POLICY BRIEF

March 2024
The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

Developing mine closure risk ratings and a post-closure opportunities framework for South Africa

A Water Research Commission (WRC) study has developed a Mine Closure Risk Rating System for South Africa, a Mine Closure Risk and Opportunity Atlas for South Africa and a Post-closure Opportunities Framework. All three tools incorporate social, economic, environmental and governance risks and opportunities related to mine closure and will be particularly useful in responding to the just transition. These novel tools will support mine closure planning, management and policy-making and can be used by diverse stakeholders in government, industry, civil society, academia and international agencies.

Background

Mine closure is a growing concern in mining countries around the world due to the associated environmental and socio-economic impacts. Mining is a critical contributor to South Africa's economy and the world's supply of metals and minerals, most notably for platinum, chromium and manganese. 230 operating mines are located in a quarter of the country's local municipalities and are supported or hosted by over 360 diverse urban and rural communities, home to over 6 million people. Many of these communities and local economies are highly dependent on mining and thus vulnerable to the risks relating to mine closure.

Despite the existence of global best practice guidelines and local legislation, mine closure remains a complex challenge in South Africa. There are a limited number of mines that have been issued closure certificates and/or successfully progressed into clearly defined post-closure land uses. In recent years, several collaborative, multi-stakeholder projects have been initiated to explore post-mining land-use and economic succession planning in South Africa. Mine closure risks and opportunities are site specific, affecting different communities to varying degrees, at different times and in distinctive ways, depending on factors such as water resources, land capability, socio-economic profiles, economic diversity, public infrastructure and access to markets. Given these complexities, the national

government, local government and other stakeholders need guidance in identifying high risk areas and suitable post-closure interventions to mitigate these risks on a case-by-case basis.

Main study outcomes

The study has provided a comprehensive literature review on mine closure, and an in-depth analysis of four case studies on post-closure land use in South Africa. It has produced three novel tools for mine closure planning, policy-making and management in South Africa. The mine closure risk rating system defines a methodology and produces results for calculating comparative mine closure risk ratings across all operating mines. The results are visualised in GIS and the map identify mines and areas where mine closure is highly likely and needs immediate attention, and ranks mines by environmental and social risk, enabling the prioritisation of mitigation and intervention by mining companies and government. The post-closure opportunities framework provides a defined process for going about identifying the most suitable options for sustainable development and economic diversification based on a participatory process that involves reviewing all possible alternatives, identifying influencing factors, and quantifying suitability indicators. Supporting the risk rating system and the land use opportunities framework is a comprehensive spatial database covering mines, processing plants, mining communities, land, water,

energy, biodiversity, infrastructure, economy and governance factors.

Case studies of post-closure land use

Four case studies of current post-closure land use were chosen based on their integrated, collaborative approach, and on the diversity of life of mine, urban/rural settings, mining methods and commodities (see Figure 1). The learnings from the case studies provide insight into current and emerging mine closure and post-mining land use approaches, the opportunities, challenges and influencing factors across social contexts, regions and different stages of life of mine.

The Community of Practice project in the Far West Rand goldfield in Gauteng highlights the opportunity to use industrial crops for both rehabilitation and the creation of downstream industries due to their ability to form multi-products from fibre and phytoremediation potential. The Bokamoso Ba Rona project in the West Rand goldfields in Gauteng shows a multi-stakeholder collaborative approach for using mine-impacted land to create large scale regenerative agricultural projects which include crops and livestock. The Green Engine project in the Witbank coalfield in Mpumalanga presents an approach that integrates post-mining land use, agriculture water treatment, waste management and industrial development but faces challenges due to vandalism and illegal mining. The Impact Catalyst project in the Mogalakwena platinum mining area in Limpopo provides lessons on early-stage project development for an operation with a significant life of mine, that has looked at integrated game farming, agriculture, and agro-processing development initiatives to align with the rehabilitation plan of the mine.
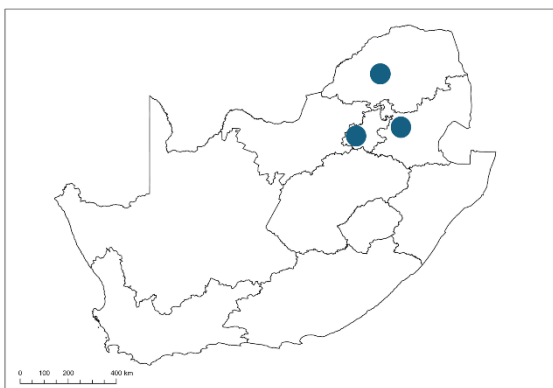

