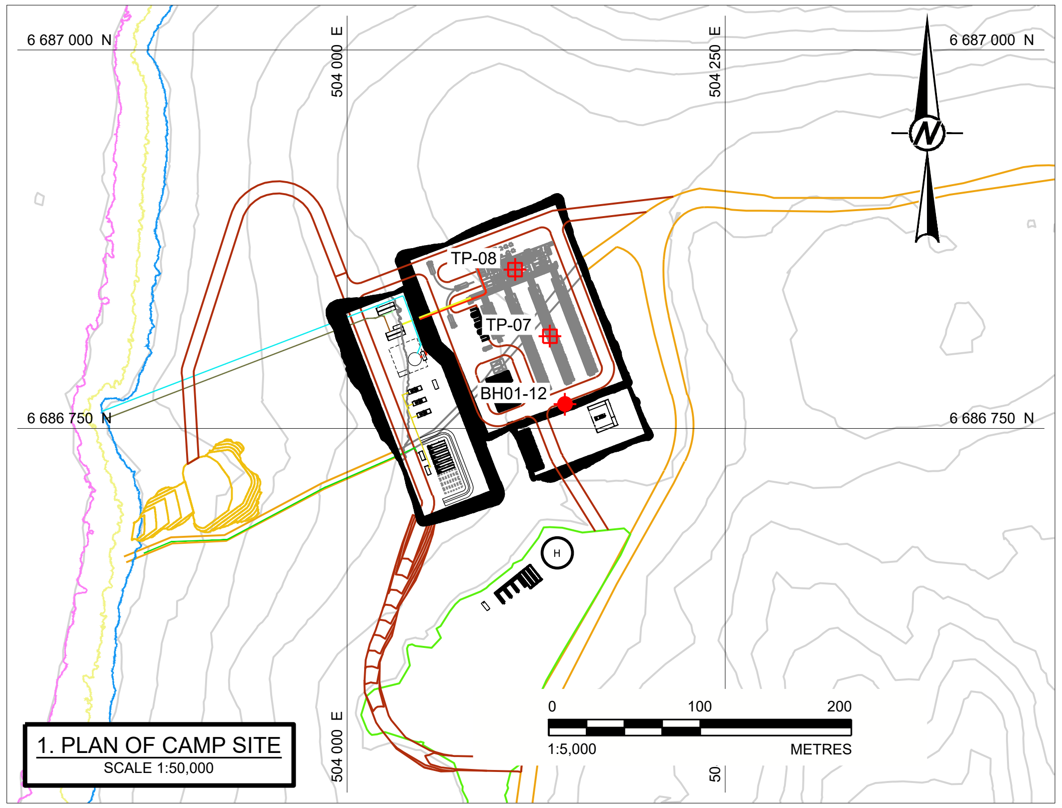
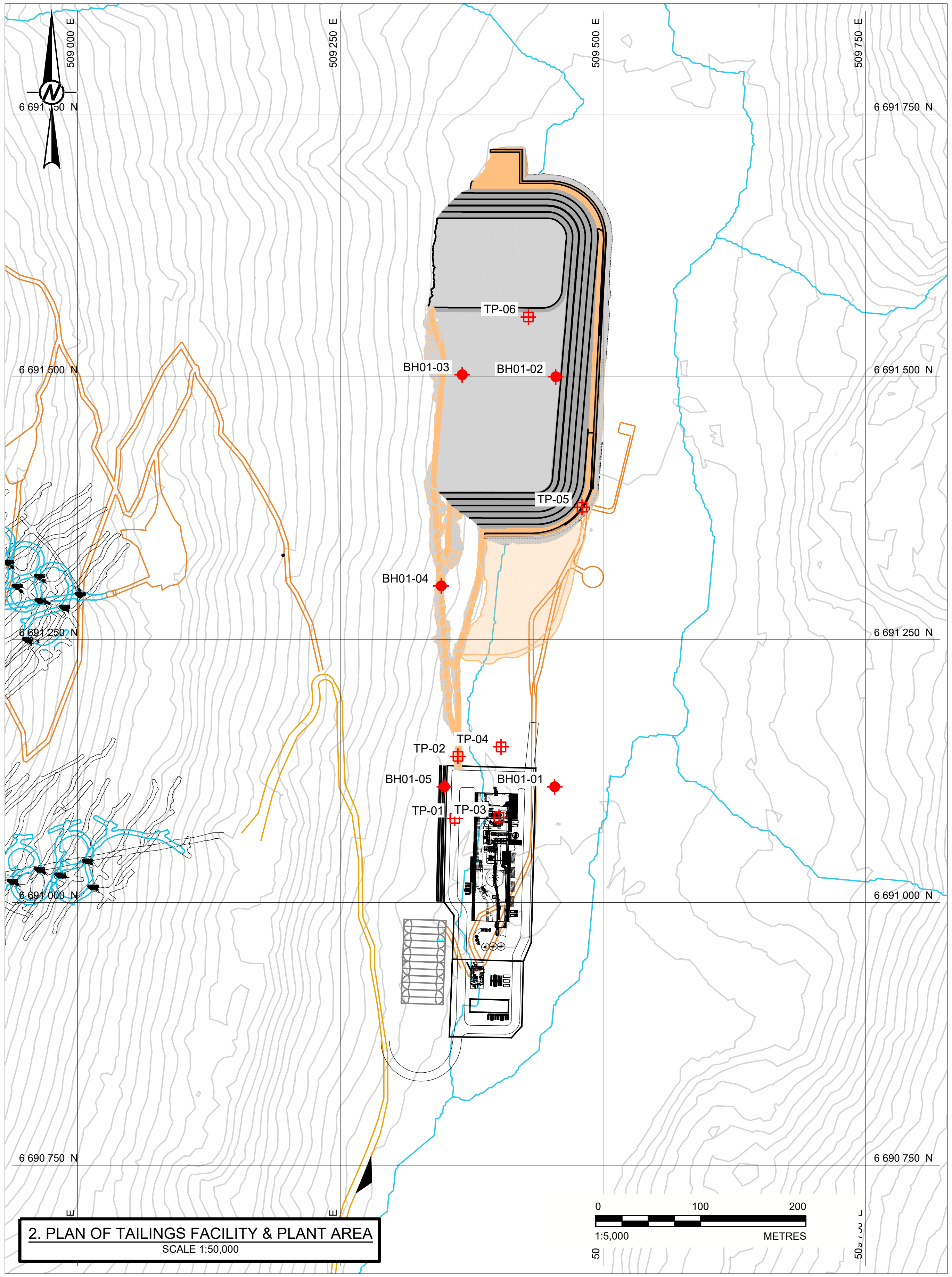


SETOUT TABLE		
POINT No.	EASTING (m)	NORTHING (m)
BH01-01	509454.00	6691110.00
BH01-02	509455.00	6691500.00
BH01-03	509366.00	6691502.00
BH01-04	509346.00	6691301.00
BH01-05	509349.00	6691110.00
BH01-12	504144.00	6686766.00

SETOUT TABLE		
POINT No.	EASTING (m)	NORTHING (m)
TP-01	509359.00	6691080.00
TP-02	509362.00	6691139.00
TP-03	509401.00	6691081.00
TP-04	509403.00	6691148.00
TP-05	509480.00	6691376.00
TP-06	509429.00	6691557.00
TP-07	504134.00	6686811.00
TP-08	504111.00	6686855.00





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4. ALL COORDINATES ARE IN METERS (UTM REFERENCE SYSTEM)

LEGEND

- BOREHOLES (2001)
- TRIAL PITS (OCTOBER 2020)

CLIENT
NALUNAQ A/S

PROJECT
NALUNAQ GOLD PROJECT

CONSULTANT
GOLDER

YYYY-MM-DD	2020-12-18
DESIGNED	ES
PREPARED	MR
REVIEWED	ES
APPROVED	PC

TITLE
SITE GEOTECHNICAL INVESTIGATION

PROJECT NO.	CONTROL	REV.	DRAWING
20136781		A	2

APPENDIX B

2002 Bankable Feasibility Study
Site Investigation

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-01

SHEET 1 OF 1

LOCATION: N 6691110.1; E 509454.9

BORING DATE: September 6 & 7, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		235.50							
0	Boyles 37A Wet Rotary using 'NW' Size Casing & Tri-Cone	Grey boulders (up to 0.5m in size), cobbles, gravel, some sand (inferred from wash out). (Fluvial)		0.00							▽
8				227.40							
		END OF BOREHOLE		8.10							
		Notes: 1. Water level in casing measured at 0.4m depth (Elev.235.1m), 20 mins. after termination of drilling. 2. Hole caved to ground surface on completion of drilling. 3. Borehole terminated within a boulder.									

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: AZ

CHECKED: KAB

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-02

SHEET 1 OF 1

LOCATION: N 6691500.1; E 509455.7

BORING DATE: September 9, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		240.10							
0	Boyles 37A; Wet Rotary using 'NW' Size Casing & Tri-Cone	TOPSOIL Grey, boulders (up to 0.45m in size), cobbles, gravel, trace to some sand (inferred from wash out). (Fluvial)		0.05							BENTONITE SEAL
2											
4											
6				233.60							CAVED MATERIAL
		Very dense, wet, grey SANDY GRAVEL, trace silt. (TILL) Numerous cobbles below 6.5m depth.		6.50	1	50 DO	71/.15		○	M	
8				231.60							
		END OF BOREHOLE Notes: 1. Water level in monitoring well measured at 0.8m depth (Elev.239.3m), 30mins. after installation. 2. Water level in monitoring well measured at 0.8m depth (Elev.239.3m), on September 24, 2001. 3. Hole caved to 1.1m depth on completion of drilling.		8.50							
10											
12											
14											
16											
18											
20											

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: AZ

CHECKED: KAB

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-03

SHEET 1 OF 1

LOCATION: N 6691502.0; E 509366.7

BORING DATE: September 9, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		245.00							
	Boyles 37A; Wet Rotary using 'NW' Size Casing & Tri-Cone	Moss and TOPSOIL.		0.00							
		Grey and brown boulders, cobbles, gravel, trace to some sand (inferred from wash out). (Fluvial)		0.18							
2											▽
4				240.40							
		END OF BOREHOLE		4.60							
6		Notes: 1. Water level in casing measured at 2.4m depth (Elev.242.6m), upon termination of drilling. 2. Hole caved to ground surface upon completion of drilling operation.									
8											
10											
12											
14											
16											
18											
20											

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: AZ

CHECKED: KAB

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-04

SHEET 1 OF 1

LOCATION: N 6691301.0; E 509346.1

BORING DATE: September 8, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GRADED GROUND SURFACE		248.10							
0	Boyles 37A; Wet Rotary using 'NW' Size Casing & Tri-Cone	Grey, boulders (up to 0.3m to 0.7m in size), cobbles, gravel, trace to some sand (inferred from wash out). (Fluvial)		0.00							▽
4				243.20							
		END OF BOREHOLE		4.90							
		Notes: 1. Water level in casing measured at 2.4m depth (Elev.245.7m), 60mins after termination of drilling. 2. Used bulldozer to create a suitable drilling area. 3. Borehole terminated within a boulder.									

