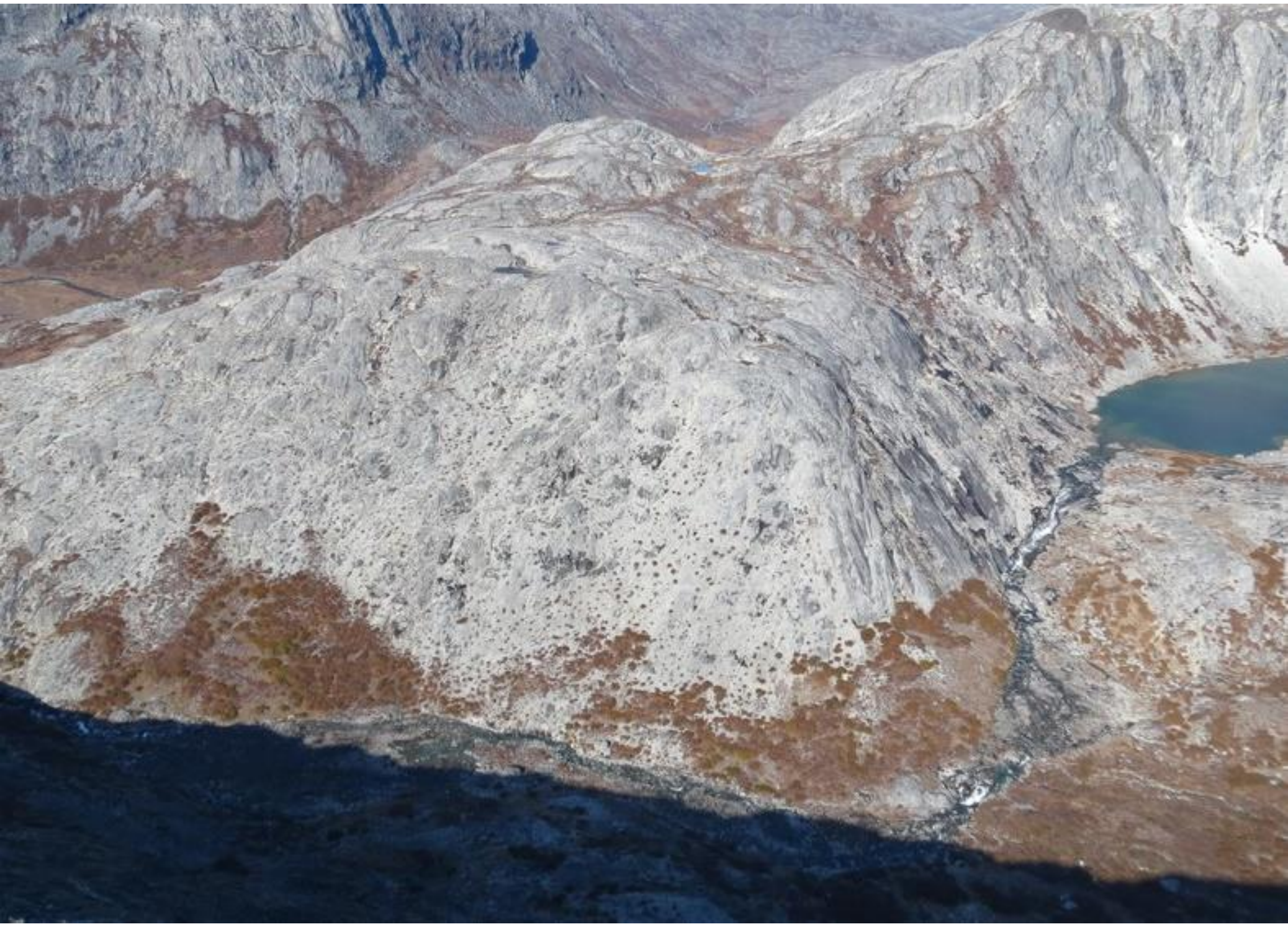

MAJOQQAP QAVA

Environmental Impact Assessment

Greenland Anorthosite Mining

Rev.no.		Description	Work by	Controlled by	Approved by
14, V11	October 2024	Sub 5.	TEHE; Maks; JOCA; MOST; AES; ANSJ; KASP	ANSJ	GAM

Content

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List of most relevant background reports

(Relevant Background reports summarised from section 13 Bibliography, Citations, and References)

Background I: Fera Science. GCL0156-UPT initial flush composite: Pseudokirchneriella subcapitata Growth Inhibition Test. York, United Kingdom: Fera Science Lt. (Fera Science, 2023b).

Background II: NIRAS. Hydraulic model. Background note (NIRAS, 2024d).

Background III: NIRAS. Calculations of expected noise related to the planned work at Majoqqap Qaava (NIRAS, 2024b).

Background IV i/ii/iii: NIRAS Greenland A/S. Baseline Sampling, Majoqqap Qaava for Greenland Anorthosite Mining (NIRAS Greenland, 2024c).
Background V: NIRAS. Land tailings deposits – structural stability risk analysis. Background note (NIRAS, 2024e).
Background VI: GAM. Monitoring background dust concentration levels in ambient air at selected locations of MAQ. (GAM, 2024).
Background VII: NIRAS . Dust deposition MAQ - Majoqqap Qaava, Greenland Anorthosite Mining (NIRAS, 2024a).
Background VIII: Wardell Armstrong. (2023). GREENLAND ANORTHOSITE MINING GEOCHEMICAL STUDY. Wardell Armstrong.
Background IX: Fiskenæsset - Greenland Anorthosite Mining. Arkæologisk forundersøgelse 2020. Nunatta Katersugaasivia Allagaateqarfialu (Larsen, 2020).
Background X: Navigational Safety Investigation NSI (ImaqPilot, 2024).
Background XI: Majoqqap Qaava Social Impact Assessment (Rambøll, 2023a).

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Abbreviations, Conventions and Descriptions

ABA	Acid Base Accounting
ARD	Acid Rock Drainage
ARDML	Acid Rock Drainage Metal Leaching
Ai	Bond Abrasion Index
ANFO	ANFO (or AN/FO) for ammonium nitrate/fuel oil is a widely used bulk industrial explosive.
AN	Ammonium Nitrate
Anorthosite	A white-grey phaneritic, intrusive igneous rock characterized by its composition.
AP	Acid Potential
ARO	Asset Retirement Obligation
BAT	Best Available Techniques
BWI	Bond Ball Mill Work Index
BWM Convention	International Convention for the Control and Management of Ships' Ballast Water and Sediments
Bytownite	A calcium rich feldspar mineral. Mineralogically, Bytownite is a member of the plagioclase solid solution series of feldspar minerals with composition between anorthite and labradorite. It is usually defined as having between 70 and 90 % An ($(Ca_{0.7-0.9},Na_{0.3-0.1})(Al(Al,Si)Si_2O_8)$)
Ceramic	A ceramic is any of the various hard, brittle, heat-resistant and corrosion-resistant materials made by shaping and then firing a non-metallic mineral, such as clay, at a high temperature. Common examples are earthenware, porcelain, and brick.
CIM Standard	The CIM Definition Standards on Mineral Resources and Reserves (CIM Definition Standards) establish definitions and guidelines for the reporting of exploration information, mineral resources and mineral reserves in Canada.
CTD	Conductivity, Temperature, Depth – often referring to the equipment measuring these parameters.
dB	Decibel
dB re µPa2 @ 1 m (rms)	Underwater source level measurements.
DCE	Danish Centre for Environment and Energy
DCP	Decommissioning and Closure Plan
DFP	Down-Flow Percolation test (subaqueous)
DMI	Danmarks Meteorologiske Institut
DL	Detection Limits
DWT	Death weight Tonnage
EAMRA	Environmental Agency for Mineral Resource Activities
EEZ	Exclusive Economic Zone within which a coastal state (Greenland) has exclusive rights to exploit natural resources.
E-Glass	Glass fibre is formed when thin strands of silica-based or other formulation glass are extruded into many fibres with small diameters suitable for textile processing. The technique of heating and drawing glass into fine fibres has been known for millennia; however, the use of these fibres for textile applications is more recent. The most common types of glass fibre used in fiberglass is E-glass glass ("E" because of initial electrical application), which is alumina-borosilicate glass with less than 1 % w/w alkali oxides, mainly used for glass-reinforced plastics.
EIA	Environmental Impact Assessment
EMP	Environment Management Plan
ENC	Electronic Navigational Chart
EPCM	Engineering, Procurement and Construction Management
Eq/t	Equivalent per ton
ESG	Environmental, Social and Governance
Feldspar	A group of rock-forming minerals that make up about 41 % of the Earth's continental crust by weight. Feldspars Formula ($KAlSi_3O_8$ – $NaAlSi_3O_8$ – $CaAl_2Si_2O_8$).
Filler	Filler materials are particles added to resin or binders (paints, plastics, composites, concrete) that can improve

	specific physical properties such as hardness, brightness, durability etc., make the product cheaper, or a mixture of both.
FLT	Flood Leach Test
FO	Fuel Oil
GAM	Greenland Anorthosite Mining A/S
GCA	Global Crustal Abundance
GHG	Greenhouse Gas
GINR	Greenlandic Institute of Natural Resources
GWQG	Greenland Water Quality Guideline.
HCT	Humidity Cell Tests
HD	Hydrodynamic
HP	Horsepower
HPGR	High-Pressure Grinding Rollers; are used for size reduction or rocks and ores. They compress the feed material between two rotating rollers, one of which is in a fixed position and another roller that is floating. The two rotating rollers generate such a high pressure that it grinds the feed material to the desired smaller grain size.
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
ICP-OES	Inductively Coupled Plasma Optical Emission Spectrometry
IUCN	International Union for Conservation of Nature
Ktpa	Kilo Tons per Annum
kHz	Kilohertz. 1 kHz = 1000 Hz = 1000 Hertz
Km/km^2	Kilometre/sq. kilometre.
kW	Kilo watt
LAT	Lowest Astronomical Tide
LC50	LC50 is the lethal concentration required to kill 50 % of a population in a given period of time.
LCM	Loose Cubic Meter
LD50	The LD50 is defined as the lethal dose at which 50 % of a population is killed in a given period of time.
LOA	Length Overall
LoM	Life-of-Mine
LSFO	Low-Sulphur Fuel Oil
ltr.	Litres
LZeq	Unit for sound measurement using Z-weighting.
MAQ	Majoqqap Qaava
MAC	Maximum Allowable Concentrations
m ASL	Metres above sea level
mm, cm, µm	millimetre, centimetre, micrometre
MMA	Mine Maintenance Area
MLSA	Mineral Licence and Safety Authority
MOB	Man-over-Board!
MRA	Mineral Resources Authority
MRC	Main Resource Components
MSL	Mean Sea Level
MT	Magnetic Tailings
mt	Metric tonne
Mt	Megatonne
m/s	Meter per second
N.a.	Not applicable, not available
NAG	Net Acid Generation
NILU	Norwegian Institute for Air Research
NI43-101	National Instrument 43-101 is a national instrument for the Standards of Disclosure for Mineral Projects within Canada that is also widely used in other jurisdictions. The Instrument is a codified set of rules and guidelines for reporting and displaying information related to mineral properties owned by, or explored by, companies which report these results on stock exchanges within Canada.
Nm	Nautical miles
NNP	Net Neutralising Potential
NoAG	Non-Acid Generating
NP	Neutralizing Potential
NPR	Net Potential Reactivity
NO_x	A generic term for the nitrogen oxides that are most relevant for air pollution, namely nitric oxide (NO) and nitrogen dioxide (NO_2)
NT	Nearly Threatened
NSI	Navigational Safety Investigation
Optical Sorting	Automated process of sorting solid products using cameras and/or lasers. Optical sorters can recognize objects' colour, size, shape, structural properties and chemical composition and separate products of different grade or types of materials.
PAG	Potentially Acid Generating
PC/PC#	Polar Class vessels
PE	Population equivalents

PEA	Preliminary Economic Assessment. A study prepared in accordance with NI 43-101 that tries to answer the question, "how can a deposit best be exploited to maximize its economic returns?"
pH	"potential of hydrogen", a scale used to specify the acidity or basicity of an aqueous solution.
PMP	Probable Maximum Precipitation
POR	Pegmatite Optical Rejects
PTS	Permanent Threshold Shift
PSD	Particle Size Distribution
PSI	Pounds per Square Inch
QA/QC	Quality Assurance/Quality Control
RER	Rare Earth Roll
RoM	Run-of-Mine
Rpm	Revolutions (or rounds) per minute
RWI	Bond Rod Mill Work Index
SFT	Shake Flask Test
SIA	Social Impact Assessment
SO_x	A generic term for the sulphur oxides that are most relevant for air pollution, mostly sulphur dioxide (SO_2)
SRK	SRK Consulting, Cardiff, Wales
Stone wool	Insulation material of inorganic origin intended for thermal and acoustic insulation, as well as for fire prevention in civil engineering, industry and the shipbuilding industry.
TTS	Temporary Threshold Shift
TEU	Twenty-foot Equivalent Unit. Exact unit of measurement used to determine cargo capacity for container ships and terminals.
TML	Transportable Moisture Limit
ToR	Terms of Reference
TPA	Ton per annum
TPD	Ton per day
TPH	Ton per hour
TSF	Tailings Storage Facility
TXF Dry	Land-based tailings storage
TSF Wet	Lake-based tailings storage
TSP or TSS	Total Suspended Particles/Solids referring to particles suspended in a water column.
t/hrs.	Tons per hours
UFP	Up-Flow Percolation test (sub-aqueous)
UNESCO	United Nations Educational, Scientific and Cultural Organization
USEPA	United States Environmental Protection Agency
VEC	Valued Ecosystem Component
VRM	Vertical Roller Mills
WAI	Wardell Armstrong International laboratory, Cornwall, UK
WRD	Waste Rock Dump/Deposit
WS #1/#2	Weather station #1/#2
WQL	Water Quality Limits
XRD	X-Ray powder Diffraction is an analytical technique primarily used for phase identification of a crystalline material.
XRT	X-Ray Transmission

1. Non-technical Summary

1.1. Regional context

Greenland Anorthosite Mining's Majoqqap Qaava project, includes the development, operation and ultimate reclamation of an anorthosite deposit in the Kuussuatsiaat Valley, in the innermost part of the Qeqertarsuatsiaat Kangerdluat (Fiskenæsfjord) in southwest Greenland. The Project includes mining from an open pit with an on-site processing facility and necessary infrastructure to produce a mineral concentrate of anorthosite for use in the insulation, E-glass, paint filler and ceramic industry. Anorthosite concentrate for E-glass, fillers and some ceramic products will require a final milling in an overseas processing hub in Europe and North America, whereas insulation products and most ceramics will be finalised in Greenland.

The defined resource of anorthosite and planned mine area is located approx. 12 kilometres inland from the fiord and app. 30 kilometres west of the Greenlandic Icecap. The overall topography in the region is defined by mountainous terrain cut by glacial valleys with common river and lake systems. Project infrastructure is to be established in the lower part of the Kuussuatsiaat valley with a 17 km haul road connecting to the mine site. The project valley rises from the fjord (sea level) to approximate 200 m above sea level before joining the base of the anorthosite massif hosting the mineral resource at the head of the valley. The valley base is traversed by a freshwater system with a main river and five lakes downstream from the future pit site.

Project description	
Tenements	MEL2019-162, M-MLSA363
Mining resource	Mining resource of 21.8 Mt
Components	1x open pit, 1x waste rock dump, 1x tailings storage facility, processing plant, ancillary infrastructure
Mining rate	560,000-930,000 tpa
Mining method	Conventional open pit, drill and blast, hydraulic excavation, load and haul
Processing type	Crushing, sensor sorting, grinding and magnetic separation
Life-of-Mine	30 years
Waste rock quantity	Non to minimal need for stripping of overburden or waste rock
Tailings waste quantity	Pegmatite from XRT sensor sorting; 35,000-60,000 tpa Concentrate from the magnetic separation; 70,000 -125,000 tpa
Mine waste characterisation	Waste rock will be Non-Acid Generating [NoAG] Tailings waste will be Non-Acid Generating
Estimated project footprint	0.65 km^2

The Majoqqap Qaava area is located in the defined Low Arctic Vegetation Zone. Temperature averages around 10 °C in the summer month and around -10 °C in the winter. Accumulated precipitation in the project area was 680 mm in 2021. No permafrost is indicated from the project area. The project area experiences a wind regime common to the west coast of Greenland but is also under influence by the topography of the central valley and the ice sheet east of the valley. Overall, wind is driven into the valley from the fiord after the heating phase during the day and is then circulated outwards during the night as temperatures drop over land.

1.2. Flora and fauna

In general, the terrestrial ecosystem of western Greenland has low mammalian diversity. Wildlife species within the region includes caribou/reindeer (*Rangifer tarandus groenlandicus*), arctic fox (*Vulpes lagopus*) and arctic hare (*Lepus arcticus*). Both caribou and arctic fox has frequently been observed within the project area during field surveys and from wildlife camera setup during the baseline surveys.

Different species of terrestrial birds such as common raven (*Corvus corax*), rock ptarmigan (*Lagopus muta*), snow bunting (*Plectrophenax nivalis*) and Lapland longspur (*Calcarius lapponicus*) is common within the project area. During fieldwork white-tailed eagles (*Haliaeetus albicilla*) were observed several times along with mallards (*Anas platyrynchos)* and loons (*Gavia immer*) in parts of the lakes. The company acknowledges that no systematic bird survey has been conducted during the breeding season. The company will ensure that a dedicated survey is initiated during the initial construction phase in the area, and to an extent that covers the early periods of the breeding season.

The large variation in physical conditions in the Majoqqap Qaava project area results in a diverse low arctic type of flora. The most common vegetation types in the area are mountain fields, shrub, heath, and steppe. The plant community in the wind exposed higher-lying mountains near the mine lack woody plants and consist almost solely of monocotyledon plants such as grasses and sedges. Heath is the most common floral community in the Majoqqap Qaava project area and covers most of the dry slopes of the valley. No rare or endemic plants has been identified from the project area.

The local fjord systems are not known as a hotspot for marine mammals, but several species (mostly seals) use the area regularly while others (whales) are likely random visitors to the area. All seal species known to Greenland, except grey seals (*Halichoerus grypus*), are potential visitors to the assessment area, but harp seals (*Pagophilus groenlandicus*) and ringed seals (*Pusa hispida*), the two most abundant Greenlandic species, are surely present. Bearded seals (*Erignathus barbatus*) and hooded seals (*Cystophora cristata*) prefer other habitats and are expected to be seen infrequently. Harbour seal distribution is not well known, and numbers are low. An active moulting site remains 60 km south of the assessment area, but other potential closer sites may exist. However, long-term monitoring using wildlife cameras has not identified the presence of Harbour seals at the bottom of Qeqertarsuatsiaat Kangerdluat. According to local hunters in Qeqertarsuatsiaat humpback whales (*Megaptera novaeangliae*) do enter the fjord and more rarely so do minke whales (*Balaenoptera acutorostrata*). A Sperm whale (*Physeter macrocephalus*) was spotted in the central part of the fjord system during the summer of 2018 In West Greenland, only male sperm whales have been observed and they mainly inhabit the deep, offshore waters, however, they do occasionally venture into the deep fjords.

The most abundant marine fish species in the fjords are expected to be the Atlantic cod (*Gadus morhua*), short-spined sculpins (*Myoxocephalus scorpius*) and sand lances (*Ammodytes spp*), most likely Northern sand lance (*Ammodytes dubius*). All species have been recorded around the proposed port site in Qeqertarsuatsiaat Kangerdluat during the baseline study, along with Arctic char (*Salvelinus alpinus*), that feed in the waters during their marine migration cycle.

1.3. Project Description

The purpose of Greenland Anorthosite Mining's mining project at Majoqqap Qaava, is to extract and process anorthosite, which consists primarily of the chemical components; aluminium, silicon and calcium.

GAM considers two different scenarios for production, which differ in relation to the quantities and types of materials produced, respectively a minimum Scenario A, which consists of a relatively simple processing circuit, and a maximum Scenario B, which involves a more comprehensive processing circuit. Products for the insulation industry and most ceramic products will be fully processed in Greenland and can be sold directly to off takers, while products for the E-glass industry, fillers and some ceramic products will have a final fine grinding done closer to the buyers' factories in either Europe or North America. This is first and foremost based on unwavering demands from E-glass manufacturers who want strict control of quality, contamination, transport and chemistry in the finely ground product. Manufacturers specifically want to be able to participate in and control the ongoing chemical sampling close to their production as part of their quality control.

In addition, as the final milling for E-glass is particularly energy-intensive, and as there is no access to sufficient green energy in the project area, this can only be done with fossil fuels in Greenland. This is contrary to the EU Commission's requirements for sustainable transition, where European companies are expected to be responsible for complying with ESG rules throughout the value chain. The leading E-glass manufacturers with whom GAM is in dialogue therefore require that fine milling is carried out in Europe or North America, where it is possible to connect to consistent "green" energy sources such as wind, solar or nuclear power. In addition to these conditions, there are also a number of technical challenges with final fine milling for E-glass in Greenland, as the practical handling of the very fine dust in the project area is difficult, and as moisture creates "lumps" in the ground material, which makes it difficult to use in E-glass smelters, and at the same time requires shipping in significantly smaller closed cement ships, which are both more expensive and also cause increased ship traffic in the fjord and increased CO_2 emissions from the project, which due to price and CO_2 accounting makes GAM less attractive as a supplier from a commercial point of view.

The proposed mining operation at Majoqqap Qaava will produce between 560,000 (A)-930,000 (B) tons of raw anorthosite annually and shipping of approximately 400,000 (A)-800,000 (B) tons of finished and semi-finished material. In the first years of mining, a reduced production plan is expected, as off-take agreements are established, and the mine is scaled up.

The mine will be operated as a conventional open pit with drill and bench blasting of solid rock. The mined ore is loaded on tipper trucks and transported to a processing plant at the coast. Processing of the ore involves several stages of crushing and grinding as well as XRT sensor sorting and magnetic separation to produce a material in the sand fraction of >700 μm. Following processing, the product for shipment will be transported by covered conveyor to a fully enclosed concentrate shed/warehouse close to the harbour.

Waste materials (tailings) from the processing plant at the coast will primarily consist of coarsely crushed pegmatite and quartz (2-12 cm) from XRT sensor sorting, as well as an iron-enriched [or Fe-enriched] concentrate (approx. 0.7 mm) from the magnetic separation. Based on results from geochemical environmental and leaching studies, it is considered that waste materials do not pose any risk in terms of leaching of harmful elements. Two potential tailings storage locations have been identified north of the mine maintenance and accommodation area; one being a land-based storage and the second being a subaqueous lake storage immediately northeast of the mine camp.

Both tailings' facilities have the capacity to hold the combined 3.91M to 4.76M metric tons process waste. For the dry land-based storage, a diversion drain will be constructed to prevent water runoff from higher grounds the mountain from entering and undermining the facility. The tailings storage facility will be operational for the life of the mine and continuously encapsulated. Due to the open pit operation, it is not possible to operate with a scenario that involves backfilling.

As the anorthosite ore is exposed on the surface, the planned mining design will not result in the deposit of large quantities of unprocessed anorthosite and other surface materials (so-called "stripping"). If necessary, a waste storage for such surplus materials is established approx. 3.5 km west of the mine along the truck haul route to the processing plant and port facilities. This waste storage will primarily consist of coarse blasted surface materials and anorthosite. The material will not contain harmful materials or cause dust nuisance in connection with disposal.

The mine and processing facility will be in planned operation 24-hours per day, seven days a week during the working season, which is anticipated to be minimum 270 days per year. During the remaining period, it is expected that the fjord system may be partly ice-filled, so shipping from the mine is reduced. In this period, the mine will operate in a maintenance scenario.

There is currently no infrastructure in the project area, and GAM will therefore need to establish port facilities, road connections, process facilities, workshops, accommodation facilities etc. The port facilities will consist of a floating barge solution connected to a fixed port installation. A mechanical ship loader will be placed on the jetty to be able to effectively load bulk carriers. A conveyor system will interconnect the process facility with the product warehouse and the port.

Based on the production rates, the estimated vessel activity under production scenarios A and B for 8-10 months of activity/year is expected to be 12-23 dry bulk vessels, 2-4 product tankers, approximately 8 supply/utility vessels and common smaller passenger transport vessels for crew rotation.

Permanent accommodation for the employees will be established in the immediate vicinity of the port and the processing plant. Other infrastructure associated with the project includes; administrative office buildings, changing rooms, workshop for vehicles and spare parts, general workshop and warehouse, fuel depot, helicopter platform, laboratory, explosives depot, a waste incinerator and a wastewater treatment plant. The mine camps power supply will be driven by a genset based power plant with a capacity of 1.2 and 3.0 MW for supporting Scenario A and B respectively. Diesel fuel for the power plant and vehicles will be stored in double skinned containerised fuel storage units.

In the construction phase of the project, employment of 30-40 people is expected. GAM currently estimates that in scenario A there will be a need for approx. 60 employees and in scenario B approx. 90 employees. Mine closure is expected to require 10-15 employees.

1.4. Key Environmental Issues and Conclusions

The environmental impact of the Majoqqap Qaava mining project have been assessed based on literature studies, baseline studies, several field and drilling campaigns and detailed geochemical laboratory test work. Annex 4 shows an overview of the project and associated EIA sampling.

The overall conclusion is that the project can be implemented without any major local or regional environmental impacts. The main environmental concerns are identified as being distribution of dust from the various aspects of the mining operation and secondarily the scarring and modifications of the existing landscape from project infrastructure and mining related activities.

The full mining operation will consist of dust generating activities such as drilling, transporting material by truck and crushing/grinding the materials prior to exporting it. It has been evaluated that the dust impact will be of a local extent and concentrated around the actual activities. The overall topography of the project valley is expected to enclose and naturally mitigate any physical dust impacts to within the project valley. Several proven dust mitigation measures are available minimizing unacceptable possible effects. There are numerous of tested techniques from similar mining operations around the world providing a broad array of mitigation actions, should dust dispersion prove an issue.

Landscape alterations are an unavoidable aspect when establishing a large project in pristine surroundings. With the pit-site located in an already barren landscape the major structures evaluated to impact the existing landscape will be the tailings storage facility, any waste rock deposits and the haul road. GAM has presented two tailings storage facility alternatives where a sub-aqueous lake tailings storage facility, compared to a land-based dry tailings deposit, would minimize the lasting effects on the landscape considerably, whereas the haul road route is fixed and bound to leave a lasting footprint throughout the landscape also post closure, similar to the infrastructure around a land-based deposit.

Overall, the terrestrial impacts are evaluated as being minor, except for the beforementioned dust spread and landscape modifications. Project baseline surveys indicated no presence of red-listed flora within the project area and the risk of a general reduction of the floral diversity within the project area is evaluated as negligible. Areas of international or national importance for flora and fauna will not be disturbed by the Majoqqap Qaava anorthosite project.

Caribou is common in the area, and experience from neighbouring mining projects in Greenland, backed by scientific literature, indicate that caribou are fairly good at adapting to increased human industrial activities within an area. It is expected that the local caribou population over time will accommodate to passing machinery with little to no fleeing behaviour, and that the project haul road will not be a physical hindering for caribou movements in the project area. Overall, it is evaluated that the project will have minor effects on the local caribou population, and thus the disturbance will have only a minor effect on the hunting activities in the area.

GAM have completed an extensive geochemical testing program on the project ore resource and the various stepwise processing products, to clarify the chemical constituents of industrial and environmental interest. The overall composition of the ore and processed products indicate little to no risk of the project causing elevated levels of environmental harmful elements in the recipient. The content of radiogenic elements is not recognized as environmental issues in the ore planned to be mined from Majoqqap Qaava anorthosite deposit. Based on a comprehensive geochemical screening program, the highest detected value of 11 ppm uranium. is significantly below the 100-ppm uranium limit set by Greenlandic legislation. Leaching tests for evaluating the net acid-generating potential (NAG) of the ore, waste rock and tailings fractions show no such potential. The project infrastructure will generally be placed in safe distance to local waterways and take future flooding scenarios into account. In addition, a separate stability analysis for the proposed land-based tailings storage facility concludes, that the risk of a tailings storage facility collapse is minimal if the tailings storage is constructed according to the proposed procedures.

Ecotoxicology studies on project tailings show that the overall environmental risks related to leaching and mixing of project material into the freshwater system and marine recipient is minor. The deposition of tailings in a land-based dry stack as well as a lake-based wet stack sub-aqueous tailings storage facility is anticipated to have only minor freshwater impact. The tailings material does not contain any significant metal content, and the leaching of metals is regarded as low. The project is not expected to affect fishing in the area.

As part of the shipment of final anorthosite products for overseas destinations, the project will cause increased marine vessel activity in the fjord system. The inner parts of the Qeqertarsuatsiaat Kangerdluat are not identified as having a particularly important role for marine wildlife. Varius species of seals and whales does occasional venture into the fiord but the shipping activity is not anticipated to have any significant impact on marine mammals. There have been identified several seabird colonies along the planned shipping routes, but vessels will transit in such distance to the colonies that no or negligible impacts are expected. The company will secure proper procedures for navigational safety and an approved oil spill response protocol and equipment. As there are no other planned developments or projects within or in close proximity to the project area, there will be only minor cumulative environmental effects from the increased shipping caused by the project.

A summary of evaluated risks and uncertainties in relation to environmental load, impacts and effects in all phases of the mine construction, operation, and closure phases are presented in the following table:

Potential impact	Project phase	Overall significance
Terrestrial impacts		
Leaching from Waste rock deposits	Operation	Negligible

Potential impact	Project phase	Overall significance
Dust – vegetation and freshwater	Construction	Negligible
Dust distribution to surroundings	Operation	Moderate
Terrestrial noise	Construction and Operation	Minor
Reduction of floral diversity and habitat	Construction	Negligible
Reduction of floral diversity and habitat	Operation and Closure	Negligible
Disturbance of nesting and freshwater birds	Construction	Negligible
Disturbance of nesting birds	Construction, Operation and Closure	Minor
Disturbance of mammals	Construction	Negligible
Disturbance of Arctic hare and Arctic fox	Operation and Closure	Negligible
Physical disturbance on caribou	Operation and Closure	Minor
Freshwater impacts		
Change of flow and transport of freshwater	Construction	Negligible
Change of flow and transport of freshwater	Operation and Closure	Minor
Leaching from TSF Dry stack	Operation and Closure	Minor
Leaching from TSF Dry stack	Post-Closure	Negligible
Leaching from TSF Wet stack (sub-aqueous)	Operation and Closure	Minor
Leaching effect from TSF on phytoplankton	Operation	Negligible
Effect on benthic invertebrates Lake #3 zooplankton	Construction, Operation and Closure	Negligible
Effect on freshwater fish populations	Construction and Post-Closure	Negligible
Effect on freshwater fish populations	Operation and Closure	Minor
Seizing of lake affiliated bird species habitat	Construction and Post-Closure	Negligible
Seizing of lake affiliated bird species habitat	Operation and Closure	Minor
Marine impacts		
Change in marine water quality	Construction and Post-Closure	Negligible
Change in marine water quality	Operation and Closure	Minor
Underwater noise effect on marine mammals	Construction, Closure and Post-Closure	Negligible
Effect on marine mammals from shipping disturbances and underwater noise	Operation	Minor
Effects on marine fish populations	Construction, Operation, Closure and Post-Closure	Negligible
Marine Invertebrate community changes	Construction, Operation, Closure and Post-Closure	Negligible
Effect on marine macroalgae	Construction, Operation, Closure and Post-Closure	Negligible
Marine birds - especially colonies.	Construction, Operation, Closure and Post-Closure	Negligible
Introduction of Invasive/non-indigenous species	Operation (Construction and Closure)	Minor

Potential impact	Project phase	Overall significance
General impacts		
Emission of greenhouse gasses	Construction and Operation	Minor
Emission of nitrogen from ANFO	Operation	Negligible
Wastewater eutrophication of marine recipient	Construction, Operation and Closure	Negligible
Risk of fuel leak and soil pollution on land	Construction, Operation and Closure	Minor
Overall risk assessment of large marine oil and product spill	Construction and Operation	Minor
Limited public access and effect on hunting	Construction, Operation, Closure	Minor
Landscape scarring	Construction	Minor
Landscape scarring	Operation	Moderate
Landscape scarring	Closure and Post-Closure	Negligible
Cumulative effects, primarily from marine Traffic	Construction and Operation	Minor

1.5. Mitigation Measures

An Environmental Management Plan (EMP) will be developed for the project, which will apply to the following areas and activities of the Majoqqap Qaava mining project:

- The open pit and the mining operation,
- Ore hauling and infrastructure (incl. harbour facility),
- Ore processing/treatment,
- Water supply,
- Generator and power supply,
- Fuel and explosives supply and storage,
- Offices and associated support facilities,
- Bulk shipping,
- Maintenance activities related to the above areas.

In the initial phase, the EMP specifies mitigation measures for risks identified in the EIA. Explicitly addressed are issues related to the physical environment, air environment, water environment, ecological environment, and waste, with an extended focus on:

- Air emissions i.e., dust by watering,
- Handling of waste rock and tailings,
- Screening of waste rock and quarry material intended for road material for sulphide/ARD,
- Sewage, wastewater discharge,
- Solid and hazardous waste,
- Spill prevention,
- Surface water protection,
- Wildlife protection from noise from helicopter movements and blasting.

The detailed EMP is presented as a separate document following this EIA and will include the following approach and sections:

- Activity – the activity associated with the mining project which has been identified to possess a potential impact or risk to the environment.

- Environmental impact – description of the negative impact of the activity (such as pollution or disturbance of natural environment).
- Action – the mitigating measure or actions identified to prevent or minimize the adverse environmental impact.
- Stage - the project stage in the life of the mine where the measures, actions, or principles have effects e.g., construction (C), operation (O) and decommissioning and closure (D).
- Frequency and/or timing – the frequency or timing when the action should take place.
- Responsibility – clear chain of command and description of party/parties responsible for ensuring the action, measure, or principle is done.

The EMP will additionally include the following documents, which are prepared/updated before the construction phase:

- Environmental Monitoring Program, (section 9),
- Health and Safety Plan
- Spill Response Plan
- Waste Management Plan
- Decommissioning, Closure and Rehabilitation Plan, (section 10).

The EMP will evolve continuously over the LoM from feedback from the monitoring program and operational experience. Similarly, the project expects to continuously identify actions or measures that can help ensure that the project's impacts on the environment are minimised.

2. Introduction

Greenland Anorthosite Mining [GAM] has initiated the process to acquire an exploitation permit for their MEL 2019-162 Majoqqap Qaava anorthosite resource license. Part of the permitting process involves presenting an Environmental Impact Assessment [EIA] for the planned mining project and mining phases.

The overall aim of this EIA is to identify, predict and evaluate the environmental effects of the planned mining project. The EIA is structured to systematically touch down on all environmental aspects of the project, providing information of the baseline state of the various ecological components and evaluating on potential effects of project activities. Key issues associated with the proposed project will be identified to ensure that potential adverse impacts are addressed before final decisions to advance mine development are made.

This document contains a full description of the project and an evaluation of the potential environmental effects associated with its completion. Impacts are evaluated for the relevant project stage for each subject, with a weighted focus on the actual mining phase, as this will constitute the majority of the expected project lifespan. The construction phase is expected to last for 2 years. The anorthosite mine at Majoqqap Qaava has a defined Life-of-Mine [LoM] of 30 years based on the defined resource and mine plan.

It has been a defined goal in developing this EIA that it is explanatory and understandable for the broad public. The EIA is founded in a series of technical background reports that provide subject specific conclusions, interpreted, and presented in this EIA.

2.1. Scoping and study plan

After preliminary consultations between GAM and EAMRA the company has prepared a scoping report which has been submitted to the Minerals Resources Authority [MRA]. This report contained an initial evaluation of the project, the project area, and the project activities. The goal of the scoping report was to identify topics of particular importance requiring field studies and special attention, as well as to disregard not assessed as relevant to the project.

This scoping process has resulted in a project Terms of Reference [ToR], published for public consultation. Greenland Anorthosite Mining's ToR for the Majoqqap Qaava project was in public consultation from 18. August 2021 to 21. September 2021 and is available online on at the Greenland Government's consultation portal.

2.2. Baseline sampling

Standing governmental guidelines require two to three years of environmental baseline studies to adequately characterize an area prior to project start.

Baseline sampling for the Majoqqap Qaava Anorthosite project includes collection of lichens, seaweed, mussels, and marine fish, freshwater and sediment from rivers, lakes and the fjord. Additionally, meteorological, and hydrological measurements have been completed along with a dust sampling program.

Environmental baseline sampling was started in October 2020 and has been carried out by NIRAS Greenland A/S and sub-consultants with several field campaigns in 2021 and 2022. Baseline sampling is summarized in a technical background baseline report (NIRAS Greenland, 2024c).

All sampling has been conducted following standing Greenlandic field protocols, including the protocol developed for collecting samples to the Greenland mineral Resources Environmental Sample Bank (DCE - Danish Centre for

Environment and Energy, 2022). In addition to sampling in the project areas, samples have also been collected from a reference area.

In addition to the environmental sampling, Greenland Anorthosite Mining has conducted a range of investigations providing solid knowledge of all major aspects of the project and project area. This includes:

- Geological drilling campaigns,
- Geological mapping,
- Geochemical leaching testing,
- Geochemical toxicological testing,
- Marine bathymetry, navigational mapping, and charting,
- Project area surveying and documentation by foot and air.
- Fiskenæsset - Greenland Anorthosite Mining. Arkæologisk forundersøgelse 2020 (Larsen, 2020)
- Majoqqap Qaava Social Impact Assessment (Rambøll, 2023a).

2.3. Public consultation

Following approval by the Naalakkersuisut this report is made available for public hearing and commenting via the Greenland Government hearing portal. The hearing period will include public meetings where the public and stakeholders will have the opportunity to ask questions to the company and authorities.

Following this hearing period all comments and input are logged and presented in a project '*white paper*'. All input will be evaluated, and the document will be updated with the necessary additions and/or explanations before final approval by MRA.

3. Regulatory framework

This section outlines the legislative framework regulating the minerals sector in Greenland with specific focus on the environmental aspects of mineral exploration/exploitation.

After the issuance of the Act on Greenland's Self-Government on 21 June 2009, Greenland took over the administrative responsibility for the raw materials sector, defined by Greenland Parliament Act No. 7 of 7 December 2009 on raw materials and mineral activities (the Mineral Resources Act), which entered into force on 1 January 2010. During the EIA process on this project, the Mineral Resources Act has largely been replaced by the Greenland Parliament Act on Mineral Activities No. 26 13/6 2023 (the Mining Act) which entered into force on 1 January 2024. In the new Mining Act, the area for general mineral activities within the mineral area is generally separated from the other parts of the raw materials area, which is covered by the Mineral Resources Act, including the hydrocarbon area (the area relating to oil and natural gas), use of the subsoil for storage, the area for local persons and museums' small-scale mineral activities and the exploitation, collection and mining of minerals by local persons and companies without permission. The Mineral Resources Act is therefore still partially applicable with the following amendments:

- *Greenland Parliament Act No. 26 of 18 December 2012*
- *Greenland Parliament Act No. 6 of 8 June 2014*
- *Greenland Parliament Act No. 16 of 3 June 2015*
- *Greenland Parliament Act No. 34 of 28 November 2016*
- *Greenland Parliament Act No. 16 of 27 November 2018*
- *Greenland Parliament Act No. 39 of 28 November 2019*
- *Greenland Parliament Act No. 27 of 13 June 2023*
- *Greenland Parliament Act No. 35 of 4 June 2024*

Greenland's Self-Government issues an exploitation permit (license) in accordance with the Mining Act. The exploitation license contains the overall conditions in relation to the duration of the licence, royalty payments as well as exploitation and decommissioning plan, reporting, confidentiality, use of local labour and local suppliers, etc. and applies as a starting point for a period of up to 30 years with the possibility of extension (§ 47).

Section 7, sections 41-46 of the Mining Act states that the following conditions must be met before the right holder can be granted an exploitation permit:

- § 41: The holder of a right to a resource exploration permit is entitled to an exploitation permit if the right holder has delineated a viable resource deposit that has been approved by Naalakkersuisut.

- § 44: The rights holder must have submitted an approved project terms of reference before the exploitation permit is granted. According to section 44, subsection 2, is subject to a public preliminary hearing.

- § 45: The holder of the right to an exploitation permit must be a limited company with management domiciled in Greenland. The right holder can apply for a postponement of this relationship for up to 24 months, as long as this is approved by Naalakkersuisut.

- § 46: The limited liability company must not be less capitalized than the group of which the company is a part. Furthermore, the limited liability company may not be taxed jointly with other companies, unless there is compulsory joint taxation.

According to the Mining Act section 15 § 100, a company must also provide an Environmental Impact Assessment for public consultation and government approval, before the mining activity can be initiated.

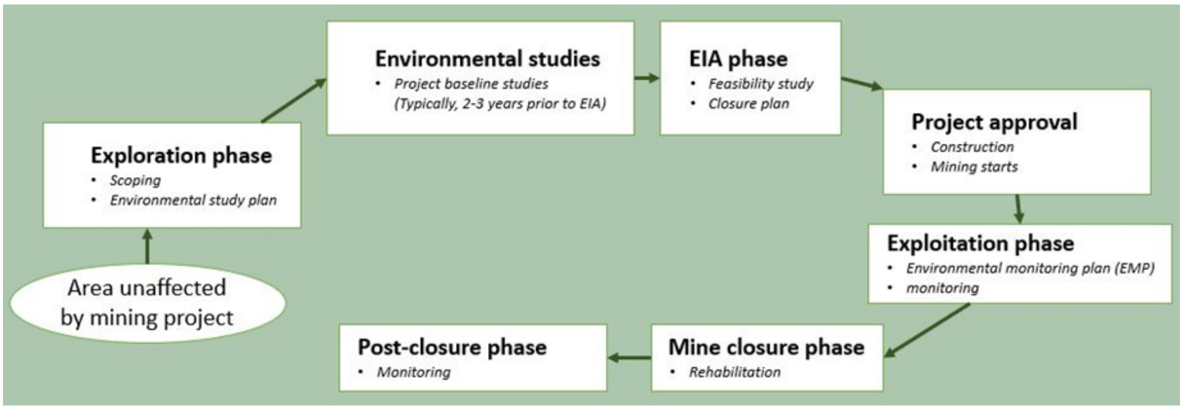


Figure 1: Regulatory lifecycle of a mining project in Greenland.

The Mineral Resources Authority's published guidelines (2015) for preparing an Environmental Assessment report for mineral exploitation in Greenland, covering aspects and processes required in developing a satisfactory EIA, has been the basis guidelines for the present EIA for the Majoqqap Qaava.

The EIA will be submitted to the Environmental Agency for Mineral Resource Activities [EAMRA] for commenting and approval. Figure 1 shows the overall schematics of the regulatory lifecycle for a mining project in Greenland.

3.1. Administration

Figure 2 shows the structure of the MRA. The EIA process is facilitated and handled by the EAMRA.

Figure 2: The administrative structure of the Mineral Resource Authority.

3.2. Maritime regulations, obligations and guidelines

All maritime transport required in connection with the MAQ project will be carried out in accordance with the relevant and applicable rules and guidelines for Greenlandic waters. The following documents shall be observed:

- *International Maritime Organisation [IMO] Polar Code*
  - *The MARPOL and Polar Code conventions' requirements for ships, equipment, training, discharges, etc. must be followed by all ships travelling to the mine.*
  - *Including amendments to MARPOL Annex 1 (regulation 43A) regarding prohibition on the use and carriage of heavy fuel oil (HFO) by ships in Arctic waters, on or after 1 July 2024.*
  - *Notwithstanding the above provision, it is possible for the local Danish Maritime Authority to temporarily exempt from the requirements for ships flying the Greenlandic or Danish flag while sailing in the Greenlandic territorial waters. However, no exemption granted under this paragraph shall apply on or after 1 July 2029.*
- *Danish Maritime Authority [DMA] - Order No. 1697 of 19 December 2015*
  - *Order for Greenland on the safe navigation, etc. of ships.*
- *Danish Maritime Authority [DMA] - Order No 169 of 04 March 2009*
  - *Technical regulation on the use of ice searchlights during navigation in Greenland waters*
- *The Ministry of the Environment and Food, Law No 1534 of 19 December 2017.*
  - *Act on the Protection of the Marine Environment in the Exclusive Economic Zone of Greenland*
- *Greenland Parliament Act no. 15 of 8 June 2017*
  - *On the protection of the marine environment*
- *The Ministry of Economic Affairs, Order No. 170 of 17 March 2003*
  - *Ordinance on ship reporting systems in Greenland waters (Greenland Reporting Service)*

Further references to Danish executive orders concerning navigation in Greenland, as well as IMO rules, circulars and guidelines and other relevant information concerning navigation in the Arctic and Greenland can be found on the Danish Maritime Authority's website http://www.dma.dk/safety-at-sea/the-arctic-region.

3.3. International obligations

Greenland has ratified a number of international conventions regarding nature and biodiversity, either as a direct convention member or through its membership of the commonwealth of Denmark and the Faeroe Islands. Some of the most important are listed below.

- The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.
- International Union for Conservation of Nature [IUCN] is an international organization dedicated to natural resource conservation. IUCN publishes a "Red List" compiling information from a network of conservation organizations to rate which species are most endangered. The first Greenlandic red list was published in 2007 and latest revision of the Greenland Red List was published in 2018.

The 2018 list include 112 species of animals and 490 species of plants of which 52 species are defined as being "*of national responsibility*", meaning that Greenland holds an international responsibility to protect these species.

- UNESCO's World Heritage Convention is a global instrument for the protection of sites of cultural and natural heritage.

  In 2004 Illulissat Icefjord was the first Greenlandic area to be admitted onto UNESCO's World Heritage List. In 2017 the area Kujataa in southern Greenland was included and in 2018 the last of the current three Greenlandic UNESCO heritage sites was admitted, Aasivissuit-Nipisat at the Greenlandic west coast.

Specific details on the project's impact on Ramsar sites, as well as other sensitive and protected areas in relation to the planned activities are provided in section 5.10. Sensitive and protected areas with regards to birdlife is described in section 5.8.7.

4. Description of the Majoqqap Qaava project

4.1. Location

Majoqqap Qaava is situated in West Greenland at an approximate latitude of N63°13' and longitude W050°12', Figure 3. The license area MEL 2019-162 hosting the anorthosite resource covers 51 km^2 and is located approximately 130 km south-southeast of Greenland's capital, Nuuk, and 40 km east-northeast of the small settlement of Qeqertarsuatsiaat (Fiskenæsset), see Figure 4.

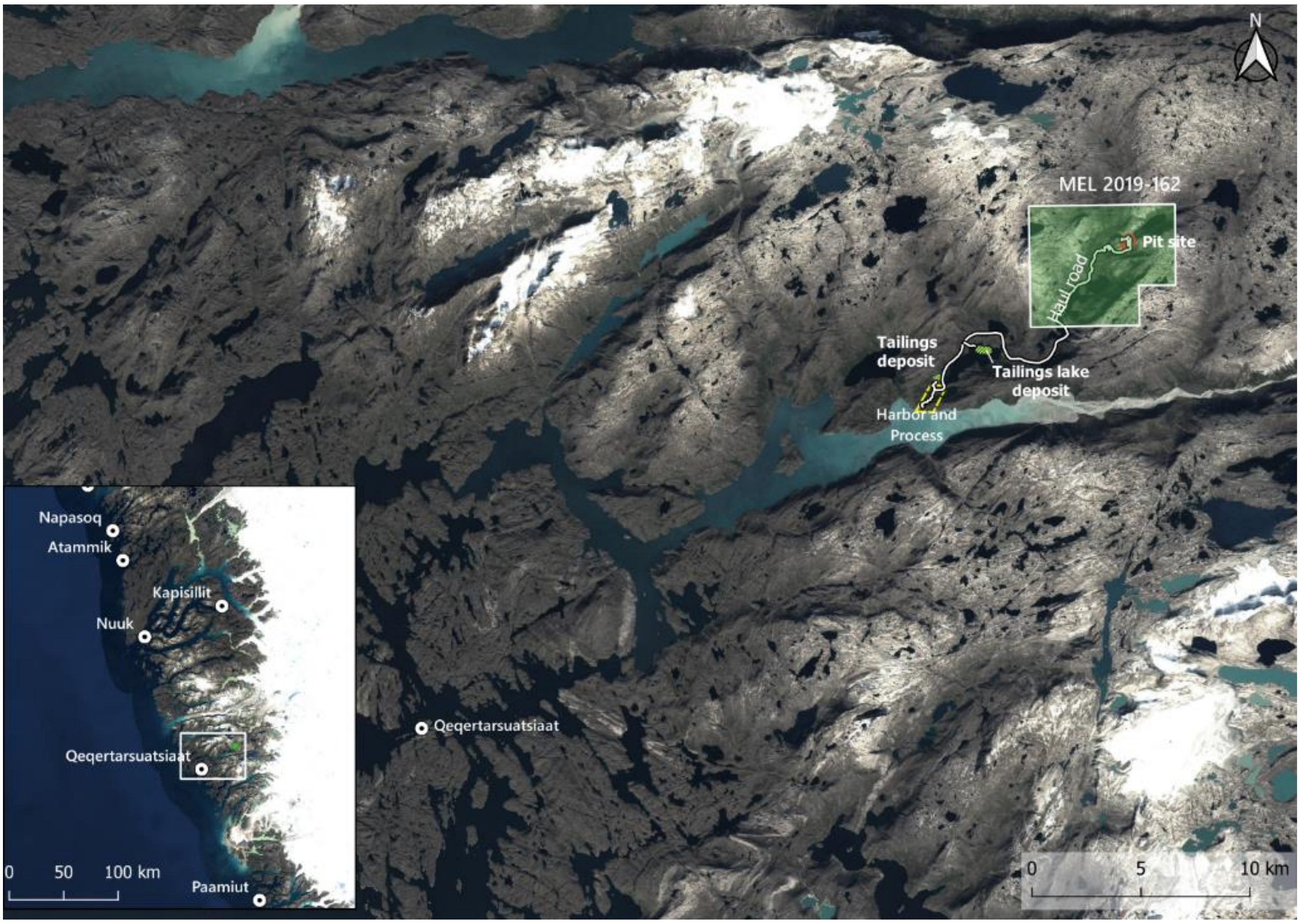


Figure 3: Project location and overall proposed project components.

The project is located at the base of the Kuussuatsiaat Valley, in the innermost part of the Qeqertarsuatsiaat Kangerdluat (Fiskenæsfjorden).

In order to secure the project access to the sea and thereby the possibility of shipping of ore, the company applied for an enlargement of license MEL 2019-162 in 2023. The area extension covers the lower southern part of the Kuussuatsiaat Valley, in order to facilitate the necessary infrastructural elements for running the mine operation such as haul roads, tailings areas, accommodation, workshops etc. The outline of the enlargement is shown in Figure 4 and Annex 1.

The topography in the wider Qeqertarsuatsiaat region varies from gentle low-lying relief (0-500 m) with moderate vegetation along the coastal stretches to areas with higher relief (up to 1,500 m) in the inland areas in vicinity of the inland ice. The region is intersected by several large deep-water fjord systems, which are generally ice-free all year round but with the possibility of annual sea ice forming in the inner parts for up to three months during winter. The area of exploration rises from sea-level to elevations of c. 1,000 m near the Majoqqap Qaava summit. The actual anorthosite resource is located at an altitude of app. 300-400 m above sea level. A system of lakes follows the flat lying southwest-trending Kuussuatsiaat valley (project valley) for more than 10 km terminating at the north coast of Qeqertarsuatsiaat Kangerdluat.

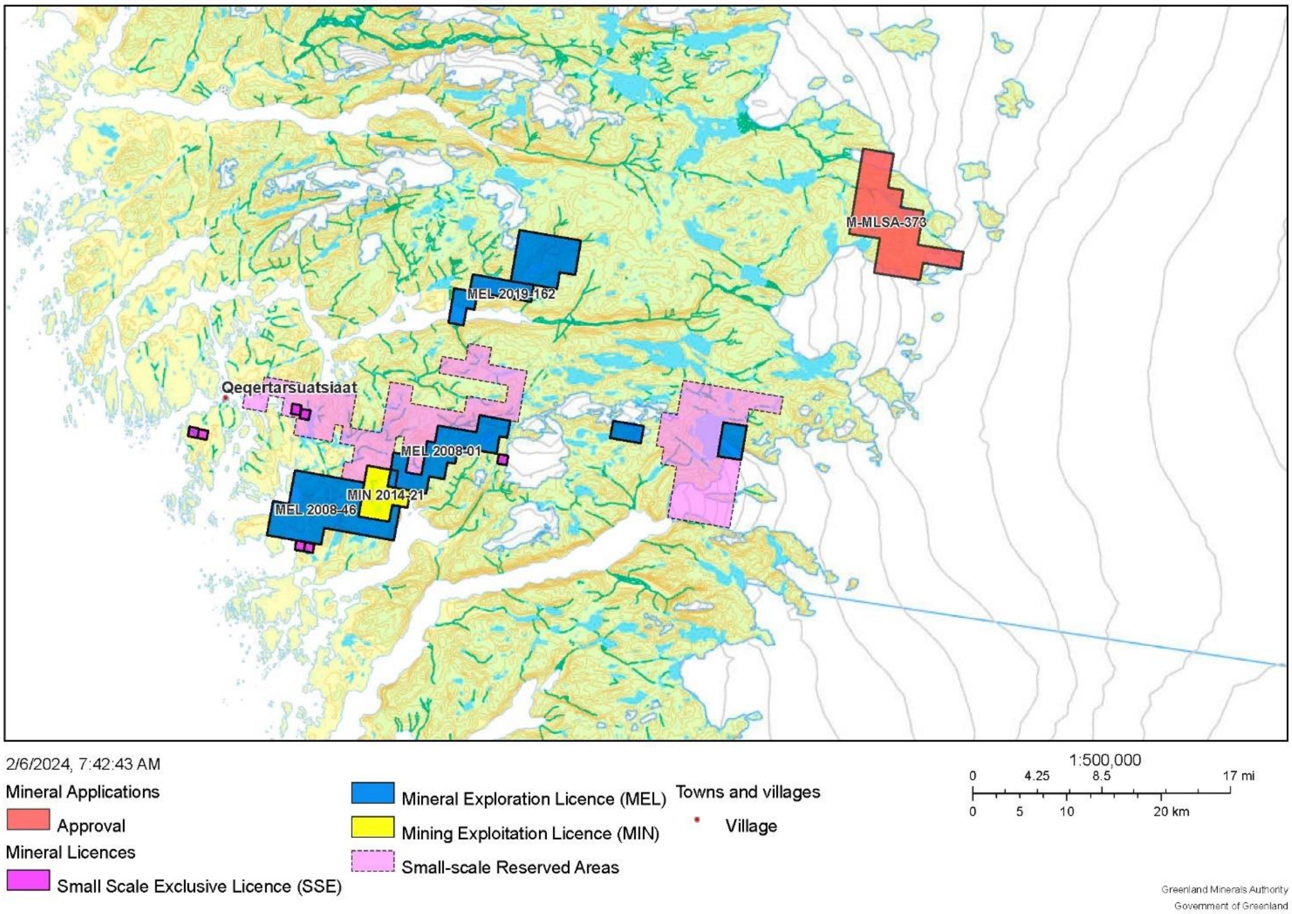


Figure 4: License map showing MEL 2019-162 and neighbouring claims.

4.2. The mineral resource

Anorthosite is a massive white rock primarily comprised of the chemical components' aluminium, silicon, and calcium. The principal product that will be produced is raw anorthosite, which is almost entirely (>95 %) composed of the feldspar mineral Bytownite (app. end-member composition $CaAl_2Si_2O_8$). Based on 1,509 m of diamond drilling in 2019 by GAM, an inferred mineral resource of 21.8 Mt according to CIM definitions has been calculated by SRK Consulting, Wales, Table 1. The resource consists of anorthosite material containing some 0.5 % K_2O and 1.8 % Na_2O, for a combined Alkali content of 2.3 %. Of the 21.8 Mt, a minimum of 7.14 Mt of anorthosite material with 1.95 % alkali metals is expected.

Classification	Density *(g/cm³)*	Tonnage *(Mt)*	Alkali *(%)*	K_2O *(%)*	Na_2O *(%)*	Al_2O_3 *(%)*	CaO *(%)*	Fe_2O_3 *(%)*	SiO_2 *(%)*	TiO_2 *(%)*
Inferred	2.8	21.8	2.3	0.5	1.8	30.2	15.0	1.2	49.3	0.03
Total	2.8	21.8	2.3	0.5	1.8	30.2	15.0	1.2	49.3	0.03

Table 1: Mineral Resource Statement for the Majoqqap Qaava Anorthosite Project, effective 25 March 2020.

The Majoqqap Qaava anorthosite outcrop is sub-rectangular in plan, 7 km long and 5 km wide, being incised by a valley almost 1,000 m deep. In three dimensions, the anorthosite sheet forms a basin that is inclined to the southeast. Figure 5 shows a simplified cross section of the Majoqqap Qaava outcrop. It can be interpreted that the large anorthosite exposure in the northern part of Majoqqap Qaava at the proposed mine site is the result of tight folding. As the folding is dipping to the southeast, it is interpreted that large volumes of anorthosite may occur below the main valley.

The geology in the focus area for Greenland Anorthosite Mining´s activities is composed of anorthosite with subordinate pegmatite, gneiss lenses and thin leuco-gabbro layers. Based on the geochemistry it has been possible to characterise slightly different anorthosite types and discrete areas as more or less favourable for mining with respect to their composition. The results clearly demonstrate that a large area in the north-eastern part of Majoqqap Qaava has a superior geochemical composition and significant tonnage of homogenous, highly acid-soluble anorthosite. An overview of the geochemical composition of the Anorthosite and pegmatite can be found in Annex 3.

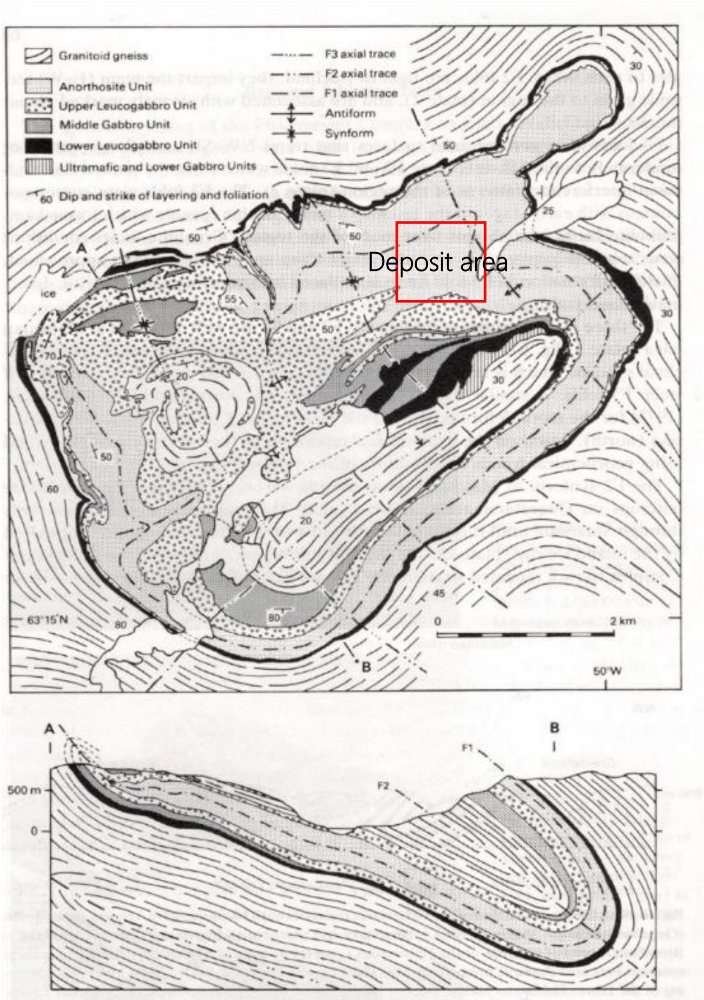


Figure 5: Simplified map cross section of the Majoqqap Qaava complex (Myers, 1981).

4.3. Mining operations

GAM is planning to establish a mining and processing operation at Majoqqap Qaava. Following ramp up, the project is planned to involve annual mining of between 560,000-930,000 tons of raw anorthosite and shipping of approximately 400,000-800,000 tons of product material to Europe and North America. A summary of mining scenarios A and B is shown in Table 2.

4.3.1. Mining method

The anorthosite mine at Majoqqap Qaava will be operated as a conventional open pit mine.

The mine pit will be located on the southeast side of a ridge. The pit design assumes that a temporary ramp will be established on the Eastern face of the mining location using of a similar cut-and-fill methodology as required to establish the haul route from the pit to the port. This design assumes that mining can progress in absence of a permanent ramp which will result in a lower stripping ratio. Ore material will be drilled, and bench blasted using ANFO (ammonium nitrate and diesel). Based on current technical studies, it is GAM´s belief that benches with a height of 7 metres, a depth of 10 metres and a width of 25 to 50 metres will be blasted. The current pit design depth is 170 m and include 6-8 m berms and a 12 m wide permanent ramp to provide access for the final bottom benches, Figure 6.

It is the intention to optimise blasting to reduce the maximum feed block size to 600 mm; thereby avoiding the need for pneumatic hammer impact crushing prior to hauling and processing. Also, it is the aim to minimize the production of fines to optimise downstream processing and reduce dust nuisance.

Due to the surface exposure of the anorthosite deposit, there is a minimum need for stripping of overburden and waste rock. GAM expects that for the majority of the resource area, high-pressure washing of the surface to remove organic material prior to mining will be sufficient.

Project description		Scenario A	Scenario B
Mining resource	Inferred mineral resource of;	21.8 Mt	
Mining rate		560,000 tpa	930,000 tpa
	Life-of-Mine production	16.8 Mt	27.9 Mt
Mining method	Conventional open pit, drill and blast, hydraulic excavation, load and haul		
Processing type	Crushing, sensor sorting, grinding and magnetic separation		
Life-of-Mine		30 years	
Waste rock quantity	Non to minimum need for stripping of overburden or waste rock		
Tailings waste quantity	Pegmatite from XRT sensor sorting;	35 Ktpa	60 Ktpa
	Tailings from the magnetic separation;	70 Ktpa	70-125 Ktpa
	Life-of-Mine tailings	4.76 Mt	3.91 Mt

Table 2: Summarizing mining scenarios A and B.

4.3.2. Mine water management and pit inflow

Because the quarry is located on the southeast side of a ridge the ex-pit runoff should be easily diverted away with small bunds around the pit rim. Given the thin to no soil cover, low bedrock permeability, steep slopes, and frozen ground for a significant portion of the year, runoff (as a proportion of precipitation) is expected to be high and groundwater recharge is expected to be low. Furthermore, groundwater recharge is expected to be mostly limited to the period between May and September when the ground is not frozen.

The quarry will be developed in low-fractured (brittle), crystalline rock (anorthosite ore and associated igneous host rocks), which are expected to be generally low permeable with groundwater flow and storage limited to secondary porosity i.e., joints and geological structures. Basic hydrogeological test work and monitoring of drill hole water levels has been conducted by GAM at Majoqqap Qaava. The results are part of the final detailed mine plan.

A basic catchment delineation for the project area has been used to produce estimated runoff volumes to the quarry. As the quarry is to be developed into the side of an SSW-NNE striking ridge runoff to the pit is likely to be limited to within the pit perimeter itself. A river and lake system runs approximately parallel to the ridge, draining south along the ESE (and lowest) side of the pit. It is expected that precipitation and surface water runoff flow into the open pit will be low, with an estimated 700 m^3/day (7 ltr./second) of inflow to the final pit extent, using the maximum hydraulic conductivity values.

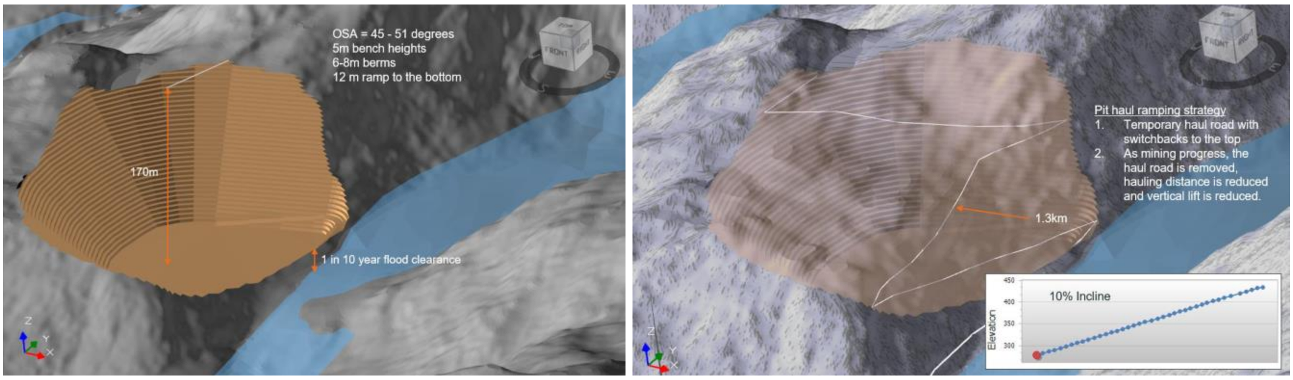


Figure 6: Pit design isometric view and visualization of pit haul ramp.

4.3.3. Waste dump at mine and Anorthosite stockpile

The anticipated pit design and mine production does not produce significant waste material from surface stripping. However, besides the limited soil overburden waste material may be produced if anorthosite material, which has not been explored to a level of detail which would allow it to be considered as a Mineral Resource, is mined. Such waste material would consist of coarse blasted blocks of anorthosite (<600 mm). A potentially suitable area to store this waste rock material, is located 3.5 km to the west of where the pit is situated along the proposed haul road (Waste Rock Dump/Deposit [WRD]), Figure 7). Resource modelling shows that material that are currently not part of the mineral resource (unclassified) amounts to a app. 1.8 Mt., of which approximately 40 % will be mined during the first 3 years of production. As soon as the material is classified as Mineral Resource, it will be removed from the temporary stockpile and put into production. A conceptual dump with sufficient Loose Cubic Meter [LCM] capacity to support the Life-of-Mine operation has been designed with conservative preliminary slope parameters of 30° angle of repose.

The key criteria for selection of the proposed WRD has been the proximity to the pit area, as this will lead to low haulage cost and minimum need for construction of additional road network. The short haulage distance from the mine site and the location along the main haul road eliminates the need for additional trucks to transport the waste materials, as it is expected this can be accommodated within the existing ore haul cycle. In addition, the catchment area upstream of the selected site is minimal and the site is safely located in relation to flood risk event, which is beneficial for minimizing water protection management costs.

GAM does not plan to stockpile significant anorthosite material, however depending on the extraction sequence and production schedule raw anorthosite plant feed material may have to be temporarily stockpiled prior to processing, to maintain the desired magnetic separation anorthosite production rates. This buffer material will be stockpiled in close proximity to the processing facility to benefit from terrain advantages. The amount of material will correspond to the process plant's needs for a 5–7-day period. Stockpiling facilitates the option of halting mining or haulage for a short period of time without suspending production. For Scenario A, this would equate to the stockpiling of 10,000-15,000 mt and for Scenario B to 15,000-25,000 mt of anorthosite ore. An isometric view of the stockpile location and dimensions is shown in Figure 8. Stockpile material would consist of coarse blasted blocks of anorthosite (<600 mm) and would only create a minimal amount of dust or leaching issues.

Immediately in front of the processing plant, anorthosite ore will be stored for a short time in connection with unloading after haulage. These materials are continuously fed into the processing plant. The quantities will be a maximum of 2-3 truckloads, corresponding to 30-90 tonnes, and will consist of coarsely blasted blocks of anorthosite (<600 mm) and will not cause leaching problems.

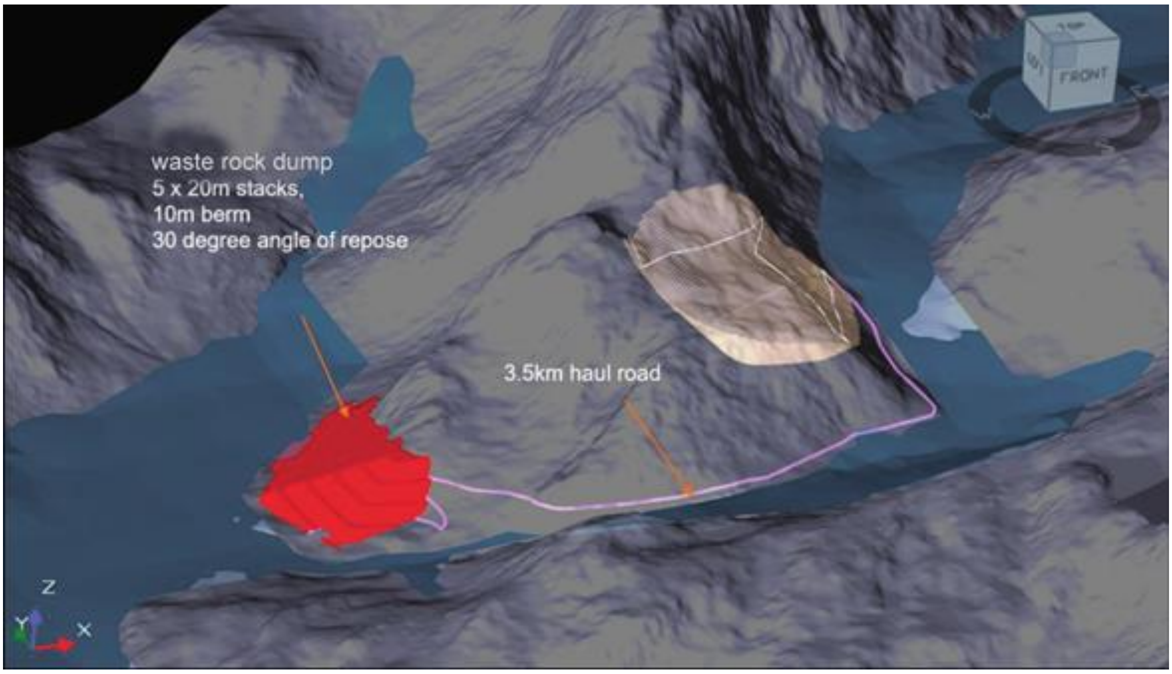


Figure 7: Conceptual waste dump design next to mining area.

4.3.4. Mining equipment

Machinery needed to run the proposed mining operation will include standard and well-known mining equipment i.e., excavators, front-end loaders, drilling equipment, a fleet of tipper trucks for hauling ore etc., Table 3. Depending on the final output scenario chosen, the number of primary equipment is estimated from first principles using benchmark data. A haulage analysis has been used to inform appropriate load and haul equipment totals, which in turn has guided the choice of ancillary equipment. Equipment selection has been based on the production rate, mining selectivity, the haulage requirements, and experience with similar sized operations. Special consideration has been made with regards to the mining trucks, whereby an off-highway tipper truck was selected for its suitability in remote locations and hauling ore in excess of 5 km.

When selecting the machine/vehicle fleet, GAM will follow international best practice. Acknowledging the wish for a 24-hour operation in Arctic conditions, the company will, in dialog with manufacturers of vehicles and mining/construction equipment, to the extent possible consider environmental impact and sustainable alternatives to diesel-powered machines/vehicles. When it comes to ore haul trucks, there are currently no electrified alternatives with sufficient operating capacity in an Arctic environment to handle the ore load without the purchase of a significantly larger truck fleet and installing powerlines all the way to the pit area. GAM will continuously follow market development in the sector in order to identify sustainable alternatives to diesel-powered units.

