

QMM Water Report 2021-2023



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Letter from David-Alexandre Tremblay, Managing Director QMM

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Legal statement

This report is based on data, samples and information that are not exhaustive and, as a result, the analysis and conclusions provided in the report, though conducted and reached in accordance with professional standards, have inherent limitations. As additional data, samples and information become available we reserve the right to correct, update or otherwise modify all or any part of the report based on such additional data, samples and information.



Letter from David-Alexandre Tremblay, Managing Director QMM



I am pleased to share with you the *QIT Madagascar Minerals (QMM) Water Report for 2021-2023*, the latest step in our water management journey.

Within Rio Tinto, our approach to sustainability is guided by our purpose: finding better ways to provide the materials the world needs. It's about driving innovation and continuous improvement to produce minerals and metals used in everyday life, in the safest and most sustainable way possible.

At QMM, sustainability considerations are deeply embedded in the way we run our business, in line with our vision to lead the world in sustainable mining. We want to leave a lasting positive legacy in Madagascar for current and future generations by aligning our business priorities with society's expectations. We have set an ambitious goal to achieve carbon neutrality. As a first step, we are advancing our solar and wind project so that renewable sources will supply more than half of the energy needs of QMM and the town of Fort Dauphin in the near future.

A critical part of sustainable mining comes from the way we use and manage water. In Madagascar, we operate in a highly sensitive area from a water and broader environmental perspective. The people of Andrakaraka, Ampasy Nahampoana and Mandromondromotra are farmers and fisherfolks, and rely on the rivers and lakes surrounding QMM's operations for their livelihoods. These are the communities who are our neighbours, and they are our most important stakeholders.

Access to clean water is a fundamental human right and is critical to sustaining biodiversity, people and economic prosperity. Disrupted weather patterns, rampant deforestation, more extreme weather events due to climate change, and a growing world population mean that efficiently managing water is more important than ever.

A critical component of ensuring a sustainable mine is listening to find better ways to address the concerns raised by the

communities and other stakeholders. We have heard concerns that our operations at Mandena are potentially causing harm to the quality and availability of water. We have also heard that it is challenging to understand our water management, and that greater transparency and equity around water management is required.

We must address these concerns. Transparency is essential to encourage accountability and build trust with local communities so that together, we can develop long-term solutions. This report is a central part of our transparent response.

Beyond words, we are taking actions. Throughout 2023, QMM hosted site visits by civil society organisations, community members, government representatives and other stakeholders. These visits enabled us to explain our water treatment and release processes and, importantly, to listen and respond to questions raised by our stakeholders about our water management.

We continue to work to increase transparency and address concerns raised by host communities. This report sets out our water management strategy and practices, both now and in the future, which aim to not only protect water, people and the environment, but also to ensure there is meaningful engagement leading to co-management of issues with local communities.

However, as technology and best practice evolve, we know there will be more to do. We are committed to continually improving our plans towards a fully sustainable mine, including through our integrated water management approach. We are committed to getting this right.

I hope that this report will go some way toward providing a better understanding of QMM's water management practices in support of our sustainable mining vision and our commitment to provide a lasting positive legacy for local communities.

We welcome your feedback.

“Our water management strategy and practices aim to not only protect water, people and the environment, but also to ensure there is meaningful engagement with local communities.”

Water highlights 2021-2023



Water import for mineral processing operation

100% water recirculation
0% freshwater



Volume of treated water release

2021:
0 m³
2022:
490,000 m³
2023:
1,260,000 m³



Annual rainfall

2021:
1,394 mm
2022:
2,071 mm
2023:
1,398 mm



Number of tropical cyclones that affected Madagascar

2021: **3 cyclones** (Eloise, Guambe, Jobo)
2022: **3 cyclones** (Batsirai, Emnati, Gombe)
2023: **2 cyclones** (Cheneso, Freddy)



Volume of emergency water release

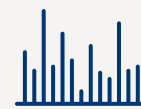
2021:
0 m³
2022:
2,760,000 m³
2023:
1,720,000 m³



Community access to potable water

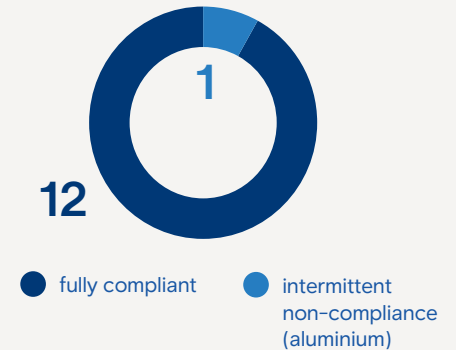
2
new potable water stations constructed for Andrakaraka and Emanaka communities

Construction of the potable water stations for Mandromondromotra and Ampasy Nahampoana will be completed soon

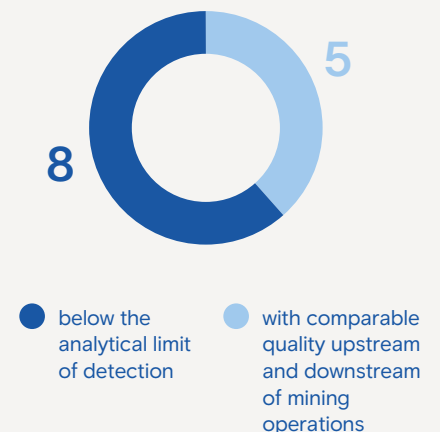


13 Regulated metals per decree

Water release to the receiving environment (where the decree applies):



Mandromondromotra River quality:



Context

The purpose of this *Water Report* is to share QIT Madagascar Minerals (QMM) water management performance and initiatives.

This report covers the period January 2021 to September 2023 and is structured into three sections:



Section 1

Overview of water management at QMM



Section 2

QMM's water management strategy



Section 3

Summary of water management performance over the reporting period

This *Water Report* continues QMM's reporting of water data which commenced with the publication *QMM Water Discharge Monitoring Data, March 2021*, covering the period from 2015 to 2020.

QMM's water reports form part of our ongoing commitment to transparency around water management.

Water management overview

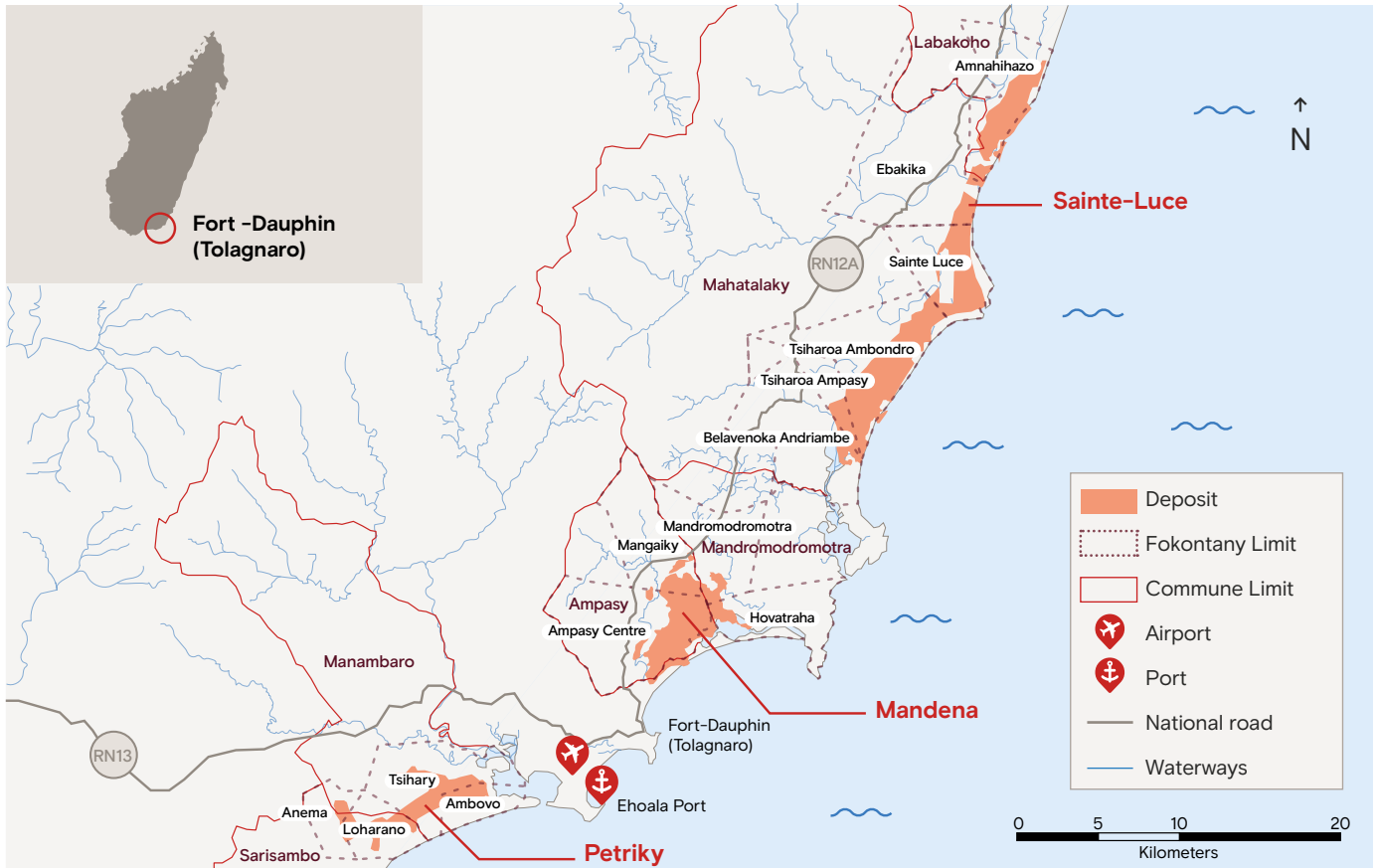


Figure 1: Location of QMM deposits and neighboring communities

Locality

QMM is a world-class ilmenite mining project located in the Anosy region of south-eastern Madagascar, near the city of Fort Dauphin (Tolagnaro). Ilmenite is a major source of titanium dioxide that is predominantly used as a white pigment in products such as paint and paper.

QMM also produces zirsill, used in the manufacture of ceramic tiles and certain types of electronic displays, and monazite, used in renewable energy technologies such as high-power permanent magnets used in wind turbines and electric vehicles.

QMM includes the deep-water public Port of Ehoala, from which the products are shipped to customers around the world and which serves as an important socio-economic development asset for the south part of Madagascar.

QMM is a joint venture that is 80% owned by Rio Tinto and 20% owned by the Government of Madagascar. QMM began exploration of the Anosy region in the late 1980s, which led to the discovery of mineral deposits equalling 6,000 ha.

The heavy mineral sand deposit area extends over 70 km of the coastal zone surrounding

Fort Dauphin. Three deposits of heavy mineral sands, Mandena, Sainte Luce, and Petriky, have been identified within its boundaries. Currently, only the Mandena deposit is being mined.

Operational description

QMM's Mandena operations commenced in November 2008.

Operations include a mining pond with dredges and a floating wet separation plant, a dry mineral separation plant (MSP), satellite mining areas (dry mining unit or DMU) and a supporting water management system.

The mine is bounded by the Mandromondromotra River and Enandrano River to the east and west respectively, and to the south by an interconnected system of rivers and lakes. The site is authorised by the Malagasy Regulator, the ANDEA (Autorité Nationale de l'Eau et de l'Assainissement), to release water into natural on-lease swamps connected to the Mandromondromotra River at several locations, subject to compliance with water quality criteria.

As part of the water management system, we operate a pilot water treatment plant located

in the south-east section of the site near the future permanent water treatment plant, that is currently undergoing construction.

As a final treatment step, the water is pumped to a polishing pond from which it flows to the release location. The polishing pond is a water basin that provides additional retention time for improved water clarity and homogeneity.

QMM holds a freshwater extraction permit from the Regulator, renewable every five years. The site is currently configured to only extract water from Lake Lanirano, to provide a potable water supply for the mine workforce and certain host communities. Historically, freshwater has also been extracted for operational mineral processing use; however, this has not occurred since 2014. For this purpose, a weir was installed on the Anony River at the start of the mine in 2009 to prevent intrusion of seawater into the lakes and the Meander River.

Figure 2 shows the relative location of these features and surrounds.



Bakoly RABARIVELO
Production geologist

“Excellence in water management is key to our mine processes and to a sustaining and prosperous world. I feel fulfilled being part of the water strategy we have developed, together with my colleagues and some world experts. It is our commitment to society and the environment, in line with our vision to pioneering sustainable mining here in Madagascar.”

“Ny fahaiza-mitantana ny rano no fanalahidin’ny fitrandrahana harena an-kibon’ny tany ho an’ny tontolo maharitra sy mandroso. Tsapako fa manana tombontsoa handray anjara amin’ny paikady momba ny rano novolavolainay aho, miaraka amin’ireo mpiara-miasa amiko sy ireo manampahaizana iraisam-pirenena. Izany no fanoloran-tenanay amin’ny fiaraha-monina sy ny tontolo iainana, mifanaraka amin’ny vinavinay hitarika izao tontolo izao amin’ny fitrandrahana harena an-kibon’ny tany maharitra sy voalohany eto Madagasikara.”



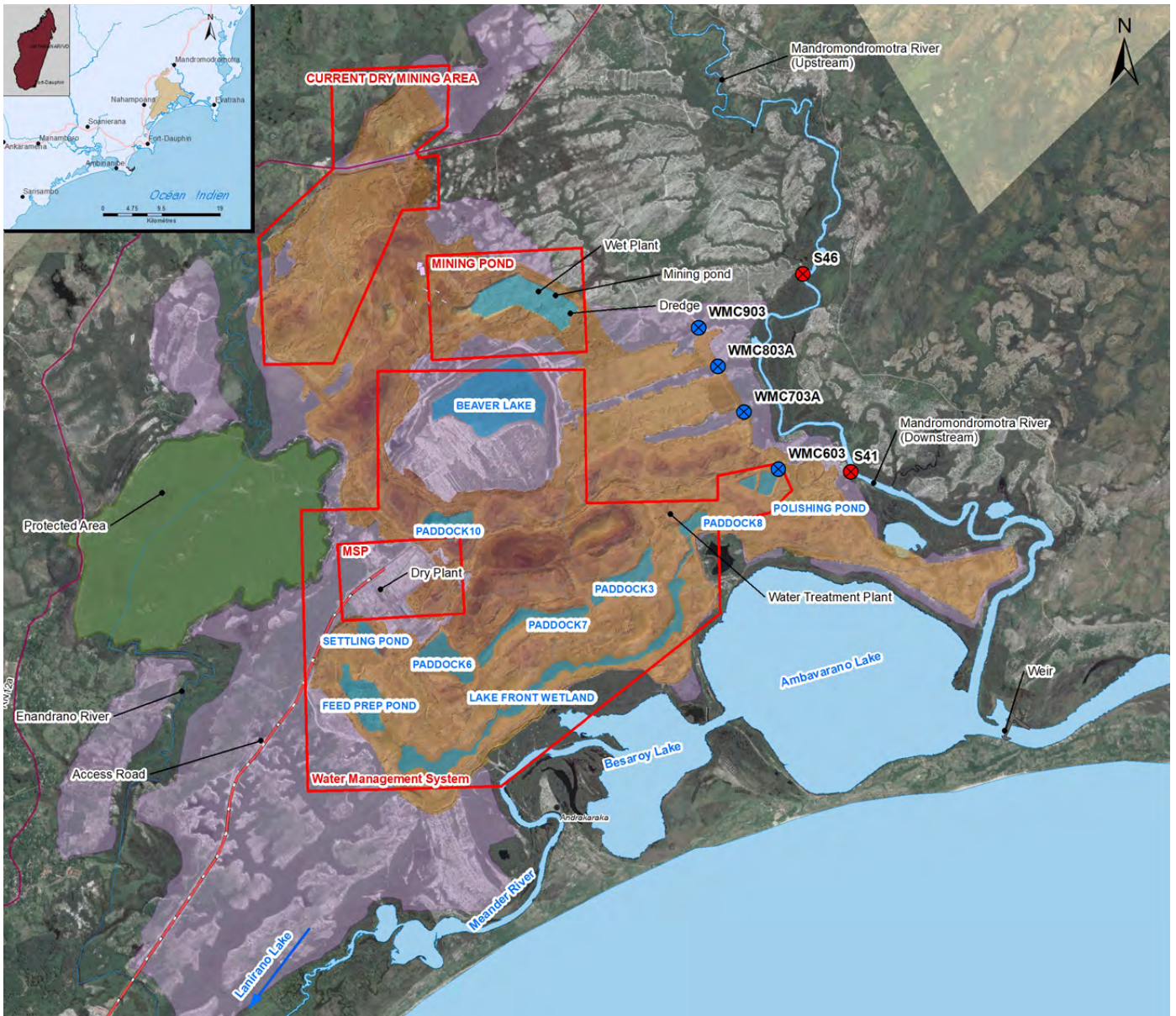


Figure 2: QMM mine site plan and main infrastructure (Q3 2023)