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: AZ

CHECKED: KAB

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-05

SHEET 1 OF 2

LOCATION: N 669110.4; E 509349.5

BORING DATE: September 6 & 7, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		239.10							
0	WET ROTARY	Moss and TOPSOIL.		0.05							
	WET ROTARY NQRC	Grey, boulders, cobbles, gravel, trace to some sand (inferred from wash out). (Fluvial)			1		35/ .05				
2	WET ROTARY NQRC				2						
	WET ROTARY NQRC				3						
	WET ROTARY NQRC				4						
4	WET ROTARY TRI-CONE				5						
6	WET ROTARY NQRC										
					6						
				231.80							
				7.30							
8		Continued on Record of Drillhole 01-05.									
		Notes:									
		1. Water level in casing measured at 1.5m depth (Elev.237.6m), 30 mins. after termination of drilling.									
		2. Hole caved to 1.6m depth on completion of drilling.									
10		3. Used 'NW' size casing refusal achieved at 6.2m depth.									
		4. Open borehole dry on September 8, 2001. Borehole backfilled with native soil on September 8, 2001.									
12											
14											
16											
18											
20											

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: AZ

CHECKED: KAB

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-06

SHEET 1 OF 2

LOCATION: N 6689580.0; E 508399.7

BORING DATE: September 10, 11 & 12, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		132.20							
0	BOYLES 37A, WET ROTARY USING 'NW' SIZE CASING, TRI-CONE	TOPSOIL, moss and grass.		0.00							▽
		Wet, grey, large rocks, boulders and cobbles. (TALUS)		0.25							
2		Numerous voids were inferred from sudden casing drops during drilling operation.									
4											
6											
8											
				123.06							
10		Wet, grey, boulders (up to 0.8m in size), cobbles, gravel, sand and silt (inferred from wash out). (Fluvial)		9.14							
12					1	WS					
14											
16	WET ROTARY USING 'NW' SIZE CASING, NQRC				2	RC					
					3	RC					
18					4	RC					
					5	RC					
20					6	RC					
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: AZ

CHECKED: KAB

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-06

SHEET 2 OF 2

LOCATION: N 6689580.0; E 508399.7

BORING DATE: September 10, 11 & 12, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
20	WET ROTARY USING 'NW' SIZE CASING NQRC	Wet, grey, boulders (up to 0.8m in size), cobbles, gravel, sand and silt (inferred from wash out). (Fluvial)			6	RC					
				111.32	7	RC					
		Very dense, wet, grey SAND and GRAVEL, trace to some silt. (Glacial TILL)		20.88	8	50 DO	77				
22					9	RC					
24					10	RC					
					11	50 DO	82/ 0.2				
26	WET ROTARY TRI-CONE										
				104.80	12	50 DO	50/ 0				
		END OF BOREHOLE		27.40							
28		Notes:									
		1. Water level in casing measured at 0.35m depth (Elev.131.85m), 30mins. after termination of drilling.									
		2. Attempted split spoon sampling various depths.									
30											
32											
34											
36											
38											
40											

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: AZ

CHECKED: KAB

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-07

SHEET 1 OF 2

LOCATION: N 6689325.0; E 507725.0

BORING DATE: September 13 & 14, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		96.60							
0	BOYLES 37A, WET ROTARY USING 'NW' SIZE CASING, TRI-CONE	Wet, grey boulders (up to 0.5m in size), cobbles and gravel, some sand and silt (sand and silt interlayers inferred from wash out, ranged from 0.1m to 0.5m in thickness). (Fluvial)		0.00							BENTONITE SEAL Sept.15/01
2					1	50 DO	30/ 0				BACKFILL
4											
6											
8					2	50 DO	50/ .05				
10											
12											
14											
16	WET ROTARY USING 'NW' SIZE CASING, NQRC				3	RC					
				80.09							
		Very dense, wet, grey SILTY SAND, some gravel, trace clay, numerous cobbles and boulders.		16.51	4	50 DO	105/ .25		O	MH	
18					5	WS					
20		*CONTINUED NEXT PAGE*									

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: AZ

CHECKED: KAB

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-07

SHEET 2 OF 2

LOCATION: N 6689325.0; E 507725.0

BORING DATE: September 13 & 14, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
20	NQRC	Very dense, wet, grey SILTY SAND, some gravel, trace clay, numerous cobbles and boulders.			5	WS					
22				74.00							
		END OF BOREHOLE		22.60							
24		Notes: 1. Water level in casing measured at 0.4m depth (Elev.96.2m) 45mins. after termination of drilling. 2. Water level in monitoring well measured at 0.9m depth (Elev.95.7m) on September 15 and 24, 2001.									
26											
28											
30											
32											
34											
36											
38											
40											

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: AZ

CHECKED: KAB

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-08

SHEET 1 OF 1

LOCATION: N 6689729.9; E 507950.0

BORING DATE: September 14, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GRADED GROUND SURFACE		133.60							
0	Boyles 37A Wet Rotary using 'NW' Size Casing & Tri-Cone	Brown, dry boulders, cobbles, gravel and sand, trace silt. (Talus)		0.00	1	CS					
2											
4											
6											
8											
				124.40							
				9.20							
10		END OF BOREHOLE									
12		Notes:									
14		1. Casing dry upon completion of drilling operation.									
16		2. Hole caved to ground surface on completion of drilling.									
18		3. Used bulldozer to create a suitable drilling area.									
20											

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: AZ

CHECKED: KAB

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-09

SHEET 1 OF 1

LOCATION: N 6689385.0; E 507410.1

BORING DATE: September 15, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GRADED GROUND SURFACE		119.80							
0	Boyles 37A Wet Rotary using 'NW' Size Casing & Tri-Cone	Very dense, moist to wet, brown becoming grey at 3m depth, boulders (up to 1.5m in size), cobbles, gravel and sand, trace silt. Sandy gravel layers up to 0.3m at 3m and 5.8m depths. (Talus)		0.00	1	50 DO	66/ .22		○	M	▽
6					2	50 DO	114/ .08				
					3	WS					
				113.20							
		END OF BOREHOLE (Practical Refusal) Notes: 1. Water level in casing measured at 3.1m depth 10mins. after termination of drilling. 2. Borehole terminated within a boulder. 3. Used bulldozer to create a suitable drilling area.		6.60							

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: AZ

CHECKED: KAB

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-10

SHEET 1 OF 1

LOCATION: N 6686470.5; E 503833.3

BORING DATE: September 16, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		6.73							
0	Boyles 37A, Wet Rotary 'NW' Size Casing & Tri-Cone	MOSS Very dense, moist, brown GRAVELLY SAND to SAND, some gravel, trace silt, occasional cobbles up tp 0.61m depth.		0.08	1	50 DO	107/.25		W	M	
2				3.53	2	50 DO	42/.15		W		
		END OF BOREHOLE Note: 1. Borehole dry upon compoletion of drilling.		3.20							
4											
6											
8											
10											
12											
14											
16											
18											
20											

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: AZ

CHECKED: KAB

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-11

SHEET 1 OF 1

LOCATION: N 6686486.3; E 504031.8

BORING DATE: September 18, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		30.63							
0	BOYLES 37A, WET ROTARY USING 'NW' SIZE CASING TRI-CONE	MOSS Compact to very dense, moist, brown GRAVELLY SAND to SAND, trace to some gravel, trace silt, trace organics up to 0.61m depth, occasional cobbles.		0.10	1	50 DO	7/ .22				
2					2	50 DO	59			M	
					3	50 DO	24				
4					4	50 DO	44				
6		Numerous cobbles below 7.3m depth.			5	50 DO	45			M	
8											
					6	50 DO	71/ .25				
10											
12				18.44							
	NQRC	Grey, boulders, cobbles and gravel. (Fluvial)		12.19	7	50 DO	40/ 0				
					8	RC					
14											
				15.03							
		END OF BOREHOLE		15.60							
16		Notes: 1. Water level in casing measured at 10.3m depth after termination of drilling on September 18, 2001. 2. Borehole dry on September 19, 2001. 3. Casing refusal achieved at 12m depth.									
18											
20											

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: AZ

CHECKED: KAB

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-12

SHEET 1 OF 1

LOCATION: N 6686766.9; E 504144.1

BORING DATE: September 19 & 20, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m
		GROUND SURFACE		29.95			
0	BOYLES 37A, WET ROTARY USING 'NW' SIZE CASING TRI-CONE	Organic SILTY SAND.		0.00	1	50 DO	32/ .15
		GRAVELLY SAND to SAND, trace to some silt, compact to dense, moist, brown.		0.25			
2					2	50 DO	53
					3	50 DO	35/ .18
4					4	50 DO	34
				24.92			
		Very dense, grey, boulders, cobbles, gravel and sand. (Fluvial)		5.03			
6					5	50 DO	50/ 0.1
	WET ROTARY NQRC				6	RC	
8					7	RC	
				21.45			
		END OF BOREHOLE		8.50			
10		Notes:					
		1. Borehole dry upon completion of drilling operation.					
		2. Casing refusal acheived at 6.4m depth.					
12							
14							
16							
18							
20							

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa — nat V. + Q - ● rem V. ⊕ U - ○: 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp W Wl; 10 20 30 40

ADDITIONAL LAB. TESTING: M

PIEZOMETER OR STANDPIPE INSTALLATION

DEPTH SCALE

1 : 100

LOGGED: AZ

CHECKED: KAB

Golder Associates

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-13

SHEET 1 OF 1

LOCATION: N 6686470.5; E 503833.3

BORING DATE: September 20 & 21, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		6.70							
0	Boyles 37A; Wet Rotary using 'NW' Size Casing & Tri-Cone	Very dense, wet, brown becoming grey at 1.5m depth, GRAVELLY SAND to SAND, trace to some silt, trace gravel, occasional cobble and boulders.		0.00							BENTONITE SEAL
					1	50 DO	85/ .08				
2					2	50 DO	50/ .05				
					3	50 DO	100/ .01				CAVED
4											
					4	50 DO	50/ .01			M	
6											
					5	50 DO	81/ .15				
8				-1.83							
		Boulders, cobble, gravel and sand (inferred from wash out). (Fluvial)		8.53							
10				-4.00							
		END OF BOREHOLE		10.70							
12		Notes: 1. Water level in casing measured at 6m depth (Elev.0.7m), immediately after termination of drilling. 2. Water level in monitoring well measured at 4.1m depth (Elev.2.6m), on September 21 and 24, 2001. 3. Borehole caved to ground surface upon completion of drilling.									
14											
16											
18											
20											

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: AZ

CHECKED: KAB

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-14

SHEET 1 OF 1

LOCATION: N 6688157.6; E 506715.7

BORING DATE: September 22, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		58.10							
0		Moss and TOPSOIL.		0.00							
		Boulders, cobbles, gravel with to some sand. (Fluvial)		0.25							
2											
				54.20							
4	Boyles 37A Wet Rotary using 'NW' Size Casing & Tri-Cone	Very dense, wet, grey, SILTY SAND to SANDY SILT, some gravel.		3.90	1	50 DO	92		○	MH	▽
		Numerous cobbles and boulders below 4.9m depth.									
6					2	50 DO	60		○		
8											
10					3	50 DO	90/ 0.2		○	MH	
12											
					4	50 DO	50/ 0.1		○		
14											
16				41.90							
		END OF BOREHOLE		16.20							
18		Note: 1. Water level in casing measured at 4.1m depth (Elev.54.0m), 15mins. after termination of drilling.									
20											

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: AZ

CHECKED: KAB

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

PROJECT: 001-1736-1

RECORD OF BOREHOLE: 01-15

SHEET 1 OF 1

LOCATION: N 6688247.7; E 506942.0

BORING DATE: September 23, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		74.30							
0	BOYLES 37A, WET ROTARY USING 'NW' SIZE CASING TRI-CONE	Compact to very dense, moist, grey SAND and GRAVEL with cobbles and boulders.		0.00	1	50 DO	29		○	M	
2				71.15	2	50 DO	50/ 0.1				
4		Grey, boulders (ranging from 0.5m to 1.5m in size), cobbles, gravel and sand. Sandy layers of up to 0.3m in thickness, inferred from wash out and resistance to drilling. (Fluvial)		3.15							▽
6											
8	WET ROTARY NQRC			65.10	3	RC					
10		END OF BOREHOLE Notes: 1. Water level in casing measured at 6.3m depth (Elev.68.0m), immediately after termination of drilling. 2. Casing refusal achieved at 6.8m depth.		9.20							
12											
14											
16											
18											
20											

