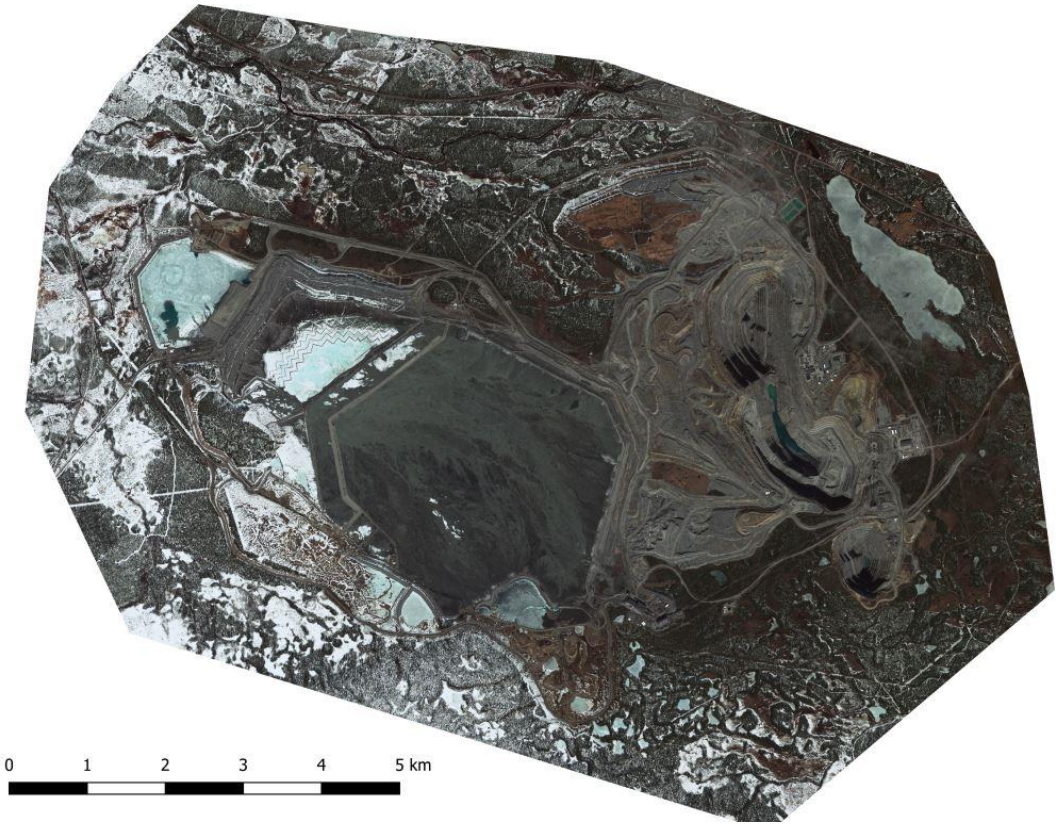
Public Disclosure Regarding Aitik Tailings Facility



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I. INTRODUCTION

Boliden has committed to apply the Global Industry Standard on Tailings Management (GISTM), adopted by the International Council for Mining and Metals (ICMM) in 2020, setting a precedent for the safe management of tailings facilities, towards the goal of zero harm (the “Standard” or “GISTM”).

The Standard contains 77 specific requirements that need to be fulfilled to be in full compliance with the Standard. The Standard also requires that adhering members annually issue a status report on their implementation of and compliance with the requirements to support public accountability. In accordance herewith, Boliden as the operator of its tailings facilities is to publish and regularly update information on its commitment to safe tailings facility management, implementation of its tailings governance framework, its organization-wide policies, standards and approaches to the design, construction, monitoring and closure of its tailings facilities.

A separate document available via Boliden web, named Public Disclosure Regarding Boliden´s Tailings Management Framework, provides a general description concerning Boliden´s tailings and dam safety management for all sites, in which much of the information within requirement 15.1 is met.

This document provides additional information specifically related to Aitik tailings facility to fully provide the required information.