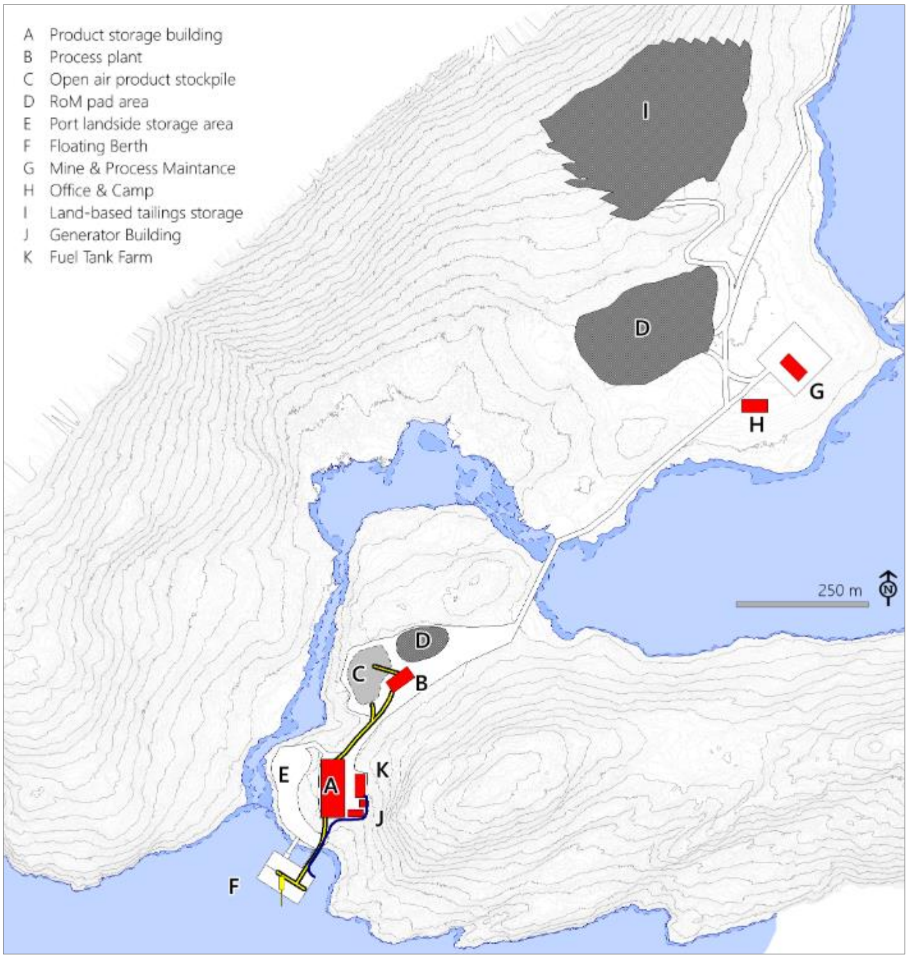


Figure 8: Conceptual ore stockpile and waste storage design locations next to mine town and processing area. Water levels represent 100-year flooding event.

Mining Equipment	Reference model	Description	Scenario A [Amount]	Scenario B [Amount
Excavator	Hitachi ZX890LC-7	Hydraulic shovel. Back-hoe 5.2 to 6.3 m^3 bucket capacity.	1	1
Front-end loader	Hitachi ZW6	FEL with 4.7 tons 13 m^3 bucket capacity	1	1
Off highway tipper truck	Mercedes Arocs	18-44 tons tipper truck	5-6	8-10
Primary drill	Sandvik Ranger DX700	Percussion crawler. 11.4-14.0 cm hole, 3.7 m rods.	1	1
Secondary drill	Sandvik Commando 300RI	Percussion crawler. 11.4-14.0 cm hole, 3.7 m rods.	1	1
Primary track dozer	CAT D8T Dozer	60 Kilowatt bulldozers. 2.4 m blade width	2	2
Stemming loader	Unspecified	4.2 m^3 bucket	1	1
Rock breaker	Unspecified	104 kg/m - 1,000 blows/min. - 3.6-8.2 mt.	1	1
Supply Equipment	Reference model	Description	Scenario A [Amount]	Scenario B [Amount
Primary motor grader	Unspecified	105 Kw grader w. ripper/scarifier, 3.7 m blade width.	2	2
Water truck	Mercedes Arocs	18,000 ltr.	1	1
Fuel / lube truck	Mercedes Arocs	Mobile field fuel/lube truck. 1,800 Gross Weight service trucks	2	2
Low bed	Mercedes Arocs	Truck flatbed 8.8 – 11.8 tons	1	1
Forklift	Unspecified		1	1
Lighting plant	Unspecified	Trailer mounted telescoping light towers. 7.8 kilowatt	3	4
Pumps	Unspecified	3.7 kilowatt	2	2
Light vehicle	Toyota Hi-Lux		2	3
Mini bus	Unspecified		2	2

Table 3: Preliminary list of required mining equipment.

4.4. Processing plant and beneficiation of ore

Flowsheets (Annex 2 – conceptual process design) has been developed to address the stated process requirements in terms of anorthosite ore treatment and selected product types. A "dry" processing approach without the usage of water has been selected as the preferred choice of separation. The plant will be operated for minimum 9 months (270 days) of the year, i.e., excluding the coldest winter months, where the plant will run on a reduced maintenance level. The processing of materials will be dictated by the boundaries of either a minimum or maximum scenario, A or B, that each have their own defined flowsheet. Scenario A involves a relatively simple circuit only producing material for E-glass, ceramics, and fillers whereas Scenario B involves a more complex circuit reflecting the added screening and production of lump and fines for stone wool. In both scenarios final milling for especially E-glass but also some types of ceramics and fillers to <45 µm will be carried out outside of Greenland for the following reasons:

- Purchasers of the material require a strict control of the fine grinding for quality reasons, and that this be placed relatively close to the factories that will use the product to avoid contamination. Experience from previous use of anorthosite has shown that the introduction of even very small amounts of contaminating materials in connection with ship transport, overland logistics and other handling has a negative influence on the smelting process. There are thus unavoidable requirements for handling, where the product, after grinding to

45 µm, is transported in closed silo trucks or closed containers that are cleaned daily according to special regulations, and driven directly to the factories' production silos for reloading,

- The final fine grinding to 45 µm is highly energy-intensive and will therefore require a very large consumption of diesel if this were to be carried out using the mine's power plant. This contradicts demands from the customers, who, in order for them to deliver a green product, also require GAM to use as much green energy as possible. The new international ESG laws [ESG] also come into play, which must be fully implemented at the end of 1Q 2023, where the seller of an end product has ESG responsibility for the entire value chain. The buyers are thus demanding more closeness and control of the part of the processing that can cause risk to the final seller of a product. When grinding in Europe, it will be possible to use more green forms of energy for the final processing and purification of the product,
- Practical handling of 45 µm material in Greenland is difficult and will increase dust issues locally and furthermore cause technical challenges during processing stemming from condensation and moisture in the product. Bulk storage of micronized material furthermore creates risks of moisture absorption and clumping of the materials, which inhibits the final material melting by end-users,
- Shipping of a 45 µm product will require transport in specialized cement-ships, which are significantly smaller (app. 10,000 DWT) than bulk-carriers (35,000-45,000 DWT) and therefore would lead to increased traffic through the fjord system as well as increased CO_2 emissions. The price of freight with these smaller ships will also affect the case negatively and possibly make it uneconomical.

4.4.1. Scenario A flowsheet:

A common crushing and grinding circuit will operate to produce a magnetic separated product (<0.7-0.8 mm / 700 µm) for E-glass/ceramics/fillers, Annex 2.

Primary crushing using a jaw crusher: Jaw crushing will produce 20-120 mm fragments for XRT ore sorting. The requirement for fragments >20 mm will require taking steps to avoid over crushing the ore; such steps will include having a vibrating grizzly ahead of the crusher, and it may also be necessary to close circuit the crusher to be able to operate the crusher with a relatively coarse close side setting.

Primary screening: This screen will separate out fractions >120 mm back to the jaw crusher and send material between 20-120 mm to the XRT ore sorter. Screen undersize (<20 mm) will report to the HPGR circuit.

Ore sorting: The 20-120 mm fragments will be fed to an XRT ore sorter to separate pegmatite (quartz) from anorthosite. Pegmatite and other losses to go to tailings storage annually are estimated at 5-10 % equal to ~25-50 Ktpa.

Secondary crushing: A cone crusher and vibrating screen will be used for size reduction <20 mm ahead of the High-Pressure Grinding Roll [HPGR] circuit. This circuit will probably need to operate in closed circuit to provide oversize protection for the HPGR.

HPGR closed circuit: The fine products will be produced from a HPGR closed circuit, where a coarse (static) separator is expected to be able to provide separation at >0.7-0.8 mm and a fine (dynamic) separator is expected to be able to provide separation at <53 µm ahead of magnetic separation.

Magnetic Separation Circuit: The magnetic separation circuit is based on the use of Rare Earth Roll [RER] permanent magnet type separators. Tailings from the magnetic separation circuit consists of an iron-enriched anorthositic magnetic concentrate. While there may be potential for this material to be blended in with one or other of the fine products, given its high Fe_2O_3 content (c. 4 % based on the test work) for the purposes of this description it is considered to be a waste stream. Given the particle size (<700 to +53 µm), it will be transported from the plant site to a dedicated Tailings Storage Facility [TSF] by truck unless the product can be blended or sold elsewhere. Magnetic waste is estimated at 15 % equal to ~70 Ktpa. Fine material <53 µm will be blended with final products to the extent possible and otherwise sent to the tailing site (maximum ~55 Ktpa).

Magnet separated semi-finished product material will be transported to a final grinding facility in Europe or the United States where the <45 µm material for E-glass/ceramic/filler is produced.

4.4.2. Scenario B flowsheet:

A common crushing and grinding circuit will operate in order to produce lump material for stone wool (60-120 mm) and magnetic separated "coarse" (<0.8-0.7 mm) fines and "fine" (<0.2 mm) fines for E-glass/ceramics/stone wool and fillers, Annex 2.

Primary crushing using a jaw crusher: The requirement for lump production will require taking steps to avoid over crushing the ore; such steps will include having a vibrating grizzly ahead of the crusher, and it may also be necessary to close circuit the crusher in order to be able to operate the crusher with a relatively coarse close side setting.

Primary screening: This screen will separate out fractions >120 mm back to the jaw crusher and send material between 20-120 mm to the XRT ore sorter. Screen undersize (<20 mm) will report directly to the HPGR circuit.

Ore sorting: The 20-120 mm fragments will be fed to an XRT ore sorter to separate pegmatite (quartz) from anorthosite. Pegmatite and other losses to go to tailings storage annually are estimated at 5-10 % equal to ~55-65 Ktpa.

Secondary double deck screening: This screen will separate out the necessary material for lump (60-120 mm fraction) and direct remaining material to the secondary crushing stage.

Secondary crushing: A cone crusher and vibrating screen will be used for size reduction <20 mm ahead of the HPGR circuit. This circuit will probably need to operate in closed circuit to provide oversize protection for the HPGR.

HPGR closed circuit: The fine products will be produced from a HPGR closed circuit, where a coarse (static) separator is able to provide separation at 0.7-0.8 mm and a fine (dynamic) separator is able to provide separation at 0.2 mm as well as 53 µm ahead of magnetic separation.

Magnetic separation circuit: Magnetic separation will be conducted dry using RER permanent magnet separators. Tailings from the magnetic separation circuit consists of an iron-enriched magnetic anorthosite concentrate. While there may be potential for this material to be blended in with one or other of the fine products, given its high Fe_2O_3 content (c. 4 % based on the test work) for the purposes of this description it is considered to be a waste stream. Given its particle size (<700 to +53 µm), it will be transported from the plant site to a dedicated TSF by truck. Magnetic waste is estimated at 20 % equal to ~70 Ktpa. Fine material <53 µm will be blended with final products to the extent possible and otherwise sent to the tailing site (maximum ~50 Ktpa).

Magnet separated semi-finished product material will be sold as final product or transported to a final grinding facility in Europe or the United States where the <45 µm material (E-glass/ceramic/filler) is produced.

4.4.3. Processing plant

The process facility will consist of a 125x50 meter process facility building containing a series of ore feeders, ore crushers and separator units and the project powerplant. The crusher and separation setup will depend on the product scenario (A or B). Both processing schedules are presented in detail in Annex 2.

The processing facility is designed at a semi-continuous, partially closed circuit. The individual process components will be shielded from the outside according to manufacturer's recommendations. To reduce dust and noise nuisance further, and to minimize ore condensation issues, the primary crushing stage is expected to be containerized, or installed in a separate secluded section of the factory hall.

4.5. Geochemical characterization of ore and tailings

The geochemical composition of the average anorthosite resource is described according to Table 1 in section 4.2. An overview of the geochemical composition of anorthosite and pegmatite can be found in Annex 3 p.2 and p.3.

		ANORTHOSITE	**PEGMATITE**	**Optical sorting**	**Magnetic separation**
		MRC	MRC	Pegmatite tailings	Magnetic tailings
SiO_2	[wt.%]	47.52	74.90	72.63	44.08
Al_2O_3	[wt.%]	31.79	14.35	16.24	28.18
Fe_2O_3	[wt.%]	1.26	0.90	0.67	4.87
CaO	[wt.%]	16.25	2.49	3.99	15.00
MgO	[wt.%]	0.74	0.21	0.17	3.52
Na_2O	[wt.%]	1.64	2.79	3.97	1.22
K_2O	[wt.%]	0.38	4.54	1.81	0.66
Cr_2O_3	[wt.%]	0.01	0.04	0.03	0.05
TiO_2	[wt.%]	0.03	0.06	0.03	0.15
MnO	[wt.%]	0.02	0.05	0.04	0.08
Total	[wt.%]	100.82	100.85	100.32	99.87
LOI	[wt.%]	1.10	0.45	0.74	2.06
C	[wt.%]	0.02	0.01	0.02	0.02
S	[wt.%]	0.02	0.03	0.03	0.06
Cr	[ppm]	51.15	260	208	383
Th	[ppm]	0.59	2.97	3.21	2.11
U	[ppm]	0.96	2.05	4.18	3.12
V	[ppm]	10	13	10	44
As	[ppm]	0.2	0.1	0.5	0.7
Hg	[ppm]	0.01	<0.005	0.01	0.02
Tl	[ppm]	0.08	0.15	0.05	0.29
Ag	[ppm]	0.50	0.03	0.07	0.15
Cd	[ppm]	0.50	0.03	0.07	0.16
Co	[ppm]	4.4	1.7	1.6	21.3
Cu	[ppm]	13.56	8.9	29.2	49.4
Mo	[ppm]	1.12	19.7	14.8	9.9
Ni	[ppm]	22.0	8.8	9.3	173.9
Pb	[ppm]	2.3	17.6	16.7	14.2
Zn	[ppm]	14	17	17	89

Table 4: Geochemical characterisation of the Main Resource Components [MRC], as well as ore sorted pegmatitic and magnetic tailings.

During the resource definition, metallurgical test work for the design of the beneficiation process, as well as the succeeding environmental and ecotoxicological testing programme, relevant anorthosite units, pegmatites, gneiss and leuco-gabbro rock types within the resource have been defined and geochemically characterised. In addition, the separated tailings products from the beneficiation process have been defined and characterised. The main ore and tailings components that the project considers in the mining, haulage and subsequent processing stages are presented in Table 4. The final chemical composition of the shipped product depends on the degree of extraction of pegmatite and magnetic concentrate from the anorthosite ore and cannot be described precisely.

4.5.1. Radiogenic elements

Along with the resource definition and geochemical environmental and ecotoxicological testing (section 5.4), approximately 7 % of all collected samples with a complete geochemical analysis package has been screened to identify potential hazardous elements or geochemical risks from the materials planned to be mined (Annex 3). These studies show that the anorthosite ore's average content of uranium and thorium is around 1-2 ppm, with maximum values of 10-11 ppm uranium and 15 ppm thorium, respectively, and thus significantly below the Greenlandic statutory limit of 100 ppm uranium (*Greenlandic Parliament Act No. 20 of 1 December 2021. Annex 3*). Therefore, the content of radiogenic elements in the anorthosite deposit is so low that it is not recognized as an environmental issue.

In addition, the geochemical studies show that the content of sulphur and sulphur-bearing minerals is less than 0.02 wt. %, and correspondingly, the content of sulphide-associated metals such as copper, zinc, nickel and cobalt is well below 200 ppm.

4.6. Tailings storage

Extraction, hauling and processing ore requires ore handling sites, 'Run of Mine' [RoM] storage areas and a long-term strategy for tailings storage.

'Tailings' is defined as the rock waste remaining after a mineral resource has been processed and concentrated. In the case of the Majoqqap Qaava project assessed in this report, tailings are expected to consist primarily of the following materials:

- Coarse pegmatite/quartz material (fraction 20-120 mm),
- Fe-enriched anorthosite (magnetic concentrate) (fraction <700-53 μm).

The main considerations for selection of a suitable site for TSF are:

- Haulage distance (from processing plant) – short distance is practical,
- Slope inclination – for construction suitability,
- Flood-risk areas for a 1- in 10-year storm event and a 1- in 100-year storm event – preferably avoiding both to avoid water protection management costs,
- Areas with a large upstream catchment area – should be avoided to minimise water protection management costs,
- Planned roads – proximity to planned roads to minimise cost of additional road construction.

The TSF will be designed according to the following factors: required storage capacity for the project duration; anticipated geotechnical and geochemical tailings characteristics; ground conditions; climatic conditions and potential flood events; operational factors including noise and dust; and concepts for facility closure.

Geochemical testing shows that the material to be deposited presents no material Acid Rock Drainage Metal Leaching [ARDML] risk and contain unsignificant levels of hazardous elements (according to relevant water quality criteria). Based on the results from the test work, it can be shown that the chemical composition of the magnetic tailings is assumed to be broadly equivalent to the anorthosite reported in the Mineral Resource, although with elevated iron content (c. 4 % Fe_2O_3) and relatively slightly lower content of other major elements.

Two potential alternatives are identified for tailings storage, Annex 4. One location involves a land-based storage, whereas the other involves wet bottom storage/deposition in the nearby lake. The main advantage of both locations is proximity to the processing plant.

4.6.1. Basis of land-based tailings storage design – [TSF Dry]

The TSF Dry site is located on a slope of suitable gradient (less than 18 degrees – to prevent mudslide) and avoids the zone at risk of flooding in a 1- in 100-year storm event, Figure 8, Figure 9 and Figure 10.

The area designated for maintenance and the mine camp is near and in front of the toe of this site, at a lower elevation. Storage of tailings in this site therefore poses a potential risk to infrastructure and occupants which needs to be suitably addressed and mitigated in the design and future studies.

The type of facility chosen for TSF Dry is a tailings 'stack' (a compressed layered stack) due to the low water content and granular nature of the waste output from the processing plant. The tailing stack will be designed in a way that prevents intruding water from the uphill areas, to minimize leaching of fluid from the tailings stack. Transport of tailings is assumed to be by haul truck from the process plant to the facility. At the facility, the tailings will be dumped, spread (by dozer) and compacted, according to the design.

A complete description of the land-based tailings deposit incl. a detailed stability risk assessment and visualizations can be found in the separate project background report *Land tailings deposits – structural stability risk analysis. Background note* (NIRAS, 2024e).

4.6.2. Basis of lake-based tailings storage – [TSF Wet]

A possible site for storage of tailings exists in the large lake east of the accommodation area (Lake #2), Figure 9 and Figure 10. Based on depot measurements and lake profiles made by NIRAS in September 2020, it was documented that several areas with more than 60 m of water depth occurs in the lake. As the lake is >2 km long it has a volume of approximately 63 million m^3, and therefor adequate capacity for storing tailings from the mine project through LoM (see 5.7.1.4 Bathymetry of lakes). The lake is geologically underlain by basement gneisses, which secures stable ground conditions. The advantage of using the lake includes the following;

- There will be no wind induced dispersion of dust and fine materials,
- Two additional reservoirs downstream the TSF Wet in upper part of Lake #2 will act as effective catchments basins for suspended fine material, thereby minimizing dispersion of these elements to the fjord,
- Besides monitoring, the lake TSF Wet will not require any additional work when the mine closes as the material effectively will settle over time at the bottom of the lake,
- Visual impact will be lesser compared to a land-based storage.

Tailings from the processing facility will be transported to the TSF Wet deposit by trucks on their way to the mine. A suitable haul ramp will be constructed next to the lake, where trucks could safely tip tailings into a gravity pipe system leading to an adequate depth below the thermocline.

A water column of more than 10 metres above the tailings will be maintained throughout the life of the project and post-closure. Based on the existing bathymetric data and assuming efficient tailings deposition patterns, 20 metres of water column above the tailings through LoM is achievable.

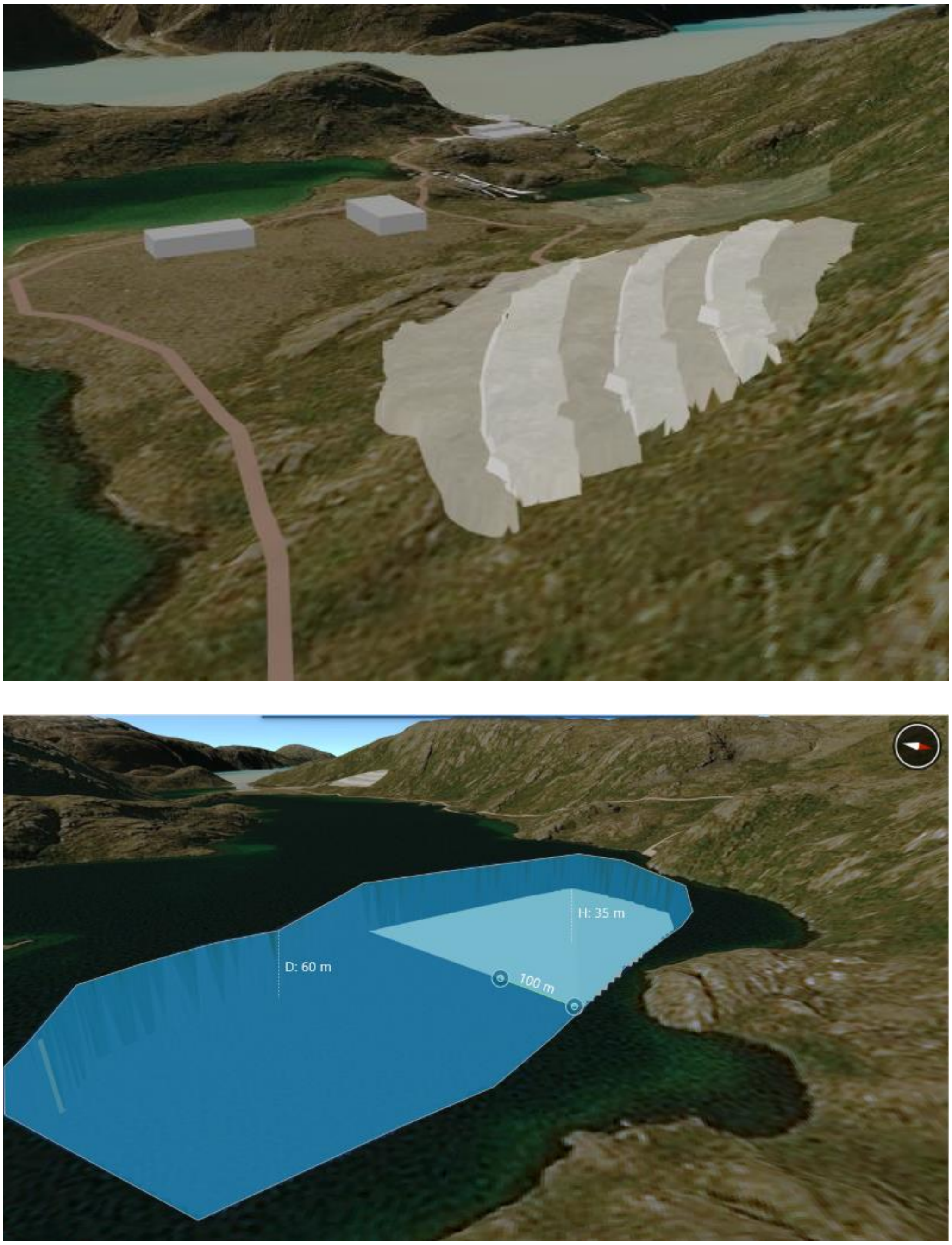


Figure 9: TSF illustrations. Top figure shows a conceptual TSF Dry land-based deposit. The dimensions of the TSF-dry are presented in scale in Annex 4. Lower figure shows a visualization of transparent part of Lake #2, holding the TSF Wet lake-based deposit.

4.7. Infrastructure

Construction and mining activities can in principle be undertaken on a year-round basis but are typically confined to the mid-March to mid-December period, due to potential navigational limitations on shipping. When the project progresses to a mining operation, it is intended that all infrastructure requirements will be self-supplied by GAM. The main components of the project layout are as follows, Figure 10:

- Mining area and potential WRD and explosive storage,

- Main haul road (between the mining area and processing plant),
- Port, processing facilities and stockpile area,
- Mine Maintenance Area [MMA] and accommodation camp,
- Product storage area,
- TSF area.

The processing plant, port facilities and stockpile area are built on the following platforms (size in brackets) and contained installations:

- Processing plant and RoM stockpile,
- ROM stockpile (before processing plant, 100x50 m),
    - *Processing plant (125x50 m, includes Power plant), and/or*
    - *Power plant (50x25 m, if installed as a stand-alone unit for noise reduction. Alternatively, built integral to the dedicated processing plant).*
- Product stockpiles & materials handling,
    - *Outside stockyard for stone wool coarse product (>60 to <120 mm) – Scenario B (100x50 m).*
    - *Covered warehouse segmented for storing stone wool fines product (<0.8 mm) and magnetic separation material ("E-glass" product <700 µm) material – Scenario A+B (100x50 m),*
    - *A general storage area (50x50 m).*
- Port facility and marine,
    - *Landside infrastructure / platform (100x50 m),*
    - *Jetty/berth; and*
    - *Fjord navigation route and aids.*
- General facilities and the mine maintenance area (e.g., workshop, offices, warehouse) (150x100 m), and
- Accommodation camp (100x100 m).

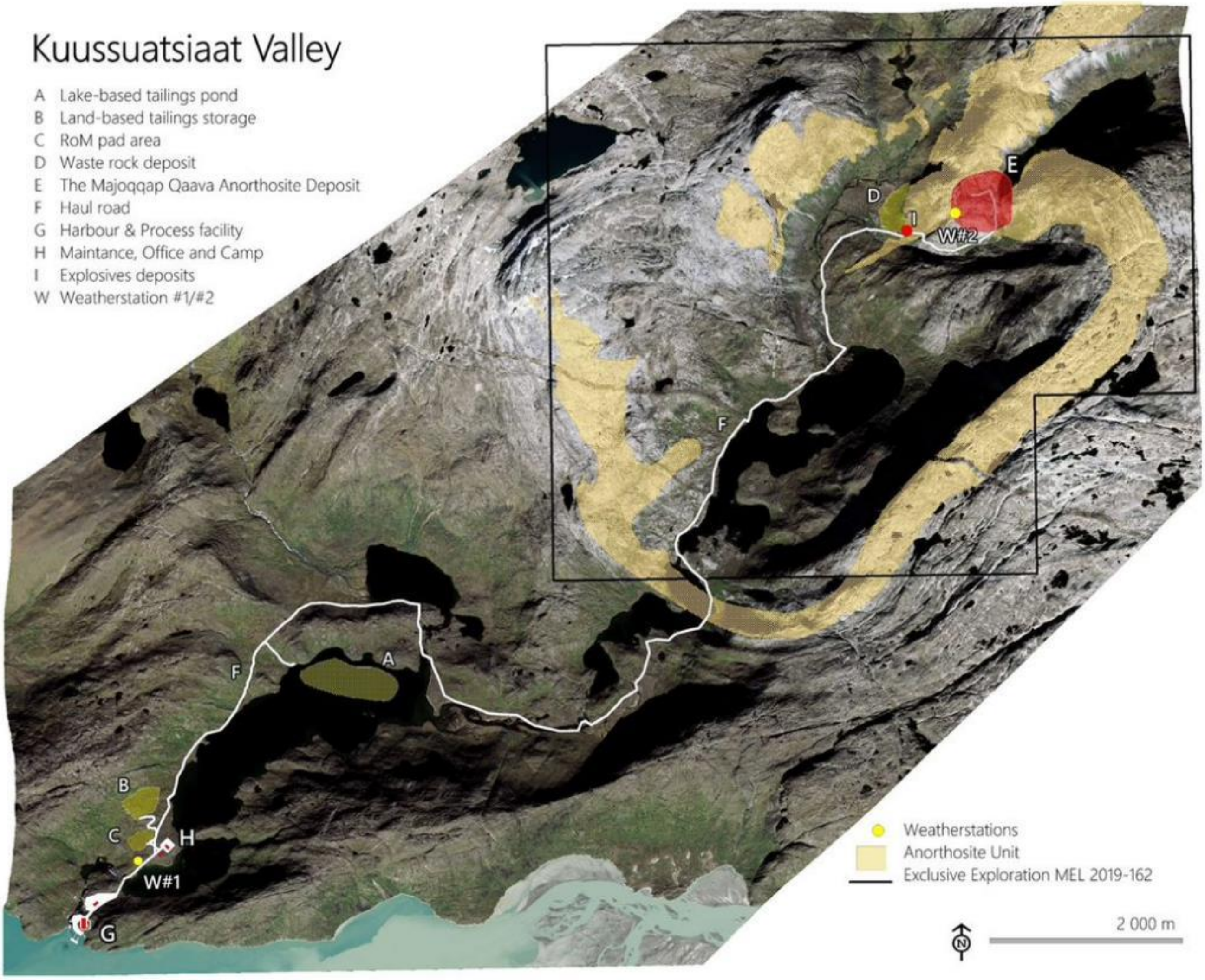


Figure 10: Infrastructural layout of the Kuussuatsiaat Valley and the Majoqqap Qaava anorthosite project. To prevent any confusion regarding topographical shadows on the satellite image, the area's drainage system, including the lake banks, has been accurately mapped in Annex 4.

4.7.1. Ore haul and tailings route

The main haul road will run from the shoreline up through the valley to the pit site, and connect the port-, processing- and accommodation areas including the RoM pad to the mining area, Figure 10. The construction concept is for a single lane road with strategic located regular bypassing shoulders to allow returning (empty) trucks to give way to down coming ore-hauling trucks. These bypassing areas will be placed once the truck hauling routine is known. The road is built with a width suitable for 18-44 tons tipper trucks.

The haul route is designed to follow the contour path in the most optimal and cost-efficient way by minimizing the requirement for blasting and build-up where possible. The road maintains a maximum of 10 % road gradient and will where possible be a combination of an entrepreneurial road and a gravel/shard road. The road surface is excavated and prepared to the required level and built up with prepared subgrade and base material with ditches and embankments as required. A sectional road design schematic is set out in Figure 11.

The total length of the haul road is app. 17 km. The road will pass over loose soil moraine deposits, basement rock and waterlogged sediments.

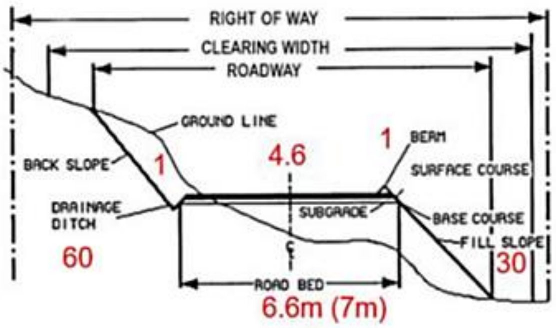


Figure 11: Conceptual haul road schematic. The running surface will be at 4.6 m in line with quarry regulations for single lane haul roads (based on an anticipated truck width of 2.5 m), A 1-m wide berm, A 1-m wide open V-drain, Total "roadbed" of 6.6 m.

Terrain in connection with the road trace and the associated facilities and gravel pits will be affected to a greater or lesser extent. A detailed road path report has been prepared by Rambøll in Nuuk, which describes the nature of the terrain, including location of filling masses that can be picked up / extracted in gravel pits found in and along the trace. The road must pass several large and small rivers / streams, which must be crossed by laying underflows / passages in the form of steel culvers dimensioned to ensure the continued and unhindered natural flow from the overlying lakes, to avoid accumulation of water within the valley.

Based on entrepreneurial studies made by Rambøll in 2020 and 2022, it is anticipated that app. 30 % of the road path terrain comprises loose material, 40 % comprises mixed material and 30 % comprises bedrock that needs to be blasted. Prior to construction of the road, an application will be made for permits to use locally available loose materials as build-up materials rather than transporting these from other places in Greenland. Once the mine operation is up and running, GAM anticipates using barren waste materials from the processing plant for maintenance of the road and other infrastructure. This material will primarily consist of coarse pegmatite rejects from the optical sorter that is deposited at the TSF and will minimize the use of local materials during the mine life.

4.7.2. Port facility and jetty

The project anticipates vessels up to 45,000 DWT Handymax Dry Bulk Carrier (length over all [LOA] 180 m, beam 28.5 m, draught 10.5 m) to moor at the port site. To provide operational flexibility, the berth design should allow for a slightly wider (but reasonable) spectrum of vessel sizes. For this berth, an upper design vessel size with dimensions approximate to a Supramax are proposed (e.g., LOA 199 m, beam 32 m, draught 12 m) which would enable shipments of 52,000 DWT. At the smaller end, the anticipated vessel will be 15,000 DWT, but for flexibility the smallest design vessel should be taken as 10,000 DWT (LOA 122 m beam 19 m, draught 8 m).

A summary of the parameters to be considered in the design of the berth at this stage of the project are:

- Operation life is expected to be minimum 30 years,
- The berth structure can be serviced by vessels ranging from 10,000 to 52,000 DWT,
- Provision is to be made for only one vessel berthing/loading at a single time,
- The fjord system is available to navigate for minimum 270 days per year between April and December.

GAM has not yet decided which solution will be used to establish a port facility. However, the jetty will involve a floating barge solution connected to a fixed port installation and will depend on the dialogue the company has with construction companies that are to carry out the task. There is no expectation that sheet piling or backfilling behind sheet piling walls will be required.

The following is an outline of a possible proposal for a floating barge solution, based on the company's Preliminary Economic Assessment [PEA] from 2020. This will utilize a jetty solution consisting of a permanent floating berth arrangement formed from standardized barge pontoon solutions (one 97x27 m pontoon forming the main berth with the two 41x11 m pontoons brought to site initially to form a pioneer jetty but then used for access) secured using mooring lines and strut bridges, Figure 12 and Figure 13. The solution would require only civil works to install the anchor points for the mooring lines on land.

The jetty will be located below the outcrop of rock to the East of the Kuussuatsiaat valley outflow. In this location the storage facilities would be located to the north requiring heavy civil works to level the rock outcrop.

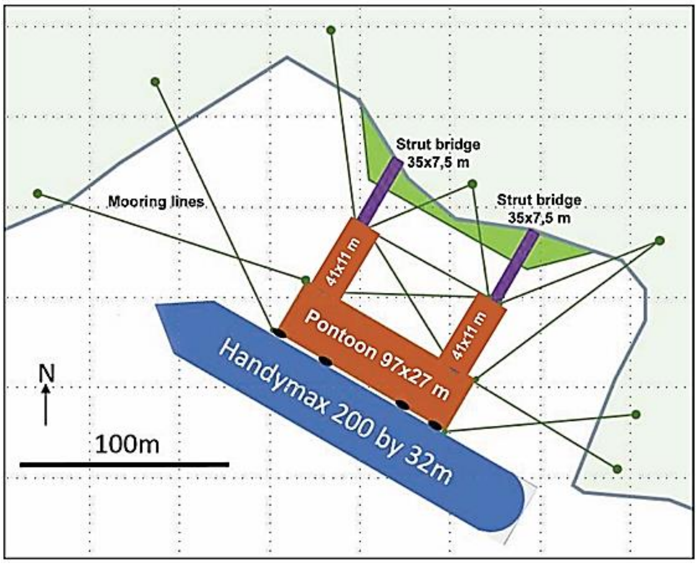


Figure 12: Tentative design of permanent floating berth below rock outcrop

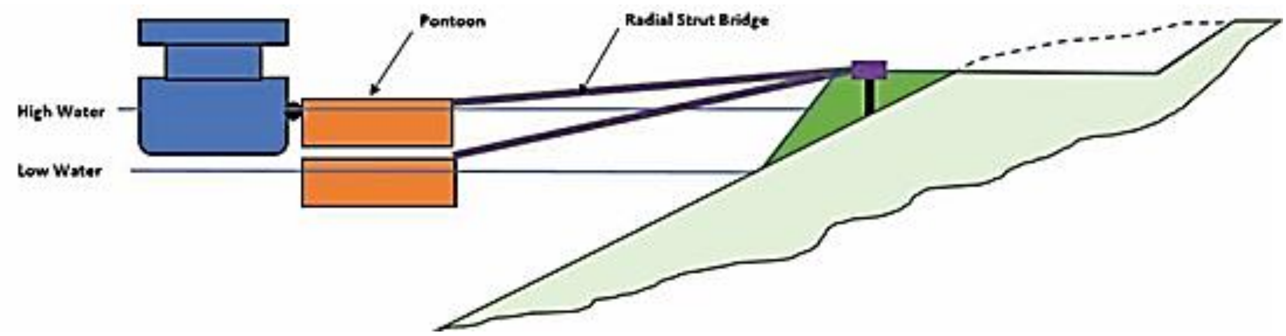


Figure 13: Schematic cross section of the Jetty showing the positioning of the pontoon berth and a Handymax at berth.

The combination of mooring lines and strut bridges is designed to restrain the pontoon against the berthing, mooring and environmental forces. As the berth is secured using mooring lines and accessed via a pair of articulating linkspan strut bridges, the berth is free to rise and fall with the tide whilst still in full operation. In addition, the berth construction will consider the formation of winter ice in the port area, which is expected to form around the elements of the jetty. The position, strength and degrees of freedom will have to be carefully designed for all structural elements as will the type, capacity and fixing arrangements for the mooring lines. The berth frontage would be approximately 97 m long and would utilise Yokohama pneumatic fenders on the front face which are relocatable to accommodate the smallest and largest design vessels.

4.7.3. Port layout

The port facility will be laid out with the cargo storage behind the berth, as close as practical while allowing a free circulation of necessary traffic with a heavy-duty road linking to the berth, Figure 14. The product storage will be in two separate formats with outside open storage (B), and inside covered storage (A+B). Fixed and mobile conveyor units will be positioned to transfer the cargo from storage to the mobile ship loader at the berth. Office buildings and workshops etc. will be positioned out of the way of operational areas.

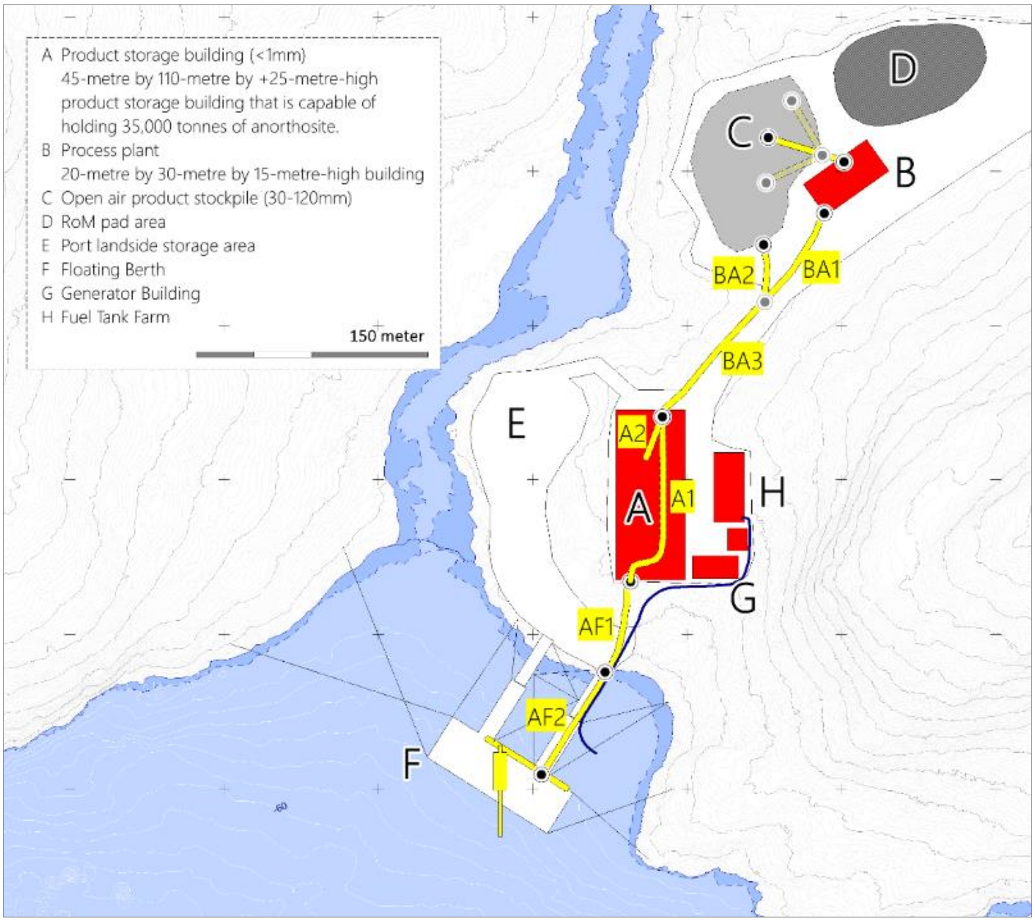


Figure 14: Tentative layout of the Harbour and Process plant area at the coast.

Roads and equipment: There will be a central road linking the berth to the stockpiles, the processing plant and the general infrastructure area. Mobile equipment will be required for unloading cargo and containers.

Support infrastructure: Power for the port operations will be supplied from the main power plant. There will be two control cabins: a shore side cabin, and a berth side cabin/shelter. It is anticipated that these will be formed of prefabricated/modular cabin units suited to arctic environment.

Fuel: Diesel fuel is anticipated to be delivered by coastal tanker using a hose line. The current concept is for loads of 900 m^3 (circa 900,000 ltr.) to be offloaded from a tanker to the fixed pumping station and fuel storage on land. Smaller quantities of other fuels and lubricants are received directly by ship at the quay in smaller portions, i.e., in 200 litre drums or 1,000 litre containers.

Domestic goods: Delivery of domestic goods to the site will be carried out by the minor settlement RAL vessels, commuting along the coast between Paamiut, Qeqertarsuatsiaat and Nuuk. The goods are anticipated to be delivered in 20' and 40' containers.

Ship loader: A mechanical ship loader will be suitably positioned on the berth to provide efficient loading of vessels. The loader can be equipped with a suitable dust suppression spout and deflection plates to minimize dust and enable even distribution of material in the ship's hold. The ship loader will be designed to achieve an average loading rate of 550 tph allowing for stoppages, switching of holds and manoeuvring of vessel and ship loader. Therefore, to account for these inefficiencies and down time, a ship loader of 1,000 tph has been proposed.

Berth occupancy: It has been assumed that the terminal will be operational from minimum April through to December, which is 270 days/annum. The total product to be produced and handled at the port will be a maximum 800,000 tpa (Scenario B), which equates to circa 3,000 tpd. In Scenario A, a maximum of 400,000 tpa will be produced, which equates to circa 1,500 tpd.

Based on the assumed vessel sizes, between 10 and 14 shipments of product per year are anticipated in Scenario A and approximately 18 to 25 vessels in Scenario B.

For Scenario B, allowing for one anticipated manoeuvre to allow the ship loader to reach the outer hold (due to the length of the selected pontoon), each of the 45,000 DWT Handymax bulker vessels will require 3 to 4 days for loading, giving a total around 54-100 days of berth occupation per annum. This is a berth occupancy of less than 50 % of the available operating period, which should allow sufficient flexibility for the terminal to cope with sailing delays, non-sailing days and accommodation of supply vessels. For Scenario A, similar estimations will give a total minimum berth occupation for loading all of the product of 21-40 days per annum.

4.8. Critical infrastructure failure mode analysis

To run an efficient mining operation at Majoqqap Qaava, the mining infrastructure is required to be of adequate technical and engineering condition to withstand critical climatic events. Overall, failure of critical infrastructure is assessed to mainly impact the actual mining operation and possibly cause a halt in the production feed to the process facility. The risk for personnel injuries is considered to be low in this regard, as today´s weather forecasts usually allow for due safety protocols to be established in time. With regard to environmental issues, the overall geochemical test work is considered sufficient to provide the necessary impact assessments, see section 5.4. In the unlikely event of the dry tailings stack partially collapsing or a slide of material from the waste rock depot at the mine or other areas where material is offloaded, the general risk of major geochemical impacts on the environment is regarded to be very low. Such incidents could cause landscape changes and likely require a mechanical clean-up effort, but a major environmental incident affecting the freshwater- and marine recipients are currently assessed as unlikely.

4.8.1. Tailings Storage Failure analysis

The Majoqqap Qaava project is considering two different alternatives for tailings storage of which only the land-based TSF Dry is considered at risk of potential failure due to severe weather conditions. The land-based TSF Dry will be constructed in accordance with the *Norwegian Highway Authority handbook N200:2022*, and based on geophysical stability calculations, (NIRAS, 2024e). In case of a collapse of a part of the tailing's facility; such as a terrasse or bench, the overall risk will primarily be centred around personal injury to any driver in a vehicle at or below the tailings stack. The current risk assessment of a larger environmental impact from collapse or instability of tailings is regarded as low. Also, a partial collapse would not necessarily halt mining production, as tailings could be deposited at a temporary tipping site while the conditions of the tailings stack is reestablished.

Overall, the TSF Dry stability modelling indicates that with actively maintained trenches (mine operational phase) the Ground Water Table (GWT) will be kept low maintaining stack stability.

Post mine closure <100 years, unmaintained trenches will cause decreased drainage capabilities which could lead to GWT raise. However, it seems likely that the bedding consisting of highly permeable masses (blast rock) will still be able to keep the GWT from raising significantly into the higher parts of the TSF thereby mitigating critical instability.

Forecasting post closure +100 years stack stability, the model uncertainty increases. Overall, in time drainage capabilities will decrease and the stack will see beginning slope and bench failure evening the surface of the stack.
Total trench failure will inevitably occur at some point, but it is questionable what will happen to the permeability of bedding masses consisting of blast rock on the long term. An undesirable combination of the above effects might cause the GWT to rise further. At some point when long-term equilibrium is obtained material runoff is expected to decrease substantially and eventually become nothing and the stack will enter a 'steady-state' and undergo natural erosion dynamics. These scenarios are visualized in appendix E of background report Land Tailings Deposit, Structural stability risk analyses (NIRAS, 2023b). With regards to an underwater tailing's storage facility TSF Wet the immediate risk of failure is regarded to be related to the area around the tailings tipping zone. In the event that the tipping facility becomes unstable, there would be an imminent risk of a vehicle ending up in the lake. Salvage of any wrecked vehicle must be quickly initiated according to the guidelines to be described in the project's Environmental Management Plan and the project's Health and Safety Plan. The final design of a tipping facility is not finalised but will include safety measures such as a life raft and safe access to land.

4.8.2. Infrastructure failure analysis

During heavy rain events and during spring thaw water masses are prone to damage or flush away roads. River crossings are likewise in risk of getting destabilized or even flushed away. Today's weather prognoses usually equal good preparation time before such events. This could include temporary shutdown of pit-site operations and rallying of personnel at the main mine camp, and deployment of road materials and machinery at strategic locations to initiate quick repair of any infrastructure. Failure of infrastructure is generally regarded as a production stop and not associated with any particular personnel or environmental risk.

4.8.3. Port and jetty failure analysis

During heavy storms, wave and wind action can cause problems at the project port site and jetty. Depending on the wind direction, ships lying at the port might be called to anchor up in the nearby bay area at a lee side. Should the bollard, mooring lines or strut bridges connecting the floating barge to the jetty collapse or be damaged during a storm, recovery and repairs would be initiated following the storm. Minor supply ships (as well as emergency response procedures) will still be able to reach the mine site with supplies and transport people in and out, even without the main floating barge.

4.8.4. Production and camp site failure analysis

The camp facility and production site will be constructed with suitable ditches to divert water and buildings engineered according to the Greenlandic building regulations, including DS/EN 1990 – DS/EN 1999 standards. Failure of production site or the generator station would require quick actions to recover the production. The mine manager would be overall responsible to initiate prioritized repairs accordingly. No particular environmental risk is identified related to production or camp site failure.

4.8.5. Fuel storage facility failure

The permanent fuel storage facility will be engineered and established according to BAT with 13x 68 m^3 double skinned containerized fuel storage units (11 at the general port storage area and one at the MMA and one at the mine area) as well as appropriate unloading and dispensing pipework, pump and booster stations. The double skinned tanks will furthermore be located in a containment area surrounded by berm, as secondary containment for protect against leaks and spills. The tank area and adjacent fuelling surface will moreover be gravelled with an underlying impermeable membrane. The above initiative will minimize the risk of major fuel spill incidents. Also, distributing fuel in 13 double hulled tanks reduces the potential spill volume considerably compared to an alternative with e.g. 3x 300 m^3 tanks.

The prepared Environmental Management Plan will furthermore include defined protocols for pumping fuel to avoid unattended pumping, and measures to contain and retrieve spilled fuel and to contain the accident site. The environmental risk due to a fuel storage facility failure is assessed as high.

	Failure event	Risk of personnel injury	Risk to environment	Risk of production stop
Tailings storage	Deposit collapse due to weather events	Moderate	Moderate/Minor	Moderate
Infrastructure (i.e. road, electrical supply)	Infrastructure is damaged due to weather events	Moderate	Minor	Major
Port and Jetty	Port site and Jetty is damaged due to storm or ice	Moderate	Minor	Minor
Camp site and production facility	Supply is damaged due to weather or equipment error	Minor	Minor	Moderate
Fuel storage facility	Fuel leak due to damage to equipment or faulty handling	Minor	Major	Minor

Table 5: Risk failure matrix for critical infrastructure.

4.9. Shipping

4.9.1. Traffic-Marine Navigational Safety Investigation

Navigation in Greenlandic waters need specialist consideration due to climate, the influence of the weather, effects on instruments that may occur due to latitude, as well as the remoteness of the area.

The Danish Maritime Authorities are responsible for navigational safety issues related to mining projects in Greenland. Therefore, as part of any future granting of an exploitation license, Greenland Anorthosite Mining has prepared a Navigational Safety Investigation [NSI] of the conditions to be experienced in the operational phase in regard to navigation and calls at ports, facilities, anchorages. The purpose of the investigation is to demonstrate that navigation can be carried out safely. The Traffic-Marine Navigational Safety Investigation is the decisive factor in determining whether sailing safety is acceptable, and the investigation is thus an element of the overall approval procedure by the Mineral Resource Authority [MRA].

All maritime transport required in connection with the MAQ project will be carried out in accordance with the relevant and applicable rules and guidelines for Greenlandic waters, as outlined in section 3.2 Maritime regulations, obligations and guidelines.

Based on legislation and extensive maritime experience from the Greenlandic pilotage company Imaq-Pilots, the company has prepared a detailed report on investigation of navigational safety issues on navigation though Greenlandic waters, with special emphasis on the final fjord approach to the project area. The resulting stand-alone NSI document *Majoqqap Qaava Anorthosite Project. Navigational Safety Investigation* (ImaqPilot, 2024) describes conditions such as: choice of route, hydrographic survey and charts, ice conditions, meteorological and oceanographic conditions, ship, and crew requirements (incl. tugboats), ports, places of call, anchorages, etc., emergency responses and risk-reducing measures, and assessment of possible environmental effects.

At the time of writing this EIA study and the NSI, no agreements have been made with a shipping company. Thus, specific details of vessel design, including loading and unloading facilities, will need to be determined at a later stage. However, in order to optimise chartering, the company will strive to combine transports of TEUs (class and non-class), as well as project cargo/equipment and supplies in holds and on main deck/decklids, with product dry cargo vessels calling. Fuel for the project is expected to be supplied from local suppliers who are familiar with sailing on the Greenlandic coast and in the fjord systems. Passenger transport will similarly be provided by local subcontractors with suitable and P-approved vessels.

4.9.2. Ship design

Vessels calling at GAM´s harbour facility must, as a starting point, be designed taking into account all the conditions that may affect the vessel's journey to the location. It is not necessary to have an ice class to navigate the west coast of Greenland all year round, as long as a route plan considers potential ice drift in the area. There may be years when Qeqertarsuatsiaat Kangerdluat freezes over, but as GAM plans to avoid shipping from the mine in the first quarter of the year, the risk of problematic ice conditions in the fjord is minimal and shipping does not require ice class tonnage. The conclusion in terms of vessel design is that Polar Class [PC] vessels are generally not necessary, but it should be mentioned that both April and December can be cold, especially at night, which is why the vessels must be able to operate in such environments. The tugboat that is expected to be stationed permanently in the area is recommended to be built to polar class PC6 or PC7 to be able to clear new ice.

When selecting subcontractors for vessel charters, GAM will specifically focus on compliance with *MARPOL Annex 1 (regulation 43)* regarding prohibition on the use and carriage of heavy fuel oil, which came into force in 2024. The company will also refer to the rules applicable to ships sailing in Greenlandic waters, including the Polar Code and the Danish Maritime Authority, as well as any local rules.

4.9.3. Operational conditions for shipping

Vessel traffic to and from the project area will include both large dry cargo vessels of up to 45,000 DWT, fuel supply tankers (e.g., Polaroil M/S Orasila, 2,525 DWT or M/S Oratank, 4,900 DWT), supply cargo vessels or tugs (w/o. barges) and small fast transport vessels (Targa's) used to transport personnel and other smaller supplies. The estimated vessel activity under production Scenario A and B for 8-10 months of activity/year is shown in Table 6. Relevant navigation rules are expected to be followed by everyone entering the project via the fjord system.

Vessel Type	Scenario A		Scenario B	
	Monthly calls	Arrivals per year, total	Monthly calls	Arrivals per year, total
Dry bulk carriers	1.5	12	2.5	23
Product tankers	0.5	6-7	0.5	6-7
Supply/utility vessels	1	8	1	8
Passenger transport vessels:	4-5	55	6-7	82

Table 6: Estimated shipping (worst case scenario) in relation to the GAM project for 8-10 months activity/year.

4.9.4. Delivery of goods and fuel

The estimated annual volume of goods through Qeqertarsuatsiaat Kangerdluat to and from Majoqqap Qaava during the operation of the mine is expected to be:

- Scenario A; 400,000 Mtpa product, Scenario B; 800,000 Mtpa product

- Scenario A; 2,546 m^3 Arctic diesel, Scenario B; 2,889 m^3 Arctic diesel
- approx. 70-100 TEU supplies [TEU].

4.9.5. Transport of workers

The mine crew operates on a rotational basis; initially with an expected rotation schedule of 4 weeks on site and 3 weeks off. The crew is replaced by Targa-type speedboats twice a week from Nuuk.

4.9.6. Auxiliary tugboat

To accompany and assist arriving and departing tonnage through difficult passages in Qeqertarsuatsiaat Kangerdluat, the company expects to engage at least one tugboat based at the mine. The tug must have adequate bollard pull capacity of c. 40-60 tons and be built to a sound polar class to be able to break and clear ice in the area where dry cargo vessels are to call/berth, and to keep the shipping channel open during periods outside the coldest winter months. The need for tug assistance will be assessed and decided by the ship master, the shipping company and the company in consultation.

4.9.7. Route selection, hydrographic survey and nautical maps

The overall description of the shipping voyage in the NSI is a full rotation from positioning outside the Greenlandic EEZ, with arrival either from Europe or North America (Mexico, Canada or USA), and into the mine. Then to the port of discharge in either Europe or Canada/USA. This present extract from the NSI deals however exclusively with navigation along the coastal route from Cape Farewell to Qeqertarsuatsiaat and further inland from Qeqertarsuatsiaat to the mining area;

The coastal route from Cape Farewell up to the mouth of Qeqertarsuatsiaat Kangerdluat lighthouse is seasonally influenced by large ice at the start of the route, and subsequently by glacial ice from the large icebergs south of Paamiut (on ice, see later section). It is therefore recommended that the coastal route be located from the 12 nautical mile line out to the 20 nautical mile line, so as to minimise the risk of encountering ice shelves and other glacial ice. This part of the route is often covered by fog most of the day in summer months and icing is to be expected in winter.

The inland route from Qeqertarsuatsiaat offers two possible entrances to the mine, both of which are considered suitable for the types of vessels selected for the launch.

- Southern entrance,
  - *Approach (A) to the southern entrance of the MAQ mine (D) is 26 nautical miles (Figure 15). After passing the settlement of Qeqertarsuatsiaat, a large course change (B) of approximately 60° is made around a 5 m skerries, with approximately 800 m to ground. In the southern entrance, the water depth is not less than 15 m at high tide.*
  - *In this entrance the current conditions are more marked than in the northern entrance and there are large current eddies which can be a challenge for safe navigation, therefore there must be smooth water at high tide when making the entrance. The passage is at its narrowest about 100 m (C), with the water depth greatest in the middle. A, D, B and C refer to locations illustrated in Figure 15.*
- Northern entrance
  - *From Approach (A) through the northern entrance to the mine (D) is 33 nautical miles (Figure 15). After passing (A), an area (E) occurs in the narrow strait with shallow water of 2-4 meters. and many islets that are not marked with buoys and therefore would make safe passage through the surveyed fairway difficult. The passage is 130 meters wide.*

- *At area F, the water depth is not less than 30 metres at high tide. However, this entrance is challenged by a sharp 90° turn (the Z-passage), therefore there must be straight water. Current conditions are marked in the course and there are large current eddies which can be a challenge to safe navigation.*

The northern passage is anticipated to require on average 4 to 5 hours to complete, depending on conditions and current. The southern passage will require 3 to 4 hours to complete.

- Sustained wind speeds above 10-15 m/s may impede navigation, though it may be possible to navigate in stronger winds once sufficient experience has been gathered. Similarly, it may be possible that more manoeuvrable bulk carriers can navigate the area at much higher wind speeds,
- Transverse currents may be present at a single location along the course of the route,
- A complete “captains' instruction” or “navigation safety instruction” will be made prior to the first approach of the inner part of the fiord system with large ships in order to describe all essential points and practical information.

Shipping through the fjord system can only begin when the relevant official nautical charts are available. The choice of the specific route is decided by the ship's captain.

<u>Port of call and safety of navigation</u>: A holding area is recommended approximately 4 nautical miles south of the beacon at position N62°58' W050°53', where there is a water depth of approximately 35 metres and where anchoring is easy if weather conditions permit. Alternatively, if the weather is not favourable for berthing or safe anchoring, the vessel may be kept out at the 3 nautical mile limit.

Within the port area, water depths increase rapidly directly from the rocky shore making it possible for large bulk carriers of 150 to 200 m length (Handysize) to moor along the berth.

A suitable anchoring point has been located in the large bay immediately west of the port area. This bay supports water depths of 40-50 m over a large area making it an ideal anchor site for bulk carriers to moor while waiting for optimal tidal or weather conditions or clearance of other ships during ship loading.

<u>Hydrographic survey and nautical maps</u>: The route from the EEZ and into Qeqertarsuatsiaat are surveyed and there are sufficient nautical charts to make a sailing plan and conduct a safe sailing. Full Electronic Navigational Chart [ENC] cells are available for the approach to Qeqertarsuatsiaat Kangerdluat at 1:22,000 scale.

A hydrographic bathymetric survey in the inner fjord system, including the route from existing ENC and from Qeqertarsuatsiaat to the entrance and harbour area of the MAQ mine project, has been adequately surveyed by GAM in autumn 2020. The survey has been carried out in accordance with the "*IHO Standards for Hydrographic Surveys 5th edition, February 2008 Special Publication no. 44*", and in accordance with the "*Danish Maritime Authority's Guidance of 10 January 2011 on the investigation of navigational safety issues, in connection with mineral exploitation projects in Greenland as a basis for navigation in the operational phase*".

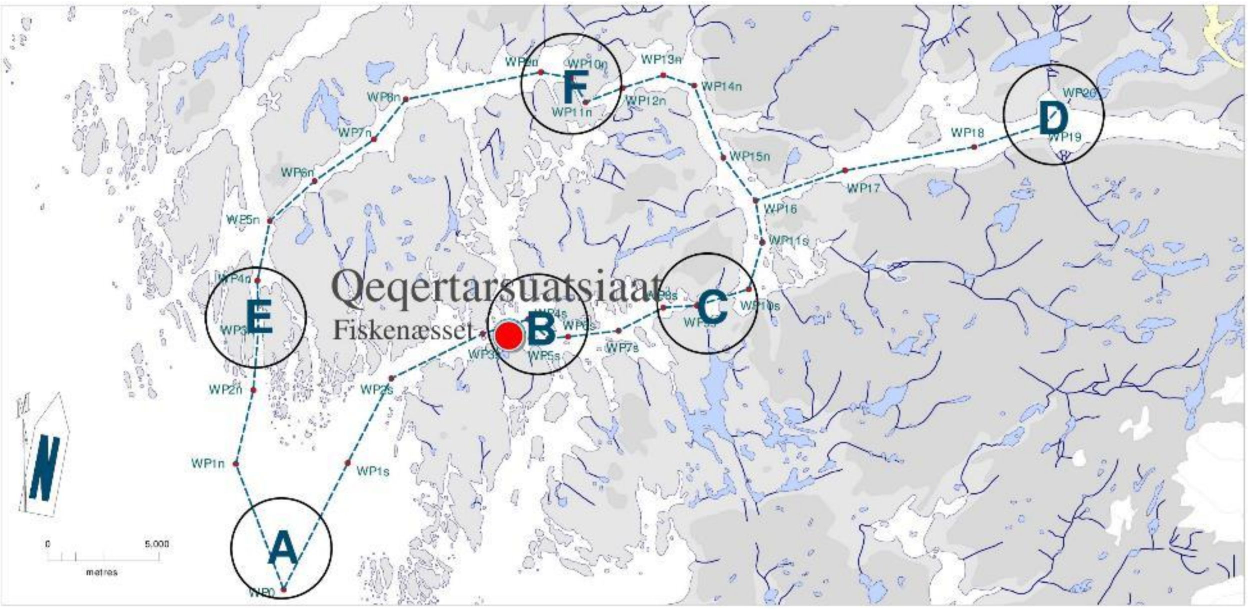


Figure 15: Overviews map of the two optional navigational routes from the Davis Strait into the mine camp area by either a northern or southern route. Distance A-E-F-D = 33 Nm. Distance A-B-C-D = 26 Nm. Location A represent the waiting area Waiting area south of the beacon at position N62°58' W050°53'.

Before the project enters the construction and operation phase, and before the mine is surveyed, new ENC's will be prepared for the entire shipping routes through Qeqertarsuatsiaat Kangerdluat. For safe navigation, the following chart coverage is required:

- ENC (DK4 coverage) at 1:22,000 scale of the inner parts of the fjord system, with linkage to existing ENC,
- ENC (DK5 coverage) at 1:4,000 scale coverage of the narrow northern Z-passage; including the entrance to the passage,
- ENC (DK5 coverage) at 1:4,000 scale of the harbour area to Majoqqap Qaava,
- For the central fjord system, ENC at a scale of 1:8,000 are required.

4.9.8. Tide measurements

The responsible captain must have knowledge of tidal conditions, since the large tidal fluctuations will result in strong tidal currents during the voyage.

Two independent tide gauges [TG1 & TG2] have been installed centrally in Qeqertarsuatsiaat Kangerdluat in connection with the hydrographic bathymetric survey; TG1 (sn74341) was kept operational during the survey period at position N63°9'48.3'' W050°28'14.4'', while the additional instrument TG2 (sn73224) was established at position N63°12'26.7'' W050°15'33.7'', and kept operational during the survey period, as well as periodically until summer 2021. After data collection, data were corrected from [MSL] to [LAT] by Danmarks Meteorologiske Institut [DMI], for the production of nautical charts. The distance between TG1 and TG2 was 12.5 km, and a time difference of ≈ 10 minutes ±2 minutes was observed. The tidal amplitude is about 4 meters, see Figure 16.

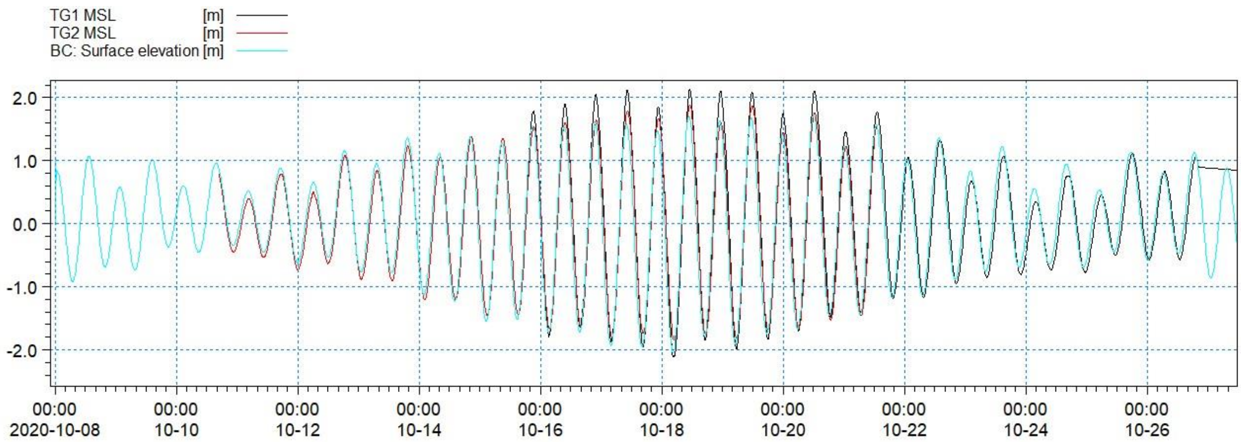


Figure 16: Preliminary tide water balance schematic in the Qeqertarsuatsiaat Kangerdluat.

4.9.9. Ice extent during winter months

To give a better insight into the diverse ice conditions that exist in the area from Cape Farewell to the mine at Majoqqap Qaava, the NSI describes the ice conditions along the route in sections:

Ice conditions along the route from EEZ to Cape Farewell: The returning ice-band east of Greenland called "Storisen" should not cause a problem for the Project. Even though the ice drifts around South Greenland into the west coast in the spring every year the presence of Storis near Qeqertarsuatsiaat (Fiskenæsset) only occurs once every 10th year. “Storisen” is widespread from late January to late May/early June and must undoubtedly be circumnavigated. There is no benefit in sailing through. “Storis” consists of multi-year ice and is therefore very hard and dangerous to come into contact with.

Ice conditions along the coastal route from Cape Farewell to Qeqertarsuatsiaat: The Sermilik is a fjord south of Qeqertarsuatsiaat with an active glacier that releases some ice into the David Straite, mainly during spring floods. These are also ice conditions that must be navigated, and shortcuts must not be taken through this area, especially during new/full moon.

Ice conditions along the route from Qeqertarsuatsiaat to the mine: There is not much concrete knowledge about the ice conditions inside the fjord, but Imaq Pilot has visited the area several times around both November and January in previous years. Some new ice (less than 10 cm of solid ice) has been observed during a trip to the area in January 2021, and it cannot be excluded that ice occurs outside the 3 hardest winter months, January, February and March.

To understand the ice conditions in the Qeqertarsuatsiaat Kangerdluat area, GAM has conducted an ice-reconnaissance of the Aniggoq - Sarfat Aariaat - Qeqertarsuatsiaat Kangerdluat access routes based on Sentinel 2 L1C satellite images from 2016 to 2020. The study reached the following conclusions:

- Ice-formation occurs all years in the shallow sand delta area in the innermost part of the Qeqertarsuatsiaat Kangerdluat east of the shipping route to Majoqqap Qaava,
- The first ice forms in late January to mid-February. The Fjord system is ice-free and fully navigable again in early to mid-May at the latest,
- In the observed period, there is no indication that fjord ice extends beyond Qeqertarsuatsiaat Kangerdluat to Sarfat Aariaat to the north, and in the south to a shallow and rocky narrow passage, halfway towards Qeqertarsuatsiaat,

- During 2 years of the 5-year period, the ice did not extend more than 2-3 km beyond the Kuussuatsiaat port area, and only for a period of less than 1 month,
- Despite the high quality of satellite imagery, it is not possible to determine the nature of the ice, thickness, and degree of break-up. However, in the last third of the ice-period, the surface appears water-saturated and broken. Considering time for the ice to build up, the area is expected to be non-navigable for a maximum period of about 2 months in years in where the ice actually forms,
- It's the company's intention to continuously examine the ice situation in future winter periods, and if possible, to evaluate and correlate the ice extent and maximum thickness with area climatic conditions.

4.9.10. Destinations

Once the material is loaded on to a ship in Greenland it will be shipped to Europe, the United States or elsewhere where it will be offloaded and stored. For the purpose of this report, it is assumed that the point of sale/ product destination will be a "European hub" which is defined as a large multi commodity, multiterminal port in northern Europe (such as Aarhus, Antwerp or Rotterdam) with a number of operators, warehouses. The European hub is assumed to have the offloading capability, materials handling equipment and storage capacity to unload the range of vessels and handle and store the cargo types.

4.10. Camp complex

During the construction of the mining camp, the company will take sustainable construction into account to the extent possible to ease the decommissioning phase, increase recycling of materials and minimise the environmental and climate impact in all phases. The company plans to build all accommodation and recreation units, kitchens and canteen, laboratory and office/control facilities and the infirmary from ready-made modular prefabricated units. After decommissioning, the various units can either be disassembled and used as integrated complexes or as individual units for other projects in Greenland, and the visible evidence after removal of the units will primarily be the foundations on which they are erected.

Whether being prefabricated units, warehouses or other installations, all facilities established in connection with the company's mining operations at Majoqqap Qaava will be constructed in accordance with applicable Greenlandic legislation and Best Available Techniques [BAT]:

- *Greenland Parliament Act no. 13 of May 26, 2010, on Construction/ Building Code.*
- *Building regulations 2006. Done pursuant to section 21 of Landsting Regulation no. 6 of December 19, 1986, on land use and planning as amended by Landsting Regulation no. 1 of June 18, 1987.*
- *Parliamentary regulation no. 12 of November 3, 1994, on Electrical power installations and electrical equipment.*

Administration office: The mine administration office will consist of modular units. The offices will be for administrative functions of the mine and will also include the first aid station.

Camp accommodation: Permanent accommodation for the employees will be established on the plain c. 500 m north of the port and the processing plant. The location is selected to minimise noise and dust nuisance from the processing plant, workshops and haulage activities.

The accommodation area consists partly of buildings with individual rooms and partly a number of common areas. For fire safety and privacy of the employees, the accommodation facility is likely to be built as individual blocks of prefabricated units, installed around covered and insulated walkways. The accommodation units will be separated by fire lanes to minimise the footprint on the terrain. Each block is expected to consist of c.10 units repeated in one level.

Building at height would otherwise require that sufficient wind stability can be maintained. The kitchen and associated canteen will be established in a separate cluster together with recreation rooms, dry and cold storage facilities for the kitchen, and probably also the mine's administration and infirmary units.

The total capacity of the camp is based on 2 x 12-hour shifts, with room for replacement over-lap. In addition, extra capacity for unforeseen personnel is included. In the construction phase of the project, employment of 10-30 people is expected. GAM currently estimates that in scenario A there will be a need for approx. 60 employees and in scenario B approx. 90 employees. Mine closure is expected to require 10-15 employees.

Each individual accommodation block will have 2 prefabricated units attached, designed for use as a change-house, containing:

- A drying room for mining apparel, boots and equipment at the end of each shift,
- A laundry area to clean operations clothing,
- Change room areas, and
- Shower facilities and washrooms.

Mobile equipment workshop & warehouse: The vehicle workshop (450 m^2) will service the mobile mining equipment fleet and ancillary equipment. The activities will include maintenance, tyre change, and vehicle wash-down. The adjacent vehicle wash will consist of concrete aprons with pollution control point and raised sides. A separate warehouse (250 m^2) is provided for storage of tyres, spares and equipment.

Fixed plant workshop and warehouse: An integrated workshop and warehouse building with an anticipated footprint of 450 m^2 is provided for maintenance, repair and storage of spares for fixed mechanical and electrical equipment for the processing plant and product warehouses.

Fuel storage: Diesel fuel is required for mining and other mobile equipment, heating and hot water, and the power plant, Table 7. Fuel will be delivered to the project via coastal tanker vessels, in the order of c. 900 m^3 per delivery. Fuel is pumped directly into the storage tanks using fuel-lines from the coastal tanker. A permanent fuel pipeline from the storage tanks to the wharf is to be installed. To receive, store and dispense the fuel, 13x 68 m^3 double skinned containerised fuel storage units will be provided (11 at the general port storage area and one at the MMA and one at the mine area) as well as appropriate unloading and dispensing pipework, pump and booster stations. The tanks will be located in containment areas with berms; secondary containment will protect against leaks and spills. The tank area and adjacent fuelling surface will be gravelled with an underlying impermeable membrane. A mobile fuel tanker is included for distribution around the site (i.e., not for refuelling of mining vehicles) and to the bunded containerised fuel storage unit at the MMA.