Monitoring Points

Type

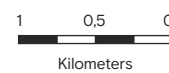
- ⊗ Surface water
- ⊗ Release locations
- Mine-Port road
- National road

Hydrography

- Hydrography
- Main area
- Water management system
- Lease area
- Protected area

Sources:

Rio Tinto Géomatiques, Relevés techniques et gestions de données 2023



Mine Technical Partners : GWM
 Novembre 2023

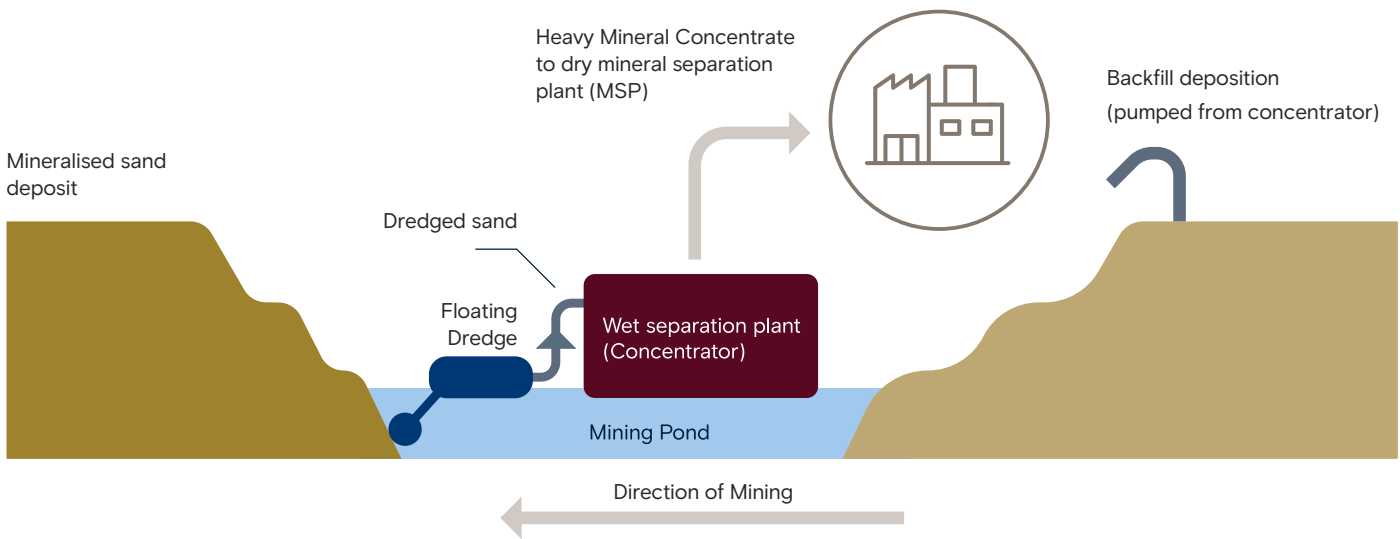
QMM uses two different mining methods at Mandena:

Dredge mining

This method uses a floating dredge and wet separation plant in a mining pond within the mineralised sand deposit. There are currently two dredges working in tandem on the mining pond. Local groundwater flows into the pond and pumps are used to raise or lower the water level as needed. Dredged sand is transferred as slurry to the floating wet separation plant, where a series of spirals separate heavy mineral concentrate (HMC) from the non-mineralised sands.

The discarded sands are pumped back to close the mining pond or previously mined areas to begin the rehabilitation process.

Water from the mining pond is also used to transport HMC in a slurry from the mining areas to the MSP. Most water used for the slurry transfer is recovered and returned to the mining pond to maintain water levels or is treated via the water management system.



Dry mining unit (DMU)

Dozers are used to excavate mineralised sands. This material is turned into slurry and then fed into the wet separation plant. As dry mining may occur below the water table, active dewatering pumping is applied to provide access to mineralised sands. The dewatering water is pumped into the water management system.

Further mineral processing is completed at the MSP, where multiple separation units allow for further extraction of HMC. The MSP requires a water supply for processing purposes. The water management system allows sediment from the MSP discharge water to settle before this water is reused again in the mining process.

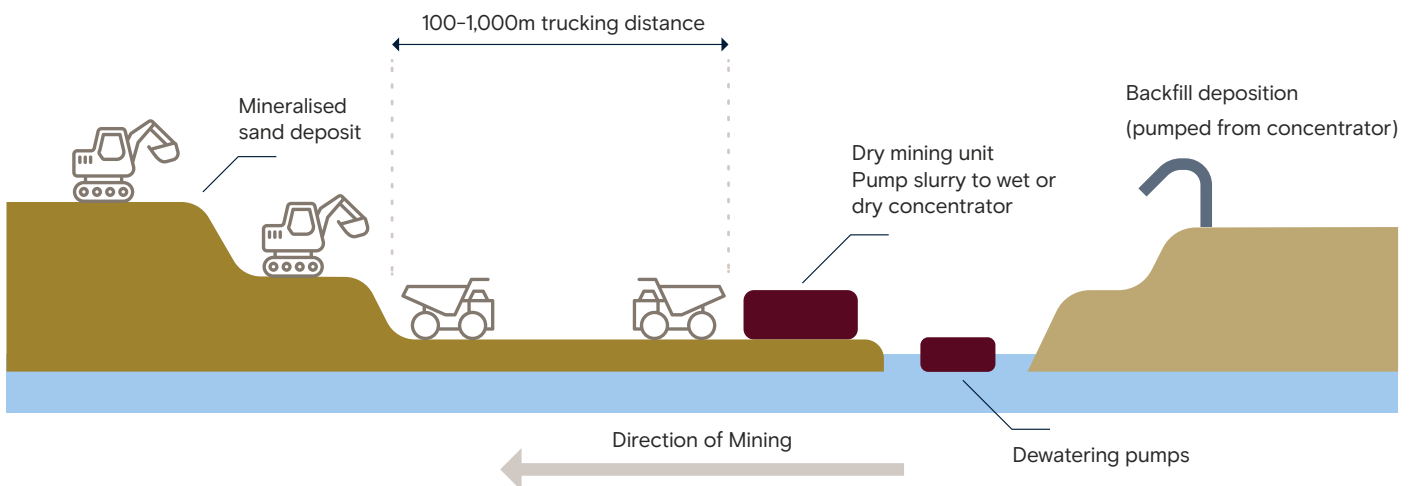


Figure 3: QMM simplified depiction of the mining methods



Water management system

The mining activity removes materials from the ground. Most of the time, these holes are backfilled. In some specific situations, we may decide to leave holes open to become an integrated part of the water management system for solids settling and water storage. These holes are referred to as paddocks and the water stored within them is referred to as “process water”, which is a combination of mineral processing water, runoff water and groundwater.

We monitor and manage process water through our water management system in three ways:

- Process water is moved through the circuit of water storage paddocks to reduce the suspended solids load.
- Once the process water is clarified, it is either recirculated to meet operation demands or pumped to the water treatment plant for release into the environment.
- The water treatment plant and polishing pond further improve the water quality by adjusting the pH and reducing the aluminium concentration.

While no chemicals are added or used in the mining process, the mining operation does influence the quality of the process water.

It lowers the pH of the water, which enables some heavy metals to dissolve in water, mainly aluminium.

Current water balance on site suggests that the mine will continue to operate within a state of water surplus, with water inflow exceeding water outflow, which we need to manage through excess water releases to the environment. Accordingly, we have constructed four release locations to the Mandromondromotra River – WMC603, WMC703A, WMC803A and WMC903. However, only release point WMC603 is currently active and permitted to be used by the Regulator. Release locations are shown in Figure 2.

According to our water management plan, excess process water is released only when necessary to preserve the operational buffer in the water management system. The operational buffer is designed to contain process water within the water management system without outflow into the natural environment. Our systems and processes ensure water elevations are maintained at safe levels to preserve the integrity of our storage infrastructure.

Two situations trigger the need for water release:

- *Normal operations*: controlled release of water through the water treatment plant and polishing pond at the approved release point WMC603 to maintain the water management system within approved inventory levels at site while maintaining sufficient volume for the mine water demand (DMU and MSP).
- *Intense rainfall conditions*: emergency release of additional volume at the approved release point WMC603 to re-establish the required operational buffer at site.

Figure 4 illustrates the simplified water flow diagram at site.

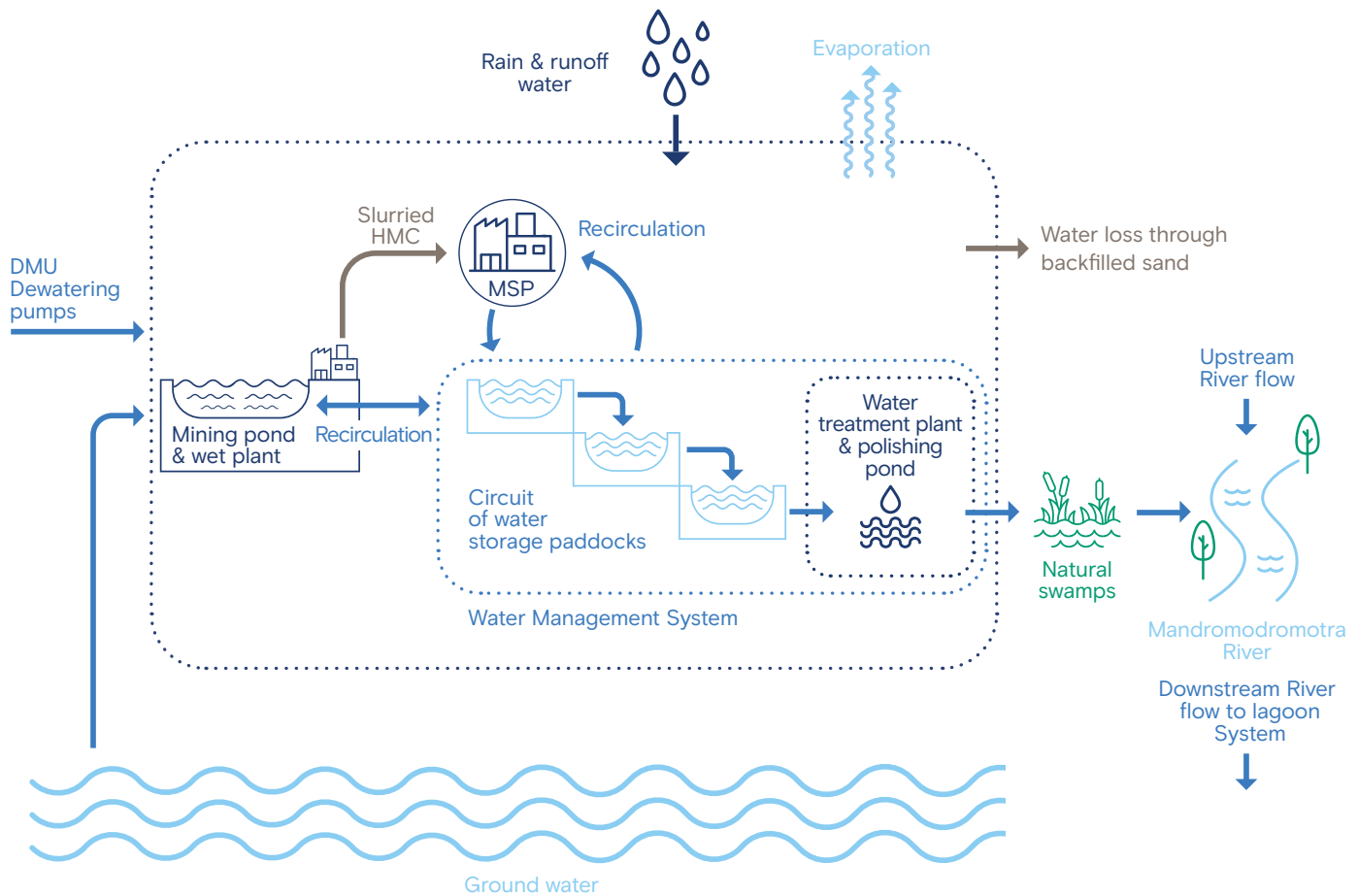


Figure 4: QMM simplified water flow diagram



Monitoring

We conduct an extensive water quality monitoring program on water within our mine lease area and around Mandena, in compliance with Regulatory requirements. We also conduct additional monitoring and sampling of groundwater, surface water, and marine water quality for the Port activities as part of this program.

Two sampling stations in the Mandromondromotra River were selected to represent river quality data upstream and downstream of the approved release point. Figure 2 shows the sampling station locations:

- WMC603: current approved release point for the operations
- S46: located in the Mandromondromotra River upstream of mining operations
- S41: located in the Mandromondromotra River downstream of mining operations

Monitoring data from the three sampling stations is presented in Appendix A.

Legal framework

The following legal requirements apply to water management for our operations:

- Décret n° 2003/464 of 15 April 2003 on the classification of surface water and regulation of liquid effluent discharges.
- Décret n° 2003-943 relating to discharges, flows, deposits in surface or underground water in the Legal Framework. The discharge permit applications are granted under this Décret n° 2003-943 and the Décret n° 2003-464.
- Décret n° 2004-635 of 15 June 2004, amending Décret n° 2003-941 of 9 September 2003 related to water monitoring, control of water intended for human consumption and priorities for access to the water resource.
- Approved monitoring protocol for SEMP 2019-2023. The 2024-2028 Social and environmental management plan (SEMP) will shortly be finalised and submitted to ONE (Office National pour l'Environnement) for validation.

Internal standards

In addition to applicable standards and regulations adopted by our host countries, all Rio Tinto operations are required to comply with Rio Tinto's internal standards. Key Rio Tinto standards applicable to water management include:

- Rio Tinto Group E11 – Water quality protection and water management standard
- Rio Tinto Group E13 – Chemically reactive mineral waste management standard
- Rio Tinto Group D5 – Management of tailings and water storage facilities standard and procedure
- Rio Tinto Group – Communities and Social Performance Standard



Copies of these are available on the Policies and Standards section of the [Rio Tinto website](https://www.riotinto.com).



Water management strategy

Water target program 2019-2023

QMM's water management strategy has been developed in line with Rio Tinto's Group-level [five-year water targets](#). These targets allow us to be more transparent about our water usage, risk profile, management and specific challenges associated with water. These targets, and the data required to measure progress against them, are integral to our commitment to water stewardship for the communities and our environment.

Rio Tinto's water targets were set in 2019 and consist of one Rio Tinto Group target and six site-based targets. These reflect our catchment-based approach and recognise that we manage vastly different water-related risks across our business. The site-based targets were chosen based on their water risk profile, our International Council on Mining & Metals (ICMM) commitments, and local community and environmental interdependencies.

Given that we operate in a highly sensitive region valued for its water resources and its environment, QMM was selected as one of the six site-based targets.

In response, we committed to reviewing our water management practices and infrastructure to improve water performance

through the development and implementation of an integrated approach to site water management.

Actions committed to and in progress as part of our response to the site-based water target include:

- Updated water management strategy and vision
- Host community engagement in water management
- Establishment of a water treatment plant and polishing pond
- Improvements in data integrity and capability in testing controls
- Improved transparency and disclosure through publication of a:
 - Water report
 - Water dashboard
- Receiving environment assessment
- Improvements in host community access to potable water
- Progress towards international Global Industry Standard on Tailings Management (GISTM) compliance
- Completion of a community radiation study.

On World Water Day, 22 March 2023, Rio Tinto disclosed its operations' surface water allocation, latest annual water usage and the associated average catchment rainfall runoff, as well as a five-year view on historical annual water usage. This disclosure, which includes QMM's water allocation, is available through an [interactive platform](#) and aligns with Rio Tinto's water targets for 2019-2023.

Rio Tinto will update its Group water targets in 2024.

Updated water management strategy and vision

The QMM water management strategy (Water Strategy) aims to provide an integrated approach to managing current and future water-related challenges and objectives, acknowledging that water is vital to our environment and access to clean water is a fundamental human right.

The Water Strategy has three pillars:



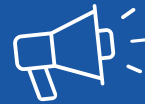
Protect water resources

– by making changes in our operations to improve water performance and environmental outcomes.



Engage with the communities

– to collaboratively understand, manage and monitor water in our environment.



Share information

– in relation to our water management practices and performance.