In addition, Chapter 11 of this document presents the status of implementation of GISTM for Aitik.

1 DESCRIPTION OF THE TAILINGS FACILITY

The Aitik mine is situated 15 km southeast of the town Gällivare in Sweden, see **Figure 1**. The coordinates (latitude, longitude) of the main entrance are 67°05'14.4"N 20°57'55.7"E.

Operation commenced in 1968 and Aitik is today one of the largest copper mines in Europe, with a permitted production rate of 45 Mton per year.

The mine is an open pit mine and the ore is processed to a mineral concentrate at site. The mineral concentrate is transported by train to the smelters in Rönnskär, while the waste products, waste rock and tailings, are deposited on site. See **Figure 2** for an aerial photo of the Aitik mine.

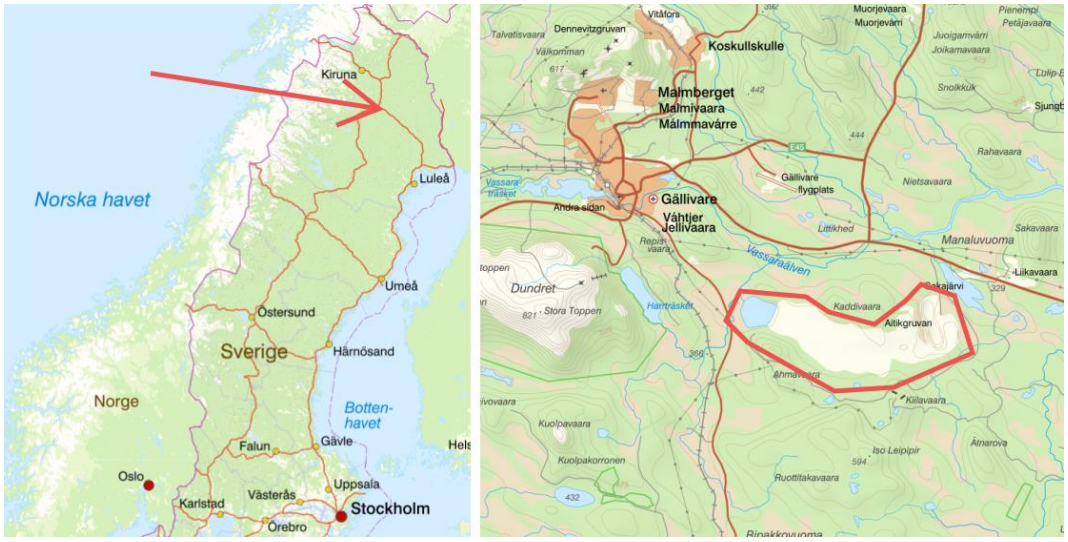

Figure 1 Geographic location of the Aitik Mine in red

The tailings facility consists of the Main TMF, the High Sulfur TMF, the Water Treatment Pond and the Clarification Pond, see **Figure 3** for an aerial photo, and **Table 1** for a description of the main structures. For more information regarding the dams, see Chapter 5.