Diesel consumption	Scenario A *(Ltr.)*	Scenario B *(Ltr.)*
Ore mining and ancillary equipment	1,507,000	1,609,000
Processing Plant	458,000	685,000
General Infrastructure, Accommodation Camp, Stockyards, Port Facility	581,000	595,000

Table 7: Annual diesel consumption covering Scenario A and B (Annex 2), estimated from the required power consumption and a conversion between 1 litre of diesel fuel to 10 kWh based on Gross Calorific Value, assuming an efficiency into kinetic energy of 30 %.

The fuel consumption during operation is estimated to c. 9.43 to 11.00 m^3 per day (Scenario A and B). The mining and hauling operation alone will use about 5.58 to 6.26 m^3 per day mainly for self-propelled diesel equipment (3 % is used in the mixing of ANFO explosives).

The risks for an incidental fuel or oil spill are most relevant to consider during the unloading operation from fuel vessels and storage facilities along the coast of the fjord in the harbour area. The project will use Arctic diesel as fuel source, which is a relatively light fuel that evaporates quickly, allowing it to only be present for a few days in the environment. GAM will generally follow best practices and the company's internal health and safety procedures to avoid accidental fuel spills and to isolate the impact of such a spill. The port and/or the tugboat may optionally be fitted with a spill protection kit for emergency use if required by the Government of Greenland and in coordination with Arctic Command. Subject to ice and stream conditions from the Kuussuatsiaat river drainage, it may be considered to deploy an oil spill protection boom around ships when they are berthed. This measure is designed to prevent any escape of fuel or other liquids to the fjord.

Medical and emergency response: Medical and emergency response facilities will be provided at the accommodation camp and office complex where there will be a medical station with qualified personnel. Based upon agreement with the municipality in Nuuk, it is GAM´s intention that the medical station also will be available to the citizens of Qeqertarsuatsiaat as a supplement to treatment in Nuuk.

Support vehicles: The following support vehicles will be housed at either the MMA or other support facilities:

- Telescopic handler, 8 T all-terrain,
- Container handler 30 T all terrain (refurbished),
- Mobile crane 30 T, rough terrain (refurbished),
- Pick-up trucks, 4x4, crew-cab,
- Rigid inflatable boat, pilot house, trailer,
- Cube van, 16 feet,
- Environmental Spill Trailer with equipment,
- Fuel truck (site distribution),
- Compactor (for road maintenance).

Heli-stop": A "heli-stop" will be established in the vicinity of the camp and mine maintenance area. The helipad will be constructed as a gravel pad with a diameter of c. 50 m including safety zones and shoulders to allow landing for the larger SAR helicopters, i.e., Airbus H225 and Airbus H155. The helipad and filling station will be established according to Greenlandic regulations and standards. A minor cache of Jet A1 in drums will be kept at an open-air fuel storage facility, equipped with heavy duty plastic lining able to retain the content of the total stored volume.

Laboratory: A packaged, containerised laboratory facility will be installed at the site to test and analyse grade control samples, product testing, and any near mine exploration activities.

Explosive storage: A storage facility for explosives will be constructed in line with applicable regulations. The Project anticipates using ANFO as the main blasting agent. The project is expecting to operate an ANFO mixing unit for the production of explosives. ANFO is to be augured into boreholes by a dedicated truck that mixes the components immediately before the product is dispensed, Table 8. The explosive storage will be located at an appropriate distance from the quarry site and other infrastructure (minimum 1 km - see Figure 10). The explosive storage will be formed of approved and bunded containers for the various components according to the Norwegian Directorate for Civil Protection [DSB] and complies with Det Norske Veritas' understanding of §7-4 DSB922, including guidance to this instruction and is approved for use in Greenland. The explosives storage facility will be fenced and locked in for security reasons. The mine will have explosive storage facilities sufficient for two months of mining.

Required blasting	*(avg. per year)*	
Drill holes	c.12,800	m
Ammonium Nitrate [AN]	c.365	tons
Fuel Oil [FO]	c.26	tons
Primer	c.12,234	pcs
Detonator	c.12,234	pcs

Table 8: Required volumes for ANFO components covering Scenario B. Scenario A will require app. 50 % by volume (Source: SRK).

<u>Power supply and distribution:</u> GAM has considered various scenarios for powering the mine and processing facility in Greenland. As the project is located in an isolated location far from the national grid, it is necessary for the project to establish and operate its own supply of energy. As the processing plant is based on an energy intensive 24-hour operation, 270 days a year, it has been assessed that neither wind nor solar energy is capable of producing the constant required energy reliability. The only viable consistent alternative energy supply would be a hydroelectric power plant. However, the project area does not contain a sufficient drainage catchment area or the possibility of damming sufficient water to make such a solution possible. The closest hydropower potential that has been identified is located +20 km from the project area and would require an out of scale capital cost for the establishment of infrastructure. However, GAM considers supplementing each accommodation block' energy supply with roof-mounted solar panels.

At the site location there is no option to connect to a power grid network. In order to power the processing plant, ancillary equipment and the camp, an off-grid solution is required, consisting of a diesel power plant and if possible and economically viable supported by green alternatives. The diesel power plant will generate power at an appropriate medium voltage, which will be distributed around the site to the main consumers including a ring main at the processing plant. A minor generator unit is planned to meet requirements at the quarry site.

Description	Installed Load *(KW)* A		Installed Load *(KW)* B	Operating hrs. *(per year)* A-B	Average Demand *(KW)* A		Average Demand *(KW)* B	Yearly Consumption *(MWh)* A		Yearly Consumption *(MWh)* B
Accommodation Camp	63	-	73	7,620	44	-	51	336	-	388
General Infrastructure		100		7,620		70			533	
Processing Plant	1,200	-	1,300	4.670 - 6,670	372	-	390	1,737	-	2,599
Stockyards		200		7,620		140			1,067	
Port Facility		50		7,620		35			267	
Total	1,613	-	1,723		661	-	686	3,940	-	4,854

Table 9: Preliminary load list for Scenario A and B.

The power consumption differs significantly from Scenario A to Scenario B, Table 9. The largest power consumer is the processing plant. In the planning of the mine operation, GAM will pay high attention to the emission of CO_2 from burning fossil fuels as this without a doubt will be a crucial requirement for future mine operations to consider and minimize.

In both scenarios a fines product of <700 µm to >53 µm is produced in Greenland whereas the final grinding (<45 µm) for E-glass/ceramic/fillers will be caried out at a European/United States port location with access to" green" power from for example wind turbines. This will lower the effective CO_2 emission by the company compared to doing this in Greenland.

The company expects to install two generators to cover the power consumption, as well as a smaller back-up generator. The total installed capacity is expected to be (2+1)x400KW and (2+1)x1,000KW for scenarios A and B respectively.

4.10.1. Site water balance and water supply systems

The project plan is for "dry" processing only and with tailings being transported by tipper-truck, i.e., water demand for dust suppression, washing of equipment and potable purposes only. Raw water for washing and dust suppression will be pumped from the nearby lake and stored in a raw water distribution system. Raw water will be supplied to a modular, containerized potable water treatment plant to produce potable water for consumption on site. The potable water will be stored in a potable water tank prior to reticulation to the Project facilities and structures. Estimated water usage for dust suppression and potable water is shown in Table 10. An initial site water balance schematic as shown in Figure 17.

Although pit surface water and groundwater inflows may be sufficient to supply water for quarry and primary ore handling and dust suppression as the pit develops, this is unlikely to be the case during construction and the early years of mining. Therefore, it is suggested to fill a water storage tank at the quarry site from nearby water sources. However, this can be better evaluated at the next stage design. The required water supply (up to ca. 16 m^3/hrs.) is likely easily sourced from surface water bodies adjacent to the port, camp and secondary ore handling facility and conveyed using lagged and heat traced pipe.

4.10.2. Waste management

A containerized incinerator will be installed and used to burn various common non-hazardous waste types such as wood, paper, cardboard and other uncontaminated materials, including organic waste collected from the site. The proposed incinerator will be built with dual combustion chambers, the secondary stage designed to operate at 850-1200°C to re-burn waste gasses which ensure thermal decomposition of smoke and harmful emissions to produce a clean, odourless vapor exhaust from the chimney. The remaining flue gases can optionally be passed through additional filtration if the system is to be used for other materials than the abovementioned waste types, whereby a fly ash is produced. The amount of slag and ash produced depends on the amount and type of material incinerated but is estimated to be around 3-5 %.

Recyclable and controlled waste will be collected and secured in a dedicated storage area which will be fenced. Secured storage will utilise shipping containers. Waste, including slag and fly ash from the incinerator, will be removed from site to a licenced contractor's facility.

Sewage will be handled via a sewage pipe system. The sewage system will connect all buildings producing black wastewater in the camp area and provide a solution for disposal of black wastewater from the pit-site. Pit-site wastewater will be trucked in a dedicated trailer-mounted sewage tank to the sewage system. Wastewater from camp accommodation and pit accommodation (black wastewater) will undergo mechanical filtration and chemical treatment prior to discharge into the sewer outlet. There is currently no final decision on brand or make of the facility, but several options are being investigated. Early estimates indicate a setup resulting in 1-2 kg sludge/person/day and a chemical solution for controlling the nutrient content (N+P) in the final sewage water.

Usage type	Location	Rate *(m³/hrs.)*	Assumptions
Dust suppression (summer only, 4 months from June to September)	Quarry and primary ore handling	0.5	460,000-940,000 t/year @ 2.5 t/m^3 = 1,840-3,760 m^3 water/year.
	Haul road	14.5	Water trucks. Road area: 17 km x 6.6 m = 112,200 m^2. 0.5 ltr./m^2 application rate x 6 times per day = 336,600 ltr./day.
	Secondary ore handling	0.5	Port, RoM and process plant. Usage as per quarry ore handling.
	TSF (dry stack)	0.1	Water trucks. 95,000-185,000 t tails/year @ 2.5 t/m^3 = 380-740 m^3 water/year.
Portable water (year-round)	Camp	0.5	Up to 50 people at 200 ltr./day/person plus 20 % contingency.
	Other	Nil	Bottled water

Table 10: Estimated site water usage.

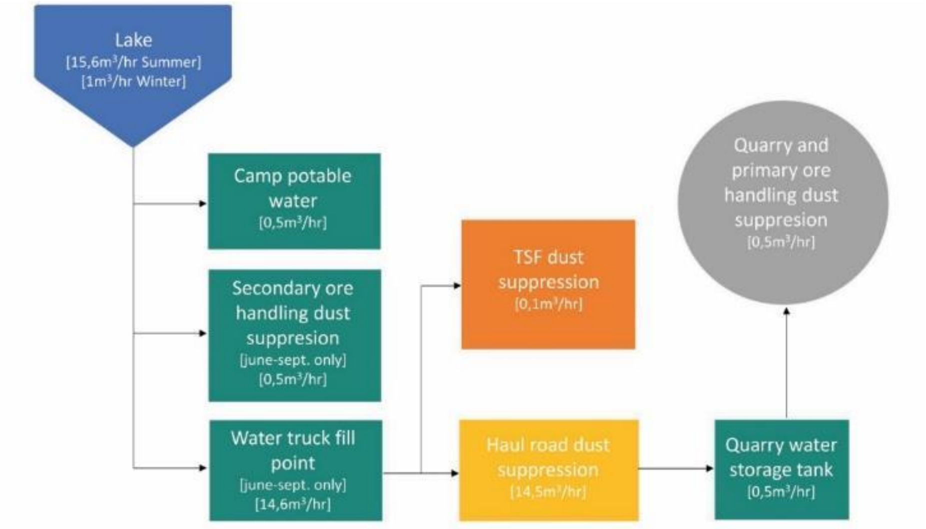


Figure 17: Preliminary site water balance schematic.

The sewer outlet will be a passive gravity sewer which will discharge wastewater (liquid fraction) to the recipient fjord through a submerged outlet. The precise location, length and depth of the outlet will depend on the local topography. The outlet will be protected against ice scouring etc. by an appropriate stone and concrete structure.

In addition, 3 solutions have been identified for the disposal of the sewage sludge fraction:

1. Incineration in a i8-40G incinerator,
2. Disposal of sludge at the TSF Dry where it will be buried and compacted along with project tailings,
3. Export in a tank on a barge solution for disposal at open sea.

Ad. 1: Depending on the capacity and operating temperature of the camp incinerator the sewage sludge fraction could potentially be incinerated. Small-scale incinerators, such as the i8-40G from INCINER8, UK that the company plans to install, are capable of incinerating waste with a moisture content of up to a maximum of 40 per cent. Incinerating sludge from the camps wastewater treatment system will therefore require an intermediate stage landfill for drainage prior to incineration. Due to the size of the combined wastewater treatment system and incinerator, and the volumes to be incinerated, the process will have to be done manually, as it is not possible to combine the two systems directly. The energy content of the incineration will vary with the mixing of the household waste and the sludge.

Based on tabular values, regular waste with a calorimetric value of approx. 10.6 MJ (megajoules) per kg (Energistyrelsen, 2023), is expected to be incinerated completely without the contribution of additional diesel after pre-heating the incinerator.

Sewage sludge with an expected moisture content of approx. 75 per cent will initially need to be pre-drained to a maximum of 40 per cent moisture before it can be fed into the incineration plant. The dry matter component is generally estimated to have a calorimetric value of approximately 12.6 MJ per kg, and despite the expected energy for evaporation of 1 litre of moisture equivalent to 2.45 MJ, the combustion process is anticipated to be similarly self-sufficient without the need for fuel supplements.

Preheating the incinerator uses approximately 9-11 litres per hour. After that, the supplier expects an additional injection of approx. 1 % diesel to ensure a sufficient combustion temperature and subsequently to ensure sufficient slag burning. Incineration of 9-27 tonnes of semi-dried (40 pct. moist) sludge per year will, assuming 1 hour daily pre-heating, result in an extra diesel consumption of approx. 3,375 to 4,285 litres of diesel on an annual basis (depending on the scenario 60-180 kg/day of sludge).

Ad 2. In respect of health and safety issues with respect to waste handling, it is the company's intention that the relatively small amounts of sludge produced are continuously buried and encapsulated in a dedicated area within the TSF. The deposited nutrient-rich sludge of 22-66 cubic metres per year will introduce app. 5.5-16.5 cubic metres of dry matter for the TSF per year, assuming drainage of c. 75 % moisture. As the tailings deposit will be designed and constructed to minimize water drainage through the tailings stack the apparent environmental impact of dispersion of nutrient rich water to Lake #2 and resulting eutrophication is regarded as small. The immediate consequence would be in regards to work environment and aesthetics at the TSF, but disposing of sludge in a coordinated manner with immediate coverage of a solid layer of tailings is expected to minimize these aspects.

Ad. 3. Disposal of wastewater sludge by exporting it and disposing of it at sea is regarded as the most rigid alternative. This would require a tank/container of appropriate dimensions for longer term sludge storage and the use of the project Tug and a minor barge, to transport the sludge to sea. This would be an expensive and fuel consuming solution why this is regarded as the last resort.

4.11. Personnel

4.11.1. Construction phase

The construction phase is expected to start once project permitting is finalized and financing is in place. The required construction work can be broken down into four categories: planning, haul road construction, equipment purchases and pre-construction/construction of mine facilities and infrastructure.

Construction of the haul road will be the first task in the overall construction phase. It is expected to take 16 months to complete the construction, and will involve 10 people including machine operators, blasters and ground workers. Required machinery includes three excavators (2x20-25 tons and 1x10-12 tons), two 30 tons dumpers/tipper trucks and two drills. The crew will stay in the project area either in a designated haul road camp or in facilities that can be used later on during mining. The camp will be supervised by GAM.

The planning phase will start with the road construction and will either involve an experienced extern construction contractor ([EPCM] solution), or alternatively, GAM will employ its own intern crew to solve the task. Following the results of the planning, the required machinery and equipment will be gradually purchased to match with the contraction needs and timelines.

Approximately 30-40 people are expected to be involved in the construction phase. Required positions include the following: construction manager and supervisor, surveyors, construction economist, boilermakers, welders, fitters, electricians, technicians, carpenters, concrete workers, machine operators, crane operators, painters, plumbers, blasters, foremen and general workers. Construction of infrastructure and buildings is expected to take 2 years. To the extent possible, machinery for use in the mine operation will also be used in the construction phase. Special machinery and vehicles like cranes, cement mixers etc. will be individually rented or purchased by GAM. During the construction phase, personnel will stay in a designated camp operated by GAM and will work in regular rotating shift schedules.

4.11.2. Operational phase

Depending on the scale of operations and considering rotating two shifts, approximately 60 (Scenario A) to 90 (Scenario B) positions are expected to be required at the mine site during operation, Table 11. A ramp-up period of minimum two years must be expected, where the requirement for workers will be reduced. The work season for the mining and processing operations will be 36-48 weeks/year. In the remaining period of the year the mine will operate in a reduced maintenance level. Approximately 40 % of all positions will be dedicated to the mining operation and transportation of ore to the processing plant, 20 % will be working in the processing facilities and laboratory, 25 % will be employed with mine and technical maintenance and 15 % within facilities operation and maintenance. Remaining staff will be working at the port area (shipping coordinator, workers), and if required, with tugboat assistance.

A labour rotation of four weeks on site followed by three weeks off is planned. On site workers will work 12-hour days, seven days per week. The final rotation schedule will be confirmed following further consultation with communities.

4.12. Alternatives considered

The orebody location is as is, and there are no alternatives to this resource within the license area. The camp and process could alternatively be located closer to the pit inland, but this would require a monumental task in supplying the operation with fuel, commodities etc. and the amount of traffic through the project valley would increase drastically, why this alternative is not environmentally or economically viable.

With regards to tailings disposal, backfilling has not been considered a reasonable solution. First of all, it is not possible to find suitable areas to backfill in the open pit as long as the mine is active without obstructing the mine operation. Second, a post-mine production backfill solution would require that the entire TSF Dry, which at this time would have stabilised and settled would need to re-activated and be transported by truck all the way back to the pit, which beyond incurring huge project costs would also delay the mine closure by several years and induce new environmental considerations during the extra transport.

Two alternatives have been proposed for handling and storage of the mine tailings. These alternatives are regarded as the most viable alternatives when taking local ecology, infrastructure and project carbon footprint into consideration. The land-based alternative is planned near the processing facility minimizing the haul distance before deposition. The stability of the tailings stack has been assessed in a separate background report and is evaluated to be stable for at least a 100-year duration if constructed and layered appropriately (NIRAS, 2024e).

The lake-based wet deposit is suggested at the deep part of Lake #2 (60 meters depth). This enables for an overall calm deposition site at large depth which is expected to turn into an almost completely static deposit once deposition of tailings ends upon termination of the mining operation (NIRAS, 2024d). During the operation phase and active deposition of tailings the lake will visually show signs of the deposited materials and a minor flux of trace materials from the tailings is expected to be transported down the freshwater system, but only to a degree assessed to have little to no impact on the local freshwater ecology. The main benefits of an underwater deposit are the fact that it does not impact the landscape, requires no maintenance and is expected to remain stable and at steady state long after termination of the mining operation.

Workforce			Scenario A	Scenario B
Mine operation	(27-36 pax)	Mine Operation Superintendent	1	1
		Drillers	3	3
		Shift Foreman	1	1
		Blasters	1	2
		Excavator Operators	2	2
		Truck Drivers	9	11
		Heavy Equip. Operators	3	6
		Utility Operators	3	5
		Laborers	3	4
		Geologist	1	1
Processing plant	(13-19 pax)	Plant Superintendent	1	1
		Shift Foreman/Operator	2	2
		Crushing Operators	2	4
		Magnetic separator and grinding Operators	2	2
		Maintenance foreman	2	2
		Maintenance technicians	2	4
		Assay technicians	1	2
		Laborers	1	2
Mine maintenance	(8-15 pax)	Maintenance Superintendent/Foreman	1	1
		Mechanics	2	5
		Electricians	1	1
		Maintenance crew	2	5
		Engineer	1	1
		Warehouse/Storage manager		1
		Environmental technician	1	1
Facility operations	(9-10 pax)	Mine/Camp Manager	1	1
		Cook / chef / kitchen assistants	5	6
		Cleaning assistants	2	2
		Nurse	1	1
Facility maintenance	(4-4 pax)	Caretakers/janitors	3	3
		IT-technician	1	1
Tugboat crew	(0-3 pax)			3
		TOTAL	61	87

Table 11: Tentative evaluation of workforce in Scenario A and B.

Regarding the project production scenarios and TSF solution alternatives, the assessments are based on 'worst case' for a given subject. I.e., Scenario A is assessed for tailings amounts, since Scenario A may lead to depositing more tailings than Scenario B despite a smaller production volume, since a minor percentage of the ore is shipped out as product. Likewise, freshwater assessments are based on a project setup utilizing underwater lake TSF Wet as this is regarded as the solution which may impact the lower parts of the freshwater system the most.

4.13. Decommissioning, Closure and Rehabilitation of the Majoqqap Qaava area

Although mining and processing activities are expected to extend over decades, Greenland Anorthosite Mining recognise they are temporary, and that other activities and land use will follow. To mitigate the impacts of a shift to a new (future) use, it is eventually the intends of the company to restore the land affected by the activities by balancing environmental and social considerations, with costs and to look for opportunities in decommissioning for rehabilitation and repurposing where appropriate, as well as long-term monitoring and maintenance.

In any case, the overall objective of the mine closure plan is to minimise the long-term physical footprint and to prevent or minimise negative long-term environmental impacts. The condition of the closed site shall be acceptable to the regulatory authorities (the Greenlandic Government) as well as the surrounding community.

Rehabilitation must be both physically safe and stable so that the abandoned area; the potential air, land and water systems altered by mining are safe for any users; people and wildlife. The area must also be chemically stable so that any deposits remaining on the surface will not release substances at a concentration that would significantly harm the environment.

To ensure that decommissioning plans reflect the expectations of the relevant stakeholders, basic assumptions and a conceptual framework of post-closure care and maintenance as deemed necessary is established. The general principals of such Decommissioning and Closure Plan [DCP], will then be regularly evaluated, and updated to ensure that it reflects different operating experiences and developments. As the closure of the mine is an integrated part of the life of the mine, the DCP is a living document that starts at the same time as the project is developed and commissioned and evolves until mining terminates.

4.13.1. Framework of Decommissioning and Closure Plan measures

Surface facilities and infrastructure	• Salvage buildings and remove these by ship/barge, • Demolish remaining buildings with demolition equipment and remove materials by ship/barge, • Salvage equipment and remove it by ship/barge, • Remove culverts and formal drainage systems and re-establish original drainage, • Removal of exposed concrete foundations, • Buried concrete foundations is covered with rock fill and soil from deposit, • Rip gravel pad, internal roads at port and plant site to encourage re-vegetation, • Reshape to restore natural slope and drainage,
Port facilities	• Salvage floating pontoons/barges and landing ramps and remove these by ship, • Leave all land-based port facilities as constructed (prefabricate bollards) except light poles, electrical cables etc.,
Haul and service roads	• Remove culverts and re-establish original drainage, • The road is left in place, but with rip surface to encourage re-vegetation, unless it is decided to leave the road for recreational or other uses,

Pipelines	• Decommission pipelines incl. supporting structure for pipes, booster stations and pump stations, remove all pipes and equipment,
Tailings management facility	• Test results indicate that waste rock from the MAQ project is inert, i.e., chemically inactive, • The TSF Dry area will be levelled for safety reasons and to adapt it to the topography of the surroundings, • The concept for wet disposal of tailings throughout the operational phase is to discharge them to TSF Wet Lake #2, where they will sink to the bottom and be permanently flooded. The environment around the tailing facility will be restored to its original appearance, • Progressive cover during establishment of TSF Dry #1 to reduce erosion of the tailings and control dust, • Remove construction facilities next to TSF Wet Lake #2 and ship these out, • Remove pipes in Lake #2, • Leave Lake #2 as is,
Open pit / quarry	• Remove equipment and ship it out, • Allow the lower levels of the pit to be naturally filled with water, • Due to the remoteness and isolated location of the quarry and the general steepness of the area, no safety bund walls, and signage is installed around the open pit

In addition, site facilities and structures will be decommissioned where possible and the materials disposed of to landfill, incinerated or shipped off site depending on their inherent properties.

The process plant and power plants will be decommissioned. Mobile equipment where of value will be re-sale otherwise it will be decommissioned in the decline prior to closure of the mine.

4.13.2. Rehabilitation and permanent changes to the mine area

The final footprint of the mining activities at MAQ will after decommissioning comprise of 1) haul and access roads, plant site, gravel pads and staging areas, all surfaces ripped to encourage re-vegetation 2) the open pit, including parts of drainage channel and safety barrier around the excavation, 3) the dry tailings storage, covered to minimize erosion and dust, 4) the wet tailings deposit and 5) minor quarries used for road aggregates during construction.

Due to climatic conditions, no active replanting is yet proposed. This means that vegetation stripped surfaces such as abandoned roads and quarries and other barren areas will be left to recover through natural recolonization.

Including dry tailings facilities, infrastructure elements etc. the anticipated total disturbed area of the Majoqqap Qaava project covers overall c. 0.65 km^2.

4.13.3. Close Down and Decommissioning of the Mine

As a result of the proximity to public infrastructure (in Nuuk) and the limited area that will be affected by infrastructure elements (mine, road, and process plant areas) and the restricted number of buildings and equipment present, decommission period is expected to last six to nine months.

5. Environmental status and impact assessments

The environmental status of the area will in this chapter be described through all available information. Key literature consists of reports and papers published by Greenland Institute of Natural Resources [GINR] and foreign universities which is supplemented by company surveys.

5.1. Environmental Impact Assessment methodology

The Environmental Impact Assessment evaluates the significance of the potential impacts identified during scoping, including cumulative effects, against the baseline conditions and identifies mitigation and management measures that could minimize potential negative impacts and/or enhance benefits.

The Impact assessment method used is developed by NIRAS and was based upon criteria in the EU's *EIA directive, annex 3*, which has been implemented in Danish environmental legislation (EU parliament & Council, 2011). The method is used as no specific terms or guidelines to an evaluation method has been defined in Greenlandic legislation. The aim of using the method is to ensure a consistent approach and wording when identifying potential impacts.

Information on potential impacts, including potential cumulative effects generated from the activities required to construct and operate the project will be obtained from various sources, including consultation with the company, input from local stakeholders and relevant authorities. The following sections define the methodology that will be used to identify and assess the potential impacts of the Project.

Impact assessment takes place as follows:

- Identify sources of impacts and the kind of impacts that are generated by any aspect of the project,
- Rate impacts compared to baseline conditions before any mitigation (for negative impacts) or enhancement (for positive impacts) is implemented,
- Suggest mitigation and enhancement measures to address the impact; and,
- Rate impacts after mitigation to produce a "residual" impact rating.

It is standard practice in EIA and SIA processes to "rate" potential impacts:

- To provide a basis for prioritization of impacts to be dealt with,
- To provide a method of assessing the effectiveness of proposed mitigation measures,
- To provide a scale which shows the level of impact both before and after a proposed mitigation measure has been applied.

A consistent system for rating impacts has been used in order to apply analytical rigor to the assessment and rating process. Specifically, an impact rating is the product of two elements: (1) the magnitude of the potential impact or enhancement and (2) the likelihood of the impact or enhancement occurring. The magnitude of each impact or enhancement has be rated using a *guidance* matrix based on the criteria in Table 12 – full *guidance* matrix can be found as Annex 6. Magnitude graduation wording and colour visualization is shown in Table 13.

The matrix is a guide which defines the approach towards an impact assessment. The final assessment will always be the result of a topic specific evaluation performed by qualified personnel.

Criteria	Factor
Importance of subject	International importance, National importance, Regional importance, Local importance, Important to directly impacted area, Insignificant or not important,
Effect duration	Permanent effect (non-reversible) for the project duration, Long-term >5 years, Temporary 1-5 years, Short-term <1 years,
Likelihood	High likelihood (>75 %), Medium likelihood (25-75 %), Low likelihood (<25 %),
Direct / indirect impact	Impacts caused directly by project activities or indirectly as collateral impact from project activities,
Cumulative effects	An effect evaluated to in combination with other activities or other projects,

Table 12: List of criteria for evaluating environmental impacts.

Significance	Description
Major impact	Impacts of sufficient importance to call for serious consideration of change to the project.
Moderate impact	Impacts of sufficient importance to call for consideration of mitigating measures.
Minor impact	Impacts that are unlikely to be sufficiently important to call for mitigation measures.
Negligible – No impact	Impacts that are assessed to be of such low significance that they are not considered relevant to the decision-making process.

Table 13: Magnitude Criteria (Negative Environmental Impacts).

Overview tables of each assessment in the report and a short justification of the assessments have been listed under each criterion in section 11 Environmental impact assessment summary.

5.2. Landscape and surroundings

The project is located at the base of the *Qeqertarsuatsiaat Kangerdluat* fiord in southwest Greenland. The actual mine pit area is located approx. 12 kilometres inland of the fiord and app. 30 kilometres west of the Greenlandic Icecap. The overall topography in the region is defined by mountainous terrain with glacial valleys and lakes scattered throughout. The actual project license area is centered around the Anorthosite Mineral resource complex, and project infrastructure will be established through the Kuussuatsiaat valley (main project valley), Figure 18. The main project valley is defined by the valley base elevating from the fiord (sea level) to roughly 200 meters above sea level before joining the base of the massif containing the mineral resource at the head of the valley.

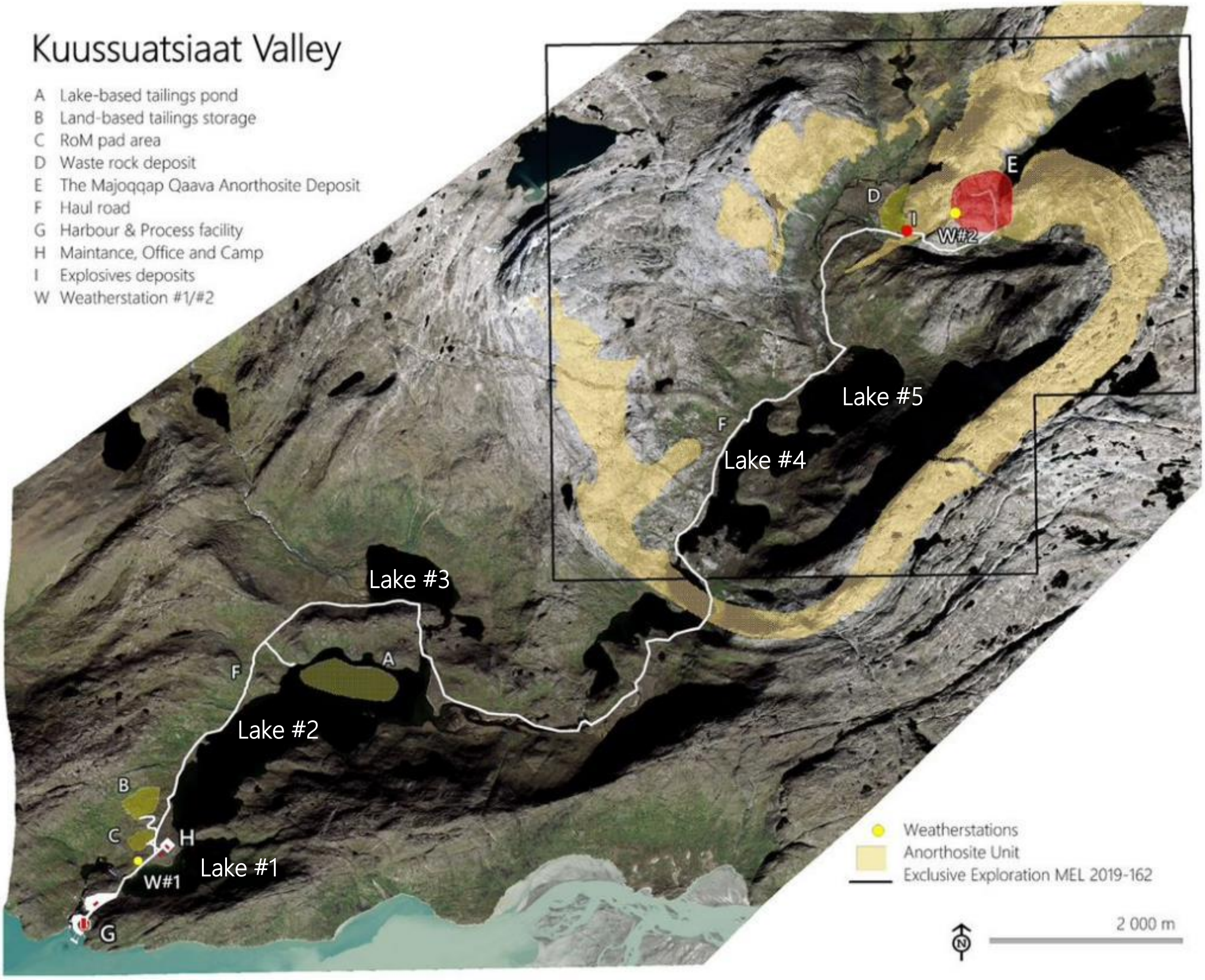


Figure 18: Map of the project area and valley of operations. Abbreviation W#1=WS #1 = Weatherstation #1 and W#2 = WS #2 = Weatherstation #2. To prevent any confusion regarding topographical shadows on the satellite image, the area's drainage system, including the lake banks, has been accurately mapped in Annex 4.

The valley base is defined by a freshwater system with a main river and 5 lakes downstream of the future pit site. The lakes are defined as Lake #1, #2, #3, #4 and #5. The freshwater system is flanked by shrub and heath ending in steep cliff- and hillsides raising abruptly to c. 800-1,000 meters. Roughly halfway through the valley additional water runs into the river system from a complex of lakes to the north (Lake #3), Figure 18.

5.3. Physical environment

The physical environment settings are a very important part of any mining project, also in the Arctic. In the Arctic the physical conditions often pose a challenge to mining activities. In an open pit mine scenario, ice, snow, wind, heavy precipitation and freezing temperatures may all impact the mining operation.

5.3.1. Hydraulic modelling

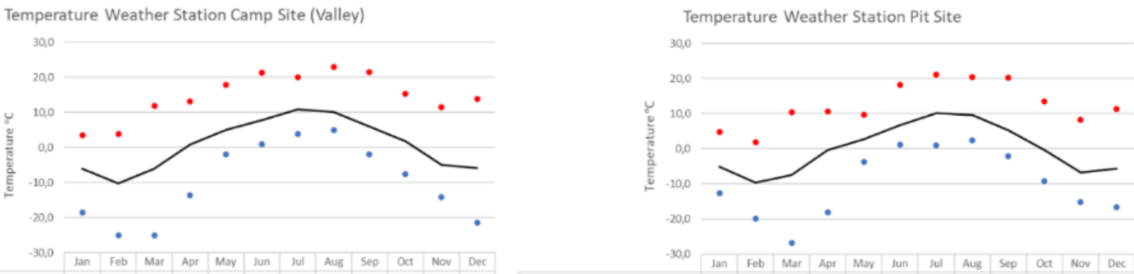
In support of the EIA a separate hydraulic study of the river continuum that runs through the area has been completed (NIRAS, 2024d). The report in details describe the topographic catchment area and includes hydraulic modelling of the DHI MIKE Hydro River. The model is based on flow measurements collected during the Baseline study, including weather data from GAM´s two weather stations in the area and is calibrated to precipitation statistics from Nuuk. Following calibration, the model has been run with extreme precipitation events with a return period of 5, 30 and 100 years to determine the critical flood extents. These have been considered in the placement of the project infrastructure, as precented in Annex 4 - High-resolution overview map of the Majoqqap Qaava project area.

5.3.2. Local weather

As part of the baseline study in the project area, two local weather stations were deployed. One station was established in the valley adjacent to the planned camp- and process area [WS #1] and another station was established at roughly 400 meter above sea level [m.a.s.l] at the planned pit-site [WS #2]. WS #1 was equipped with an OTT Pluvial[2] L precipitation gauge providing precipitation information for the project valley.

5.3.3. Temperature

Temperature averages around 10 ºC in the summer month and around -10 ºC in the winter. There is little difference during the year between the two weather stations, Figure 19.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature month peak	3,6	3,8	11,8	13,1	17,9	21,3	20,1	23,0	21,4	15,3	11,4	13,9
Temperature monthly average	-6,0	-10,3	-6,0	0,9	5,0	7,8	10,8	10,2	5,9	1,7	-5,0	-5,8
Temperature month Low	-18,6	-25,0	-24,9	-13,6	-1,9	1,0	3,8	5,0	-1,9	-7,5	-14,2	-21,3

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature month peak	4,8	1,9	10,5	10,6	9,7	18,2	21,2	20,4	20,2	13,4	8,2	11,3
Temperature monthly average	-5,0	-9,7	-7,4	-0,3	2,7	6,6	10,1	9,5	5,2	-0,4	-6,7	-5,7
Temperature month Low	-12,7	-19,9	-26,7	-18,1	-3,8	1,2	1,1	2,5	-2,1	-9,1	-15,2	-16,7

Figure 19: Yearly temperatures in the Valley and pit-site respectively during 2021.

5.3.4. Precipitation

Accumulated precipitation in the project area was 680 mm in 2021. Generally, precipitation rates drop as you move eastwards from the westerly coastline of Greenland. Nuuk received 892 mm precipitation during 2021 (318 measure days). Due to technical problems DMI could note report precipitation in Nuuk in October 2021, why the correct accumulated precipitation in Nuuk is assumed to be +900 mm in 2021. This gives an indication of the difference between coastal weather and mainland climate.

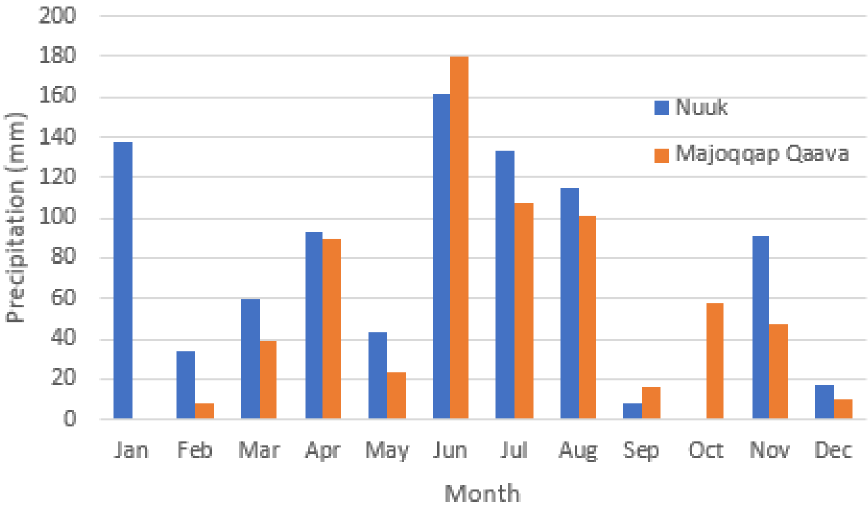


Figure 20: Precipitation in 2021 for Nuuk and Majoqqap Qaava.

During January in both 2021 and 2022 0 mm and 7.5 mm precipitation was recorded at the project site respectively, why the January column above displays 0, see Figure 20.

5.3.5. Wind

The project area experiences a wind regime common to the west coast of Greenland but is also under influence by the topography of the central valley and the ice sheet at the head of the valley. During the summer period solar radiation heats up the valley and generates regular heating and cooling circulation driven by thermals. Overall, wind is driven in from the fiord after the heating phase during the day (heated air raises and drags in colder air from the fiord) and wind is then circulated outwards during the night as temperatures drop over land.

This pattern is visualized in a wind rose at the weather station located in the valley with predominant winds of 5-10 m/s blowing in from west-southwest and with the less powerful and overall, more diffuse out-going "cooling circulation" from northeast, see Figure 21. The visualization is an average for a full year.

At the head of the valley a predominantly northeasterly wind is driven by the cold winds flowing through the rifts and valleys from the inland icecap. Wind speeds average between 5-10 m/s.

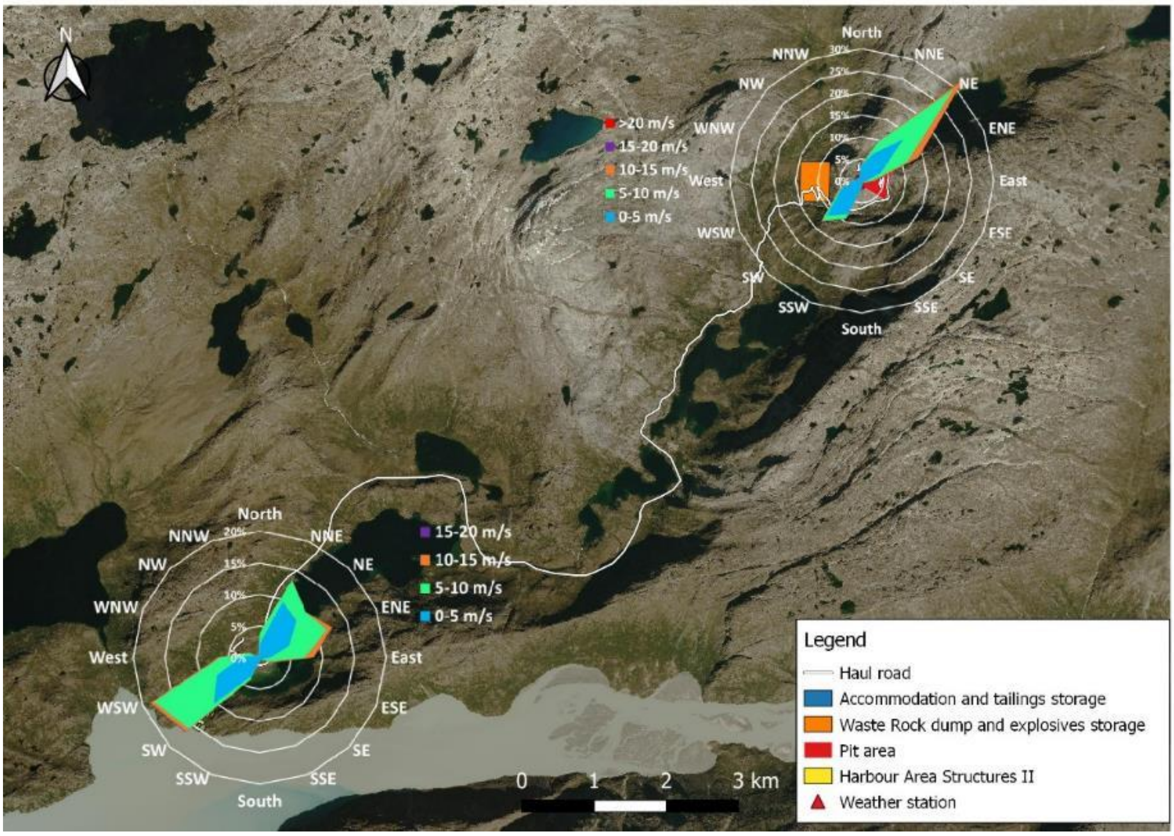


Figure 21: Map showing prevailing wind directions in the project area. To prevent any confusion regarding topographical shadows on the satellite image, the area's drainage system, including the lake banks, has been accurately mapped in Annex 4.

5.4. Geochemistry and tailings

A cornerstone in evaluating potential environmental effects from a mining operation is knowledge of the material to be mined. The Majoqqap Qaava has been geologically surveyed and evaluated over a long period, but geological surveys are only able to present the overall constituents of an area. Detailed information of potential effects from extraction of the orebody requires geochemical test work. A geochemical environmental and ecotoxicological testing programme for the Majoqqap Qaava project has for that reason been carried out by independent consultants Wardell Armstrong International, UK.

The geochemical tests are divided into static and kinetic test types. The static tests refer to analyses or tests measuring the quality and quantity of different constituents in a sample at one point in time or during a very short time span (< approx. 24 hrs.) while the kinetic tests determine how the material (ore, waste rock and tailings) will react over time on a long-term basis. The purpose of the static tests is to provide an overview of the chemical properties of the ore materials, in other words the element composition of the solid materials. This information forms an estimate of the possible metal leaching and Acid Rock Drainage [ARD] potential and defines the design of the kinetic tests. The kinetic tests then give information about reaction rates, release rates of elements to water and time for onset of net acid production etc. The geochemical test program for Majoqqap Qaava consists of an extensive test program and includes both static tests and kinetic tests with the latter including sub-aerial and sub-aqueous leaching column testing as well and a flood leach test and is based on internationally recognized best practice and guidance set out in Danish Centre for Environment and Energy [DCE] Report 132, (Søndergaard, et al., 2018).

For the geochemical tests a total of 26 representative samples were analysed. Twenty samples represent the orebody collected from different locations and depths in the pit area, and six samples represent the project tailings: three from the Magnetic Tailings [MT] separation and three from the Pegmatite Optical Reject [POR]. A part of the sample material was used for 7 composite samples for the kinetic leaching tests. Five of the composite samples were made from the RoM material, (one sample from the POR and one from the MT, (Wardell Armstrong, 2023).

The 26 samples were subject to the following initial static tests:

- XRD analysis for mineralogical content,
- Whole rock elemental analysis,
- Paste pH and EC (1:2 solid to water for minimum of 12 hours),
- Total sulphur and sulphide sulphur content (for Acid Base Accounting [ABA]),
- Neutralizing Potential [NP] and Acid Potential [AP],
- Fizz rating test and Acid Neutralising Capacity (minimum 0.5 g and 2 g of <75 µm respectively).

And for Acid-base potential:

- Net Acid Generation [NAG] tests (2.5 g of <75 µm) with
- Chemical analysis of the NAG leachate.

Net Neutralising Potential [NNP] and Net Potential Reactivity [NPR] are two different parameters used to assess acid generation and acid neutralization in mineral materials. While NNP shows how effectively the material can neutralize acidity, NPR shows the likelihood of acid generation. Together, these two parameters can provide a more complete assessment of the material's acid generation potential and help implement appropriate control measures. NNP is calculated as NP-AP.

The kinetic tests are conducted on 7 composites samples formed from the pit shell samples and test work tailings samples based on results of the initial ABA and Net Acid Generation tests from the initial analyses and static testing. The specific kinetic tests, beside the Shake Flask Test [SFT], are selected to simulate the long-term effect from stockpiling ore, deposit of waste rock, deposit of tailings on land and tailings deposits in Lake #2.

The test includes Shake Flask water leaching Tests [SFT], Humidity Cell Testing [HCT], Sub-aqueous Down-Flow Percolation test [DFP], Sub-aqueous Up-Flow Percolation test [UFP] and a Flood test on the POR and MT samples only.

- The purpose of the SFT is to assess short-term leachability of metals in samples into water. This mimics the period immediately after tipping the tailing into Lake #2.
- The HTC is designed to mimic geochemical leaching processes at the laboratory scale and is probably the best-known kinetic leach test method. The purpose of the test is to simulate and estimate any long-term acid generation behaviour of waste rocks and tailings and to determine variation in leachate water quality over time. This test simulates the land-based tailing deposit.
- The DFP is designed to mimic precipitation running through and leaching out at the bottom of a tailings pile at surface under natural climate conditions in a terrestrial deposit.
- The UFP is designed to mimic disposal of mine tailings under water in a Lake #2 – Lake-based tailings deposit.

Beside the short-term static tests, a static long-term Flood Leach Test [FLT] was added to the program simulating porewater in a sub-aqueous tailing's disposal. The material used for this test were the same as the two tailings composite samples also used in the kinetic tests.

This testing program is very comprehensive given that acid generation is not expected to be a significant issue; and major or noteworthy metal contaminants in the excavated material are unlikely. However, such stringent early testing provides valuable information to assess possible geochemical risks from development of the Project in such a vulnerable area as the Arctic. For further details on the test methodology see: (Wardell Armstrong, 2023).

The results of the static tests on solid material from the ore is, in lack of better, compared to the Global Crustal Abundance [GCA]. The leachate from the NAG test and the leachate from the kinetic tests are compared to the Greenlandic Water Quality criteria/Guideline [GWQG] based on Greenland legislation, EU requirements and international guidelines. Where applicable Greenlandic standards do not exist, the most stringent international regulations and standards have been identified. However, these criteria may be revised following liaison with Greenland regulators and with consideration of ambient conditions. It is a feature of European permitting systems that site-specific limit values are identified during the permitting process, where ambient baseline conditions are used to determining limits which can result in project-specific thresholds different to statutory limits.

5.4.1. Geochemical composition

The mineralogical Assessment by fine powder XRD analysis identified differences across the ore, pegmatite, POR and MT samples. However, a general decreasing in content from bytownite (feldspar) > muscovite > quartz > clinozoisite > chlorite, with variable amphibole and zoisite was found. Minor K-feldspar and biotite occur in the pegmatite and some tailings samples; and there is trace epidote in most of the bulk-rock samples but not in the tailings. Albite only occurs in two of the POR samples, at 36 %.

Notably, no potentially acid-forming sulphide- or S-containing minerals are identified, nor is there any carbonate minerals that contribute to acid-neutralisation.

The chemical composition for all samples showed Si, Al and Ca oxide forms levels around 85-90 % of the whole mass. Chemical compounds decrease from SiO_2 > Al_2O_3 > CaO > Na_2O > Fe_2O_3 > MgO > K_2O, with minimal Cr_2O_3, TiO_2, MnO, P_2O_3, SrO, and BaO, see full composition (wt.%) in Annex 3 p. 2.

Combining the results from the static tests provides an overview of the composition and basic properties of the waste rock, ore and tailings from the project, and gives a hint of which elements that could possibly be mobilized in the mining process. Conclusions from the static tests are the following:

- The GAM materials contain some elements in higher concentrations compared to the average Earth's crust including for Cr and Mo for all 26 samples; most have elevated Li; MT have elevated Sn and W; pegmatite and POR have elevated U; and some samples have Pb elevated above GCA.
- The GAM materials are all low in pyrite and other sulphide minerals that contribute to ARD. However, there are marginally elevated concentrations of some metals as shown in the GCA comparisons, that are contained within the bulk mineralogy of the rocks.

These metal occurrences at concentrations above the GCA do NOT imply any raised contamination risk. It is noted that these metal values are not a reflection of potential contaminants and are likely to be significantly lower than those of the gabbro in the surrounding regional ultramafic-mafic complex.

Only one sample gave any reaction to the fizz rating test (to determine amount of acid to add for the NP test), and this only a slight reaction. This indicates that there are negligible reactive neutralising minerals present, like carbonates, that would react vigorously with the addition of hydrochloric acid.

The NAG test is based on the reaction of a sample with hydrogen peroxide, which accelerates the oxidation of sulphides and other minerals in the sample. During the test, both acid generation and acid neutralization reactions occur simultaneously, with the final pH representing a direct measurement of the net amount of acid generated by the sample under these conditions. The NAG values are calculated from the consumption of NaOH used in titration to return the pH to 7, (Wardell Armstrong, 2023).

Acid Rock Generation conclusions:

- All the GAM materials have given Non-Acid Generating results from all the static tests, Paste pH, Acid-Base Accounting and Net Acid Generation tests.
- Sulphur analyses for all samples were between 0.01 % and 0.07 %, well under the defined 0.1 % upper limit for 'inert' waste.
- Paste pH for all samples are over pH 8.7.
- ABA results show that NNP for all samples are positive, and while 13 are below +20 and therefore classified as 'Uncertain' according to MEND (2009), all samples have NPR greater than 3 and are thus classified as Non-Acid Generating.
- In the NAG tests, only 5 samples gave post-boil pH below 6.5 and given the lack of correlation with ABA tests and very low S %, it is suspected these results are due to other mineralogical acid-simulating reactions.
- The conclusion of the Flood Leach tests showed the MT leachate just exceed the most stringent limits for Al and Sb; while Cu and U exceed limits from the POR, Table 14

The results of short-term static- and NAG tests on the full suite of 26 samples indicated that the GAM materials are unlikely to be acid generating and are therefore unlikely to be a potential issue at the GAM site, (Wardell Armstrong, 2023).

5.4.2. Water and leachate chemistry

Leaching results from the comprehensive geochemical study have been compared against specific Greenland mine Water Quality guidelines/Limits [WQL] as recommended by the MRA. However, as these guidelines only cover 9 metals, various other regulatory water quality standards, including the USEPA, WHO and EU water quality limits have been used.

Table 14 gives the maximum analysis results from the project baseline monitoring of ambient conditions, together with the highest leachate concentrations for the elements of concern from each of the leaching tests, in µg/ltr.

Parameter	EU MAC	Other	Greenland	Ambient**	NAG	Shake Flask	HCT	Down-flow	Up-Flow	Flood
Al	200		-	360	372[a]	4,720	1,090	147	938	236
Sb		6 USEPA	-	0.65	6.08	4.9	19.6	26.2	8.65	7.31
As	50	10 MAC	4	0.98	2.06	8.85	22.4	15.3	21.9	2.01
Cd	0.1	0.45	0.1	0.043	BD	0.045	16.2	0.29	-	0.018
Cr	100	100 USEPA	3	1.9	88.6 (4>50)	0.83	0.88	0.86	0.59	0.72
Co		100		0.12	1.4	0.3	0.64	2.76	0.36	BD
Cu	20	3.76	2	1.0	2.37	15.5	5.48	135.0	21.0	3.56
Fe	1000		300	9.6	BD	461.0	11.0	26.0	BD	BD
Pb	2.5	7.2 AAEQS	1	0.27	0.351	12.2	0.963	2.07	0.197	0.295
Li		10 MAC		3.8	10.8 (3>10)	34.8	4.1	57.0	6.2	7.5
Mn	100	50 MAC		5.0	20.2	13.6	32.7	460.0	7.36	12.9
Hg			0.05	0.0027	66.9	0.028	BD	0.007	BD	0.0195
Mo		70 WHO		0.68	60.2	6.12	16.2	60.4	9.28	6.41
Ni	8	20 AAEQS	5	0.9	0.66[b]	9.31	8.68	53.5	9.62	BD
Rb		*Unregulated*		2.1	-	6.1	19.0	15.3	4.31	12.7
Se		10 WQL		0.077	BD	0.406	0.586	0.95	0.675	0.276
Sr		700		11	28.5/18.2	15.9	16.4	52.9	9.72	19.9
S		50,000		650	4,990	2,760	2,760	33,200	4,530	2,570
Sn		10-25		3.3	-	0.17	0.48	0.28	0.4	1.0
W		*Unregulated*		0.064	-	23.9	177.0	465.0	76.3	26.6
U		30 WQL		0.028	7.58	25.2	66.4	583.0	40.7	296.0
V	15	20		0.089	6.7	2.82	3.12	1.16	3.41	BD
Zn	70		10	7.7	6.28	13.1	3.8	32.7	2.9	2.8

** Ambient site water quality monitoring data; [green] Exceedance of other WQL; a – Excluding anomaly 1050; b – Excluding an anomaly 5.74.

Table 14: Water Quality Limits and Comparisons with Maximum Leach Test Results including all samples and testing methods and Ambient Baseline Monitoring Results (µg/ltr.).

The NAG results show WQL exceedances for aluminium [Al], antimony [Sb], chromium [Cr], copper [Cu], lithium [Li] and mercury [Hg]. Most of these occur from the rock samples, except for Cu, which is only elevated above WQL from MT. Cr is over the Greenland limits for all samples, but this only occurs from the NAG tests. Given that the complete oxidation required for these tests do not reflect project field conditions, and no Cr exceedance is found from any of the other leaching tests, it is unlikely to be a contamination concern.

The short-term leachability of elements in the GAM materials from the SFT from all the composite samples exceeds the most stringent WQL for Al, Cu and Li. Of the other metals over WQL, iron [Fe] and zinc [Zn] only occur from the pegmatite composite; lead [Pb] from pegmatite and other rock samples; nickel [Ni] from several of the rock samples from the POR; and arsenic [As] from the pegmatite and MT.

The kinetic leaching tests – HCT, DFP, and UFP, show similar exceedances for Al, Sb, As, cadmium [Cd], Cu, Ni and U, with additional exceedance for Li, magnesium [Mn] and Zn from the DFP only. For the HCT results, all exceedances are from analysis of the first flush at the start of the tests. The increased levels rapidly decrease in both concentrations and leach rates over time. Ten elements show levels above WQLs in the DFP. Of these ten elements, seven decreases rapidly over time after the first flush, while Sb and Pb levels remained at the same level whereas the As concentration and leach rate increased over time, only. In the UFP tests, all metal exceeding the WQL's, shows a decrease rapidly after the first flush, except for Al, as this element continuous a slightly increase.

The Flood Column tests on the two tailings materials show exceedance of WQL only for Al and Sb from the MT; and for Cu and U from the POR. Al, Sb and Cu are all only just above the most stringent limits.

In most leach tests, the MT had highest- and often above WQL results for Al, Sb and As. The POR had the highest exceedances for Cd, Cu, Ni, U and Zn. Most of the other elements above limits (Fe, Pb, Li and Mn) were from pegmatite or pegmatite-anorthosite mixes.

It must be noted that most of the SFT exceedances are from the GAM rock samples, pegmatite in particular, which in reality will not be deposited or exposed in the crushed and ground form used for the tests. Furthermore, the baseline water quality monitoring has not shown any naturally occurring high metal values in the area, despite water running over bare rock, including some of the more metalliferous surrounding ultramafic country rock.

There have been no tests to determine radioactive risks including radon release tests. While it is noted that some of the GAM materials have elevated U concentrations above GCA, and the kinetic tests showed some leachate U exceedances, mostly from the POR. The baseline water quality monitoring of ambient surface water conditions shows U levels only just above detection, and well below the water quality limits. It is likely that elevated U levels only occur with crushing and grinding of U-containing minerals and is therefore mainly found for the GAM tailings. Sub-aqueous disposal of these tailings is likely to reduce the active leaching rate while mixing with a larger volume, and while operational monitoring should watch U levels, the overall project significance of U is considered low.

5.4.3. Waste rock deposit, ore stockpile and weathering of pit walls

The waste rock deposit is to be located just west of the pit, Figure 7 and a potential stockpile of ore will be in vicinity to the process facility, Figure 8. The waste rock deposit will be established with a permeable berm, preventing the waste rock to slide downhill. Leaching of elements from the waste rock and stockpiled ore is best simulated by the HCT. The logic behind this assessment is that the waste rock material would consist of coarse blasted blocks of anorthosite that will never be saturated with water why mobilization of elements will primarily be generated from weathering (sun, frost, wind and precipitation). In other words, the waste rock and stockpiled ore will have the same leaching characteristics as the water entering the pit and weathering of the pit walls.

Leachability of elements under sequential extraction tests HCT show consistent but generally low exceedances of Al, Sb, As, Cd, Cu, Ni and U. In almost all cases, the highest leachate concentrations occur in the first stage leachate sampling and rapidly decrease well below limits with time. Many of these initial first flush exceedances are also only for the low Greenland mine WQL but are within other limits. The HCT are simulations of waste material stored at surface with the limitation that testing is undertaken on pulverized sample, which is more representative of process tailings, rather than deposited waste rock or stockpiled anorthosite. The results are therefore a worst-case scenario. Thus, it will be impossible to calculate correct absolute values of the element leaching from the WRD or the Pit area, as a single rock of 1,000 kg will not leach elements at the same level as 1,000 kg of powdered waste rock.

Potential impact	Leaching from Waste rock deposit, ore stockpile and pit
Impact phases	Operation
VEC	Water quality

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	negligible
Regional	Low	Long-term >5 years	Medium 25-75 %	

Disposal of waste rock consisting of large rock boulders with small relative surface area for leaching interface reducing the possibility to oxidate or leach metals. The same applies to exposure of wall rock in the open pit, which will be no different from existing natural rock exposure in the area. Any elevated levels would possibly only occur in the first flush after new material is deposited and/or exposed and these elevated source levels are not expected to impact the ambient freshwater system.

It is therefore believed that metal leaching and potential contamination from waste rock, stockpiled ore and pit walls is unlikely and the impact on the environment will be negligible.

5.4.4. Tailings disposal

The volume of tailings depends on the degree of sellable product from each ton of ore mined. Scenario A may result in more tailings than Scenario B, despite processing less ore, since Scenario B features further ore beneficiation, thus turning a larger portion of the mined ore into commercial products. Following the project Scenario A flowsheet, total tailings produced during LoM are estimated to be up to a maximum of 4,230,000 tons of material, or approximately 2,820,000 m^3.

With the planned 88,000 m^2 dryland TSF this would result in a 28 metres high evenly distributed tailings stack. However, the TSF would in reality be arranged in layers and terraces for stability and accessibility and the finer details regarding stacking heights and deposit area will depend on the actual physical settings (landscape, tailings properties etc.).

Using the above amounts, distributing tailings under water in Lake #2 would, if spread evenly across the total area of Lake #2 (2,158,000 m^2), result in an overall elevation of the lakebed by 1.3 meters. If deposited in a theoretical cone with a final cone height of 30 meters (reached when the final tailings have been deposited and mine closure commences) this would theoretically require a spherical lakebed surface area of 282,000 m^2.

The beneficiation of the ore includes as formerly described two separation processes, an optical- and a magnetic sorting. The optical sorting separate pegmatite (quartz) from anorthosite and are estimated be 5-10 % of the ore that equal ~45.0-90.0 Ktpa (for scenario B – highest optical separated tailing amount). The second step in the process is the magnetic separation where the waste is estimated to be 20 % equal to ~70.0 Ktpa. The processing plant will be operational 270 days a year. This adds up to an average daily deposit of 333 tons optic sorted tailings and 260 tons MT.

Production tailings, defined in section 4.6, are planned to be deposited either on land or sub-aqueously in Lake #2 or both. The possible disposal methods are described in section 4.6.1 and 4.6.2. HCT and DFP are designed to simulate land-based disposal of mine waste - at surface under natural climate conditions. SFT and UFP tests are designed to simulate sub-aqueous under water, in this project, the lake disposal scenario. Additionally, a Flood leaching test was made to simulate a long-term sub-aqueous deposit.

Assessments related to freshwater and distribution of leachate are covered in section 5.7.2 – details are presented in a separate background report on project hydrology (NIRAS, January 2024).

5.4.4.1. Land-based tailings deposit

The leaching potential from the land-based deposit is simulated through the kinetic leaching tests – HCT and DFP. The HCT is a proxy for simulating the upper layer of a land-based tailing pile, that alternates between being dry and becomes moist from precipitation. The DFP columns were added deionised water to the top of the column on a weekly basis to simulate rainfall. Leachates drained freely through the test materials and were collected and analysed. This simulates the dynamics from precipitation entering the TSF and drain through the TSF matrix and leach out from the bottom of the tailing pile.

The logic behind the implementation of the HCT and DFP in the evaluation of the land-based TSF, is that a new layer is added on top of the TSF on weekly basis, i.e., the absolute value of elements from the first week of HCT is to be a part of the total elements leaching from the pile. From the estimate of the total amount of element, both from HCT and DFP, that could be mobilized from the TSF together with the average precipitation a daily leching concentrations of elements can be estimated.

In almost all cases, the highest concentrations for most elements were found in the eluate form the first or second week of HCT leachate sampling and decreases in all cases rapidly after the third sample (week 3) (Annex 5). Concentration of Cu was above the Greenlandic WQL in both the MT and POR tailing samples. As and Ni showed elevated value in the MT and POR samples, respectively. In the MT the highest concentrations for As and Cu were 22.4 µg As /ltr. and 5.5 µg Cu/ltr. and the POR test showed levels of 12.6 µg Cu/ltr. and 5.8 µg Ni/ltr. in the first flush. Additionally, five elements, Al, Sb Li, S and U, had values above other water quality criterions, such as the Maximum Allowable Concentrations [MAC] for drinking water in EU and North America. All five elements, except Al and S showed values below 100 µg/ltr. Highest values of these elements were 1 mg Al/ltr. and 5.27 mg S/ltr. Despite the elevated S value, no NAG's were found for the tailings, see section 5.4.1.

The results of the DFP test showed that both concentrations and leach rates decrease rapidly after the first flush, for all elements except Al. The concentrations of the elements As, Cd, Cu, Ni and Zn exceeds the Greenlandic WQL in the eluate from the first flush in one of the tailings samples. In the MT, As reaches a level of 15.3 µg As/ltr., Cu reaches a level of 26.9 µg Cu /ltr. and Zn reaches a level of 27.1 µg Zn/ltr. In the analysis of the POR, Cd reaches a level of 0.29 µg Cd/ltr., Cu reaches a level of 135 µg Cu/ltr., Ni reaches a level of 45.8 µg Ni /ltr. and Zn reaches a level of 32.71 µg Zn/ltr. in the first flush. Since water is continuously added to the land-based TSF though rainfall the cumulative values of absolute amount of elements released from the tailings, is evaluated to be the best proxy for the leaching dynamics in the TSF. Analysis of the DFP eluate were made once a month for six months. It is important to note that these specific leaching tests are designed to maximize wash-out of elements, and that values only exceed WQLs on few occasions, even under these circumstances. The actual environmental aspects of leaching are covered in section 5.7.2 - Water chemistry.

Beside the five elements already mentioned exceeding the Greenlandic WQL in the HCT and DFP tests, the elements Al, Sb, Li, Mn, U exceeds other water quality criterions such as the MAC for drinking water in EU and North America in the first flush. However, in the MT the average values of all samples showed values above the threshold for Al (in HCT), Sb and Li, only. In the POR sample average values above the thresholds were found for Mn and U, only. The average U value exceeded the threshold some 8-9 times. It seems like the elevated U levels only occur with crushing and grinding of minerals and is therefore mainly found in the GAM tailings. Sub-aqueous disposal of these tailings is likely to reduce leaching and the large mixing volume will affect concentrations, and while operational monitoring should watch U levels, the radioactive risk is low.

5.4.4.2. *Sub-aqueous tailings deposit*

For the sub-aqueous deposit SFT simulate the release of elements from sediment sinking through the water column to the bottom of the lake. The analyse of the SFT of the two tailings fragment samples, POR and MT shows exceedances of the Greenland mining WQL three times. The POR material shows copper value of 15.1 µg Cu/ltr., which is well above the threshold of 2 µg Cu/ltr. of the second tailings fraction, the MT shows As concentrations of 8.85 µg As/ltr. and Cu values of 2.84 µg Cu/ltr. In this fraction the copper is just above the threshold, whereas the As level was more than twice the Greenland mining WQL of 4 µg As/ltr. Beside the elements exceeding the Greenlandic WQL, Al, Sb, Li and U exceeds other water quality criterions such as the MAC for drinking water in EU and North America. In absolute values these elements are all, but Al, less than 50 µg/kg (ppm). The inert element Al shows values of up to 2.16 mg/ltr. or 4.56 mg/kg.

The UFP test together with the Flood test mimics leaching from the tailings that is situated on the lake bottom. The underlying principle for leaching from the tailings pile at the bottom of the lake, is that since new tailings is added on a daily basis and that the newly added layer is sealing off the underlying tailings. This minimises leaching from the underlying tailings. Thus, the result from UFP from the first analysis will be most descriptive of what may be leached on a daily basis. Since the tailing pile on the lake bottom takes time to settle and become more compact, porewater may leach out of the pile. The flood test is evaluated to best simulate the level of elements in the porewater.

The analyse of the UFP showed highest values in the first eluate extraction, which is also the eluate expected to leach to the lake. The results showed exceedance of Greenland mining WQL four times. For the POR, Cu and Ni levels reached 20.9 µg Cu /ltr. and 9.4 µg Ni /ltr., respectively. For the MT sample levels of 6.65 µg Cu /ltr. and 21.9 µg As /ltr. were found. Cu values were up to 11 times the Greenland mining WQL, Ni was twice as high and As exceeded the Greenland mining WQL around 4 times.

Evaluation of the natural dilution and dispersion of elements leaching from both the Dry and sub-aqueous TSF's are based on calculations and conclusions in the project technical background report on hydrology (NIRAS, 2024d). The environmental assessment is found in section 5.7.2 – Freshwater chemistry.

5.4.4.3. *Tailings solution due diligence*

The two presented tailings deposit solutions each have pros and cons, Table 15. The company will do a final due diligence prior to production start-up to choose the optimal solution. The final solution will be incorporated in the exploitation plan and closure plan. Overall, the below matrix summarises the various considerations and the evaluated impacts outlined in various chapters of this report.

Risk subject	TSF Dry / Dry-stack tailings solution		TSF Wet / Lake-tailings solution	
Structural failure	Moderate	See section 4.8.1	Negligible	See section 4.8.1
Leaching potential	Minor	See section 5.7.2.1	Minor	See section 5.7.2.2
Post-closure risk assessment	Minor	See background report (NIRAS, 2024e)	Negligible	See section 10.4.2
Operational considerations in regard to Construction and maintenance				
Operational requirements	Moderate		Negligible	
Accessibility / mitigative responses	A land-based TSF is operationally favourable and positive, as the landfill can be monitored directly, and potential mitigation responses can be accessed immediately.		A TSF Wet is operationally difficult to monitor and impractical in terms of potential mitigation measures.	

Table 15: Tailings deposition due diligence and risk matrix.

5.5. Dust

The project baseline studies involved measurement of naturally occurring dust spread within the project area. The monitoring was based on in-situ measurements using handheld equipment and stationary dust traps.

5.5.1. Current status

NILU dust fall traps were deployed for a 75-day period during the summer of 2021. Dust contents were determined by an accredited laboratory and showed low levels of dust during the period, Table 16. Generally, it has been evaluated that dust levels below 0.133 $g/m^3/day$ will only very rarely result in discomfort (Miljøstyrelsen, 2003).

	Measure period				Measure station	
Number	Start	Stop		FORCE #1	FORCE #2	FORCE #3
			(days)		*(g/m²/day)*	
1	06-06-2021	20-08-2021	75	0.002	0.003	0.007
2	20-08-2021	24-09-2021	35	0.026	0.019	0.009

Table 16: Results from baseline dust fall within the project area.

On-site measurements of fine particulate matter (dust) in the area were conducted using a TROTEC PC 220 Particle Counter. Measurements were done during September on all sample locations, Table 17.

Measuring fine dust in-situ is an extremely sensitive task. Due to natural number of fine particles in the air (ex. naturally occurring pollen) it is not possible to determine the actual source of particles measured, and with fine particles being distributed by wind each measurement is an 'in-the-moment' snapshot. An example of monitoring background dust concentrations in ambient air at the location of the weather station in the valley (WS #1) is presented in Figure 22, (GAM, 2024).

Station	Detailed description	Latitude *(WGS84)*	Longitude *(WGS84)*
WS #1	Weather station no. 1 - Installed at the dock and process facility site.	N63°13'27.9''	W050°12'11.9''
WS #2	Weather station no. 2 - Installed at the mining/pit area.	N63°17'01.8''	W050°1'57.3''
FORCE #1	Dust collector no. 1 - Located on a sand plateau; north of the proposed processing facility and east of the proposed tailings deposit.	N63°13'54.9''	W050°11'45.6''
FORCE #2	Dust collector no. 2- Located on elevated flats along the haul road.	N63°13'81.1''	W050°8'23.9''
FORCE #3	Dust collector no. 3 - Located southwest of the Mining/Pit area on a plateau across a stream-gully.	N63°16'45.1''	W050°1'57.3''

Table 17: Fine particle dust measurements and locations.