QMM's vision is to build trust and improve environmental outcomes through our decisions, partnerships and transparency in water management.

Host community engagement in water management

The communities where we operate are central to our water management strategy and sustainable mining vision.

We believe the more we involve the communities in water management, and understand how they use the land and environment, the better our Water Strategy will be. We also believe that this partnership extends beyond our mine lease boundaries, and together with host communities, we can protect, monitor and care for our surrounding environment.

Accordingly, we are developing a community-centred water monitoring approach focused on:

- **Information sharing** – To understand, preserve and protect the waters at and around our operations long-term, we need to learn from local communities what their water needs are. We also need to share our information transparently so that communities are aware of and understand our water management strategy and approach. This will build the necessary foundation for successful co-design of long-term sustainable solutions.

- **Co-designed monitoring program** – QMM supports independent community-led monitoring of water-related aspects that are recognised as important to communities. This program is about what is of concern and meaningful to them; not focused on QMM's monitoring needs. We are working with host communities and an independent external party to develop and implement this program.



Water treatment

Historically, QMM has operated under a national decree exemption approved by the Regulator that allowed the release of water into the receiving environment with a pH between 3.2 and 6.

As of November 2020, the Regulator required QMM to comply with the national decree for all surface water release, with a pH between 6 and 9. This triggered the need for QMM to install a water treatment plant to comply with the amended decree.

We commissioned PROXA Water, a global company specialising in water treatment, to design and construct a pilot-scale unit to treat water using controlled addition of limestone so that it complies with the national decree for pH and aluminium concentration.

The pilot water treatment plant, commissioned in July 2022, has treated approximately 1,750,000 m³ of water during its first year of operation, with a rate of around 400 m³/hr. The pilot will be expanded to a full-scale plant with the capacity to treat at a rate up to 1,500 m³/hr of water in 2024.

We commissioned an independent Environmental Impact Assessment (EIA) to identify the potential impacts of constructing and operating the permanent water treatment plant. QMM commits to integrating the mitigation measures identified by this assessment.

Figure 5 illustrates the water treatment process, which consists of a series of reactors and clarifiers. As part of the treatment,

limestone and a polymer are added to the water. Limestone is required to raise the pH, which subsequently reduces aluminium concentration. The polymer is necessary to efficiently clarify the water. The treated water is mixed with additional blend water, when required, to reach the desired pH level, and is subsequently transferred to the polishing pond for improved water clarity and homogeneity.

Sludge is generated as part of the water treatment process from the reaction of the limestone with the water and the precipitation of suspended solids. Currently, the sludge is dewatered and contained in geotextile bags on site. While this approach is a proven

method for sludge dewatering and an appropriate method of containment aligned with good industry practice, we are looking for an alternative long-term solution. Unlike other jurisdictions where we operate, there is currently no long-term knowledge base for the management of this type of water treatment sludge within Madagascar. As a result, we are undertaking a detailed analysis of the sludge, supported by independent external experts SRK Consulting, to help us understand and to inform environmentally appropriate long-term options for the water treatment sludge management in Madagascar.

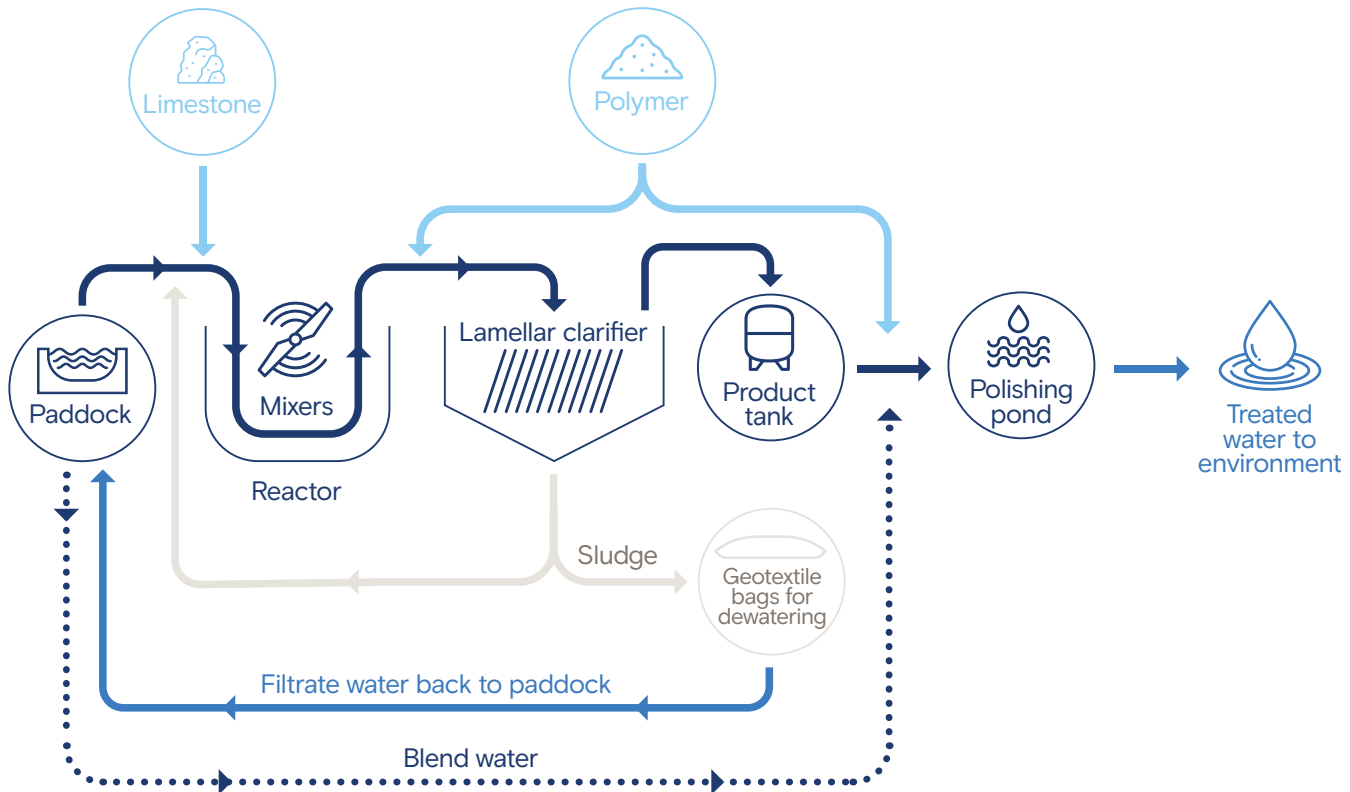


Figure 5: QMM water treatment plant





Lantosoa RASOLONDRAZAO

Senior hydrogeologist

“When I arrived in Fort Dauphin at the start of the project in 2009, I was blown away by the beauty of the nature and the environment. I understood that here, water is a vital resource that must be protected and cherished. Let us combine all our strengths and efforts, as a responsible company, together with the communities, partners, and the government, to manage water efficiently for the sustainable development of our environment, local communities, and the world. I am proud to play my part, through my job at QMM, in protecting this very precious resource.”

“Rehefa tonga teto Fort Dauphin aho tamin’ny fanombohan’ny tetikasa tamin’ny 2009, dia nanaitra ahy ny hakanton’ny zavaboary sy ny tontolo iainana. Tsapako fa eto, ny rano dia loharano tena ilaina tsy maintsy arovana sy ankamamiana. Andeha isika hanatevin-daharana ny herintsika sy ny ezaka rehetra, amin’ny maha-orinasa tompon’andraikitra antsika, miaraka amin’ny vondrom-piarahamonina, mpiara-miombon’antoka ary ny governemanta, mba hitantana tsara ny rano ho fampandrosoana maharitra ny tontolo iainantsika, ny fiaraha-monina misy antsika ary izao tontolo izao. Mirehareha amin’ny anjarako ao amin’ny QMM aho, amin’ny fiarovana ity loharanon-karena tena sarobidy ity.”

Improvement in data integrity and capability in testing controls

We routinely sample, monitor, analyse and report to the Regulator water quality within our operation and in the surrounding environment. However, for the results to be meaningful and trusted by our stakeholders, there must be a high degree of confidence in standards applied by the laboratory analysing the samples.

Acknowledging the challenges associated with the on-site laboratory analytical processes, we decided in 2021 to use external accredited laboratories to conduct water quality sample analyses and also initiated work to upgrade our on-site laboratory capability and processes.

The metal monitoring data presented in this *Water Report* is based only on external laboratory data obtained from the following recognised and accredited laboratory:

- Eurofins Environment Testing Australia (ISO/IEC 17025 accredited laboratories) (Eurofins)

In addition to their accredited quality assurance procedures, this facility undertakes water quality analyses with limits of analytical detection that are more suitable for environment assessment.

This incorporation of external laboratory data is an important step in the development and improvement of QMM's water quality dataset.

Transparency

Water Report

We previously issued our *2021 Water Report*, covering data from the period 2015 to 2020.

This *Water Report* continues QMM's transparent sharing of water-related data for the period January 2021 to September 2023. We intend to continue to periodically report water data.

Beyond our *Water Report*, we need to share information transparently with host communities so that they are aware of and understand our water management strategy and approach. To this end, the QMM social engagement team adopts a process of co-design whereby community members are involved in identifying the most effective tools and strategies for communicating and discussing information related to water. Giving the community ownership of this process is crucial for building trust around our water management process.

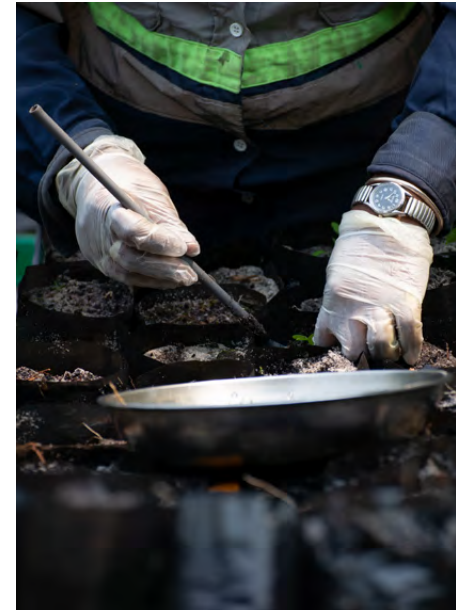
Water dashboard

Commencing in 2024, QMM will publish an online monthly water dashboard tool which will set out retrospective data on rainfall, volume of water released into the Mandromondromotra River, and water quality in surrounding waterways. For the first edition, the included water quality data will be pH and turbidity at the release point into the Mandromondromotra River, and upstream and downstream of the release point. See Figure 2 for release locations.

QMM's water dashboard will be an evolving tool and will incorporate improvements based on stakeholder feedback.

Receiving environment assessment

In June 2023, QMM engaged independent experts WSP Global Inc. (WSP) to undertake a receiving environment assessment surrounding QMM's operations, with the intention to complement QMM's existing water monitoring program and collect data on the aquatic receiving environment. This work continues QMM's commitment to address areas of concern raised by the communities, particularly in relation to water quality, and to better understand and monitor our operating and surrounding environment. Preliminary results will be available in 2024 and will inform next steps.





Community potable water access

Access to safe and clean water is a fundamental human right. We are committed to playing our part in protecting water in and around our operations and helping host communities, including the people of Fort Dauphin, to have access to potable water.

From 2021 to 2023 we have invested to help the communities in the communes of Ampasy Nahampoana, Mandromondromotra, Andrakaraka and Emanaka receive access to potable water.

- The construction of the Andrakaraka and Emanaka potable water stations was finalised in 2022 and 2023 respectively.
- The construction of the potable water stations for Mandromondromotra and Ampasy Nahampoana will be completed soon.

We will continue to make this a community development priority. In November 2023, the Governor of Anosy Region officially announced the launch of a major project to improve access to potable water for Fort Dauphin and its surrounding areas. QMM, in collaboration with other entities will contribute to this project, the details of which will be shared soon.

GISTM compliance

In August 2023, in alignment with the Global Industry Standard on Tailings Management (GISTM), Rio Tinto disclosed Group-level detailed information on global tailings facilities rated Very High or Extreme under GISTM classifications, with the highest potential consequences in the unlikely event of a failure.

As QMM facilities, which are managed under the same commitments, are not classified as Very High or Extreme, they are scheduled to comply with GISTM by August 2025.

QMM currently manages process water and facilities under the Rio Tinto standards for Management of Tailings and Water Storage Facilities (D5) and Management of Slope Geotechnical Hazards (D3). Copies of these are available on the Policies and Standards section of the [Rio Tinto website](#).

Radiation study

In September 2023, QMM published the findings of an independent community radiation study around QMM's site conducted by leading international environmental experts JBS&G Australia Pty Ltd. The study concluded that there is no need for heightened health concerns around local radiation levels.

The analysis completed on five cycles covering various seasons from November 2019 to October 2022 showed that local food sources, water, air and dust are safe from a radiological perspective.

Further, the study found that QMM's contribution to the radiation dose within the community was far smaller than the variation in natural background radiation levels and below national and international regulatory limits for radiation.

We will work with the communities where we operate to determine how, together with the Regulator, we can continue effective monitoring going forward.





Georges LUY RAZANAMALALA
Environmental Advisor

“To me, water is life. When I think about water, I think about the beautiful environment our region offers. I think about our local communities who are heavily reliant on this precious resource for agriculture, stock-raising, fishing, washing, drinking water and social identity. At QMM, we work tirelessly to preserve our water resource by adopting practices to use it rationally whilst ensuring that the communities benefit from access to good quality water. This is what matters to us, and to me.”

“Amiko ny rano dia fiainana. Rehefa mieritreritra momba ny rano aho dia mieritreritra ny tontolo mahafinaritra atolotry ny faritra misy antsika. Mieritreritra momba ny vondrom-piarahamoninay eo an-toerana aho izay miantehitra mafy amin'ity harena sarobidy ity ho an'ny fambolena, fiompiana biby, jono, fanasan-damba, rano fisotro ary ny maha-olona. Ao amin'ny QMM, miasa tsy an-kijanona izahay amin'ny fitahirizana ny loharanon-dranonay amin'ny alàlan'ny fampiharana ny fomba fampiasana azy io amin'ny fomba mitombina ary miantoka fa ny fiarahamonina misy anay dia mahazo tombony amin'ny fahazoana rano tsara. Izany no zava-dehibe amintsika sy amiko.”





Water performance

January 2021 – September 2023

Climate

The climate in the Fort Dauphin area is tropical, with a hot, rainy season extending from November to April and a cooler, dry season between May and October. Rainfall is highly variable both seasonally and yearly, which significantly impacts water management on site. Precipitation can range approximately 1,000 mm to just over 3,000 mm annually, with an average yearly rainfall of 1,703 mm based on a December to November climatic year. It can be influenced by cyclonic activity

within the South Indian Ocean, with this region experiencing on average 6.1 tropical cyclones per year ([reference](#)). The tropical cyclones that affected Madagascar in the reporting period are:

- three cyclones in 2021 (Eloise, Guambe, Jobo)
- three cyclones in 2022 (Batsirai, Emnati, Gombe)
- two cyclones in 2023 (Cheneso, Freddy)

Annual rainfall for the reporting period, presented in Figure 6, is shown to be within 20% of the historic average, with the 2021 and 2023 annual totals being lower than average at around 1,300 mm.