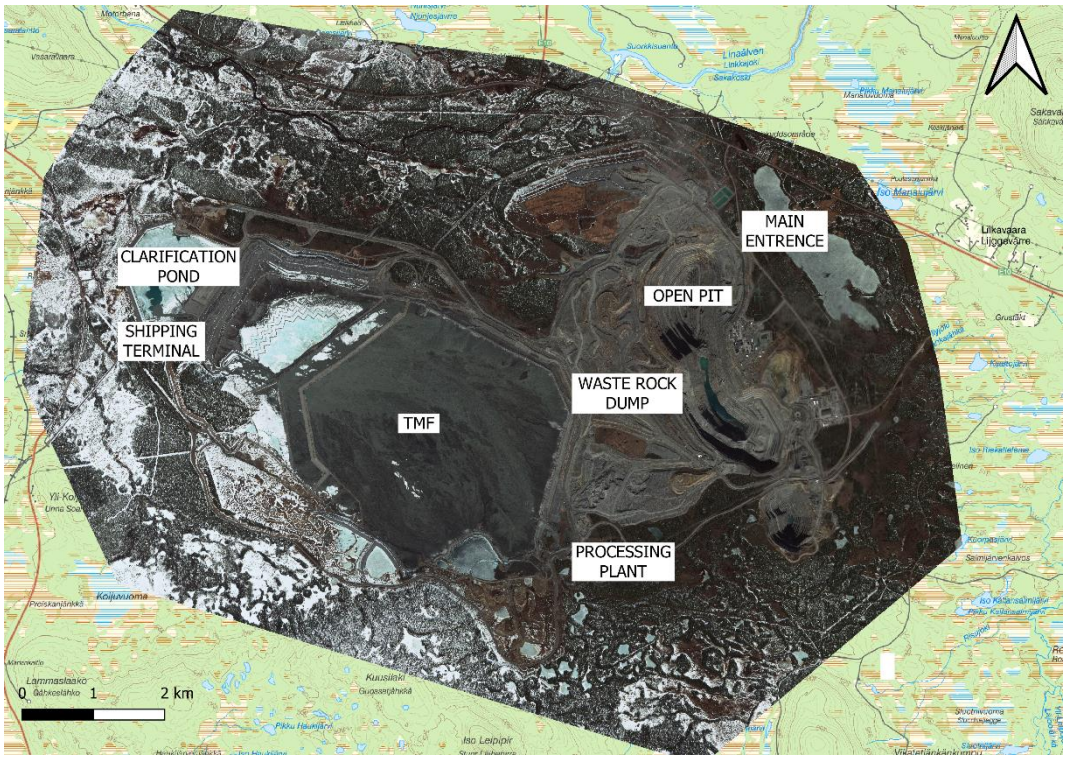

Figure 2 Aerial photo (May 2023) of the Aitik mine

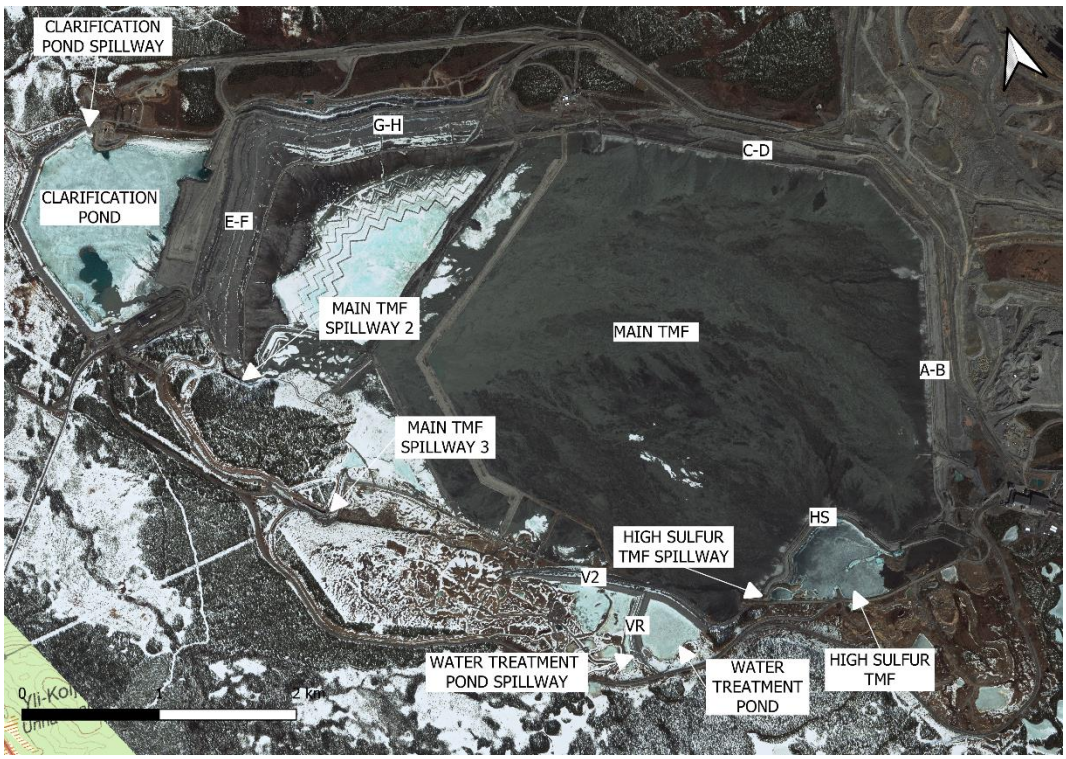

Figure 3 Aerial photo (May 2023) of the Aitik tailings facility

Table 1 Description of main structures of the Aitik tailings facility

Structure	Description
Main TMF	Commenced in 1968. Receives the low sulfur tailings from the process plant by hydraulic deposition. Contained by the A-B, C-D, G-H, E-F, HS and V2 dams and natural ground. Covers an area of approximately 16 km^2 [1]. About 1 000 Mton of tailings and water is stored. Process water exits the tailings facility by gravity, through an active spillway, to the Clarification Pond.
High sulfur TMF	Commenced in 2019. Receives the high sulfur tailings from the process plant. Is contained by the HS and HS2 dams and natural ground. Covers an area of approximately 0,4 km^2. Less than 5 Mton is stored. Process water exits the facility by gravity, through a passive spillway, to the Main TMF.
Water Treatment Pond	Commenced in 2020. The purpose is to treat water from the High Sulfur TMF. Inflow is currently limited to run-off from the catchment area of the pond. Is contained by the V2 and the VR dam and natural ground. Covers an area of approximately 0,2 km^2. The storage capacity is about 3,3 Mm^3. Water exits the pond by gravity, through a passive spillway, to the Clarification Pond.
Clarification Pond	Commenced in 1985. Receives process water from the Main TMF and High Sulfur TMF for sedimentation and storage. Contained by the I-J dam and natural ground. Covers an area of approximately 1,8 km^2. The storage capacity is about 18,3 Mm^3. Water is pumped back to the process plant. Excess water exits by gravity, through an active spillway, to the recipient Leipojoki.

2 CONSEQUENCE CLASSIFICATION

The consequences in the event of a tailings facility failure in Aitik are estimated from breach analyses. The consequence classifications refer to conditions within the current permit.