	#1.	#2.	#3.	#4.	#5.	#6.	#7.	#8.	#9.	#10.	#11.
Location:	**WS#1**	**WS#1**	**WS#1**	**WS#1**	**WS#1**	**WS#1**	**WS#1**	**WS#1**	**WS#1**	**WS#1**	**WS#1**
Date:	18-09-21	19-09-21	20-09-21	22-09-21	23-09-21	24-09-21	25-09-21	12-09-22	14-09-22	19-09-22	24-09-22
Time:	11:36	11:40	07:26	08:37	11:53	11:59	17:56	09:18	14:03	10:42	15:03
n:	2	2	2	3	2	2	2	1	1	1	1
WS1 Wind direction [°]:	262.5	257.4	285.0	28.1	209.2	106.7	87.0	308.9	143.2	15.4	256.9
WS1 Wind speed [m/s]:	0.00	3.19	2.52	2.01	2.01	7.05	4.03	0.00	1.01	1.51	7.05
Mode:	**Cumulative Counts**										
0.3 µm	12,960	1,557	6,881	1,999	5,554	1,335	1,561	2,619	1,505	349	10,638
0.5 µm	4,662	528	2,842	553	2,552	476	526	950	526	73	3,778
1 µm	1,200	119	663	98	521	144	102	255	69	45	776
2.5 µm	252	20	150	12	117	36	44	37	10	5	143
5 µm	60	5	22	3	35	10	10	0	0	0	30
10 µm	8.5	0.5	2.5	1.0	7.0	0.5	0.5	0.0	0.0	0.0	2.0
Mode:	**Concentration of Mass [µg/m^3]**										
PM2.5 µm	n.a	n.a	n.a	n.a	n.a	n.a	n.a	3	1	0	15
PM10 µm	n.a	n.a	n.a	n.a	n.a	n.a	n.a	6	1	0	25
AT °C	8.4	6.3	2.2	2.4	5.3	2.9	8.4	8.4	11.2	16.7	7.6
DP °C	0.25	-3.60	-3.10	-8.37	-5.05	-12.75	-11.95	5.00	4.90	5.75	1.10
RH %	51.1	46.4	64.1	41.9	44.6	28.8	20.9	75.7	62.2	46.3	60.3
WB °C	5.4	3.3	0.8	0.1	2.5	-0.3	1.2	7.2	8.6	11.8	5.3

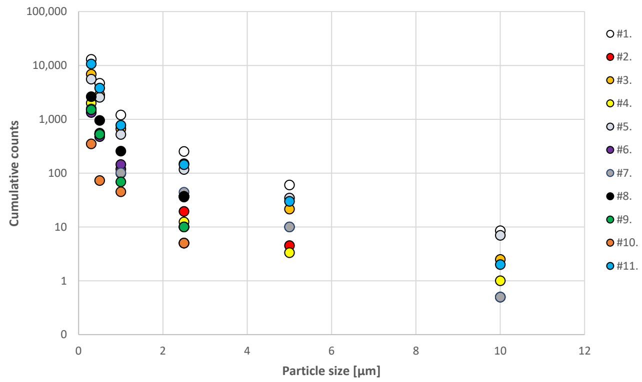


Figure 22: Measurements of fine particulate matter in-situ from WS #1 in the period from 18. September 2021 to 12. September 2022. The abbreviations refer to n=number of single measurements in that station, PM2.5 = Particle counter 2.5 µm, PM10 = Particle counter 10 µm, AT= Air temperature, DP=Dew point temperature, RH= Humidity and WB = Wet-bulb temperature.

5.5.2. Construction phase impact assessment

The following assessments are based on calculations presented in a separate background report *Dust deposition MAQ - Majoqqap Qaava, Greenland Anorthosite Mining* (NIRAS, 2023a).

Dust in the construction phase will be most intense at the base of the valley during establishment of the mining town, process areas and other infrastructures. The gradual cut-and-fill roadworks will over time reach the head of the valley and the pit area. Increased dust levels will be introduced through excavation of material for the mine town and material being loaded onto tipper trucks, transported, and unloaded for road construction. The construction is planned not to include crushing of material. This reduces the release of fine particles that have a potential to travel over a long distance.

Dust dispersal have the capability to affect the environment. The environment may be affected on several trophic levels. First, the plant community can be affected either direct through dust coverage of the leaves or indirect through changes in soil chemistry, (Chen, et al., 2017). A change in the plant community may have an impact on herbivore animals such as birds, hare, and caribou. However, the dust levels in the construction phase of Majoqqap Qaava are expected to be modest, temporal <1 year, and very local. On this background no change in the vegetation or higher trophic guilds from the construction can be foreseen and the impact from dust on the environment is assessed to be negligible.

Potential impact	Dust particles covering vegetation and settling in freshwater
Impact phases	Construction
VEC	Plant life ecology and freshwater

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Short-term <1 year	Medium 25-75 %	

5.5.3. Operation phase impact assessment

The Majoqqap Qaava mining operation involves several activities that will cause dispersion of dust. Resource extraction starts with rock blasting, digging, and loading onto tipper trucks. The extracted ore is transported to the beneficiation plant, where the ore is crushed and grinded into the desired fractions before being loaded onto bulk carriers. Any fraction not part of the final product is extracted and deposited at a Tailings Storage Facility (TSF). All these steps release various amounts of dust to the surrounding environment.

Anorthosite is almost entirely (>95 %) composed of the feldspar mineral bytownite, which is calcium rich-feldspar and therefore has physically similar properties as many other feldspar-dominated rocks such as granite and gneiss, which are the dominating rock types in western Greenland.

Dust dispersion and dust spread known as aeolian processes are defined by dust particle size, level of erosion/emission and wind speed and direction. Overall, dust particle size is the main factor defining the transport distance of dust. Particles <10 µm may be transported several kilometres by the wind whereas particles <2.5 µm is potentially dispersed on a regional level. Larger particles (>30 µm) will settle relatively close to their emission point depending on wind-speed and actual particle size, Figure 23 and Figure 24

Dust emission calculations are based on the methodology developed for the mining and rock crushing industry by the U.S. Environmental Protection Agency (US.EPA, 1974) with later revisions. Estimating dust emissions included equation constants for particle's physical properties following stokes law and various elements relevant for the given operation.

5.5.3.1. Blasting

The main activity of the mining operation is mobilizing the resource which is done by drilling holes for explosives and blasting the ore. The loosened ore is loaded onto trucks and transported to the process facility where it is refined. Dust emission from blasting can be estimated from an equation based on data from the crushed stone industry, which is assessed to be comparable to the Majoqqap Qaava project and mineral resource (US.EPA, 1998). Calculating on Scenario B with maxed out RoM, production of raw Anorthosite is ~940,000 tpa. Meeting this quota on a 270 days/year operation would require the equivalent of daily blasting of roughly 1,270 m^3 of ore (3,481 t[1]), which could be a 181 m^2 area at 7 meters depth (calculations are based on c.19 drill holes at 8.7 meters depth (incl. subdrill)). This operation would release an estimated 3.9 kg of Total Suspended Particles/Solids [TSP or TSS], which during a 270 days/year operation sums up to some 920 kg TSP/year at the pit-area.

5.5.3.2. Ore hauling

The extracted ore is hauled to the beneficiation plant via the c. 17 kilometres haul road down through the valley. Research and experiments have shown that the physical effect of dust dispersion from unpaved roads is highest closest to the road and that dust fall decreases relative to distance to the road, Figure 24. Using an equation based on

[1] Density of Anorthosite is ~2,740 kg/m^3

parameters such as haul road length, weight of the truck, anticipated silt level of the road and precipitation, dust dispersion from 1 truck transport going from the pit site and back is ~3 kgs of total suspended road dust particles. A yearly ore throughput of 940,000 tpa. would require roughly 9-10 truck hauls (30 t ore pr. haul) per hour on a 12-hour workday, 270 days/year. Given the anticipated particle sizes being whirled up from trucks driving on the dirt road, the majority of the dispersed dust is expected to settle within a 200-400-meter-wide belt on each side of the road. With trucks also returning to the pit site after unloading, this would mean deposition of some 0.015 kg/m^2/year (theoretic estimate with 270 production days) if all dust were deposited within 200 meters on each side of the 17 km haul road. In reality, dust will disperse further from the road on some stretches and concentrate in certain areas on others, so how the adjacent areas to the road are actually affected is hard to predict precisely. Overall, dust dispersion calculations for trucks driving on unpaved roads depend on so many factors that pre-production calculations and the calculated dust amounts remain a best guess. Several mitigation measures are available should dust spread prove problematic, with dust suppression using water or chemicals (e.g., magnesium chloride) as the most common solution – see section 8.1.1 Environmental Management Plans.

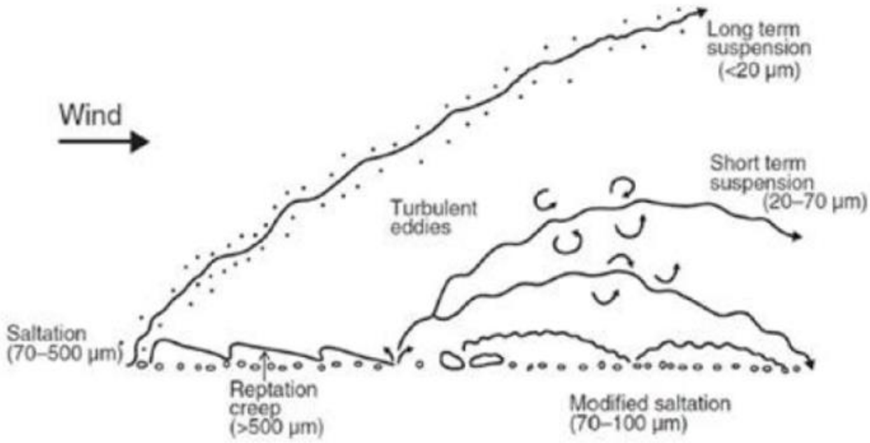


Figure 23: Dynamics of dust dispersion relative to particle size.

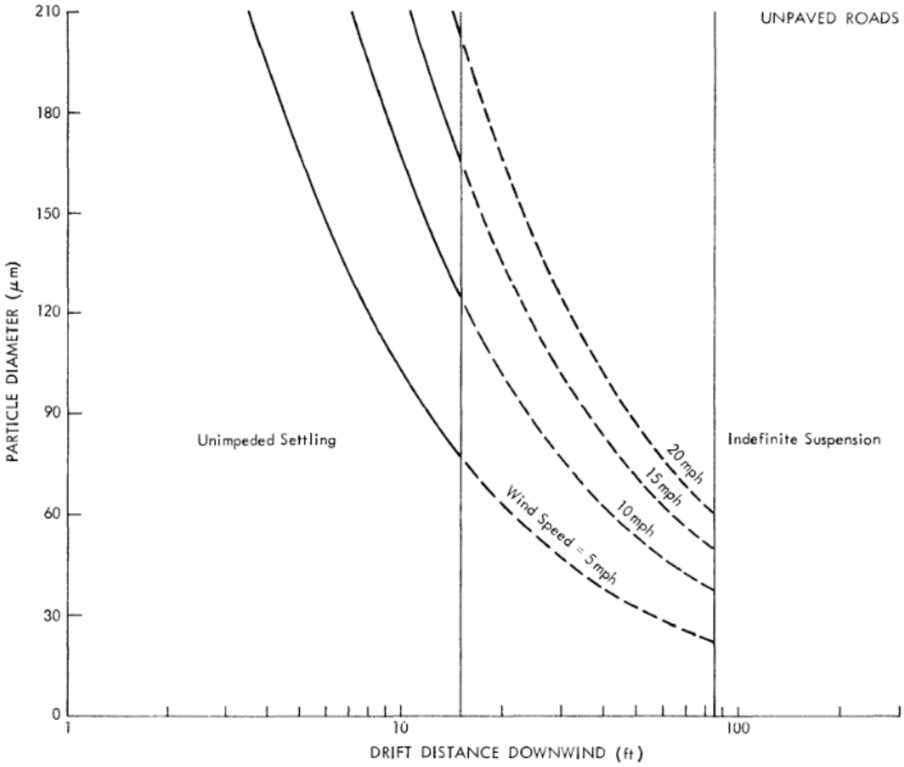


Figure 24: Particle drift distance (foot) relative to particle diameter and wind speed on dust released from traffic on unpaved roads (US.EPA, 1974)

5.5.3.3. Ore processing and tailings

Ore processing is a dry crushing operation carried out in a closed plant facility. This largely reduces dust spread from crushing and grinding. Dust from cyclones shrub and belt separators will be mixed in with the other tailings fractions to be deposited at the project TSF. Utilizing an underwater lake deposit will remove the wind erosion and resulting dust spread factor from the deposit. A land based TSF Dry will undergo wind erosion and result in some dust spread to the surroundings. Using equations created to evaluate dust spread from tailings storage facilities in the rock crushing industry, dust emissions have been estimated (US.EPA, 2019). Using production values following project Scenario B, estimated dust emissions are calculated – Table 18. Control factors include an enclosed production facility and a maintained dry TSF, with active management of dust suppression during the driest periods and when dust spread is a visible issue. The TSF is defined as an 88,000 m^2 deposit with 270 active tailings depositing days per year (with deposition of total tailings amount spread evenly across this period). Aerial dust suppression at the TSF is mainly achieved via progressive rehabilitation of tailings surfaces, minimising areas of open active tipping zones and exposure of tailings throughout the LoM.

Activity	Source	Faction	Tons/year
Crushers	Primary	PM	0.031
	Secondary	PM	0.224
Screens	#1	PM	1.04
Stockpiles	TSF	PM	0.643

Table 18: Dust dispersion from plant facility and TSF calculated from general equations for Rock Crushing (US.EPA, 2019).

5.5.3.4. *Other dust sources*

During operations various other activities are sources of dust with the most important being the distribution of ore by front-end loaders, conveyers etc. and loading of bulk carriers when shipping out product. These tasks would happen at irregular intervals and on demand why it is difficult to generalize them. However, these activities will take place at the process and port area which is the main operating area of the project. A summary of dust sources and mitigation measures are presented in Table 19.

Activity	Location	Dust source	Extent	Mitigation
Blasting and loading	Pit site	Blasting crushes rock and ore and the air pressure disperse dust into the air.	Each blast loosens many tons of ore. Overall, dust spread from blasting is of minor extent.	
Ore hauling	Haul road	Dust is whirled into the air by the vehicle driving on the unpaved haul road.	The haul road is c. 17 kilometres long and dust spread are generally limited to areas alongside the road	During the driest month watering particular dry parts of the haul road would significantly reduce dust spread.
Unloading	RoM Stockpiles	Unloading material will whirl up dust from the truck tip and from the offloading pad.	The project involves ongoing ore unloading of mostly >120 mm rocks. Due to the rock size dust dispersion is minor.	
Ore beneficiation	Process plant	Dust is caused by crushing, grinding and conveying/moving ore.	With the preferred dry process plan for crushing anorthosite, ore beneficiation is expected to generate significant amounts of dust including finer particles (<53 µm). Limiting the grind size in Greenland to app. <700 µm will however limit this issue.	Ore crushing and grinding is held inside a closed process facility. Dust suppression is active and exhaust air is run through cyclone filters. Final milling to 45 µm is carried out overseas.
Tailings deposition	TSF	Dust is generated from unloading tailings, dozing, and maintaining the TSF and from wind erosion.	Dust dispersion from a well-planned and maintained TSF is of minor extent.	Progressive rehabilitation of tailings surfaces, minimising areas of open active tipping zones and exposure of tailings
Shipping	Harbour area	Loading product onto bulk carriers using conveyers.	Conveying processed anorthosite is expected to result in significant dust dispersion	Equipping the loader with a suitable dust suppression spout and deflection plates will minimize dust. Also, closed conveyer systems are a project alternative.

Table 19: Summary of the major project dust sources, their expected extent and planned mitigation measures.

5.5.3.5. *Dust spread assessment*

In any bulk mining operation dust spread will be a subject that needs to be taken into consideration. The topography in the Majoqqap Qaava project area with one main valley physically defined by elevated mountainous boundaries provides a well-defined operating area. The wind regime in the valley, which is the primary driver for dust dispersion, is driven by the thermodynamics as described in 5.3.5. Figure 25 shows the project haul road with a 200-meter zone marked on both sides of the road. This zone is expected to show visible dust coverage caused by trucks using the road, with dust originating from the surface material retrieved by the proposed cut-and-fill approach. The dust cover is not expected to be uniformly distributed and some areas might remain visibly unaffected while other zones might accumulate dust. Accumulation of dust at certain stretches of the road will be driven by the wind dynamics. The figure displays general expected katabatic winds and directions based on topography and own observations, and overall visible dust is expected to settle adjacent to the road due to these physical properties of colder winds pushing down from the steep hillsides.

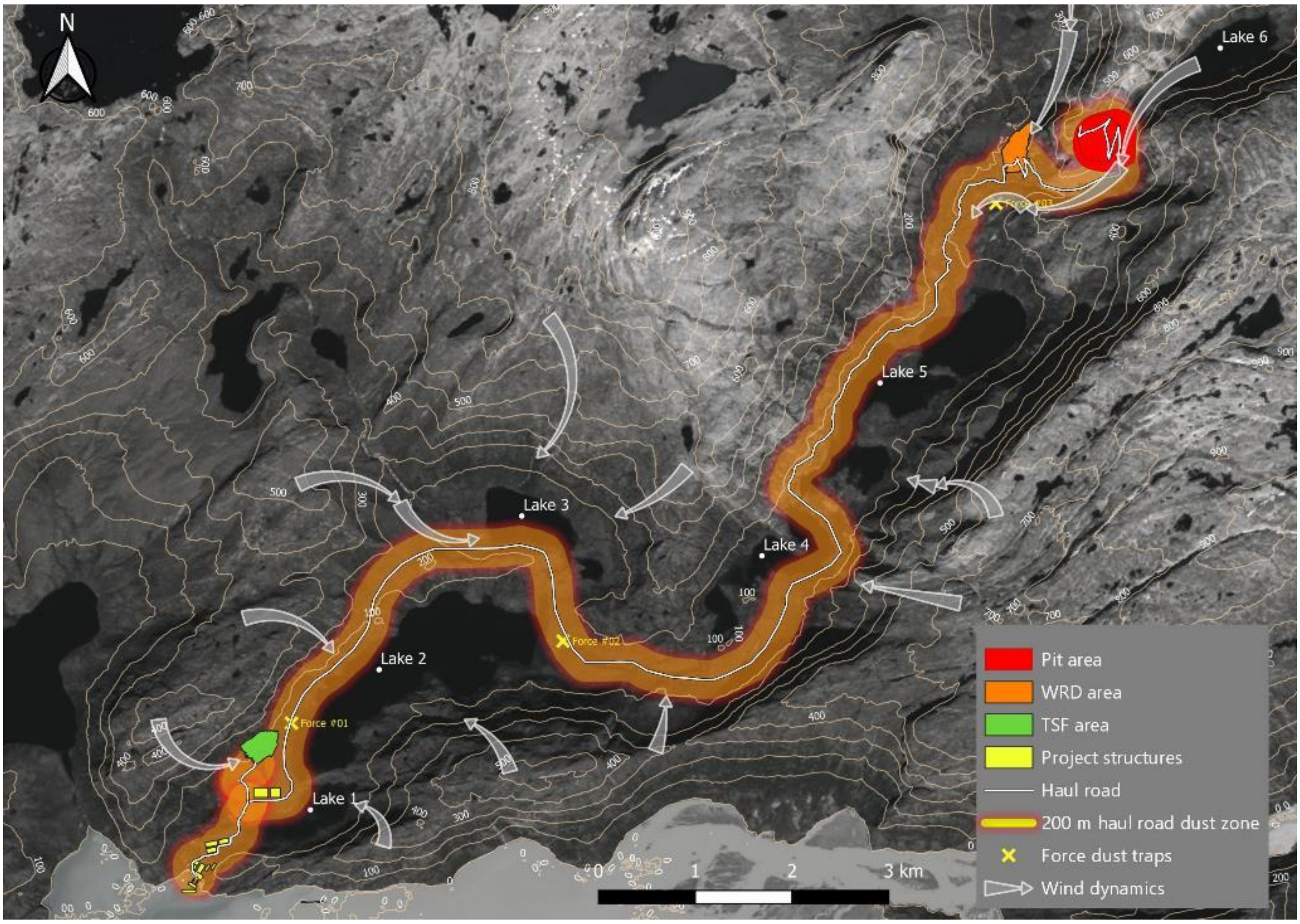


Figure 25: Haul road with 200-meter zones on each side of the road. To prevent any confusion regarding topographical shadows on the satellite image, the area's drainage system, including the lake banks, has been accurately mapped in Annex 4.

Project activities such as blasting, processing and maintaining the WRD and the TSF will also cause dust dispersion. The baseline study validated the overall expected wind directions at the process area and pit area. Based on these and the general assumptions of dust dispersion dynamics, three zones are identified to be potentially affected by dust spread, Figure 26. These are:

- Area 1. The port and processing area, due to crushing and grinding activity, on-going transportation and stockpiling of ore and product and maintenance of the TSF,
- Area 2. The shoreline area around a potential lake deposit site,
- Area 3. The area at the pit site including the hillsides west-southwest of here.

Area 1; port and processing area is likely to be most affected due to the sheer volume of activity. The measured wind directions and wind speeds (southwest wind rose on Figure 26), >30 µm dust particles will likely spread northeast following the ridge line and likely settle in the lower parts of the hillsides, Figure 27. Dust settling on Lake #2 will drain with the surface water and eventually end in the marine recipient. The same goes to some extent for dust settling on the vegetation and hillsides, which will be transported towards lakes and streams with surface runoff during larger rainfall events.

Area 2; defined as the area surrounding the tip-site for tailings to lake deposit. Tipping truckloads will cause dust dispersion and due to topography, most is expected to disperse over the lake. The ridge north of the unload point, going to the northeast will show signs of dust coverage after the first year of production, as this will likely become a dust sink for the Lake #3 area.

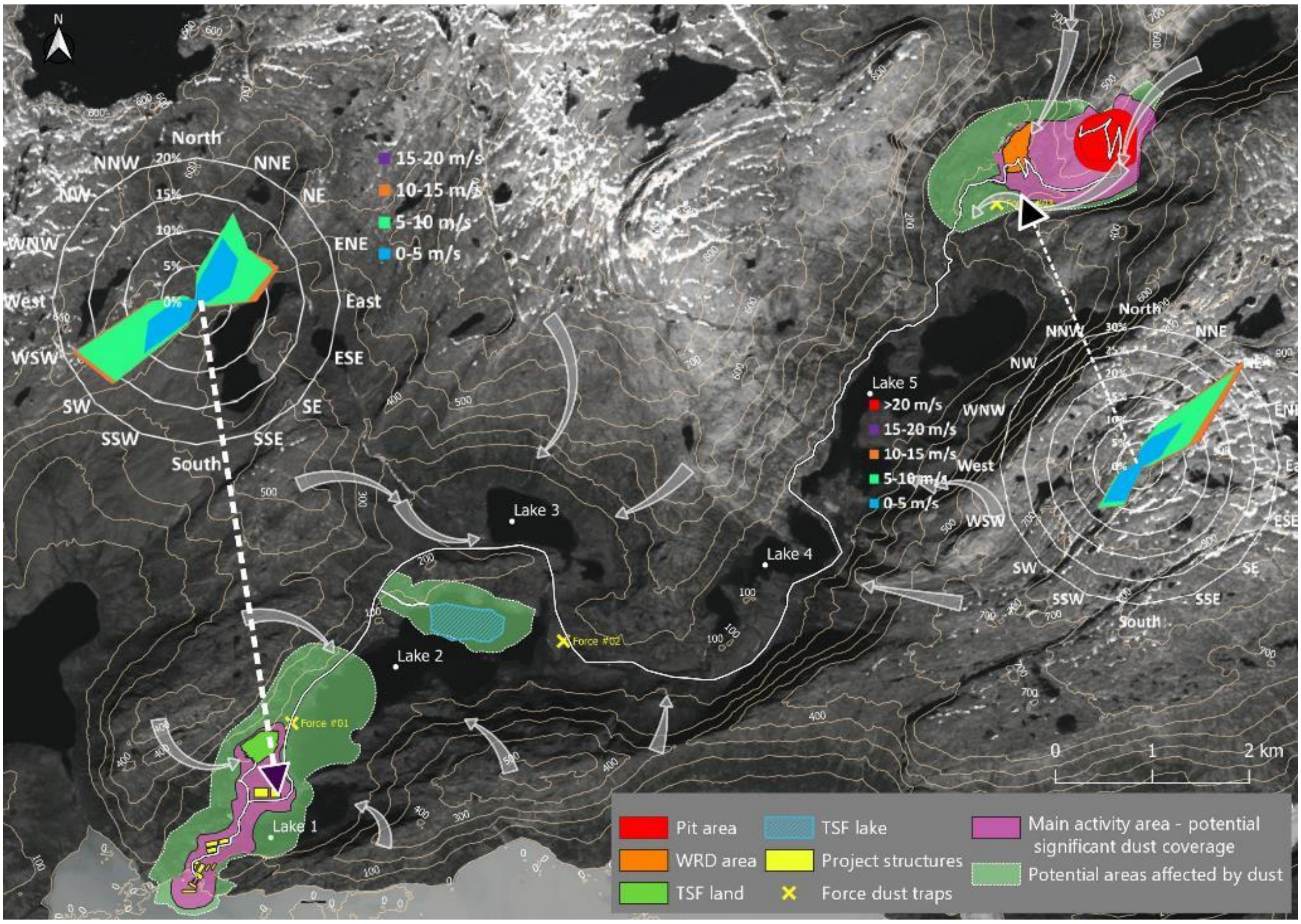


Figure 26: Expected dust affected zones based on wind regime and topography (dotted arrows mark weather station locations). To prevent any confusion regarding topographical shadows on the satellite image, the area's drainage system, including the lake banks, has been accurately mapped in Annex 4.

The pit site area 3; is also expected to be affected by dust dispersion. Blasting, excavating and loading trucks and utilizing the WRD will cause dust spread and due to the dominant north-easterly wind, energized by the cold air from the icecap to the east, dust will primarily spread towards the southwest. The terrain here is steep hills and ridges, potentially acting as a physical barrier, and dust particles >30 µm will likely settle on the hillsides and in the ridges, naturally mitigating dust spread, due southwest, Figure 28. The barren landscape in this region could cause dust to travel farther due to the scarcity of vegetation.

Fine dust particles <30 µm can stay suspended for long periods of time and disperse on a regional level. The nearest settlement is Qeqertarsuatsiaat located some 30 kilometres to the west. Modelling on atmospheric dust dispersion is based on a variety of assumptions, and model results in this region could be misleading. One study showed that models AERMOD and CALPUFF are highly dependent on solid weather data, and they proved weak in predicting actual dispersion in complex terrain (Tartakovsky, Stern, & Broday, 2016). The Majoqqap Qaava project area and its surroundings are categorized as being complex terrain with elevation fluctuating from sea level to >800 meters, local erratic wind phenomena in the fiords and observed catabatic winds flowing from the icecap to the east. A larger fine particle model has not been developed for this project at the current phase. This relates to the scarcity of data for the region and project, which decreases the model strength (increases model uncertainty). Since model results are prone to receive a high credibility rating, this could result in inappropriate actions or lack of the same. Instead, it is proposed to supplement the environmental impact assessments based on likely scenarios. A separate project background report assess dust spread related to the project activities in detail (NIRAS, 2024a).

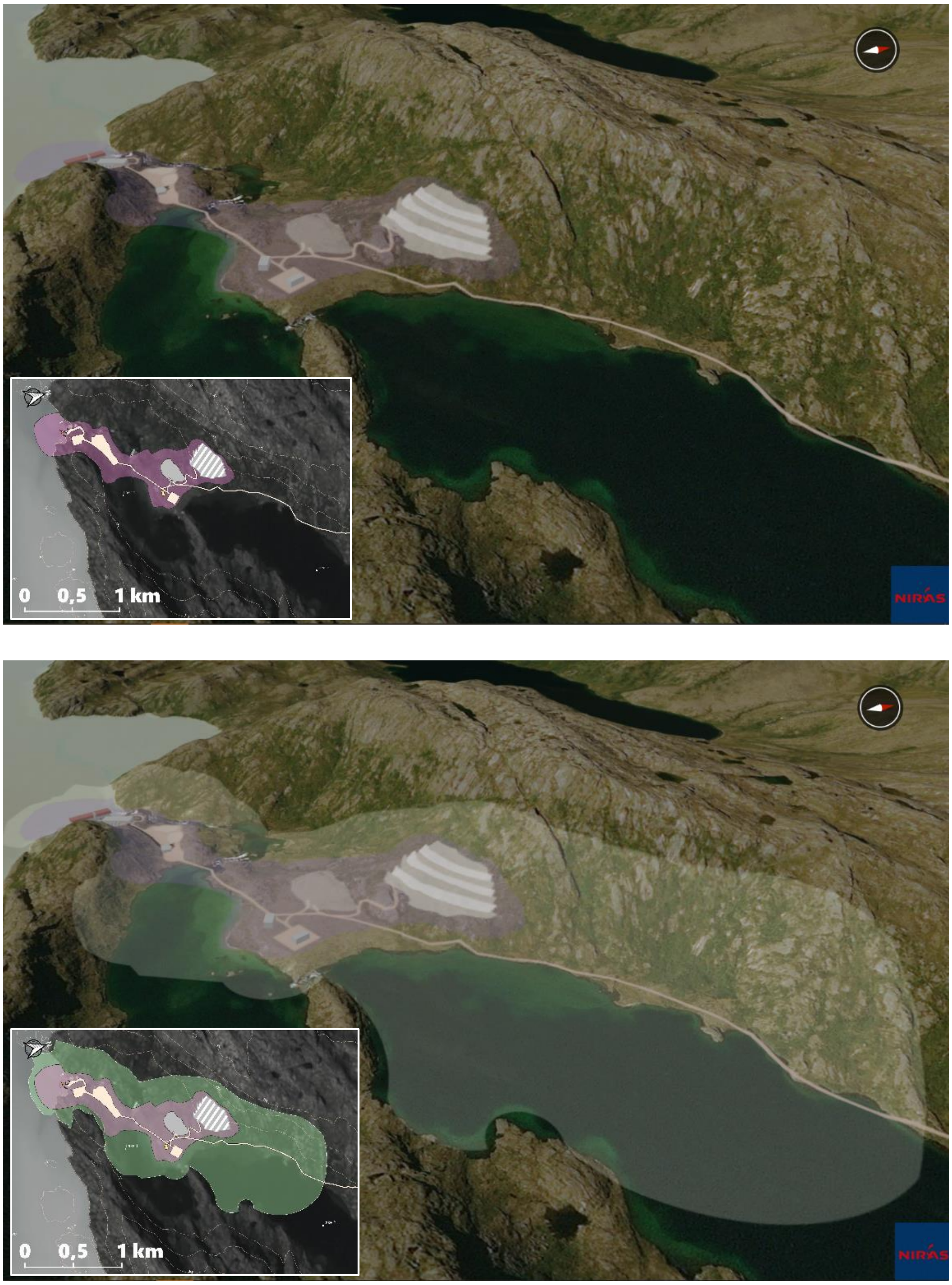


Figure 27: Visualization of process and TSF Dry site. Purple (top) marks expected active area with visible dust spread from heavy continues activity. Light green (bottom) marking is expected inactive area, with light particle dispersion.

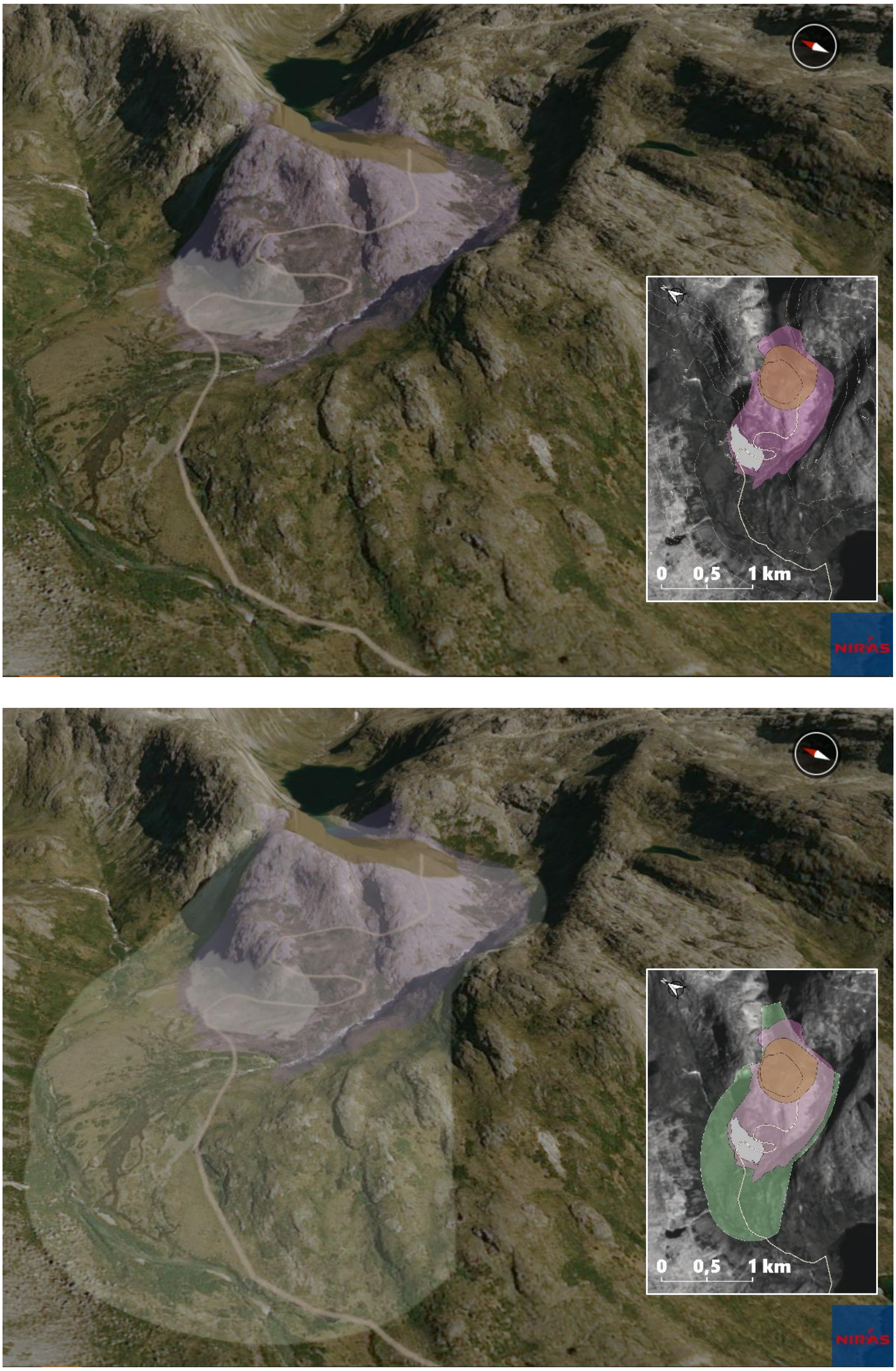


Figure 28: Visualization of mine- and blast site showing the gorge and ridge potentially acting to prevent dust dispersion of >30 µm particles to the south. Purple (top) marks expected active area with visible dust spread, light green (bottom) marking is expected inactive area, affected by light particle dispersion by wind.

Aeolian transport of fine particles will undoubtedly occur but the remoteness of the project location and the generally non-sensitive and common type of environment for this region means that aeolian transported particles is regarded to have little to no impact on humans or the environment in general.

A study on dust dispersion effects on caribou forage indicates effects of dust spread on soil pH and lichen coverage in relative distance to a Canadian mine and mining haul road, thus potentially affecting the local caribou population and wildlife (Chen, et al., 2017). The study is however non-conclusive in defining a direct effect from the observed dust spread. Results are masked by the natural variability of the study area and no single parameter could be identified as causing a specific impact, though an increase in pH was highlighted. An increase in pH is not expected at the Majoqqap Qaava mining project, due to the geological composition of the ore-resource, with naturally high calcium content.

Overall, the presented project will cause dispersion of dust to the local surroundings and due to the length of the haul road, the nature of the open pit mining strategy and processing and material grinding on-site, dust is expected to be of moderate local ecological significance. Furthermore, leaching tests on Majoqqap Qaava project ore show little risk of eluate resulting in acidification of the surrounding environment, and the ecological effects from dust spread on wildlife and vegetation is hence evaluated by the physical consequences of actual dust coverage. This will add to the cumulative physical effects of the overall mining operation activities (noise, light disturbance, engine exhausts, vibrations etc.).

The constituents from the various dust sources will vary according to the diversity of the ore, but the overall composition of the various sources are indicated by values listed in section 4.5 - Table 4. Regarding dust being flushed into the freshwater system, this effect is evaluated in section 5.7.2 Water chemistry.

By conducting environmental monitoring during the construction and operation phases the actual potential impacts of the Majoqqap Qaava can be assessed and source specific mitigations can be initiated from the vast selection of mitigation measures and dust suppression strategies available – see section 8 for the proposed Environmental Management Plan [EMP].

Potential impact	Dust particles covering vegetation and settling in freshwater
Impact phases	Operation
VEC	Plant life ecology and freshwater

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Moderate
Local	Medium	Long-term >5 years	High >75 %	

5.6. Terrestrial environment

The terrestrial environment is defined as ecological components related to dry land. The terrestrial environment includes generally all the project valley from the highlands to the freshwater banks. Some species are associated with both land and freshwater, e.g., some birds, and these will be evaluated where most appropriate.

5.6.1. Terrestrial noise

Mining operations including blasting and pit works, transportation with heavy machinery and general increased activity on land create noise that may potentially affect the biological environment near the site. The closest settlement of Qeqertarsuatsiaat is located roughly 30 kilometres (straight line) from the project site and will not be affected directly by project noise.

Anthropogenic noise on land may influence wildlife such as: caribou (*Rangifer tarandus*), arctic fox (*Vulpes lagopus*), hare (*Lepus arcticus*), and various bird species in the area. The noise may cause a behavioural avoidance response or temporal displacement. At the harbour and process area, rock crushing, process facilities, traffic on the site including loading of materials, are expected to be the significant persistent noise sources. At the mine site, drilling holes for explosives, excavating and transport of rocks as well as sirens in relation to explosion procedure will contribute to the elevated noise level and have a temporary effect on the fauna. The act of detonation itself will obviously be noisy but is not seen as an acoustical significant impact on the surroundings, due to the very short duration and relatively small parts of the energy being represented as sound energy ((NIRAS, 2021b). Intense traffic between the harbour and the pit during work hours will also cause elevated noise levels.

Noise around the harbour and process area, pit area and connecting infrastructure in relation to project activity have been modelled (Figure 29 and Figure 30), to assess how this will add on to the current noise levels, where generally no human activity is found. How the noise will spread depends on topography and weather conditions, especially wind speed, where high wind speed will mask the sound more extensively than on calm days. Therefore, a background noise level of LZeq: 25 dB, which roughly corresponds to a quiet wind, has been used in the model of a "*worst case scenario*" (that is, low background noise masking from wind) and calculations on noise have been performed on relevant noise generating activities based on known source levels, Table 20 (NIRAS, 2024b).

Noise Source	Emission distribution *[Hz]*									
	Lw	63	125	250	500	1,000	2,000	4,000	8,000	
					[dB(A)]					*(Intensity/hrs)*
Heavy traffic	101	81	84	90	93	97	94	88	80	10 units
Dumper	102	76	87	92	95	97	97	92	86	100 %
Wheeled loader	110	83	92	98	103	105	104	97	86	
Mixed earthworks	110	85	95	103	104	103	101	100	94	
Rock drilling	121	92	97	100	105	113	116	116	115	25 %

Table 20: Noise sources and emission distribution values used in Soundplan modelling.

In the harbour area, the noise is expected to be dampened to the northwest and southeast by the surrounding topography. Towards southwest the noise can spread unhindered across the water, however modelling shows that noise is likely to spread at a longer distance towards northeast, inland, where levels above LZeq1h: 50 dB may occur up to 4.5 kilometres away.

At the pit area, noise will be dampened to the southwest and west due to the topography. Towards north, east, southeast and south the noise levels above LZeq1h: 50 dB may be detected at a distance up to 1.5 kilometres. Noise at both the harbour and pit areas is continuous throughout all working hours. Noise from transportation on the roads will of course depend on the traffic/production any given day and time of day, and by the fact that the source is moving, meaning that the exposure will be limited to a short duration of time at a given position. The noise from the heavy traffic is expected to exceed LZeq1h: 50 dB in a roughly 200 m radius from the moving source however the noise is illustrated as a belt along the road.

As described in section 5.6.4, arctic fox and arctic hare are found in most regions of Greenland with no specific hot spots, and they are likely found randomly dispersed in the project area. Because of their irregular, unpredictable presence but general distribution and high abundance nationally, the impact of noise as a threat to the species is assessed as insignificant in the assessment of this project and will not be discussed further. The same general argument is used for the birdlife (e.g., ptarmigans, raven, Lapland longspur, snow sparrow etc.) in the area. Their high mobility makes the impact of noise generated in the area insignificant. The vulnerable white tailed eagle and the near threatened gyrfalcon are however sensitive to human disturbance around their nest (Boertmann & Bay, 2018b) why it has been recommended to regulate traffic close to the nests from March to July, (Christensen, et al., 2016). In other countries such distances vary from 100-1,000 m (Ruddock & Whitfield, 2007) yet in Greenland no legislations exist regarding protection zones around nest for birds of prey. As disturbance relates to human activity near the nests, rather than the impact of noise, disturbance of these species is assessed in section 5.6.

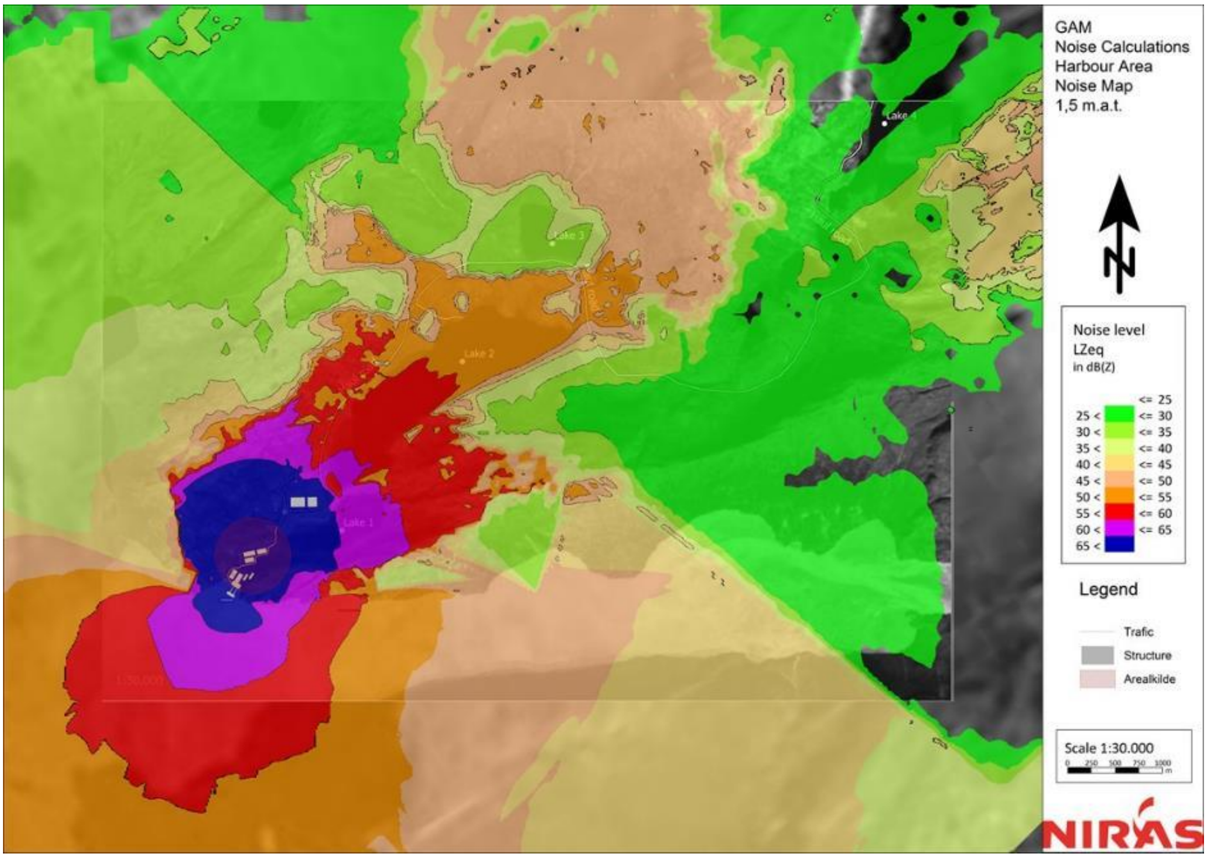


Figure 29: Noise distribution during full workload at harbour and process area.

Caribou that use the area and surroundings for foraging may be sensitive to the generated noise and the hearing capacity of reindeer have been shown to range from 70 Hz to 38 kHz at a sound pressure of 60 dB with the lowest hearing threshold of 3 dB at 8 kHz (Flydal, Hermansen, Enger, & Reimers, 2001). However, as the caribou calving sites are far away (~80 km NNE) the noise will not affect these areas where the caribou is considered most vulnerable. Also, with a density of 0.83 caribou/km^2 it is relatively few animals that will be affected by noise. The noise may keep caribou away from the pit area and harbour area during hours of human activity and vehicles are also expected to scare caribou off while passing if caribou are present. Yet, studies have shown that their response to sudden human activity appears to be short term, with caribou moving away from areas of human activity but returning once the activity has been terminated (Bradshaw, Boutin, & Herbert, 1997). A study on caribou at Svalbard indicates a habituation on local animals, probably by individual learning mechanisms (Hansen & Aanes, 2015). The observed Escape Distance (ED) for disturbed animals in this study ranges from 5 – 500 meters. It is worth mentioning, that the disturbance was induced by approaching the caribou on foot. Personal observations and interviews with personnel on active mine sites in Greenland indicate, that passing as closely as 30 meters or less of feeding caribou in a vehicle only rarely induce an escape response. However, stopping and leaving the vehicle on foot in the direction of the caribou will induce an escape response of varying distance. This is further supported by personal observations and statements from locals in Qeqertarsuatsiaat who have experienced wild caribou foraging and resting at other mining and camp sites nearby (Rambøll, 2023b). Displacement of caribou due to noise/human activity may however have a larger impact during winter, as it may cause a higher energy expenditure in a period where food resources are scarce if the animals are forced to move around more. This is mitigated as the mine may not be operating through all winter months and as the area impacted by noise is restricted and stationary (except from the road, but noise does not travel far from here and snow does dampen sound distribution).

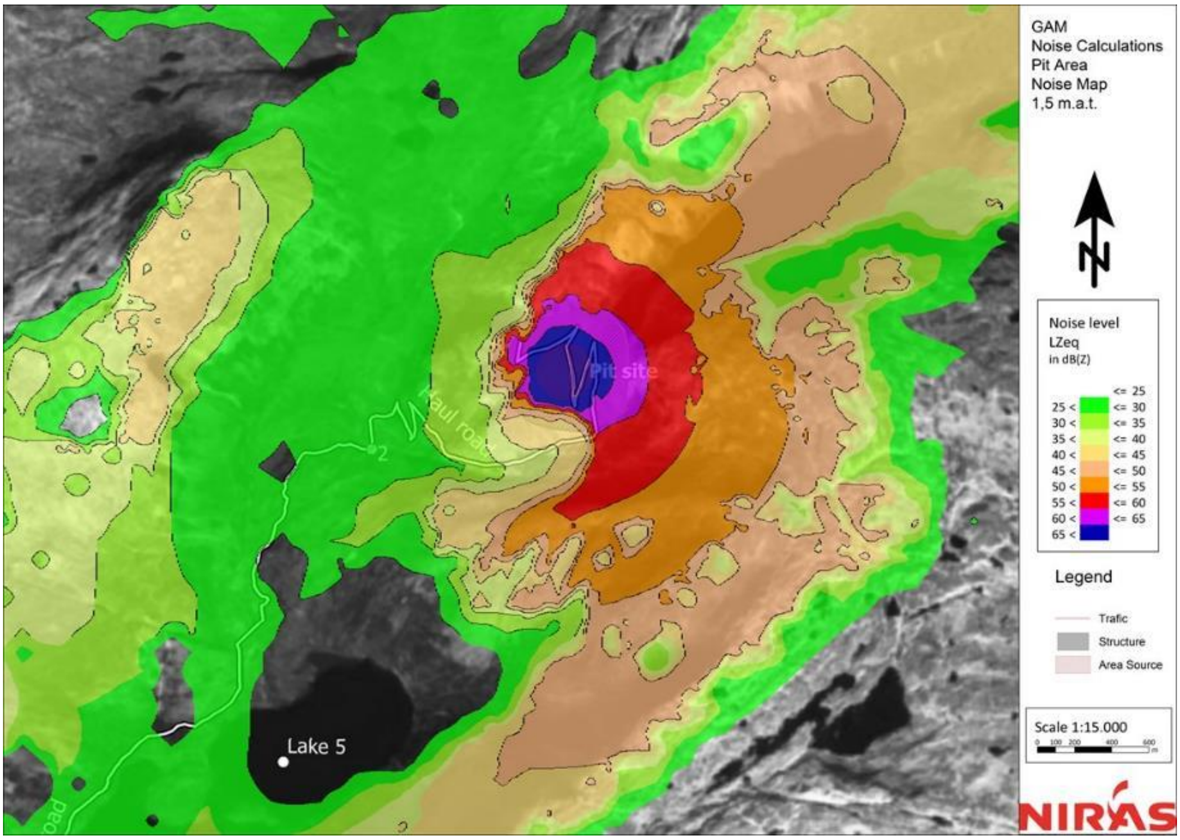


Figure 30: Noise distribution during full workload at the pit area.

Hence, the degree of disturbance on this regional population of caribou by noise is assessed to be low as the animals are expected to obtain a degree of habituation over time resulting in minimal escape responses from mine related traffic. Also, the mine may not operate during the entire winter period. However, the noise will be generated during work hours throughout the "Life-of-Mine" (Long-term >5 years) and caribou are expected to be found frequently in the area as surveys of the Qeqertarsuatsiaat caribou population show they are found from the inland to the coast but with a density of 0.83/km^2. The overall assessment of the impact of noise on caribou is minor.

Potential impact	Noise from construction, mining activity, transportation, and camp site
Impact phases	Construction and Operation
VEC	Caribou from the Qeqertarsuatsiaat population

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Minor
Regional	Low	Long-term >5 years	Medium 25-75 %	

5.6.2. Floral communities

Arctic vegetation can be divided into several plant communities according to species composition (Figure 32), life strategies, degree of vegetation cover and relationship to physical parameters, such as soil texture and water content, snow cover and slope and aspect of the terrain.

Figure 31: Alder, birch, and willow trees in a heath area in the project area (left) and heath – 1 m^2 (right).

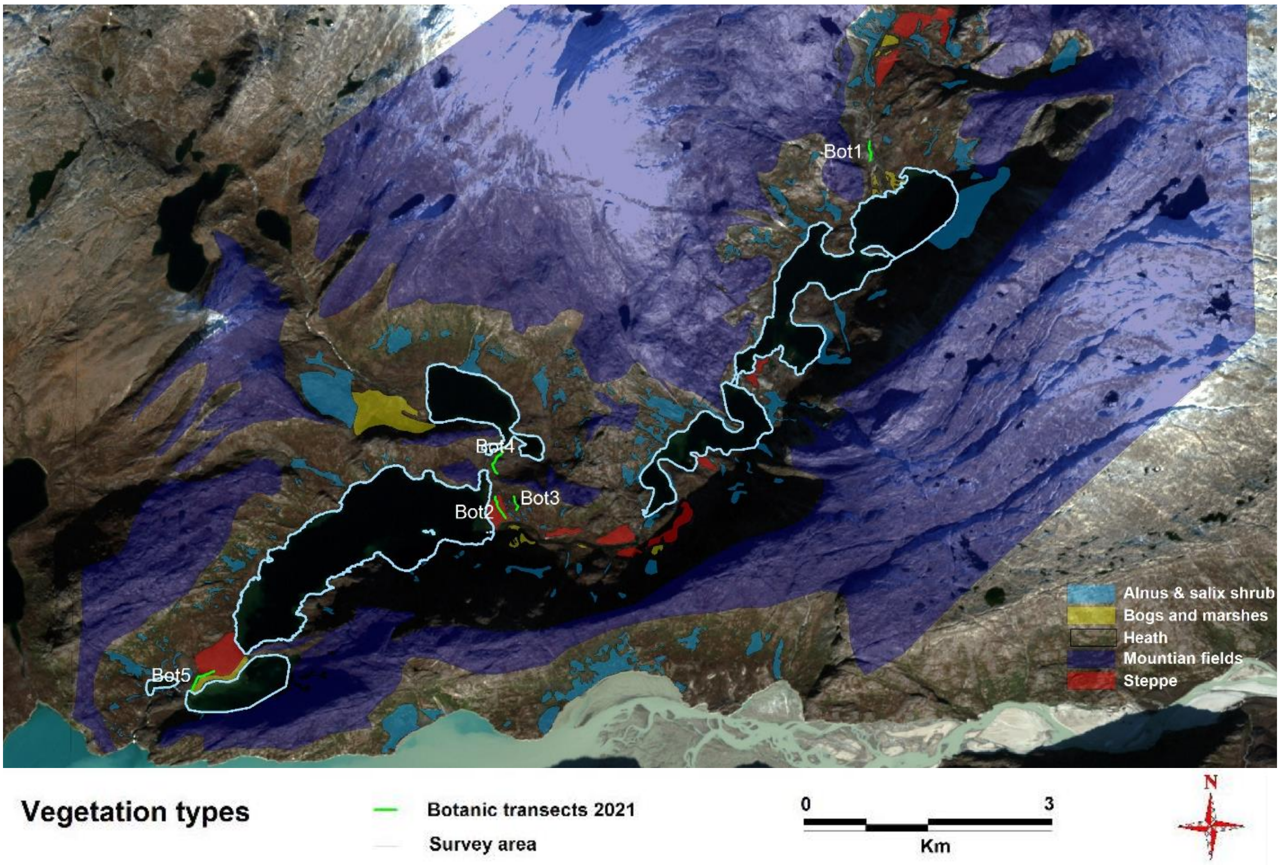


Figure 32: Plant communities mapped from aerial photos and "ground truth" transects made during the field work in 2021. The extent of the lakeshore has been duly marked with a light blue line.

5.6.2.1. Current status

The large variation in physical conditions in the Majoqqap Qaava project area results in a diverse low arctic type of flora. The most common vegetation types in the area are mountain fields, shrub, heath, and steppe. The plant community in the wind exposed higher-lying mountains near the mine lack woody plants and consist almost solely of monocotyledon plants such as grasses and sedges. Heath is the most common floral community in the Majoqqap Qaava project area and covers most of the dry slopes of the valley. The characteristic heath plants in the area are a mixture of Cowberry, Labrador Tea and occasionally also Arctic Blueberry. The heath areas have scattered specimens of especially birch, but also willow, Figure 31.

Although there are no regular forests in the project area, certain areas in the valley support patches of dense shrub and bushes of blue-green willow (*Salix glauca*) and green alder (*Alnus crispa*). The alder shrub is mainly found on moist slopes and seems to be denser near the valley floor and have an altitude limit of approximately 200 meters.

The steppe like plant communities is registered on the plains/riverbanks of the large river draining the valley. The vegetation on the steppe is very sparse and consists mainly of monocotyledon plants such as grasses and sedges and with only a few willows scattered. Besides the major plant communities already described, minor patches supporting herbs were also observed in some of the south-facing slopes. A list of plant species was made during the second year of baseline. During this survey no red-list species were registered. The distribution of the plant communities is shown in Figure 32.

5.6.2.2. Construction phase impact assessment

During the construction phase the main impact on the floral community is from clearing areas for future buildings, tipping pads and other infrastructure and from the cut-and-fill task when constructing the haul-road. As the vegetation types found in the project valley are very common and no rare or red-list species were observed during the botanical baseline screening studies the effect during the construction phase will be <u>negligible</u>.

Potential impact	Reduction of floral diversity and habitat sizing and dust
Impact phases	Construction
VEC	Floral communities on species and habitat level

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Short-term <1 year	Low <25 %	

5.6.2.3. Operation phase impact assessment

As described in section 5.6.2.1 the vegetation types found in the project area are alder/salix shrub, heath, steppe, bogs/marshes, and mountain fields. All vegetation types which are common in the region, see Figure 32.

Implementation of this project will affect the vegetation in the local area, as some of it will be covered by infrastructure elements such as a road, tailing, waste rock and buildings. A major potential element is the establishment of a land-tailings deposit. If the establishment of the Tailings Storage Facility (TSF) involves the removal and temporary deposition of topsoil, it will be re-established on the landfill site during the establishment process to prevent erosion. Similarly, if the establishment of the TSF involves the removal of vegetation, the affected area will be replanted or prepared to induce natural vegetation re-establishment.

Potential impact	Reduction of floral diversity and habitat sizing and dust
Impact phases	Operation and closure
VEC	Floral communities on species and habitat level

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Long-term >5 year	Low (<25 %)	

Indirect dust spread may also have influence on the plant communities along the road and other infrastructure, see section 5.5.3. The vegetation types in the project area are very common and no rare or red-list plants was observed during the botanic survey in 2021. Thus, the botanic species are more or less similar to the rest of inland sheltered valleys in the region and despite the expected length of the project the effects on local flora from seizing of area and dust will be negligible.

5.6.3. Birds

5.6.3.1. Current status

During project-related fieldwork birdlife was observed and registered at project relevant sites. Baseline data and methodology is described in the project baseline report (NIRAS Greenland, November 2022). Different species of terrestrial birds such as Common raven (*Corvus corax*), Rock ptarmigan (*Lagopus mutus*), snow bunting (*Plectrophenax nivalis)* and Lapland longspur (*Calcarius lapponicus)* are common within the project area. Also, several white-tailed eagle sightings (*Haliaeetus albicilla*) were registered.

The White-tailed eagle (*Haliaeetus albicilla*) is Greenland's largest breeding bird and is listed as vulnerable in the Greenlandic Red List. The eagle´s typical breeding sites are on cliff shelfs usually close to shallow lakes, streams, archipelagos or river outlets, which are all important foraging areas. The diet is primarily fish such as cod and char, but also other birds such as common eider (*Somateria mollissima)*.

In summer, it is observed that young eagles congregate in such habitats in the inner fjord areas. Thus, such areas are likely important summer areas for the white-tailed eagle (*Haliaeetus albicilla*).

In the project area the white-tailed eagle is present in the inner part of the Kuussuatsiaat Valley, and an adult bird was observed several times in 2020. It remains however unclear whether the white-tailed eagle nests in the valley or if, especially the river, is just a part of its hunting grounds. The caribou hunting season may attract eagles scavenging on caribou remains left by the hunters. Adult white-tailed eagles typically stay in the territory during winter, while younger birds migrate to the southern parts of Greenland (GINR, 2013). The white-tailed eagle is listed as "vulnerable" on the Greenland Red List of threatened species (Boertmann & Bay, Grønlands Rødliste, 2018a).

The Rock Ptarmigan (*Lagopus mutus*) is a common breeder throughout Greenland, where three subspecies occur: *L. mutus rupestris* (south), *L. mutus saturatus* (northwest) and *L. mutus captus* (north and northeast), the two latter being endemic (Boertmann 1994). The northernmost populations are migratory, presumably wintering in southern Greenland. They depart from the north in late September/October and return from February and onwards, usually with males returning before females.

Other species such as the snow bunting (*Plectrophenax nivalis*), Lapland longspur (*Calcarius lapponicus*), Northern wheatear (*Oenanthe oenanthe*) and common raven (*Corvus corax*) are common and widespread throughout south and West Greenland and common breeders at low to medium altitude in Qeqertarsuatsiaat area. None of the species are present on the Greenlandic Red List, and thus not subject to any threats and do not require special attention.

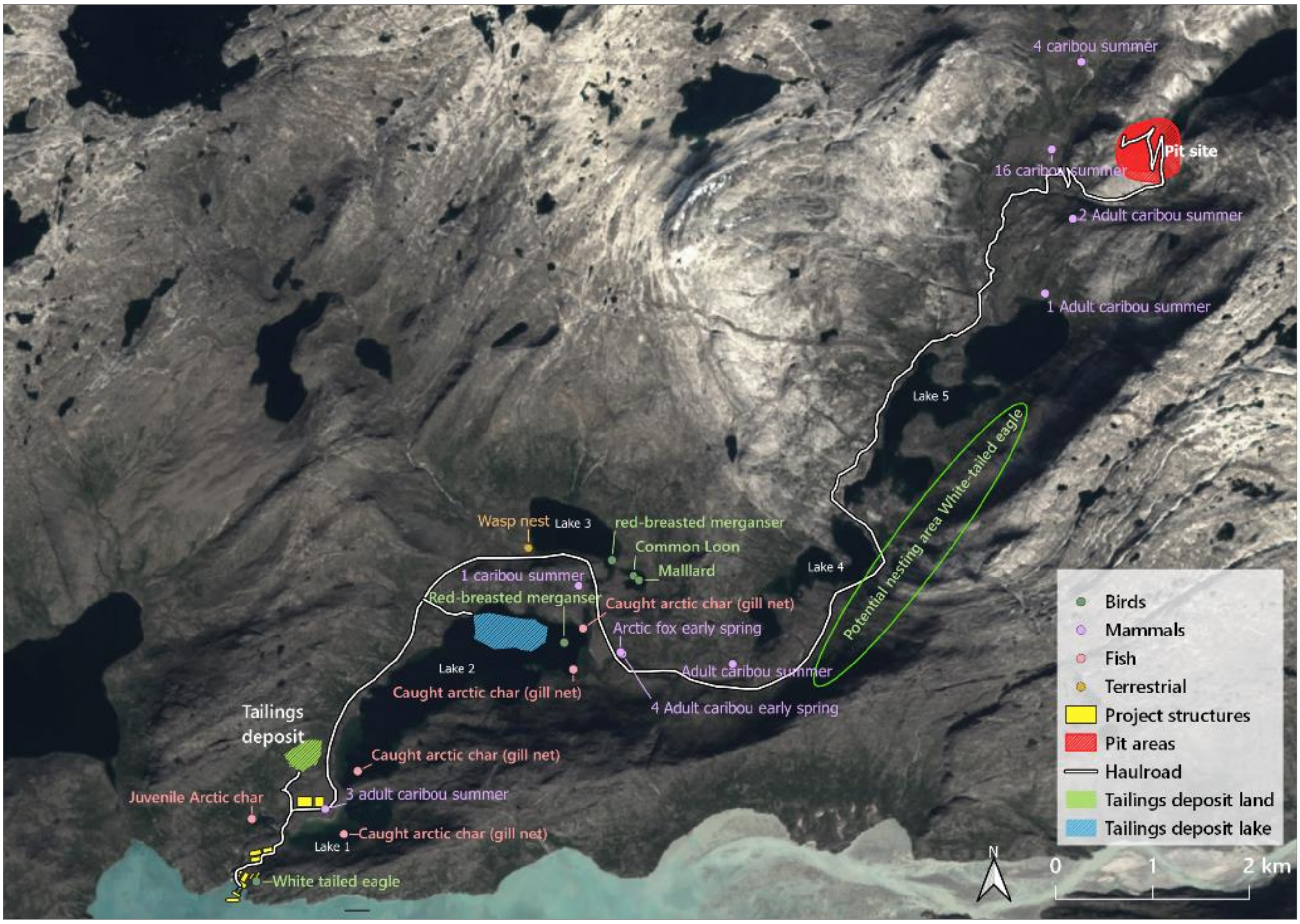


Figure 33: Wildlife observations in 2020. To prevent any confusion regarding topographical shadows on the satellite image, the area's drainage system, including the lake banks, has been accurately mapped in Annex 4.

During fieldwork several bird species related to freshwater were observed within the project area. Lake #3 and Lake #2 was seen to support minor flocks of mallard (*Anas platyrynchos)*, common loon (*Gavia immer)* and red-breasted merganser (*Mergus serrator*), Figure 33. Bird species related to freshwater are discussed in section 5.7.6. The presence of these freshwater birds was constant during a 14-day baseline survey with individuals moving around in- and between the lakes.

The company acknowledges that no systematic bird survey has been conducted during the breeding season. The company will ensure that a dedicated survey is initiated during the initial construction phase in the area, and to an extent that covers the early periods of the breeding season.

5.6.3.2. Construction phase impact assessment

Terrestrial bird wildlife has primarily been observed in the inner parts of the valley, and with construction phase and mobilization commencing at the fjord shoreline the initial work poses little disturbance. As the project is working its way up through the valley, preparing building sites and constructing the haul road, bird wildlife will be affected to some extent. The primary effects are caused by moving material, machine lights and machinery noise. Noise effects have been covered in section 5.6.1 where the physical disturbance from machinery is assessed to be minimal. Experience and observations from other projects operating in desolate parts of Greenland have shown, that wildlife quickly learns to identify project activities and keeps a cautious distance to humans and machinery but remain in the region. The majority of the observed terrestrial birds are all common and widespread throughout the west-coast of Greenland and are expected to be only negligible impacted. Nests might be relocated from a particular project site area, but the majority of the species are expected to relocate within the valley and not leave the region due to project construction activities.

The White-tailed eagle differs as being red-listed and has proven particularly vulnerable to disturbances during nesting season from March to July. No nests were observed in the valley during the baseline field studies but eagles were seen circling the valley. White-tailed eagles are known to have variable sized nest home ranges for foraging, ranging from some km^2 up to several hundred km^2. With main project activities taking place in the lowlands of the valley, no direct disturbance of eagle nests is expected. Occasional helicopter transportation will be carried out in accordance to standing regulations and general good practice (BMP, 2000). In conclusion, a temporary and local impact through the local construction phase is evaluated to have a negligible impact on the local terrestrial birdlife.

Potential impact	Disturbance of nesting and freshwater birds
Impact phases	Construction
VEC	Terrestrial birds - especially the White-tailed eagle

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Short-term <1 year	Medium 25-75 %	

5.6.3.3. Operation phase impact assessment

Several terrestrial bird species have been observed in the vicinity of the project area, see section 5.6.3.1. Most of the observed species are very common in the region, and as such not subject to special conservation measures. None of these birds, apart from the white-tailed eagle, are known to be particularly sensitive to human disturbance. The white-tailed eagle is most sensitive to disturbance during the breeding season (March-July) and will most likely avoid having a nest within a range of 1-2 kilometres from the mine area, roads, port and mining camp.

The project is not believed to have a major impact on the distribution of nesting pairs of these common species in the region. With respect to the white-tailed eagle, no nests have been observed in the vicinity of the project area, but it seems likely that a nest may be located somewhere along the freshwater system as there is registered several observations in this area. The nest could easily be located facing the fjord just south of the southern valley ridge as the white-tailed eagles utilize large areas for foraging. The white-tailed eagle has been known to take advantage of the spawning migrations of numerous arctic chars for hunting in August-September. Thus, the eagles often inhabit the outlet of rivers or at natural barriers/ponds where they find the highest densities of Arctic char in the migrating season. The project valley holds a healthy population of arctic char, but analyses indicate that these are a lake population since migration to sea is not possible due to the large waterfall/rapids in the lower part of the system, see section 5.7.5.

Potential impact	Disturbance of nesting birds
Impact phases	Construction, operation and closure
VEC	Terrestrial birds - especially the White-tailed eagle

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Minor
Local	Low	Long-term >5 years	Medium 25-75 %	

The activities around the mine area, roads, port and mining camp could potentially have an effect on nesting white-tailed eagle, but since no nest locations were observed during the comprehensive baseline work neither in June nor in August, it seems unlikely that a nest is present within the sensitivity zone from the mining activities.

Thus, the impact on the white-tailed eagle and other terrestrial birds for that matter are therefore assessed to be minor being of low magnitude and contained to a geographically local area.

5.6.4. Mammals

5.6.4.1. Current status

Several sources of information on terrestrial wildlife in and around the project site are available. GINR conducted general wildlife surveys by helicopter across southwestern Greenland in March 2005, 2006, and 2012, and included five study regions: Naternaq, North, Central, South, and Paamiut. The Project is located within the southern survey region. In general, these surveys indicated that the terrestrial ecosystem of western Greenland has low mammalian diversity. Wildlife species observed within the southern region included caribou/reindeer arctic fox and arctic hare.

Arctic hare: Arctic hare is most likely present in the Kuussuatsiaat Valley, despite no observations of this species has been made either in the caribou survey in 2006 or during the field work in the area in 2020/2021, (Cuyler et al., 2009) and (pers. obs.). Human activities in the project area are not expected to have any impact that can threat neither the local stock nor the arctic hare's abundance in general. This is supported by the observations of several hares inside the settlement of Narsarsuaq, in southern Greenland (pers. obs.).

Figure 34: Arctic fox captured by wildlife camera on December 2021, direction south, facing Lake #2.

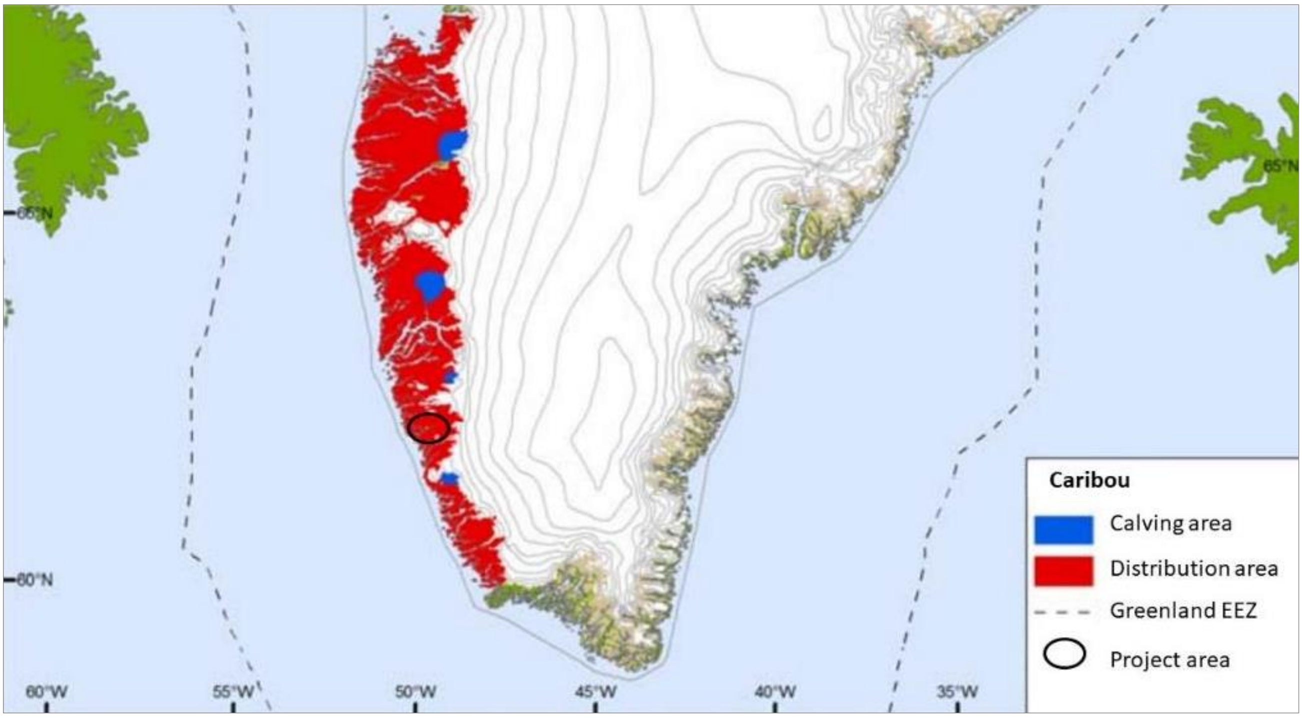


Figure 35: Caribou distribution (red) and calving areas (blue). Project site is found within the black circle. Modified from (Christensen, et al., 2016).

<u>Arctic fox:</u> Arctic fox is present in the Kuussuatsiaat Valley, despite no observations of this species has been made in the caribou survey in 2006 (Cuyler et al., 2009). The wildlife camera setup during the baseline surveys identified arctic fox several times confirming that they are present in the area, but the population densities remain unknown, Figure 34. The Arctic fox has a great ability to adapt to changes in the environment including human activities. Thus, the Arctic fox is frequently observed around settlements in Greenland where they are attracted by food and overfilled trash bins and other garbage. The proposed mine activities are unlikely to have any significant impact on this species as they are notoriously hardy animals - The mine will work actively to not attract foxes, as they could potentially bring a health liability.

<u>Caribou</u>: The Qeqertarsuatsiaat caribou population inhabit an area between Sermilik fjord and Frederikshåb Isblink and include the project area, Figure 35. Although the fjord and the ice cap separate caribou belonging to the Ameralik and Qassit population from the Qeqertarsuatsiaat population, the border is permeable permitting movement between the areas, e.g., over winter sea ice (Cuyler, Nymand, Jensen, & Mølgaard, 2016; Boertmann & Bay, 2018). The Qeqertarsuatsiaat population has fluctuated greatly from a pre-calving population estimate of approx. 181 caribou in 1993 to a pre-calving population estimate of c. 5,372 and 5,224 caribou in 2001 and 2006, respectively (Cuyler, Nymand, Jensen, & Mølgaard, 2016). The latest estimate of 4,800 individuals was made in 2012 and corresponds to 0.83 caribou/km^2, (Cuyler, Nymand, Jensen, & Mølgaard, 2016).