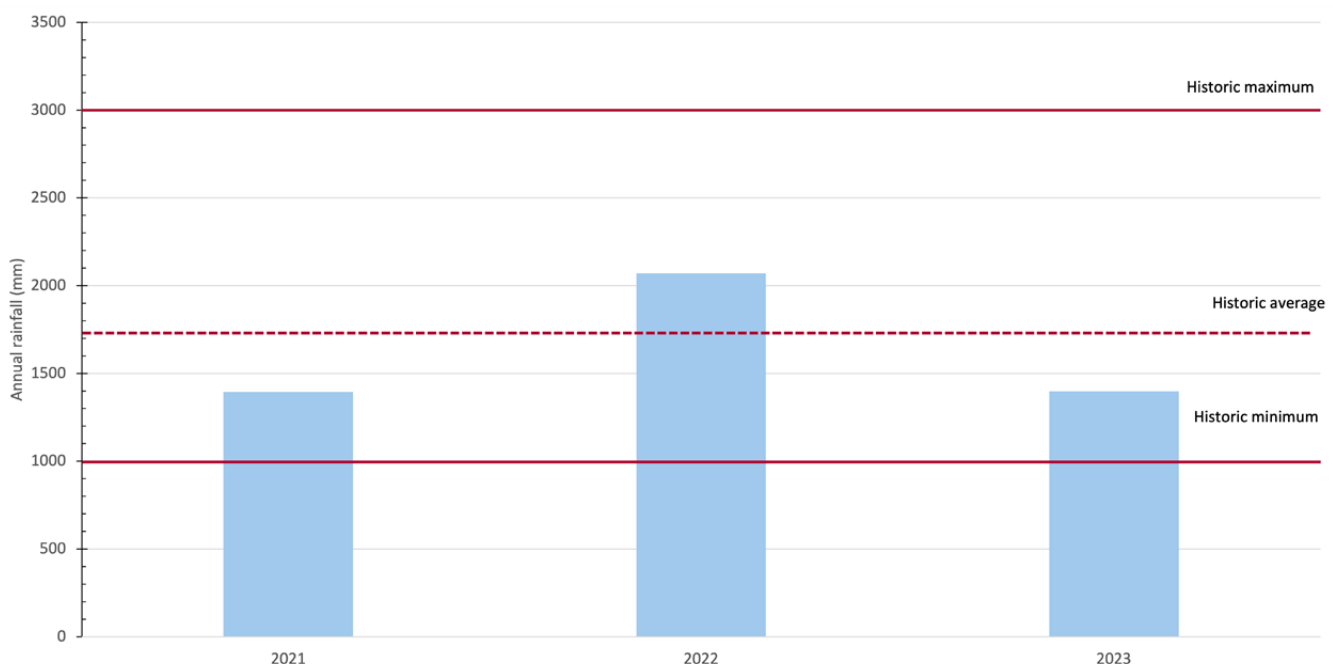


Figure 6: QMM annual rainfall 2021 to 2023

2023: partial year total January to September

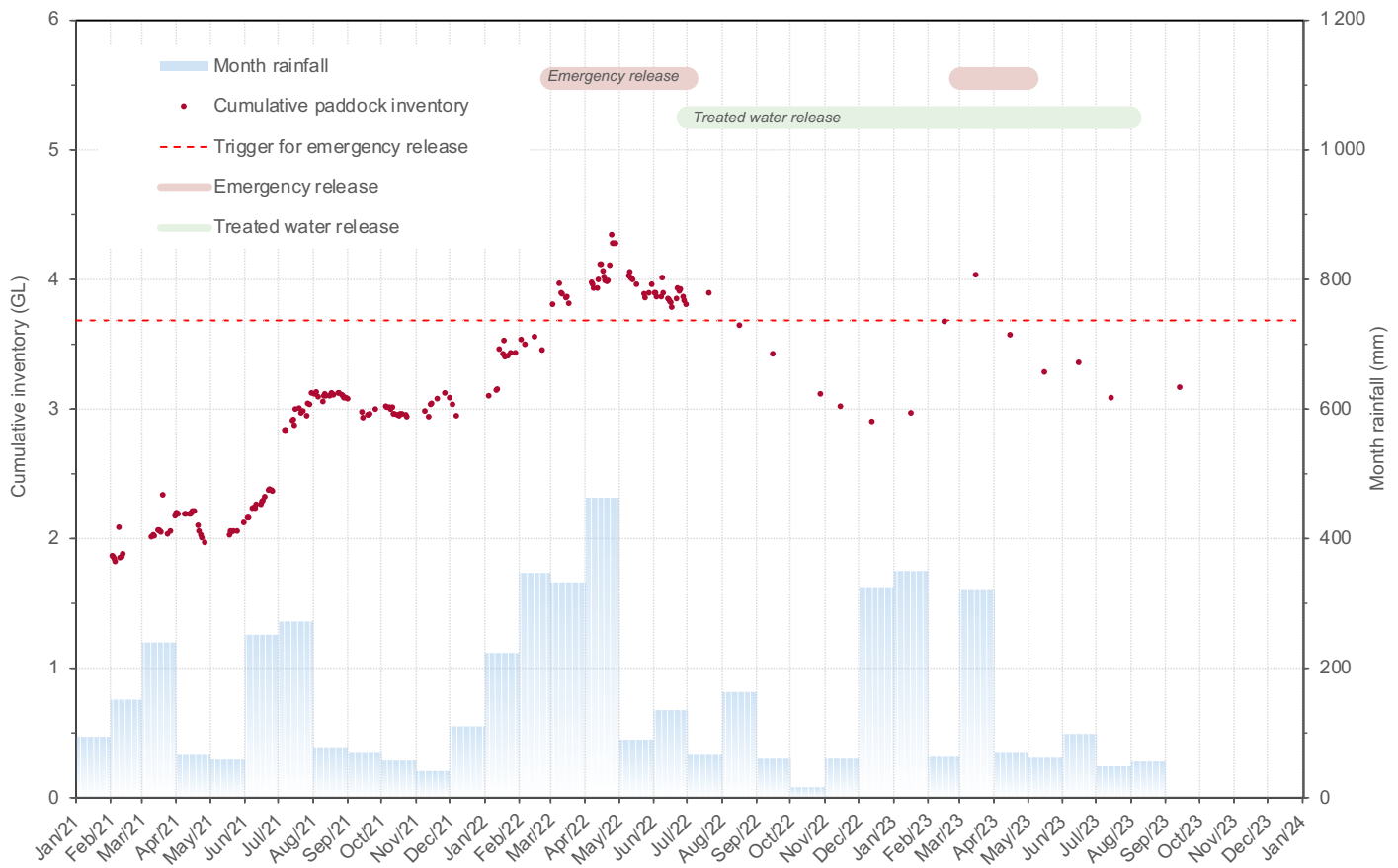


Figure 7: QMM cumulative paddock inventory 2021 to 2023

System inventory

QMM monitors the cumulative inventory in the paddocks, to ensure that operational buffer is available (refer to Water management system section).

Figure 7 presents the cumulative paddock inventory for the reporting period. The figure shows:

- **Cumulative paddock inventory*** – representative estimate of water management containment status.
- **Trigger for emergency release** – representative estimate of the containment trigger volume for initiating emergency release from the water management system based on safe water elevations, to preserve the integrity of our storage infrastructure.
- **Monthly rainfall** – drives the paddock inventory increases witnessed during the wet season.
- **Treated water release** – time-bar showing the occurrence of the pilot water treatment plant operation.
- **Emergency release** – time-bar showing the occurrence of emergency release.

* Cumulative paddock inventory and emergency release trigger volumes are representative as changes in paddock storage. This storage is associated with sedimentation and waste sand placement, and these characteristics vary over time. Confirmation of underlying assumptions used in the calculation of each item is undertaken as part of the annual water management review process, with the estimated volumes adjusted accordingly.

Review of Figure 7 highlights the following:

- Increasing cumulative paddock inventory through 2021, associated with the development of a new paddock, wet season rainfall and the lack of any inventory reduction through system release.
- Cumulative paddock inventory exceeding the containment trigger volume in March to July 2022 and March to April 2023 resulting in two separate emergency release periods.
- An ongoing treated water release that is associated with the pilot water treatment plant commissioned in July 2022.





Faly M. RANDRIATAFIKA
Biodiversity and Climate Change Principal Advisor

“Water means life and is also source of life. Finding excellence in the way we manage water is critical to preserve and promote the unique biodiversity of our region, and improve the quality of life of local communities. This is what my job is all about, and I am proud of it.”

“Ny rano dia midika fiainana ary loharanon’aina koa. Ny fitadiavana fahaiza-manao amin’ny fomba fitantanana ny rano dia zava-dehibe amin’ny fitahirizana sy fampiroboroboana ny zavamananaina tsy manam-paharoa ao amin’ny faritra misy antsika, ary hanatsarana ny kalitaon’ny fiainan’ny vondrom-piarahamoninay. Izany no asako, ary mirehareha amin’izany aho.”

Water supply

QMM extracts freshwater from Lake Lanirano to provide a potable water supply to its mining workforce and certain host communities (local orphanage, community of Llafiatinana and community of Antagnatagna). Annual extraction volumes are:

- 2021 – 0.376 GL
- 2022 – 0.337 GL
- 2023 – 0.286 GL (partial year total January to September)

Note that no freshwater was extracted for use in mineral processing operations during the reporting period, with 100% of QMM operations' water demand supplied through water recirculation.

Site releases

Monthly process water release volumes for the reporting period are presented in Figure 8. Note that no site release was undertaken in 2021.

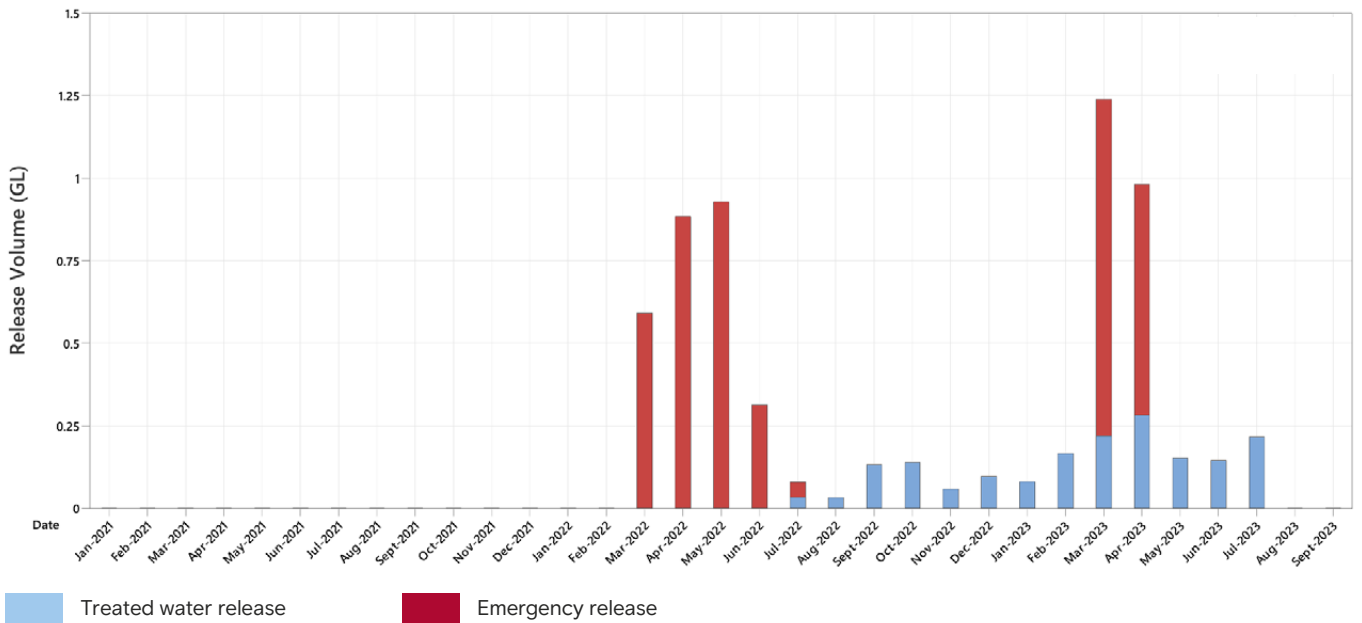


Figure 8: Monthly site volume releases by type 2021 to 2023

Monitoring data


Monitoring data for the reporting period is provided in Appendix A. Metal quality data has been provided by external laboratory Eurofins with low analytical limits of detection and incorporates improved site sampling practices and analysis. Limited water quality data is presented for 2021 as no site release occurred during that year (refer to Figure 8).

Monitoring data is presented in a series of graphs showing water quality data at the release point, and sampling stations upstream and downstream of the release point (refer to Figure 2 for station locations).

Appendix A reference figures for each reported water quality parameter are

- Figure A1 - pH
- Figure A2 - Turbidity
- Figure A3 - Conductivity
- Figure A4 - Aluminium
- Figure A5 - Arsenic
- Figure A6 - Cadmium
- Figure A7 - Chromium
- Figure A8 - Iron
- Figure A9 - Manganese
- Figure A10 - Mercury
- Figure A11 - Nickel
- Figure A12 - Tin
- Figure A13 - Selenium
- Figure A14 - Tin
- Figure A15 - Uranium
- Figure A16 - Zinc

High-level analysis of the monitoring data is provided in the section on “Performance analysis”.

 For detailed data parameter comments, refer to the Appendix A figures.

Performance analysis

Site Release

- Treated water released is compliant with the decree limits for all regulated metals, pH and turbidity following the completion of construction of the polishing pond in March 2023.
- Water treatment plant design has targeted water release compliance. Monitoring data for pH and aluminium show the influence of the water treatment plant on these parameters and supports the decision to expand the water treatment plant.
- Emergency release water quality for pH and aluminium: noticeable improvement in pH and aluminium levels from 2022 to 2023 due to the implementation of the pilot water treatment. This trend is expected to continue with the construction of the permanent and higher capacity water treatment plant.

Receiving environment

- Mandromondromotra River, upstream and downstream of the release point, samples are below the laboratory limit of detection for the following parameters:
 - Arsenic
 - Cadmium
 - Chromium
 - Lead
 - Mercury
 - Selenium
 - Tin
 - Uranium
- Mandromondromotra River upstream samples show detectable levels for the following parameters. Downstream samples remain comparable to upstream:
 - Aluminium (post water treatment plant)
 - Iron
 - Manganese
 - Nickel
 - Zinc
- Uranium, Lead and Cadmium were identified as constituents of potential concern from the *2021 Water Report*. Analytical results presented for this reporting period show that all parameters are below analytical limits of detection upstream and downstream of the release point.



2022 fish death incident

Following three cyclones and intense rainfall in Fort Dauphin in early 2022 (see Figure 7), a planned and authorised emergency release was carried out at QMM. This release raised concerns from our host community members who found fish deaths in the bodies of water surrounding the mine. Following these concerns, the following actions were taken:

- **Regulator investigation:** QMM, together with the Regulator, undertook a series of water sample analyses, in addition to ongoing release water monitoring. These showed no conclusive link between our mine activities and the observed dead fish by community members.
- **Independent investigation:** QMM commissioned a further study, led by Water Research Group (WRG), an independent South African environmental research centre. This study, which investigated the cause of the fish deaths phenomena, analysed a series of fish and water samples collected from the same location as the deaths as well as other monitoring points in the river and lagoon system. WRG's preliminary results indicate that the 2022 fish deaths are unlikely to have been caused by any of the metals concentrations in fish. WRG's final report will be published in early 2024.

Notable events

2022 overflow incident

In February and March 2022, a series of cyclones and extreme rainfall affected southern Madagascar, putting the site under stress and leading to two water overflows (see Figure 7).

In February 2022, slurry from a pipe outlet at the back of the mining pond accumulated in the collector channel until it was completely obstructed. The blockage raised the water level of the collector channel, causing an overflow that lasted less than six hours before being rectified by QMM.

In March 2022, the storage ponds reached maximum capacity due to heavy cyclonic rain. Water overflowed into the South Lakefront located within the mining site and began to run off into the adjacent wetland near Besaroy Lake for approximately seven hours before being rectified by QMM.

As with any incident on site, both incidents were diligently investigated according to Rio Tinto's global incident investigation process. Learnings from the investigations have been integrated into our environmental management system.

WSP has been engaged to undertake a receiving environment assessment surrounding QMM's operations. This assessment will improve our understanding of aquatic life and the environment surrounding our operations (refer to page 19).