0The consequence classification for the Aitik tailings facility have been defined both according to Swedish legislation (Miljöbalken) and according to GISTM, see **Table 2**.

The consequence classification of the tailings facility according to Swedish legislation is "**Dammsäkerhetsklass B**"[2]. The classification was approved by the national regulatory authority for dam safety (County Administrative Board) in 2016[3] and 2019[4]. The classification is currently being reviewed and an updated consequence classification will be submitted for approval to the authorities.

The consequence classification of the tailings facility according to the Global Industry Standard on Tailings Management (GISTM) is **Very High**[3].

[1] Including footprint of both pond and dams.
[2] All dams are classified individually and "Dammsäkerhetsklass B" respectively "Very high" is the highest classification of any of the dams in Aitik.
[3] Dam A-B, C-D, E-F, G-H and I-J
[4] Dam HS and HS2

Table 2 Overview of consequence classes for all dams of the Aitik tailings facility

Dam	Consequence class according to:	
	Swedish legislation (Miljöbalken)	Global Industry Standard on Tailings Management (GISTM)
A-B	U	Very High
C-D	U	Very High
G-H	B	Very High
E-F	B	Very High
HS	C	Significant
HS2	B	Very High
I-J	B	Very High
V2	B[5]	Very High
VR	C[2]	High

3 RISK ASSESSMENT

Aitik has assessed risks in a manner consistent with the risk management instruction established by Boliden. Assessment of risks related to the operation and closure of tailings facilities have been undertaken by a team of multidisciplinary specialists. The risks have been evaluated regarding potential consequences related to a range of aspects, included but not limited to health and safety, environment, infrastructure, social aspects and local communities.