As the population estimate is ten years old, it has likely changed, however caribou in Greenland are categorized as *least concern* on the Greenland Red list and the total Greenland population is estimated to comprise 113,000 individuals (Boertmann & Bay, 2018b). In September-October 2020, 23 caribou were observed in the Majoqqap Qaava project area during field studies and the observations were primarily made in the inner most parts of the Kuussuatsiaat Valley Figure 33. Also, wildlife camera footage from the 2022 season captured several groups of caribou transiting the central part of the project valley, indicating a healthy and active local population, Figure 36. In general, caribou from the Qeqertarsuatsiaat population are found from the inland ice cap to the maritime coastal habitat (Cuyler, Nymand, Jensen, & Mølgaard, 2016).

Figure 36: Wildlife camera photos of caribou in the project valley in April and July, respectively.

Caribous are hunted in Greenland and the hunt is regulated under Greenland legislation. In the period 2014-2019 an average of 12,000 animals per year have been caught (Naalakkersuisut, 2021) where 2.5 % (on average 300 caribou/year) are caught from Qeqertarsuatsiaat (APN, 2022). Hunting has not affected the caribou population much since 2005 but has contributed to less fluctuation in abundance (Boertmann & Bay, 2018b). Hunting is however assessed to cause the main disturbance of caribou. Other potential threats are destruction of habitats and local disturbance in connection with industrial development and infrastructure but overall caribou are not sensitive to irregular single disturbances outside the breeding period and their calving grounds (Boertmann & Bay, 2018b; Christensen, et al., 2016). Caribou sensitivity and sensitive areas are further addressed in section 5.8.

5.6.4.2. Construction phase impact assessment

Generally, the construction phase is most intense at the base of the valley with establishment of the mining town and process areas. The gradual cut-and-fill roadworks will over time reach the head of the valley and the pit area, but due to the gradual approach local wildlife will have time to move and adjust to the activity. The valley topography is rich with minor gullies and landscape hills and slopes providing especially local caribou good opportunities to retrieve to quiet, out-of-sight and undisturbed areas.

Studies on caribou populations at Svalbard with a comparable herd structure show, that individuals that were exposed to high levels of human activities appear to familiarize and habituate to human presence (Colman, Jacobsen, & Reimers, 2001) (Hansen & Aanes, 2015). These studies often focus on response to hunting by humans on foot. Unpublished local observations from sites in Greenland indicate that wildlife, particularly caribou, do initially withdraw from sites of construction activity, but often return to these sites after a habituation period of varying duration. These behavioural observations were validated by local hunters during a public meeting in Qeqertarsuatsiaat (Rambøll, August 2023b).

Potential impact	Disturbance of mammals from human activity
Impact phases	Construction
VEC	Terrestrial mammals

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Short-term <1 year	Medium 25-75 %	

5.6.4.3. *Operation phase impact assessment*

Arctic Hare and Arctic Fox: Arctic hare and Arctic fox usually habituate well to human activities if not hunted. Especially foxes are swift to adapt to the presence of humans and are expected learn to benefit from the mining activities quickly. Thus, no measurable impacts on hares or foxes are therefore expected, and the impact is assessed to be negligible.

Potential impact	Disturbance of Arctic hare and Arctic fox
Impact phases	Operation and closure
VEC	Terrestrial mammals

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Long-term >5 year	Medium 25-75 %	

Caribou: Caribou is the largest local mammal and the most important game-species in the area and the local caribou population is expected to be disturbed in certain parts of the project area. The disturbance will typically be related to noise from blasting, traffic and machines, and visual disturbance from persons, buildings, and traffic.

It is difficult to distinguish whether a disturbance is caused by noise or visual disturbance. The impact from noise is assessed in section 5.6.1 and some of the arguments may be repeated in this section.

In Greenland caribou typically move around in small herds of 3-10 animals (whereas in North America they form large herds). An aerial screening was conducted by GAM in 2021. The screening revealed that min. 3-4 groups of caribou inhabited the project valley.

In general, caribou are sensitive to human activity and especially in areas with low human activity and very limited industrial development, as in most of West Greenland, where hunting is usually the type of human activity that disturbs the animals most (Skogland & Grønvan, 1988). This is indeed the case at Majoqqap Qaava prior to mineral exploration in the area. Studies from North America on caribou behaviour concluded that calving caribou avoided the area within 5-6 km from the disturbance (Cameron, Reed, Dau, & Smith, 1992). This is likely the case in Greenland also, but the project area has not been categorized as a caribou calving location. Studies have shown that their response to sudden human activity appears to be short term, with caribou moving away from areas of human activity but returning once the activity has been terminated (Bradshaw, Boutin, & Herbert, 1997).

Studies on larger migratory caribou herds in northern Québec and Labrador, Canada, indicate a notable disturbance from human activities. A study indicates that infrastructure, mining exploration and active mining has an impact on the migratory caribou populations. The study identified areas avoided by caribou among human activities (mines, human settlements, power lines, roads) and concluded that overall, human disturbances have a broad negative effect on caribou behaviour (Plante, Dussault, Richard, & Côte, 2018). The particular study area and caribou populations and herd dynamics do however not necessary translate to local Greenlandic conditions. Studies from Canada (including (Plante, Dussault, Richard, & Côte, 2018)) are usually conducted in areas with an incomparable level of human activity (large scale mining, large roads with heavy traffic, airfields etc.) why it is evaluated that e.g. (Hansen & Aanes, 2015) and similar studies from Svalbard translates better to the Greenlandic setting, Greenlandic caribou population dynamics and the project in question. Such studies along with valuable unpublished observations from actual mining projects in Greenland of comparable sizes as the project in question show, that caribou have been observed to adapt and habituate to mining activities over time, even utilizing the manmade roads as trails (pers. obs.). This indicates that dirt roads pose no significant barrier effect on caribou movement within an area. The MAQ project has no stretches of elevated ground structures such as on-ground pipelines or fences which could be an actual barrier to the local caribou.

It is likely that caribou may be displaced from the mining site during the operational phase, compared to their current distribution in the area. However, this displacement will constitute a very small part of their overall distribution in the region and feeding and resting will be possible within the near surroundings. Should the caribou, however, habituate to the mining activities in the project valley over time, the valley may even function as a sort of sanctuary for the caribou, as hunting for safety reasons will be prohibited within a specified range to the mining activities (Rambøll, August 2023b). The overall impact from the project on the caribou is considered minor as hunting is intense in the valley in periods of the year already and as experience has shown that Greenlandic caribou are to some extent able to adapt and habituate to human activity over time.

Potential impact	Physical disturbance on caribou
Impact phases	Operation and closure
VEC	Terrestrial mammals

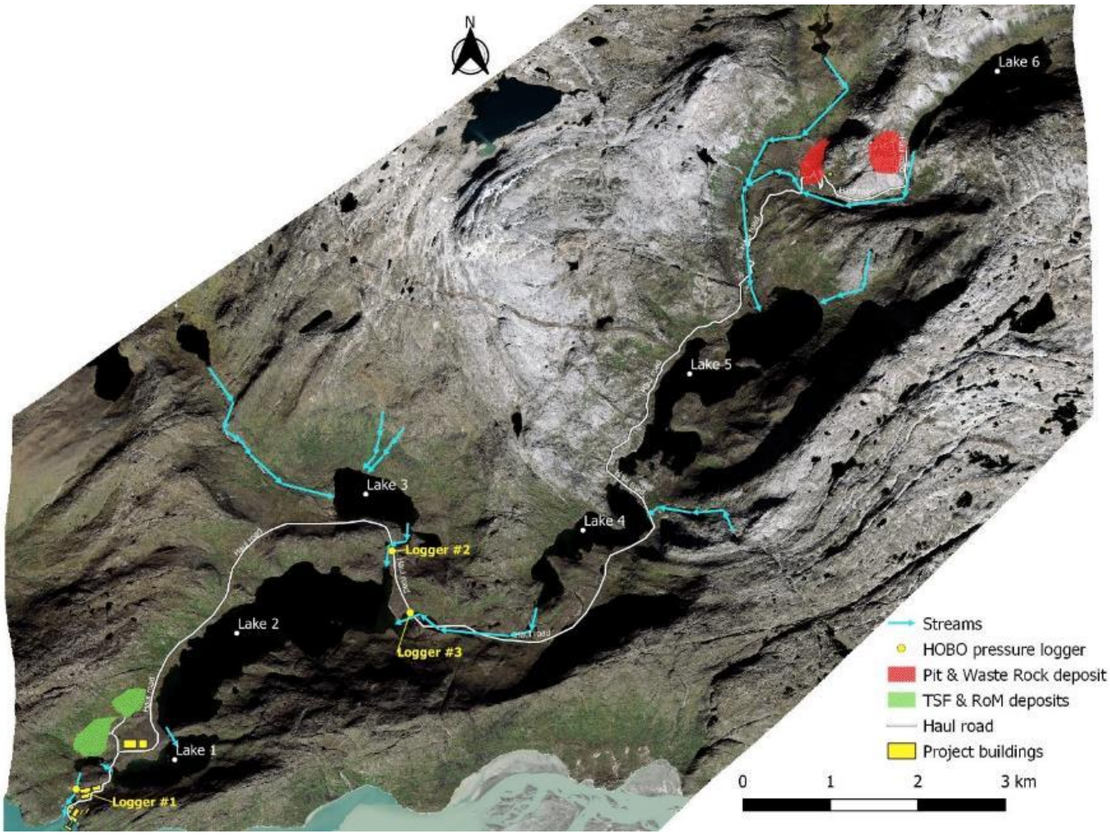
Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Minor
Local	Low	Long-term >5 years	Medium 25-75 %	

5.7. Freshwater

The freshwater system potentially affected by the planned project activities consists of 5 lakes interconnected by streams. The catchment area is approximately 175 km^2 and the total length of the freshwater continuum from the inland lake east of the mining area and to the marine recipient is roughly 16 kilometres, Figure 37.

5.7.1. Physical properties and impacts

Mapping the physical conditions of the freshwater in the valley included: a bathymetric survey of Lake #1 and Lake #2, in-situ flow measurements in rivers, temperature, and water level logging on strategic locations in the freshwater system.



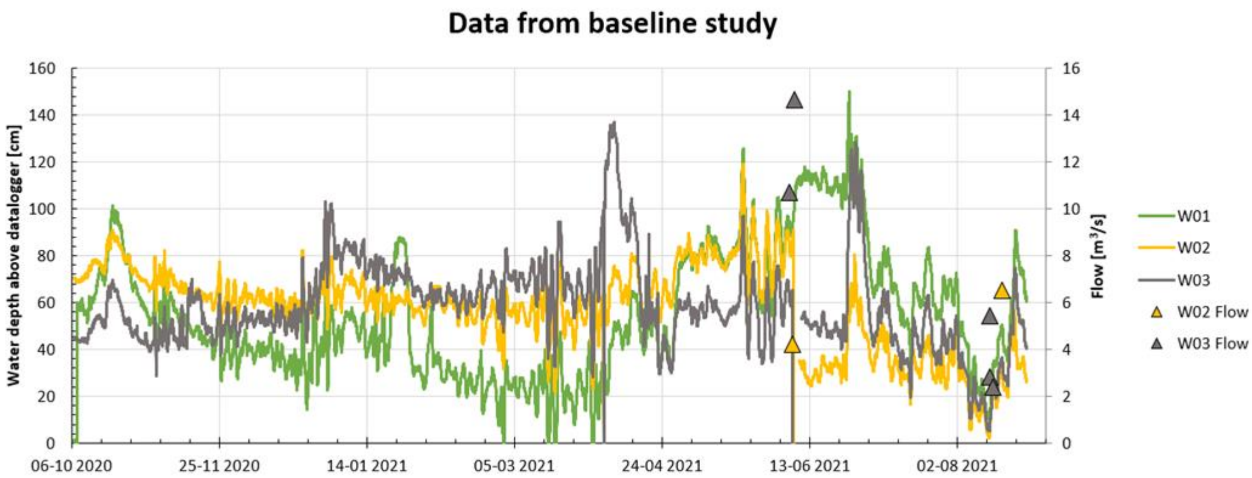


Figure 37: Measured water depth and flow from baseline study. Be aware that the water depth is the water depth above the data logger. The elevation above sea level cannot be determined because the elevation of the loggers is not measured. To prevent any confusion regarding topographical shadows on the satellite image, the area's drainage system, including the lake banks, has been accurately mapped in Annex 4.

5.7.1.1. Water balance in the area

The water balance in the area was calculated from three water level dataloggers. The loggers were placed at "bottle-necks" where a build-up could be expected. Figure 37 shows the project area with markings of the main tributaries and locations of deployed dataloggers. The loggers measured relative water depth[2] (cm) and the diagram below the map clearly shows the freshwater dynamics. From January till April, it appears that water is more or less constrained from flowing past Lake #1 due to frost. During April the spring melt event creates a peak at Logger #3 due to the large amounts of snow melting in the upper part of the valley. This signal spreads late April and May to Logger #1 increasing the relative depth by ~45 cm, which also gives an indication of the buffer capacity of Lake #2 during heavy rainfall and melt-off events. Figure 38 show the accumulated volume relative to depth of Lake #2.

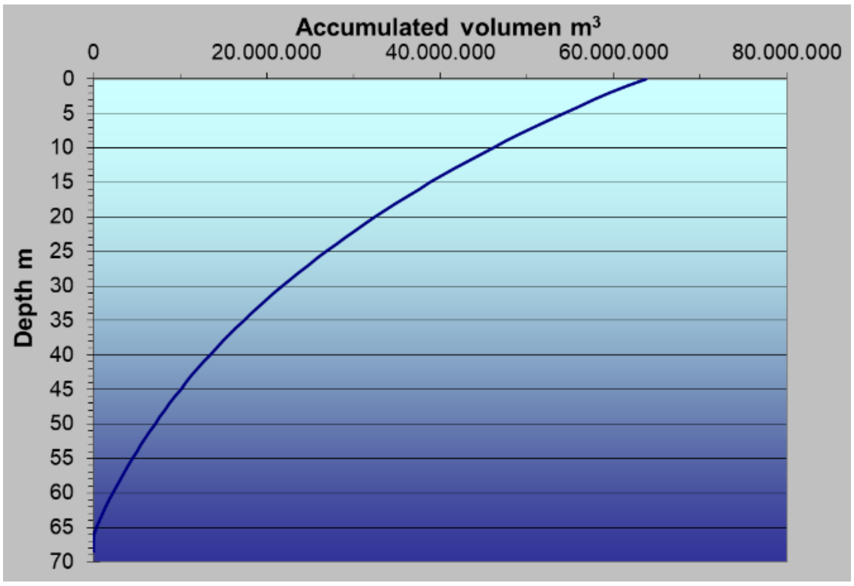


Figure 38: Lake #2 accumulated volume relative to depth based on bathymetric measurements.

Overall, the freshwater system dynamics are quite straight forward with few inlets and one major outlet. During fieldwork, waterflow was measured at key locations. These data validate the overall assumptions of the waterflow dynamics – that inflow to Lake #1 is almost solely defined by inflow rates from Lake #3 and from the valley ENE of Lake #2. Hence, insignificant amounts of water from other sources drain into Lake #2 (apart from surface runoff during rainfall). Figure 39 displays waterflow (m^3/s) at the 3 key waterways in the lower part of the system on June 8th. 2021. As expected, the flowrate at the outlet of Lake #2 of 18.77 m^3/s is roughly equal to the sum of the flowrates at the two major inlets.

[2] Relative and not actual water depth since the loggers were not all deployed directly at the bottom due to practical reasons.

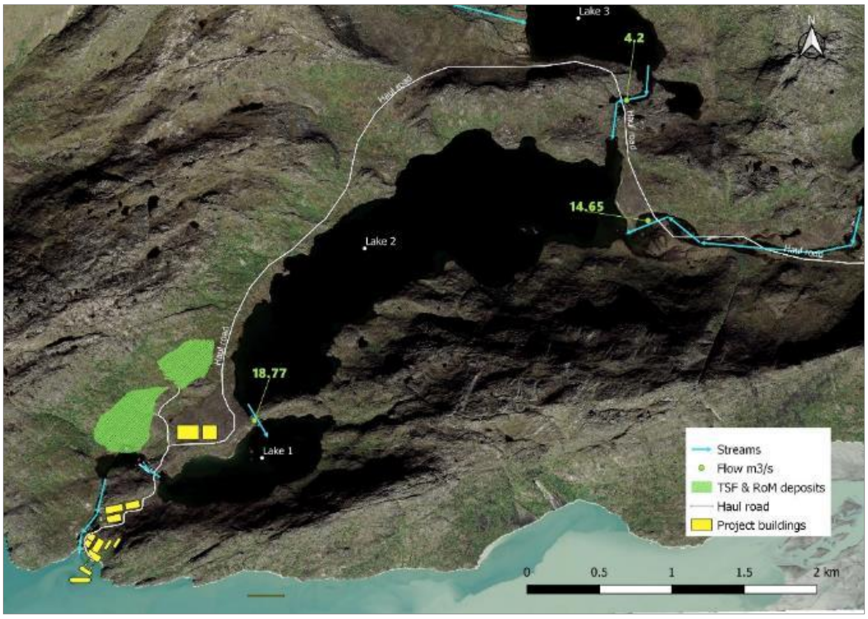


Figure 39: Left: Flowrates (m^3/s) at key locations on June 8, 2021, Right: SonTek ADCP measurement at Lake #2 outlet.

The water balance of the area responds quite quickly to larger rainfall events. The bedrock geology allows for minimal vertical transport and water is quickly concentrated in the main tributaries and lakes. Lake #2 acts as the main capacity buffer in the lower part of the valley with a surface area of roughly 2 km^2. Utilizing a *DHI MIKE Hydro River* model heavy rainfall events and their effect on the landscape was be modelled. Model setup is visualized in hydrology report figures 2.4 and 2.5 (NIRAS, January 2024). Precipitation data from Nuuk was correlated to precipitation data at the project site and this correlation was used to create a rainfall frequency plot defining the magnitude of 5-, 30- and 100-year events, Figure 40.

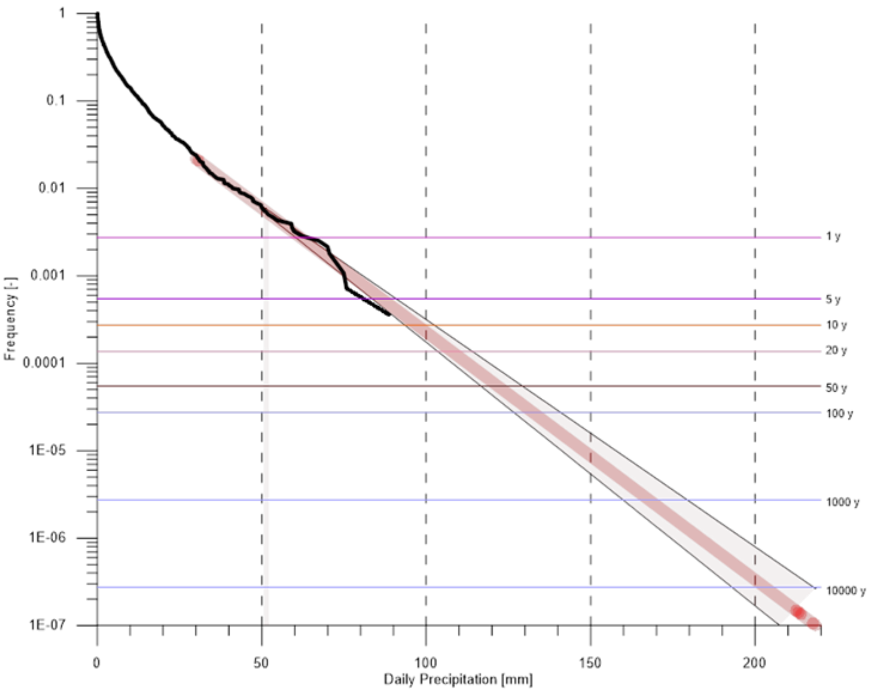


Figure 40: Frequency plot based on daily precipitation measurements in Nuuk (17-year timeseries).

The model showed that during prolonged rainfall equal to a statistical 5-year event the water level of Lake #2 raises up to 50 cm. A 100-year event would result in up to 100 cm above mean water level at specific stretches of water, but due to the generally sharp edged and steep riverbanks and wide main waterways, flooding of land areas would be minimal, Figure 43.

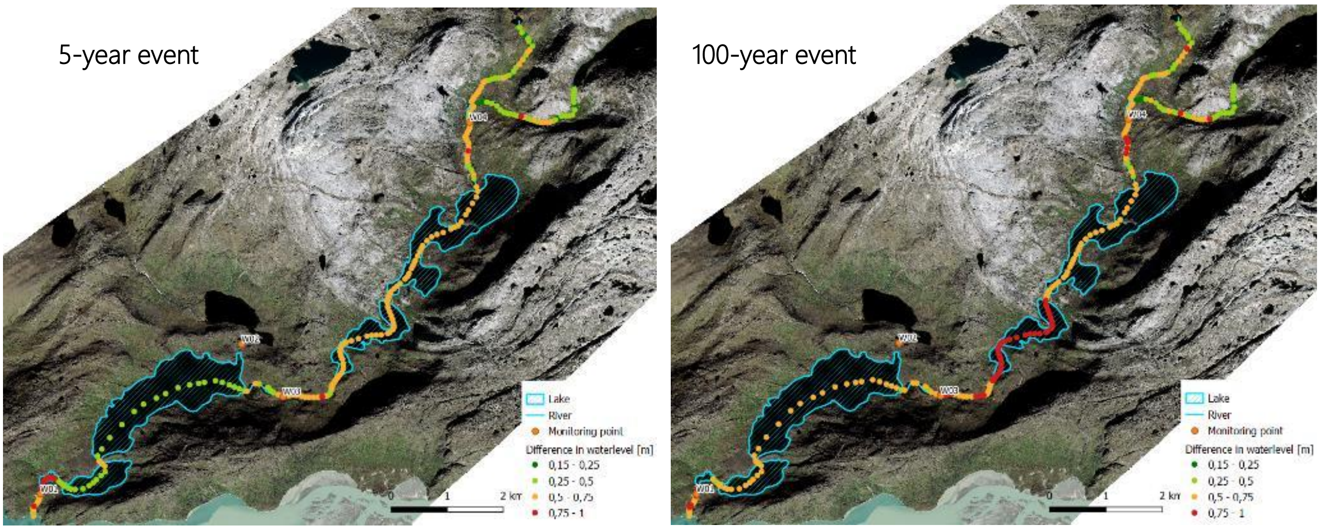


Figure 41: Charts showing expected difference in water level (m) through the freshwater system during a 5- and 100-year precipitation event.

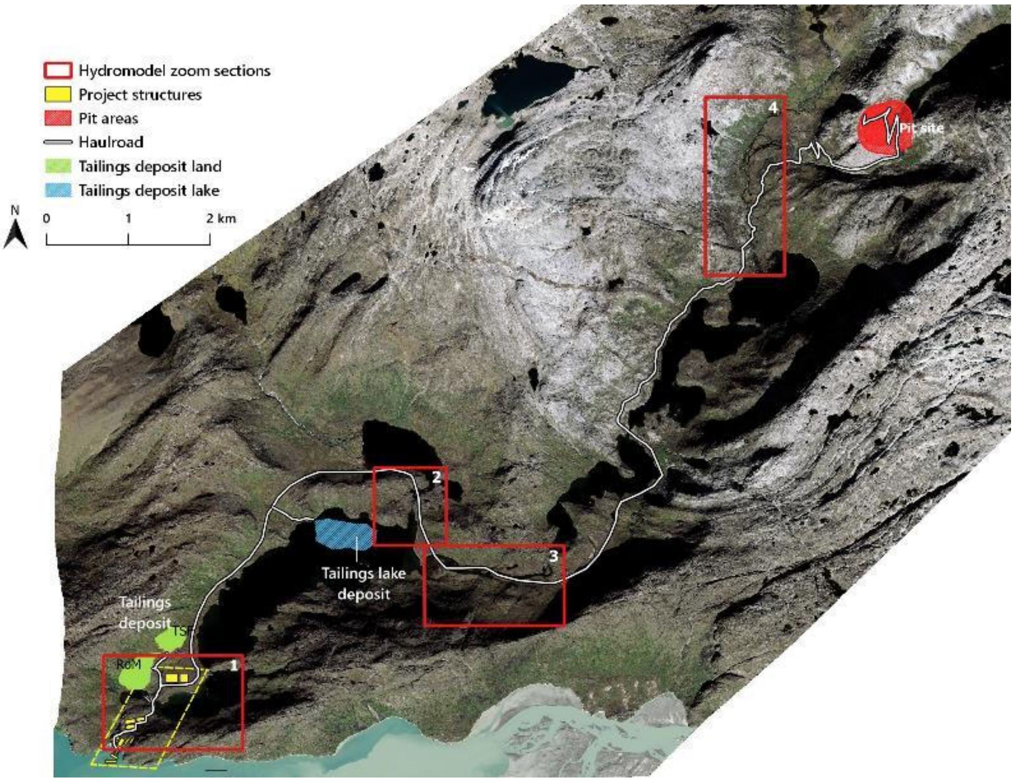


Figure 42: Map marking the flood modelled sections displayed in Figure 43.

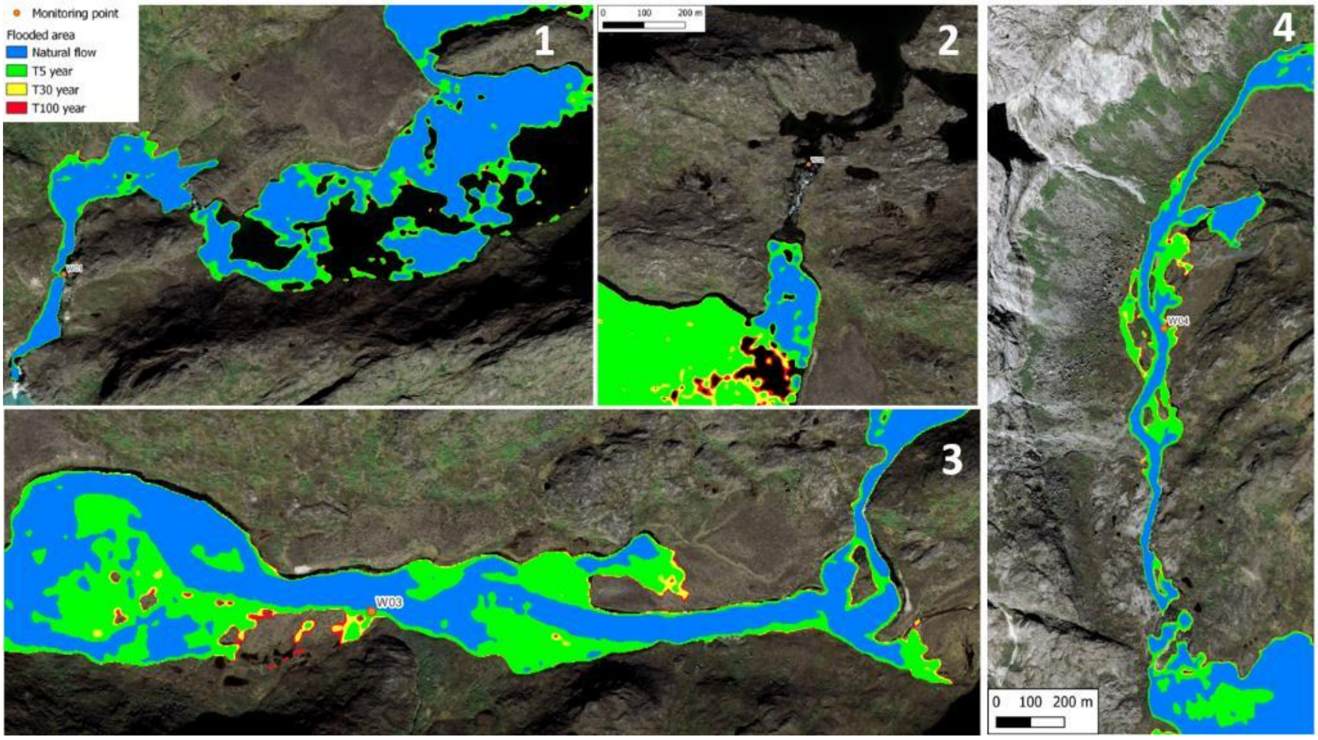


Figure 43: Maps showing modelled flooding scenarios for 5, 30 and 100-year precipitation events on selected stretches.

The hydrological model concludes that the water system will be able to distribute water masses equivalent to a 100-year precipitation event without flooding the planned primary project infrastructure areas. As seen in Figure 42 and Figure 43 the areas flooded during a 5-year event are mainly lowland and marsh areas identified during fieldwork as being occasionally flooded, so the model results consistent with personal observations where a night of heavy rain caused the water level in lake #2 to rise by 25 cm. The water level rise was measured with a surveyor stick deployed on arrival at the lakeside camp in June 2021.

Following the recommendations of the Global Industry Standard on Tailings Management (GISTM, 2020), a flood event of a 1:10,000 annual exceedance probability criteria (Probable Maximum Precipitation [PMP]) has also been assessed using the hydrological model developed for the project. A 10,000-year event is indeed an extreme event, and the resulting calculated values validate this fact. The resulting flow for a PMP-event (1:10,000 years event) at location W03 is 341 m^3/s which is a very high flow. The total flow from the project catchment area flushing to the recipient fiord during a PMP event is 513 m^3/s. To put this flow into perspective this value is comparable to the biggest rivers in Norway. The 1:10,000 annual exceedance probability flow is in the same range as the average flow of Norway's largest river, the *Glomma*. Glomma however, has a hydrologic catchment area roughly 240 times bigger (42,000 km^2) than for the river in the project area valley.

Even during an extreme PMP-event, the calculated flood extent is nevertheless remarkably small in most areas (see Figure 44), particularly at the base of the valley at the mine town zone. This is due to the sharply defined and steep shorelines of most parts of the freshwater system here. The flatter and marsh-like areas further upstream would then again be flooded during a PMP-event, after which the water level in the stream and lakes would withdraw to the normal steady state flow levels.

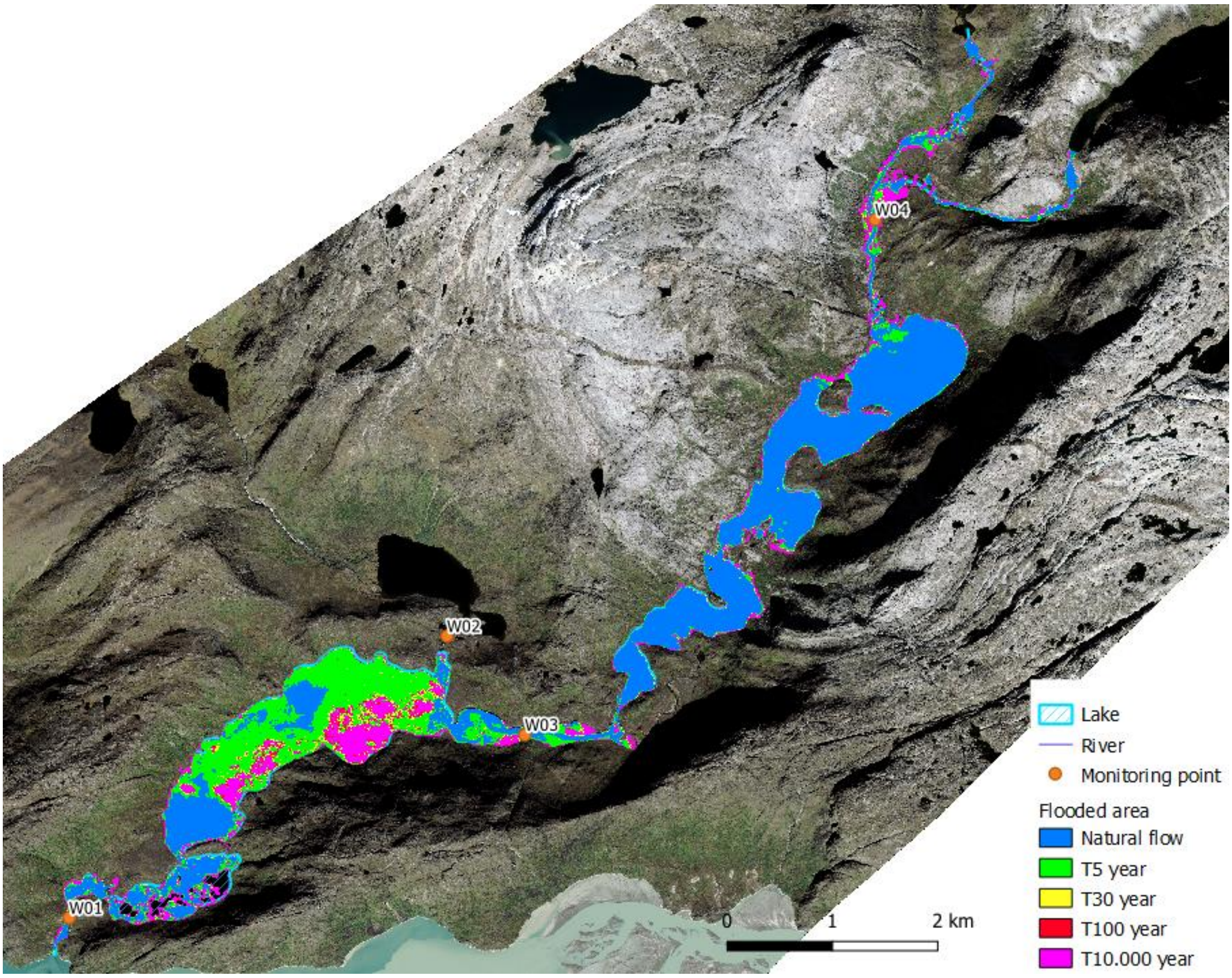


Figure 44: Map displaying the flood extent during various precipitation events. Pink visualizes a 1:10,000-year event.

5.7.1.2. Construction phase impact assessment

Overall, the project aims at avoiding changes in the freshwater continuum and there are no plans for dams or redirection of existing waterways in the area. During construction the only actual effect would be short-term work in and around waterway crossings. However, all crossings/bridges will be dimensioned to allow transportation of water masses equal to a 100-year precipitation event and so only negligible effects are expect to the freshwater continuum dynamics.

Potential impact	Altering the natural flow and transport of freshwater
Impact phases	Construction
VEC	Freshwater continuum

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Short-term <1 year	Medium 25-75 %	

5.7.1.3. Operation phase impact assessment

As mentioned, the project does not require any alteration of the natural flow of freshwater. Utilizing Lake #2 to deposit tailings would during LoM result in an elevation of the seabed with the deposition zone which would result in a decrease of the lake volume, Figure 45. This would in time result in a decrease in lake retention time but also an increase in the average summer temperature of Lake #2. On the other hand, depositing tailing in Lake #2 may increase the turbidity even if tailings are scurried beneath the summer thermocline in the lake. This elevated TSS levels in the lake may have the thermocline to establish higher in water column as the sun lights do not penetrate as far into the water as it does in clear water.

The overall effect on the natural waterflow and flow capacity of the freshwater system is however not expected to be affected by depositing tailings in Lake #2 and as such the changes of lake bathymetry on the ecology of the lake is minor.

Work at the pit site could result in the need to redirect surface water uphill from the worksites, which could lead to a more direct discharge into the stream south of the pit site. Again, this would probably have a visual effect but no effect on the overall water continuum or the general discharge of freshwater through the valley.

Potential impact	Altering the natural flow and transport of freshwater
Impact phases	Operation and closure
VEC	Freshwater continuum

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Minor
Local	Low	Long-term >5 year	Medium 25-75 %	

Overall, the project will be designed according to the natural freshwater system today and only minor effects is to be expected.

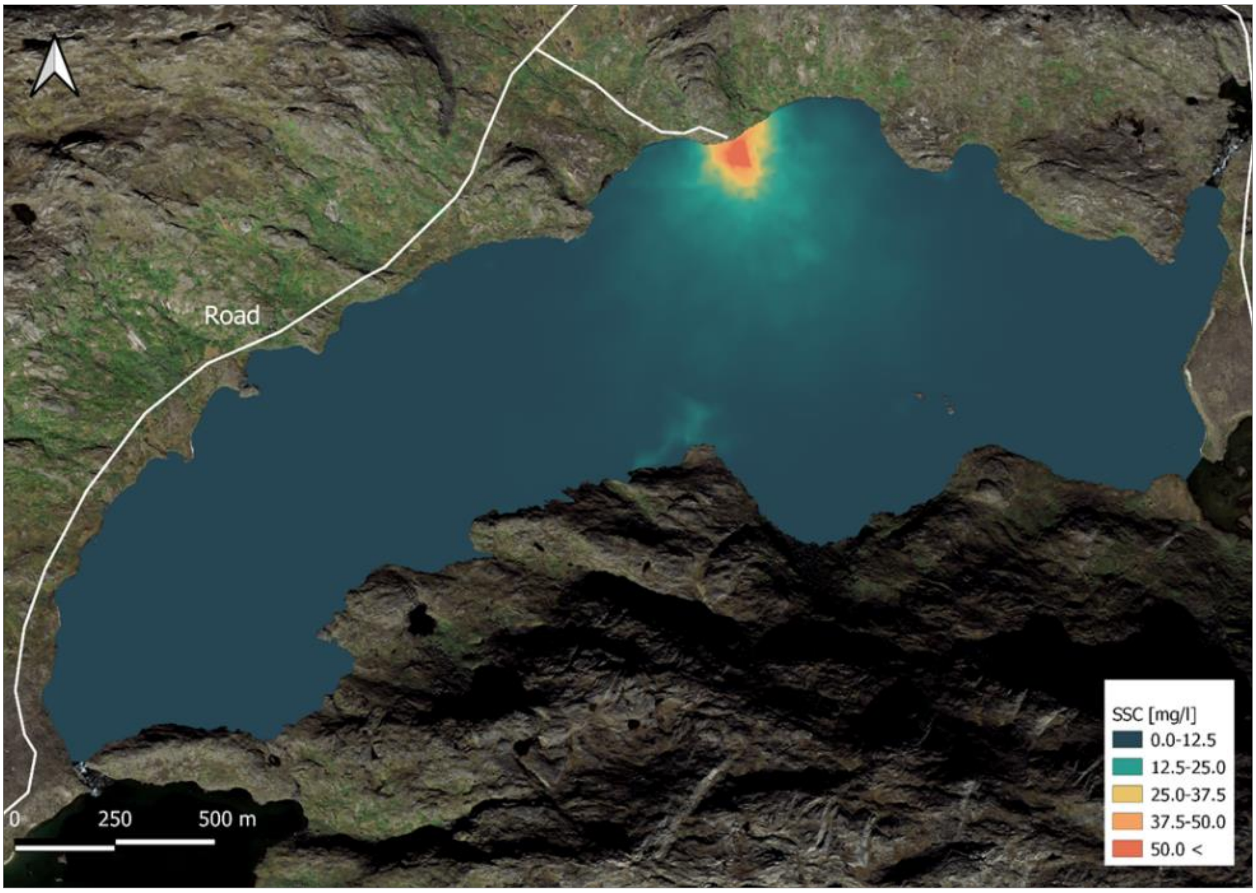


Figure 45: Sediment dispersion in Lake #2 modelled by MIKE 21 hydrodynamic [HD] flexible mesh model. Model assumptions are tipping of material to the lake surface at a constant rate reflecting Scenario B tonnage.

5.7.1.4. Bathymetry of lakes

The Majoqqap Qaava anorthosite Project area include five lakes. Bathymetric surveys were made in Lake #1 in 2020 and in Lake #2 in 2021. Lake #1 is relatively small (0.4 km^2) and is relatively shallow with at maximum depth of 12 metres and a volume of 1.75 million m^3. The area of Lake #2 is 2.16 km^2 and the volume is 63.7 million m^3, Figure 38. This results in an average depth of Lake #2 of 29.5 meters. The maximum depth is 68.5 meters, Figure 46.

Lake #2 has been identified as a possible tailings deposit, and the bathymetric survey identified a threshold in Lake #2 with depth rising from >40 meters to 27 metres in the south-western part, Figure 46. Lake #3 have not been systematically measured but drop-down measurements show approximately 20 meters depth in the central part of the lake. In Lake #2 and Lake #3 a thermocline was established during the summer. In august a thermocline of 6°C was established at a depth of 12-15 metres. Thus, the water column in Lake #2 was divided into an upper and a lower water layer during the summer. The lower column has approx. ~40 million m^3 water and the upper layer consist of roughly ~20 million m^3, Figure 38. The residence time of water in the upper water column during the summer is approximately 20-23 days. From start December to early May no significant water transport is expected. At thaw the water flow is expected to be increase and when water column is fully mixed the retention time is approximately 104 days (modelled using an assumed average water depth of 45 meters).

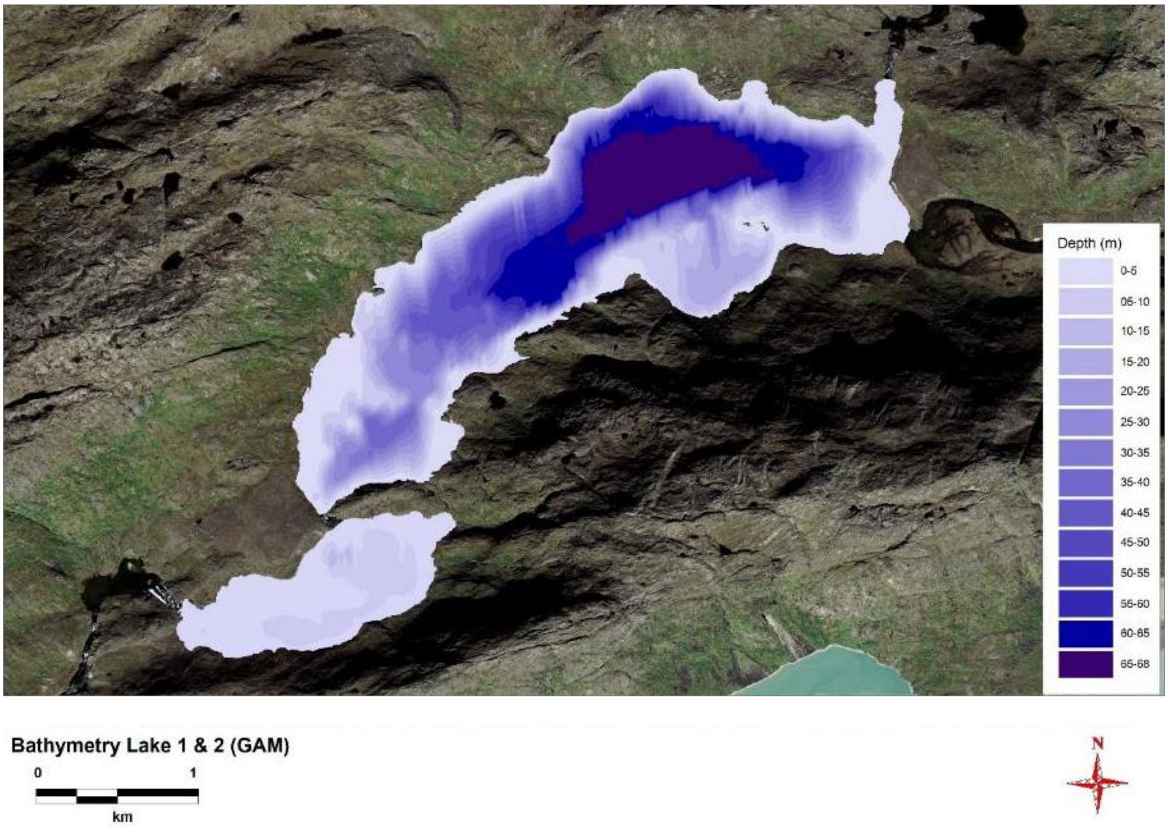


Figure 46: Bathymetry maps of Lake #1 and Lake #2.

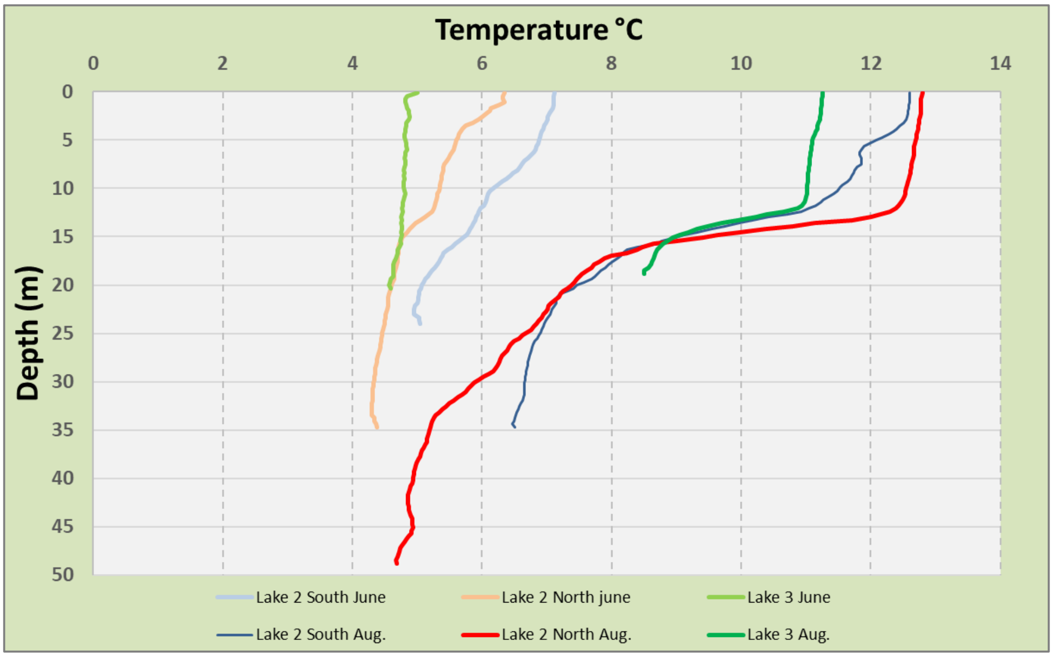


Figure 47: Temperature profiles from Lake #2 (South and North) and Lake #3.

5.7.2. Water chemistry

GAM has sampled and analysed water from eight stations in the project area in 2020 and 2021 and 2022. The samples have been analysed to determine the total metal concentration of 12 constituents, including As, Cd, Cr, Cu, Fe, Pb, Hg, Ni, Zn, Total-P (phosphorus) and Total-N (nitrogen). The natural content of trace metals in the Majoqqap Qaava anorthosite Project area is generally low with only a few elements occasionally exceeding the threshold criterium set by MRA, (Mineral Resources Authority, 2015).

The results of water samples from rivers showed an elevated background level of Total-P and Total-N. Neither Total-P or Total-N concentrations exceeded the MRA guideline levels at the stations; F01, F06 and F07 in October 2020. The Cu concentrations at station F07 in October 2020 were slightly higher than the MRA guidelines, Table 21. The average concentrations at station F06, F07 and F08 were all below the threshold limit. However, one sample at station F07 from September 2021 found Cu concentration of 7.2 µg/ltr.

Station	N	As	Cd	Cr (III)	Cu	Fe	Pb	Hg	Ni	Zn	Total-P	Total N	TSS**
							(µg/ltr.)						*mg/ltr.*
October 2020													
D.L. (µg/ltr.)	1	0.02	0.003	1	0.03	10	0.03	0.001	0.03	0.3	10	50	-
F01	1	<d.l.	0.009	<d.l.	0.87	<d.l.	<d.l.	0.001	0.21	3.8	17	290	-
F02	1	<d.l.	<d.l.	<d.l.	0.13	7	<d.l.	<d.l.	0.17	1.8	15	300	-
F03	1	<d.l.	<d.l.	<d.l.	0.11	<d.l.	<d.l.	<d.l.	0.09	1.2	32	190	-
F04	1	<d.l.	0.009	<d.l.	0.59	<d.l.	<d.l.	0.007	1.86	1.7	26	150	-
F05	1	0.05	0.006	<d.l.	0.49	<d.l.	<d.l.	0.002	0.15	2.4	24	190	-
F06	1	<d.l.	0.013	<d.l.	0.59	<d.l.	0.03	0.002	0.38	4.0	16	230	-
F07	1	<d.l.	0.023	<d.l.	3.51	1	0.04	<d.l.	0.47	6.8	16	170	-
F08	1	<d.l.	<d.l.	<d.l.	0.11	<d.l.	<d.l.	<d.l.	0.22	1.6	23	150	-
F09-ref	1	<d.l.	0.012	<d.l.	0.53	6	<d.l.	<d.l.	0.34	3.5	27	650	-
Mean (June-Oct.) 2021 and September 2022													
D.L. (µg/ltr.)		0.03	0.015	0.32	0.15	10	0.03	0.01	0.03	0.3	3	50	0.08
F01 mean	2	<d.l.	<d.l.	<d.l.	0.31	<d.l.	<d.l.	<d.l.	1.06	2.45	<3	120	2.99
F01 S.D.	2	-	-	-	0.07	-	-	-	0.84	1.05			
F02 mean	2	<d.l.	0.028	<d.l.	0.54	<d.l.	0.055	<d.l.	1.46	4.70	<3	180	2.09
F02 S.D.	2	-	0.025	-	0.04	-	0.014	-	1.15	1.50			
F03 mean	2	<d.l.	<d.l.	<d.l.	0.23	<d.l.	0.035	<d.l.	0.58	2.00	<3	61	0.50
F03 S.D.	2	-	-	-	0.04	-	0.009	-	0.39	0.20			
F04 mean	2	<d.l.	<d.l.	<d.l.	1.41	<d.l.	0.098	<d.l.	3.50	3.60	4	280	0.23
F04 S.D.	2	-	-	-	0.60	-	0.073	-	1.60	1.60			
F05 mean	2	<d.l.	0.046	<d.l.	0.73	<d.l.	0.383	<d.l.	1.92	3.15	<3	100	1.38
F05 S.D.	2	-	0.038	-	0.47	-	0.358	-	1.58	1.05			
F06 mean	11	<d.l.	0.015	0.18	0.34	<d.l.	0.045	<d.l.	0.94	3.01	3.6	103	0.46*
F06 S.D.	11	-	0.007	0.094	0.13	-	0.023	-	0.60	1.39	1.8	30	0.33*
F07 mean	10	0.07	0.039	<d.l.	0.99	<d.l.	0.129	<d.l.	0.80	23.37	<3	164	0.89*
F07 S.D.	10	0.05	0.068	-	2.07	-	0.249	-	1.21	52.90	-	105	1.38*
F08 mean	3	<d.l.	<d.l.	<d.l.	0.29	<d.l.	0.061	<d.l.	0.38	1.93	<3	62	0.29
F08 S.D.	3	-	-	-	0.08	-	0.036	-	0.08	0.40	-	16	0.13
F09-ref	1	0.06	<d.l.	<d.l.	0.48	<d.l.	0.130	<d.l.	0.55	3.50	3	77	0.29
MRA¥ threshold		4.0	0.100	3.0	2.0	300	1.0	0.05	5.0	10	20	300	50

*Table 21: Result of the filtered freshwater analyses from rivers in the project area. ¥ MRA GWQC for freshwater. * N=7 ** = 1. D.L. = Detection Limit for analysis.*

Lake water samples were collected both above and below the thermocline, Table 22. The lake water quality is generally good and most of the elements are below detection limit and none of the samples collected in the lakes in august 2021 had values above the threshold levels set by MRA. Lake #2 and Lake #3 both had very clear water with a secchi-depth of 21 meters. This is also reflected in Table 23 showing TSS levels of less than 1.5 mg/ltr.

Lakes 2021 and 2022			As	Cd	Cr (III)	Cu	Fe	Pb	Hg	Ni	Zn	Total-P	Total N
Station	*Strata*	*N*						*(µg/ltr.)*					
D.L. (µg/ltr.)			0.03	0.015	0.22	0.15	10	0.03	0.01	0.03	0.3	3	50
Lake #2 South Mean	Upper	2	<d.l.	<d.l.	<d.l.	0.475	<d.l.	0.05	<d.l.	0.51	1.75	<d.l.	90
Lake #2 South S.D.	Upper	2	-	-	-	0.075	-	<d.l.	-	0.00	0.55	-	30
Lake #2 South	Lower	1	<d.l.	<d.l.	<d.l.	0.650	<d.l.	0.22	<d.l.	0.79	4.40	<d.l.	67
Lake #2 North mean	Upper	2	<d.l.	<d.l.	<d.l.	0.375	<d.l.	0.05	<d.l.	0.41	1.85	<d.l.	98
Lake #2 North S.D.	Upper	2	-	-	-	0.205	-	0.03	-	0.06	0.75	-	32
Lake #2 North	Lower	1	<d.l.	<d.l.	<d.l.	0.490	<d.l.	0.18	<d.l.	0.91	2.40	<d.l.	120
Lake #3	Upper	1	<d.l.	<d.l.	<d.l.	0.440	<d.l.	0.30	<d.l.	0.33	5.50	<d.l.	65
Lake #3	Lower	1	<d.l.	<d.l.	<d.l.	0.310	<d.l.	0.05	<d.l.	1.90	1,70	<d.l.	66
MRA* threshold			4.0	0.100	3.0	2.0	300	1.0	0.05	5.0	10	20	300

Table 22: Result of the filtered freshwater analyses from Lake #2 and Lake #3 above and below the thermocline. S.D = Std. Derivation.

Station	Strata	N	Mean (mg/ltr.)	S.D.
Lake #2 south	Upper	1	0.110	-
Lake #2 south	Lower	1	0.120	-
Lake #2 north	Upper	2	0.085	0.035
Lake #2 north	Lower	2	0.245	0.065
Lake #3	Upper	2	1.369	0.601
Lake #3	Lower	2	0.238	0.058
MRA* threshold			50	

Table 23: Result of the freshwater TSS analyses from Lake #2 and Lake #3 above and below the thermocline. Mean and Std. derivation (S.D.) of values from June and August 2021.

5.7.2.1. Leaching from land-based tailings deposit

The land-based tailings pile is expected to cover an area of approximately 88,000 m^2 and add an elevation of roughly 20-40 meters to the natural terrain. The location of the TSF Dry at the base of a hillside will result in surface water draining to the tailings deposit. The amount of surface water draining to the TSF Dry is defined by local topography and the area defined as the catchment area. Using available height models the extent of the catchment area related to the tailings pile is estimated to be approximately 0.3 km^2. Berms and/or ditches will be required to divert up-hill water around the TSF Dry. This will minimize surface water entering the tailings stack thereby decreasing the potential leaching of particles and pollutants from the stack and increase stability. Rainwater will however drain through the stack (top-down) and is expected to be the main source for leaching water. The total annual precipitation in the Majoqqap Qaava area is measured to be 680 mm in 2021, which accumulates to a total of 59,840 m^3 water that would sieve through the tailings stack during that given year. In the camp area close to the TSF Dry area rainfall was registered approximately 40 % of the days, throughout the measure period from November 2020 to October 2022.

According to section 5.4.4, concentrations of As, Cd, Cu, Ni and Zn were found above the Greenlandic WQL's, within the first or second flush in either the Humidity Cell Test or the Down-Flow Percolation test. Hereafter the elevated values immediately dropped to levels well below the WQL's. However, the average daily concentration leaching from the tailing's deposits in the combined test period was determined to be below the Greenlandic WQL's.

Leachate transport dynamics:

To evaluate on the propagation of leached elements in the freshwater system, it is assumed that the inflow of water from the TSF Dry to Lake #2 will be thoroughly mixed with the water volumes situated at the southern part of Lake #2.

For freshwater entering the fjord the final concentrations are assessed using a box-model (Figure 48), that provides a method to estimate whether the local properties (mainly precipitation, flow and tailings amount) cause a dilution, or an up-concentration of the laboratory test results, hence projecting the laboratory results onto the physical setting of the project. These scenario calculations are based on several highly varying inputs why a range of assumptions need to be established, of which the overall assumptions used includes:

- In the period from 1 December to 30 April, the area is below freezing with little or no leachate,
- May is the month of first flush of tailings by precipitation and first snow melting,
- June is the month with maximum washing of material due to high precipitation and intensive snow melting,
- September is the month with minimum washing due to low precipitation and absence of snow in the catchment area,
- The tailings material is deposited equally in the TSF Dry over the year.
- Evaporation is not taken into consideration,
- All water from the precipitation event runs off to the river,
- Concentration of compounds in freshwater is a function of liquid to solid ratio from the column test and from the tailing's leachate, i.e. the test concentration dilutes with higher liquid to solid ratio and up-concentrates with lower liquid to solid ratio for a certain month.

Field parameters used in the calculations are:

- 600 t/day of deposited material,
- 80,000 m^2 deposition site,
- 680 mm/year precipitation,

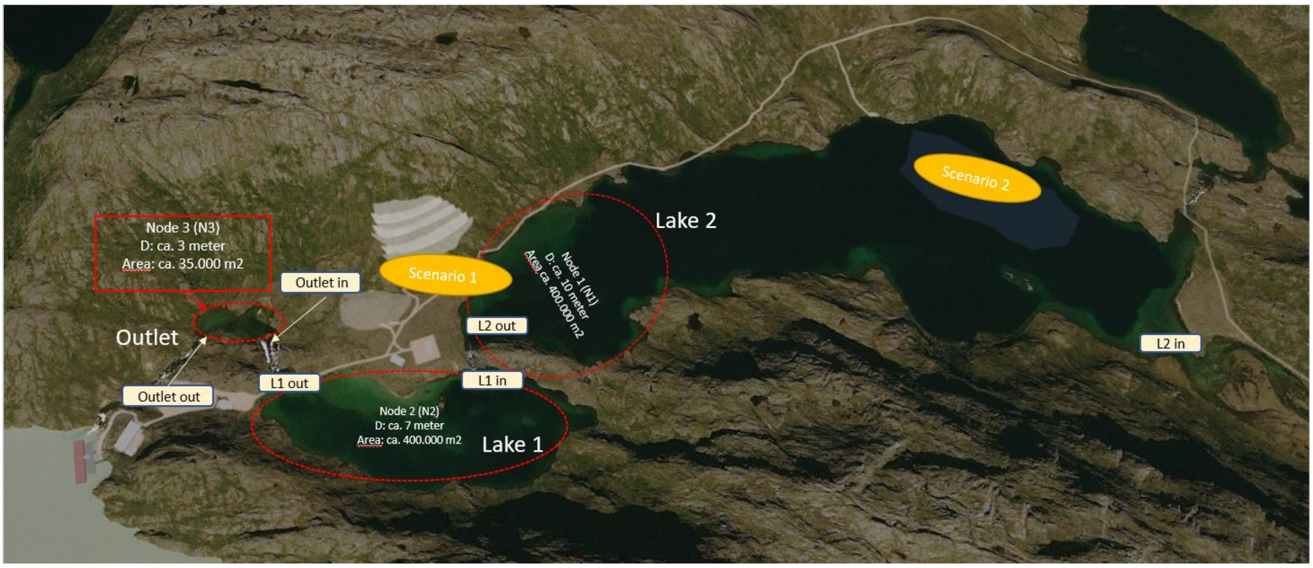


Figure 48. Setting and assumptions for box-model analysis of leachate element transport

Station		Normal state [m^3/s]	1:5 year [m^3/s]	1:30 year [m^3/s]	1:100 year [m^3/s]	1:10,000 year [m^3/s]
Lake #2	L2 in	1.5	63	73	79	341
	L2 out	1.8	79	91	98	504
Lake #1	L1 in	1.8	79	91	98	505
	L1 out	1.9	79	91	98	511
Outlet	Outlet in	1.9	79	91	98	512
	Outlet out	2.0	79	91	98	514

Table 24: Model simulated Water flow in the lake system bottleneck locations.

Assumptions for precipitation and water flow are:

- 100 mm/month i.e. 2.6 mm/day precipitation and 2 m^3/s waterflow in Outlet outflow in May (normal flow in Table 24)
- 250 mm/month i.e. 8.3 mm/day precipitation and 20 m^3/s waterflow in Outlet in June due to high precipitation and snow melting,
- 35 mm/month i.e. 1.2 mm/day precipitation and 0.5 m^3/s waterflow in Outlet in September due to low precipitation and absence of snow,
- 60-80 mm/month i.e. 1.9-2.6 mm/day precipitation and 0.5 m^3/s waterflow in Outlet in July-August and October-November,

Column test parameters for the quantification of downward leaching (geochemical Down-Flow column test) (scenario 1, Figure 48) are:

- 2.5 kg of tailings sample,
- 0.4 ltr. of water per month (2.4 ltr. of water over 6 months),
- 0.16 ltr. of leachate per kg of sample per month,

Liquid/solid ratio is dependent on precipitation and deposited material. Note that 'Solids flush monthly equivalents' is positive in May due to a large amount of deposited material in the previous month with little precipitation (fixed as snow/ice due to season). This up-concentration is however mitigated by the June scenario with high precipitation and additional flow due to melting of snow and ice – hence close to 0 accumulated unwashed monthly equivalents.

Down-Flow column test	Units	Column 1st month	May	June	July	Aug	Sep	Oct	Nov	Annual sum
Field parameters										
Deposit area	80,000 m^2									
Deposition daily	600 tons/day									
Total precipitation monthly	mm/month		100	250	80	60	35	75	80	
Total precipitation daily	mm/day		3.2	8.3	2.6	1.9	1.2	2.4	2.7	
Leaching daily	m^3/day		258	667	206	155	93	194	213	
Column test parameters										
Water/solid ratio	Ltr./kg	0.16	0.43	1.11	0.34	0.26	0.16	0.32	0.36	
Relation to column test monthly ratio (washed deposited monthly equivalents)		1.0	2.7	6.9	2.2	1.6	1.0	2.0	2.2	18.6
Accumulated washed monthly equivalents			2.7	9.6	11.8	13.4	14.4	16.4	18.6	
Deposited monthly equivalents			6.0	1.0	1.0	1.0	1.0	1.0	1.0	12.0
Available deposited monthly equivalents			6.0	4.3	1.0	1.0	1.0	1.0	1.0	
Solids flush monthly equivalents*			3.3	-2.6	-1.2	-0.6	0.0	-1.0	-1.2	-6.6
Accumulated Solids flush monthly equivalents*			3.3	0.7	-0.5	-1.1	-1.1	-2.0	-3.3	
Mixing factor: leachate / column first month			0.4	1.6	2.2	1.6	1.0	2.0	2.2	1.6
Up-concentration factor: column first month / leachate			2.2	0.6	0.5	0.6	1.0	0.5	0.5	0.6

*Solids flush equivalents where <0 = dilution

Table 25: Mixing volume of leachate in relation to Down-Flow leaching test (scenario 1).

The results of the Down-Flow geochemical column experiment demonstrate that leachate concentrations max out after 1-2 months in 43 out of 49 parameters (anions and nutrients, and dissolved metals) and the concentration decreases to <10 % or below the detection limit in 19 parameters, see appendix 1 in technical report on Hydrology (NIRAS, 2024d).

<u>Mass balance assessment:</u> Leachate from the deposit ends up as surface runoff in Lake #2 and subsequently downstream in Lake #1, in outlet and finally in the end recipient fjord. To evaluate on element quality criteria in freshwater mixing volumes are estimated as a simple box model of each freshwater body, where leachate is divided by the sum of volume and water exchange for normal (May), high (June) and low (September) waterflow. Ideal mixing in all water bodies is assumed to have occurred during one month of leaching and a constant flow in all water bodies, i.e. leachate mixes with the entire water in the affected part of Lake #2 (N1 in Figure 48) - and gets further mixed in the entire volume and the additional flow in both Lake #1 and Outlet.

Based on an extrapolation of a mass balance calculation using the above parameters, the dissolved mass (419 tons) accounts to 0.01 % of the total LoM deposit tailings (total 4.2 Mt), Appendix 1 in technical background report on Hydrology (NIRAS, 2024d). Five major components (anions and nutrients, and dissolved metals) constitute 82 % of the leached tailings mass (kg): sulphate 23 %, sodium 19 %, calcium 16 %, chloride 16 % and sulphur 8 %.

After deposition the dissolved mass elements in the system is expected to discharge into the sea 104 days after the end of the depositing period, which is the retention time of the lake/river system. As the geochemical column tests have shown, the initial flush is by far the most substantial in washing out elements why the leaching rate after a production stop is expected to fade to negligible levels within months.

Dilution in river/lake system	Unit	Lake #2	Lake #1	Outlet	Sum	Dilution of Down-Flow column test results
Area	m^2	400,000	400,000	35,000	835,000	
Depth	m	10	7	3		
Volume	1,000x m^3	4,000	2,800	105	6,905	
Conservative volume	1,000x m^3	400	280	11	691	
Volume	%	58	41	2	100	
Normal additional flow (May)	1,000x m^3/month	4,821	268	268	5,357	
Max additional flow (June)	1,000*m^3/month	46,656	2,592	2,592	51,840	
Min additional flow (September)	1,000*m^3/month	1,166	65	65	1,296	
Additional flow	%	90	5	5	100	
Sum volume and normal add. flow (May)	1,000x m^3/month	5,221	548	278	6,047	
Sum volume and max add. flow (June)	1,000x m^3/month	47,056	2,872	2,603	52,531	
Sum volume and min add. flow (September)	1,000x m^3/month	1,566	345	75	1,987	
Sum normal volume mixing (May)	1,000x	627	66	33	726	325
Sum max volume mixing (June)	1,000x	2,118	129	117	2,364	3,807
Sum min volume mixing (September)	1,000x	503	111	24	639	621
Sum normal natural dilution (May)	%	86	9	5	100	
Sum max natural dilution (June)	%	90	5	5	100	
Sum min natural dilution (September)	%	79	17	4	100	

Table 26: Mixing volume in the recipient freshwater system and total dilution factor for the first month of leaching including precipitation.

Down-Flow	Quality criteria		Calculated conc. with min. mixing m3			Geochem test result	
(scenario 1)	Fresh-water	Sea	Max Lake #2 (min mixing m^3)	Max Lake #1 (min mixing m^3)	Max Outlet (min mixing m^3)	Max test conc.	Avg. test conc.
	[µg/ltr.]	[µg/ltr.]	[µg/ltr.]	[µg/ltr.]	[µg/ltr.]	[µg/ltr.]	[µg/ltr.]
Arsenic, dissolved	4	5	0.000030	0.00002491	0.00002396	15.3	5.6
Cadmium, dissolved	0.1	0.2	0.00000058	0.00000048	0.00000046	0.3	0.0
Chromium, dissolved	3	3	0.0000017	0.00000140	0.00000135	0.9	0.5
Copper, dissolved	2	2	0.00027	0.00021976	0.00021143	135.0	17.9
Iron, dissolved	300	30	0.000052	0.00004232	0.00004072	26.0	11.3
Lead, dissolved	1	2	0.0000019	0.00000154	0.00000148	0.9	0.2
Mercury, dissolved	0.05	0.05	0.00000001	0.00000001	0.00000001	0.0	0.0
Nickel, dissolved	5	5	0.000091	0.00007455	0.00007173	45.8	5.2
Zinc, dissolved	10	10	0.000065	0.00005323	0.00005121	32.7	6.1
Nitrate (as N)	300		0.043	0.03516116	0.03382834	21,600	3,456.8
Nitrite (as N)	300		0.000013	0.00001058	0.00001018	6.5	1.9

Table 27: Quality criteria and concentrations estimated from maximum concentrations from Down-Flow column test and minimum natural dilution.

During the depositing season the concentration of dissolved compounds will vary in the three water bodies (Lake #2, Lake #1 and Outlet) depending on waterflow and precipitation. Concentrations of the compounds with Greenlandic quality criteria for mining activities do not exceed those criteria when estimated conservatively using maximum concentrations from the column test and minimum natural mixing volume scenarios.

The impact from leaching from the TSF Dry is expected to be local and have minor impact on the water quality. Impact from the TSF Dry stack is expected to be an issue during operation and closure and mainly be a result of suspended solids and elevated turbidity. However, impact during closure and post-closure is expected to be much less than during operation where new tailings material is added continuously.

Potential impact	Leaching chemical elements From TSF Dry stack – reduce freshwater quality
Impact phases	Operation and closure
VEC	Freshwater quality

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Minor
Local	Low	Long-term >5 year	Medium 25-75 %	

Five additional elements, Al, Sb Li, S and U, had values above other water quality criterions, such as the MAC for drinking water in EU and North America. All five elements, except S showed values below 100 µg/ltr. Highest values of these elements were 1 mg Al/ltr. and 5.27 mg S/ltr. Despite the elevated S value, no NAG's were found for the tailings, see section 5.4.1.

Closure of the TSF Dry will not introduce any special closure tasks, as the construction will be built solid during the operations phase. Thus, a closure of the TSF Dry will include an inspection of the dam and walls of the stack and a calculation of the static of the facility. This calculation will include best knowledge on changes in future weather regimes at the time of closure. This will make sure that the construction can withstand changes in the climate in particular increasing precipitation. A long-term TSF Dry stability assessment is included in background report Land Tailings Deposit and visualized in appendix E of said report. The overall conclusion of the long-term stability assessment is that a potential rise of the ground water table caused by unmaintained trenchworks could cause some decreased stability. The nature of the stack bedding will however likely mitigate these effects and the stack will in time reach 'steady-state' and follow natural erosion dynamics (NIRAS, 2023b).

Water leaching from the dry stack will continue during the closure phase, but the concentrations of elements mobilised will be less than during the operation, simply because highest mobilisation of elements occur within the first 2-3 weeks and no new tailings will be added during closure. The impact on the environment from leaching of elements from the TSF Dry during the closure and in case of a collapse of the dry stack is assessed to be negligible.

Post-closure is the long-term environmental impact from the mining operation. The impact during the operation phase was assessed to be minor because a new layer of tailing will be added the TSF Dry each day and the leaching tests showed that highest mobilisation of elements occurs within the first 2-3 weeks. When the mine is closed no new material will be added the TSF Dry, and only marginal leaching of elements is expected to continue. Thus, the impact on the freshwater environment is downgraded from minor during operation to negligible in post-closure.

5.7.2.2. Leaching from sub-aqueous lake tailings deposit

Tailings from the processing facility will be transported to the lakebed TSF deposit (TSF Wet) by trucks on their way to the mine. A suitable haul ramp will be constructed next to the lake, where trucks could safely tip tailings into a gravity pipe system leading to an adequate lakebed depth below the thermocline - for more details see section 4.6.2.

Normally, lakes have a water current at the surface that is generated by the wind. The current circulation is determined by the topography of the area both above and below water level. The gravity pipe system ensures sure that the tailings are released below the summer thermocline. In 2021 the thermocline was established at 15 m during the summer, Figure 47. In Figure 45 the 2D spread of particles are modelled using a worst-case scenario, where a gravity pipe system is not used, i.e., the tailings are tipped directly into the lake from the surface. The distribution of fine particles is expected to resemble that of chemical elements released from the shaken flask analyses.

Once the sediment is settled on the lakebed at 40-60 m the spread of fine particles is expected to be very limited as no waves can re-suspend the sediment at this depth. The current may be able to transport some of the upper most diffuse and fine sediment. Table 28 shows current velocity boundaries for sediment dispersal.

Velocity range	Sediment transport
$V > 0.25\ m/s$	Sediment will start to resuspend
$0.21 < V < 0.25$	Sediments will remain in the water column
$V < 0.21$	Sediments will deposit
$V < 0.05$	Sediments will move along the bottom of the lake

Table 28: Critical velocities for sediment dispersion.

Sediment transport is envisaged to be predominantly constrained to the lakebed, with marginal potential for migration. This projection is grounded in the presumption that tailings are discharged in areas with a water depth surpasses 40 meters. Moreover, the probability of current velocity at this depth exceeding 0.1 m/s is deemed highly unlikely, (NIRAS, 2024d).

The spread of contamination elements throughout the system is controlled by the mobilization (leaching) of elements, water flow and the retention time of the freshwater system. The water retention time in Lake #2 is estimated to be approximately 104 days.