BOREHOLE 001-1736.GPJ GLDR_CAN.GDT 19/6/02 MMZ

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: AZ

CHECKED: KAB

TABLE 1

SUMMARY OF WATER CONTENT DETERMINATIONS

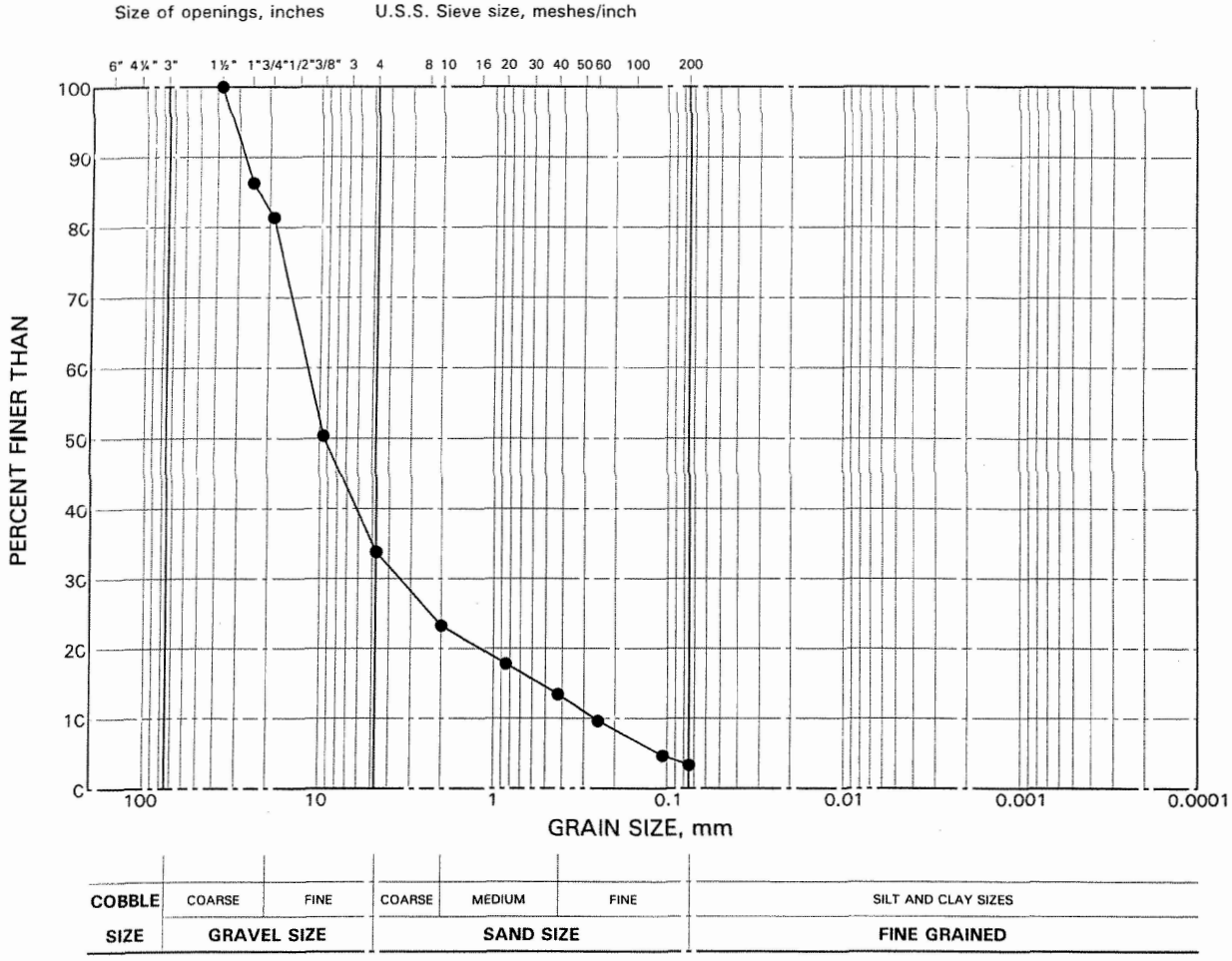
PROJECT NUMBER	001-1736-1
PROJECT NAME	Kvaerner Metals / Feasibility / Greenland
DATE TESTED	November, 2001

Borehole No.	Sample No.	Depth (ft)	Depth (m)	Water Content (%)	Atterberg Limits LL, PL, PI
01-02	1	23.0-24.0	7.01-7.32	9.2%	
01-07	4	55.0-56.5	16.76-17.22	14.5%	
01-09	1	10.0-10.8	3.05-3.29	5.5%	
01-10	1	5.0-6.3	1.52-1.92	12.2%	
01-10	2	10.0-10.5	3.05-3.20	13.7%	
01-11	1	0.0-0.8	0.00-0.24	20.3%	
01-11	2	5.0-6.5	1.52-1.98	6.2%	
01-11	3	10.0-11.5	3.05-3.51	14.2%	
01-11	4	14.0-15.5	4.27-4.72	11.0%	
01-11	5	20.0-21.5	6.10-6.55	7.3%	
01-11	6	29.0-30.3	8.84-9.24	15.5%	
01-12	1	0.0-3.0	0.00-0.91	17.8%	
01-12	3	10.0-11.1	3.05-3.38	9.5%	
01-12	4	14.0-15.5	4.27-4.72	24.3%	
01-13	1	5.0-5.3	1.52-1.62	9.1%	
01-13	3	12.0-12.3	3.66-3.75	20.5%	
01-13	4	20.0-20.8	6.10-6.34	20.6%	
01-14	1	14.0-15.4	4.27-4.69	17.1%	
01-14	2	22.0-23.5	6.71-7.16	22.8%	
01-14	3	32.0-33.3	9.75-10.15	22.9%	
01-14	4	42.0-42.8	12.80-13.05	16.5%	
01-15	1	4.0-5.4	1.22-1.65	7.0%	

GRAIN SIZE DISTRIBUTION

Sandy Gravel Till

FIGURE 6



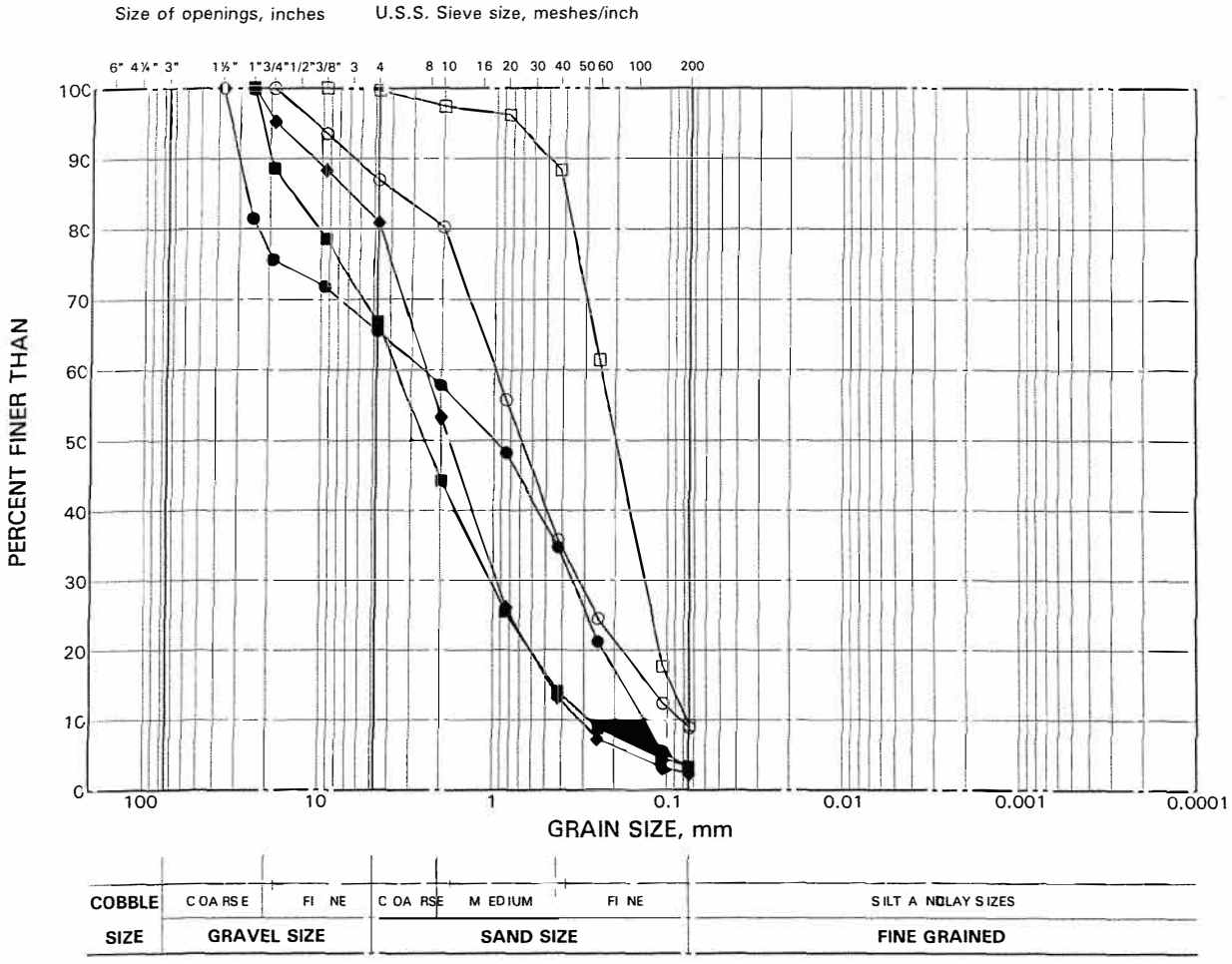
LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	01-02	1	7.3

GRAIN SIZE DISTRIBUTION

Gravelly Sand to Sand

FIGURE 11



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	01-10	1	1.9
■	01-11	2	2.0
◆	01-11	5	6.6
○	01-12	3	3.4
□	01-13	4	6.3

Project 001-1736-1

Golder Associates

APPENDIX C

2020 Trial Pit Logs and Laboratory Test Results

Project: Nalunaq Gold Project

GOLDER

TRIAL PIT No: TP01
(Process Plant)

Job Number: 20136781	Date Start: 03/10/2020 Date Finish: 03/10/2020	Coordinate System: WGS_1984_UTM_Zone_23N Easting (m): 509359 Northing (m): 6691080
Client : **Nalunaq A/S**		Elevation (m): 237 Method/Plant Used: Mechanical Excavator

Sheet **1** of **1**

SAMPLES & TESTS			Water Elevation	STRATA			Backfill
Depth (m)	Type	Result		Legend	Depth (m)	Description	
					0.0 - 0.15	Well Graded Sand with Gravel, Cobbles (SW) - About 75 % medium to coarse sand, about 15 % fine to coarse sub-rounded gravel, about 10 % cobbles; moist, brown, with trace of organic fines and moss (TOPSOIL)	Backfilled after completion of test pit log and sampling. YES
2.00	BU				0.15-2.7	Well Graded Gravel and Sand, with Cobbles and Boulders (GW) About 50% coarse to fine sub-rounded hard gravel; about 50% fine to coarse sand, moist, grey; field material had hard, sub-rounded cobbles and boulders with a maximum dimension of 500 mm (ALLUVIUM)	
						Test pit terminated at 2.7 m	