Hervé MIHANTAMAMINIRINA
Environment Superintendent

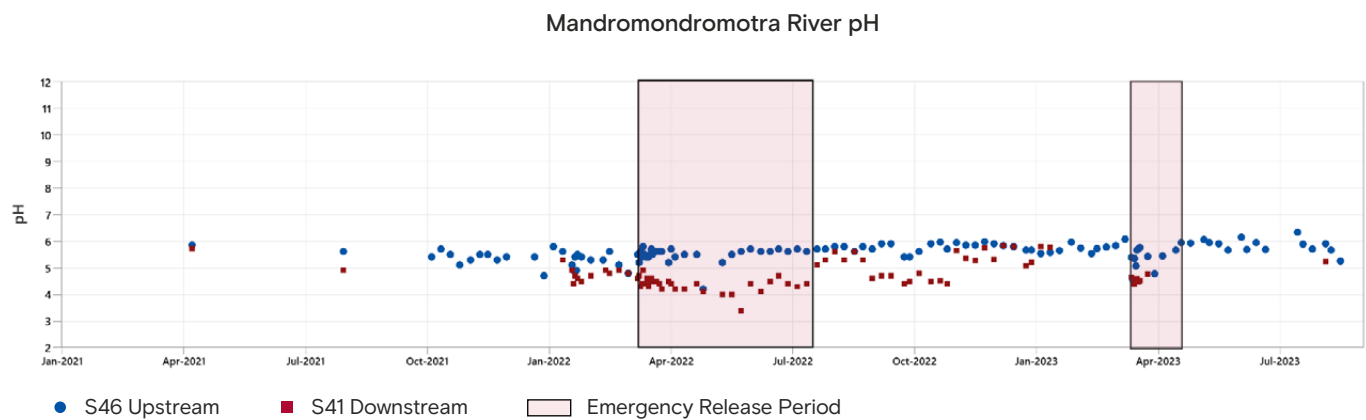
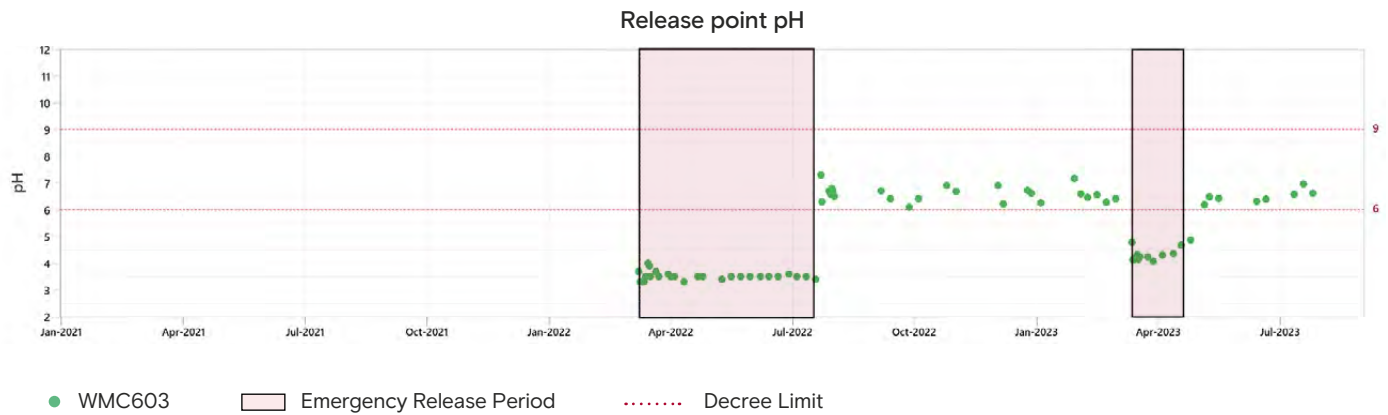
“Protecting the receiving environment is an absolute priority for QMM. This is why we will continue to better understand our environment, strengthen our water monitoring, and be transparent about how we manage water. We will do all that hand in hand with host communities.”

“Laharam-pahamehana tanteraka ho an'ny QMM ny fiarovana ny tontolo iainana. Izany no antony hitohizantsika ny fahafantarana bebe kokoa ny tontolo iainantsika, hanamafisana ny fanaraha-maso ny rano, ary hampangarahara ny fomba fitantanana ny rano. Hanao izany rehetra izany miaraka amin'ny vondrom-piarahamoninay izahay.”

Appendices

Appendix A – Water quality monitoring data 2021-2023

Figure A1 – Monitoring data pH



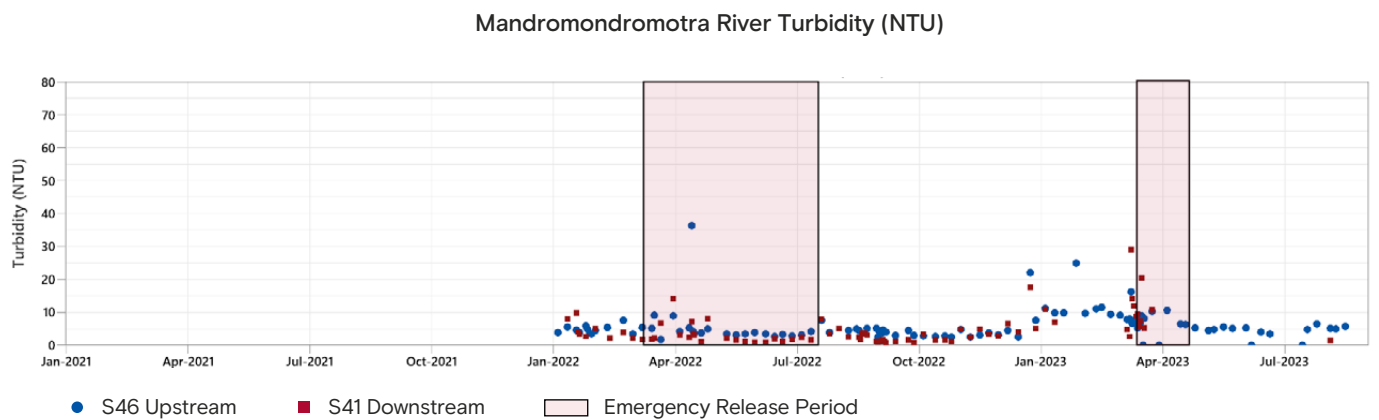
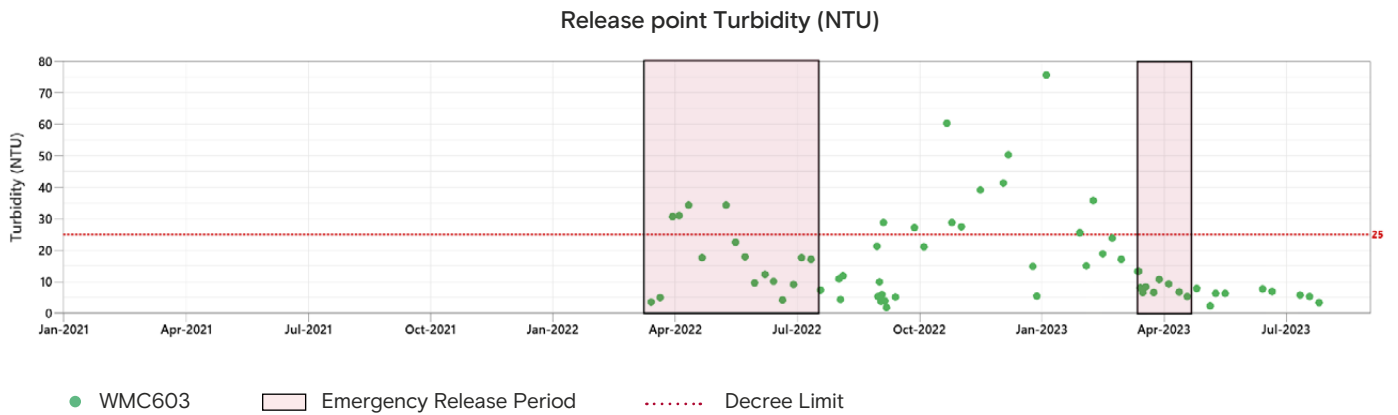
Discharge at the release point pH commentary

- Water treatment plant release is compliant with the pH decree limit range of 6 to 9.
- Raised pH during the March to April 2023 emergency release shows the effect of blending in the higher treated water pH with emergency released water.

Mandromondromotra River pH commentary

- The downstream Mandromondromotra River pH shows the influence of the water treatment plant operation after August 2022, resulting in downstream pH comparable to upstream pH.
- The upstream Mandromondromotra River shows pH between 5 and 6.

Figure A2 – Monitoring data Turbidity



Turbidity is the degree of cloudiness in water (or air) that is caused by the presence of suspended solids ([reference](#))

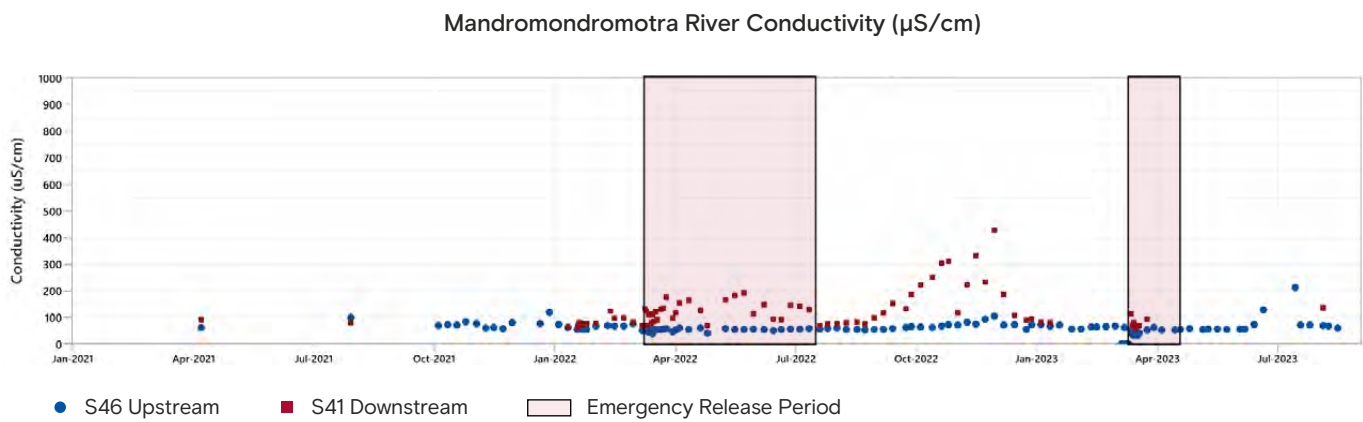
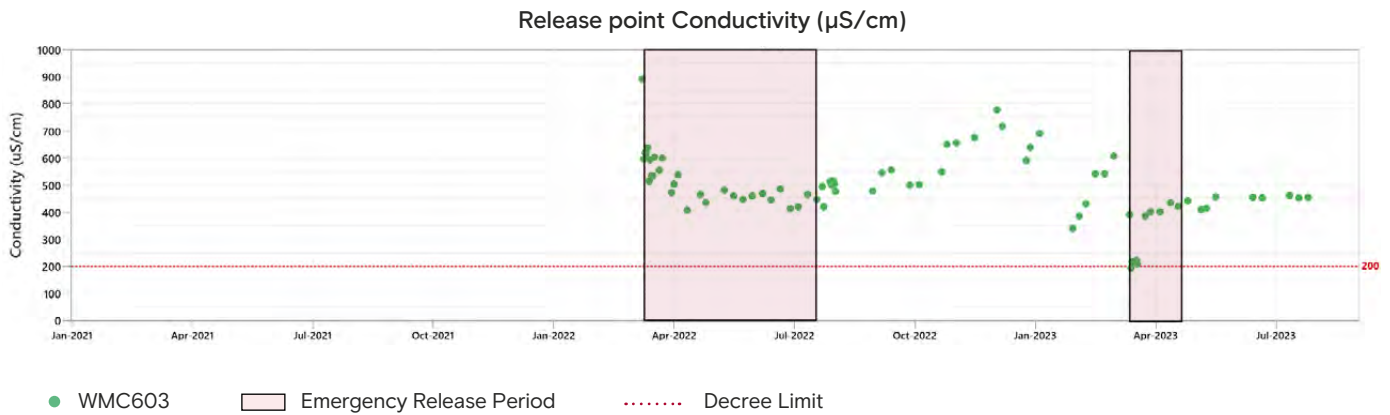
Discharge at the release point turbidity commentary

- Exceedances of the turbidity decree limit of 25 NTU are observed prior to March 2023.
- After March 2023, compliance with the turbidity decree limit has been achieved.
- This improved turbidity performance is associated with the introduction of the water treatment plant polishing pond in March 2023.

Mandromondromotra River turbidity commentary

- Mandromondromotra River turbidity both upstream and downstream is generally low throughout the wet and dry season.

Figure A3 – Monitoring data Conductivity



Conductivity is a measure of the ability of a sample of water to carry an electrical current, which reflects concentration of ionized substances (dissolved solids) in the water ([reference](#))

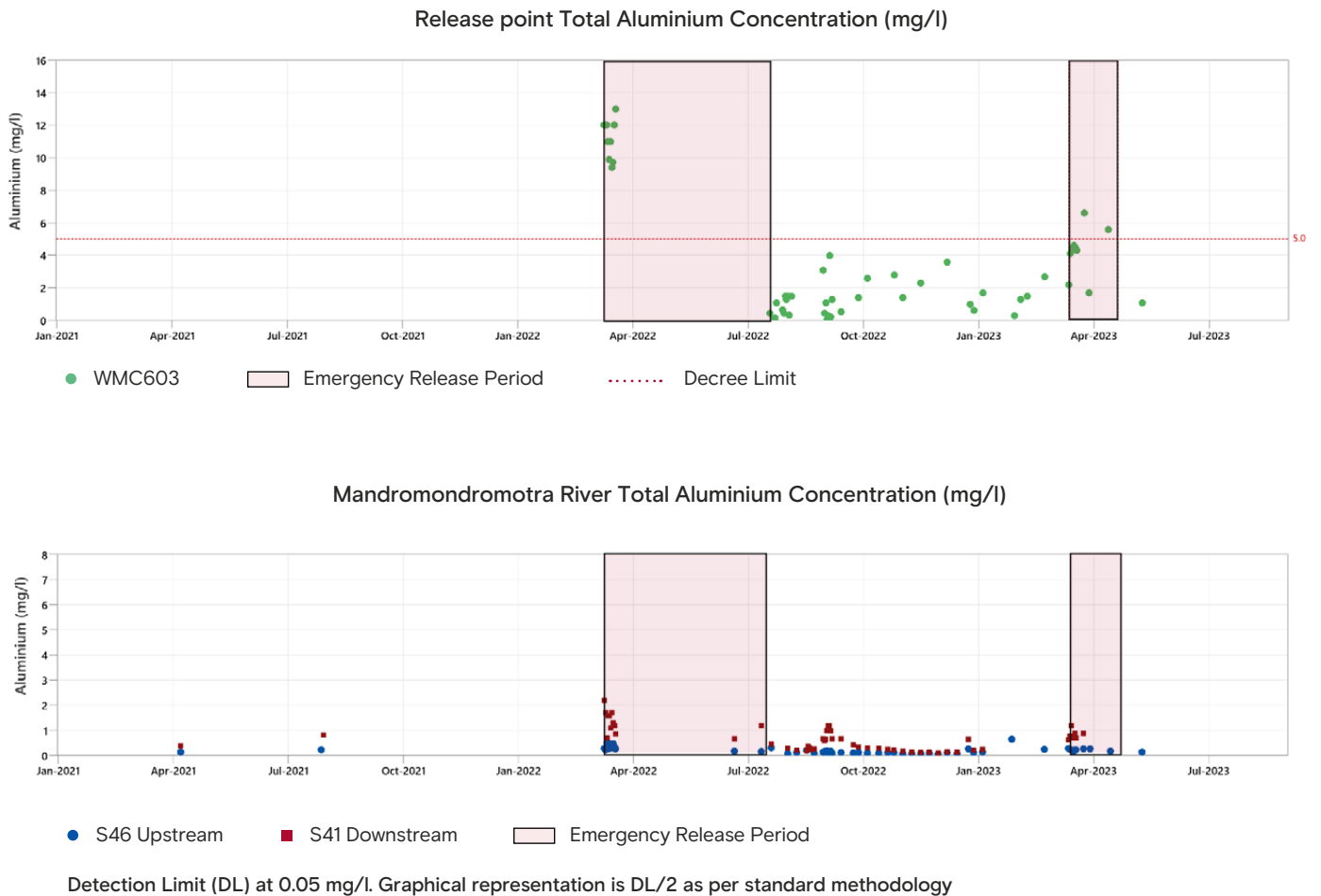
Discharge at the release point conductivity commentary

- Ongoing exceedances of the conductivity decree limit of 200 µS/cm are observed throughout the reporting period.
- Limestone doses for the water treatment plant increases the dissolved salts in the water, which contributes to the conductivity increase. In our case, this specific increase is beneficial for water quality as it increases pH and lowers metal concentration in the water.

Mandromondromotra River conductivity commentary

- Mandromondromotra River conductivity downstream shows the influence of the water treatment plant operation after September 2022.