Figure 1 Case studies locations

Learnings across the projects highlighted the importance of considering numerous social, economic and environmental influencing factors in planning for mine closure and post-mining land use development. Despite the various identified opportunities and increasing effort to consider more holistic regenerative post-mining development initiatives, there continues to be a lack of integration in social development initiatives, rehabilitation and post-mining development, which continues to pose a risk to long-term regional development beyond mining activity. There also continues to be uncertainty on the continuity of alternative land-use projects when assets are bought by another company, which often happens when mines near their end of life.

Mine Closure Risk Rating System

The Mine Closure Risk Rating System was developed to aid management and evidence-based policy-making regarding mine closure in the South Africa. It describes a methodology and results for three components – likelihood of closure, social risk of closure and environmental risk of closure – which are calculated for all operating mines in South Africa. For each component, influencing factors, indicators and weightings were defined and data were collected from national and global databases and other sources. Weighted indicators were aggregated for each component to calculate an overall likelihood of closure, social risk and environmental risk for each mine. The risk rating system was tested with 10 case study mines and rating categories and weightings were adjusted accordingly.
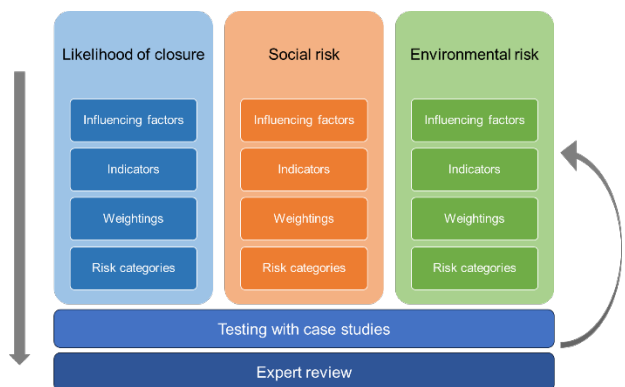

Figure 2 Mine closure risk rating system

The risk ratings for all mines were plotted in ArcGIS Pro (see Figure 3, 4 and 5). The draft risk rating system was tested with 19 experts from academia, civil society, industry, multilateral agencies and

government in a stakeholder workshop and in follow-up interviews. The risk ratings were refined and updated based on the expert feedback, with additional data collected and analysed.
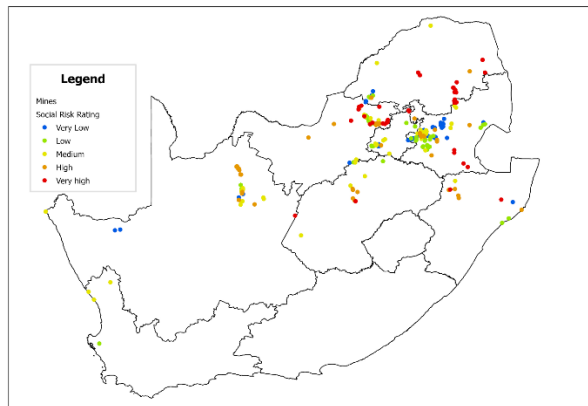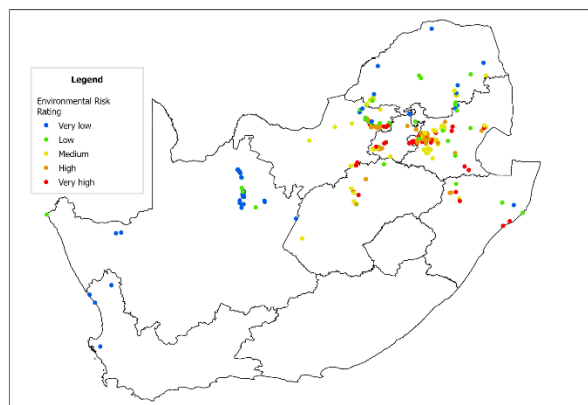