TRIAL PIT INFORMATION			GENERAL REMARKS
Dimensions(m)	Groundwater Observation	Key	Standpipe installed for groundwater monitoring
	Groundwater encountered at 2.0m	SU: Small Grab Undisturbed Sample SD: Small Grab Disturb Sample BU: Large Bulk Undisturbed Sample BD: Large Bulk Disturbed Sample	

All Dimensions in metres	Logged by: ES	Approved by:

Project: Nalunaq Gold Project

GOLDER

TRIAL PIT No: TP02
(Process Plant)

Job Number: 20136781	Date Start: 03/10/2020 Date Finish: 03/10/2020	Coordinate System: WGS_1984_UTM_Zone_23N Easting (m): 509362 Northing (m): 6691139
Client : **Nalunaq A/S**		Elevation (m): 236 Method/Plant Used: Mechanical Excavator

Sheet **1** of **1**

SAMPLES & TESTS			Water Elevation	STRATA			Backfill
Depth (m)	Type	Result		Legend	Depth (m)	Description	
					0-0.1	Well Graded Gravel with Sand, Cobbles (GW) - About 70 % fine to coarse sub-rounded gravel, about 15 % medium to coarse sand, about 5 % cobbles; moist, brown, with Loose, brown, coarse gravel with trace of organic fines and moss (TOPSOIL)	Backfilled after completion of test pit log and sampling. YES
					0.1-2.1	Well Graded Gravel with Sand, Cobbles and Boulders (GW) About 70% coarse to fine sub-rounded hard gravel; about 40% fine to coarse sand, moist, brown; field material had hard, subrounded hard cobbles and boulders with a maximum dimension of 500 mm (ALLUVIUM)	
				Test pit terminated at 2.1 (Refusal)			

TRIAL PIT INFORMATION			GENERAL REMARKS
Dimensions(m)	Groundwater Observation	Key	
	No groundwater encountered.	SU: Small Grab Undisturbed Sample SD: Small Grab Disturb Sample BU: Large Bulk Undisturbed Sample BD: Large Bulk Disturbed Sample	

All Dimensions in metres	Logged by: ES	Approved by:

Project: Nalunaq Gold Project

GOLDER

TRIAL PIT No: TP03
(Process Plant)

Job Number: 20136781	Date Start: 03/10/2020 Date Finish: 03/10/2020	Coordinate System: WGS_1984_UTM_Zone_23N Easting (m): 509401 Northing (m): 6691081

Client : **Nalunaq A/S**

Elevation (m): 235
Method/Plant Used: Mechanical Excavator

Sheet **1** of **1**

SAMPLES & TESTS			Water Elevation	STRATA			Backfill
Depth (m)	Type	Result		Legend	Depth (m)	Description	
					0.0 - 0.3	Well graded Gravel with Sand (GW) about 80% hard sub angular gravel, about 15% medium to coarse sand, about 5% cobbles; dry, grey (FILL)	Backfilled after completion of test pit log and sampling. YES
					0.3-1.8	Poorly Graded Gravel with Sand, Cobbles and Boulders (GW) About 50% coarse to fine sub-rounded hard gravel; about 45% medium to coarse sand, moist, brown ; field material had hard, sub-rounded cobbles and boulders with a maximum dimension of 500 mm (ALLUVIUM)	
Test pit terminated at 1.8 m							

TRIAL PIT INFORMATION

Dimensions(m)	Groundwater Observation	Key
	Groundwater encountered at 1.6m	SU: Small Grab Undisturbed Sample SD: Small Grab Disturb Sample BU: Large Bulk Undisturbed Sample BD: Large Bulk Disturbed Sample

GENERAL REMARKS

Standpipe installed for groundwater monitoring

All Dimensions in metres	Logged by: ES	Approved by:

Project: Nalunaq Gold Project

GOLDER

TRIAL PIT No: TP04
(Process Plant)

Job Number: 20136781	Date Start: 03/10/2020 Date Finish: 03/10/2020	Coordinate System: WGS_1984_UTM_Zone_23N Easting (m): 509403 Northing (m): 6691148
Client : **Nalunaq A/S**		Elevation (m): 236 Method/Plant Used: Mechanical Excavator

Sheet **1** of **1**

SAMPLES & TESTS			Water Elevation	STRATA			Backfill
Depth (m)	Type	Result		Legend	Depth (m)	Description	
					0.0 - 0.1	Well Graded Gravel with Sand, Cobbles (GW) - About 50 % fine to coarse sub-rounded gravel, about 45 % medium to coarse sand, about 5 % cobbles; moist, brown, with Loose, brown, coarse gravel with organic fines and moss (TOPSOIL)	Backfilled after completion of test pit log and sampling. YES
1.5	BU				0.1-1.6	Well Graded Gravel with Sand, Cobbles and Boulders (GW) About 60% coarse to fine sub-rounded hard gravel; about 40% fine to coarse sand; moist, brown; original field sample had hard, sub-rounded cobbles and boulders with a mix mum dimension of 500 mm (ALLUVIUM)	
Test pit terminated at 1.6 m							

TRIAL PIT INFORMATION			GENERAL REMARKS
Dimensions(m)	Groundwater Observation	Key	Standpipe installed for groundwater monitoring
	Groundwater encountered at 1.5m	SU: Small Grab Undisturbed Sample SD: Small Grab Disturb Sample BU: Large Bulk Undisturbed Sample BD: Large Bulk Disturbed Sample	

All Dimensions in metres	Logged by: ES	Approved by:

Project: Nalunaq Gold Project

GOLDER

TRIAL PIT No: TP05 (DTSF)

Job Number: 20136781	Date Start: 03/10/2020 Date Finish: 03/10/2020	Coordinate System: WGS_1984_UTM_Zone_23N Easting (m): 509480 Northing (m): 6691376
Client : **Nalunaq A/S**		Elevation (m): 239 Method/Plant Used: Mechanical Excavator

Sheet **1** of **1**

SAMPLES & TESTS			Water Elevation	STRATA			Backfill
Depth (m)	Type	Result		Legend	Depth (m)	Description	
					0.0 - 0.2	Well graded Gravel with Sand (GW) about 80% hard sub angular grave, about 15% medium to coarse sand, about 5% cobbles; dry, grey (FILL)	Backfilled after completion of test pit log and sampling. YES
1.5	BU				0.2-1.8	Well Graded Sand with Gravel, Cobbles and Boulders (SW) About 45% medium to fine sand, about 50% coarse to fine sub-rounded hard gravel; moist, grey; original field sample had hard, subrounded cobbles and boulders with a maximum dimension of 500 mm (ALLUVIUM)	
						Test pit terminated at 1.8 m	

TRIAL PIT INFORMATION			GENERAL REMARKS
Dimensions(m)	Groundwater Observation	Key	Standpipe installed for groundwater monitoring
	Groundwater encountered at 1.7m	SU: Small Grab Undisturbed Sample SD: Small Grab Disturb Sample BU: Large Bulk Undisturbed Sample BD: Large Bulk Disturbed Sample	

All Dimensions in metres	Logged by: ES	Approved by:

Project: Nalunaq Gold Project

GOLDER

TRIAL PIT No: TP06 (DTSF)

Job Number: 20136781	Date Start: 03/10/2020 Date Finish: 03/10/2020	Coordinate System: WGS_1984_UTM_Zone_23N Easting (m): 509429 Northing (m): 6691557
Client : **Nalunaq A/S**		Elevation (m): 241 Method/Plant Used: Mechanical Excavator

Sheet **1** of **1**

SAMPLES & TESTS			Water Elevation	STRATA			Backfill
Depth (m)	Type	Result		Legend	Depth (m)	Description	
					0.0 - 0.15	Well Graded Sand with Gravel, Cobbles (SW) - About 75 % medium to coarse sand, about 15 % fine to coarse sub-rounded gravel, , about 10 % cobbles; moist, brown, with trace of organic fines and moss (TOPSOIL)	Backfilled after completion of test pit log and sampling. YES
					0.15-3.0	Well Graded Sand with Gravel, Cobbles and Boulders (SP) About 45% medium to fine sand, about 50% coarse to fine sub-rounded gravel; moist, brown; original field sample had hard, subrounded cobbles and boulders with a maxmum dimension of 500 mm (ALLUVIUM)	
				Test pit terminated at 3.0 m			

TRIAL PIT INFORMATION			GENERAL REMARKS
Dimensions(m)	Groundwater Observation	Key	Standpipe installed for groundwater monitoring
	Groundwater encountered at 1.0m	SU: Small Grab Undisturbed Sample SD: Small Grab Disturb Sample BU: Large Bulk Undisturbed Sample BD: Large Bulk Disturbed Sample	

All Dimensions in metres	Logged by: ES	Approved by:

Project: Nalunaq Gold Project			**TRIAL PIT No: TP07 (Camp Site)**
Job Number: 20136781	**Date Start: 04/10/2020** **Date Finish: 04/10/2020**	**Coordinate System: WGS_1984_UTM_Zone_23N**	
		Easting (m): 504134	
		Northing (m): 6686811	
Client : **Nalunaq A/S**		Elevation (m): 31	Sheet **1** of **1**
		Method/Plant Used: Mechanical Excavator	

SAMPLES & TESTS			Water Elevation	STRATA			Backfill
Depth (m)	Type	Result		Legend	Depth (m)	Description	
					0.0 - 0.15	Well Graded Sand with Gravel, Cobbles (SW) - About 75 % medium to coarse sand, about 15 % fine to coarse sub-rounded gravel, , about 10 % cobbles; moist, brown, with trace of organic fines and moss (TOPSOIL) Loose, brown, coarse gravel with sand, cobbles and organic matter (TOPSOIL)	Backfilled after completion of test pit log and sampling. YES
					0.15-1.8	Well Graded Sand with Gravel (SW). About 70% coarse to fine sand, about 25 % corase to fine gravel sub-rounded, about 5% cobbles and boulder with maximum size 500 mm; dry, grey (Alluvium)	
						Test pit terminated at 1.8 m	

TRIAL PIT INFORMATION			GENERAL REMARKS
Dimensions(m)	Groundwater Observation	Key	
	No groundwater encountered.	SU: Small Grab Undisturbed Sample SD: Small Grab Disturb Sample BU: Large Bulk Undisturbed Sample BD: Large Bulk Disturbed Sample	

All Dimensions in metres	Logged by: ES	Approved by:

Project: Nalunaq Gold Project

GOLDER

TRIAL PIT No: TP08
(Camp Site)

Job Number: 20136781	Date Start: 04/10/2020 Date Finish: 04/10/2020	Coordinate System: WGS_1984_UTM_Zone_23N Easting (m): 504111 Northing (m): 6686855
Client : **Nalunaq A/S**		Elevation (m): 31 Method/Plant Used: Mechanical Excavator

Sheet **1** of **1**

SAMPLES & TESTS			Water Elevation	STRATA			Backfill
Depth (m)	Type	Result		Legend	Depth (m)	Description	
					0.0 - 0.15	Well Graded Sand with Gravel Cobbles (SW) - About 80 % medium to coarse sand, about 45 % fine to coarse sub-rounded gravel,, about 5 % cobbles; moist, brown, with Loose, brown, coarse gravel with organic fines and moss (TOPSOIL)	Backfilled after completion of test pit log and sampling. YES
1.5	BU				0.15-2.4	Well Graded Sand with Gravel (SW). About 70% coarse to fine sand, about 25 % corase to fine gravel sub-rounded, about 5% of ines (silt), field material had hard cobbles and boulder with maximum size 500 mm; dry, grey (Alluvium)	
						Test pit terminated at 2.4 m	

TRIAL PIT INFORMATION			GENERAL REMARKS
Dimensions(m)	Groundwater Observation	Key	
	No groundwater encountered.	SU: Small Grab Undisturbed Sample SD: Small Grab Disturb Sample BU: Large Bulk Undisturbed Sample BD: Large Bulk Disturbed Sample	

All Dimensions in metres	Logged by: ES	Approved by:

1. INTRODUCTION

This memorandum presents the results of that laboratory tests carried out on six (6) large sand and gravel samples received on November 15, 2020; two (2) from potential borrow pits for use in concrete (BP-01 and BP-02), three (3) from standard test pits (TP-01, TP-04 and TP-05) and a fourth from the potential sand pits (TP-08). Physical, mechanical and chemical tests were performed on the samples received as suggested by Golder Associates.