Figure A4 – Monitoring data Aluminium



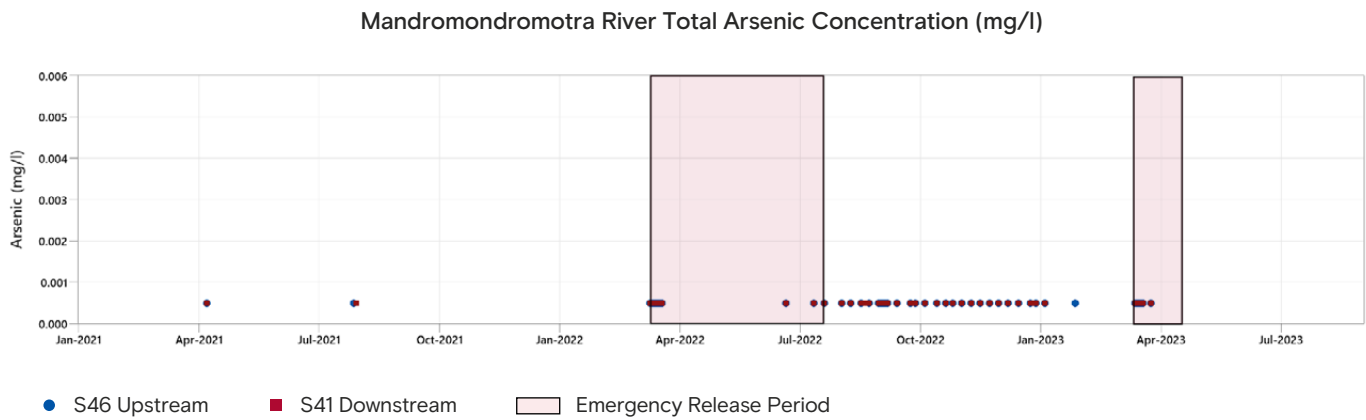
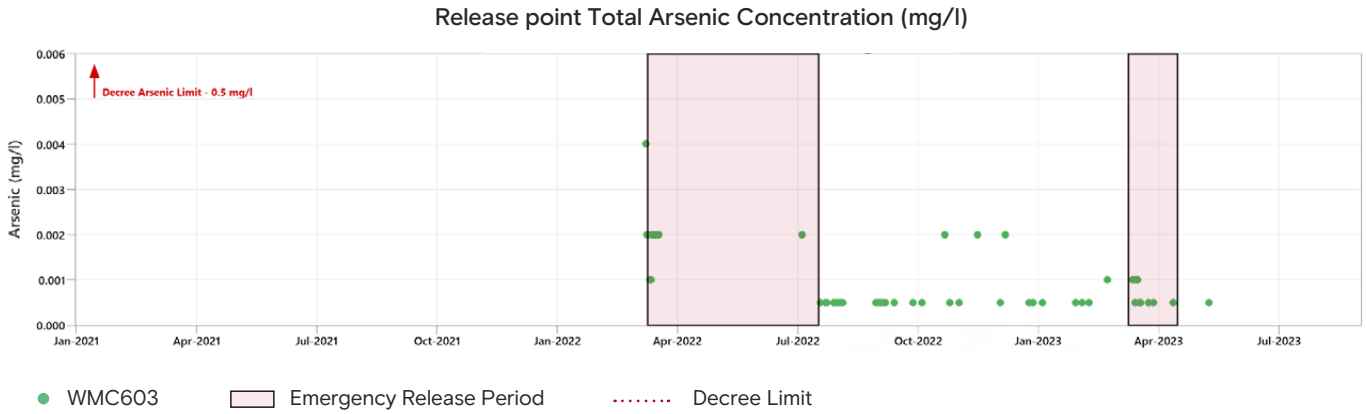
Discharge at the release point aluminium commentary

- Since its implementation in July 2022, water treatment plant release is compliant with the aluminium decree limit of 5 mg/L.
- Noticeable reduction in aluminium levels from 2022 to 2023 emergency release period, due to the implementation of the water treatment plant.

Mandromondromotra River aluminium commentary

- The downstream Mandromondromotra River aluminium concentrations show the influence of the water treatment plant operation after August 2022.

Figure A5 – Monitoring data Arsenic



Detection Limit (DL) at 0.001 mg/l. Graphical representation is DL/2 as per standard methodology

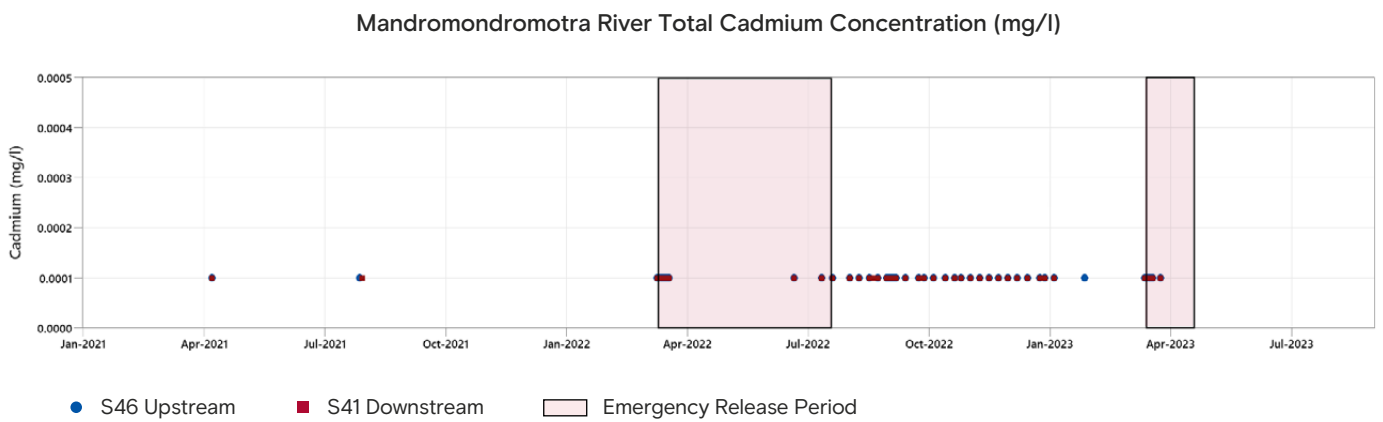
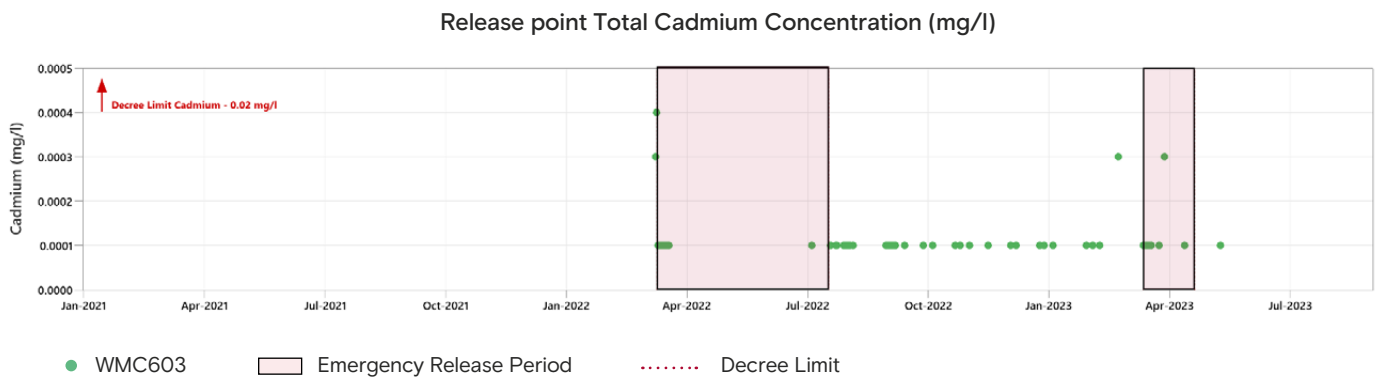
Discharge at the release point arsenic commentary

- Treated water and emergency release water are compliant and well below the arsenic decree limit of 0.5 mg/L.
- The majority of discharge samples are below the arsenic laboratory limit of detection of 0.001 mg/L.

Mandromondromotra River arsenic commentary

- All upstream and downstream Mandromondromotra River samples are below the arsenic laboratory limit of detection.

Figure A6 – Monitoring data Cadmium



Detection Limit (DL) at 0.0002 mg/l. Graphical representation is DL/2 as per standard methodology

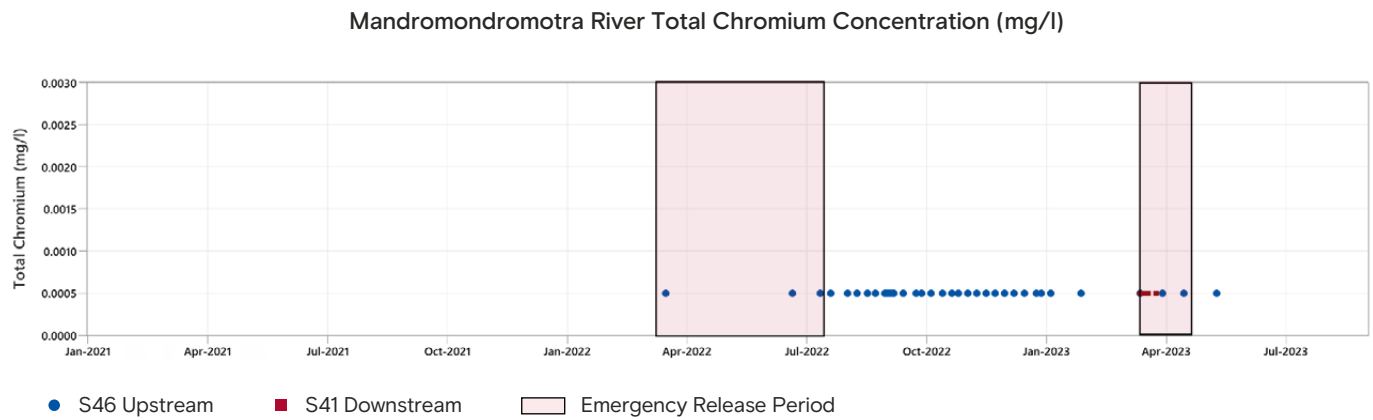
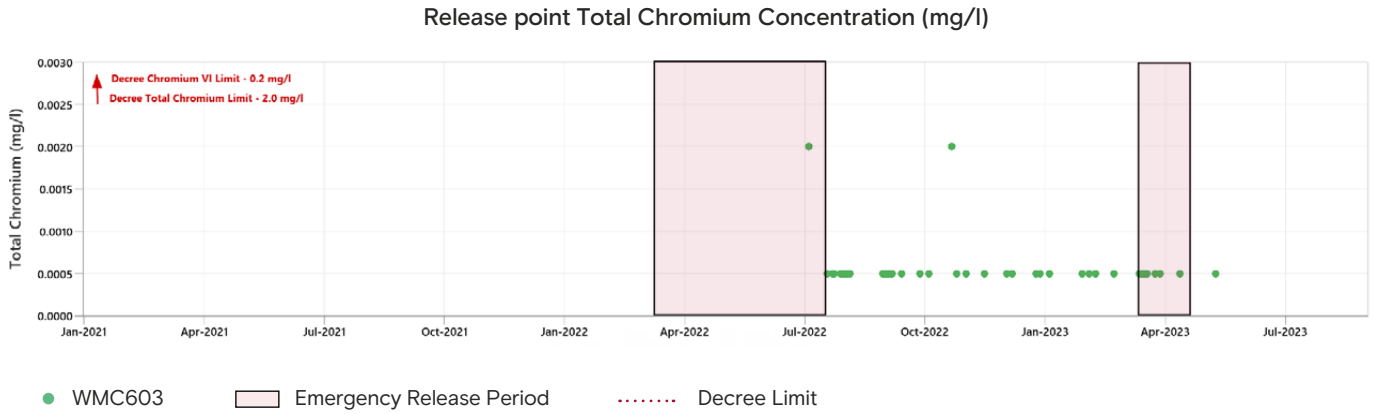
Discharge at the release point cadmium commentary

- Treated water and emergency release water are compliant and well below the cadmium decree limit of 0.02 mg/L.
- The majority of discharge samples are below the cadmium laboratory limit of detection of 0.0002 mg/L.

Mandromondromotra River cadmium commentary

- All upstream and downstream Mandromondromotra River samples are below the cadmium laboratory limit of detection.

Figure A7 – Monitoring data Chromium



Detection Limit (DL) at 0.001 mg/l. Graphical representation is DL/2 as per standard methodology

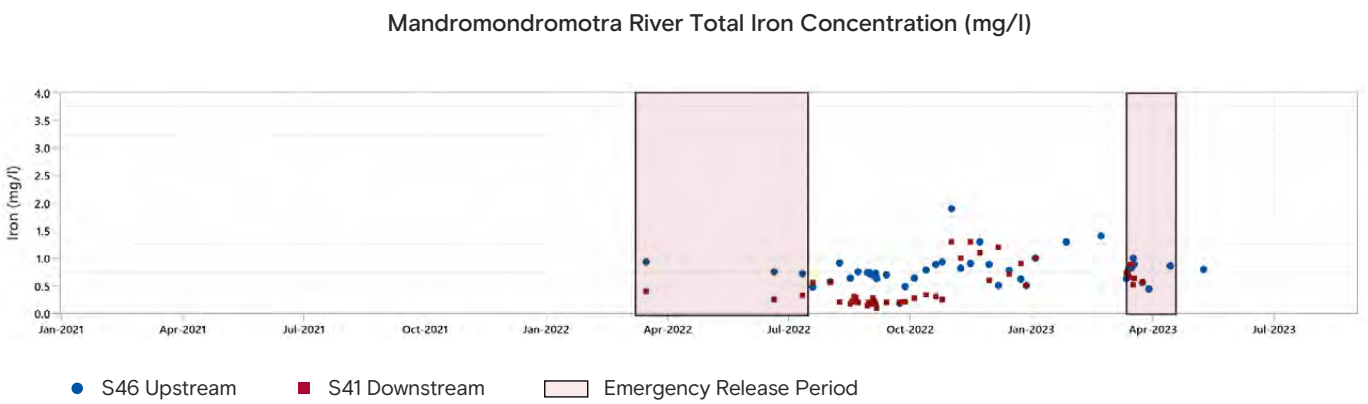
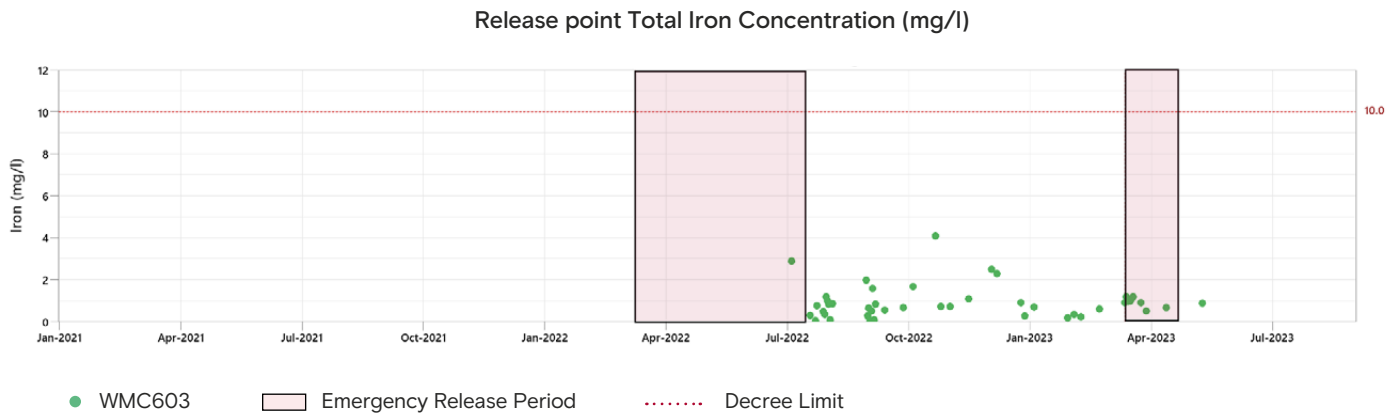
Discharge at the release point chromium commentary

- Treated water and emergency release water are compliant and well below the total chromium decree limit of 2.0 mg/L and the chromium IV decree limit of 0.2 mg/L.
- The majority of discharge samples are below the chromium laboratory limit of detection of 0.001 mg/L.

Mandromondromotra River chromium commentary

- All upstream and downstream Mandromondromotra River samples are below the chromium laboratory limit of detection.