In **Table 3** the most severe identified risks are presented along with the status of associated mitigation measures.

The identified events which can potentially lead to flow failure events, are used as input for the dam breach analysis (see Chapter 4), as well as for the Trigger Action Response Plan and the Emergency Preparedness Response Plan (see Chapter 8).

[5] The classification is not yet approved by the national regulatory authority for dam safety

Table 3 Most severe identified risks and associated mitigation plans

Dam	Identified risk	Mitigation	Status
E-F, G-H	Margin for global stability is lower or potentially lower than desired due to: • Post liquefaction. residual shear strength. • Potential weak zones in foundation. • High pore pressures in dam or foundation. • Rapid drawdown in the Clarification Pond (dam E-F only).	Maintaining a wide beach to keep pore pressure and gradients within acceptable limits. Review of monitoring regime and installation of additional monitoring instruments. Characterization of tailings and lab analyses of post liquefaction strength. Water and tailings management plan adjusted to minimize water upstream of dam. Geotechnical investigation of dam and underground. Review of stability analysis with updated underground and material data. Design of dam adjusted, and size of buttress increased to meet required Factor of Safety. Construction works for adjusted dam design.	Continuous Conducted Conducted Conducted Conducted Conducted Conducted Ongoing
A-B, C-D, G-H, E-F, I-J	Margin for global stability or deformation is potentially lower than desired due to seismic events.	Determine design seismic events. Review seismic stability and deformation analyses.	Conducted Ongoing
E-F	No filter between the moraine and the rock fill buttress in the starter dam which may lead to internal erosion.	Maintaining a wide beach to keep pore pressure and gradients within acceptable limits. Review of monitoring regime and installation of additional monitoring instruments. Implement Trigger Action Response Plans for pore pressure increases in the dam toe and foundation.	Continuous Conducted Conducted
G-H	Observed seepage at toe may be a sign of internal erosion.	Monitoring of pore pressure in dam and underground. Monitor seepage.	Continuous Continuous
I-J	Margin for global stability is potentially lower than desired due to seepage in foundation.	Review of monitoring regime and installation of additional monitoring instruments. Review stability analysis with updated underground pore pressure data. Adjust design of dam if needed	Ongoing Ongoing Ongoing

4 IMPACT ASSESSMENT

The impact assessments for the Aitik tailings facility are based on breach analyses of credible flow scenarios. The results are used to evaluate the consequence classification (see Chapter 2) of the dams and to develop the Emergency Preparedness Response Plan, see Chapter 8.

The impact assessment has been evaluated within two different frame works, according to Swedish legislation (Miljöbalken), and according to the Global Industry Standard on Tailings Management (GISTM).

The impact assessments presented in this document refer to conditions within the current permit.

The impact assessment according to Swedish legislation (Miljöbalken) is based on breach analyses from 2015[6] and 2018[7], se **Table 4**. The impact assessment is currently being reviewed and an updated assessment will be submitted for approval to the authorities.

The impact assessment according to the Global Industry Standard on Tailings Management (GISTM) is based on breach analyses from 2021, see **Table 5**.

[6] Dam A-B, C-D, E-F, G-H and I-J
[7] Dam HS and HS2

Table 4 Summary of the Aitik impact assessment according to Swedish legislation (Miljöbalken)

Dam	Impact assessment (major, large, moderate, small)	Risk for loss of, destruction of or disturbance of:						
		1. Human life	2. Cultural values	3. Electricity infrastructure	4. Infrastructure	5. Essential services	6. Environment	7. Economy
A-B	Small							
C-D	Small							
G-H	Large	X			X		X	
E-F	Large	X			X		X	
I-J	Large	X			X		X	
HS	Moderate						X	
HS2	Large	X			X		X	
V2	Large	X			X		X	
VR	Moderate or Small						X	