In addition, since the borrow pit samples were intended to be used for concrete preparation, other useful tests were added to determine water absorption values and organic content in the materials.

2. PETROGRAPHIC EXAMINATION

Since the type of aggregates used in the concrete is a very important consideration, petrographic examinations were considered to be the first analyses to be carried out on the borrow pit samples in order to determine the type of source rock from which these aggregates were derived.

Below are the petrographic test results obtained, beginning with physical properties of the primary and major fragments contained in borrow pits BP-01 and BP-02:

a) BP-01 Mixture of hard, semi-rounded granitic rocks and banded layered metamorphic gneiss. The generally light pinkish-coloured granitic fragments are composed of coarse, crystalline plagioclase quartz. The darker rock consists of fine grained, angular gneissic fragments tending to fracture along the laminations within the rock, resulting in more tabular shaped pieces. Specific gravity values obtained on these fragments varied between 2.7 and 3.2 and absorption values of less than 1.0% were obtained (low water absorption).

b) BP-02 The major coarse rock fragments in borrow pit BP-02 are very similar in shape, form and composition as identified in BP-01. It is clear that these granular materials have originated from the similar source rock formations: igneous granite and metamorphic gneiss.

Granite fragments

Gneissic fragments

BP-01

Granite fragments

Gneissic fragments

BP-02

3. LABORATORY TEST RESULTS

Below are two tables reporting all laboratory test results obtained, beginning with physical properties of the primary and major fragments contained in borrow pits BP-01 and BP-02.

The highlighted rows of the tables indicate additional non-destructive test results suggested and carried by Journeaux Assoc. for concrete mixes requirements.

PHYSICAL AND MECHANICAL TESTS

TEST	TP-01 Depth=2 m	TP-04 Depth=1.5 m	TP-05 Depth=1.7 m	TP-08 Depth=2 m	BP-01	BP-02
a. Soils identification (ASTM D2488)	Clean sand and gravel	Clean sand and gravel	Clean sand and gravel	Gravelly Sand	Sand and gravel	Sand and gravel
b. Moisture Content (ASTM D2216)	8.0 %	2.6 %	6.4 %	3.8 %	3.7 %	4.5 %
c. Atterberg Limits (ASTM D4318)	Non-plastic.	Non-plastic.	Non-plastic.	Non-plastic.	Non-plastic.	Non-plastic.
d. Particle Density, g/cm^3	Granit 2.7 Gneiss 3.2	Granit 2.7 Gneiss 3.2	Granit 2.7 Gneiss 3.2	Granit 2.7 Gneiss 3.2	Granit 2.7 Gneiss 3.2	Granit 2.7 Gneiss 3.2
e. Absorption	< 1	< 1	< 1	< 1	< 1	< 1
f. PSD Sieving (ASTM D6913)						
• % fines (< 0.08 mm)	3.6	0.8	3.3	6.6	4.0	3.5
• % sand (< 5 mm)	51.2	38.3	54.7	75.5	44.0	42.4
• % < 20 mm	79.3	64.3	70.9	88.7	66.2	71.1
• % < 28 mm	87.5	72.4	79.6	90.7	74.1	80.7
g. PSD Hydrometer (ASTM D7928)	Not done, fines 3.6%	Not done, fines 0.8%	Not done, fines 3.3%	Not done, fines 6.6%	Not done, fines 4.0%	Not done, fines 3.5%
h. Standard Proctor (ASTM D698)	2235 kg/m^3	2177 kg/m^3	2028 kg/m^3	1892 kg/m^3	2138 kg/m^3	2312 kg/m^3
i. Modified Proctor (ASTM D1557)	2350 kg/m^3	2227 kg/m^3	---	---	---	---
j. Coefficient of Permeability, k	10 cm/sec (based on literature)	15 cm/sec (based on literature)	5 cm/sec (based on literature)	5x10^{-2} cm/sec (based on literature)	15 cm/sec (based on literature)	

Highlighted rows: Additional non-destructive tests suggested and carried by Journeaux Assoc. for concrete mixes requirements.

CHEMICAL TESTS

TEST	TP-01 Depth=2 m	TP-04 Depth=1.5 m	TP-05 Depth=1.7 m	TP-08 Depth=2 m	BP-01	BP-02
a. Soil pH	6.43	6.34	7.56	5.94	5.92	6.43
The neutral pH value is 7.0, and the normal range for soils is typically 4.0-8.5. The pH values measured on the samples are therefore within the normal range and close to neutral (range ±6 to ±7.5).						
b. Sulphate [SO4] (Water Soluble), mg/kg	20	9.8	14	6	10	10
c. Sulphate [SO4] (Acid Soluble), mg/kg	24	7	12	4	7	6
Effect of sulphate in the soil is negligible for the concrete for concentrations < 1000 mg/kg						
d. Total Sulphur, mg/kg	<200	<200	<200	<200	<200	<200
e. Total Sulphur, %	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Total sulphur is below detection limits (200 mg/kg)						
f. Chloride, mg/kg	4	4	2	1	2	2
A chloride concentration threshold value of 500 mg/kg (0.05%) is generally used to designate soil or water as being corrosive.						
g. Fraction of Organic Carbon	<0.0015	0.002	0.002	<0.0015	0.003	0.003
h. Fraction of Organic Carbon by Organic Plate No. (ASTM C40) *	3	4	4	2	5	5
** If the color of the supernatant liquid is darker than that of the reference standard color solution (No. 3), the fine aggregate under test shall be considered to possibly contain injurious organic impurities, and further tests should be made before approving the fine aggregate for use in concrete.*						
Highlighted rows: Additional non-destructive tests suggested and carried by Journeaux Assoc. for concrete mixes requirements.						

4. CONCLUSION

From this series of laboratory tests carried on proposed borrow materials, it is concluded that the hard, resistant, low water absorption, frost-resistant fragments are suitable for production of the 1,000-cubic metre mass concrete. However, the organic content in the materials noted in the samples collected at the surface of the two (2) borrow pits is a concern because the chemical tests carried out show lower concentration of organics while the simpler colour test (ASTM C40) done using the organic Plate No. colour chart show unacceptable levels in borrow pits BP-01 and BP-02 when compared to the clear colour for the sands in test pit TP-08 where the sample was taken at the 2-metre depth and this being considered representing acceptable material for use in concrete.

The sand-gravel materials with trace of fines may be classified as having excellent free drainage characteristics under gravity (Burmister 1951) thus relatively high permeability.

Since it is assumed that the wind-blown organic materials are limited to the thin surface layer of the borrow pits and that, at depth, the materials would probably be acceptable. However, additional testing would be required to determine the thickness of the organic layer when the construction site is reopened.

In the absence of photos showing the territory in the borrow pit area, it is our opinion that, in order to access the underlying materials, the topsoil layer including the large cobbles and boulders (+80 mm) would probably have to be removed to a depth of at least 300 mm.

The surface layer may to be removed with a bulldozer and stockpiled beyond the borrow pit limits; these bulk materials can be used for such purposes as road construction, pad construction, deviation berms and control of surface waters and as common fills in sections where cut and fill operations are required.

JOURNEAUX ASSOC.
a division of LAB JOURNEAUX INC.

Noel L. Journeaux, P. Eng., M.S.C.E., F ASCE
OIQ 14341

APPENDIX A

Particle size distribution curves

JOURNEAUX ASSOC
Division LAB JOURNEAUX INC.

GRAIN SIZE ANALYSIS

CSA A23.2-2A

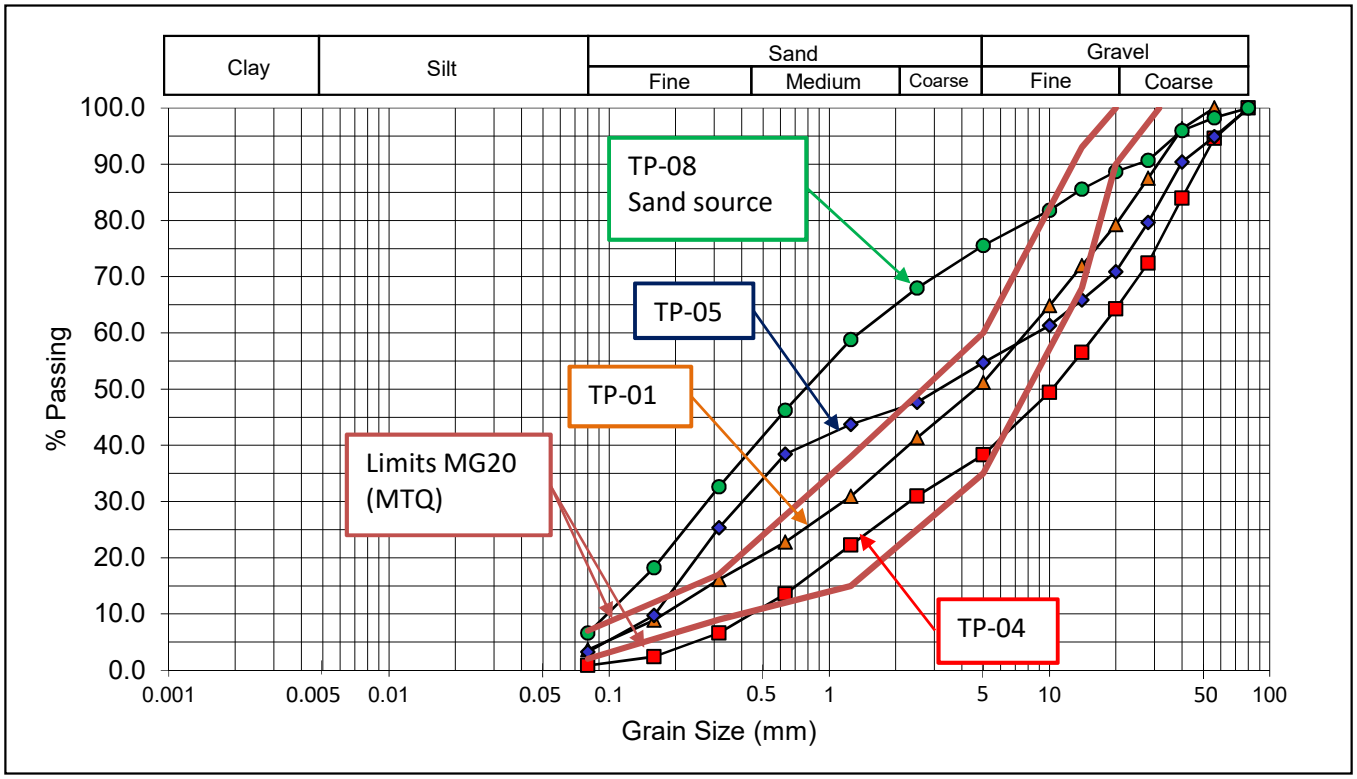
Project No. : L-20-2296
LJA No. : GS2296-TP-01

Client : AEX GOLD
Project : Laboratory tests Nalunaq Gold

Results

Legend >>>		TP-01	TP-04	TP-05	TP-08
Sample No. :		Building area			Sand source
Depth (m) :		2.00	1.50	1.70	2.00
Elevation (m) :		---	---	---	---
	Sieve (mm)	% Passing			% Passing
	80		100.0	100.0	100.0
	56	100.0	94.6	94.9	98.2
	40	96.3	84.0	90.4	96.0
	28	87.5	72.4	79.6	90.7
	20	79.3	64.3	70.9	88.7
	14	71.9	56.6	65.9	85.6
Gravel	10	64.8	49.4	61.3	81.8
Sand	5	51.2	38.3	54.7	75.5
	2.5	41.3	31.0	47.6	68.0
	1.25	30.9	22.2	43.7	58.8
	0.63	22.8	13.5	38.4	46.2
	0.315	16.1	6.6	25.3	32.6
	0.16	8.9	2.4	9.8	18.2
	0.08	3.6	0.8	3.3	6.6

MG20		
(mm)	min.	max.
31.5	100	
20	90	100
14	68	93
5.0	35	60
1.25	15	38
0.315	9	17
0.080	2	7



Sampled by : CLIENT Date : --- Analyzed by : --- Date : 13-Nov-20

JOURNEAUX ASSOC
Division LAB JOURNEAUX INC.