Figure 3 Social risk of mine closure

Figure 4 Environmental risk of mine closure

The risk maps are novel and useful tools for managing mine closure in South Africa. Firstly, they identify mines and regions where mine closure is highly likely and needs immediate attention – for example, the coal mines in Mpumalanga and gold mines in Gauteng and the Free State. The data show that 48 mines are expected to close in the next 10 years. Secondly, they categorise and rank mines by social risk of closure, highlighting that deprived communities are the most vulnerable to closure, for example, the platinum mines in Limpopo and North West provinces. Thirdly, they categorise and rank mines by environmental risk of closure, highlighting the major water-related risks in the gold and coal mining areas. These rankings enable the prioritisation of risk mitigation and management interventions by mining companies and government.

There are numerous areas in the South African mining policy and planning arena where this risk rating system can be applied. It can be used in developing Mine Closure Plans, undertaking Environmental Risk Assessments and assessing financial provisions for rehabilitation of negative environmental impacts, all required by mining companies in South Africa under Regulation 11 (1) of Government Notice R1147. It can also be used by Future Forums designated in Social and Labour Plans for engaging host communities in mine closure planning, in the development of Integrated Development Plans (IDPs) by local municipalities, and in regional spatial planning by district municipalities and provincial governments. Finally, it could play a supporting role in the implementation of the National Mine Closure Strategy by the national Department of Mineral Resources and Energy (DMRE).

The risk ratings proposed here are a first attempt at a national comparison of likelihood of mine closure, social risk and environmental risk, and will require further testing and analysis in the future. Additional datasets will be required to fill gaps and ensure that the risk ratings capture all of the influencing factors. The results of the risk ratings could promote deeper discussions on mine closure management and planning amongst a diverse group of stakeholders, and support evidence-based decision-making. While the risk rating system has been developed for South Africa, the concepts, design and insights could be applied to any mining country in the world.

Mine Closure Risk and Opportunities Atlas

Supporting the risk rating system and the land use opportunities framework is the National Mine Closure Risk and Opportunities Atlas ('the Atlas'), a freely available online GIS tool, shown in Figure 5. The Atlas was developed with inputs from experts in the mining industry and potential stakeholders of mine closure to communicate mine closure risks to a wide audience and to enable stakeholders to interrogate the risks and opportunities related to mine closure.

The Atlas incorporates a comprehensive spatial database of over 65 datasets covering operating mines, processing plants, mining host communities, land, water, energy, biodiversity, infrastructure, and economic, social and governance factors. The Atlas provides a link to the 'custodian' of each dataset, ensuring that the information it hosts is trusted. The Atlas also includes links to project reports and
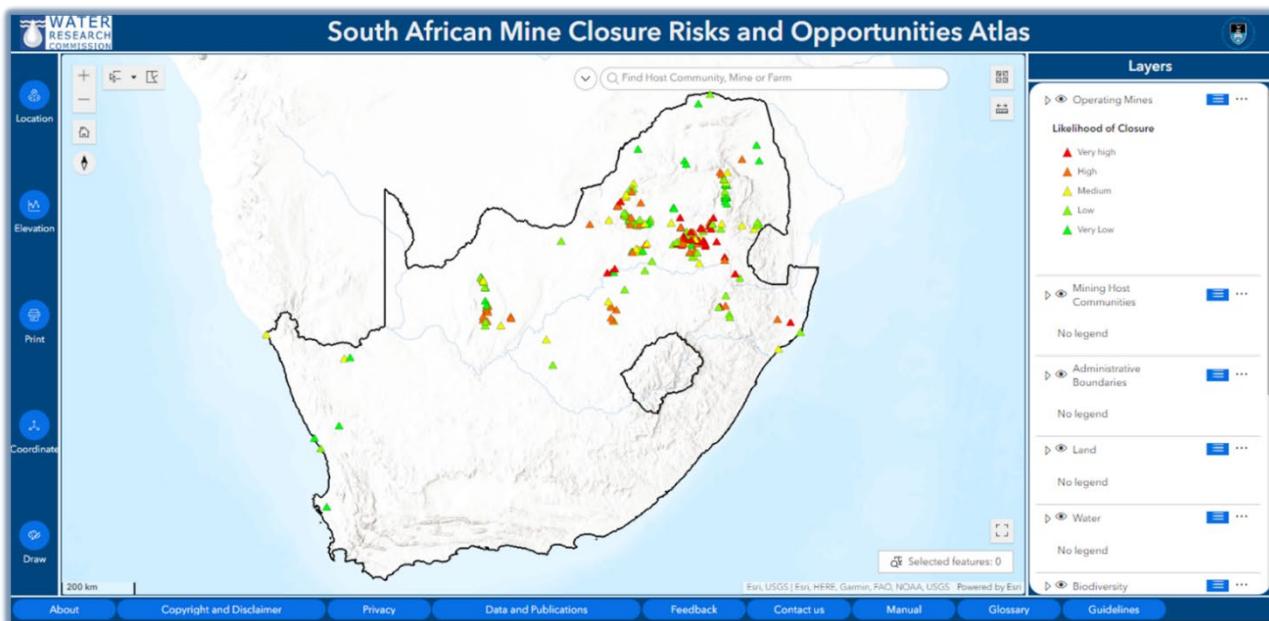
Figure 5 Mine Closure Risk and Opportunities Atlas home page showing likelihood of closure for all operating mines