Table 5 Summary of the Aitik impact assessment according to the GISTM

Consequence Criteria	Classification	Impact assessment
Potential Population at risk (PAR)	High (Between 10 and 100)	Impact varies from dam to dam but for every dam the population at risk is less than 100 (A-B and HS2; staff in open pit. C-D; impact on road E10, bridges. GH, EF, I-J, K-L, V2; houses and camp site, bridges, road)
Potential Loss of Life (LOL)	Very High (Between 10 and 100)	Estimated to be likely (between 10 and 100 people) commensurate with the numbers in PAR and derived from the damage parameters values.
Environment	Very High (Permitted levels) to potentially extreme (Life of Mine)	Very high local and regional losses due to volume of tailings and water in Natura 2000 areas High and long term effect, benthic fauna, reindeer pastures Process water quality – low toxicity ARD or metal leaching potential – high (due to time of restoration) Potential area of impact greater than 20 km^2 Restoration potential – greater than 5 years (if possible, for LOM)
Health, Social and Cultural	High	Disruption of business, services, or social dislocation – high (500 to 1000 people Impact on regional/national heritage, recreation, community or cultural assets – High- national interest for reindeer herding and Swedish Armed Forces Human health effects – Potential for short term health effect
Infrastructure and Economics	Very High (Permit) to potentially extreme (LOM)	High economic consequences for Boliden due to remediation costs and production loss. Potentially significant local and regional consequences for employees and contractors due to production loss Significant local and regional impact on infrastructure Economic consequences to the community due to limitations in land use and effect on tourism industry and reindeer herding

5 DESCRIPTION OF THE DESIGN OF THE TAILINGS FACILITY

See **Table 6** for a description of the design of the main dams. For a description of the overall tailings facility and the location of the dams is presented in Chapter 1.

Table 6 Description of the design for the dams in the Aitik tailings facility

Dam	Description
A-B	External dam in the main tailings facility. Part of the dam has a lower part that is designed to be impermeable and the upper to be drained, and part of the dam is designed to be drained from foundation to top. Method of raise has been upstream from the start. Dam length is about 3 300 m and the maximum dam height is about 80 m. Dam A-B is partly integrated with the Waste Rock Dump (WRD).
C-D	External dam in the main tailings facility. The lower part is designed to be impermeable and the upper to be drained. Method of raise has been upstream from the start. Dam length is about 1 600 m and the maximum dam height is about 45 m. Dam C-D is partly integrated with the WRD.
E-F	External dam in the main tailings facility. One section of the dam has a lower part that is designed to be impermeable and the upper to be drained, and another section of the dam is designed to be drained from foundation to top. Method of raise was downstream from the start and later changed to upstream. Dam length is about 1 600 m and the maximum dam height is about 70 m.
G-H	External dam in the main tailings facility. The lower part is designed to be impermeable and the upper to be drained. Method of raise was downstream from the start and later changed to upstream. Dam length is about 2 100 m and the maximum dam height is about 75 m.
HS	Internal dam between the main tailings facility and the high sulfur tailings facility. The dam is designed to be impermeable. Method of raise has been upstream (into the main tailings facility) from the start. Dam length is about 1 600 m and the maximum dam height is about 35 m.
HS2	External dam for the high sulfur tailings facility. The dam is designed to be impermeable. Method of raise has been downstream from the start. Dam length is about 500 m and the maximum dam height is about 25 m.
V2	Internal dam between the main tailings facility and the Water treatment pond and external dam in the main tailings facility. The dam is designed to be impermeable. The dam has never been raised. Dam length is about 1 500 m and the maximum dam height is about 25 m.
VR	External dam in the Water treatment pond. The dam is designed to be impermeable. The dam is not intended to be raised. Dam length is about 600 m and the maximum dam height is about 30 m.
I-J	External dam in the Clarification Pond. The dam is designed to be impermeable and has previously been raised with the downstream method. The dam is not intended to be raised further. Dam length is about 2 100 m and the maximum dam height is about 25 m.