GRAIN SIZE ANALYSIS

CSA A23.2-2A

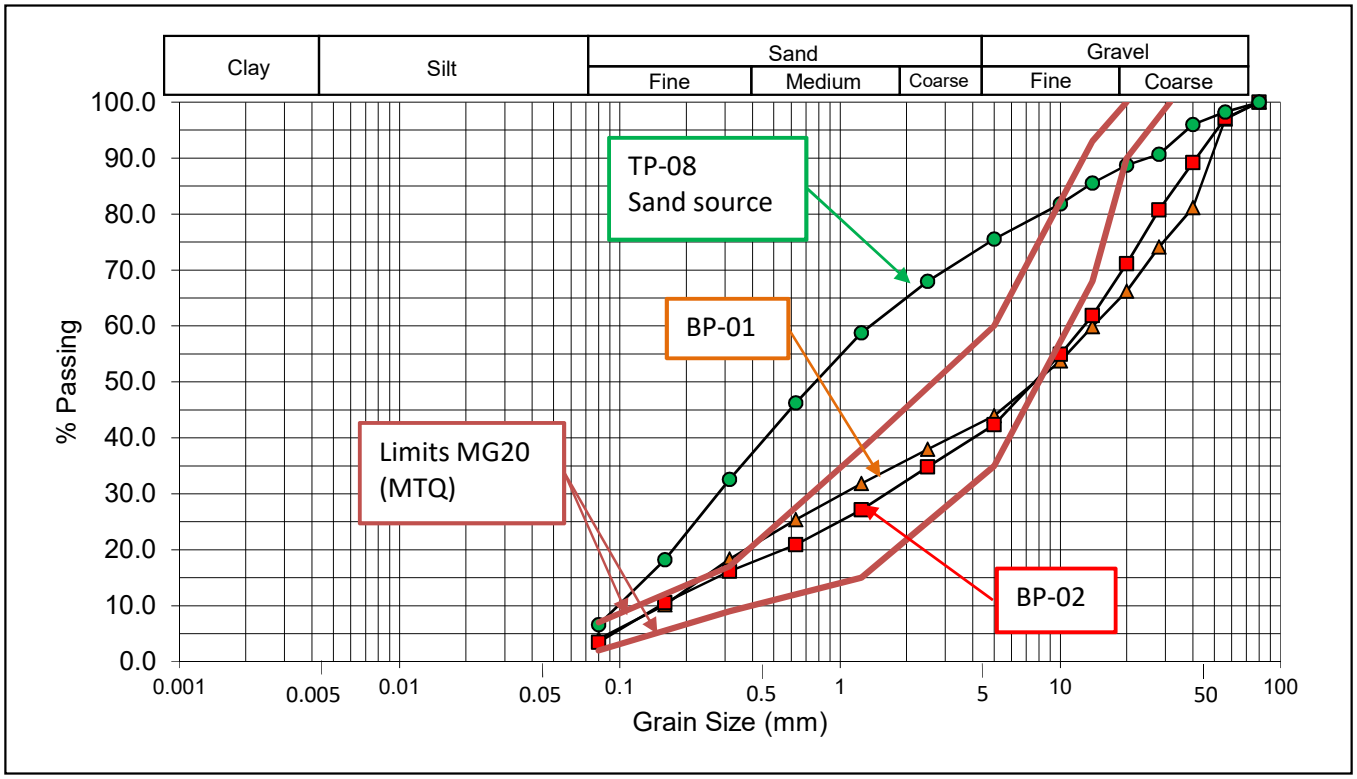
Project No. : L-20-2296
LJA No. : GS2296-BP-01

Client : AEX GOLD
Project : Laboratory tests Nalunaq Gold

Results

		Legend >>>	BP-01	BP-02	TP-08
		Sample No. :	Borrow pits		Sand source
		Depth (m) :	---	---	2.00
		Elevation (m) :	---	---	---
			%		%
		Sieve (mm)	Passing		Passing
		80	100.0	100.0	100.0
		56	97.0	97.1	98.2
		40	81.1	89.2	96.0
		28	74.1	80.7	90.7
		20	66.2	71.1	88.7
		14	59.8	61.8	85.6
Gravel		10	53.7	54.9	81.8
Sand		5	44.0	42.4	75.5
		2.5	37.9	34.8	68.0
		1.25	31.8	27.1	58.8
		0.63	25.4	20.9	46.2
		0.315	18.3	16.2	32.6
		0.16	10.2	10.6	18.2
		0.08	4.0	3.5	6.6

MG20		
(mm)	min.	max.
31.5	100	
20	90	100
14	68	93
5.0	35	60
1.25	15	38
0.315	9	17
0.080	2	7



Signature : _____

Sampled by : CLIENT Date : --- Analyzed by : M.J. Date : 11-Nov-20

JOURNEAUX ASSOC
Division LAB JOURNEAUX INC.

GRAIN SIZE ANALYSIS

CSA A23.2-2A

Project No. : L-20-2296
LJA No. : GS2296-TP-02

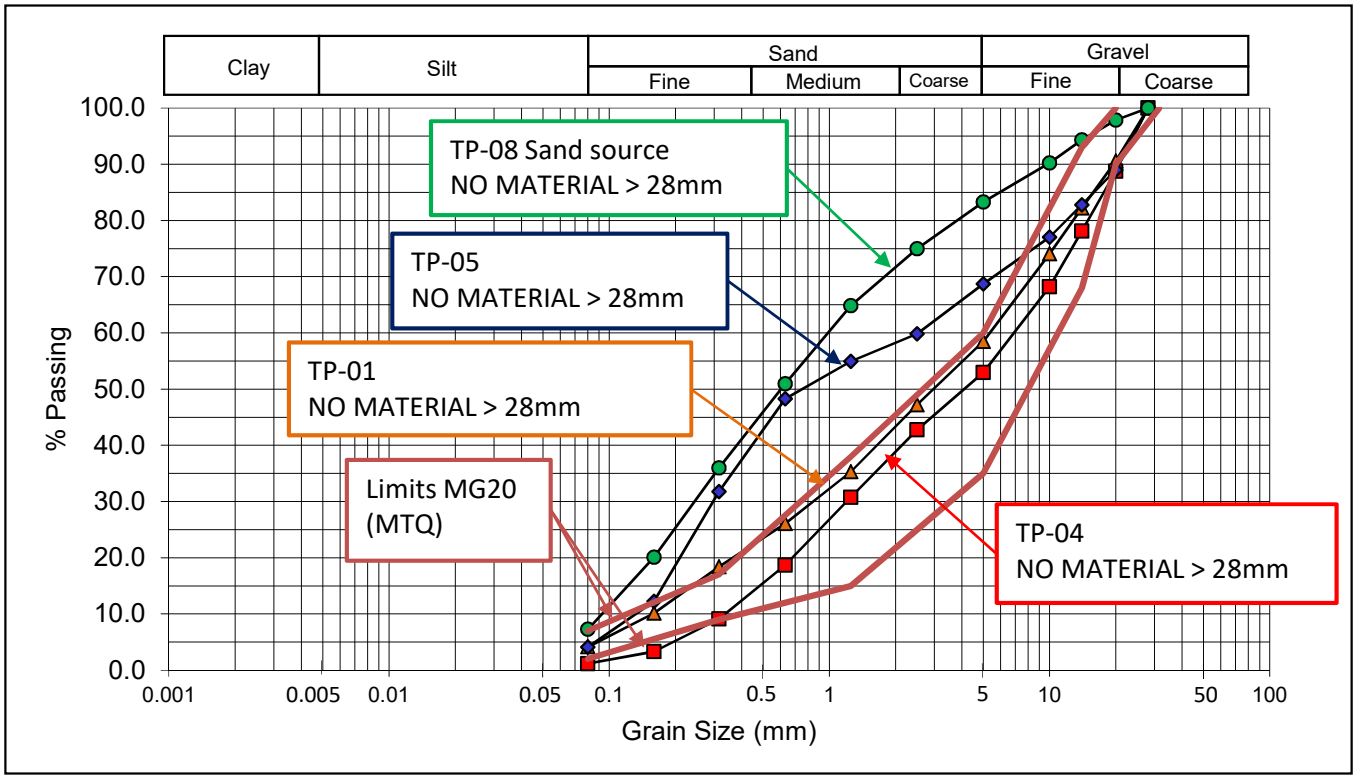
Client : AEX GOLD
Project : Laboratory tests Nalunaq Gold

Results

Legend >>>		TP-01	TP-04	TP-05	TP-08 Sand source
Sample No. :		Building area			
Depth (m) :		2.00	1.50	1.70	2.00
Elevation (m) :		---	---	---	---
	Sieve (mm)	% Passing			% Passing
	80				
	56				
	40				
	28	100.0	100.0	100.0	100.0
	20	90.6	88.7	89.0	97.9
	14	82.2	78.1	82.8	94.4
Gravel	10	74.1	68.2	77.0	90.2
Sand	5	58.5	52.9	68.7	83.3
	2.5	47.2	42.8	59.8	75.0
	1.25	35.3	30.7	54.9	64.9
	0.63	26.1	18.7	48.3	51.0
	0.315	18.4	9.1	31.8	36.0
	0.16	10.2	3.3	12.3	20.1
	0.08	4.1	1.2	4.1	7.3

PARTICLE SIZE DISTRIBUTION OF MATERIAL SCREENED AT 28mm

MG20		
(mm)	min.	max.
31.5	100	
20	90	100
14	68	93
5.0	35	60
1.25	15	38
0.315	9	17
0.080	2	7



Sampled by : --- Date : --- Analyzed by : --- Date : ---

JOURNEAUX ASSOC
Division LAB JOURNEAUX INC.