Figure A8 – Monitoring data Iron



Detection Limit (DL) at 0.005 mg/l. Graphical representation is DL/2 as per standard methodology

Discharge at the release point iron commentary

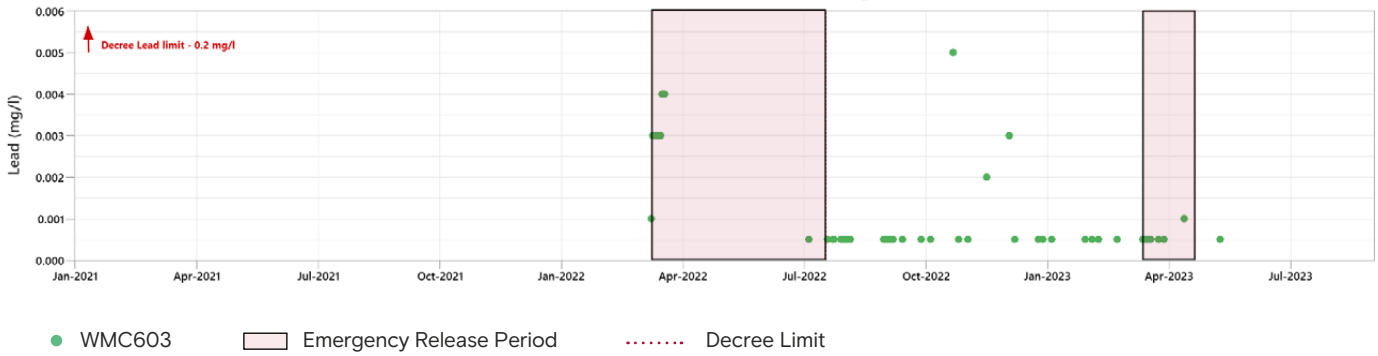
- Treated water and emergency release water are compliant and well below the iron decree limit of 10.0 mg/L.

Mandromondromotra River iron commentary

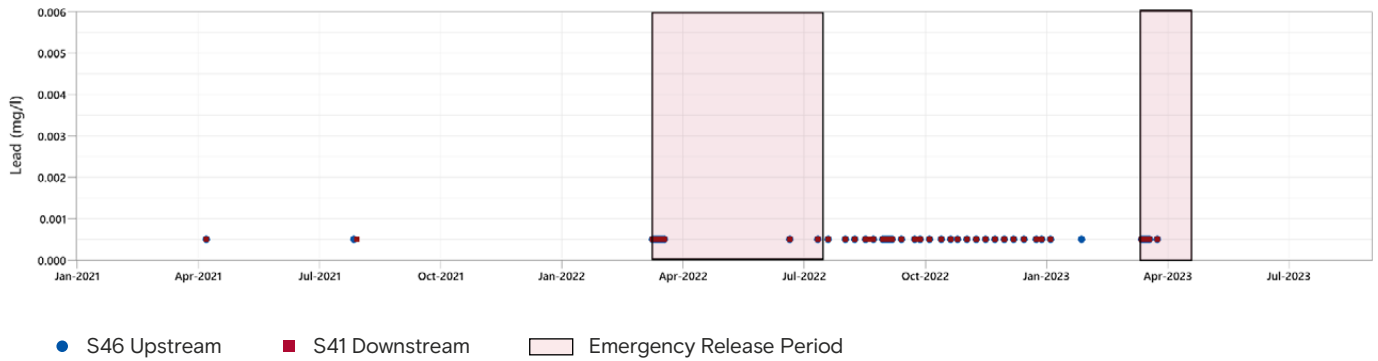
- Mandromondromotra River iron concentration for both upstream and downstream is generally within the same range.

Figure A9 – Monitoring data Lead

Release point Total Lead Concentration (mg/l)



Mandromondromotra River Total Lead Concentration (mg/l)



Detection Limit (DL) at 0.001 mg/l. Graphical representation is DL/2 as per standard methodology

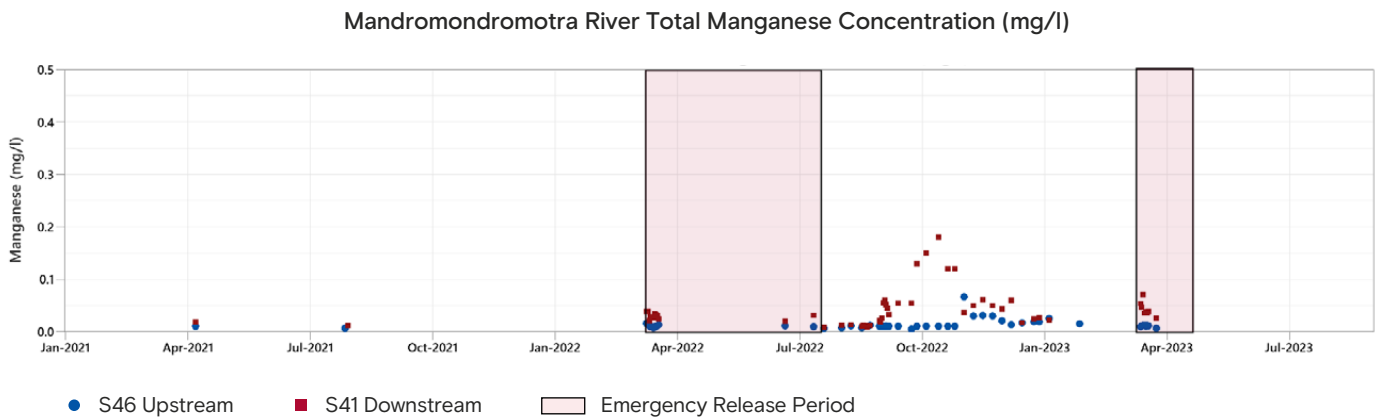
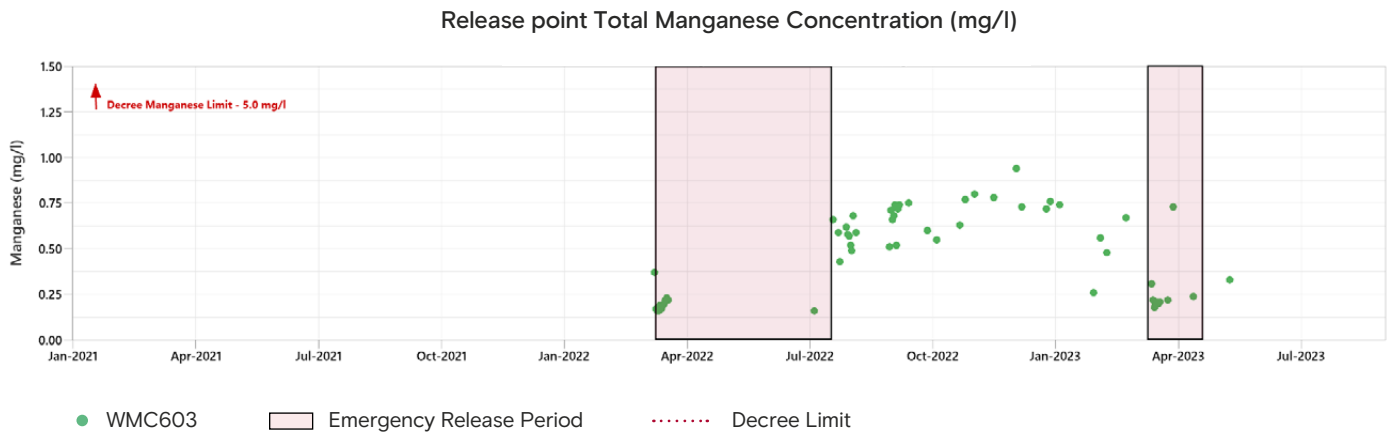
Discharge at the release point lead commentary

- Treated water and emergency release water are compliant and well below the lead decree limit of 0.2 mg/L.
- The majority of discharge samples are below the lead laboratory limit of detection of 0.001 mg/L.

Mandromondromotra River lead commentary

- All upstream and downstream Mandromondromotra River samples are below the lead laboratory limit of detection.

Figure A10 – Monitoring data Manganese



Detection Limit (DL) at 0.005 mg/l. Graphical representation is DL/2 as per standard methodology

Discharge at the release point manganese commentary

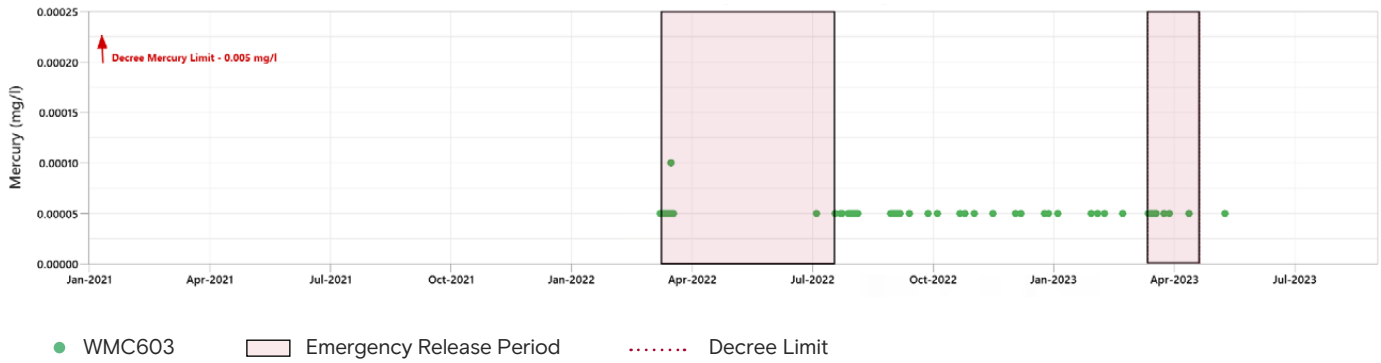
- Treated water and emergency release water are compliant and well below the manganese decree limit of 5.0 mg/L.

Mandromondromotra River manganese commentary

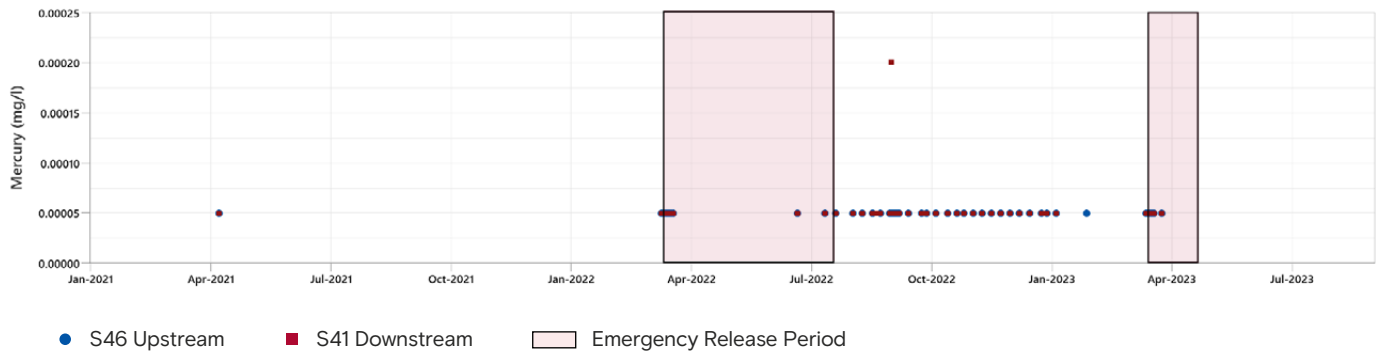
- Mandromondromotra River concentration for both upstream and downstream is low throughout the dry and wet season.

Figure A11 – Monitoring data Mercury

Release point Total Mercury Concentration (mg/l)



Mandromondromotra River Total Mercury Concentration (mg/l)



Detection Limit (DL) at 0.0001 mg/l. Graphical representation is DL/2 as per standard methodology

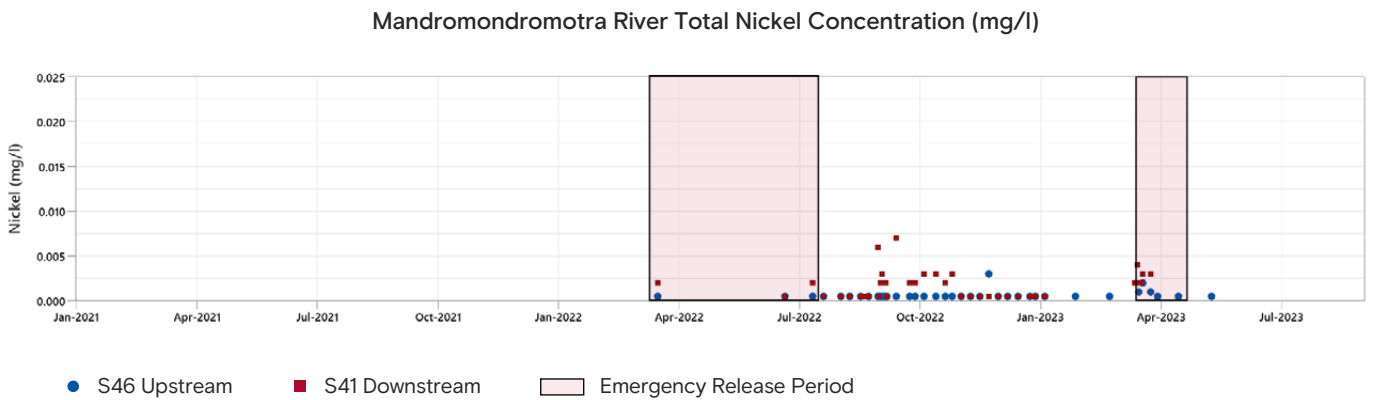
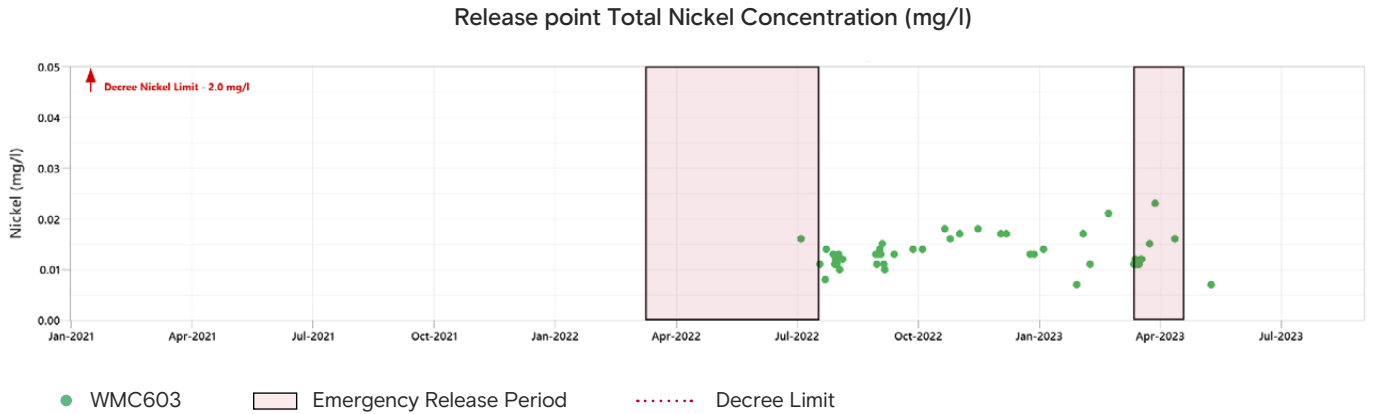
Discharge at the release point mercury commentary

- Treated water and emergency release water are compliant and well below the mercury decree limit of 0.005 mg/L.
- All discharge samples except for one are below the mercury laboratory limit of detection of 0.0001 mg/L.

Mandromondromotra River mercury commentary

- All upstream and downstream Mandromondromotra River samples are below the mercury laboratory limit of detection.

Figure A12 – Monitoring data Nickel



Detection Limit (DL) at 0.001 mg/l. Graphical representation is DL/2 as per standard methodology

Discharge at the release point nickel commentary

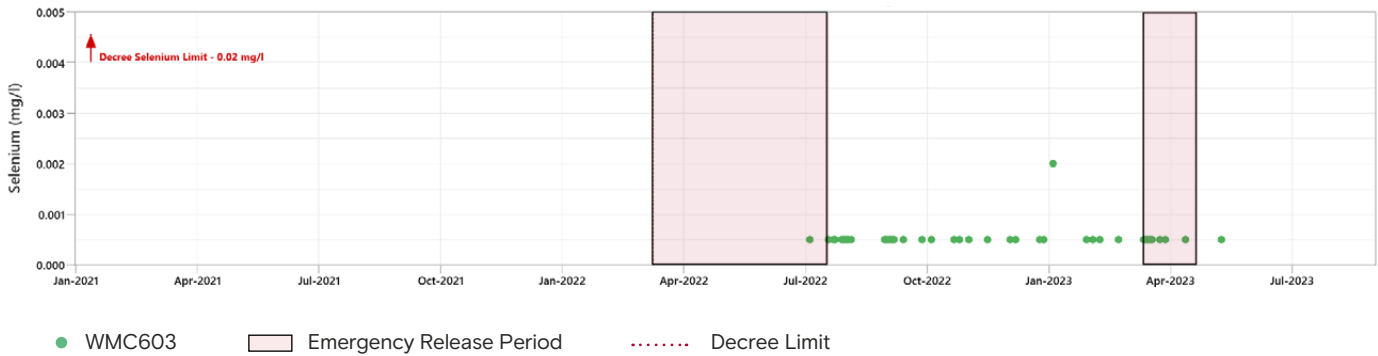
- Treated water and emergency release water are compliant and well below the nickel decree limit of 2.0 mg/L.
- The majority of discharge samples are below the nickel laboratory limit of detection of 0.001 mg/L.