The main goal for mine closure is to leave an area free of hazards which allows for alternative use of the area, for example recreation, hunting and forestry. To achieve the main goal the facility will be treated so that:

- The environmental impact from pollution is restricted in accordance with environmental requirements set in the approved closing plan for the mine.
- The facility will melt into the landscape using morphology.
- The facility needs a minimal of maintenance and supervision.

Methods to reduce the environmental impact from pollution are for example:

- Waste rock dumps are covered by moraine and/or soil improvement materials (for example sludge from wastewater purification plants).
- Due to separation of high and low sulfur tailings since 2019, the main TMF will be covered by a layer of low sulfur tailings. The dams and the areas closest to the dams of the main tailings facility, which are potentially drained in the long term phase, are covered by a higher grade moraine cover which is thicker and well compacted. The central part of the TMF is predicted to have a higher ground water surface, which will reduce the potential for oxidation. These parts will be covered by vegetation.
- High sulfur waste rock and tailings are separated and are treated separately.
    - High sulfur waste rock is encapsulated by low sulfur waste rock and covered by a higher grade moraine cover.
    - High sulfur tailings (in the High sulfur tailings facility) will be kept saturated and covered by low sulfur tailings and a moraine cover.

As far as possible, objects of cultural and historical importance will be kept.

6 ANNUAL PERFORMANCE REVIEWS

The following activities relating to dam safety and tailings management were undertaken during 2022:

- Review of the main tailings facility dam design. The review has included extensive geotechnical site investigations, in tailings and in the foundation of the dams, as well as stability assessments, see Chapter 3.
- Installation of additional instruments and routines to monitor the G-H and E-F dams, see Chapter 3.
- Buttressing and remediation works on dams:
    - The A-B and C-D dams has been remediated with additional buttresses and an updated buttressing plan for future raises has been produced.

  - A design and a plan for constructing a buttress on the E-F dam has been produced. Construction works was commenced in November 2022, see Chapter 3.
  - A design and a plan for constructing a buttress on the G-H dam has been produced. Construction works is scheduled to start in 2023, see Chapter 3.
- Review of the tailings and water management plan to avoid further loading on the dams E-F and G-H (including construction of tailings and water management structures on the main tailings facility surface), see Chapter 3.
- Dam raises (A-B, C-D and H-S) and construction of a new emergency spillway for the High Sulphur tailings facility.
- Environmental permit applications (all remediation works on dams as well as the structures on the tailings facility surface are subject to a permit application for changes within the existing environmental permit).
- ITRB review and 3rd party review, see Chapter 9.

7 ENVIRONTMENTAL AND SOCIAL MONITORING PROGRAMME

The environmental performance of the tailings facility is monitored according to an established environmental monitoring program.

Groundwater monitoring is carried out at 16 monitoring wells installed around the perimeter of the tailings facility, as well as in a downstream wetland area. The water is sampled and analyzed 2-3 times a year. Comparing with criteria published by the Swedish geological survey, sulfate concentrations are considered to be “very high” while nickel concentrations are “high” to “very high”.

Surface water monitoring is carried out in the creek Leipojoki upstream and downstream of the discharge from the clarification pond, as well as in downstream Vassara and Lina rivers. Water samples in downstream sampling points are collected monthly. When water is being emitted from the clarification pond, the sampling frequency is increased to twice a week.

Settling dust is measured monthly at 24 stations surrounding the operations. The concentration of particles in air is measured in four nearby villages.

Dam seepage through the I-J dam is collected in a ditch which leads to a collection pond from where the water is pumped back into the clarification pond.

Dust control measures involve planning of release of tailings slurry through different spigots in order to keep the beach moist. Water and/or road salt are applied to roads and beaches. Polymers are sometimes applied to inactive areas of

the tailings pond. At present, a large inactive area close to the E-F dam has been seeded in order to establish grass.