GRAIN SIZE ANALYSIS

CSA A23.2-2A

Project No. : L-20-2296
LJA No. : GS2296-BP-02

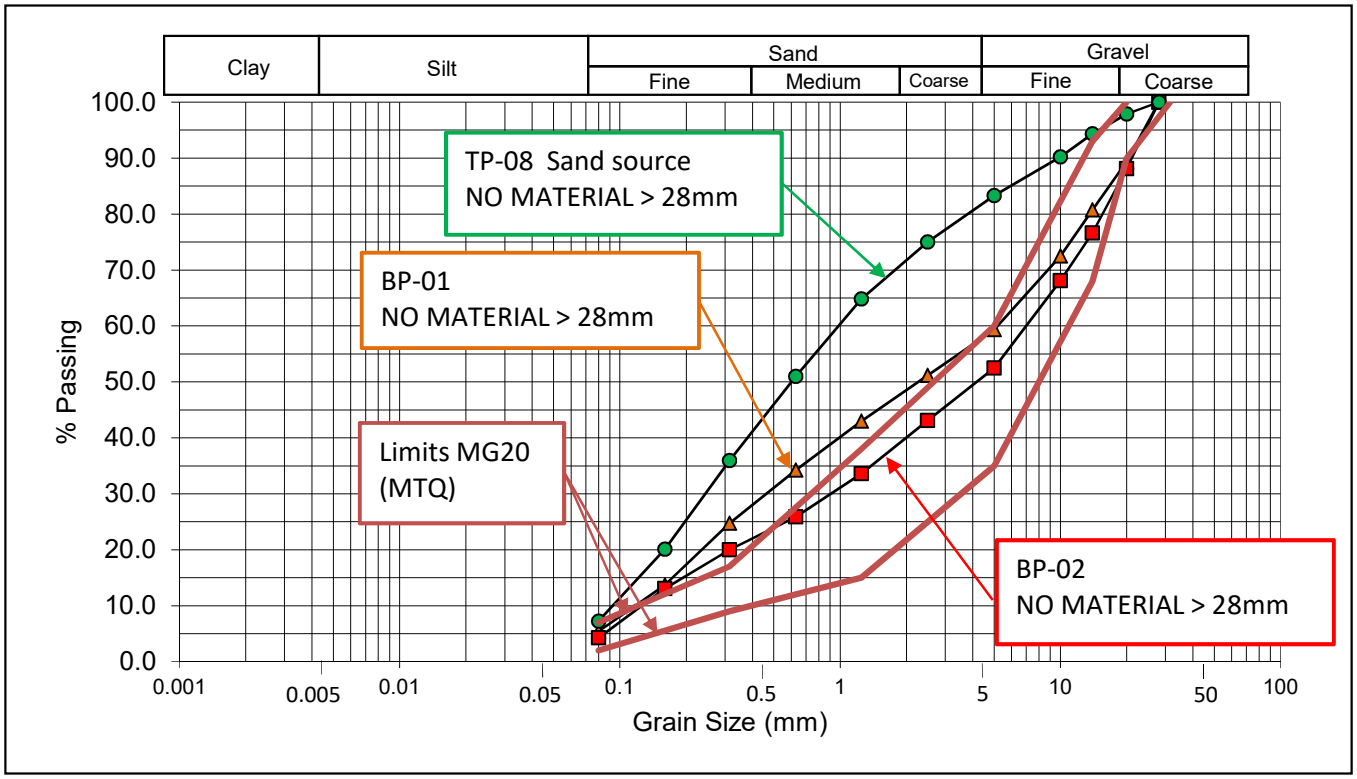
Client : AEX GOLD
Project : Laboratory tests Nalunaq Gold

Results

PARTICLE SIZE DISTRIBUTION OF MATERIAL SCREENED AT 28mm

	Legend >>>	BP-01	BP-02	TP-08
	Sample No. :	Borrow pits		Sand source
	Depth (m) :	---	---	2.00
	Elevation (m) :	---	---	---
	Sieve (mm)	% Passing		% Passing
	80			
	56			
	40			
	28	100.0	100.0	100.0
	20	89.4	88.1	97.9
	14	80.8	76.6	94.4
Gravel	10	72.5	68.1	Gravel 90.2
Sand	5	59.3	52.5	Sand 83.3
	2.5	51.2	43.1	75.0
	1.25	43.0	33.6	64.9
	0.63	34.2	25.9	51.0
	0.315	24.8	20.0	36.0
	0.16	13.7	13.1	20.1
	0.08	5.4	4.3	7.3

MG20		
(mm)	min.	max.
31.5	100	
20	90	100
14	68	93
5.0	35	60
1.25	15	38
0.315	9	17
0.080	2	7



Signature : _____

Sampled by : --- Date : --- Analyzed by : --- Date : ---

APPENDIX B

Chemical tests reports

AGAT Laboratoires

9770 ROUTE TRANSCANADIENNE
ST. LAURENT, QUEBEC
CANADA H4S 1V9
TEL (514)337-1000
FAX (514)333-3046
http://www.agatlabs.com

NOM DU CLIENT: JOURNEAUX ASSOC (DIV. DE LAB JOURNE
801 RUE BANCROFT
POINT-CLAIRE, QC H9R4L6
(514) 630-4997

À L'ATTENTION DE:

N° DE PROJET:

N° BON DE TRAVAIL: 20M678510

ANALYSE DES SOLS VÉRIFIÉ PAR: Amar Bellahsene, Chimiste

DATE DU RAPPORT: 04 déc. 2020

NOMBRE DE PAGES: 12

VERSION*: 1

Pour tout complément d'information concernant cette analyse, veuillez contacter votre chargé(e) de projet client au (514) 337-1000.

*Notes

Avis de non-responsabilité:

- *L'ensemble des travaux réalisés dans le présent document ont été effectués en utilisant des protocoles normalisés reconnus, ainsi que des pratiques et des méthodes généralement acceptées. En vue d'améliorer la performance, les méthodes analytiques d'AGAT pourraient comprendre des modifications issues des méthodes de référence spécifiées.*
- *Tous les échantillons seront éliminés dans les 30 jours suivant l'analyse, sauf accord contraire expressément convenu par écrit. Veuillez contacter votre chargé(e) de projet client si vous avez besoin d'un délai d'entreposage supplémentaire pour vos échantillons.*
- *La responsabilité d'AGAT en ce qui concerne tout retard, exécution ou non-exécution de ces services s'applique uniquement envers le client et ne s'étend à aucune autre tierce partie. À moins qu'il n'en soit par ailleurs convenu expressément par écrit, la responsabilité d'AGAT se limite au coût réel de l'analyse ou des analyses spécifiques incluses dans les services.*
- *Sauf accord écrit préalable d'AGAT Laboratoires, ce certificat ne doit être reproduit que dans sa totalité.*
- *Les résultats d'analyse communiqués ci-joint ne concernent que les échantillons reçus par le laboratoire.*
- *L'application des lignes directrices est fournie « en l'état » sans garantie de quelque nature que ce soit, ni expresse ni tacite, y compris, mais sans s'y limiter, les garanties de qualité marchande, d'aptitude à un usage particulier ou de non-contrefaçon. AGAT n'assume aucune responsabilité à l'égard de toute erreur ou omission dans les directives que contient ce document.*
- *Toutes les informations rapportables sont disponibles sur demande auprès d'AGAT Laboratoires, conformément aux normes ISO/IEC 17025:2017, DR-12-PALA et/ou NELAP.*

AGAT Laboratoires

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FAX (514)333-3046
http://www.agatlabs.com

Certificat d'analyse

N° BON DE TRAVAIL: 20M678510

N° DE PROJET:

NOM DU CLIENT: JOURNEAUX ASSOC (DIV. DE LAB JOURNE

À L'ATTENTION DE:

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

Analyses Inorganiques (sol)

DATE DE RÉCEPTION: 2020-11-16

DATE DU RAPPORT: 2020-12-04

					IDENTIFICATION DE L'ÉCHANTILLON:		**BP1**	**BP 2**	**TP 01**	**TP 04**	**TP 05**
					MATRICE:		**Sol**	**Sol**	**Sol**	**Sol**	**Sol**
					DATE D'ÉCHANTILLONNAGE:		**2020-10-06**	**2020-10-06**	**2020-11-04**	**2020-11-04**	**2020-11-04**
Paramètre	**Unités**	**C / N: A**	**C / N: B**	**C / N: C**	**C / N: D**	**LDR**	**1696044**	**1696046**	**1696047**	**1696048**	**1696049**
Chlorure disponible	mg/kg					1	2	2	4	4	2
pH	pH					NA	5.92	6.43	6.43	6.34	7.56
Soufre total (%)	%	0.04	0.2	0.2		0.02	<0.02[<A]	<0.02[<A]	<0.02[<A]	<0.02[<A]	<0.02[<A]
Soufre total	mg/kg	400	2000	2000		200	<200[<A]	<200[<A]	<200[<A]	<200[<A]	<200[<A]

					IDENTIFICATION DE L'ÉCHANTILLON:		**TP 08**	
					MATRICE:		**Sol**	
					DATE D'ÉCHANTILLONNAGE:		**2020-11-04**	
Paramètre	**Unités**	**C / N: A**	**C / N: B**	**C / N: C**	**C / N: D**	**LDR**	**1696050**	
Chlorure disponible	mg/kg					1	1	
pH	pH					NA	5.94	
Soufre total (%)	%	0.04	0.2	0.2		0.02	<0.02[<A]	
Soufre total	mg/kg	400	2000	2000		200	<200[<A]	

Commentaires: LDR - Limite de détection rapportée; C / N - Critères Normes: A se réfère QC PTC 2016 A, B se réfère QC PTC 2016 B, C se réfère QC PTC 2016 C, D se réfère QC RESC (Annexe 1)
Les valeurs des critères sont uniquement fournies comme référence générale. Les critères fournis peuvent être ou ne pas être pertinents pour l'utilisation prévue. Se référer directement à la norme applicable pour l'interprétation réglementaire.

1696044-1696050 Une LDR plus élevée indique qu'une dilution a été effectuée afin de réduire la concentration des analytes ou de réduire l'interférence de la matrice.

Certifié par:

AGAT Laboratoires

9770 ROUTE TRANSCANADIENNE
ST. LAURENT, QUEBEC
CANADA H4S 1V9
TEL (514)337-1000
FAX (514)333-3046
http://www.agatlabs.com

Certificat d'analyse

N° BON DE TRAVAIL: 20M678510

N° DE PROJET:

NOM DU CLIENT: JOURNEAUX ASSOC (DIV. DE LAB JOURNE

À L'ATTENTION DE:

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

Fraction Organic Carbon

DATE DE RÉCEPTION: 2020-11-16

DATE DU RAPPORT: 2020-12-04

	IDENTIFICATION DE L'ÉCHANTILLON:			**BP1**	**BP 2**	**TP 01**	**TP 04**	**TP 05**	**TP 08**
	MATRICE:			**Sol**	**Sol**	**Sol**	**Sol**	**Sol**	**Sol**
	DATE D'ÉCHANTILLONNAGE:			**2020-10-06**	**2020-10-06**	**2020-11-04**	**2020-11-04**	**2020-11-04**	**2020-11-04**
Paramètre	**Unités**	**C / N**	**LDR**	**1696044**	**1696046**	**1696047**	**1696048**	**1696049**	**1696050**
Fraction Organic Carbon-1	NA		0.0015	0.002	0.003	<0.0015	0.002	0.003	<0.0015
Fraction Organic Carbon-2	NA		0.0015	0.003	0.003	<0.0015	0.002	0.003	<0.0015
Fraction Organic Carbon-3	NA		0.0015	0.002	0.004	<0.0015	0.002	0.002	<0.0015
Fraction Organic Carbon-Avg	NA		0.0015	0.003	0.003	<0.0015	0.002	0.002	<0.0015

Commentaires: LDR - Limite de détection rapportée; C / N - Critères Normes

1696044-1696050 Fraction Organic Carbon is a calculated parameter from Total Organic Carbon values. Samples were analyzed and are reported in triplicate. Analysis was performed without external heating and no conversion factor is used to equate the organic carbon value to the thermal oxidation method.