Mandromondromotra River nickel commentary

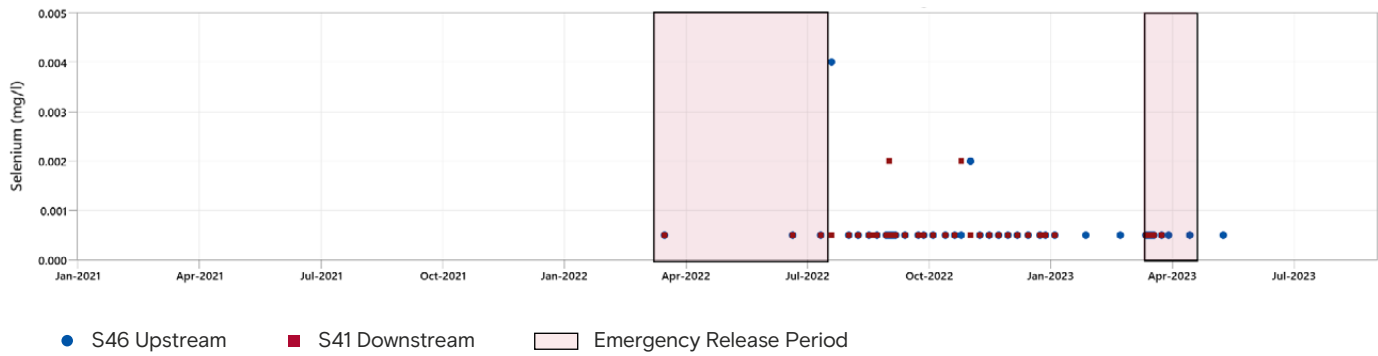
- The majority of upstream and downstream Mandromondromotra River samples are below the nickel laboratory limit of detection.

Figure A13 – Monitoring data Selenium

Release point Total Selenium Concentration (mg/l)



Mandromondromotra River Selenium Concentration (mg/l)



Detection Limit (DL) at 0.001 mg/l. Graphical representation is DL/2 as per standard methodology

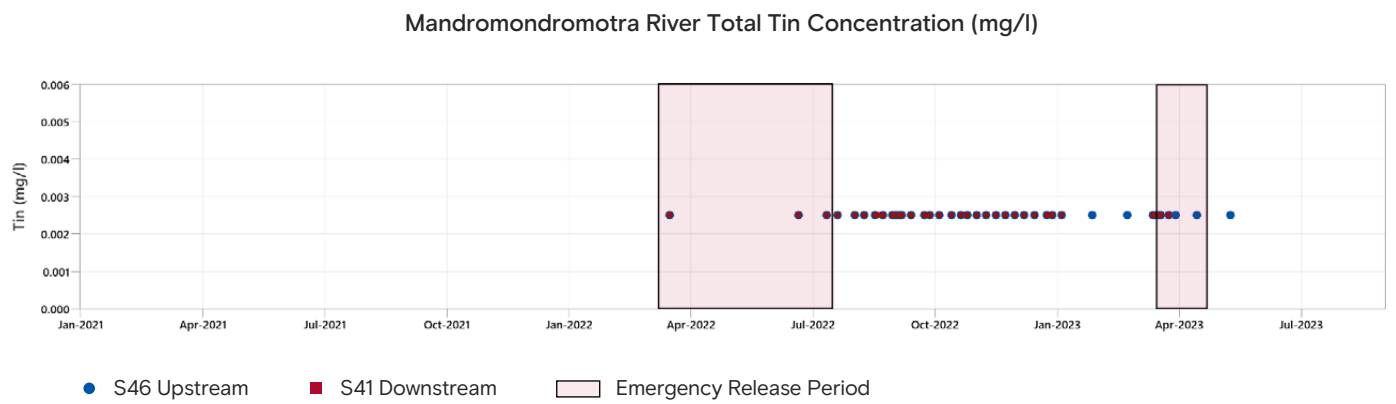
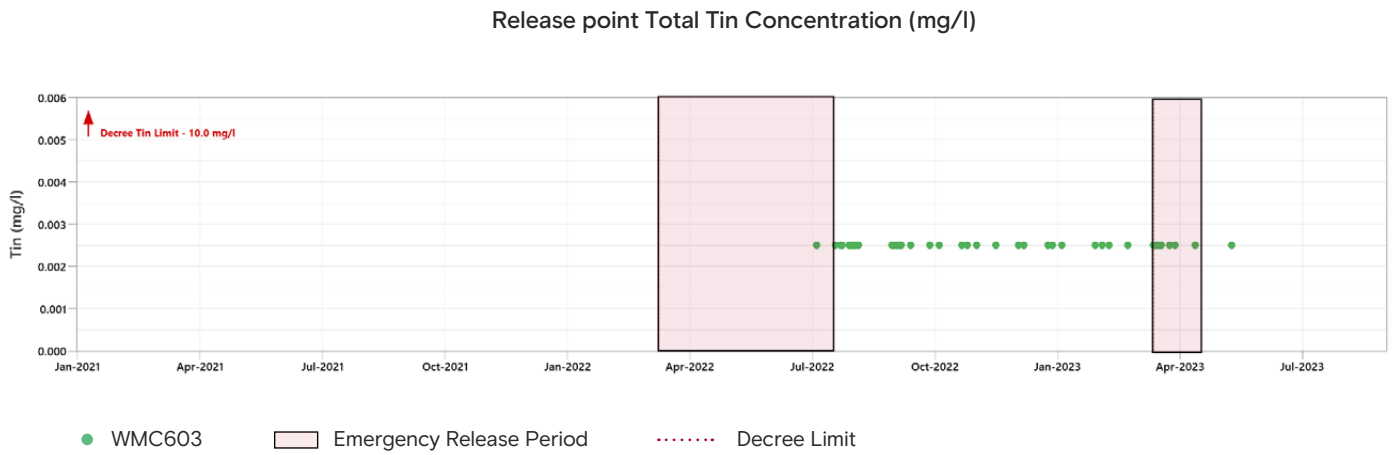
Discharge at the release point selenium commentary

- All discharge samples except for one are below the selenium laboratory limit of detection of 0.001 mg/L.

Mandromondromotra River selenium commentary

- The majority of upstream and downstream Mandromondromotra River samples are below the selenium laboratory limit of detection.

Figure A14 – Monitoring data Tin



Detection Limit (DL) at 0.005 mg/l. Graphical representation is DL/2 as per standard methodology

Discharge at the release point tin commentary

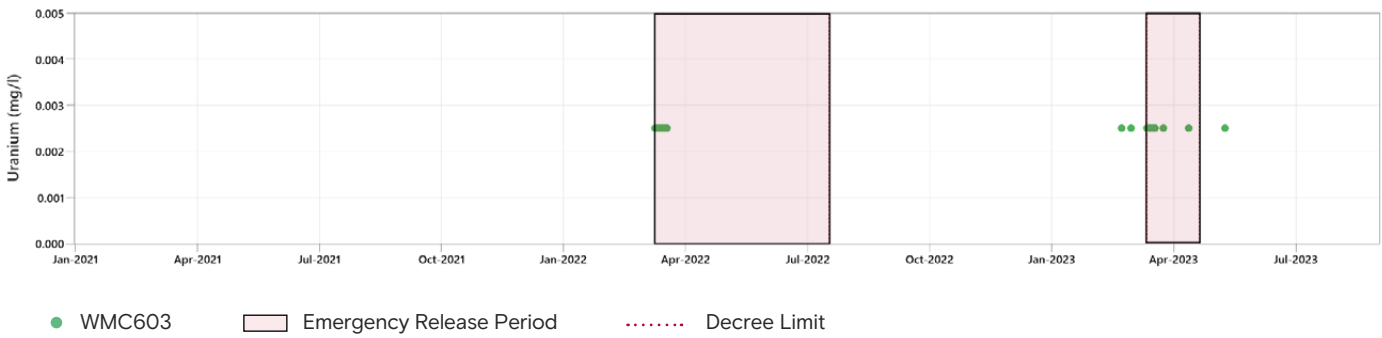
- Treated water and emergency release water are compliant and well below the tin decree limit of 10.0 mg/L.
- All discharge samples are below the tin laboratory limit of detection of 0.005 mg/L.

Mandromondromotra River tin commentary

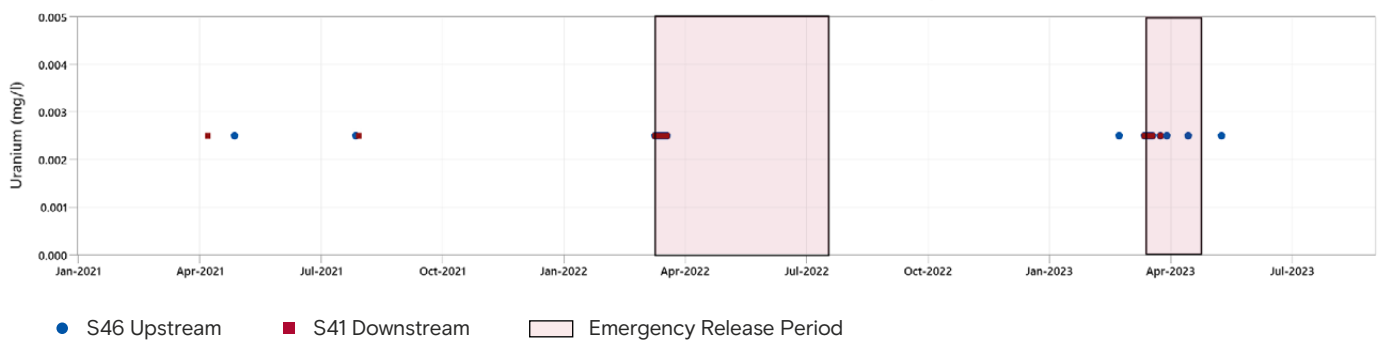
- All upstream and downstream Mandromondromotra River samples are below the tin laboratory limit of detection.

Figure A15 – Monitoring data Uranium

Release point Total Uranium Concentration (mg/l)



Mandromondromotra River Uranium Concentration (mg/l)



Detection Limit (DL) at 0.005 mg/l. Graphical representation is DL/2 as per standard methodology

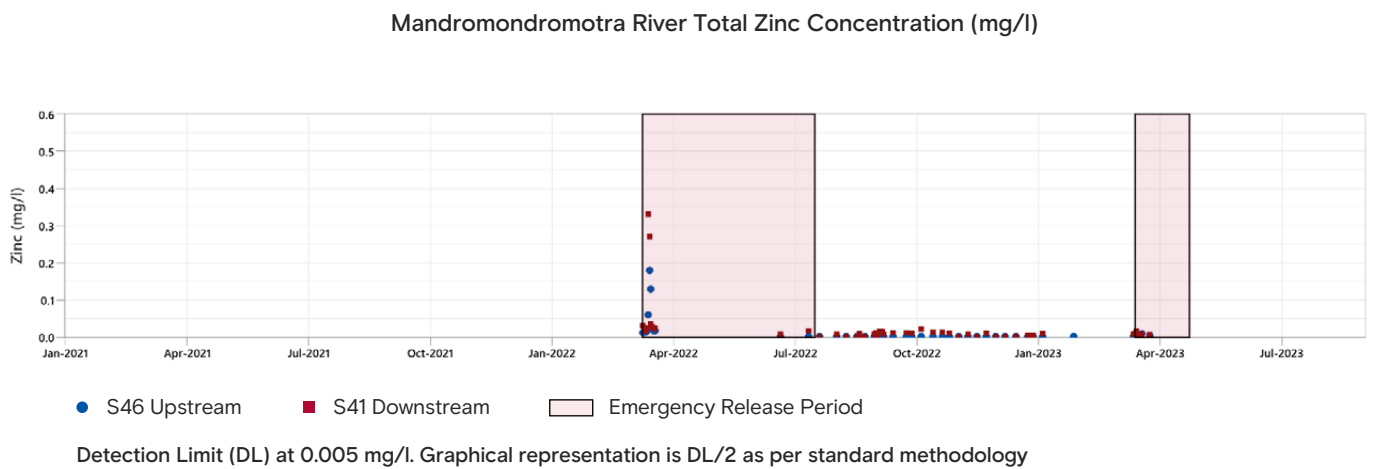
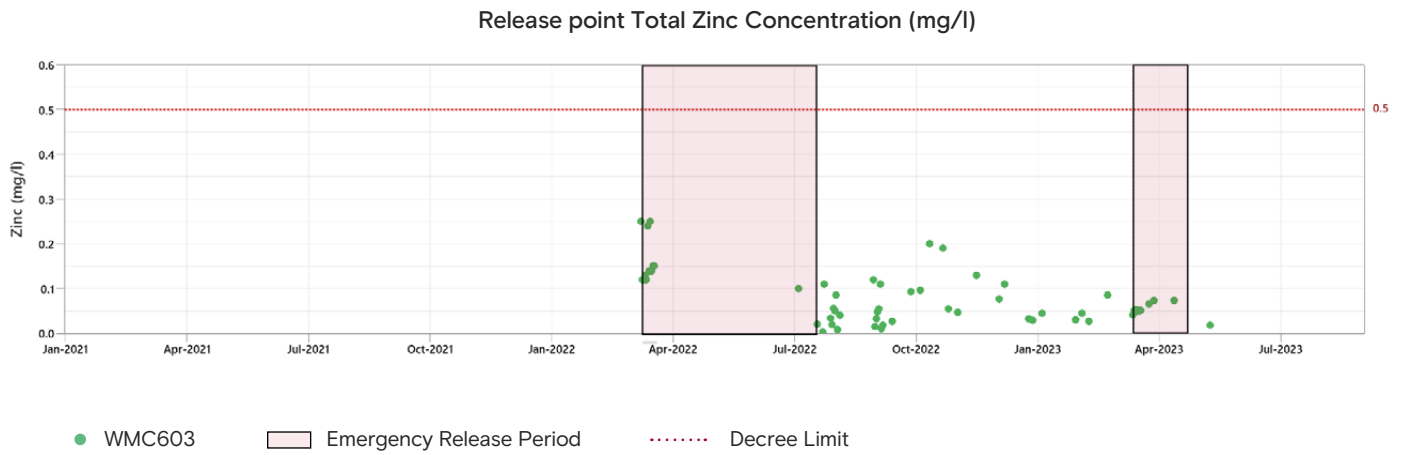
Discharge at the release point uranium commentary

- All discharge samples are below the uranium laboratory limit of detection of 0.005 mg/L.

Mandromondromotra River uranium commentary

- All upstream and downstream Mandromondromotra River samples are below the uranium laboratory limit of detection. This is consistent with the findings of the independent community radiation study conducted around QMM's site conducted by leading international environmental experts JBS&G Australia Pty Ltd between November 2019 to October 2022.

Figure A16 – Monitoring data Zinc



Discharge at the release point zinc commentary

- Treated water and emergency release water are compliant with the zinc decree limit of 0.5 mg/L.

Mandromondromotra River zinc commentary

- Mandromondromotra River concentration for both upstream and downstream show a similar trend.

Appendices

Appendix B - Glossary of terms

Terms	Definition
ANDEA	Autorité Nationale de l'Eau et de l'Assainissement or Regulator
DMU	Dry mining unit
Eurofins	Eurofins Environment Testing Australia (ISO/IEC 17025 accredited laboratories)
GISTM	Global Industry Standard on Tailings Management
ha	Hectares
HMC	Heavy mineral concentrate
ICMM	International Council on Mining and Metals
m	Meter
m ³	Cubic meter
mm	Millimeter
MSP	Mineral separation plant
ONE	Office National pour l'Environnement
Paddocks	Water basins for solids settling and water storage
Polishing pond	Water basin that provides additional retention time for improved water clarity and homogeneity
Port	Port Ehoala
Process water	Water that comes into contact with areas disturbed by mining
QMM	QIT Madagascar Minerals
Regulator	ANDEA
Reporting period	January 2021 to September 2023
SEMP	Social and environmental management plan
WRG	Water Research Group
WSP	WSP Global Inc.
<i>2021 Water Report</i>	QMM Water Discharge Monitoring Data for the 2015–2020 period, March 2021



Mediction
Rio Tinto

Rio Tinto

MANDENA OVERVIEW



RioTinto

Rio Tinto Tana
Lot 35, 5^{ème} étage,
Ivandy Business Center,
Antananarivo 101
Madagascar

Rio Tinto Fort Dauphin
Mandena, Fort Dauphin
614
Madagascar