The results from the environmental monitoring are reported quarterly to the supervising authority (the county administrative board). An annual environmental report is uploaded to the Swedish portal for environmental reporting (SMP).

External stakeholder meetings are held with e.g. neighbors, the local Sami community, the municipality of Gällivare and the county administrative board. Measures exist to record and address any potential grievance. At present, a human impacts assessment is being carried out.

8 EMERGENCY PREPAREDNESS AND RESPONSE PLAN (EPRP)

The Emergency Preparedness and Response Plan (EPRP) is triggered by a failure or a near failure. The triggers of the EPRP are defined in the Trigger Action Response Plan (TARP), see Chapter 3.

When the EPRP is triggered by a dam safety related incident, the dam safety emergency group is activated to support the Aitik emergency group with technical dam safety expertise. The dam safety emergency group is responsible for assessing the situation as well as proposing and leading dam safety related measures but is subordinated the Aitik emergency group.

The structure of the dam safety emergency group is similar to the dam safety organization in normal operation. Each role in the group has one responsible individual and at least one substitute. For each role, a checklist is available.

In case of an emergency, the EPRP provides routines for cooperation with local emergency authorities “Räddningstjänsten in Gällivare municipality”.

Emergency response simulations are held at five years interval.

The EPRP is reviewed yearly and updated when necessary. The EPRP will undergo a thorough review during 2023.

9 INDEPENDENT REVIEWS

An Independent Tailings Review Board (ITRB) has been established for Aitik, with online meetings and a site inspection scheduled annually.

A Dam Safety Review (DSR) is ongoing (July 2023). The DSR is conducted by the internationally renowned company Klohn Crippen Berger (KCB). The reviews

are scheduled every five years as required based on the consequence classification.

Table 7 Planned, ongoing and conducted independent reviews

Type	Conducted/planned	Year	By
ITRB	Conducted	2022	ITRB
Independent reviewer	Conducted	2022	Independent reviewer
DSR	Ongoing	2023	KCB
ITRB	Planned	2023	-
DSR	Planned	2028	-

10 RECLAMATION SECURITIES AND OTHER FINANCIAL SAFEGUARDS

Mining operations, including tailings management, are subject to court/authority approved environmental permits, including the posting of mandatory reclamation securities, usually in the form of bank guarantees. These securities are intended to make sure that the operator has sufficient financial capacity to cover estimated costs of planned closure, early closure, reclamation, and post-closure of the tailings facility and its appurtenant structures. In addition, insurance is used to cover sudden and unexpected tailings related incidents.

Boliden´s current provisions for reclamation works, can be found in its Annual and Sustainability Report.

11 IMPLEMENTATION OF THE GLOBAL INDUSTRY STANDARD ON TAILINGS MANAGEMENT

At Aitik an initial self-assessment of the conformance to GISTM, based on the guidance in the ICMM Conformance Protocols, was conducted by the site personnel with involvement from the management team. To validate the self-assessment support was later provided by a panel of subject matter specialists from Boliden Mines Staff Functions.

The results from the self-assessment show that Aitik is not yet in conformance with the Standard. While significant progress has been achieved towards conformance, there are still several actions that need to be taken for the tailings facility to be in full conformance with all requirements. These actions have been summarized in a corrective action plan that has been submitted and approved by the mine management team.

Currently the most important actions to enable Aitik to reach full compliance are the following:

- Since April 2022, significant remediation works is ongoing at the tailings facility to increase stability of these embankments.
- In order to secure long term sustainable tailings storage, a new permit application is currently being developed. Related to this, significant work is underway to design the tailings facility for the life of mine. The work requires many aspects of design to be updated and is planned to be completed by end of 2023.
- As the remediation and permitting works advance, the measures according to already set corrective action plans can be implemented in order to fully conform to the Standard by the end of 2024.

To conclude, it is important to note that all activities related to the integrity of the tailings facility, or that may have safety implications for the tailings facility, have been, and will continue to be given the highest priority and therefore the current conformance status should not be seen as a direct reflection of the safety of the tailings facility.