Certifié par:

AGAT Laboratoires

9770 ROUTE TRANSCANADIENNE
ST. LAURENT, QUEBEC
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FAX (514)333-3046
http://www.agatlabs.com

Contrôle de qualité

NOM DU CLIENT: JOURNEAUX ASSOC (DIV. DE LAB JOURNE

N° BON DE TRAVAIL: 20M678510

N° DE PROJET:

À L'ATTENTION DE:

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

Analyse des Sols

Date du rapport: 2020-12-04

PARAMÈTRE	Lot	N° éch.	DUPLICATA			MATÉRIAU DE RÉFÉRENCE				BLANC FORTIFIÉ			ÉCH. FORTIFIÉ		
			Dup #1	Dup #2	% d'écart	Blanc de méthode	% Récup.	Limites		% Récup.	Limites		% Récup.	Limites	
								Inf.	Sup.		Inf.	Sup.		Inf.	Sup.
Analyses Inorganiques (sol)															
Chlorure disponible	1709079		6	7	15.4	< 1	89%	70%	130%	86%	80%	120%	94%	70%	130%
pH	1696044	1696044	5.92	5.99	1.2		98%	80%	120%	101%	80%	120%	NA		
Soufre total (%)	1697165		0.18	0.17	5.7	< 0.02	80%	70%	130%	100%	80%	120%	82%	70%	130%
Soufre total	1697165		1790	1660	7.5	< 200	80%	70%	130%	100%	80%	120%	82%	70%	130%

Commentaires: NA : Non applicable

NA dans l'écart du duplicata indique que l'écart n'a pu être calculé car l'un ou les deux résultats sont < 5x LDR.

NA dans le pourcentage de récupération de l'échantillon fortifié indique que le résultat n'est pas fourni en raison de la concentration trop élevée par rapport à l'ajout.

NA dans le blanc fortifié ou le MRC indique qu'il n'est pas requis par la procédure.

Le pourcentage de récupération du MRC peut être en dehors du critère d'acceptabilité s'il est conforme à l'écart du certificat du matériau de référence.

! Sous-traitance															
Sulfates solubles à l'acide (CEAEQ)	1709079	14	16	14.1	< 1	115%	70%	130%	100%	80%	120%	96%	70%	130%
Fraction Organic Carbon															
Fraction Organic Carbon-1	1696044	0.096	0.097	1.0	< 0.003	95%	70%	130%				NA	70%	130%

Certifié par:

CHIMISTE
Amar Bellahsene
2011-214
QUÉBEC

AGAT Laboratoires

9770 ROUTE TRANSCANADIENNE
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CANADA H4S 1V9
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FAX (514)333-3046
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Sommaire de méthode

NOM DU CLIENT: JOURNEAUX ASSOC (DIV. DE LAB JOURNE

N° BON DE TRAVAIL: 20M678510

N° DE PROJET:

À L'ATTENTION DE:

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

PARAMÈTRE	PRÉPARÉ LE	ANALYSÉ LE	AGAT P.O.N.	RÉFÉRENCE DE LITTÉRATURE	TECHNIQUE ANALYTIQUE
Analyse des Sols					
Sulfates solubles à l'acide (CEAEQ)			Sous-traitance	Sous-traitance	N/A
Chlorure disponible	2020-11-20	2020-11-20	INOR-101-6004F, non accrédité MDDELCC	MA. 300 - Ions 1.3	CHROMATO IONIQUE
pH	2020-11-19	2020-11-19	INOR-101-6021F	MA. 100 - pH 1.1	PH METER
Soufre total (%)	2020-11-24	2020-11-24	INOR-101-6056F	MA.310-CS 1.0	COMBUSTION
Soufre total	2020-11-24	2020-11-24	INOR-101-6056F	MA.310-CS 1.0	COMBUSTION
Fraction Organic Carbon-1	2020-11-23	2020-11-23	INOR-93-6062	Skjemstad & Baldock, 2008 & Walkley & Balck 1934	SPECTROPHOTOMETER
Fraction Organic Carbon-2	2020-11-23	2020-11-23	INOR-93-6062	Skjemstad & Baldock, 2008 & Walkley & Balck 1934	SPECTROPHOTOMETER
Fraction Organic Carbon-3	2020-11-23	2020-11-23	INOR-93-6062	Skjemstad & Baldock, 2008 & Walkley & Balck 1934	SPECTROPHOTOMETER
Fraction Organic Carbon-Avg	2020-11-23	2020-11-23	INOR-93-6062	Skjemstad & Baldock, 2008 & Walkley & Balck 1934	SPECTROPHOTOMETER

Votre # de commande: 166569
Votre # Bordereau: N-A

Attention: AGAT soutraitance

AGAT Laboratories
Siège social
2905 12th NE
Calgary, AB
CANADA T2E 7J2

Date du rapport: 2020/12/03
Rapport: R2623890
Version: 1 - Finale

CERTIFICAT D'ANALYSES

 # DE DOSSIER LAB BV: C059064
Reçu: 2020/11/24, 12:50

Matrice: Sol
Nombre d'échantillons reçus: 6

Analyses	Quantité	Date de l' extraction	Date Analysé	Méthode de laboratoire	Méthode d'analyse
Anions disponibles	6	2020/12/01	2020/12/01	STL SOP-00014	MA.300–Ions 1.3 R3 m

Remarques:

Laboratoires Bureau Veritas sont certifiés ISO/IEC 17025 pour certains paramètres précis des portées d'accréditation. Sauf indication contraire, les méthodes d'analyses utilisées par Labs BV s'inspirent des méthodes de référence d'organismes provinciaux, fédéraux et américains, tels que le CCME, le MELCC, l'EPA et l'APHA.

Toutes les analyses présentées ont été réalisées conformément aux procédures et aux pratiques relatives à la méthodologie, à l'assurance qualité et au contrôle de la qualité généralement appliqués par les employés de Labs BV (sauf s'il en a été convenu autrement par écrit entre le client et Labs BV). Toutes les données de laboratoire rencontrent les contrôles statistiques et respectent tous les critères de CQ et les critères de performance des méthodes, sauf s'il en a été signalé autrement. Tous les blancs de méthode sont rapportés, toutefois, les données des échantillons correspondants ne sont pas corrigées pour la valeur du blanc, sauf indication contraire. Le cas échéant, sauf indication contraire, l'incertitude de mesure n'a pas été prise en considération lors de la déclaration de la conformité à la norme de référence.

Les responsabilités de Labs BV sont restreintes au coût réel de l'analyse, sauf s'il en a été convenu autrement par écrit. Il n'existe aucune autre garantie, explicite ou implicite. Le client a fait appel à Labs BV pour l'analyse de ses échantillons conformément aux méthodes de référence mentionnées dans ce rapport. L'interprétation et l'utilisation des résultats sont sous l'entière responsabilité du client et ne font pas partie des services offerts par Labs BV, sauf si convenu autrement par écrit. Labs BV ne peut pas garantir l'exactitude des résultats qui dépendent des renseignements fournis par le client ou son représentant.

Les résultats des échantillons solides, sauf les biotes, sont rapportés en fonction de la masse sèche, sauf indication contraire. Les analyses organiques ne sont pas corrigées en fonction de la récupération, sauf pour les méthodes de dilution isotopique.
Les résultats s'appliquent seulement aux échantillons analysés. Si l'échantillonnage n'est pas effectué par Labs BV, les résultats se rapportent aux échantillons fournis pour analyse.

Lorsque la méthode de référence comprend un suffixe « m », cela signifie que la méthode d'analyse du laboratoire contient des modifications validées et appliquées afin d'améliorer la performance de la méthode de référence.
Notez: Les données brutes sont utilisées pour le calcul du RPD (% d'écart relatif). L'arrondissement des résultats finaux peut expliquer la variation apparente.

Note : Les paramètres inclus dans le présent certificat sont accrédités par le MELCC, à moins d'indication contraire.

889 Montée de Liesse, Ville St-Laurent, Québec, Canada H4T 1P5 Tel: (514) 448-9001 Fax: (514) 448-9199 Ligne sans frais : 1-877-462-9926

Votre # de commande: 166569
Votre # Bordereau: N-A

Attention: AGAT soutraitance

AGAT Laboratories
Siège social
2905 12th NE
Calgary, AB
CANADA T2E 7J2

Date du rapport: 2020/12/03
Rapport: R2623890
Version: 1 - Finale

CERTIFICAT D'ANALYSES

 # DE DOSSIER LAB BV: C059064
Reçu: 2020/11/24, 12:50

clé de cryptage

Veuillez adresser toute question concernant ce certificat d'analyse à votre chargé(e) de projets
Ramona Dascal, Chargée de projet
Courriel: Ramona.Dascal@bvlabs.com
Téléphone (514)448-9001 Ext:7066250

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Ce rapport a été produit et distribué en utilisant une procédure automatisée sécuritaire.
Lab BV a mis en place des procédures qui protègent contre l'utilisation non autorisée de la signature électronique et emploie les «signataires» requis, conformément à l'ISO/CEI 17025. Veuillez vous référer à la page des signatures de validation pour obtenir les détails des validations pour chaque division.

PARAMÈTRES CONVENTIONNELS (SOL)

ID Lab BV		IP7588	IP7589	IP7590	IP7591	IP7592	IP7593		
Date d'échantillonnage		2020/10/06	2020/10/06	2020/10/04	2020/10/04	2020/10/04	2020/10/04		
# Bordereau		N-A	N-A	N-A	N-A	N-A	N-A		
	Unités	**1696044**	**1696046**	**1696047**	**1696048**	**1696049**	**1696050**	**LDR**	**Lot CQ**
% HUMIDITÉ	%	0.2	0.2	3.6	4.0	7.8	2.5	N/A	N/A
CONVENTIONNELS									
Sulfates (SO4) †	mg/kg	10	10	20	9.8	14	6.0	5.0	2149277

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
N/A = Non Applicable
† Accréditation non existante pour ce paramètre

BP01 BP02 TP01 TP04 TP05 TP08

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REMARQUES GÉNÉRALES

Les résultats ne se rapportent qu'aux échantillons soumis pour analyse

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RAPPORT ASSURANCE QUALITÉ

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
2149277	BPH	Blanc fortifié	Sulfates (SO4)	2020/12/01		105	%
2149277	BPH	Blanc de méthode	Sulfates (SO4)	2020/12/01	<5.0		mg/kg

Blanc fortifié: Un blanc, d'une matrice exempte de contaminants, auquel a été ajouté une quantité connue d'analyte provenant généralement d'une deuxième source. Utilisé pour évaluer la précision de la méthode.

Blanc de méthode: Une partie aliquote de matrice pure soumise au même processus analytique que les échantillons, du prétraitement au dosage. Sert à évaluer toutes contaminations du laboratoire.

Réc = Récupération

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PAGE DES SIGNATURES DE VALIDATION

Les résultats analytiques ainsi que les données de contrôle-qualité contenus dans ce rapport furent vérifiés et validés par les personnes suivantes:

Shu Yang, B.Sc. Chimiste, Montréal, Analyste 2

Lab BV a mis en place des procédures qui protègent contre l'utilisation non autorisée de la signature électronique et emploie les «signataires» requis, conformément à l'ISO/CEI 17025. Veuillez vous référer à la page des signatures de validation pour obtenir les détails des validations pour chaque division.

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