To assess the leaching rate from an underwater deposit and the sequential spread in the freshwater system a similar approach as used on the land-based deposit assessment has been used. However, the assumptions differ since the flow dynamics are different on a lakebed. The difference in assumptions to the Down-Flow land-based leaching (scenario 1) are as following:

- The material is deposited under the seasonal thermocline,
- Full mixing of material with the entire lake volume under thermocline,
- Waterflow below thermocline is constant, without seasonal differences, i.e. inflow below thermocline and outflow in the water column above thermocline are equal,
- Water volume below thermocline is exchanged by waterflow below thermocline, and volume above the thermocline is conservatively not considered for volume mixing quantification,
- Mass reduction of the deposited material by washout under thermocline is not considered for quantification of the dilution factor by volume under thermocline,

Additional field parameters are:

- 4.2 million tons of material deposited in 30 years of mining,
- 40 million m^3 water volume in Lake #2 under thermocline.
- 10 % of waterflow in Lake #2 is under the thermocline, i.e. 0.2 m/s normal flow.

- 90 % of waterflow in Lake #2 is above the thermocline, i.e. 1.8 m/s normal flow.

The Up-Flow geochemical column trial setup differed from the Down-Flow test with the configuration below, which has an effect on the liquid/solid ratio, which is taken into account in the calculations:

- 3.5 kg of tailings sample,
- 4 ltr. of water in the first month (28 ltr. of water over 5 months),
- 1.15 ltr. of leachate per kg of sample in the first month,

Total dissolved element mass (65 tons) leaching from an underwater deposit in Lake #2 accounts to only 0.0016 % of the total 4.2 Mt deposited during LoM (compared to 0.01 % in land-based deposit, Scenario 1). This is a result of the decrease in flow through the tailings deposit at the lakebed since gravity is not pulling precipitation actively through the deposited layers as is the case on land. Instead, leaching underwater is driven by a much more subtle, passive laminar and sub-laminar flow. Five major components (anions and nutrients, and dissolved metals) constitute an even higher mass (kg) percentage of 91 % than in Scenario 1: sulphate 28 %, sodium 27 %, calcium 16 %, chloride 13 % and sulphur 7 %. The basic assumptions of leachate and volume mixing calculations is presented in Table 29.

Up-Flow column test	Unit	General	1 Year	30 Years
Column test parameters				
Column water/solid ratio	ltr./kg (m^3/tons)	1.15		
Mixing volume in Lake #2 below thermocline				
Deposition	million tons		0.14	4.2
Volume under thermocline	million m^3	40		
Water/solid ratio in volume under thermocline	ltr./kg (m^3/tons)		286	9.5
Volume mixing factor: deposition in volume ratio / column ratio			248	8
Deposition daily	tons/d	600		
Water flow under thermocline	m^3/s	0.2		
Seconds per day conversion factor	s/d	86,400		
Water flow under thermocline	m^3/d	17,280		
Water/solid ratio in flow under thermocline	ltr./kg (m^3/tons)	29		
Volume mixing factor: deposition in flow ratio / column ratio		25		
Total natural dilution factor under thermocline			6,222	207
Mixing volume in Lake #2 above thermocline				
Water flow above thermocline	m^3/s	1.8		
Water flow above thermocline	m^3/d	155,520		
Volume mixing factor: below / above thermocline		9.0		
Total natural dilution in Lake #2			55,998	1,867

Table 29: Leachate - freshwater mixing at deposit in Lake #2 (scenario 2) compared to Up-Flow geochemical leaching test.

During the deposition season the concentration of dissolved compounds will vary in the 3 waterbodies (Lake #2, Lake #1 and Outlet) depending on waterflow and precipitation. Compared with a Greenlandic quality criteria for mining activities the concentrations of the elements leached do not exceed those criteria when estimated conservatively for year 1 and year 30. The conservative estimates for the production phase are based on the maximum observed leaching values for each element (µg/l, geochemical column test) multiplied by the estimated minimum seasonal volumes of the three lakes (*Lake #2, Lake #1 and Outlet*). Table 30 displays estimated conservative concentrations for '*Max Lake #2*' (Lake #2 volume), '*Max Lake #1*' (volume Lake #2 + Lake #1) and '*Max Outlet*' (volume Lake #2 + Lake #1 + outlet). The used volumes are calculated for minimum volume exchange based on 2021 data. Concentrations for a 30-

year period incorporates the larger maximum tailings volume and the resulting reduced Lake #2 mixing volume. Year 30 Lake #1 and Outlet volumes are assumed unchanged.

Up-Flow	Quality criteria		Calculated conc. with min. mixing m³						Geochem test result	
(scenario 1)	Fresh-water	Sea	Max Lake #2	Max Lake #1	Max Outlet	Max Lake #2	Max Lake #1	Max Outlet	Max test conc.	Avg. test conc.
				Year 1	(min mixing m³)		Year 30			
	[µg/ltr.]	[µg/ltr.]	[µg/ltr.]	[µg/ltr.]	[µg/ltr.]	[µg/ltr.]	[µg/ltr.]	[µg/ltr.]	[µg/ltr.]	[µg/ltr.]
Arsenic, dissolved	4	5	0.00039	0.00013	0.00011	0.01173	0.00019	0.00016	21.9	4.42
Cadmium, dissolved	0.1	0.2	0.00000009	0.00000003	0.00000003	0.00000273	0.00000005	0.00000003	0.0051	0.0050
Chromium, dissolved	3	3	0.000011	0.000004	0.000003	0.000316	0.000005	0.000004	0.59	0.509
Copper, dissolved	2	2	0.00037	0.00013	0.00011	0.01120	0.00019	0.00015	20.9	3.22
Iron, dissolved	300	30	0.00018	0.00006	0.00005	0.00536	0.00009	0.00007	10	10
Lead, dissolved	1	2	0.0000022	0.0000007	0.0000006	0.0000659	0.0000011	0.0000009	0.123	0.0573
Mercury, dissolved	0.05	0.05	0.00000009	0.00000003	0.00000003	0.00000268	0.00000004	0.00000004	0.005	0.005
Nickel, dissolved	5	5	0.00017	0.00006	0.00005	0.00505	0.00008	0.00007	9.42	1.433
Zinc, dissolved	10	10	0.000032	0.000011	0.000009	0.000964	0.000016	0.000013	1.8	1.08
Nitrate (as N)	300		0.00	0.00	0.00	0.05	0.00	0.00	84	16.14
Nitrite (as N)	300		0.00	0.00	0.00	0.00	0.00	0.00	1	1

Table 30: Quality criteria and concentrations estimated from maximum concentrations from Up-Flow column test and minimum dilution in deposition year 1 and 30.

The overall concerns with respect to tailings disposal differ from a land-based deposit and a deposit under water. For a land-based deposit, the main concerns are the actual physical lasting footprint in the landscape and physical structural integrity, risk of pollutants leeching to the surroundings and unintended spread of pollutants from wind erosion. The benefits of a lake deposit are minor impact on the landscape, indications of an inert deposit with little to no dispersion from deposited material in the deeper part of the lake and a maintenance free post-closure scenario. From a production point of view a disadvantage is the fact that once material is deposited on great depth then it is non-recoverable for potential further utilization.

It is estimated that the risk of severe metal leaching from a sub-aqueous deposition of tailings at GAM's project area is <u>minor</u> (NIRAS, January 2024).

Potential impact	Leaching chemical elements from TSF Wet stack (sub-aqueous) – reduce freshwater quality
Impact phases	Operation and closure
VEC	Freshwater quality

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	
Local	Low	Long-term >5 year	Medium 25-75 %	Minor

5.7.3. Phytoplankton

The primary production of phytoplankton is expected to be low due the level (<3 µg/ltr.) of total phosphorus concentrations found in Lake #2, Table 22 The effect from the leachate from the TSF Wet was tested in a laboratory. As more or less similar elements are mobilized from the TSF Dry as from the TSF Wet, the test results will be a proxy for both tailings deposits. The test used composite of mining leachate samples generated through environmental testing of a real-world material via an Up-Flow percolation test. The test organism was the plankton algae *Pseudokirchneriella subcapitata.* The algae were exposed to an undiluted initial flush composite over a 72-hour period. Initially a potential effect was observed but in a second test run, nutrient was added to the composite fluid, and it was demonstrated that the effect observed in the first setup was a result of limited nutrients available rather than element toxicity of the composite fluid, Figure 49. The test showed that none of the elements with elevated concentrations were found at a toxic level for the phytoplankton. Similar, cocktail effect of several elements having elevated concentrations could be seen from the test, (Fera Science, 2023b).

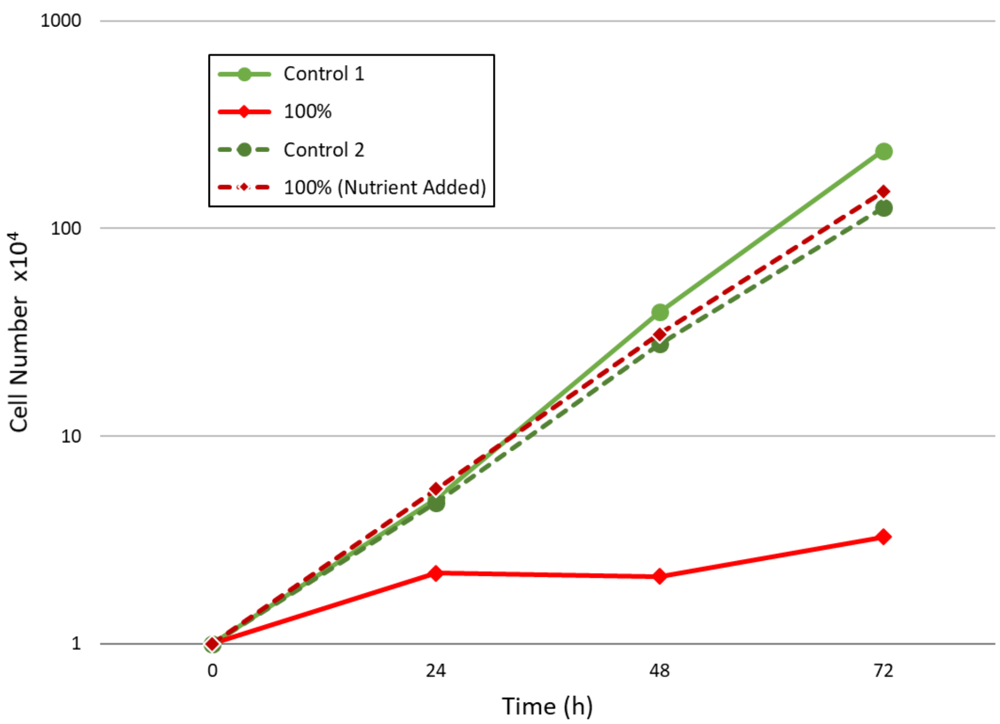


Figure 49: Mean cell number of Pseudokirchneriella subcapitata in the control and undiluted composite sample dependent on time, in the definitive and supplementary tests.

Potential impact	Effect of leaching from TSF on phytoplankton
Impact phases	Operation
VEC	Freshwater quality

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Long-term >5 year	Low 25 %	

5.7.4. Invertebrates

River and lakes both constitute the freshwater habitat for many insect larvae. The most diverse and dominant order are Diptera (flies and mosquitoes), that constitute more than 50 % of all insect species found in Greenland (pers. obs.). The two dominating families are *Simuliidae ssp*. (blackflies) and *Chironomidae ssp*. In 2021 a few “kick samples” were made at a station in the river connecting Lake #2 and Lake #4 (St. F07) and at a station just before the outlet to the fjord (St. F08), Figure 50 and Figure 51. Low numbers of invertebrates were found in the project areas and the most abundant group was *Simuliidae ssp*., Table 31. The ecological role of freshwater macro-invertebrates is significant, as they are canalizing energy up the food web, by foraging on benthic and planktonic algae before acting as food items for other insects, fish (including Arctic char) and birds.

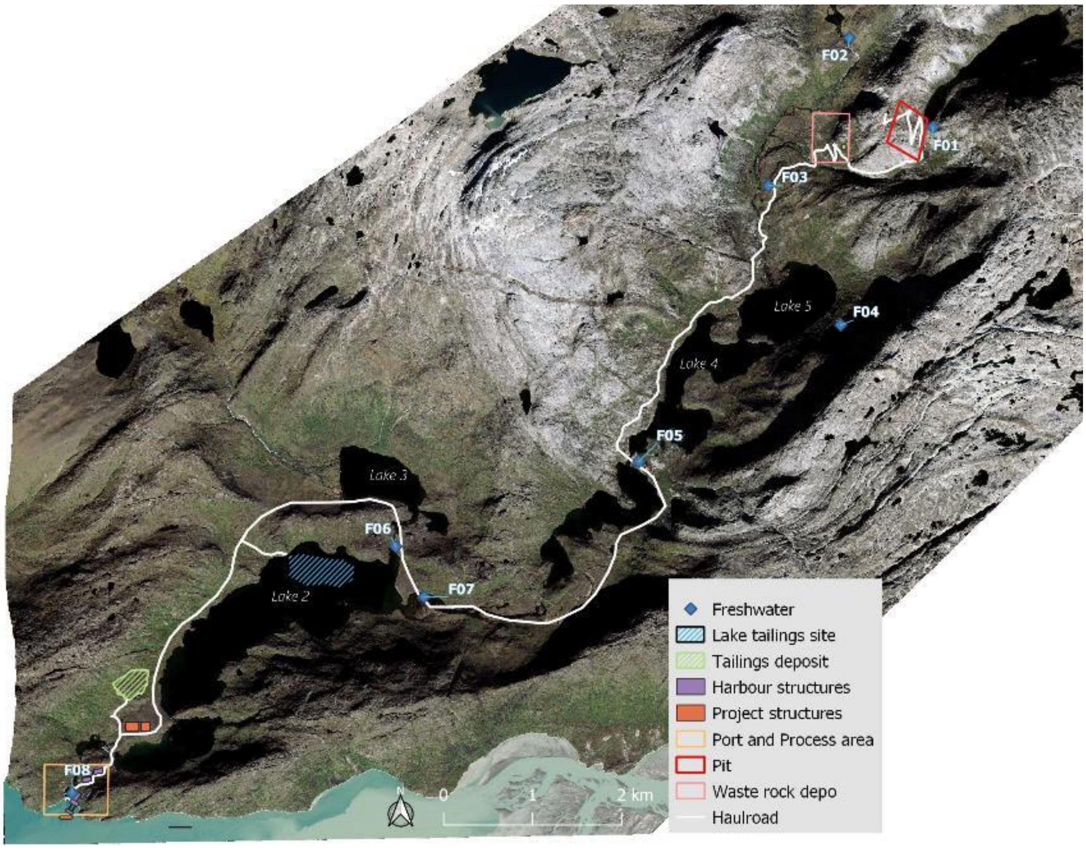


Figure 50: Map showing the 8 freshwater stations.

Station	Organisms	Rank
F07	*Simuliidae ssp*	+++
	Midge sp.	+
	Trichoptera sp.	+
F08	*Simuliidae ssp*	+
	Chironomidae sp.	+
	Oligochaeta sp.	+
	Trichoptera sp.	+

Table 31: Result of two kick-samples in the river system (rank + = one specimen and +++= more than 10 specimens).

In the lakes no specific invertebrate survey was made. However, a few diptera was observed at the northern shore of Lake #2. During baseline fieldwork attention was on potential presence of tadpole shrimps (*Lepidurus arcticus*) and/or fairy shrimp (*Branchinecta paludosa*) but none were observed. However, this is normal in freshwater habitats with a population of Arctic Char.


Figure 51: Kick sampling (left) and example of sample (right).

5.7.4.1. Construction phase impact assessment

As there are no plans to divert or alter the existing waterways and as the construction phase does not include deposition of materials in most of the freshwater sources. Thus, no impact is expected to the invertebrate community.

5.7.4.2. Operation phase impact assessment

Simuliidae spp. and *Chironomidae spp*. are the most common benthic invertebrate species in the freshwater. The ecological role of the invertebrates is important as they, together with zooplankton, are the major vector in canalizing energy up the food web. The Midges eats the pelagic- and benthic algae and they serve as a food source for fish and birds. In general, benthic invertebrates can withstand temporary high levels of suspended solids and experience a fast recovery after short time exposure but become increasingly affected by long-term exposure even at low TSS levels. Suspended sediment effects on invertebrates include direct impacts due to abrasion, interference with respiration and by clogging of filtration mechanisms. The effects from TSS on the benthic invertebrates are species specific and affect filter-feeders the most and may include forced drifting, change in respiration, and decreased settling of new individuals, (Robertson, Scruton, Gregory, & Clark, 2006). In extreme cases mortality from smothering and burial may occur, (Berry, Rubinstein, Melzian, & Hill, 2003). The highest levels of TSS are expected to occur in the southern part of Lake #2 as well as Lake #1 and the rivers downstream, where the system will also receive suspended solids from the deposition of tailings.

The density of diptera larvae and zooplankton in Lake #1 and parts of Lake #2 is expected to be unaffected as the TSS levels is modelled the be less than 12.5 mg/ltr. in Lake #1, most parts Lake #2 and in the river downstream Lake #2.

Beside TSS, high concentrations of chemical elements may have influence in the benthic invertebrates. In the eluate elevated concentration of copper have been found in most of the kinetic tests. Midges are in general tolerant toward high copper concentrations and lethal effect [LC50] has been found at 30 mg/ltr. (50 mg/ltr. $CaCO_3$). Less tolerant is the mayfly (not found in the GAM area) and large mortalities has been found at concentrations of 25 µg/ltr. in ten days, (Eisler, Handbook of chemical risk assessment: health hazards to humans, plants, and animals, 2000). These concentrations are much higher that the estimate for Cu concentration in rivers downstream Lake #2 during operation and closure.

The Daphnia is a planktonic invertebrate-group of which 5 species is commonly found throughout Greenlandic lakes, (Böcher, 2001). Life-cycle exposures of four daphnia species to graded concentrations of copper show reductions in survival at more than 40 ug Cu/ltr. and reductions in growth and reproduction at 40 to 60 ug Cu/ltr (Eisler, 1997). Studies have found that increasing copper concentrations in freshwater in the range of 0 to 50 ug/ltr., causes a reduction in total zooplankton and changes in diversity; within 4 days, copepods became dominant at the expense of *Cladocera's* (including daphnia), (Eisler, Handbook of chemical risk assessment: health hazards to humans, plants, and animals, 2000).

The impact from the marginal changes in water quality generated by the GAM mining project on Daphnia magna, has been tested by Fera Science Ltd., (Fera Science, 2023a). The test design included the immobility of daphnia by exposure for 48 hours to different concentrations of composite fluid. The composite fluid was mixed from all the initial flush in the Up-Flow percolation test and was diluted from 0-99 %. The result of the test showed no immobility of daphnia in any of the tests, not even in the undiluted fluid. This demonstrated that the concentrations of potential harmful elements are below levels that have impact on zooplankton. Additionally, no cocktail effect by the mixture of elements with elevated concentrations was observed. The impact from mining activities including leaching form TSF Wet will be negligible impact on the zooplankton.

The overall impact from the mining activities on invertebrates is assessed to be negligible as the effect is local and low in magnitude even though it will occur during the entire lifetime of the mine i.e., more than 25 years. Furthermore, recolonization during post-closure will be fast due to the flying adult stage of the mosquitoes and the short life-cycle of the daphnia.

Potential impact	Reduction of Benthic invertebrates and zooplankton
Impact phases	Construction, Operation and Closure
VEC	Freshwater invertebrates – changes in water quality

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Long-term >5 year	Medium 25-75 %	

5.7.5. Fish

The freshwater fish species in the Majoqqap Qaava project area constitutes Three-spined stickleback (*Gasterosteus aculeatus*) and Arctic char (*Salvelinus alpinus*). The three-spined stickleback is found in many lakes including isolated lakes not connected to other freshwater bodies. In the project area three-spined sticklebacks were observed at several locations and are expected to be present in the entire river continuum as well as the lakes.

Arctic char is found in freshwaters throughout Greenland. Arctic char occurs in two forms – a migrating anadromous form and a resident form. The anadrome form spawns and lives its first 3-5 years in freshwater, before starting to migrate and spending the summers at sea, before returning to freshwater in the autumn/winter. The resident form is present in lakes and or streams throughout its lifetime. The freshwater system in Majoqqap Qaava anorthosite Project area includes five large and relatively deep lakes connected by a main river. During the baseline study of the rivers and lakes in the project area, arctic char has been caught with multi-mesh gillnets in both Lake #1 in (2020) and Lake #2 (in 2021), see Figure 54. The length of the fish caught was from 7 to 42 cm, length frequencies are presented in Figure 55. Of the smaller individuals some were already mature despite their size and are assumed to be a part of a resident lake-system stock. To investigate if the larger specimens are andadromous, otoliths from three of the largest mature fish were removed and subjected to a Sr-laser ablation analysis. The Sr-analysis can determine whether a fish has spent time in seawater or has remained in freshwater, by analysing the levels of Sr. The elevated levels of Sr in seawater will be incorporated into the fish otolith thereby providing a distinct signal related to the sea.

The results from Majoqqap Qaava showed no indication that any of the three analysed specimens had been in the Ocean, Figure 52. If so, the Sr signal would show at least two peaks with values nearing 10^6, which was not the case. This means that either one or both waterfalls from the fjord to Lake #2 are too steep for char to be able to pass them, Figure 53.

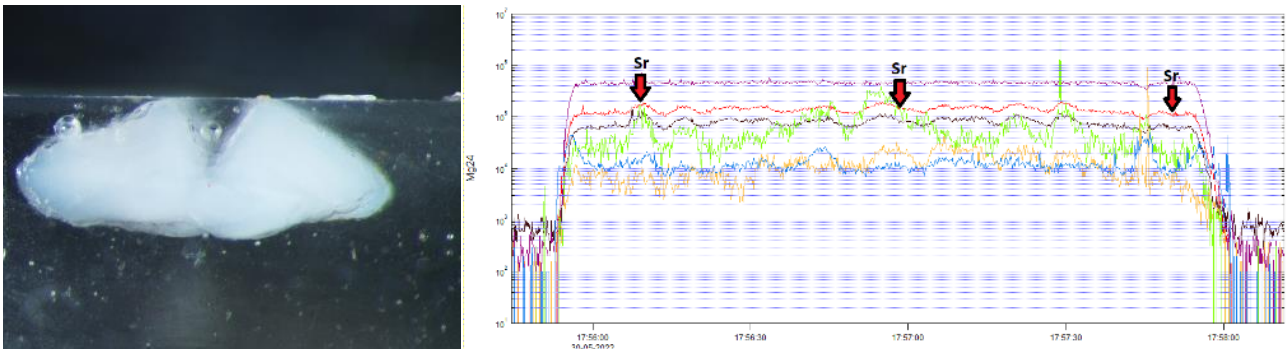


Figure 52: Otolith prepared for analysis from arctic char caught at Majoqqap Qaava and example for laser ablation readout.

The fact that the river in the Majoqqap Qaava valley is not a migration path for arctic char means that the arctic char caught is part of a resident population. Usually, migratory trout populations consist of larger individuals and also proportionally larger younglings, since the growth rate is much higher during their stay at sea. Stationary lake populations hold fewer large individuals, and with individuals often being smaller when reaching maturity. The larger individuals are often piscivores (feeding on fish) in order to get sufficient energy, impacting the population size. Due to larger populations with bigger individuals the anadromous populations and their habitat rivers are generally considered a more valuable ecological component than the secluded smaller lake populations, due to the much larger secondary production and the spin-off effects this has on the surrounding ecology including the marine ecosystem.

Beside the Majoqqap Qaava project valley the Qeqertarsuatsiaat fjord system holds numerous rivers known as good fishing locations, and the Qeqertarsuatsiaat Kangerdluat is commonly used by local hunters and fishermen for catching arctic charr with gillnets, Figure 56 (Nielsen, Mosbech, & Hinkel, 2000); SIA interview input from hunters in Qeqertarsuatsiaat (Rambøll, 2023b) (Rambøll, 2023a).

Figure 53: Waterfall at the outlet into the fiord (left) and at the entrance to Lake #1 (right).

Figure 54: Shoal of Arctic char (10 fish) close to the outlet to the fjord (left) and a shoal of Three-Spined sticklebacks in the river between Lake #4 and Lake #2 (right).

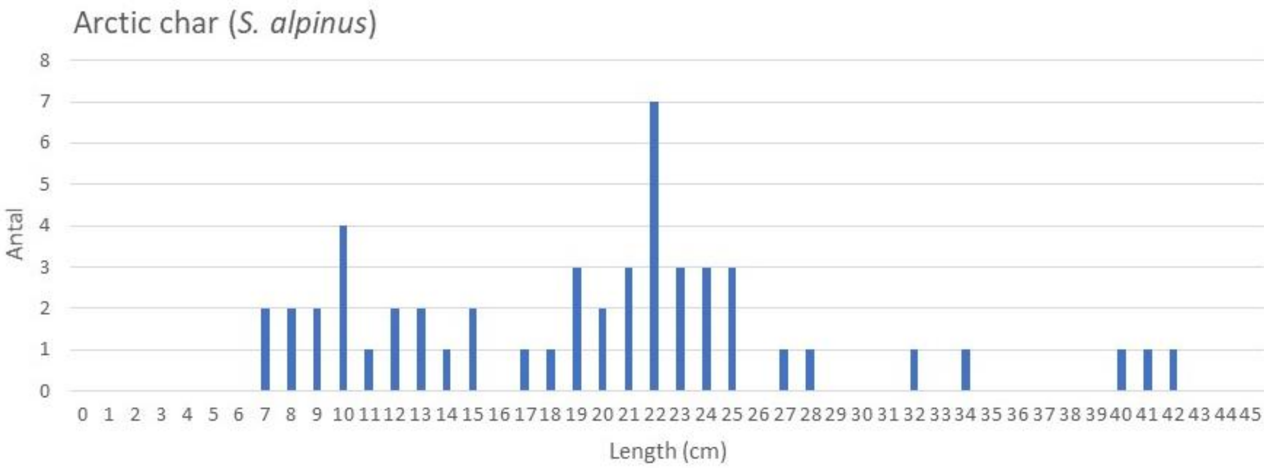


Figure 55: Length frequencies of Arctic char caught in three multi-mesh survey nets in Lake #2 in August 2021.

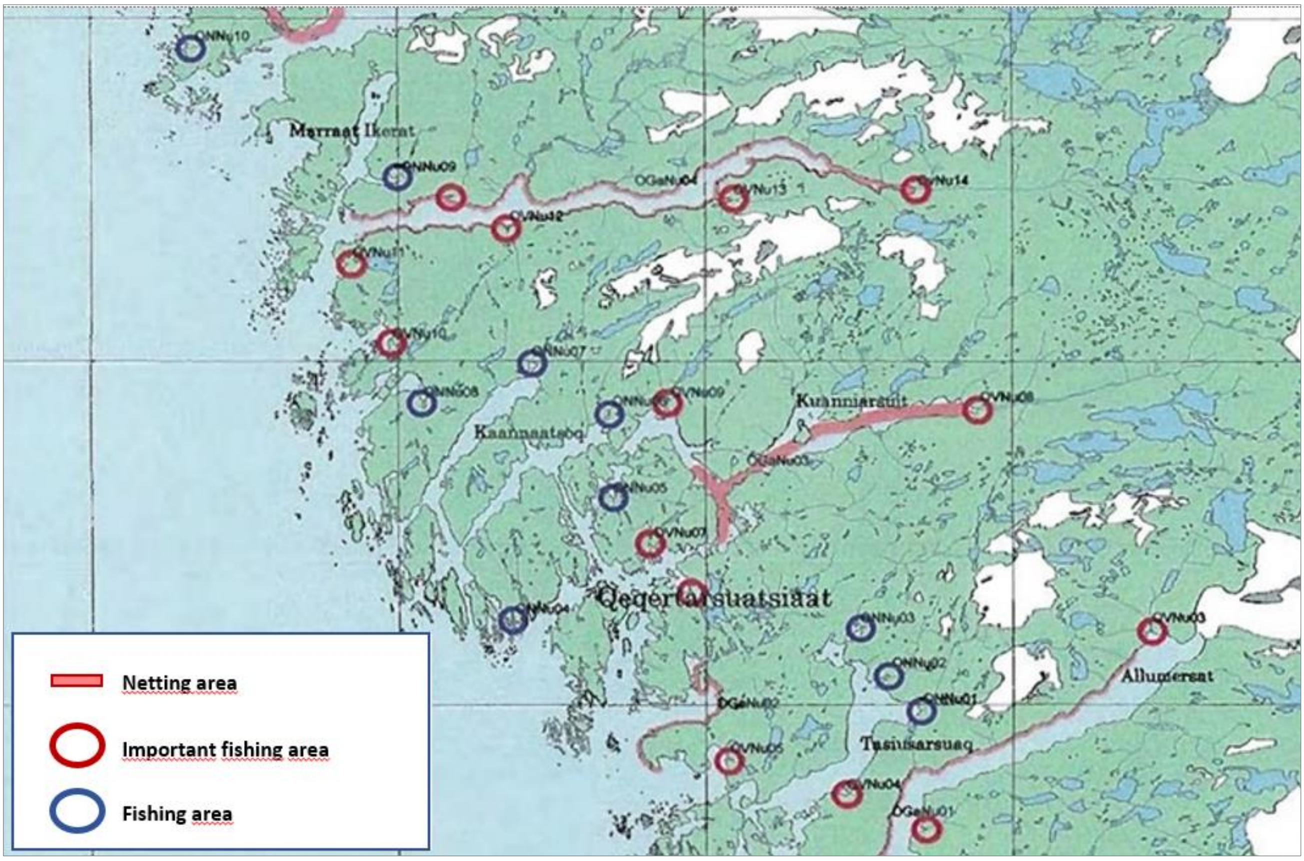


Figure 56: Important area for fishing Arctic char at Qeqertarsuatsiaat.

5.7.5.1. Construction phase impact assessment

The construction phase is not expected to impact arctic char in the project area. All construction will take place on land except for the 4 or 5 river crossings, which will require some work in the river. Constructing the river crossings will be a temporary construction phase which will probably require some digging or even blasting, which would result in dispersion of solids and gravel being flush downstream. This could affect the river stretch downstream, but the crossings will be constructed and dimensioned to have the least possible impact on the natural flow and any temporary change in terms of increased turbidity and dispersion of sand and gravel is expected to return to baseline state within a short time span.

Regarding waste and wastewater, this will be handled at the very base of the valley close to the marine recipient and is not as such expected to have any eutrophication effect on the freshwater system – see section 5.12. Sticklebacks are widespread and quite resilient fish not registered as a vulnerable and will not be evaluated further.

Potential impact	Freshwater fish population
Impact phases	Construction and Post-Closure
VEC	Arctic char

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Temporary <1	Medium 25-75 %	

5.7.5.2. *Operation phase impact assessment*

During the baseline studies the lower parts of the freshwater system were investigated for fish. In the lowermost part of the system several (>20 individuals) juvenile Arctic char (*Salvelinus alpinus)* was observed in small dead-end creeks and pools, see Figure 57. During the 2020 fieldwork a few specimens of arctic char were caught in Lake #1, with one individual being adult.

During the 2021 fieldwork, gillnets were placed on 2 locations in Lake #2, to establish weather arctic char were present, and if so, if they were a stationary or anadromous population. The gillnets caught numerous arctic chars and though no fishing efforts were made in Lake #3 and Lake #4, arctic char is likely also found here. Three-spined sticklebacks (*Gasterosteus aculeatus)* were observed throughout the freshwater system. Analyses indicate that the population of char in the project valley is a resident population.

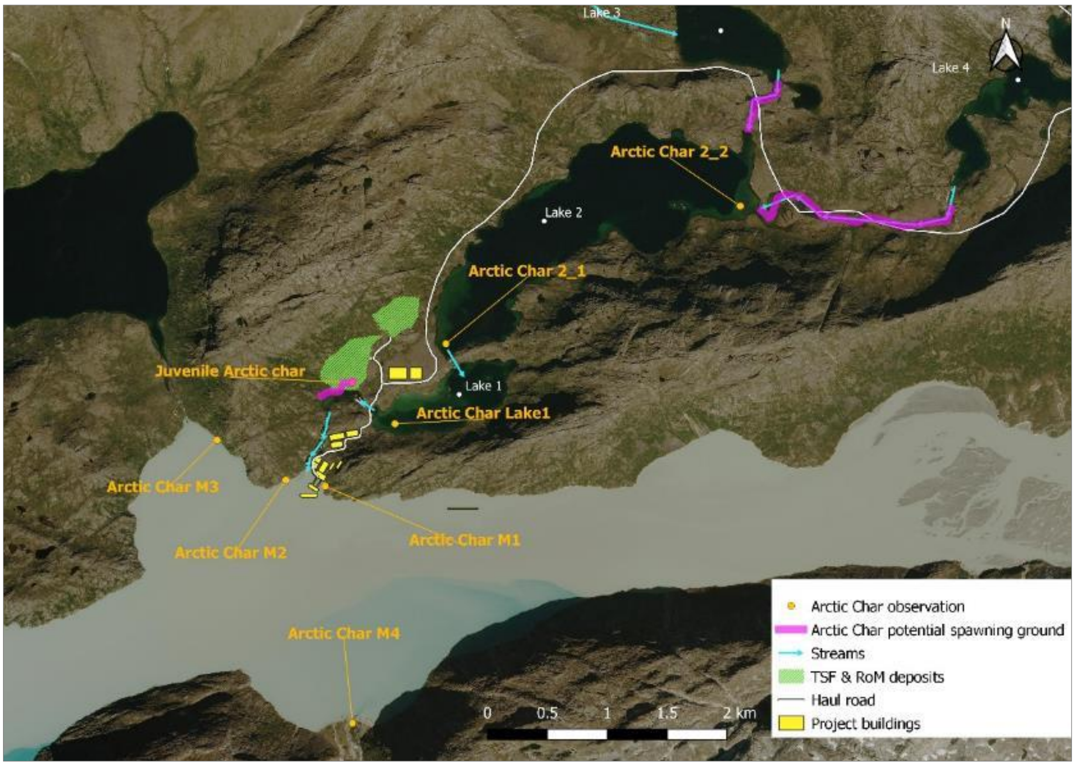


Figure 57: Map showing Arctic Char samples.

The most significant impact to Arctic char is generally considered to be the release of pollutants and fine sediments to rivers or lakes and the obstruction of streams connecting the sea and freshwater spawning grounds. Overall, arctic char is very resilient to high turbidity levels and freshwater fish can in general tolerate high levels of suspended solids (SS) and lethal effect is first seen at concentration above 10,000 mg/l. (Robertson, Scruton, Gregory, & Clark, 2006). This is apparent from the amount of char caught in the highly turbid inner parts of Qeqertarsuatsiaat Kangerdluat, also, M1-M4 in Figure 57. Additionally, recent data from another project site proved presence of Arctic char in a highly turbid glacial freshwater lake in Southwest Greenland (NIRAS, 2021a). Hence, an increase in turbidity would not directly force local arctic char from their habitat, but studies have shown that salmonid spawning grounds are susceptible to lower hatching success and potentially lower hatchling survival due to sediment clogging the eggs, depriving them from sufficient oxygen (Low, Igoe, Davenport, & Harrison, 2011).

As for the previous assessed organisms Cu is the only element that potentially may affect the freshwater fish. No copper dose response experiments on Arctic char (*Salvelinus alpinus*) have been found but the very similar brook char

(*Salvelinus fontinalis*) was investigated, and it was found that concentrations from 3.4 to 17.4 µg Cu/ltr. did not affect survival, growth, and reproduction of adults. However, exposure to concentrations of 17.4 and 32.5 µg Cu/ltr. showed noticeable effects on survival and growth of fry and juvenile. The LC50 was found to be 100 µg Cu/ltr. at exposure of 96 hours, (Eisler, Copper hazards to fish, wildlife, and invertebrates: a synoptic review. U.S.Geological Survey, Biological Resources Division, Biological Science Report, 1997). The Cu concentration was estimated to be 15.85 µg Cu/ltr. in the leachate from the TSF Dry and this concentration will be diluted significantly in Lake #2.

Previously, phytoplankton and zooplankton concentrations has been assessed to be unaffected by the mining activities and as such the food availability to both arctic char and stickleback are expected to remain at the same levels as before the mining activities. However, with all indicators pointing towards the arctic char population in the valley being a resident population, the unlikely reduction of the char population would have only very local ecological effects.

Impact to the freshwater system is unavoidable when initiating mining activity in the project area. However, with the expected level of disturbances, and the expected highest impact in the lowest parts of the freshwater system, the overall ecology of the larger part of the valley streams and lakes would suffer a minor and likely reversible impact.

Potential impact	Reduction of freshwater fish populations
Impact phases	Operation and Closure
VEC	Freshwater fish, particularly Salvelinus alpinus

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Minor
Local	Low	Long-term >5 year	Medium 25-75 %	

5.7.6. Freshwater birds

Several birds are associated with freshwater in Greenland. Species of geese use lakes for resting, whereas other species utilize lakes and rivers for foraging, especially on invertebrates and Arctic Char. Of the birds associated to freshwater, the common loon (*Gavia Immer*) and the Harlequin Duck (*Histrionicus histrionicus*) are included in the Greenland Red List of threatened species, both listed as Near Threatened [NT] (Boertmann & Bay, Grønlands Rødliste, 2018a).

In 2003 1 male and 5 female Harlequin Ducks were registered on a river in the Qeqertarsuatsiaat fiord. However, exactly what river in the fiord is not clearly defined (Boertmann D. , 2003) . From interviews with hunters from Qeqertarsuatsiaat, Harlequin Ducks should be present in Lake #1 and Lake #2. However, no Harlequin Ducks were spotted during the baseline work in either 2020, 2021 or 2022.

The common loon (*Gavia immer)* is a widespread but rather sparse breeding bird in Greenland. They usually breed on small islands in large, deep undisturbed lakes. The food consists of fish, especially Arctic char. The size of the Greenlandic population is unknown but estimated at 685 couples and is listed as "near threatened" due to the species' small (and vulnerable) breeding population (Boertmann & Bay, Grønlands Rødliste, 2018a).

During fieldwork several species related to freshwater were observed within the project area. Lake #3 and Lake #2 was seen to hold mallard (*Anas platyrynchos)*, common loon (*Gavia immer)* and red-breasted merganser (*Mergus serrator*). The presence was consistent during a 14-day survey with individuals moving around in- and between the lakes.

The common loon (*Gavia immer*) arrives at the nesting areas in May-June and leaves in October. The lakes in the Majoqqap Qaava anorthosite Project area may function as both nesting and nursery area for this species. The reason why no common loon was observed in June may be a combination of the relatively short period of field time, and the fact that the birds may have spent most of their time incubating the eggs in this period. Despite the common loon is listed as Near Threatened, limitless hunting is still allowed from 1. September to October 15. (Naalakkersuisut, 2019a).

The red-breasted merganser (*Mergus serrator*) is quite common in West Greenland, where they breed along the fjords and inland lakes. The size of the Greenlandic breeding population is not known. The red-breasted merganser spends the winter along the coast of South-West Greenland and arrives at the nesting grounds in May or early June. The diet consists primarily of fish including Arctic char. In august 2021 a stationary flock of 8 red-breasted merganser was registered in the project area between Lake #2 and Lake #3. As for the common loon, the red-breasted merganser probably breeds in small numbers in the lake system or along the fjord.

5.7.6.1. Construction phase impact assessment

The construction phase will mainly impact birds affiliated to freshwater during construction of the haul road. No freshwater affiliated bird species were identified in the inner part of the valley, and it is evaluated that the northern part of Lake #2 and Lake #3 has the highest ecological rating for such birds. The activity while constructing the road stretch NE of Lake #2 and near Lake could cause freshwater birds here to withdraw from the area. They would most likely retrieve to the northwestern part of Lake #3 or to the southern shore (north part) of Lake #2 and the overall activity would probably not have a big impact on the birds during the initial construction phase. As construction will be ongoing for 1-2 years the second year could potentially cause the observed common loon and mergansers to choose a different local lake, if the level of disturbance is too high. However, the relocation would not have any impact on the overall populations.

Potential impact	Seizing of lake affiliated bird species habitat
Impact phases	Construction and Post-Closure
VEC	Freshwater bird

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Short-term <1 year	Medium 25-75 %	

5.7.6.2. Operation phase impact assessment

Birds related to freshwater such as the observed common Loon and red-breasted Merganser are expected to retrieve from the NE part of Lake #2, if an underwater lake tailings deposit will be established here. Individuals observed in Lake #3 and in the small waterbodies southeast of Lake #3 are not likely impacted by traffic on the haul road located some 300-500 metres west, once the production routine is up and running.

Potential impact	Seizing of lake affiliated bird species habitat
Impact phases	Operation and closure
VEC	Freshwater bird.

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Minor
Local	Low	Long-term (>5 years)	Medium 25-75 %	

The sheer size of Lake #2 and size -and little interaction between Lake #3 and planned project infrastructure lead to the conclusion, that these lakes will remain suitable as seasonal habitats to the freshwater bird species observed here. Individual birds are likely to retreat to other parts of the lakes in periods of high activity levels in particular locations near the shorelines, but this is evaluated to have little impact on their overall condition. Also, lake basins 4 and 5 further upstream will likely remain overall undisturbed and are expected to remain a potential seasonal habitat to migrating freshwater birds.

5.8. Marine

The Qeqertarsuatsiaat Kangerdluat is more than 200 meters deep in the area just off the coast from the planned harbour site. The coastline of the inner part of the fjord is characterized by an undulating shoreline with relatively steep slopes. The coastal area in the vicinity of the project harbour is diverse and includes rocky shores of bedrock or sedimentary rocks, covered with soft silty sediment. This leads to the presence of several marine habitats in the vicinity of the project area.

Sheltered coastlines normally support high biodiversity, but the marine environment in the inner parts of the Qeqertarsuatsiaat Kangerdluat is strongly influenced by high silt concentrations [TSS], generated by the inland glacier. A lot of organisms suffer from high silt concentrations and the ecosystem in the fjord is dominated by a few species with high silt tolerances. Furthermore, high TSS concentrations may also reduce the primary production in the area. The dynamics of the fjord are subject to the tidal cycle that changes twice a day between high and low tides.

The mining activity at Majoqqap Qaava is in general expected to have little impact on the marine environment, as the pit area is located some 12 kilometres inland. The process facilities will be located in the lower part of Kuussuatsiaat Valley, and tailings will be deposited on land or in Lake #2, according to the mining plan layout. Thus, the expected impact of the mining activities will mainly be introduced to the water quality in the operation phase through increased levels of nutrients, trace metals and suspended sediments. Besides the water quality parameters, physical activity from shipping in supplies and exporting product may also have some impact on both the construction and operation phases.

5.8.1. Water quality

The inner part of Qeqertarsuatsiaat Kangerdluat is covered with ice during most winters. As soon as the ice melts and the freshwater begin to drain at thaw, a segregation of the water column is established. The water column is separated into an upper brackish water body and a deep more saline water body. In august 2021, the bottom layer could be divided into two layers separated at 40 meters of depth. The water column below 40 meters was most likely oceanic water entering the fjord. The dynamic in the fjord is driven by the tidal cycle as well as wind-generated waves and currents. The tide in the fjord is around 4 metres from the lowest to the highest tide, (DMI, 2022).

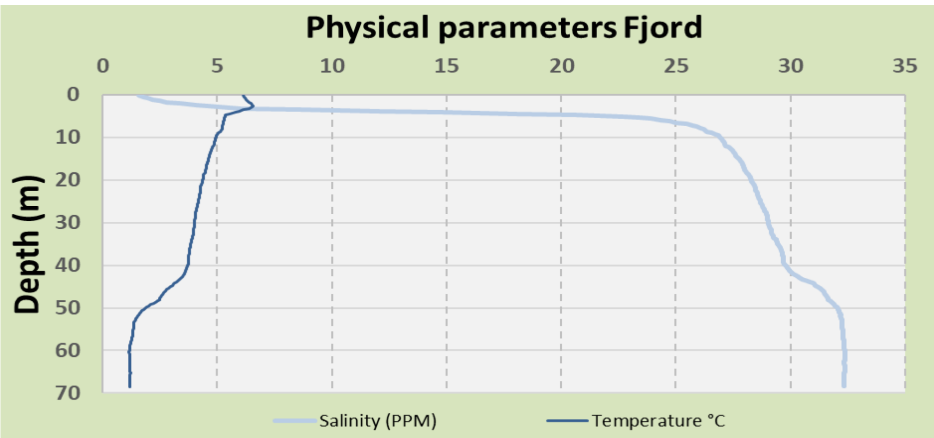


Figure 58: Temperature and salinity in the Qeqertarsuatsiaat Kangerdluat on the 25th of August 2021.

The water quality in the Qeqertarsuatsiaat Kangerdluat is under great influence by the high concentrations of silt in the upper water column. Water samples were collected above and beneath the upper pycnocline in depths of 5 meters and 35 meters (Figure 58). The surface water had TSS levels of 7.1 mg/ltr. and the lower water column had TSS levels of 6.3 mg/ltr. The differences in TSS between upper and lower strata are driven by the silty freshwater runoff restricted to the upper water column by the salinity gradient, whereas the lower water column is a mixture of silty freshwater and oceanic seawater. The chemical composition of seawater in the fjord showed levels below the threshold set in MRA's Guidelines for all elements except Cu and Zn in the lower strata. These two elements had levels of 1.5 times the threshold, Table 32.

Station	Strata	As	Cd	Cr (III)	Cu	Fe	Pb	Hg	Ni	Zn	Total-P	Total N	TSS
		(µg/ltr.)	*(µg/ltr.)*	*(µg/ltr.)*	*(µg/ltr.)*	*(mg/ltr.)*	*(µg/ltr.)*	*(µg/ltr.)*	*(µg/ltr.)*	*(µg/ltr.)*	*(mg/ltr.)*	*(mg/ltr.)*	*(mg/ltr.)*
	Upper (5-m)	0.72	<0.060	<0.20	1.2	<0.010	0.79	<0.002	0.67	9.6	0.009	0.24	7.08
	Lower (35-m)	1.5	<0.060	<0.26	2.9	0.012	1.1	<0.001	1.4	15	0.012	0.13	6.31
MRA* threshold		5.0	0.2	3.0	2.0	30	2.0	0.05	5.0	10	-	-	50

*Table 32: Result of the filtered seawater analyses below (35-m) and above (5-m) the pycnocline. * MRA WQL for seawater. Values that exceed the Greenlandic WQL threshold are marked with green.*

5.8.1.1. Construction phase impact assessment

Apart from the harbour facilities, the construction of infrastructure will be directed to the valley and the pit area. Construction could potentially affect the water quality in the fiord. However, due to the magnitude and duration of dust generated during construction, both inland and at the harbour, the impact from the construction phase is assessed to be negligible to the water quality of the marine environment.

Potential impact	Change in marine water quality
Impact phases	Construction and Post-Closure
VEC	Marine Water Quality

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	negligible
Local	Low	Short-term <1 years	Low (25 %)	

5.8.1.2. Operation phase impact assessment

The background levels of freshwater entering the Qeqertarsuatsiaat Kangerdluat (Freshwater station F08) were on average 0,223 µg Cu/ltr., i.e., much lower than the level in the fiord. The tailings deposit will leach eluate. The eluate from the column test and the humidity cell test were analysed for potential harmful metals. The result showed that there were high levels of leaching of especially Cu within the first 1-2 days, after which the concentration level decreased below the background Cu concentrations in the fjord. The element level in the freshwater leading into the fiord was estimated to be 0.35 µg Cu/ltr. on average over a half-year and the maximum mobilised during the highest flush was estimated to be 15.85 µg Cu/ltr. lactate from the TSF Dry (worst-case), section 5.7.2.1. Before the lactate enter the marine environment is will be diluted by more than a factor 10 (daily participation on rainy days/daily outflow from Lake #2). This result in a level of approximately 1.59 µg Cu/ltr. entering the marine environment.

The MRA guideline is 2 µg/ltr. and it is recommended in: "Handbook of chemical risk assessment: health hazards to humans, plants, and animals" that, Cu concentrations in marine ecosystems on average should be below 4 µg Cu/ltr. and never exceed 23 µg Cu/ltr. (Eisler, Handbook of chemical risk assessment: health hazards to humans, plants, and animals, 2000). The values from the leaching tests show a Cu concentration above the recommended values in a worst-case scenario but Cu concentration in the freshwater that enters the fiord will be diluted and be lower than the recommended values. Thus, the impact on from the mining process on the marine water quality is assessed to be minor. This assessment is also supported by the estimate in Section 5.7.1 and 5.7.2 that show that the copper concentration in the freshwater from Kuussuatsiaat Valley that enters the fiord will be lower that the copper concentrations in the upper part of the water column at in the fiord Table 32.

Potential impact	Change in marine water quality
Impact phases	Operation and Closure
VEC	Marine Water Quality

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Minor
Local	Low	Long-term >5 year	Medium 25-75 %	

5.8.2. Vessel traffic and underwater noise

Transportation to the project site through the northern passage (Aniggoq - Sarfat Aariaat fjord) is 30 nautical miles long (from coast to project site) and it is estimated that it on average will require 4 to 5 hours for bulk carriers and tankers to complete the route, depending on conditions and current. The southern passage (Qeqertarsuatsiaat Kangerdluat) is approximately 23 nautical miles long and will require 3 to 4 hours to complete. This corresponds to speeds of 6-8 knots. The routes are relatively narrow and less than 2,000 meters wide at most positions, see section 4.9. Hence, noise from bulk carriers, product tankers and supporting tugboats, will likely increase the ambient noise levels at the entire width of the fjord. However, cruising at a reduced speed will also result in reduced noise levels (Mckenna, Wiggins, & Hildebrand, 2013). The larger vessels will operate at low speeds to navigate safely in the fjords. Underwater noise from the Targa-class boats used for crew change will integrate into the existing noise pattern from present traffic in the area.

Ship traffic already occurs in the project area centred around the Qeqertarsuatsiaat settlement. The traffic consists of smaller local boats with outboard engines as well as small-scale fishing vessels (Snyder, Jacobsen, & Delaney, 2017). Furthermore, every second weeks Qeqertarsuatsiaat receives supplies from Royal Arctic Line containerships (650 DWT) (RAL, 2022). The vessel traffic introduced by the GAM project will add to the already existing traffic. The expected shipping activity for the project is listed in Table 6.

Increased shipping noise may affect marine mammals as they are highly dependent on sound for navigation, localising prey and communication. Ships sailing to and from the project site will involve both large vessels up to 45,000 DWT (bulk carriers), tankers used for fuel supply, cargo ships and small boats (Targa-class) used for transportation of personnel and other supply. The increased vessel traffic will inevitably increase ambient noise levels in the marine environment which at this point is affected only by smaller boats moving within the fjord.

Bulk carriers moving just around 14 knots have been found to have a broadband (20-1,000 Hz) source level of approximately 185 dB re µPa2 @ 1 m (rms) with the highest source level between 100-200 Hz. (McKenna, Ross, Wiggins, & Hildebrand, 2012) (Meaning that 1 m from the source, i.e., a bulk carrier, underwater noise levels up to 185 dB at frequencies between 100-200 Hz can be measured). However, noise from a range of different vessel types has been shown to elevate ambient noise levels across frequencies from 0.025 to 160 kHz for a range of up to 1,000 m (Hermannsen, Beedholm, Tougaard, & Madsen, 2014). The possible impact from increased vessel traffic and underwater noise on the marine environment is addressed later in section 5.8.3 – Marine mammals and section 5.8.4 – Fish.

5.8.3. Marine mammals

The fjord systems Qeqertarsuatsiaat Kangerdluat and Aniggoq – Sarfat Aariaat is not a known hotspot for marine mammals, but several species (mostly seals) use the area regularly while others (whales) are likely random visitors to the area. The text is based on knowledge found in the available literature and catch statistics gathered from the Greenland Government.

5.8.3.1. Seals

Six species of seals are found in Greenland: the harp seal (*Pagophilus groenlandicus*), ringed seal (*Pusa hispida*), hooded Seal (*Cystophora cristata*), bearded Seal (*Erignathus barbatus*), harbour seal (*Phoca vitulina)* and grey seal (*Halichoerus grypus*), all referred to the group "true seals". Harbour seal and grey seal are low in numbers and protected from hunting. The remaining four species of seals are subject to hunting. Catch statistic does not provide information on specific catch positions but the statistics for the settlement Qeqertarsuatsiaat does give an indication of species presence within or in the vicinity of the project area, Figure 59.

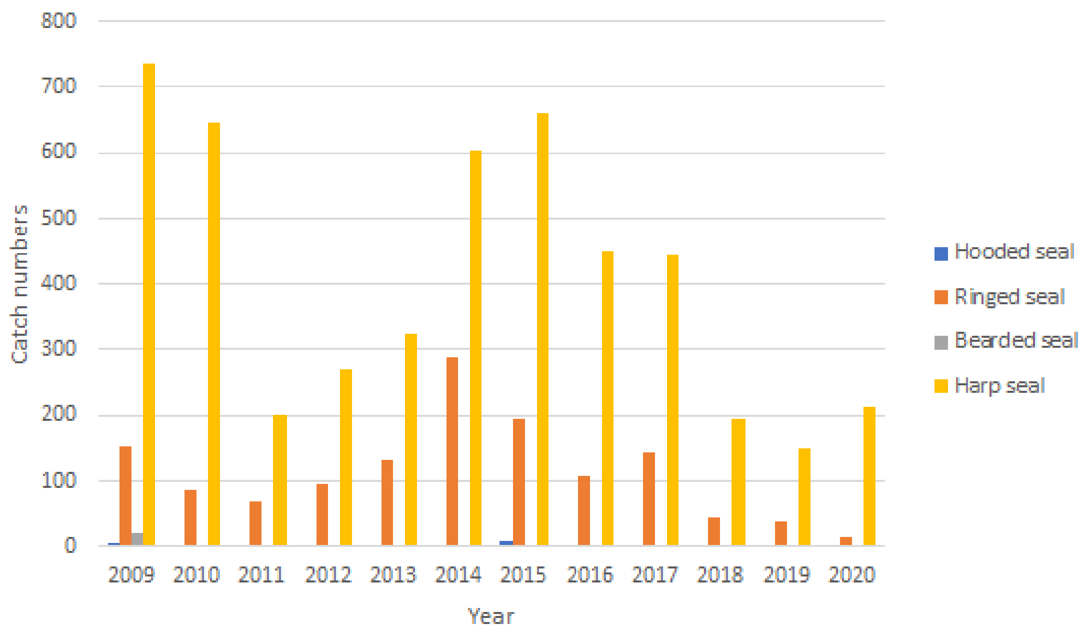


Figure 59: Catch statistics of four seal species registered by hunters from the settlement Qeqertarsuatsiaat (Fiskenæsset) in the period 2009-2020 (APN, 2022).

Grey seals (two individuals) were first registered in Greenland in 2009 near Cap Farewell, the southern tip of Greenland (Rosing-Asvid, Teilmann, Dietz, & Olsen, 2010). The last time a grey seal was registered in Greenland was in 2010 in the same area, as the year before (Christensen, et al., 2016). Hooded seals and bearded seals are ice-associated and depend on ice for hauling out, moulting and breeding. Hooded seals primarily move along the continental shelf and reside offshore (Andersen, Wiersma, Stenson, Hammil, & Rosing-Asvid, 2009). Bearded seals mainly reside over the shallow waters of the continental shelf in areas with drift ice or near shore leads off both East and West Greenland. The highest numbers are found in areas where sea ice is present (Laidre, et al., 2008). Both species may be observed around Qeqertarsuatsiaat, however as catch statistics indicate, numbers (catches) are low, Figure 59. It is assessed to be highly unlikely that grey seals are found within the assessment area. Similarly, hooded seals and bearded seals are expected to be rare visitors to the area. Therefore, these three species will not be further addressed.

Harbour seals are one of the world's most common seal species. In Greenland, they have never been widely distributed, yet the species has been subject to intense hunting and numbers are low. As a consequence of the low numbers, harbour seals have been protected against hunt since December 2010. At present they are considered *critically endangered* on the Greenland Red List (Boertmann & Bay, 2018b), but are classified as *least concern* on the Global IUCN Redlist (Lowry, 2016). Little is known about their current distribution in Greenland. Basic information on breeding and moulting sites and indications of trend in numbers is known only for the three sites: Kangerlussuaq (West Greenland), Majorariaq (Southwest Greenland) and Qeqertat near Cap Farewell, Figure 60. Only a few seals remain in Kangerlussuaq whereas numbers around Majorariaq and Qeqertat likely constitute less than 100 individuals on each site with an increasing trend (NAMMCO, 2021b). Harbour seals have sporadically been spotted in the Sermilik and Angorlia fjord systems just north of Qeqertarsuatsiaat (Christensen, et al., 2016) and local fishermen and hunters state that harbour seals are seen in the innermost part of Qeqertarsuatsiaat Kangerdluat (Rambøll, 2023a). Furthermore, catch statistics from Qeqertarsuatsiaat report that one and two harbour seals were caught near the settlement in 2010 and 2011 respectively (APN, 2022). Thus, harbour seals may likely be present in the project area. No harbour seals have been registered during fieldwork, neither by the field personnel nor on the wild cameras that were placed to overlook sandy beaches in the inner part of the fjord as part of the project EIA and baseline.

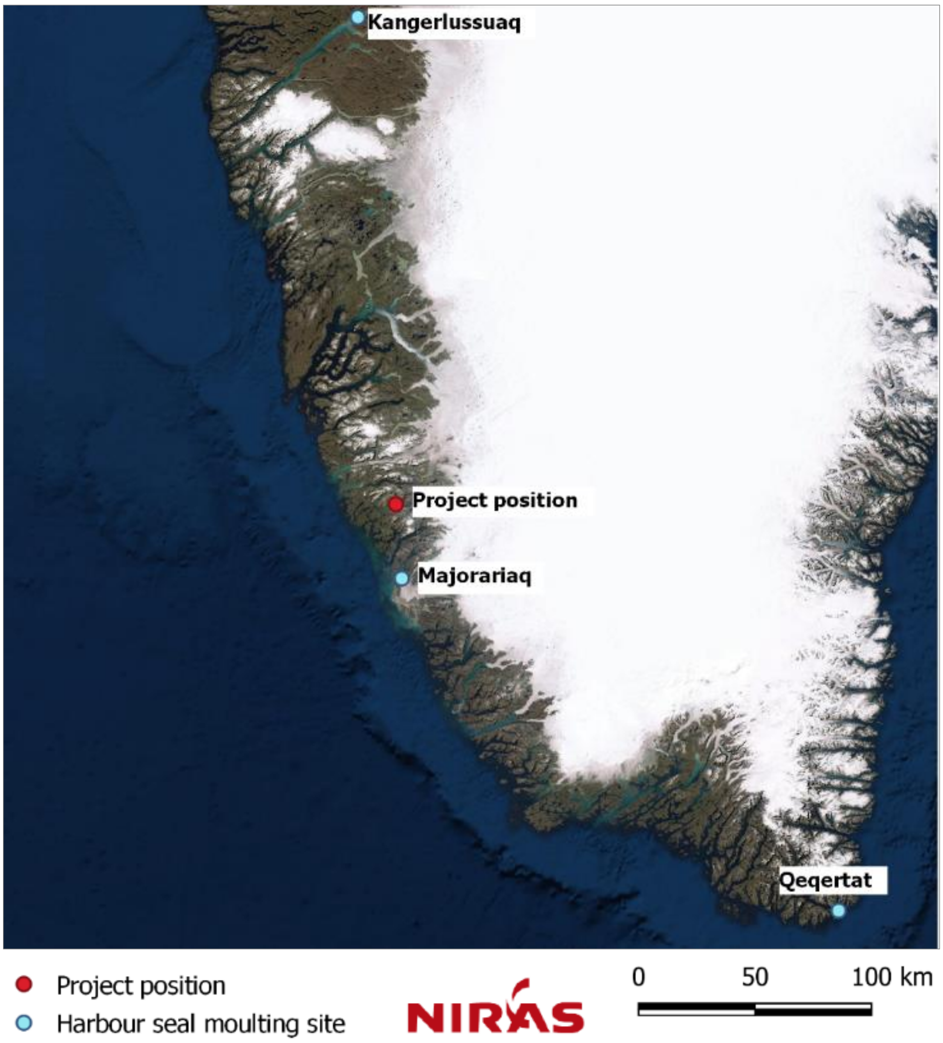


Figure 60: Known and active harbour seal moulting sites (2020) in relation to the GAM project area. Modified from (NAMMCO, Report of the Scientific Committee Working Group on Coastal Seals, January 2021. Tromsø, Norway., 2021b).

Harbour seals breed, moult and haul out on land – unlike the most common Greenlandic seals. They use the same haul-out sites year after year and it is during their time on land that the seals are most vulnerable to disturbance, especially as so few haul-out sites remain in Greenland for harbour seals. The seals are however capable of some degree of habituation to regular human disturbances (Christensen, et al., 2016). There are no known haul-out sites within the project area.

Ringed seals are also dependent on ice for breeding, moulting and resting and therefore a common feature of their distribution areas is the availability of sea ice (Kovacs & Lydersen, 2008). The Qeqertarsuatsiaat Kangerdluat fjord system does not represent the preferred ringed seal habitat and their main distribution on the West coast is north of 69°N (Teilmann & Kapel, 1998), however, they are found and caught year-round within the project area, Figure 61. During breeding, ringed seals highly depend on land-fast ice with the presence of a significant snow cover which is required for lair construction (Kovacs & Lydersen, 2008). They also use land-fast ice for hauling out and moulting. The Qeqertarsuatsiaat Kangerdluat fjord system is completely ice-free during Summer and Fall but ice forms in the bottom of the fjord system during Winter, making it possible for ringed seals to reside in the area. This is also the time of year when catches start to increase in the area before they peak during late Spring. Hereafter, an abrupt decrease is seen. This is likely because the mobility and the size of the area used by ringed seals are consistently greater during the open water season (Born, Teilmann, Acquarone, & Rigét, 2004) and most seals may swim off to areas where more ice is present. Like bearded seals, the ringed seals are distributed throughout the Artic and Subarctic with no specific areas of congregation. This makes them robust to overexploitation and on both the IUCN Global Red List and the Greenland Red List (Boertmann & Bay, 2018b) ringed seals are listed as *least concern*.

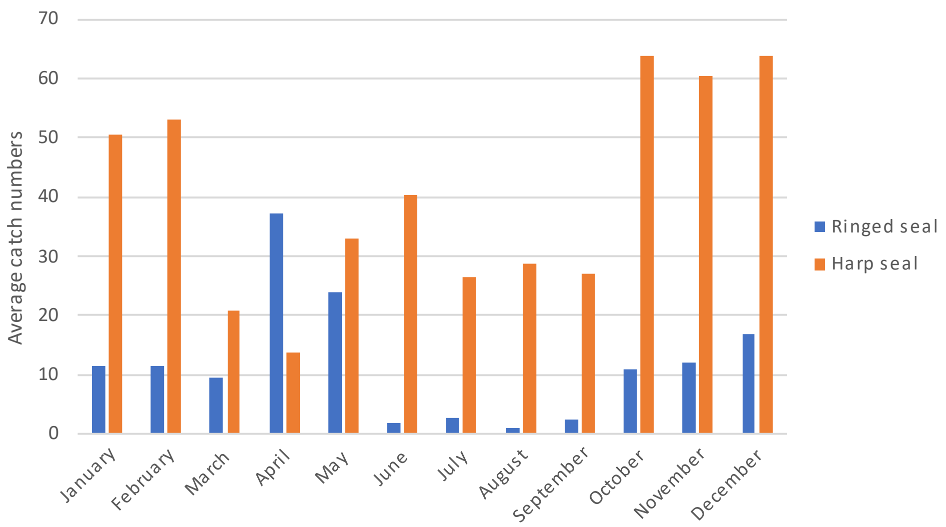


Figure 61: Average catch numbers of ringed seals and harp seals in the period 2009-2017 (APN, 2021) for the project area. Ringed seals show an increase in presence in (in the vicinity of the project area) during spring and again during late Autumn/Winter. Harp seals are present year-round.

Harp seals are divided into three different populations: the Northwest Atlantic, East Greenland, and the White Sea (Sergeant, 1991) where seals relevant to the project area belong to the Northwest Atlantic stock. Harp seals are the most abundant seal species in the North Atlantic (Stenson, Haug, & Hammill, 2020). This is mirrored in catch statistics around the settlement Qeqertarsuatsiaat where harp seal catches by far exceed those of the other species, Figure 59 & Figure 61. The Northwest Atlantic harp seals migrate from their moulting and breeding sites near Newfoundland (Stenson, Buren, & Koen-Alonso, 2016), and arrive in West Greenland and the project area around May. According to the catch statistics, not all harp seal migrates back to their breeding areas during the winter, as harp seals are caught year-round near Qeqertarsuatsiaat, Figure 61.

Harp seals are found both offshore and in coastal areas and in the south and central west Greenland, where their main prey is capelin (*Mallotus villosus*) (Lawson, Anderson, Dalley, & Stenson, 1998; Sergeant, 1991). It is therefore very likely that harp seals will follow spawning capelin into the innermost parts Qeqertarsuatsiaat Kangerdluat fjord system,

Figure 66. The population size of harp seals in the northwest Atlantic has been estimated to be around 7.4 million (NAMMCO, 2019a) and on both the IUCN Global Red List and the Greenland Red List the species is listed as *least concern*.

To sum up, all seal species, except grey seals, are potential visitors to the assessment area, but harp seals and ringed seals, the two most abundant species, are surely present. Bearded seals and hooded seals prefer other habitats and are expected to be seen infrequently. Harbour seal distribution is not well known, and numbers are low. An active moulting site remains 60 km south of the assessment area, but other potential closer sites may exist. It is expected that the assessment area is used mainly for foraging due to the known ecology and migratory patterns of the different species. The assessment area does not constitute a hot spot or key area for any of the seal species in Greenland.

5.8.3.2. Whales

Various whale species are found in Greenland waters. Some of the species are found regularly along the coast near Qeqertarsuatsiaat. e.g., humpback whales (*Megaptera novaeangliae*), minke whales *(Balaenopetera acutorostrata*) fin whales (*Balaenoptera physalus*) and harbour porpoise (*Phocoena phocoena)* (Laidre, et al., 2010; Nielsen, et al., 2018).

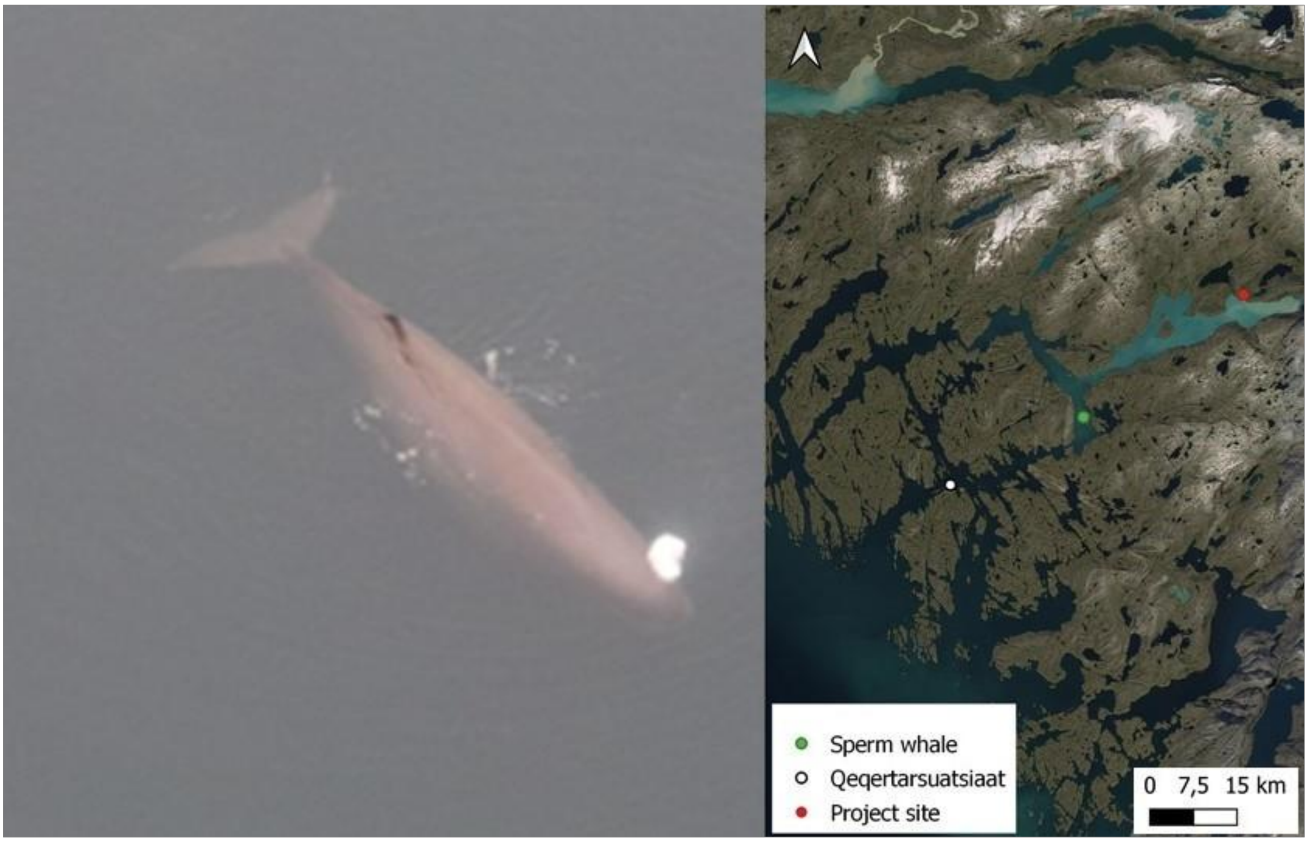


Figure 62: A Sperm whale was observed in the central part (App. N63°7'12.0'' W050°28'12.0'') of Qeqertarsuatsiaat Kangerdluat in 2018.

Others exhibit either a more northern distribution with specific migration patterns (e.g., narwhale (*Monodon monoceros*), belugas (*Delphinapterus leucas*) and bowhead whales (*Balaena mysticetus*)) (Heide-Jørgense & Laidre, 2006) or an irregular, sporadic, mostly offshore distribution (e.g., killer whales (*Orcinus orca*), pilot whales (*Globicephala melas*) White-beaked dolphins (*Lagenorhynchus albirostris*) and northern bottlenose whales (*Hyperoodon ampullatus*) (Teilmann & Dietz, 1998; NAMMCO, 2021a) making them rare and only potential brief visitors in the project area. Hence, the project area is not a key area for any of these whale species (Christensen, et al., 2016).

Along the West coast of Greenland, several (likely dynamic) hot spots have been pointed out for foraging baleen whales on the offshore banks where the one closest to the project area is just north of Paamiut, south of Qeqertarsuatsiaat (Laidre, et al., 2010). Minke whales, fin whales and humpback whales belonging to the West Greenlandic feeding aggregations come here to feed on either krill or large numbers of shoaling fish, most likely capelin. It is possible that they briefly enter the fjord arms adjacent to Qeqertarsuatsiaat in their search for prey. According to local hunters in Qeqertarsuatsiaat humpback whales do enter the fjord and more rarely so do minke whales (Rambøll, 2023a). A Sperm whale (*Physeter macrocephalus*) was spotted in the central part of the fjord system during the summer of 2018, Figure 62. In West Greenland, only male sperm whales have been observed and they mainly inhabit the deep, offshore waters, however, they do occasionally venture into the deep fjords (Ugarte, Rosing-Asvid, Heide-Jørgensen, & Laidre, 2020). Sperm whales are protected both globally and in Greenland and are therefore not subjected to hunting.

Harbour porpoises (*Phocoena phocoena*) are found along the coast outside the assessment area, and they have their main distribution in coastal areas between Paamiut (N62°) and Sisimiut (N67°) (Teilmann & Dietz, 1998). The abundance of harbour porpoises in Greenland has been estimated to be approximately 106,800 animals in 2015 (NAMMCO, 2019b). As, harbour porpoises are associated with the continental shelf and as part of their mostly coastal presence during summer, harbour porpoises may therefore visit Qeqertarsuatsiaat Kangerdluat and the surrounding fjord arms (Nielsen, et al., 2018; Hansen, et al., 2018). This is supported by locals in Qeqertarsuatsiaat (Rambøll, 2023a). Catch statistics also show that many harbour porpoises are caught annually by hunters from Qeqertarsuatsiaat, Figure 63, left. There is no information on the main hunting area, and this may well be along the coast near Qeqertarsuatsiaat.

Catch statistics also show the previously mentioned irregular presence of other cetacean species near Qeqertarsuatsiaat, see Figure 63, right. These hunts are expected to not have been within Qeqertarsuatsiaat Kangerdluat and surrounding fjord arms as they are species with offshore or northern distributions.

