FOUNDATION PROJECT 3.1

Integration of Biophysical Aspects in Mine Closure Planning

CRC TiME
Transformations in Mining Economies

In mine closure planning, there are interconnections between each of the biophysical aspects needing to be considered, such as surface water and groundwater, geochemistry and water quality, biodiversity, self-sustaining and resilient ecosystems and landform stability. This project helped to determine what is generally missing within mine closure plans when each biophysical aspect is looked at in isolation, in order to suggest strategies that could promote a better integrated view for mine closure.

KEY FINDINGS

Five key findings resulted from this project:

- **There are many models or approaches that could be used to capture the main dimensions around integrating biophysical parameters through the application of system thinking. The level of detail encapsulated by each model is generally largely guided by the intended users.**
- **Systems thinking and the integration of environmental aspects constitute a complex area of research and, therefore, exploration should focus on simpler approaches – namely ones that will deliver the greatest benefits for relatively small investments.**
- **Findings from the five CRC TiME foundational projects in the Operational Solutions Program (Program 3) – each covering a key technological theme of significant impact on the process of mine closure and relinquishment – will feed into the systems-thinking and integrated approaches.**
- **The lack of regional planning and of a comprehensive national framework for land use planning is preventing selection and assessment of innovative Post Mining Land Uses (PMLUs). There is a strong need for system approaches, which would demonstrate how mines contribute to a region.**
- **Despite the need to link technical studies, there is currently no robust method to achieve this. This constitutes a key research gap.**

THE CHALLENGE

The mining industry has overlooked strategies to promote an integrated view of mine closure. Little has been done to discover what is missing as each biophysical aspect is assessed in isolation from the others. The key challenge here was therefore to look at available strategies that could promote an integrated approach to mine closure.

THE OPPORTUNITY

In seeking to discover an integrated approach to mine closure, through a consolidated review of biophysical aspects, this project has reviewed:

- Current frameworks and practices for selecting closure objectives and performing environmental risk assessments;
- Trends shaping future mining; and
- Systems-thinking concepts for understanding interactions between biophysical aspects, categorising these approaches and providing examples.

Groups of intended users for the system-thinking approach were defined and options for the level of detail and the type of causal models required for each were proposed.

Emphasis was placed on the lack of integration of the technical studies that support a closure plan, rather than on the lack of integration within a closure plan in general.

Two stages were undertaken; Stage 1 comprised of a literature and documentation review to help inform the project's objectives; Stage 2 defined the groups of intended users, developing examples of prototypes for each group of users.

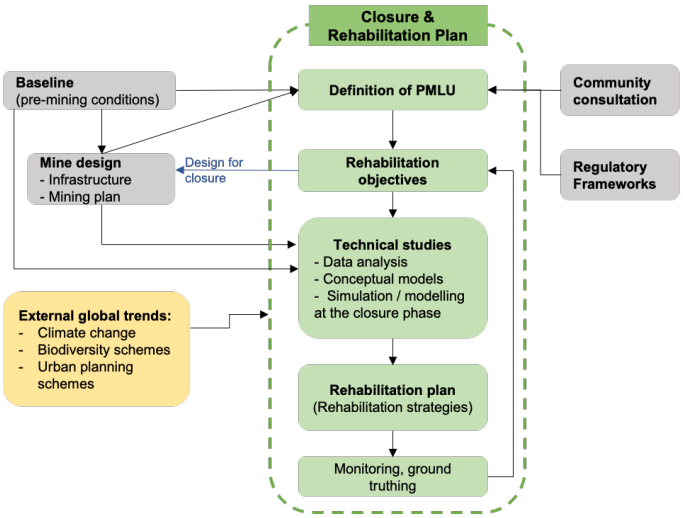

Figure 1: Mine closure and rehabilitation planning process

OUTCOMES

Based on key findings, the project outcomes consisted of the following recommendations:

- Defining closure and rehabilitation objectives is critical, along with the ability to adjust them to global, national, and regional trends. There is no agreed methodology for the selection of post-mining land use, which constitutes a key gap in current practices. There needs to be sustained effort to bridge that gap.
- To facilitate effective communication of closure planning with external stakeholders, a robust methodology is required to guide the development of communication and engagement tools. The methodology should consider the potential for these tools to be delivered in spatial form, using land management studies as examples.
- The future research activities that are likely to provide the most benefits are those that apply the concepts articulated by this research project to case studies. For example, a project or operation with a range of complex interrelations of biophysical parameters could be used to clearly illustrate the benefits of applying system-thinking to closure planning.
- The findings from the CRC TiME foundational projects of the Operational Solutions Program should be compared with the outcomes of this project, as they are likely to further outline the interlinking between the biophysical themes. This interlinking would then help to inform key priorities for future research work in operational solutions.

NEXT STEPS

There is opportunity to inform further research into adopting a systems-level approach to conceptualise the relationships between biophysical aspects and capturing their complexities and changes. As these approaches can require a high level of investment, the focus should be on simple approaches that deliver the greatest value at a relatively small budget.

Various biophysical themes are covered in the CRC TiME Operation Solutions Program foundational projects (including Project 3.3). Their report findings would have a direct influence on future work in this space.

PROJECT PARTNERS

The University of Queensland

PROJECT REPORTS/PUBLICATIONS

REVIEW FULL REPORT

1. Report:

   Côte, CM., Garcia Zavala, C., Chrystal, RA., Asmussen, P. (2022). Integration of Biophysical Aspects in Mine Closure Planning. CRC TiME Limited, Brisbane, Australia.

2. Dig Deep Webinar: intended for a broader audience.

   Côte, CM, (2022). Mine Closure Planning: Do we have the right tools? Integration of biophysical aspects in mine closure planning. Dip Deeper Webinar: Framework for Environmental assessment and integrating the biophysical. Foundation Projects. Presented on 28st July 2022. CRC TiME Limited, Brisbane, Australia.

   Presentation and webinar available on the CRC TiME website.

3. Contribution to an online workshop: CRC-TiME 2021 forum

   Workshop 5: Implementing technology for positive impact
   Facilitated and presented by Dr Claire Côte, University of QLD
   https://crctime.com.au/home/crc-time-2021-forum/forum-program/

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ABOUT US

The Cooperative Research Centre for Transformations in Mining Economies is part of Australia's national innovation ecosystem. Our diverse partnership brings scale, collaboration and coordinated investment to tackle the most complex mine closure and post-mine transition challenges. Together we're rethinking what's possible to improve outcomes for people, communities, the environment and industry.

We acknowledge the traditional custodians across all the lands on which we live and work, and we pay our respects to Elders both past and present.

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