academic papers, national guidelines relating to mine closure, and community toolkits that enable mining communities to understand the risks and opportunities they face.

The Atlas is a complementary tool to other web-based GIS tools such as the Water Research Commission's Mine Water Atlas, which assesses mine water threat, and the Department of Forestry Fisheries and the Environment (DFFE) Screening Tool, which is used for Environmental Impact Assessments in South Africa. The Atlas has a wider array of datasets and relies on its users to conduct independent analyses and assessments using the data that it hosts to derive their own conclusions – it is an analytical facilitator rather than an analyst. Its presentation of risk for individual operating mines is unique and it has specifically been configured to function on smartphones as well as computers to ensure that the affected mining communities, have access to all the information presented in the Atlas. This could support community participation in mine closure planning and economic diversification opportunities.

Post-closure Opportunities Framework

Current post-closure policy and practices focus on pre-determined land uses with a limited review of alternatives. There is limited consideration of factoring of risks to address post-closure liabilities and the suitability of land-uses. However, global practices are slowly shifting towards more holistic

approaches to mine closure planning. The aim of this project was to develop a procedural framework that can be incorporated into mine closure planning processes. The framework aims to identify viable opportunities for post-closure land use and economic diversification around mines, while ensuring stakeholder inclusion and participation to support the clear definition of overall goals for communities and mining regions, and to account for local and regional influencing factors. The Post-closure Opportunity Framework was developed through evaluating and integrating expert input from interviews and workshops, and findings from a comprehensive literature review of current and emerging practices. The framework, shown in Figure 6, outlines a six-step procedure which provides a defined process for identifying the most suitable options for a specific mine site.