To summarize, individual whales may enter Qeqertarsuatsiaat Kangerdluat while foraging along the west coast of Greenland, but it is not expected that whales enter the inner part of the fjord near the project site very often. The project area does not constitute a hotspot for any of the whale species in general.

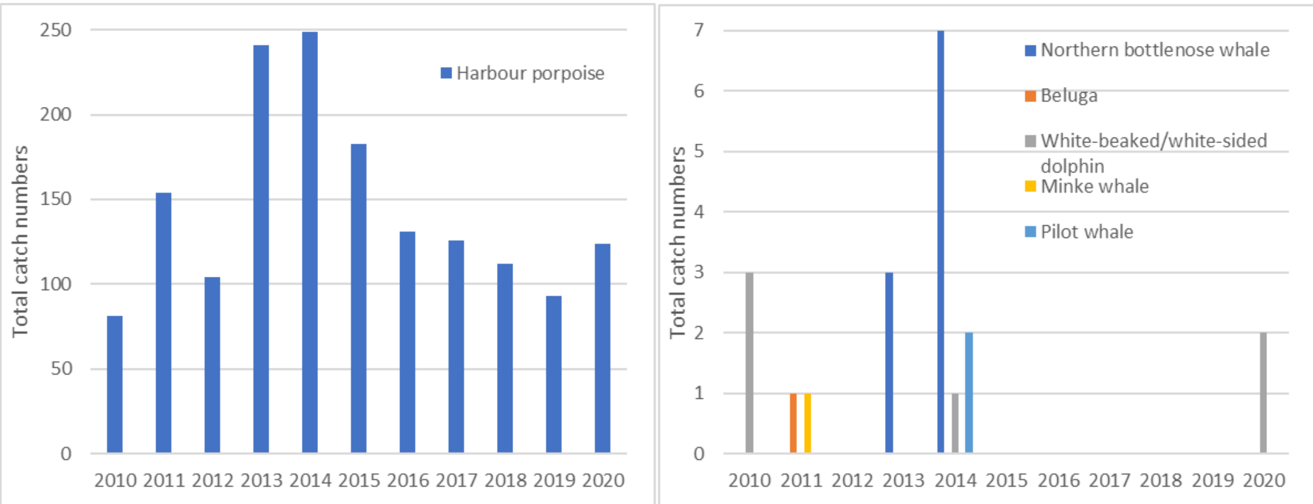


Figure 63: Catch registrations from Qeqertarsuatsiaat. Note the different scaling. Left: harbour porpoise which is caught regularly. Right: various species. Catch positions are not known, but likely offshore/coastal (and not in fjord) for the majority of the species due to species ecology (APN, 2022).

5.8.3.3. *Underwater noise and Marine mammals*

Increased noise levels may cause a reduced range at which the marine mammals can communicate (Masking), behavioural changes or, in the worst case, a temporary increase in the hearing threshold (Hermannsen, Beedholm, Tougaard, & Madsen, 2014; Boye, Simon, & Madsen, 2010). Cetaceans (whales, dolphins, and porpoises) are in general more sensitive to underwater noise compared to phocid seals (NMFS, 2018) and assessments of underwater noise are therefore based on cetaceans.

Baleen whales, such as humpback whales and fin whales also produce sounds in the low-frequency range, down to 10 to 15 Hz for the largest species, and their hearing is believed to be the most sensitive at low frequencies (Hermannsen, Beedholm, Tougaard, & Madsen, 2014). Small odontocetes, such as harbour porpoises produce and can hear sounds at high frequencies and are most sensitive between 10 and 120 kHz (Dyndo, Wisniewska, Rojano-Donãte, & Madsen, 2015). Phocid pinnipeds have adapted to hearing both above water and underwater. Underwater generalised hearing for phocids pinnipeds spans 50 Hz to 86 kHz (NMFS, 2018) and within this range, the best hearing of e.g., harbour seals have been shown to span 0.5 to 40 kHz (Kastelein, Wensveen, Hoek, & Terhune, 2009). The following assessments are based on acoustic calculations presented in section 3 of project background report *Calculations of expected noise related to the planned work at Majoqqap Qaava* NIRAS (2022).

5.8.3.4. *Construction of port and harbour facilities*

All ships listed in Table 6 will dock at the port site in the far inner part of Qeqertarsuatsiaat Kangerdluat. The project jetty will consist of a floating barge attached to land through mooring lines and strut bridges fixed to online anchor points (see description in section 4.7.2). The noise-generating activity from the construction of the jetty will primarily be on land when anchors are drilled and mounted to the bedrock. Noise may travel through the bedrock and manifest itself in the water as vibrations, but it is not currently possible to model how such vibrations from rock works on land will distribute in water. However, the transition from rock to water (a change in the medium which transports the sound) will by default cause a reduction in the noise levels transferred to the underwater environment and the activity is assessed not to impact the marine environment and will not be further assessed.

Potential impact	Underwater noise from harbour construction
Impact phases	Construction, Closure and Post-Closure
VEC	Marine mammal

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Regional	Low	Short-term <1 year	Low (25 %)	

5.8.3.5. *Operation phase impact assessment*

The main disturbance of marine mammals related to the operation phase is assessed to be A). Underwater noise from vessels travelling to and from the project site and, B). Disturbance by the physical presence of the passing vessels.

<u>Physical disturbance:</u> Disturbance by the presence of passing ships will primarily be linked to the underwater noise as marine mammals always will be able to hear motorised vessels and boats before visual presence. However, if the noise itself has not caused avoidance behaviour there is a chance that the presence of vessels and boats close to marine mammals may result in avoidance behaviour (Boye, Simon, & Madsen, 2010) or ship strikes. Lethal strikes by larger vessels seem unlikely given the low numbers and modest speed of the vessels going to the project site each year (Leaper, 2019) and the scarcity of whales in the fjords around Qeqertarsuatsiaat.

It seems however highly likely, that the smaller boats (Targa-class) used for crew change and other supplies may cause a change in dive behaviour, and swimming direction or temporarily stop foraging of marine mammals if coming too close. These effects have been seen during e.g., whale watching where boats follow and approach individual whales (Boye, Simon, & Madsen, 2010). However, this is not the case here where the smaller boats will go a direct route from Qeqertarsuatsiaat to the project site and have large manoeuvrability in case marine mammals come across the route. Hence, vessel/boat strikes seem highly unlikely as speeds are reduced within the fjord by large vessels and whale numbers are low. Mere presence by smaller boats is likely to cause a behavioural response in marine mammals at the individual level if coming too close. However, it is assessed that disturbance by presence will be short-term and will have a minor and fully reversible effect at the population level.

Underwater noise: According to the supporting technical report on external noise (NIRAS, 2024b) the calculated impact distances for Temporary Threshold Shifts [TTS] and Permanent Threshold Shifts [PTS] in marine mammals are less than 1 meter. This means that marine mammals have to be within 1 meter of a bulk carrier to experience either temporary or permanent loss of hearing and this is assessed to be highly unlikely. It is assessed that both the high-frequency harbour porpoises and the low-frequency baleen whales will be affected by the underwater noise generated from the larger vessels (e.g., bulk carriers) that instead may cause behavioural changes in terms of avoidance (Hermannsen, Beedholm, Tougaard, & Madsen, 2014), stop in foraging or a change in dive behaviour (Boye, Simon, & Madsen, 2010). However, it is assessed that a potential effect is within a limited time frame as the ship is passing and it is assessed that the effect will be fully reversible at an individual level. Furthermore, the frequency of smaller ships will be low and a maximum of three larger vessels will visit the project site each month. Therefore, increased noise levels are temporary and limited to the ships' transit time and the different segments of the fjord. For underwater noise, the vessel speed and environmental conditions of the transit routes largely influence the impact distances on marine mammals. Hence, the channel width, depth, bends, obstacles, outcroppings, and inlets of the transit routes which call for reduced vessel speed during transit, is evaluated to result in no risk of PTS or TTS (Permanent or Temporary hearing impacts) if marine mammals should be present during transit.

Finally, it is expected that few whales will be present within the fjord during transit as this is not a marine mammal hot spot. All facts combined it is assessed that noise from increased shipping in Qeqertarsuatsiaat Kangerdluat to the project site will have a minor and fully reversible effect on marine mammals on an individual level and on the marine mammal populations to which the affected individuals belong.

Potential impact	Physical disturbances and underwater noise from increased shipping
Impact phases	Operation
VEC	Marine mammals

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Minor
Regional	Low	Long-term >5 year	Medium 25-75 %	

5.8.4. Fish

The most abundant marine fish species in the fjords are expected to be the Atlantic cod (*Gadus morhua*), short-spined sculpins (*Myoxocephalus scorpius*) and sand lances (*Ammodytes spp.*), most likely Northern sand lance. All species were either caught around the proposed port site in Qeqertarsuatsiaat Kangerdluat during the 2020 field studies and/or captured on a drop-down video. The silty water gives the resident cod a more pale/light grey colouration compared to cod caught in clear water with well-developed vegetation on the seabed (pers. obs.). This indicate that the observed cod is a local resident and have been in the fiord for a longer period of time.

Cod is expected to occur in relatively high abundances in the Qeqertarsuatsiaat fiord system, Figure 65. Furthermore, Capelin (*Mallotus villosus*) may also occur in specific parts of the Qeqertarsuatsiaat Fiord system, Figure 66. Capelin spawn on sandy beaches along the coast but also in the innermost part of the fjord systems (Friis-Rødel & Kanneworf, 2002). Cod may also spawn in Qeqertarsuatsiaat Kangerdluat, but unlikely in the innermost parts. The Lumpsucker (*Cyclopterus lumpus*) is an important species in commercial fisheries, however, the Qeqertarsuatsiaat Kangerdluat seems less important than the coastline west and south of the settlement of Qeqertarsuatsiaat as well as further off-shore, Figure 67. Arctic char is both a marine and a freshwater species. The Arctic char is described under the fresh-water section because of the resident population inhabiting the freshwater system in the valley. However, it should be mentioned that Arctic char is abundant in most inner parts of the fjord during summer, maybe attracted by a large amount of freshwater outflow from the glacier. It remains unknown if the Arctic char spawn in parts of the glacial river.

Figure 64: Sand lances on a silt seabed – bottom of photo (left) and a "pale" cod on the same silt bottom just outside the harbour area.

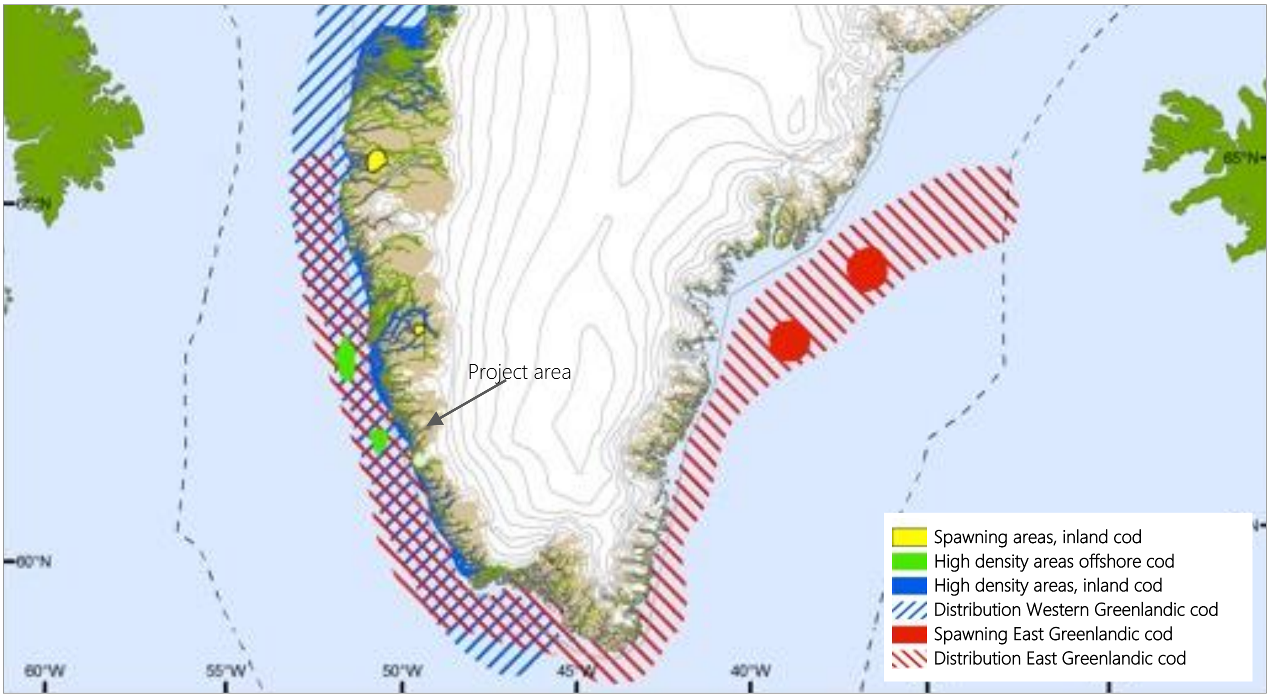


Figure 65: Important areas for fishing cod at Qeqertarsuatsiaat, (Christensen, et al., 2016).

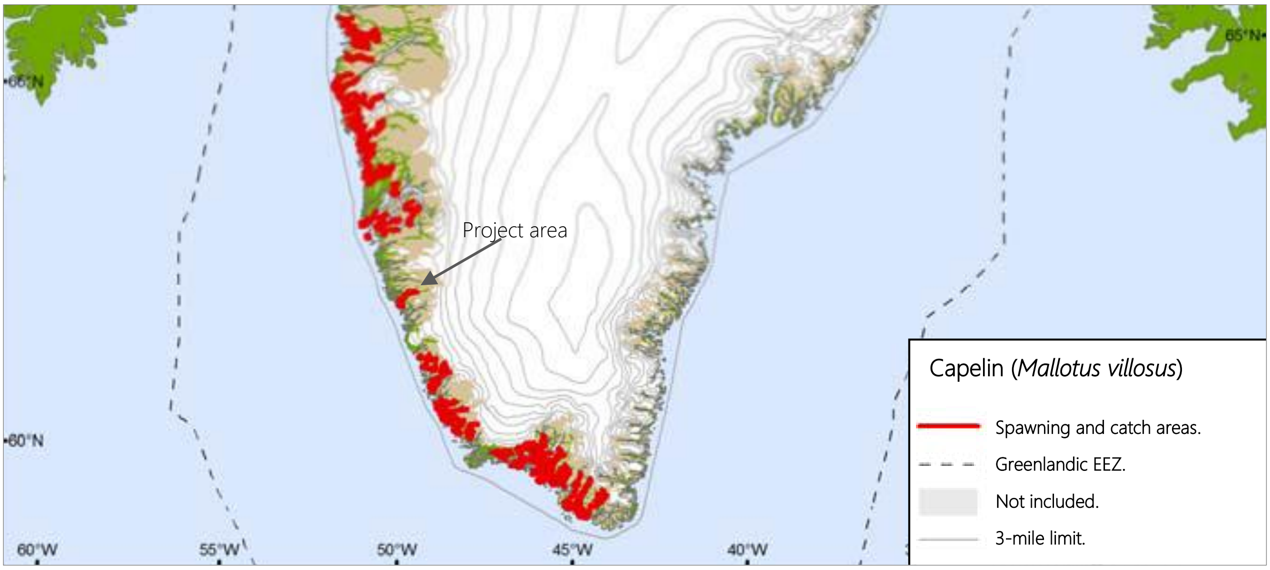


Figure 66: Important areas for fishing and spawning of Capelin at Qeqertarsuatsiaat, (Christensen, et al., 2016).

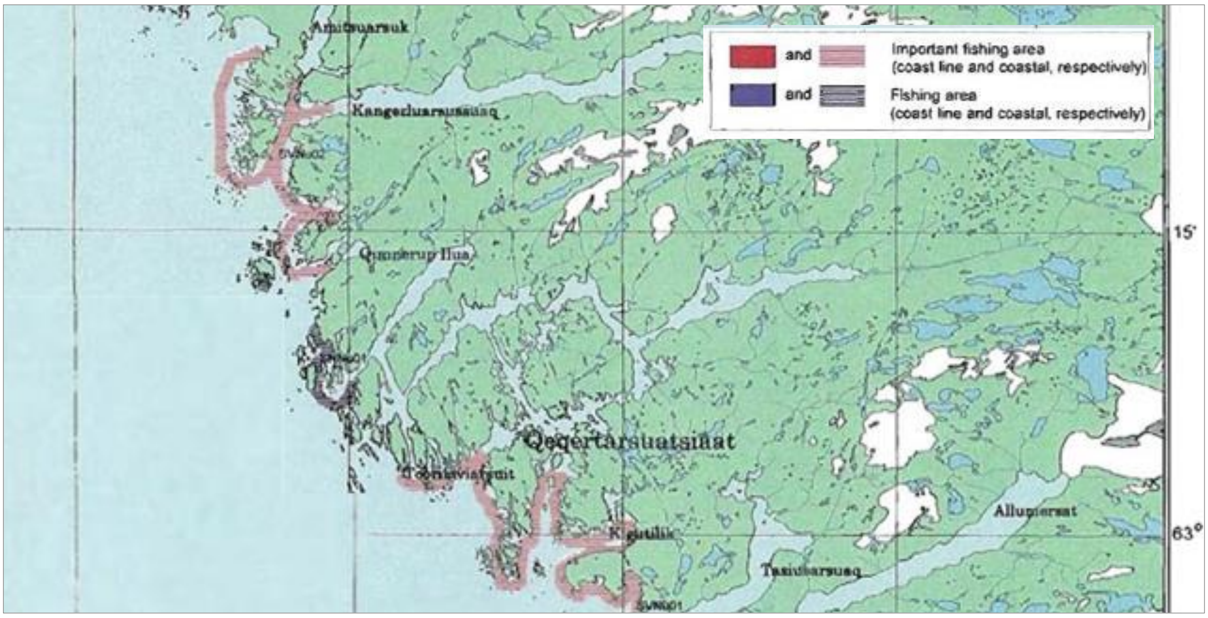


Figure 67: Important areas for fishing lumpsucker at Qeqertarsuatsiaat, (Nielsen, Mosbech, & Hinkel, 2000).

5.8.4.1. Construction phase impact assessment

The construction phase may affect the marine fish during the construction of the harbour front. The activities may include altering the existing shoreline through drilling, dredging and increasing vessel activities. The marine fish will be exposed to underwater noise and increased levels of suspended sediment. Noise can be detected by most fish species, and in particular by "hearing generalists" like gadoid fish with swim bladders and by "hearing specialists" having anatomic adaption to hearing (clupeid species). Cod is expected to be the most noise-sensitive species in the harbour area. This is supported by the fact that they are using grunting sounds for communication. Cods have the capability of hearing sound frequencies in the intervals 10-800 Hz but are most sensitive in the range of 100-300 Hz with a peak hearing at 160 Hz (Chapman, 1973). The hearing threshold at peak frequency for cod has been identified to be 75 dB re 1µ Pa – 1 m, (Thomas, Lüdemann, & Kafemann, 2006). Bulk carriers moving just around 14 knots have been found to have a broadband (20-1,000 Hz) source level of approximately 185 dB re µPa2 @1 m (rms) 1 meter from the source, with the highest source level between 100-200 Hz calculated from (McKenna, Ross, Wiggins, & Hildebrand, 2012). There is no direct evidence of mortality or potential mortal injury to fish from ship noise, but cod is expected to exhibit behavioural changes in the near field of the vessel (Popper, et al., 2014). In practice, marine fish will never enter the near field of the vessel (best guest within 10 meters) it will simply swim away from the relatively slow-moving vessel. The near-field avoidance behaviour is expected to become less with increasing distances to the vessel. Furthermore, the high level of background noise generated by wind and waves will mask the vessel noise. Therefore, the impact on marine fish is assessed to be negligible due to the expected low frequency, short duration and the little area of impact.

Potential impact	Underwater noise on marine fish populations
Impact phases	Construction, Closure and Post-Closure
VEC	Marine fish

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Short-term <1 year	Low (25 %)	

5.8.4.2. Operation phase impact assessment

Noise from vessel traffic is expected to be similar to the construction phase i.e., negligible. The effect of elevated levels of Cu on fish has been found to decrease with increasing salinities (Blanchard & Grosell, 2006) and salmonid fish has shown to be more tolerant to high Cu levels at low pH rather than high pH, (Woody & O'Neal, 2012). Experiments have shown that Cu concentration below 6 µg Cu/ltr. for cod and 9.3 µg Cu/ltr. for char (*Salvelinus ssp*.) did not have any effect on any life-stage, (Farkas, et al., 2021) and (Eisler, Handbook of chemical risk assessment: health hazards to humans, plants, and animals, 2000). Thus, the Cu maximum level of 15.85 µg Cu/ltr. in the freshwater from the mining area is not expected to have any impact on Arctic char nor cod – or other marine fish, as this level is expected to be diluted 10 times to at least 1.59 µg Cu/ltr. (see section 5.8.1.2), before is enters the fiord. The two species are evaluated as valid representatives for the overall marine fish community, and it seems safe to assess that the mine will have a negligible impact on marine fish throughout the LoM.

Potential impact	Noise and elevated elements on marine fish populations
Impact phases	Operation
VEC	Marine fish

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Long-term >5 year	Low (25 %)	

5.8.5. Invertebrates

The invertebrates that inhabit the fiord are adapted to high levels of suspended sediment in the water column and sedimentation of silt on the seabed. Little is known of the invertebrate community in the Qeqertarsuatsiaat Kangerdluat. Overall, two habitat types exist in the fiord, hard-bottom with epifauna and soft-bottom inhabited by epi- and infauna species. The most abundant macro-invertebrate on the hard-bottom substrate in the upper littoral zone is the common mussel (*Mytilus edulis*), but also specimens of the great spider crab (*Hyas araneus*) and barnacles have been observed during skin-diving. Infauna organisms include both dwelling mussels and bristle worms as ventilation holes were identified with a drop-down camera, Figure 64. However, detailed species identification was not possible.

5.8.5.1. Construction phase impact assessment

In section 5.8.1.1 it was assessed that the marine water quality in the fiord will remain unaffected by the construction of the mine and associated berth and jetty. In line with this, it is assessed that the construction activities will have a negligible impact on the invertebrates also, even though the berth construction may have a very local (a total of 10-20 m^2) physical footprint from blasting and founding mooring points that will have a vary temporary impact on the epifauna invertebrates.

Potential impact	Invertebrate community changes
Impact phases	Construction, Closure and Post-Closure
VEC	Invertebrates

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Short-term <1 year	Medium 25-75 %	

5.8.5.2. Operation phase impact assessment

The mining activities in the operation phase are expected to increase both the level of suspended sediment and sedimentation. The invertebrate fauna could suffer from being buried under extreme sedimentation rates. In the Qeqertarsuatsiaat Kangerdluat, this seems unlikely because all infauna organisms in the fiord must be adapted to the high naturally occurring sedimentation rates. Furthermore, the increase of total suspended sediment and sedimentation generated by the mining activities will be only permille of the natural glacial silt concentration in the fiord. The TSS in the fjord is around 5-7 mg/ltr. Sedimentation of mining related TSS will occur over a huge area because the sediment particles in the freshwater are very fine (larger particles will sediment in Lake #2 or Lake #1). Net sedimentation is therefore estimated to be just a few millimetres at the most. Studies have shown that sedimentation of particles <3 mm will never have any effect on infauna species (Gibbs & Hewitt, 2004) and several polychaetes and mussels can stay on top of sedimentation of more than 5 cm, (Essink, 1999). The impact from increased suspended sediment and sedimentation on the invertebrates in the fiord is therefore assessed to be negligible.

The invertebrates may be affected by the elevated levels of Cu – however, the general effect in the marine environment is expected to be lower than in freshwater (Wheeler, et al., 2002). The Cu concentration of the seawater in Qeqertarsuatsiaat Kangerdluat is above the maximum Cu level in the freshwater entering the fiord. Thus, no impact on the marine environment is to be expected and the impact is evaluated to be negligible.

Potential impact	Invertebrate community changes
Impact phases	Operation
VEC	Marine invertebrates, especially common mussels

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Long-term >5 year	Medium 25-75 %	

5.8.6. Macroalgae

The species richness with respect to seaweed in the inner parts of Qeqertarsuatsiaat Kangerdluat is low and dominated by species adapted to high levels of suspended sediment and high sedimentation rates as well as being above the water at low tide. The most abundant seaweed species in this part of the fjord were found to be the multiannual bladderwrack (*F. vesiculosus*) and rockweed (*F. distichus*). The vegetation is restricted to a narrow band in the littoral zone and the upper part of the sub-littoral zone (pers. obs. and (Pedersen, 2011). The narrow band of vegetation is controlled by a combination of high turbidity caused by the high level of TSS and through the steep intertidal slopes in the fjord. This reduces the area where light can penetrate all the way to the seabed. The intertidal habitat of the Majoqqap Qaava anorthosite project port area is similar to habitats found along the shoreline of Qeqertarsuatsiaat Kangerdluat, and in other areas where a large glacial river is entering the fjord.

In addition, TSS material will settle at the bottom and cover macroalgae with a layer of fine sediment thus preventing or reducing photosynthesis. In the upper littoral zone, the fine sediment overlaying the algae is occasionally swept away by wave action, enabling growth in the shallow and wind-exposed parts at depths of less than approximately 1-2 meters below the lowest tide.

5.8.6.1. Construction phase impact assessment

The harbour will be constructed as a floating dock as outlined in chapter 4.7.2. The construction work and harbour operation will include seizing and re-profiling some of the coastline and intertidal areas. It is projected that approximately 150 m of coastline and 20 m off the shore will be changed. This will cause the loss of intertidal habitats. The intertidal seabed that is expected to be seized has been surveyed from skin diving and no special plants were found – the marine flora was very sparse. The sparse vegetation may be caused by a combination of the high turbidity and a large amount of freshwater entering the fiord at the port site. The harbour construction will of course have an impact on the area seized for the new harbourfront i.e., the plants will die. The new shoreline will provide a new substrate that will be colonized by new plants within a few years or maybe even sooner. Change in the intertidal area seized by the harbour facilities is permanent but very local and will within a few years return to the existing environment as the jetty will involve a floating barge solution connected to a fixed port installation. The overall impact of the port footprint is assessed to be negligible.

Potential impact	Change in Macrophyte due to seizing and sediment
Impact phases	Construction, Closure and Post-Closure
VEC	Marine macroalgae

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Short-term <1 years	Low (25 %)	

5.8.6.2. Operation phase impact assessment

The mining activities in the operation phase are expected to increase both the level of suspended sediment and sedimentation as well as mobilize trace metals.

The macroalgae flora in Qeqertarsuatsiaat Kangerdluat suffers from extreme levels of naturally suspended sediment and sedimentation. This is exemplified by the fact that the macroalgae alone inhabit the upper 1-2 metres of the water column. Normally the suspended sediment and sedimentation from the mining activities will increase the overall stress level significantly on the flora. In Qeqertarsuatsiaat Kangerdluat the natural level of suspended sediment is expected to be several times (5-7 mg/ltr.) as high as the contribution from the mine. Likewise, the sedimentation is estimated to be just a few millimetres at the most which is expected to be much less than the natural sedimentation. The impact on the flora from suspended sediment and sedimentation is assessed to be negligible.

Cu has been found to inhibit growth in macroalgae by up to 50 % when exposed to a Cu level of 5 µg Cu/ltr. (Eisler, Copper hazards to fish, wildlife, and invertebrates: a synoptic review. U.S.Geological Survey, Biological Resources Division, Biological Science Report, 1997). The macroalgae in Qeqertarsuatsiaat Kangerdluat is unlikely to be affected by the levels of Cu n the freshwater entering the fiord as the maximum Cu concentration in the freshwater is below the Cu concentration of the seawater. Thus, no impact on the marine macroalgae is to be expected and the impact is evaluated to be negligible.

The total-N in the fiord is on average 185 µg N/ltr., Table 32. The leaching of nitrogen into the river system will reach a maximum outflow concentration of 2.55 µg N/ltr. i.e., much less than both the natural seawater levels and the Greenland WQL the limit for discharge of total-N to aquatic systems from mining activities set to 300 µg N/ltr., (Mineral Resources Authority, 2015). The impact from total-N generated by the Majoqqap Qaava mine on the macrophytes is on this background assessed to be negligible.

Potential impact	Change in Macrophyte due to nutrient enrichment, trace metals and sediment
Impact phases	Operation
VEC	Marine macroalgae

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Long-term >5 year	Medium 25-75 %	

5.8.7. Birds

The project area is located at the very base of the Qeqertarsuatsiaat Kangerdluat. Project activities can be divided into activities in proximity to the actual land-based operation and activities related to the shipment of ore and supplies.

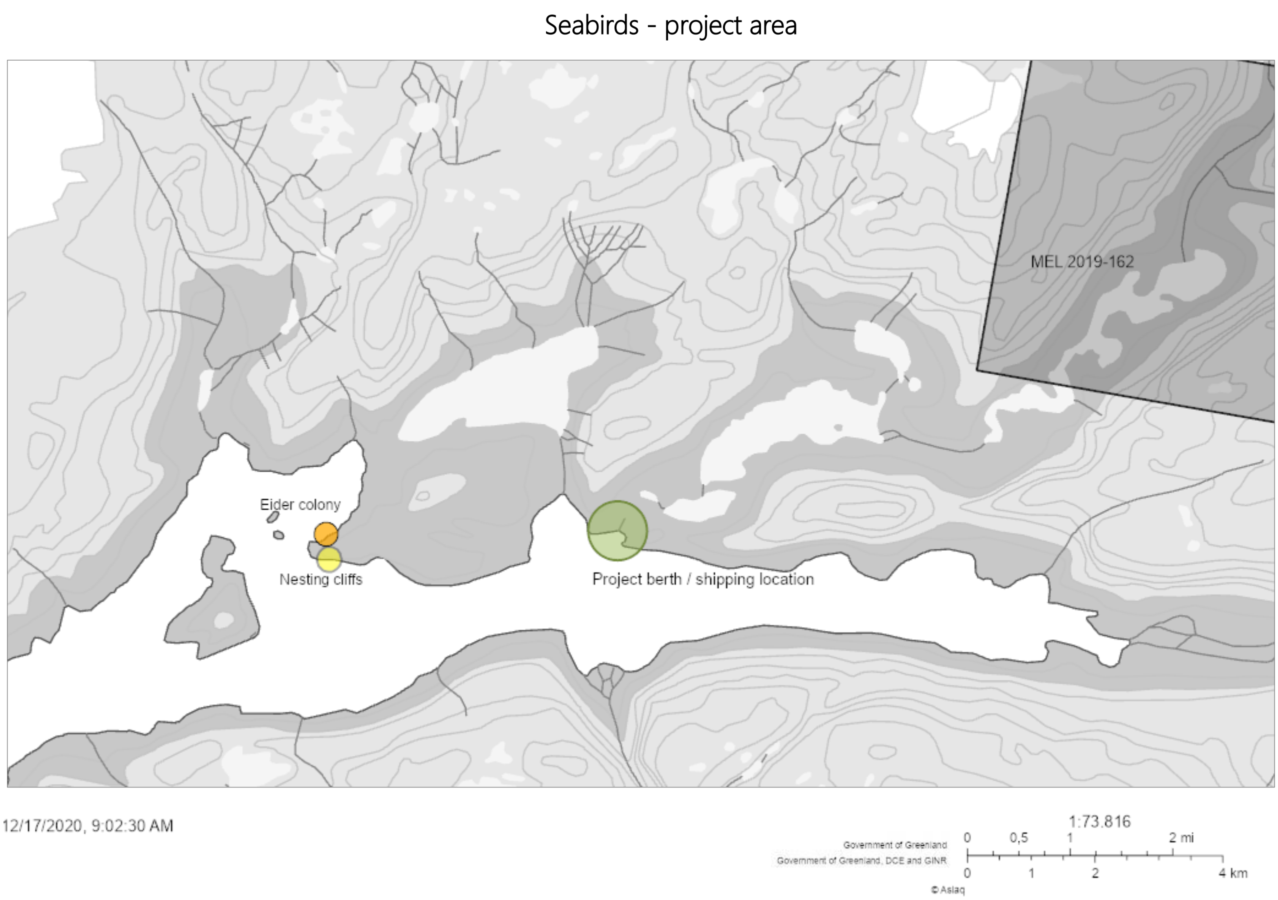


Figure 68: Mapped bird locations closest to the project shipping area.

Regarding potential effects on marine birds in marine areas close to the land-based operation, two sites require attention. These are the two seabird colonies mapped to be located roughly 5 kilometres west of the project berth area. These colonies are described as a common eider colony and as a nesting cliff for various seabirds, Figure 68.

No bird colonies have been identified along the conceptual shipping routes within the fjord system. When reaching the group of islands bordering the open waters of the Davis straight, several seabird colonies are identified, Figure 69. These colonies are described as murre colonies (probably a mix of Alcidae species such as common murre (*Uria aalge*), thick-billed murre (*Uria lomvia*) and black guillemot (*Cepphus grylle*)), eider colonies and colonies of nesting seabirds (expected to consist of various species of gulls e.g., Glaucous Gull (*Larus hyperboreus*), Great Black-backed Gull (L. marinus) and Iceland Gull (*L. glaucoides*) along with other species such as skuas (*Stercrarius spp*.).

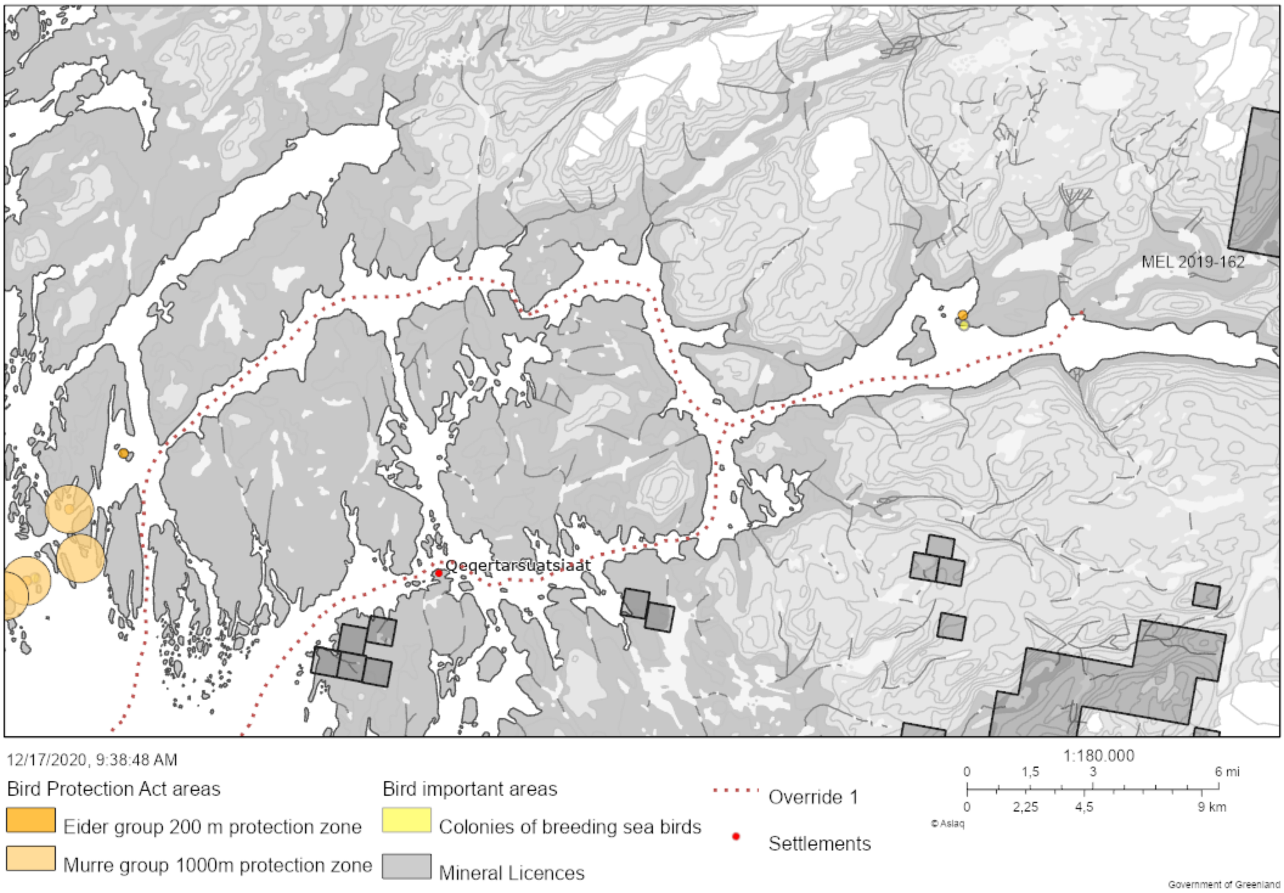


Figure 69: Identified bird colonies along the conceptual shipping routes.

5.8.7.1. Construction and Operation phase impact assessment

In both the construction and operation phases sea bird colonies could potentially be affected by the increased vessel traffic, transporting material and staff to and from Majoqqap Qaava. The distance from the harbour site to the nearest bird colony is more than 5km i.e., more than the limit where field exploration activities need to apply for a special permit (BMP, 2000) and five times the distance protected by the law (Frederiksen, et al., 2017). The two shipping routes are both very distant from bird colonies. The northern route in the Aniggoq - Sarfat Aariaat fjord is the one closest to colonies, and it is still more than 1 km from the nearest eider colony and >3 km from the more sensitive murre colony, Figure 69. The impact from the construction and operation phases are similar and negligible due to the great distances to the bird colonies along both shipping routes.

Potential impact	Marine birds - especially colonies
Impact phases	Construction, Operation, Closure and Post-Closure
VEC	Marine birds

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Long-term >5 year	Medium 25-75 %	

5.9. Invasive non-indigenous species

Invasive and non-indigenous species can be spread worldwide through ballast water. Introducing new non-indigenous species unintended to a new geographical location where they can reproduce will be a threat to the local ecosystem. To prevent the potentially devastating effects of the spread of potentially harmful aquatic organisms, the International Convention for the Control and Management of Ships' Ballast Water and Sediments [BWM Convention] was adopted in 2004. The convention will come into force 12 months after ratification by 30 states, representing 35 % of world merchant shipping tonnage. In 2017, the treaty has been ratified by more than 60 countries, including Denmark, and represents more than 70 % of world merchant shipping tonnage.

The convention, and the so-called D-2 standard, prescribing mid-ocean ballast water exchange, which requires the installation of a ballast water treatment/cleaning system before discharge, will become mandatory for all ships on 8 September 2024.

Realizing that the bulk-carriers GAM intends to use to ship the anorthosite, are obliged to follow the international rules, including the BWM convention, the introduction of invasive or non-indigenous species into Greenlandic waters is considered unlikely. However, in the unlikely event of accidentally introducing an invasive species to the fiord, the impact may be severe to some of the native species inhabiting overlapping niche in the food web. This may pose a threat to the ecosystem if the introduced species can adapt to the physical environment. Despite the bleak predictions from introducing invasive species the overall impact assessment is minor, primarily based on all the precautions setup in the BWM convention, making introduction of invasive species very unlikely.

Potential impact	Introducing Invasive and non-indigenous species
Impact phases	Operation (Construction and Closure)
VEC	Water quality and biodiversity

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Minor
Regional	Medium	Long-term >5 year	Low <25 %	

5.10. Sensitive and protected areas

As mentioned in section 5.8.7 several protected bird sites have been pointed out among the smaller islands that border the fjord entry leading to the project site, Figure 72. Also, there are two seabird colonies located roughly 5 kilometres west of the future project berth area, Figure 68. These protected sites, under management zone 3, consist of moulting sites and colonies of breeding sea birds that are protected under Greenland legislation (Naalakkersuisut, 2019b; Naalakkersuisut, 2000). The relevant legislation state e.g., protection zones where disturbance of moulting birds is illegal or time periods where disturbance, hunting and collection of eggs is prohibited within the sites. Protection zones vary between 200 meters to 1,000 meters depending on bird species and possible restriction to a limited time-period either from 15th April to 15th September or 1st June to 15th of September depending on the legislation in practice

(Naalakkersuisut, 2016; Naalakkersuisut, 2000). During non-restricted periods, hunting of birds with a quota and traffic within the sites are legal. Hence, the sites are not under a permanent protection.

Greenland has through the Danish Realm ratified the Ramsar convention and 11 Ramsar sites have been pointed out in Greenland (Naalakkersuisut, 2016). Ikkattoq and adjacent archipelago (Ramsar site 387) is the Ramsar site nearest to the project site. It is a 44,880-ha large area important to bird species such as the White-tailed eagle (*Haliaeetus albicilla*), red-breasted merganser (*Mergus serrator*) and the harlequin duck (*Histrionicus histrionicus*) (Ramsar, 2019). However, the site is located just north of Sioqqap Sermia (Frederikshåb Isblink), 45 km south of Qeqertarsuatsiaat and 70 km from the project site, Figure 70.

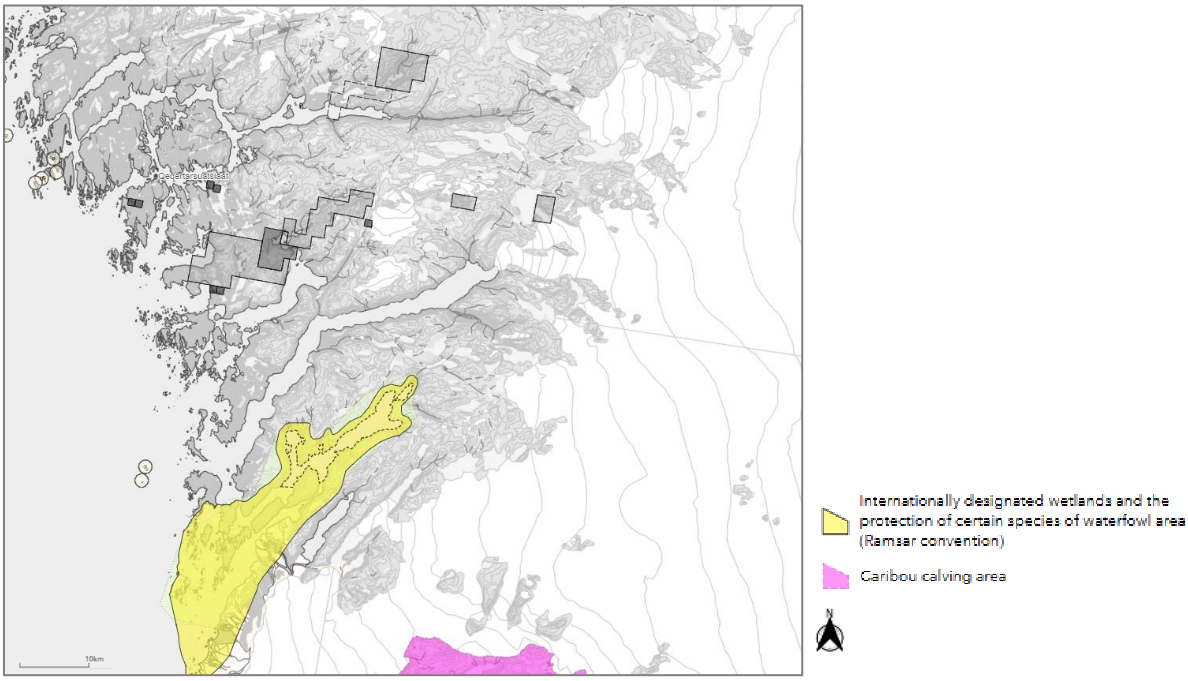


Figure 70: Location of protected or important Ramsar and caribou calving areas in relation to the project area.

Two important caribou calving areas have been pointed out 65 km north (Qallit Nunaat) and 75 km south (Kangaartarsuup Tasersua) (beeline) of the project area, Figure 72. These areas are sensitive to disturbance during breeding season from May through June and pregnant females may gather here in larger herds prior to calving (Christensen, et al., 2016). In general, caribou are vulnerable to disturbance during winter where resources are scarce. Sensitive wintering grounds are less well defined for the Qeqertarsuatsiaat caribou population (Cuyler, Nymand, Jensen, & Mølgaard, 2016). In the aerial survey conducted in March 2012, caribou observations stretched entire transects from the inland ice cap to the maritime coastal habitat (Cuyler, Nymand, Jensen, & Mølgaard, 2016).

In 2000 the Danish Energy Agency under the Ministry of Environment and Energy published a sensitivity atlas as a part of the preparations for exploratory offshore drilling in Greenland (Mosbech, et al., 2000). The sensitivity atlas points out areas sensitive to oil spill. This is relevant in this context in relation to the marine traffic that is part of the planned project. The traffic could potentially cause local oil spills from vessels if an accident was to occur. The Sensitivity Atlas has pointed out the inner part of Qeqertarsuatsiaat Kangerdluat as highly sensitive, Figure 71. This is due to the Arctic char fishery that takes place along most of the coastline of the inner part of the fjord. The central part of Qeqertarsuatsiaat Kangerdluat and the shorelines along the archipelago outside Aniqqoq-Sarfat Aariaat have been categorized as moderately sensitive, Figure 71 and Figure 72. Here, hunting takes place and also to some extent arctic char fishery. Also, several bird colonies are found here. The coastal area and entrance to Qeqertarsuatsiaat

Kangerdluat has been categorized as extremely sensitive to oil spill. This is due to fishery for lumpsucker that takes place around the islands. Risk handling for marine shipping is evaluated in the following sections.

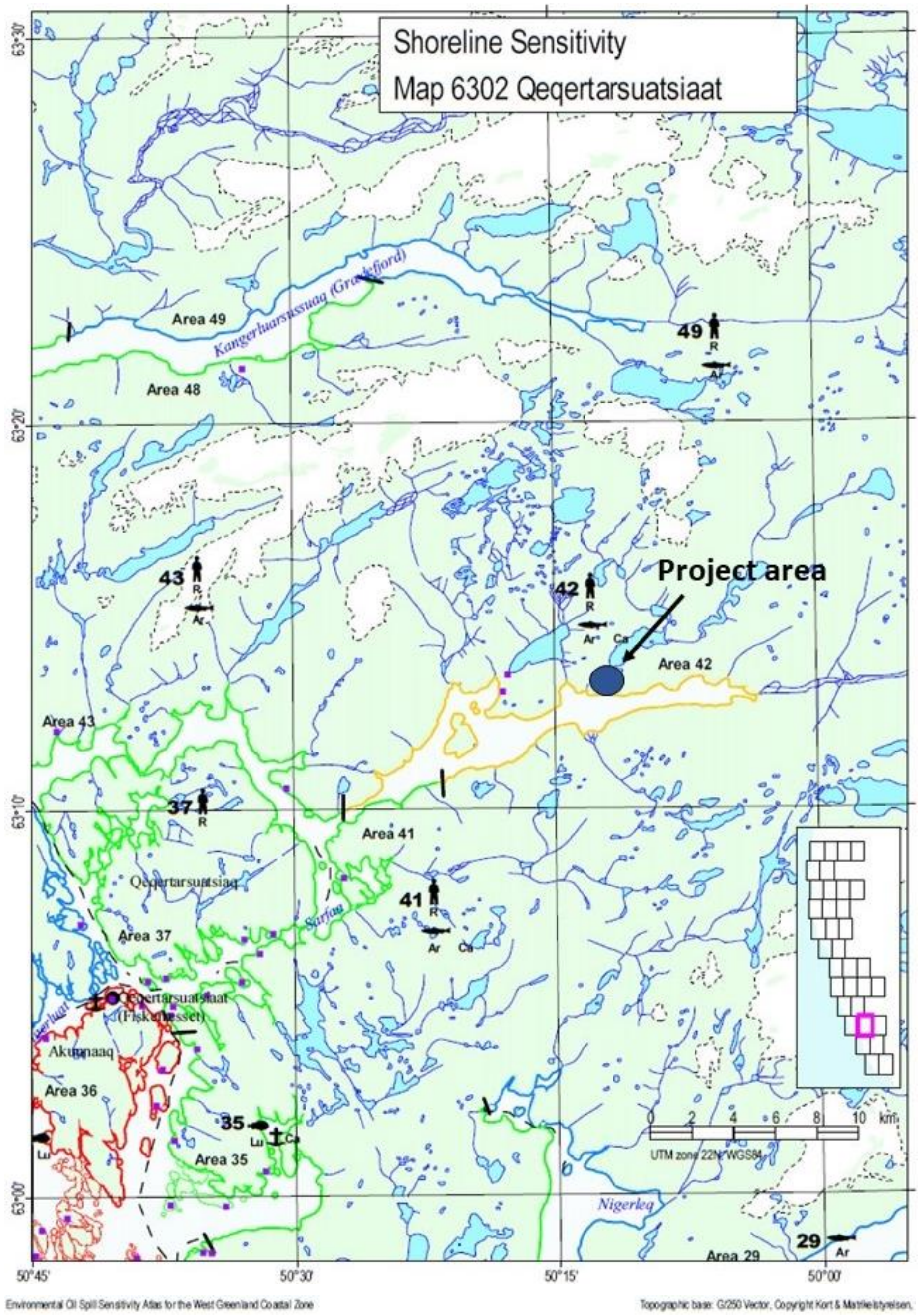


Figure 71: Sensitivity of the shoreline surrounding the project area. Blue: low sensitivity, Green; moderate sensitivity, Yellow: high sensitivity and Red: extreme sensitivity. Modified from (Mosbech, et al., 2000).

5.10.1. Traffic-Marine Navigational Safety Instruction

Current traffic in the project area consists primarily of smaller leisure boats used for fishing, hunting and recreational purposes but larger fishing vessels of 10-24 meters also fish in the fjords and coastal areas off Qeqertarsuatsiaat (Snyder, Jacobsen, & Delaney, 2017). Every second week Qeqertarsuatsiaat receives supplies from Royal Arctic Line containerships (650 DWT) (RAL, 2022) and as the settlement provides public fuel distribution, boats from other towns and settlements come to refuel their boats when commuting north/south along the coast (Rambøll, 2023a). Relevant navigation rules are expected to be followed by everyone entering the fjord system. The main traffic into the fjord, however, includes primarily locals in either small boats or fishing vessels. As the settlement has some 176 inhabitants the overall number of local boats and daily traffic is low. Most traffic occurs during summer where activity around the settlement is peaking. Within the project area no infrastructure exists. The current traffic is scarce, and the area is only accessible by foot and canoes during summer and hunting season and by foot and snowmobile during winter. However, winter activity is literally not existing.

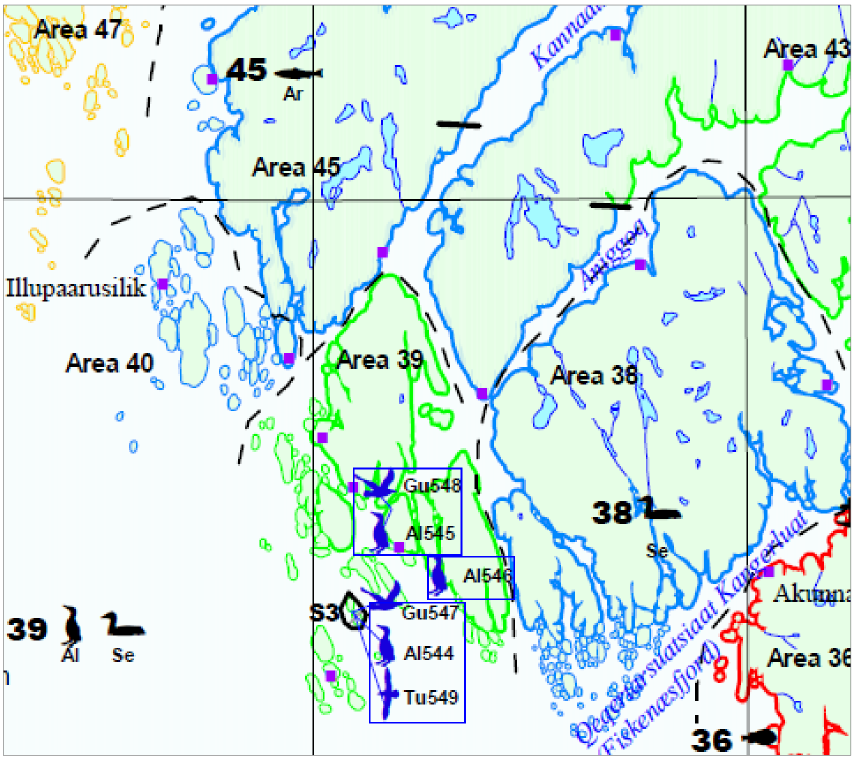


Figure 72: Sensitivity of the shoreline at the coast outside Qeqertarsuatsiaat t. Blue: low sensitivity, Green; moderate sensitivity, Yellow: high sensitivity and Red: extreme sensitivity. Blue icons refer to site specific shoreline species. Black icons refer to species found at the shoreline (Mosbech, et al., 2000).

5.10.2. Maritime legislation and standing guidelines

All maritime logistics required in connection with the Majoqqap Qaava project is carried out in accordance with the relevant and applicable rules and guidelines for Greenland waters, including executive orders issued under the aforementioned laws. The following documents must be observed:

- International Maritime Organisation [IMO] Polar Code,
- The Danish Maritime Authority Executive Order no. 1697 of 19 December 2015,
- Executive Order for Greenland on the safe navigation of ships, etc.
- Danish Maritime Authority Executive Order no. 169 of 04 March 2009,
- Executive order of technical regulation on the use of ice flood lights when sailing in Greenlandic waters,
- The Ministry of Environment and Food, executive order no. 1534 of 19 December 2017,
- Law on protection of the marine environment within the exclusive economic zone (EEZ) in Greenland,

- Greenland Parliament Act no. 15 of 8 June 2017 on the protection of the marine environment,
- Ministry of Industry, Business and Financial Affairs, executive Order no. 170 of 17 March 2003,
- Executive Order on ship reporting systems in the waters off Greenland (Reporting obligations in Greenland).

A compiled complex of Danish executive orders on safe navigation in Greenlandic waters, IMO regulations, circulars and guidelines and other relevant information about navigation in Greenland and the Arctic region can be found on the Danish Maritime Authority website: https://www.dma.dk/safety-at-sea/the-arctic-region.

5.10.3. Charts and surveys

The company NSI is focused on the conditions inside the Greenlandic EEZ. The shipping route from EEZ to Qeqertarsuatsiaat has been chartered and adequate charts are available to plan and execute safe sailing. Electronic charts for the approach to Qeqertarsuatsiaat Kangerdluat exists and is available. A bathymetric survey of international standard of the inner parts of the fiord mapping the route from the existing charts to the harbour site at Majoqqap Qaava. The bathymetric was carried out by the company in 2020 and is up to date. The survey was carried out according to BAT and following IHO Standards for Hydrographic Surveys 5th edition, February 2008 Special Publication no. 44, IHO Standards for Hydrographic Surveys (S-44) 6. edition, March 2020 and the guideline from the Danish Maritime Authority of 10. January 2011 regarding navigational safety issues related to mineral exploitation in Greenland and navigation during the operation phase.

The company is currently in dialogue with the Danish Geodata Agency regarding the final preparation and publication of the relevant charts for the navigation of the MAQ project. Unfortunately, due to a lack of capacity and a long-term strategy of simultaneous publication of paper charts and electronic navigational charts (ENC) for the most important shipping routes along the west coast of Greenland for the benefit of commercial shipping, raw material projects have been downgraded. If the above principle of simultaneous publication is maintained, this means that GST will not have the capacity to produce the necessary charts for the anorthosite project until the beginning of 2027. After that, the timeframe for production is approximately 4-6 months.

In order to optimise commercial navigation to the project in the future operational phase and reduce environmental impact, GAM has also initiated further hydrological modelling of ice formation, wave and current conditions in the fjord system. The modelling will establish the interaction between local climatic conditions, salinity, tides, currents and the 3-dimensional shape of the fjord system. The results will be available before navigation in the project area begins.

5.10.4. Shipping routes

The total description of the project shipping routes includes a full rotation from positioning outside the Greenlandic EEZ arriving from either Europe or North America (Mexico, Canada or USA) and onwards to the mine. From here the vessel will do a return trip to either Europe or Canada/USA.

The detailed choice of route can vary from each rotation, depending on given ice- and weather conditions and the limitations for a given vessel defined by its "*Polar Water Operational Manual*" and "*Polar code Certificate*". The final choice of a safe shipping route comes down to a decision made by the ship captain and the shipping company. Shipping through the fjord system can though only begin when the relevant official nautical charts are available.

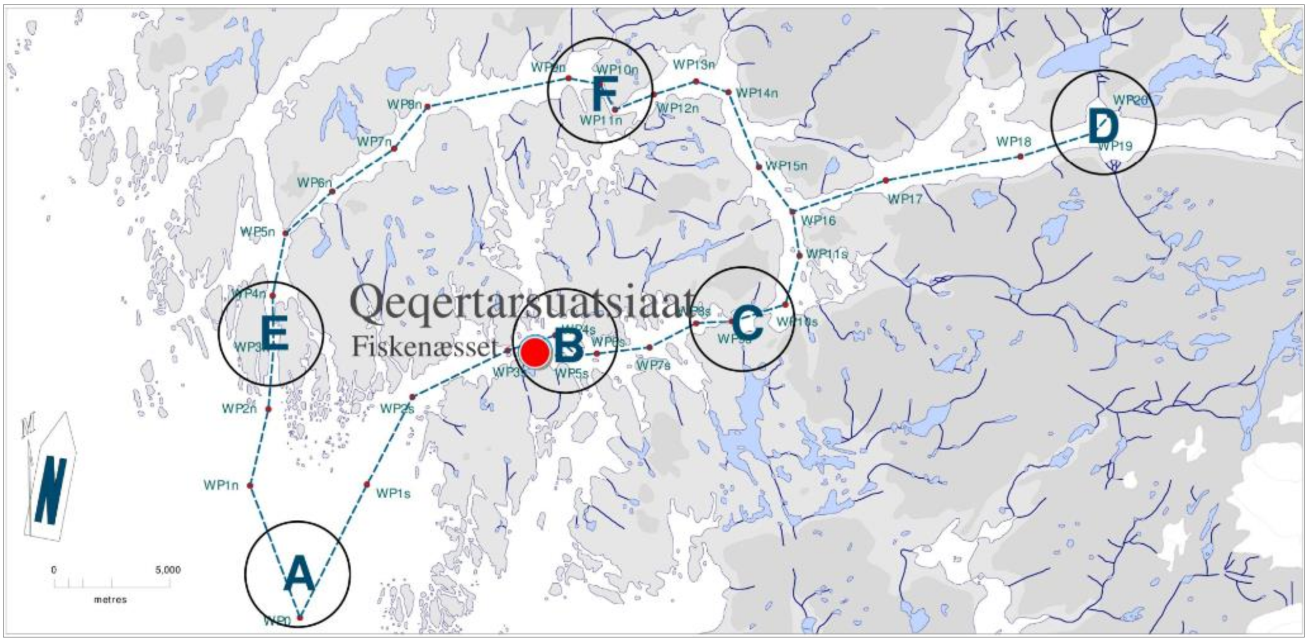


Figure 73: Map showing the shipping routes to the mine with marking of areas of navigational interest.

There are two possible approach routes to the mine, both adequate for safe navigation according to the types of vessels in question.

- <u>Southern route</u>: Going from Approach (A) following the southern route to the mine (D) is 26 nautical miles. After passing Qeqertarsuatsiaat navigation is required (B) to avoid a particular shallow area. Following the defined route, the depth is more than 15 meters at high tide (max tidal amplitude is 3.5 meters). Following the southern route vessels will encounter distinct current regimes where larger whirls could cause a challenge why this route is only recommended during calm waters and at high tide. The narrowest passage is c. 100 meters wide (C), Figure 73.
- <u>Northern route</u>: From Approach (A) following the northern route to the mine (D) the route distance is 33 nautical miles. Following the northern route vessels will encounter a narrow strait with nearby low water depths of 2-4 meters and numerous unmarked reefs (E), which could complicate a safe passage through the chartered shipping lane of 130 meters width. The Northern route is particularly challenged by a sharp 90° turn (F) which requires calm water and weather. As in the Southern route vessels could encounter distinct current regimes where larger whirls could cause a challenge why the Northern route is only recommended during calm waters and at high tide, Figure 73.

5.10.5. Shipping during winter

Sailing in arctic waters does pose a higher risk than sailing in tempered regions. The arctic waters are to a large extent unchartered and sailing here generally include risk factors necessitating vessels to have a higher degree of adequate equipment and crew vigilance.

For vessels transiting the Majoqqap Qaava mine, equipment should by standard include:

- Ice flood lights providing adequate observation distance for timely manoeuvring.
- Safety equipment (life wests with PLB), Man-over-Board [MOB] boat, life rafts and MOB buoys, fire extinguisher and firefighting equipment approved for temperatures of -20° C.
- Clothing for crew suitable for working in cold environment.

- Heater traced windows at the vessel bridge or a heating source with similar effect.

Vessels transiting the mine should be prepared for ship and equipment ice coverage and heavy snowfall at the vessel decks and mooring areas and equipment to resolve this is to be available on project vessels.

5.10.6. Emergency procedures

As the project evolves the company will develop and expand the safety plan and Environmental Management plan. These will comply to the remoteness of the project site and risk- and probability analyses will ensure that adequate mitigation measures are in effect.

A specific independent emergency plan for maritime vessel operations will be presented which will include a separate procedure for "Loss of Containment". In the unlikely event of a maritime accident resulting in release of fuel or product the emergency plan will come into effect. This will include swiftly reporting to relevant authorities and issuing of the local project pollution containment and extraction equipment.

5.11. Emissions

Greenland Anorthosite Mining expect the project to require burning c. 2.96 million litres of diesel pr. year for the large-scale Scenario B. Of these 2.96 million litres the powerplant, running 3 diesel powered generators, is expected to burn 1.28 million litres burning 1 litre of arctic diesel roughly emits 2,600 grams of CO_2 which sums up to a yearly project CO_2 emission of 7,692 tons/year including estimated emissions from shipping out product, Table 34. As Greenland in total emitted roughly 515,000 tons of CO_2e in 2020 the Majoqqap Qaava would release CO_2 equivalent to 1.49 % the total emissions once in full production, following Scenario B (Ritchie, Roser, & Rosado, 2020).

Regarding NO_x emissions an estimate has been calculated from the planned machinery used for running the mine. Calculations are based on an estimated kW effect per machine, avg. machine load factor and expected operating hours. NO_x emissions are derived expecting equipment to follow stage IIIA 130<=kW<=560 engines or later emitting NO_x 3.4 g/kWh (National Environmental Research Institute, Denmark, 2006). Data is presented in Table 33 showing an estimated NO_x emission of 334.4 tons per year incl. powerplant (with precaution for the selected machinery and work factor values). Table 33 also include a CO_2 estimate showing that the expected amount of CO_2 released from project machinery accounts for 56 % (4,363 ton) of the total land-based operation.

Reference model	Equipment	Amount	Fuel consumption *(Ltr./hrs.)*	Effective utilisation	Direct Operating Time *(hrs./year)*	Fuel consumption total *(Ltr./year)*	CO_2 *(tons)*	NO_x *(tons)*	SO_x *(kg)*
Hitashi ZX890LC-7	Excavator	1	87.2	0.7	4,641	404,768	1,052	13.4	8.1
Hitashi ZW6	Front End Loader	1	33.1	0.7	4,641	141,792	368.7	4.7	2.8
Mercedes Arocs	Off highway tipper truck	10	20.0	0.7	2,735	546,957	1,422	18.0	10.9
"Bench-mark"	Primary Drill	1	33.6	0.2	1,085	33,159	86.2	1.1	0.7
"Bench-mark"	Secondary Drill	1	30.6	0.0	11.0	330	0.9	0.0	0.0
CAT D8T Dozer	Primary Track Dozer	1	18.4	0.8	5,378	198,248	515.4	6.5	4.0

"Bench-mark"	Primary Motor Grader	3	17.5	0.7	4,626	243,143	632.2	8.0	4.9
Mercedes Arocs	Water Truck	1	14.4	0.2	1,080	15,530	40.4	0.5	0.3
Mercedes Arocs	Fuel Truck	3	9.5	0.3	1,727	49,015	127.4	1.6	1.0
Mercedes Arocs	Low Bed	1	18.6	0.0	284	5,259	13.7	0.2	0.1
"Bench-mark"	Lighting Plants	4	1.3	0.5	3,240	16,200	42.1	0.5	0.3
Pumps		1	1.2	1.0	6,480	7,582	19.7	0.3	0.2
Hilux pickup similar	Light Vehicle	3	5.0	0.2	1.1	16,200	42.1	0.5	0.3
MACHINERY					Total:	1,678,183	4,363	55	34
POWERPLANT		3 pcs. 600 kVA generator setup			Total:	1,280,211	3,329	279	26
					SUM:	2,958,394 ltr./year	7,692 tons/year	334.4 tons/Y	59.2 kg/year

Table 33: Calculated NO_x and CO_2 from estimated machinery for project Scenario B.

Emissions from shipping out product has also been evaluated. Using production tonnage calculated by the company on the two scenarios, A and B, an estimate on required number of Handymax sized bulk carrier vessels have been calculated.

Using the shipping route distances defined in the project NSI, see section 5.10.4, and adopting an estimate on CO_2 release for Handymax vessels, emission values on two scenarios have been calculated (Kanberoglu & Kökkülünk, 2021). The calculation anticipates ships to switch between using the south and north shipping route.

Route		Return trip distance *(Nm)*	CO_2/ nautical mile *(tons)*	CO_2/ return trip *(tons)*	Return trips *(amount)*	CO_2/ year *(tons)*	Sum CO_2/year *(tons)*
Scenario A	North route	66	0.45	29.7	5	148.5	265.5
	South route	52	0.45	23.4	5	117	
Scenario B	North route	66	0.45	29.7	10	297	531
	South route	52	0.45	23.4	10	234	

Table 34: CO_2 emissions from shipping. Calculation anticipates ships using north and south route equally.

On a larger scale, an in-direct emission effect in this context is the fact that the use of anorthosite from the Majoqqap Qaava in the relevant industries, e.g., as a replacement for kaolin (clay minerals) in the manufacturing of fiberglass. This would result in an overall reduction of CO_2 and NO_x due to from reduced energy demand when utilizing anorthosite compared to existing materials. The anorthosite potentially enables the consuming companies to decrease their energy consumption (e.g., from burning natural gas) by 10-14 % for melting and burning their products.

Quantitatively, the use of anorthosite yields significant Greenhouse Gas [GHG] reductions, both directly and indirectly. At full substitution on a 170 ton/day furnace, the estimated reductions are as follows, Table 35.

Emission	Source Reduction	Tons Reduced
CO_2	Limestone replacement	2,400
	Energy reduction	2,590
SO_X	Salt cake replacement	570
H_2O	Kaolin replacement	2,700
	Energy reduction	110

Table 35: Case showing emission reductions using anorthosite in an E-glass composition batch (at 100 % batch substitution level) (Hains, London, & Merivale, 2008).

5.11.1.1. Construction and operation phase impact assessment

This significant decrease in energy consumption will potentially more than offset the increase in CO_2 emissions in Greenland. Overall, the project would potentially result in a net reduction in CO_2 emissions when perceiving the Majoqqap Qaava anorthosite on a circular scale.

The total emission from the project is considered minor compared to Greenland's CO_2 output (project induced increase of 1.49 %), and global CO_2 emissions will potentially be reduced by the use of the Majoqqap Qaava Anorthosite as a substitute to today's materials when manufacturing e.g., fiberglass, thus having an overall positive impact on global climate change.

Potential impact	Emission of greenhouse gasses
Impact phases	Construction and operation
VEC	Global atmospheric footprint

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Minor
International	Low	Long-term >5 year	High >75 %	

Nitrogen is readily soluble if exposed to water, and as such, one of the more significant risks is the introduction of nitrates into the water system. Nitrates can be introduced into the water system through wet blast holes and the movement of ground water from blast sites. Classic ANFO explosives are a source of ammonium nitrate which, if used inappropriately or is detonated too late, tends to sieve into rock cracks, leaving unexploded residual matter after detonation. This is a known source of nitrate to surrounding freshwater systems from mining operations. There are several mitigative measures to using ANFO more effectively, where the most straight forward solution is using it as emulsion, which thickens the product thereby minimizing the leakage into rock cracks. Emulsion ANFO (heavy ANFO) optimize the amount of ANFO exploded and minimize the residual matter. Also, emulsion is water-resistant which is an advantage for working in rain and during winter (Boshevski & Dambov, 2013).

Potential impact	Emission of nitrogen from ANFO – eutrophication of water
Impact phases	Operation
VEC	Water quality

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Long-term >5 year	Medium 25-75 %	

With the company's natural focus on mining efficiency and the company policy on the environmental approach to the project, ore blasting is expected to cause little effect on the surrounding environment in terms of eutrophication.

Though the bacterial denitrification efficiency is considered low in cold environments, focus on minimizing ammonia and nitrogen release at the source (e.g., by using efficient explosive agents) is expected to keep eutrophication low (Karkman, Mattila, Tamminen, & Virta, 2011). The impact from the use of ANFO on eutrophication is assessed to be negligible.

5.12. Impact from Waste and Wastewater

As mentioned in section 4.10.2 organic waste will be incinerated in an approved incinerator or composted, as permitted. Hazardous waste materials such as used oil containers, used oil, used oil- and fuel filters, batteries etc. will be collected and removed from site to an approved disposal facility. If such facilities are not available, hazardous wastes will be securely stored in containers for shipment to an approved disposal facility in Europe.

Hazardous liquid wastes (used oil, etc.) will be disposed in a suitable approved high temperature incinerator or drummed for shipment to Europe for disposal at an approved facility. Wastewater from the camps sewage treatment system will be discharged to Qeqertarsuatsiaat Kangerdluat. As the system is relatively small (approximately 10 PE (population equivalents) during construction and app. 30-80 PE in operation, the annual contribution of N and P to the fiord will be approximately 1,752 kg organic material (BI_5), 80 kg of P/year and 352 kg N/year for 80 people (Miljøstyrelsen, 2006).

5.12.1.1. Construction and operation phase impact assessment

The above sources of nitrogen and phosphor are expected to result in negligible environmental effects, as solid and hazardous waste are disposed under secure conditions. The contribution of wastewater to Qeqertarsuatsiaat Kangerdluat is of such low magnitude, that it is not expected to cause measurable changes in the recipient, not at least due to the high turbidity in the fiord and the rather high water change due to the tidal cycle.

Potential impact	Eutrophication of marine recipient
Impact phases	Construction, Operation and Closure
VEC	Marine ecology

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Long-term >5 year	Low (<25 %)	

5.13. Oil and chemical spill risk assessment

5.13.1. Land activities

The mining project is a relatively simple blast, haul and crush operation and will therefore not store other chemicals than what is required to run a workshop and mine camp. Lubricants, oil etc. will be stored in the workshop on impermeable flooring and with required oil separators for wash water. The main risk of a fuel pollution is identified to be on refuelling operations and transportation of fuel. Refuelling operations is defined as both main resupplying of the camp fuel storage facility and frequent refuelling of project vehicles and machinery.

Overall, the fuel facility and fuel hub storages will be constructed according to Best available practice. Larger fuel tanks will be double hulled and with overflow alarm and located on impermeable surfaces. The main storage facility will be installed within a containment area with berms; a secondary containment that will protect against leaks and spills. The tank area and adjacent fuelling surface will be gravelled with an underlying impermeable membrane.

In case of a spill from the main fuel storage facility the containment area will withhold the fuel enabling for a full recovery of the spill. Should fuel leak to the environment absorbents will be deployed and the absorbed spill material will then be dug up and shipped out to the municipal waste centre. Fuelling of vehicles will take place at designated sites on impermeable membranes enabling absorption of spill with gravel.

In the unlikely event of a major fuel leak accident, the management plan will be enacted, and the leak will be located and stopped. If possible, the fuel will be diverted to avoid drainage into the freshwater system and clean-up will commence. There are few ways to clean up a diesel spill and overall, the best way to clean up minor spills is to dig up the polluted earth layer and leave it at a designated site to let the fuel evaporate or ship it out to the municipal waste centre.

Following many years of production certain areas may over time be polluted to an extent that a remediation action is required. Several experiments have been tested regarding remediation of polluted soil in the Arctic - including thermal remediation to land farming, where naturally occurring microorganisms are triggered to break down hydrocarbons in the soil (Arkil, NIRAS, 2019; Johnsen, Boe, Henriksen, Malmquist, & Christensen, 2021). This has proven to be an efficient, passive and long-term method to clean up larger patches of polluted soil.

Potential impact	Risk of fuel leak and soil pollution on land
Impact phases	Construction, Operation and Closure
VEC	Terrestrial environment and freshwater

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Minor
Local	Medium	Temporary 1-5 years	Low <25 %	

5.13.2. Marine activities

Greenland Anorthosite Mining plan to use Arctic diesel as the primary energy source. Arctic diesel is a relatively light fuel, composed of hydrocarbon fractions C14-C20, where crude oil and heavy fuel oil consists of fractions C20-C70. This makes arctic diesel more volatile with quicker evaporation rates and also more difficult to collect if spilled. However, the faster evaporation makes the long-term consequences less severe than a heavy fuel oil spill.

The main risk zone for accidental oil spill is during the unloading operation from the fuel vessels to the land-based fuel storages, and when distributing from these to the project tankers. In case of accidents at the harbour site the Qeqertarsuatsiaat Kangerdluat fiord will be affected.

Fuel is anticipated to be delivered by coastal tanker using a hose line or by ship or/and barge in 200 ltr. drums or 1,000 ltr. containers. The current concept is for loads of 900 m^3 (c. 900,000 ltr. to be offloaded) from a tanker up to approximately 3 times per year in Scenario B. This sums up to the anticipated yearly consumption of c. 2,970 m^3 diesel fuel, to arrive by tankers and unloaded at the port site. The fuel will be pumped from the vessel/barge through a pipeline to spill protected double wall storage tanks. Furthermore, the tanks will be installed in a secondary containment structure able to retain the volume of the largest tank.

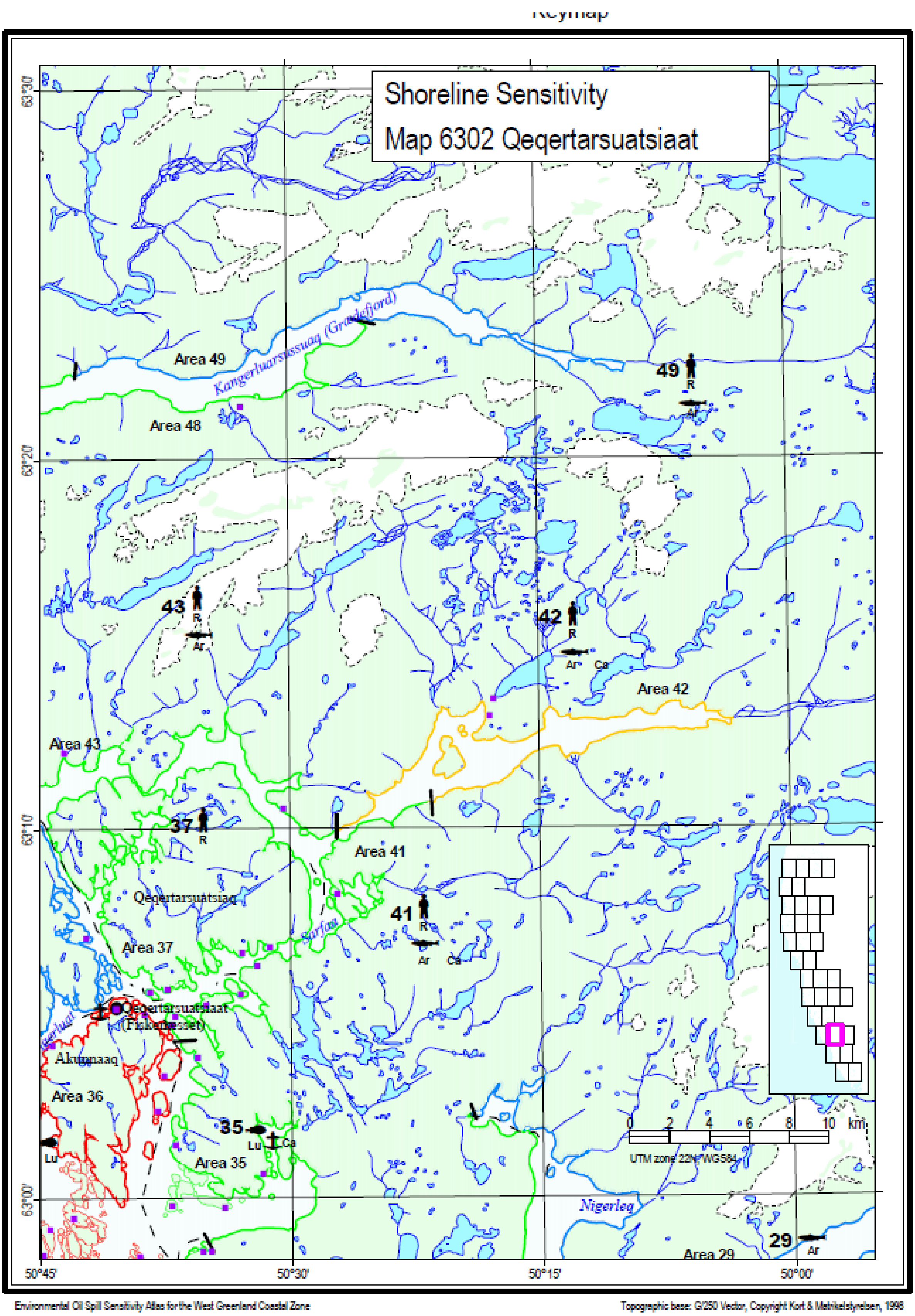


Figure 74: Shoreline sensitivity map Qeqertarsuatsiaat.

Important fishery for Arctic char at one river outlet and along coasts, herring fishery and occasional hunting throughout the year except when ice covers the fjord. This was identified in an oil spill sensitivity study in 2000 in the inner part of the Qeqertarsuatsiaat Kangerdluat fiord, (Mosbech, et al., 2000).

Birds are extremely vulnerable to oil spills in the marine environment. Most fatalities following oil spills are due to direct oiling of the plumage, but sometimes birds also die from intoxication, hypothermia, starvation, and drowning. The arctic diesel is less hazardous than heavy fuel to the water environment as diesel will evaporate even when spilled in water or attached to the plumage. However, a large-scale spill on Greenland's east coast have shown the significance from Solar diesel oil spilled to the environment and the timeframe and difficulties from cleaning up a large spill (Sermitsiaq, 2022).

Marine mammals such as seals and whales are generally less sensitive to oiling compared to many other marine organisms (e.g., fish larvae) and can generally survive short periods of fouling and contact with oil. However, direct contact with an oil product can irritate the skin and can seriously affect the eyes or cause direct poisoning through ingestion (Boertmann, Blockley, & Mosbech, 2020). As marine mammals breathe at the surface, there is a risk of inhalation of vapours from volatile organic compounds which have been suspected to have lethal effects (Boertmann, Blockley, & Mosbech, 2020) Feeding might be suppressed in case of oil spills.

This risk of a large heavy fuel spill is considered relatively low. Since no oil bunkering will take place in the fiord the only scenario for a large oil spill would be if a tanker or bulk carrier should hit a reef or the shoreline. GAM has taken all possible precautions in their efforts to enable safe shipping to and from the project site. The sailing routes and adjacent waters have been officially chartered according to international standards and a proper response plan will been filed to the responsible authorities, see section 5.10.4. To minimize the risk of accidents the company intends to enforce a systematic fuel handling plan with dedicated workers responsible for these tasks – see section 8.

5.13.2.1. Construction and operation phase impact assessment

In the oil spill sensitivity study including the inner parts of the Qeqertarsuatsiaat Kangerdluat fiord was assessed to be "High sensitive" to oil spill. This ranking is among others driven by the relative high abundance of capelin and arctic char, (Mosbech, et al., 2000). As described above accidents in the marine traffic may have an impact on the marine environment. Fortunately, ship catastrophes are extremely rare but if an accident happens, the effect on the marine life will in most cases be major. The company NSI describes the procedure for sailing in the fiord past the settlement of Qeqertarsuatsiaat. The NSI reduces the likelihood of an accident in the vessel traffic to and from the Majoqqap Qaava mine project to a very minimum. The main risk to the marine environment from accidents in the marine traffic is oil spill and/or spill of product. The product spill will not pose any environmental risk as no elevated hazardous elements have been found in the product that is shipped, see section 5.4. Oil spill will cause an impact on the marine environment as Handymax bulk carriers are estimated to carry from 110,000 – 150,000 ltr. of bunker fuel (arctic) in the fuel tanks. The vessels are expected to fuel outside Greenland. Ship bunkering is regarded as a sensitive manoeuvre since this involves open tank valves and transportation/pumping of fuel. Fuelling outside Greenland eliminates this aspect. A derived effect from this is the fact that ships arriving and leaving the Majoqqap Qaava port will be sailing with only partly filled tanks. This reduces the amount of fuel oil which could be dispersed in the environment in the unlikely event of a shipwreck.

According to the company's NSI, larger ships passing through the fiord system will furthermore be accompanied by tug capacity. The purpose of the escort vessels is partly to assist the bulk carriers through difficult passages and partly as part of the company's Environmental Management preparedness, as a main component of the company's Oil Spill Response action plan. Also, the presence of tugs assisting transiting ships enables quick action in securing a ship should accident strike. This reduces the risk of a ship actually sinking to a minimum which increases the effectiveness of combatting a potential pollution significantly.

The company's Oil Spill Response action plan is part of the company's Environmental Management Plan (see section 8), which will be regularly evaluated and adapted to the project's development phases from construction, operation and decommissioning, as well as changes in external circumstances such as a statutory requirement to use Low-Sulphur Fuel Oil [LSFO] when sailing in Greenlandic waters. The adaption of new fuel oils could change the methods of combatting a potential spill and GAM intend to incorporate revised oil response procedures as the effectiveness of said procedures has been documented.

Therefore, the overall impact from oil spill from vessels calling the project is assessed to be minor.

Potential impact	Risk of vessel accident and oil- or product spill
Impact phases	Construction and operation
VEC	Marine water quality and marine fauna – especially birds

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Minor
Local	Major	Long-term >5 year	Low <25 %	

6. Landscape, Cultural Heritage and human activities

6.1. Cultural Heritage and human activities

The project mine site, Majoqqap Qaava is located 40 km northeast of Qeqertarsuatsiaat. The proposed camp site and harbour facilities are located just under 30 km away from Qeqertarsuatsiaat, approximately 1 hour by boat. So far, there exists no infrastructure that connects the project site to the rest of Greenland and construction of necessary infrastructure is part of the planned project.

The *Greenland National Museum & Archives* registers all sites of protected cultural heritage and a 20-meter protection zone surrounding these sites are effectuated (Naalakkersuisut, 2019). Sites of cultural heritage include cairns, ruins, stone rings and other sites that witness human activity from prior to the year 1900. As part of the preparations for the Majoqqap Qaava project, archaeologist from the Greenland National Museum & Archives searched the area for sites of cultural heritage. They found a total of 18 minor sites representing caribou hunting activities and movement in the landscape, as well as a single grave from the Thule culture (outside the area impacted by building activities). Based on their survey they concluded that the proposed activities would not conflict with the heritage sites found (Larsen, 2020). Also, Greenland Anorthosite Mining will comply with current legislations and activity, and project related activities will not take place within 20 meters from the identified sites.

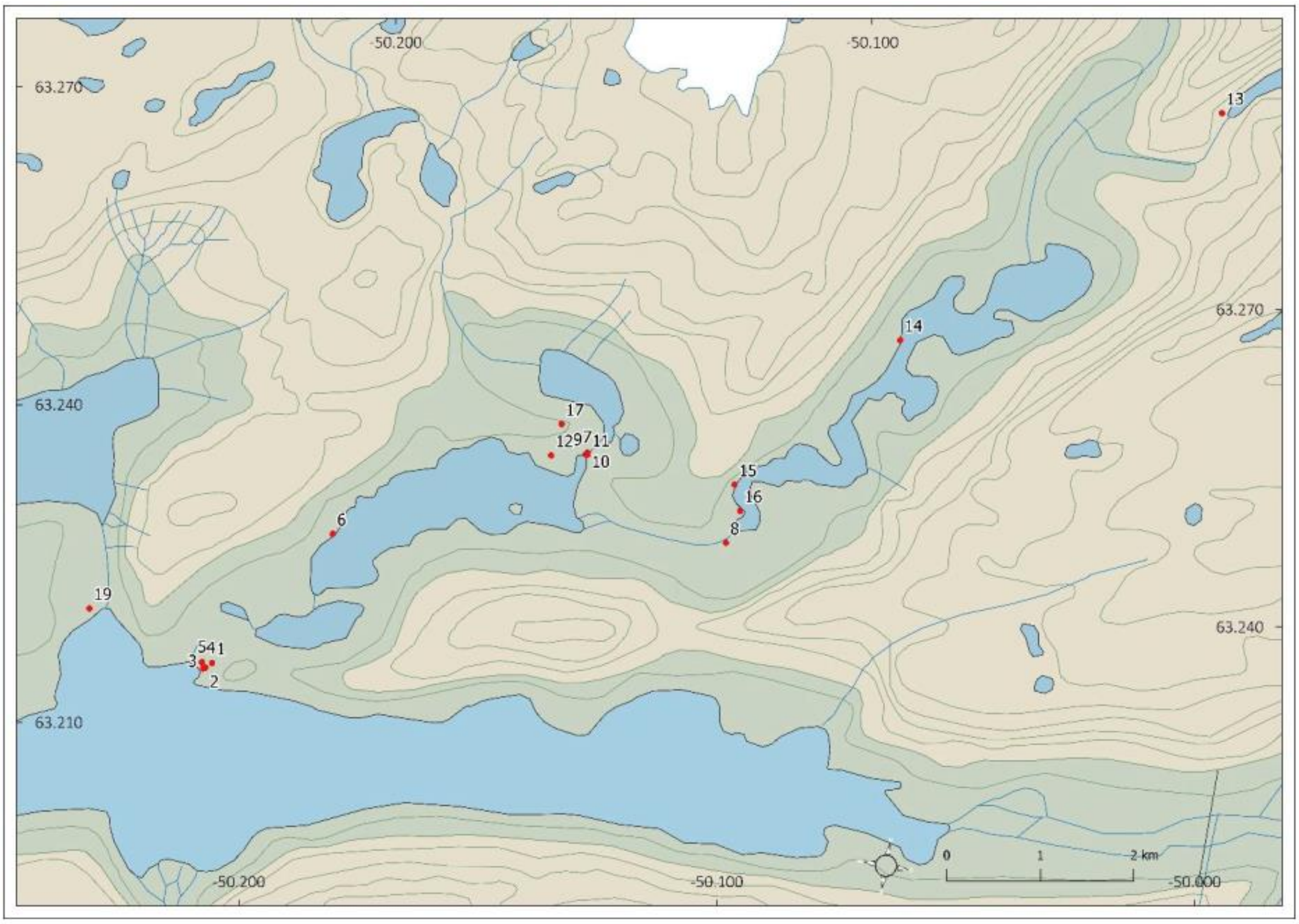


Figure 75: Overview of archaeological sites registered during survey in 2020 (Larsen, 2020)

The area and its surroundings are used widely by locals as both hunting and fishing ground as well as for recreational use. Caribou, hare, fox and ptarmigans are hunted within the area during their respective hunting seasons and for example cod, capelin, redfish and wolffish fisheries take place in the fjords along with arctic char fisheries in both the marine and freshwater systems in the area. The cod fishery represents the most important commercial fishery in Qeqertarsuatsiaat and in 2015, 29 residents of 213 inhabitants had employments related to this industry (Snyder, Jacobsen, & Delaney, 2017). At present day, approximately 17 residents of the total 176 inhabitants work full time within hunting and fishing and locals' state that the fishery is what keeps the settlement going (Rambøll, 2023a). Other job lines include electricians, carpenters and jobs within public service.

Tourism in Qeqertarsuatsiaat is very limited. However, recently there has been an increasing interest in the area from locals and from tourist due to the occurrence of minerals found in the area and since the opening of Greenland Ruby, the ruby mine south of Qeqertarsuatsiaat (Kommuneqarfik Sermersooq , 2016). Also, hunters from e.g., Nuuk and Paamiut, respectively 150 km north and 130 km south of Qeqertarsuatsiaat come to hunt caribou in the area.

Potential impact	Reduced hunting and fishing potential, limited public access
Impact phases	Construction, operation, closure
VEC	Locals in Qeqertarsuatsiaat

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Minor
Local	low	Long-term >5 year	High (>75 %)	

The mining area, camp site and in between infrastructure will have an onsite, local impact on the environment both due to the physical constructions (see e.g., section 4.7 and 4.10) and due to the increased human activity during work hours. This may have an indirect impact on hunters if nearby wildlife is pushed further away (see section 5.6.4). Also, local sites used for recreational purposes and berry picking in and near the camp site are likely to be affected either directly by land seizures or indirectly by noise or dust from e.g., nearby infrastructure. On the other hand, the infrastructure following the project makes remote areas more accessible. Finally, an impact could be if locals are hired to assist in mine related work, hereby making them unavailable to other local jobs. It is however assessed that the project will have overall minor impact on the cultural heritage and human activities in the area. Historical sites will be maintained and local use in terms of hunting, fishing, berry picking, and camping will continue.

6.2. Effects on landscape characteristics

The arrival and use of heavy machinery and the initiation of earthworks for establishing project infrastructure in the undisturbed project valley, will affect landscape characteristics.

The overall project landscape is dominated by a glacial valley defined by >250 m high mountainous ridges on both sides, with some areas comprising barren steep walls and others showing lesser volatile increments providing vegetated hillsides, Figure 76. One of the main characteristics of the project area is the freshwater system of lakes and creeks, which constitutes a significant freshwater continuum running through the length of the valley. The lakes and creeks are surrounded by wetland and marshes providing a lush habitat for wildlife during summer and act as drainage ways for snow melt-off during spring. The head of the valley is formed by bleak and windswept mountainous peaks, one of which is the future mining pit area. The lower part of the valley is overall covered in heath vegetation, Figure 78. The project valley can be defined as a typical undisturbed Greenlandic glacial valley found throughout the southwest coast of Greenland. The effects on the landscape are derived from the fact that the valley today is pristine and undisturbed which is the overall quality trait of the valley today. However, this is not a unique trait as most of glacial valleys in southwest Greenland complies with this definition.

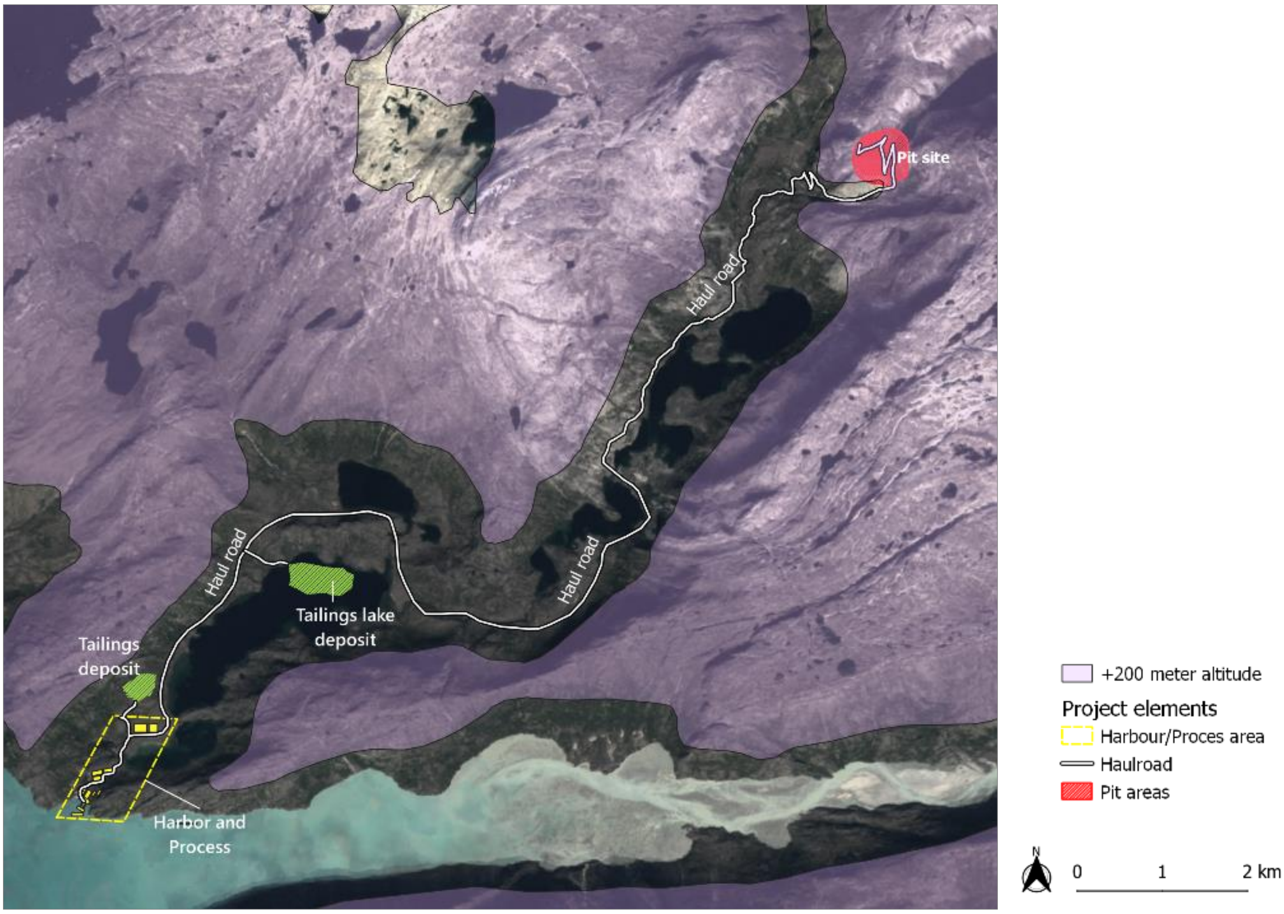


Figure 76: Project area with +200 m altitude areas visualised.

The project area has been divided into zones, based on the natural properties of the landscape, Figure 77. Parts of the lower section (A) are visible from the fiord and the section is overall vegetated with heath and shrub. The border between the lower section (A) and the mid-section (B) is defined by a natural ridge across the valley, which interrupt the line of sight from A into B. The pit-site section (C) is defined as the barren and rocky head of the valley at higher altitude and little to no vegetation.

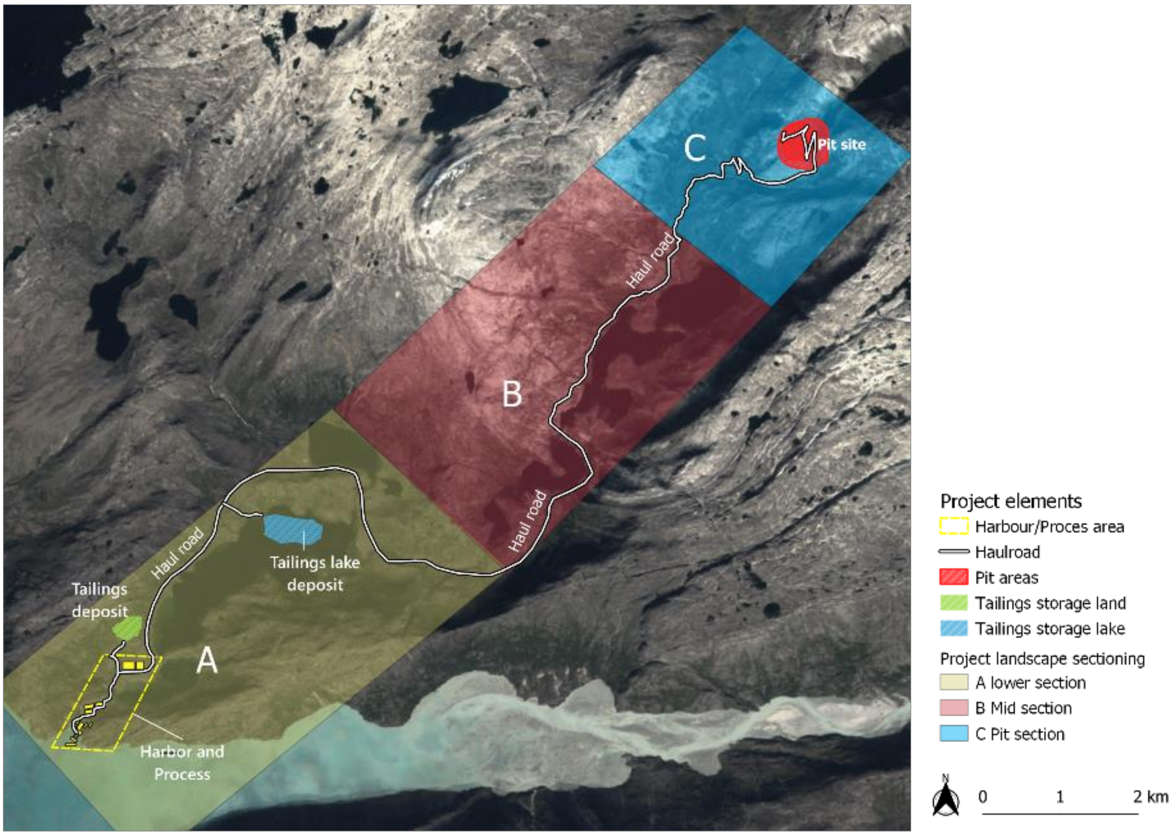


Figure 77: Sectioning of the project area.

Figure 78: Left: Lower part of project Valley (Section A) Right: Head of the valley (Section C).

6.2.1. Construction phase

Project development will start at the harbour site with barging in necessary equipment, machinery, and camp facilities. The work base will be established at the future accommodation site by clearing of topsoil and potentially blasting rocks to create level surfaces for future project structures such as buildings, tipping pads and storage tanks and other facilities. The goal is to utilize all areas used for storage etc. during construction as part of the production setup, thereby reducing the footprint from construction work (e.g., no areas are stripped of topsoil and left unused after the construction phase). From here work on the project haul road will be prioritized, with a cut-and-fill approach to prepare the c. 17 km long road to the mining site. The cut-and-fill approach basically means that materials retrieved by blasting or dozing on road transects that needs levelling, will be used at the road transects that needs material filling to create an even road. If the amount of needed filling material exceeds the amount retrieved from earthworks, gravel pits have been identified along the proposed road transect. Using material from designated gravel pits will secure proper material that is suitable for stabilizing the road and it minimizes the earthwork zones in the landscape. The intention is to have a few zones with intensive earth and gravel works instead of a lot of minor and more diffuse scarring sites along the road.

Figure 79: Example of dirt road through terrain (2022 - an access road related to the Buksefjord hydropower facility).

A road through the landscape will be perceived as a clearly defined linear structure through the landscape, disturbing the natural rugged and hilly natural look, Figure 79. The road will to some extent follow waterways and lake shorelines in the valley, thereby blending into the landscape and softening up the level of disturbance. At fixed intervals and where the landscape allows it, the road will be widened to allow passing of opposite moving vehicles and machinery.

Potential impact	Landscape scarring
Impact phases	Construction phase
VEC	Undisturbed glacial valley

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Minor
Local	medium	Short-term <1 year	Medium 25-75 %	

There are no current plans for changing the freshwater system. The project involves no dams or establishment of new major drainage channels. Road river crossings will be constructed using culverts dimensioned to handle large precipitation events and yearly spring melt runoff.

The construction work will slowly be ramped up as construction sites are prepared and will intensify when approaching initiation of the mining activity. The construction phase is evaluated to be of a *local extent* of *medium magnitude* and *temporary* (1-5 years). This will result in a minor impact on the local landscape.

6.2.2. Operation phase and closure

Having established the project infrastructure, the mining phase will start. This will result in blasting and removal of large tonnage of rock, hauling the mined product along the haul road to the processing plant and the establishment of large areas for Run of Mine tipping sites and material handling. At the process and harbour site several large buildings are established, and vehicle and machinery activity will run around the clock. Depending on the preferred solution, tailings and waste material will either be disposed of at a tailing's storage facility on land or via a ramp tipped into a lake. A land-based tailings facility is evaluated as a worst-case scenario, which will have a big impact on the vegetated lower section of the valley. Depositing tailings at the proposed 88,000 m^2 TSF Dry would result in a 28-meter high evenly distributed tailings stack. However, the TSF would for practical reasons be arranged in layers and terraces for stability and accessibility and the finer details regarding stacking heights and deposit area will depend on the actual physical settings (landscape, tailings properties etc.).

Figure 80 shows a large blast rock depot from another infrastructure project in Greenland. The depicted blast rock deposition site is roughly 30,000 m^2 - hence, the Majoqqap Qaava TSF will be 3 times the extent which is considered to result in a major impact to the lower part of the project valley.

Figure 80: Example of a large blast rock deposition site following a hydropower project. The potential project TSF will be several times larger.

At the pit site at the head of the valley, blasting and carving out the existing rock massif will also cause a large impact on the area. However, this part of the valley is barren with little to no vegetation which reduces the impact ratio. The continued hauling activity through the valley is expected to cause some dust spread along the haul road which in time will give a distinct sign of human activity through the valley. Should tailings be deposited in the designated lake suitable for this purpose (Lake #2) the lake is expected to change appearance with a heavy increase in suspended solids which results in high turbidity, for as long as tailings is continued to be put in the lake. The effect has been modelled using existing data and the conclusion is, that the effect will be most severe at and around the tailings tipping site, and that the majority of the material will deposit before reaching Lake #1 downstream, Figure 45.

Overall, approaching the project valley from the fiord is expected to give a clear impression of industrial activity in the lower section of the project valley (A) due to the harbour facilities and storage sites. The larger buildings and process plant will be located farther inland but probably still partly visible from the fiord. Moving up through the valley the haul road will be the persistent sign of the ongoing activity with minor gravel sites along the road. In a scenario with a full-scale land-based TSF site, the tailings will be the dominant feature of the lower part of the valley.

The midsection of the valley (B) will solely be impacted visually by the haul road and moving traffic.

At the pit site section (C) large changes will occur, but the landscape here is remote and not accessible to the broad public and dominated by a barren, rocky exposures. Therefore, the mining activities here are not evaluated to cause a major impact on the properties of the existing landscape. After mine closure the abandoned pit is not expected to be easily detectable due to the already barren and eroded rocky surroundings, and the main element leading one's attention towards the pit site will be the haul road.

In conclusion, the accumulated project elements are regarded as a *major impact* on a *local* geography with *permanent duration* and *high probability*, which is evaluated to cause a moderate project impact. This is regardless of the choice of TSF due to the fact that the project is of local extent either way. It should be noted that the land-based TSF Dry scenario will have an increased impact post-closure, since the underwater tailings solution will have no visible effect on the landscape post-closure of operations.

Potential impact	Landscape scarring
Impact phases	Operation and Closure
VEC	Undisturbed glacial valley

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Moderate
Local	Major	Permanent	High (>75 %)	

6.3. Areas of Interest / Conflicts

The project area is located in the vicinity of the village Qeqertarsuatsiaat. The local inhabitants from Qeqertarsuatsiaat travel widely to fish and hunt, which are two of the main occupations in the village. The project area itself and areas in close proximity are known to provide hunting grounds for caribou and arctic hare. Several freshwater systems in and around the project area are known to hold populations of arctic char, although field studies showed that the main river in the project valley is not a migration path and spawning ground for anadromous arctic char (spawn in freshwater and forage in the fiord).

Main marine resources utilized by the locals in the surrounding fjord system are fisheries for cod and capelin, the latter being seasonal dependent, and coastal fishing for migrating arctic char and salmon.

In the project EIA, the consequences of the proposed project on local use of the project area and neighbouring areas, will rely heavily on interviews and conclusions from the project Social Impact Assessment [SIA] (Rambøll, 2023a).

7. Cumulative effects

The cumulative project effect is a term used to express if potential project effects has increased severity or advantages in combination with existing or planned projects and their impacts.

Though Southwest Greenland is the most densely populated part of Greenland the distances between most settlements and land-based activities are huge. The Majoqqap Qaava project is located some 40 kilometres east of the settlement of Qeqertarsuatsiaat and 32 kilometres NE of the existing ruby mine run by Greenland Ruby (license MIL 2014-21). Overall, no direct cumulative effects are expected from the land-based project activities. There have been no reports of any effects in Qeqertarsuatsiaat from other activities in the region though these are located closer to the settlement than the Majoqqap Qaava project. Even the potential dispersion of aeolian dust particles is not expected to reach or influence the settlement of Qeqertarsuatsiaat or be even measurable in the region between Majoqqap Qaava and the Ruby mine.

The mine will cause increased marine traffic in the fiord which would add to the existing marine traffic load. The mine will be the only project in the fiord and the increased activity here is therefore not to be categorized as a cumulative effect. Vessels transiting from outside the Greenlandic EEZ to the approach to the fiord will add to the cumulative load of shipping in these waters. During recent years the increase in shipping activity in the arctic has become an important ecological subject. Associated with large mining operations in arctic Canada the number of vessels transiting the Davis Strait has increased dramatically, and studies suggest that the disturbance, both physical and due to underwater noise, could potentially impact especially marine mammals negatively (especially in northern Greenland). Ships transiting the arctic waters must follow the IMO Polar Code (IMO, 2017). The Polar Code covers the full range of design, construction, equipment, operational, training, search and rescue and environmental protection matters relevant to ships operating in the inhospitable waters of the Arctic and enables for registration of ship activity.

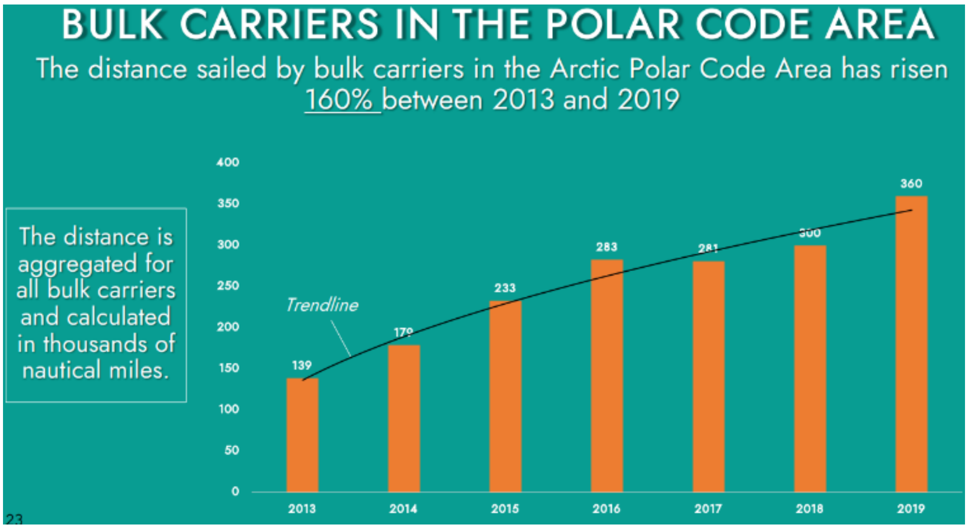


Figure 81: Chart showing the trend of increased marine activity visualized as distance for bulk carriers in thousands of nautical miles (PAME, 2022).

Issued via the Arctic Council, PAME (Protection of the Arctic Marine Environment) is the focal point of the Arctic Council's activities related to the protection and sustainable use of the Arctic marine environment (PAME, 2023). PAME facilitates an *ASTD* ship survey program providing continuous information on arctic ship activity and position via AIS data and ship registrations. The AIS data is continuously logged into a database. This work shows a clear increase in the activity in arctic waters surrounding Greenland, Figure 81.

Especially the large iron mining project located in Nunavut (Baffinland) (Figure 82) has caused a heavy increase in ship traffic through the Davis Strait, causing concern for the Canadian and Greenlandic marine ecology.

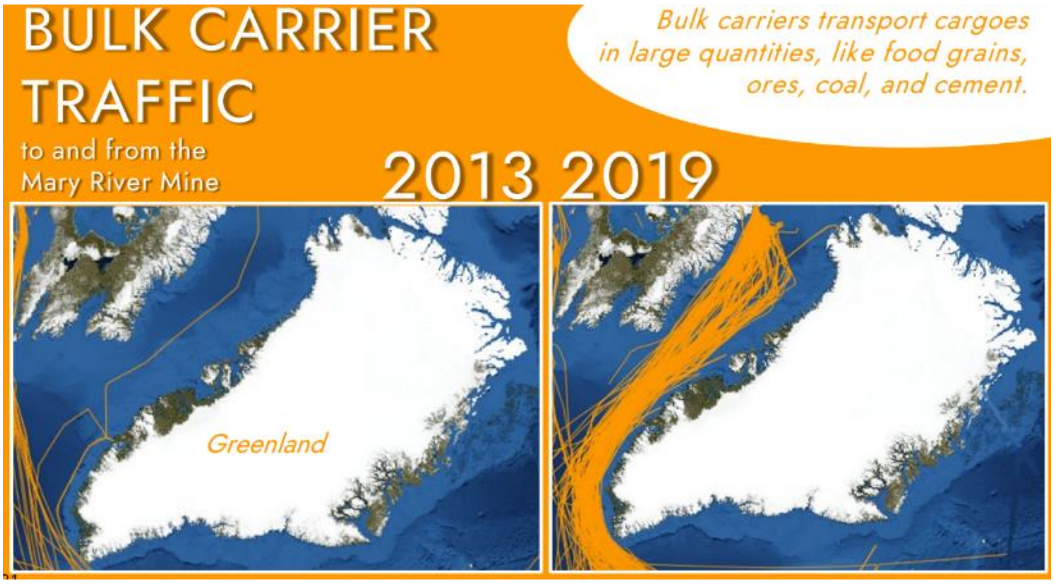


Figure 82: Map comparing marine bulk carrier traffic through the Davis Strait from 2013 to 2019, with focus on the Mary River Mine (PAME, 2022).

Global warming has opened previously inaccessible arctic areas, both on land and at sea. This is expected to increase the overall activity in the arctic region. The Majoqqap Qaava project will require 7-25 bulk carrier rotation visits per year (1 rotation being a ship arriving and departing), depending on mining activity and production scenario. Due to the location of the mine, shipping will not take place in the northern most areas of Greenland where narwhales (*Monodon monoceros*), beluga whales (*Delphinapterus leucas*) and walruses (*Odobenus rosmarus*) are particularly sensitive towards ship traffic disturbances. The Handymax bulk carriers are expected to follow the defined shipping lanes when arriving from Europe or North America and will overall not move in undisturbed waters. In comparison, Royal Arctic Line has some 54 containership rotations enroute between Greenland and Denmark per year and Greenland was visited by some 400 cruise ships in 2022. The majority of ships working in the arctic waters are however fishing vessels, which typically have a more persistent presence in specific areas. Project emissions, section 5.11, are evaluated as having a minor impact when compared to the general CO_2-e emissions of Greenland.

Considering the Majoqqap Qaava project location, the relatively modest number of yearly bulk carrier visits and the size limit to these vessels, the project is evaluated to cause minor cumulative effects regarding the existing marine traffic in the region.

Potential impact	Cumulative effects from marine traffic
Impact phases	Construction and Operation
VEC	Ecological state of arctic marine mammals

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Minor
National	Low	Long-term >5 year	High (25-75 %)	

8. Environmental Management Plan

Environmental Management is a significant component of overall project management in the context of development and operation of the mine.

The principles, strategies, and functions of Greenland Anorthosite Mining's Environmental Management Plan [EMP] for Majoqqap Qaava is to be prepared to outline measures to manage environmental impacts during construction, operation, decommissioning and post-closure phases to minimize adverse impacts and risks from the Majoqqap Qaava anorthosite project.

The EMP will be dynamic and living document, which will be continuously reviewed and updated throughout the LoM. At this current stage, in the EIA context, the EMP version is a draft to present the general framework, and thus provides a link between the potential impacts identified in the preceding EIA report, the proposed mitigation measures and monitoring methodology.

An updated version of the Majoqqap Qaava EMP will be prepared prior to the mine construction phase. Based on the findings and conditions uncovered during the construction phase, a version for the mining phase may subsequently be prepared.

8.1. Application of Environmental Management

The EMP will serve as a guide for management, contractor(s) and workforce on their roles and responsibilities in environmental site management. All employees, contractors and sub-contractors must therefore be informed of, commit to, and comply with the EMP, including its procedures and other regulations and rules deriving from these.

The company will develop a management system to ensure that all contractors and subcontractors are informed and aware of the EMP, and a contract mechanism that will encourage contractors and their subcontractors to comply with the EMP.

8.1.1. Environmental Management Plans

The EMP will be applied to the following areas and activities of the Majoqqap Qaava mining project:

- The open pit and the mining operation,
- Ore hauling and infrastructure (incl. harbour facility),
- Ore processing/treatment,
- Water supply,
- Waste and wastewater,
- Generator and power supply,
- Fuel and explosives supply and storage,
- Offices and associated support facilities,
- Bulk shipping,
- Maintenance activities related to the above areas.

The EMP consist of individual management plans, each dealing with specific potential key activities and their impacts from the planned operations. The plans identify actions to be performed to minimize disturbance of the natural environment and prevent or minimize all form of pollution. Also, the program defines and assign the roles, responsibilities, and authorities to implement the program.

In the initial phase, the EMP specifies mitigation measures for risks identified in the EIA. Explicitly addressed are issues related to the physical environment, air environment, water environment, ecological environment, and waste, with an extended focus on:

- Air emissions i.e., dust by watering,
- Handling of waste rock and tailings,
- Screening of waste rock and quarry material intended for road material for sulphide/ARD,
- Sewage, wastewater discharge,
- Solid and hazardous waste,
- Spill prevention,
- Surface water protection,
- Wildlife protection from noise from helicopter movements and blasting.

The detailed EMP is presented as a separate document following this EIA and will include the following approach and sections:

- Activity – the activity associated with the mining project which has been identified to possess a potential impact or risk to the environment.
- Environmental impact – description of the negative impact of the activity (such as pollution or disturbance of natural environment).
- Action – the mitigating measure or actions identified to prevent or minimize the adverse environmental impact.
- Stage - the project stage in the life of the mine where the measures, actions, or principles have effects e.g., construction (C), operation (O) and decommissioning and closure (D).
- Frequency and/or timing – the frequency or timing when the action should take place.
- Responsibility – clear chain of command and description of party/parties responsible for ensuring the action, measure, or principle is done.

The EMP will additionally include the following documents, which are prepared/updated before the construction phase:

- Environmental Monitoring Program, (section 9),
- Health and Safety Plan
- Spill Response Plan
- Waste Management Plan
- Decommissioning, Closure and Rehabilitation Plan, (section 10).

The EMP will evolve continuously over the LoM from feedback from the monitoring program and operational experience. Similarly, the project expects to continuously identify actions or measures that can help ensure that the project's impacts on the environment are minimised.

9. Environmental Monitoring plan

The project's environmental monitoring consists of two parts: the company's own monitoring and that conducted by the authorities.

The self-monitoring programme aims to track emissions and discharges from mining-related sources and assess environmental conditions in the vicinity of its operations, such as tailings disposal, freshwater systems, and dust emissions around the mine and processing areas.

The role of the authorities is to audit and verify the company's monitoring practices, as well as to undertake independent environmental monitoring. Their programme is structured to track pollution, contamination, and environmental damage resulting from mining activities. It is adaptable and can be modified if project activities change or if new data, either from the company or authorities, necessitates further action.

The programme outlined in this EIA represents an initial draft of an overarching programme for the company. The company recognises that the programme is overly comprehensive, as it includes components that legally fall under the responsibility of the authorities. To prevent duplication of effort, any overlapping monitoring activities will thus be modified once the size and scope of relevant mixing and buffer zones for rivers, lakes and seas have been determined.

The company's final, detailed self-monitoring activities will be outlined in a separate Environmental Monitoring Plan. The following sections provides a summarised overview of the current programme design

9.1. Marine environment

The marine monitoring shall include the collection of sediment material from 2 stations, as well as marine indicator species from 4 stations from the baseline program with varying distance from the project site and from the reference station, Figure 83. At all stations a full sampling set will be collected consisting of:

- Livers from five (5) female sculpins (*Myoxocephalus scorpius*), together with information of liver weight and the length and weight of each fish,
- Meat from twenty (20) common mussels (*Mytilus edulis*) from each of the three size groups (2-3cm, 4-5cm and 6-7 cm) together with information of the length of each mussel (mm) and the total weight of meat from each size group,
- A handful of new growths (tips) of bladderwrack (*F. vesiculosus*) 2 replicates,
- A marine sediment sample.

All samples are numbered and registered according to the instruction from DCE and kept frozen until analysis, including at least screening for: As, Cu, Ni, Zn, Hg, Cd and Pb.

As all indicator species are known to be slow growing sampling in the marine and intertidal environment sampling is carried out at the end of the growing season; in August-September.

9.2. Freshwater monitoring

Freshwater monitoring shall consist of freshwater samples from 6 river stations (FORCE #1 to FORCE #8) and 2 lake stations in Kuussuatsiaat valley, as well as from the remote reference station (FORCE #9). At each of the stations Lake #1 and #2_1 profile measurement of temperature and conductivity shall be made in order to decide the depth and annual variation of the thermocline. Sample collection will each time include a sample above and a below the thermocline.

At each station the following will be collected and monitored:

- In situ conditions of pH, temp, turbidity/TSS, conductivity, dissolved O_2.
- Collection of a filtered and an un-filtered water sample for later analysis for As, Cd, Cr, Cu, Fe, Pb, Hg, Ni, Zn and total-N, total-P according to standard guidelines (MRA, 2015).

In addition, freshwater monitoring will also include:

- Monitoring of Lake #1 including CTD readings, TSS deposition and elements in sediment,
- Monitoring of Lake #2 including CTD readings, water samples from two depths to be analysed for trace elements and TSS and sediment samples,
- An overall survey of seasonal water flow at relevant bottleneck locations.

Freshwater sampling is to be carried out monthly throughout the ice-free season of the year, starting with the post-winter run-off. The assessment criteria are to be defined in cooperation with EAMRA.

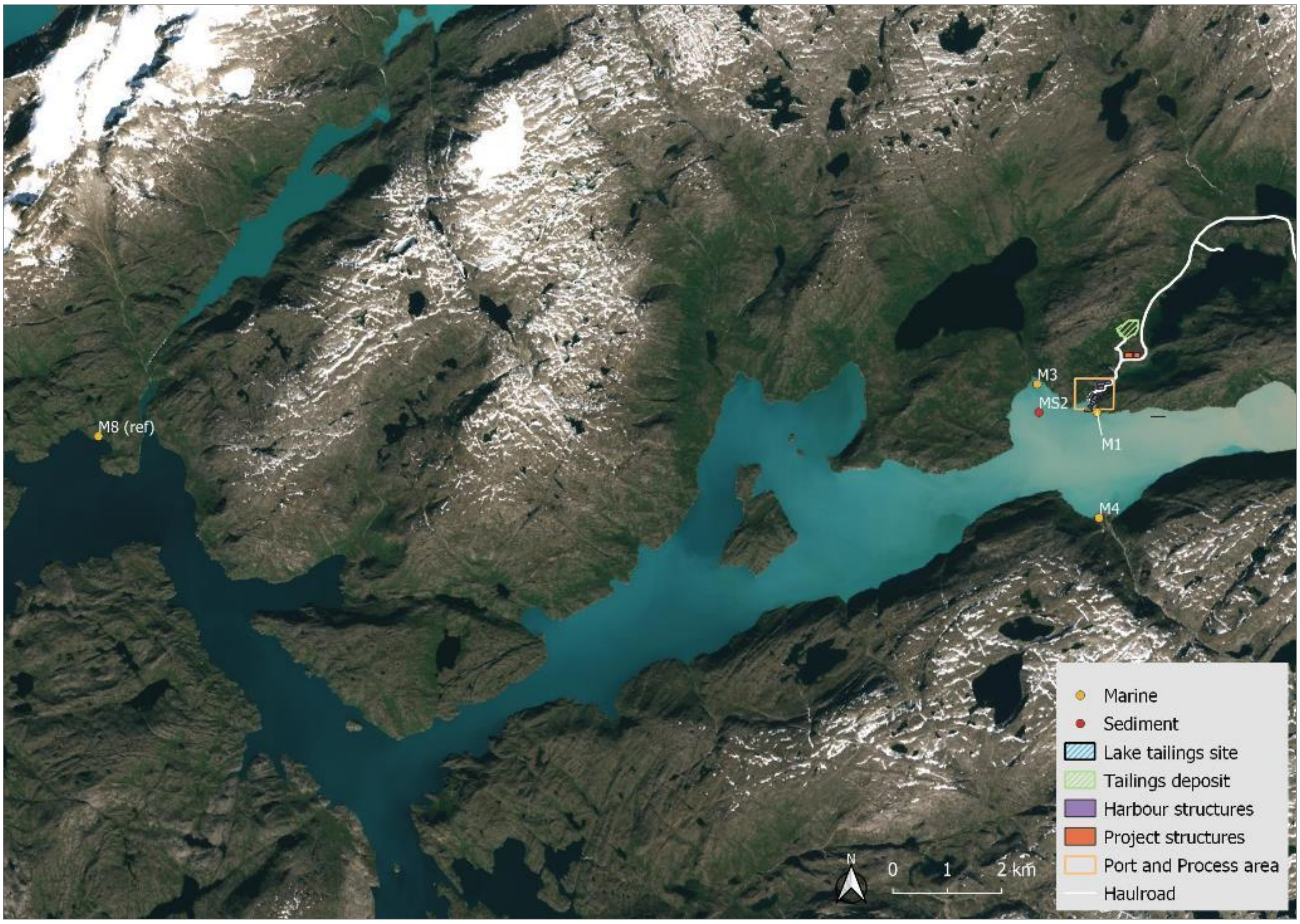


Figure 83: Proposed marine sample locations.

9.3. Terrestrial monitoring

Terrestrial monitoring shall consist of yearly collection of lichens (*Flavocetraria nivalis)* and continues dust spread monitoring. The dust spread gauges will be located at similar sites as were used during the baseline studies and may be supplemented with a station in close range to the product facility.

Lichens will be collected from selected stations also sampled during the baseline. The selected stations are scattered throughout the project valley with specific focus on the main project worksites; harbour site, process facility site, tailings disposal site and the pit site. Lichen stations will also be sampled along the proposed haul road and from the baseline reference site (Figure 85).

9.4. Wastewater effluent discharge

Sampling shall be carried out quarterly from the discharge of wastewater effluent discharge from the camp to the river and lakes in Kuussuatsiaat Valley and into Qeqertarsuatsiaat Kangerdluat. The flow from the different installations will be measured and the monthly discharge volume will be recorded.

The assessment criteria are to be defined in cooperation with EAMRA.

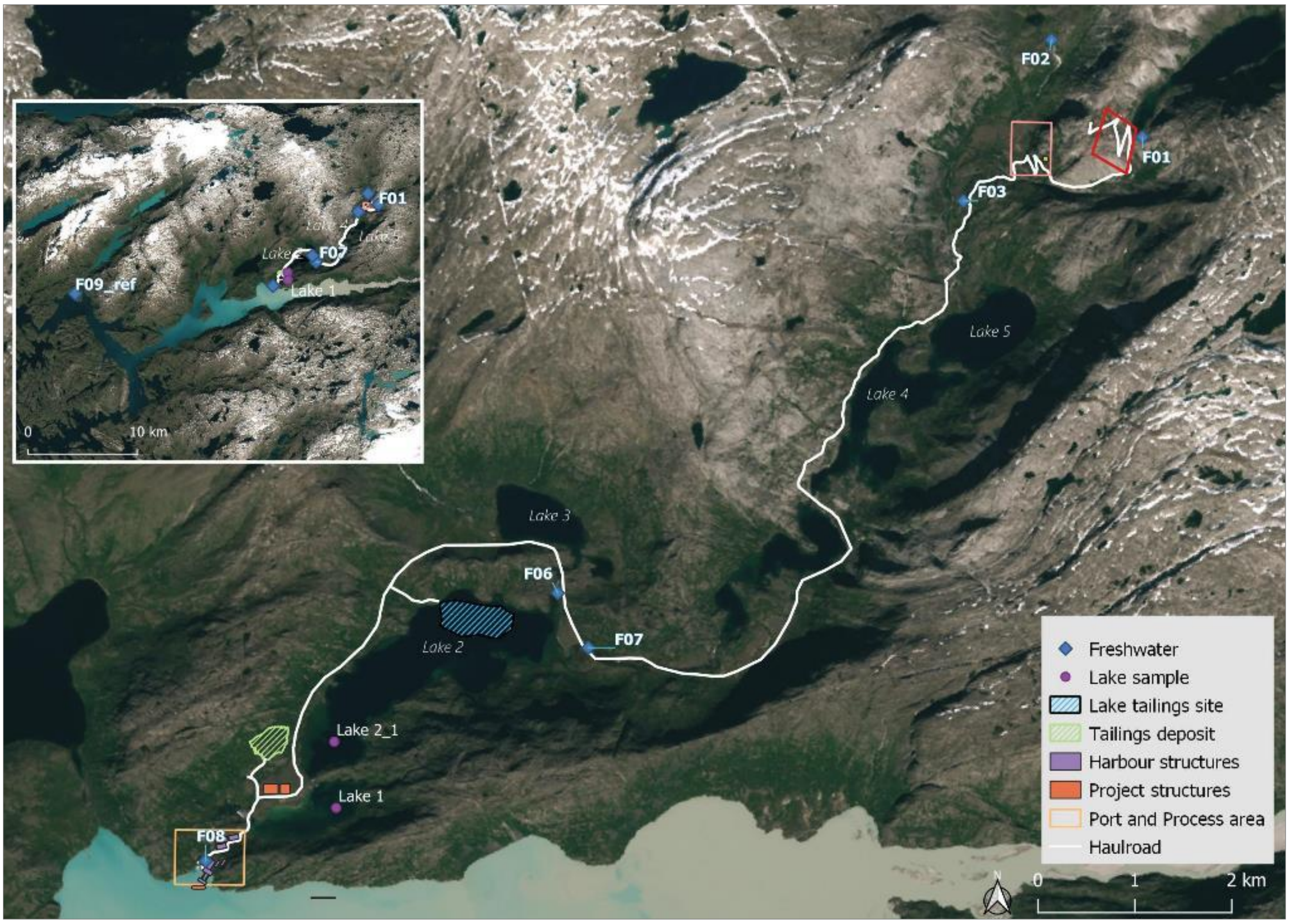


Figure 84: Proposed freshwater sampling locations.

9.5. Acid generating waste rock

Potentially Acid Generating [PAG] may develop when rocks are oxidized by surface weathering and form acid which can then mobilize and leach metal ions that may be harmful to fish and other aquatic lifeforms. A significant factor in acid formation is the content of sulphide in the rock, and a preliminary criteria suggest a specific sulphur cut-off value of 0.25 wt. %. for NoAG rocks. The deposit of anorthosite at Majoqqap Qaava is found to have negligible PAG levels. However, screening for acid generation will be conducted regularly and upon initiation of ore excavation from new areas.

Especially in the construction phase, GAM has increased its focus on ensuring that materials with a high PAG level are not selected as aggregates for road design and construction.

The assessment criteria are to be defined in cooperation with EAMRA.

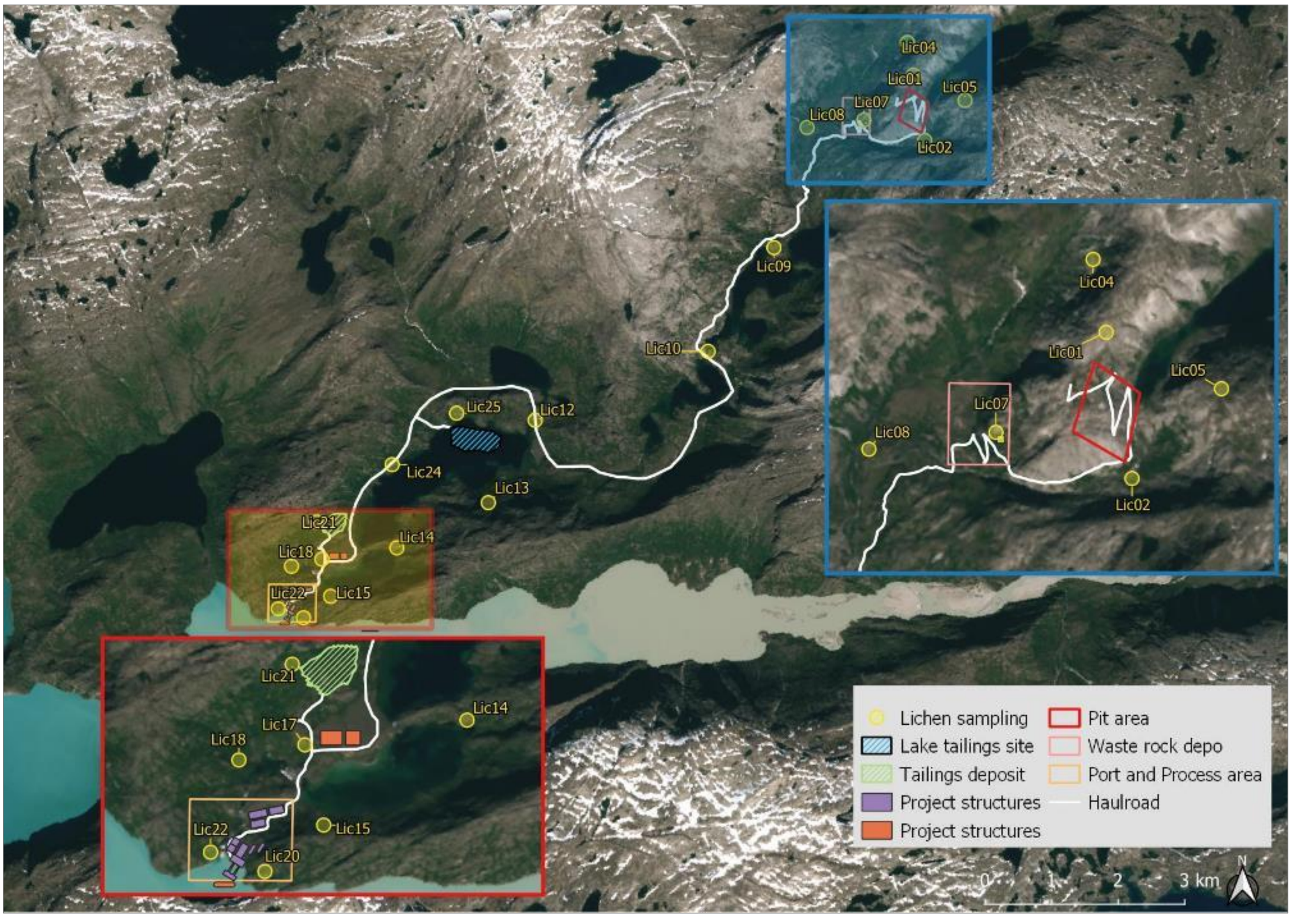


Figure 85: Proposed lichen sample locations.

9.6. Reporting

A report on the analyses is presented annually and potential adjustments to the program are discussed with the authorities.

9.6.1. Reassessment of monitoring program

The present monitoring program has been designed based on the extensive baseline studies collected during the EIA study. The monitoring program is in the nature of a screening and is very comprehensive. Consequently, it is expected that a number of the observed parameters will subsequently prove to be irrelevant, e.g., if the measured concentrations are consistently below the defined detection values. Once the program has been implemented for a period of 3 years, the company intends to re-evaluate the program to remove parameters and samples that may not show any changes in result for a period of time and that turn out to be irrelevant to the program.

10. Closure activities

Although mining and processing activities is expected to extend over decades, Greenland Anorthosite Mining recognise they are temporary, and that other activities and land use will follow. To mitigate the impacts of a shift to a new (future) use, it is eventually the intention of the company to restore the land effected by the activities by balance environmental and social considerations, with costs and to look for opportunities in decommissioning for rehabilitation and repurposing where appropriate, as well as long-term monitoring and maintenance.

In any case, the overall objective of the mine closure plan is to minimise the long-term physical footprint and to prevent or minimise negative long-term environmental impacts. The condition of the site left shall be acceptable to the regulatory authorities (the Greenlandic Government) as well as the surrounding community.

Rehabilitation must be both physically safe and stable so that the abandoned area; the potential air, land and water systems altered by the mining is safe for any users; people and wildlife. The area must also be chemically stable so that any deposits remaining on the surface will not release substances at a concentration that would significantly harm the environment.

To ensure that decommissioning plans reflect the expectations of the relevant stakeholders, basic assumptions and a conceptual framework of post-closure care and maintenance as deemed necessary is established. The general principals of such Decommissioning and Closure Plan [DCP], will then be regularly evaluated, and updated to ensure that it reflect different operating experiences and developments. As the closure of the mine is an integrated part of the life of the mine, the DCP is a living document that starts at the same time as the project is developed and commissioned and evolves until mining terminates.

The closure activities are described in detail in a separate Decommissioning and Closure Plan.

10.1. Framework of Decommissioning and Closure Plan measures

10.1.1. Surface facilities and infrastructure:

- Salvage buildings and remove these by ship/barge,
- Demolish remaining buildings with demolition equipment and remove of the material by ship/barge,
- Salvage equipment and remove it by ship/barge,
- Remove culverts and formal drainage systems and re-establish original drainage,
- Removal of exposed concrete foundations,
- Buried concrete foundations is covered with rock fill and soil from deposit,
- Rip gravel pad, internal roads at port and plant site to encourage re-vegetation,
- Reshape to restore natural slope and drainage.

10.1.2. Port facilities

- Salvage floating pontoons/barges and landing ramps and remove these by ship,
- Leave all land-based port facilities as constructed (prefabricate bollards) except light poles, electrical cables etc.

10.1.3. Haul and service roads

- Remove culverts and re-establish original drainage,
- The road is left in place, but with rip surface to encourage re-vegetation.

10.1.4. Pipelines

- Decommission pipelines incl. supporting structure for pipes, booster stations and pump stations, remove all pipes and equipment.

10.1.5. Tailings Management Facility

Test results indicate that tailings from the Majoqqap Qaava project are inert, i.e., largely chemically inactive. The TSF Dry #1 and the WRD areas will be levelled for safety reasons and to adapt it to the topography of the surroundings.

The concept for wet disposal of tailings throughout the operational phase is to discharge them to TSF Wet #1 Lake #2, where they will sink to the bottom and be permanently flooded. The environment around the tailing's facility will be restored to its present appearance.

- Progressive cover during establishment of TSF Dry #1 to reduce erosion of the tailings and control dust,
- Remove construction facilities next to TSF Wet #1 Lake #2 and ship these out,
- Remove pipes in Lake #2
- Leave Lake #2 as is.

10.1.6. Open pit / quarry

- Remove equipment and ship it out,
- Allow the lower levels of the pit to be naturally filled with water,
- Due to the remoteness and isolated location of the quarry and the general steepness of the area, no safety bund walls, and signage is installed around the open pit,

In addition, site facilities and structures will be decommissioned where possible and the materials disposed of to landfill, incinerated or shipped off site depending on their inherent properties. The process plant and power plants will be decommissioned. Mobile equipment where of value will be re-sold otherwise it will be decommissioned in the decline prior to closure of the mine.

10.2. Rehabilitation and permanent changes to the mine area

The final footprint of the mining activities at Majoqqap Qaava will after decommissioning comprise 1) haul and access roads, plant site, gravel pads and staging areas, all surfaces ripped to encourage re-vegetation 2) the open pit, including parts of drainage channel and safety barrier around the excavation, 3) the dry tailings storage, covered to minimize erosion and dust, 4) the wet tailings deposit, 5) and minor quarries use for road aggregates during construction.

Due to climatic conditions, no active replanting is proposed. This means that vegetation on the abandoned roads and quarries and other barren areas will only come back slowly through natural succession.

Including dry tailings facilities, infrastructure elements etc. the total disturbed area of the Majoqqap Qaava project covers overall c. 0.65 km^2.

10.3. Close Down and Decommissioning of the Mine

As a result of the proximity to public infrastructure (in Nuuk) and the limited area that will be affected by infrastructure elements (mine, road, and process plant areas) and the restricted number of buildings and equipment present, decommission period is expected to last six to nine months.

10.4. Closure and Post-closure impact assessment

10.4.1. Terrestrial environment

The closure phase is expected to be similar to the construction phase. Machines will be used to re-establish the original environment and erase most scars on the landscape and break down all the established infrastructure in the mining area. This will increase the dust level and change the noise regime known from operations phase and resemble the magnitude of disturbance as expected during the construction phase. The duration of the decommission is expected to be very short, 6-9 months, and only affect the environment locally around infrastructures related to mine. Therefore, the impact on the terrestrial environmental and in particularly on caribou and flora from the closure is assessed to be negligible like during the construction phase.

Post-closure is the long-term of environmental impact from the mining operation. All tasks assessed to be minor or negligible to the terrestrial environment during construction and operation phase is not expected to be any issue after the mine has been closed and the natural environment restored. Dust and scares in the landscape were assessed to moderate during operation of the mine. The scares in the landscape from infrastructures except the pit will be erased during the closure phase. Thus, negligible impact on the migration of caribou and other wildlife is to be expected. Dust is expected to return to background levels shorty after closure of the mine. This is caused by the fact that no new dust is generated from human activities. Additionally, dust in the surroundings from the former mining activities will be immobilized by precipitation. In the longer term, the flora will spread and further reduce the likelihood of the remobilization of the dust. The impact on the terrestrial environment from dust during post-closure is assessed to be negligible.

Potential impact	Disturbance of Caribou migration and change in the terrestrial habitats
Impact phases	Closure and Post-closure
VEC	Wildlife and flora.

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Long term >5 years	Medium 25-75 %	

10.4.2. Freshwater environment

Closure of the wet TSF deposit will not introduce any special closure tasks. The closure and decommissioning phase will be very similar to the construction phase. Equipment used to slurry the tailings beneath the spring layer will be decommissioned and generation dust but is not expected to resuspend and mobilize any of the deposited tailings from the lakebed. Closure of the mine will diminish the impact on the freshwater environment as leaching of elements from the tailing's deposits both dry and wet TSF will be reduces significantly as well as the level of TSS because not new tailings is added the TSF´s. The impact from the mine on freshwater environment (leaching) during the mine closure is expected to be negligible.

Post-closure is the long-term environmental impact from the mining operation. In post-closure the leaching of elements from the tailing's deposits both dry and wet TSF are expected to be reduced significantly as well as the levels of TSS. The impact during the operation phase was assessed to be minor, because a new layer of tailing will be added the deposits (dry and wet) each day and all the leaching tests showed highest leaching of elements within the first 2-3 weeks. When the mine is closed no new material will be added Lake#2 or the tailings stack, and only marginal leaching is expected to occur. Within a manageable time, the lake is expected to clear up and the freshwater water quality flora and fauna is expected to be as it was before the mining activities. The impact on the freshwater environment, is on this background expected to be negligible at post-closure.

Potential impact	Reduction of freshwater fish populations changes in water quality
Impact phases	Closure and Post-closure
VEC	Water quality, phyto- and Zooplankton, Freshwater fish and birds.

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Long-term >5 years	Medium 25-75 %	

10.4.3. Marine environment

Closure of the mine will include decommission of the harbour facilities. The decommission work is expected to have similar environmental impact as during the construction phase. The assessment of impact from construction on the marine environment resulted in no major impact for the construction. Thus, the impact from the closure phase is also assessed be **negligible**.

At post-closure only elements left at site can have an impact on the marine environment and no increased human activity except for hunters is expected. At the GAM anorthosite mine the only TSF´s will be left in the area, both wet and dry TSF. The impact from both these TSF´s could be leaching of environmental contaminants to lakes and rivers and finally into the marine environment. The results of the leaching tests showed that within a few weeks after stopping adding more tailings to the TSF deposits, elements leaching will be reduced significantly, and the impact on the marine water quality is assessed to be less than during operation phase that was assessed to be negligible.

Potential impact	Underwater noise and change water quality
Impact phases	Closure and Post-closure
VEC	Water quality and marine mammals.

Residual impact assessment criteria				Overall significance
Geographical extent	Magnitude	Duration	Likelihood of impact	Negligible
Local	Low	Long-term >5 years	Medium 25-75 %	

11. Environmental impact assessment summary

Potential impact	Project phase	Overall significance
Terrestrial impacts		
Leaching from Waste rock deposits	Operation	Negligible
Dust – vegetation and freshwater	Construction	Negligible
Dust distribution to surroundings	Operation	Moderate
Terrestrial noise	Construction and Operation	Minor
Reduction of floral diversity and habitat	Construction	Negligible
Reduction of floral diversity and habitat	Operation and Closure	Negligible
Disturbance of nesting and freshwater birds	Construction	Negligible
Disturbance of nesting birds	Construction, Operation and Closure	Minor
Disturbance of mammals	Construction	Negligible
Disturbance of Arctic hare and Arctic fox	Operation and Closure	Negligible
Physical disturbance on caribou	Operation and Closure	Minor
Freshwater impacts		
Change of flow and transport of freshwater	Construction	Negligible
Change of flow and transport of freshwater	Operation and Closure	Minor
Leaching from TSF Dry stack	Operation and Closure	Minor
Leaching from TSF Dry stack	Post-Closure	Negligible
Leaching from TSF Wet stack (sub-aqueous)	Operation and Closure	Minor
Leaching effect from TSF on phytoplankton	Operation	Negligible
Effect on benthic invertebrates & zooplankton	Construction, Operation and Closure	Negligible
Effect on freshwater fish populations	Construction and Post-Closure	Negligible
Effect on freshwater fish populations	Operation and Closure	Minor
Seizing of lake affiliated bird species habitat	Construction and Post-Closure	Negligible
Seizing of lake affiliated bird species habitat	Operation and Closure	Minor
Marine impacts		
Change in marine water quality	Construction and Post-Closure	Negligible
Change in marine water quality	Operation and Closure	Minor
Underwater noise effect on marine mammals	Construction, Closure and Post-Closure	Negligible
Effect on marine mammals from shipping disturbances and underwater noise	Operation	Minor
Effects on marine fish populations	Construction, Operation, Closure and Post-Closure	Negligible
Marine Invertebrate community changes	Construction, Operation, Closure and Post-Closure	Negligible

Effect on marine macroalgae	Construction, Operation, Closure and Post-Closure	Negligible
Marine birds - especially colonies.	Construction, Operation, Closure and Post-Closure	Negligible
Introduction of Invasive/non-indigenous species	Operation (Construction and Closure)	Minor
General impacts		
Emission of greenhouse gasses	Construction and Operation	Minor
Emission of nitrogen from ANFO	Operation	Negligible
Wastewater eutrophication of marine recipient	Construction, Operation and Closure	Negligible
Risk of fuel leak and soil pollution on land	Construction, Operation and Closure	Minor
Overall risk of large marine oil and product spill	Construction and Operation	Minor
Limited public access and effect on hunting	Construction, Operation, Closure	Minor
Landscape scarring	Construction	Minor
Landscape scarring	Operation	Moderate
Landscape scarring	Closure and Post-Closure	Negligible
Cumulative effects, primarily from marine Traffic	Construction and Operation	Minor

Table 36: Summary of evaluated risks and uncertainties in relation to environmental load, impacts and effects in all phases of the mine (Construction, Operation, Closure and Post-Closure).

12. Conclusions

The environmental consequences of the proposed Majoqqap Qaava mining project have been assessed. The assessments are based on numerous field campaigns, company drilling campaigns and a detailed geochemical laboratory process.

The overall assessment is that the project can be implemented without any major local or regional environmental impacts.

Two subjects with a high probability of causing a moderate local impact have been identified:

- Distribution of dust from running the mining operation
- Scarring and modification of the landscape within the mining operation area from infrastructure and mining facilities

Regarding spread of dust, several mitigation measures are available with good chances of minimizing these effects. There are thus several available methods utilised in other mining operations around the world providing a broad array of mitigation actions, should dust dispersion prove an issue.

Regarding landscape scarring, this is an unavoidable consequence when establishing a large project in pristine surroundings. With the pit-site located in an already barren rocky landscape the major structures impacting the existing landscape will be the tailings storage facility [TSF] and the haul road. The company has presented two TSF alternatives where a sub-aqueous lake TSF would minimize the lasting effects on the landscape considerably, whereas the haul road route is fixed and bound to leave a lasting footprint throughout the landscape.

The company has presented an environmental monitoring plan and a comprehensive environmental management plan to ensure that any environmental issues can be handled timely and efficiently.

Overall, the degree of project details presented in this EIA provides a solid environmental foundation for the upcoming project development and operation of the mine.

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