The first step is stakeholder mapping and a participatory process to ensure an inclusive process, to identify post-closure objectives and stakeholder priorities, and to determine the developmental pathways that align with the shared stakeholder values. The risk rating system can be used as a supporting tool in this process. The second step is to review all possible land use alternatives identified in the global literature and national case studies, summarized in tabular form. The review shows that there are specific potential land uses that are more
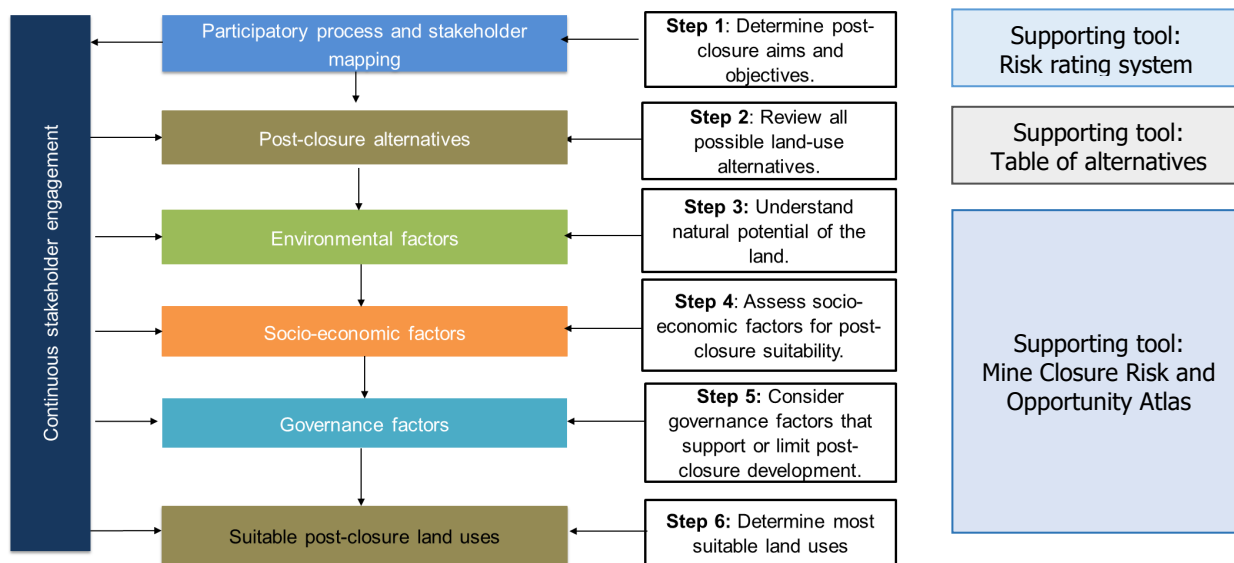
Figure 6 Post-Closure Opportunities Framework for mining

suitable for the South African context and have limited application in other parts of the world. Land use categories include agriculture, industry, renewable energy, water storage, community and culture facilities, and conservation. Step 3 assesses the environmental factors (water supply, water stress, land capability, biodiversity, energy potential) that determine what is or is not possible at the site. Step 4 assesses the range of social and economic factors that inform suitability, including infrastructure, land zoning, social wellbeing, skills availability, and job creation. Step 5 assesses the governance factors that support or hinder post-closure alternatives. Steps 3-5 are applied iteratively using quantified indicators and spatial datasets to narrow down the list of options and makes use of the Atlas as a supporting tool. In Step 6 the financial viability of the short list of post-closure opportunities is evaluated.

Application of the Framework

The proposed procedural framework can be incorporated as part of mine closure planning processes undertaken by mining companies and consultancies. It can support the National Mine Closure Strategy (currently under review) to guide the selection of sustainable post-closure land uses. It is suggested that participatory stakeholder processes and framework iterations may require an external body to oversee the process, however, existing institutional arrangements should be used to avoid unnecessary delays and costs.

Conclusion

The study has produced three novel tools for mine closure planning, policy-making and management in South Africa that can be used throughout the life cycle of a mine across the country. The Mine Closure Risk Rating System identifies mines and areas where mine closure is highly likely and needs immediate attention. It also ranks mines by environmental and social risk of closure, enabling the prioritisation of mitigation and intervention by mining companies and government. The post-closure land use framework provides a defined process for going about identifying the most suitable options for sustainable development and economic diversification based on a participatory process that involves reviewing all possible alternatives, identifying influencing factors, and quantifying suitability indicators. Supporting the risk rating system and the land use opportunities framework is the South African Mine Closure Risk and Opportunities Atlas – a comprehensive spatial database of mines, processing plants, mining host communities, land, water, energy, biodiversity, infrastructure, economic, social and governance factors. Future research could see the expansion of the datasets incorporated into the three tools and ideally the Atlas would be updated at least annually

as the underlying global and national datasets are updated.

The tools are aimed at supporting and informing a wide range of stakeholders, with particular effort given to ensuring mining community members are able to access information about their nearby mine. The functionality of the Atlas on all types of devices empowers the most vulnerable in society who often do not have a voice in post-closure discussions. It is hoped that this will support just economic transitions away from mining in different regions across the country. In addition, the Atlas could promote deeper discussions on mine closure management and planning amongst a diverse group of stakeholders, and support evidence-based decision-making. Finally, while the three tools have been developed for South Africa, the concepts, design and insights could be applied to any mining country in the world.