

Collaborative planning for mine repurposing and post-mining outcomes, integrating insights across frameworks, approaches and tools

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Abstract

As part of an overarching research agenda to support post-mining transformations, CRC TiME has developed a portfolio of projects focused on collaborative approaches to planning in mining regions. These projects include developing multi-stakeholder and rightsholder frameworks to guide mine site repurposing and tools related to key aspects of post-mining transformation, such as guidance for opportunities related to mine pit lakes. This paper summarises the different strands of this portfolio and discusses the different approaches and methods for different scales. These approaches can be used individually or in combination according to the particular needs of a given situation. The paper begins by recognising the importance of values in collaborative planning and approaches to socially acceptable repurposing. Across each of the frameworks and tools, a key common element is the inclusion of a diverse range of voices as a fundamental principle for achieving better post-mining outcomes. An exemplar of this is the key role of Traditional Owners in planning and decision-making at all scales.

Keywords: regional planning, post-mining land use, governance, cumulative effects, participation

1 Introduction

The Cooperative Research Centre for Transformations in Mining Economies (CRC TiME) was created in 2020 to address the multiple dimensions of mine closure and post-mining transformation. One of the key issues that CRC TiME has been addressing is collaborative planning for mine repurposing and post-mining outcomes as part of a broader research agenda focusing beyond closure (Measham et al. 2024). Collaborative planning can involve multiple parties. For example, in Victoria's coal mining and power generation region of Latrobe Valley, a collaborative visioning project supported by CRC TiME involved the direct participation of Traditional Owners and Traditional Custodians, non-Indigenous residents, mine operators, local government, state government regulatory and planning agencies, and non-government organisations.

To craft common pathways forward, it is important to raise the level of awareness and understanding about mine closure and post-mining transition across all parties involved. Within mining companies, specific aspects of closure are well understood by closure teams, but less well understood by other parts of the business. More broadly, there is a need to increase the level of understanding and participation among other

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stakeholders and rightsholders across regions where mining occurs as well as those who are outside the region, but whose influence can affect regional outcomes, such as regulators and investors.

An important overarching goal is that post-mining outcomes be viewed as net-positive from multiple perspectives, that is, diverse groups regard the sum of all benefits as outweighing the costs. Along with the above goal, stakeholders in 3 Australian regions undergoing mine closure transitions also attached overarching value to distributing responsibility, risk and opportunity fairly (Foran et al. 2024).

Mining is a temporary land use, but one impacting significantly on Country, landscapes, biodiversity and local economies. It is important that post-mining land use (PMLU) is incorporated into regional planning well ahead of closure (and ideally, before a mine opens) to ensure a smoother transition and better outcomes for the host community.

Across the CRC TiME research portfolio, several projects contribute to supporting collaborative planning for mine repurposing and post-mining outcomes. While it is not possible to cover all aspects of all projects involved, the following key elements are the focus of this paper:

- the importance of values in collaborative planning towards post-mining transitions
- recognising social asset values for mined areas, focusing on pit lakes
- multi-stakeholder and rightsholder participation frameworks
- collaborative planning processes: case study of Latrobe Valley
- cumulative regional effects and management.

The frameworks, approaches, methods and tools within these projects were initially developed individually in response to specific needs at specific spatial and temporal scales. Moving forward, we propose that the frameworks, approaches, methods and tools can be used in combination, considering cross-scale linkages as outlined in Figure 1.

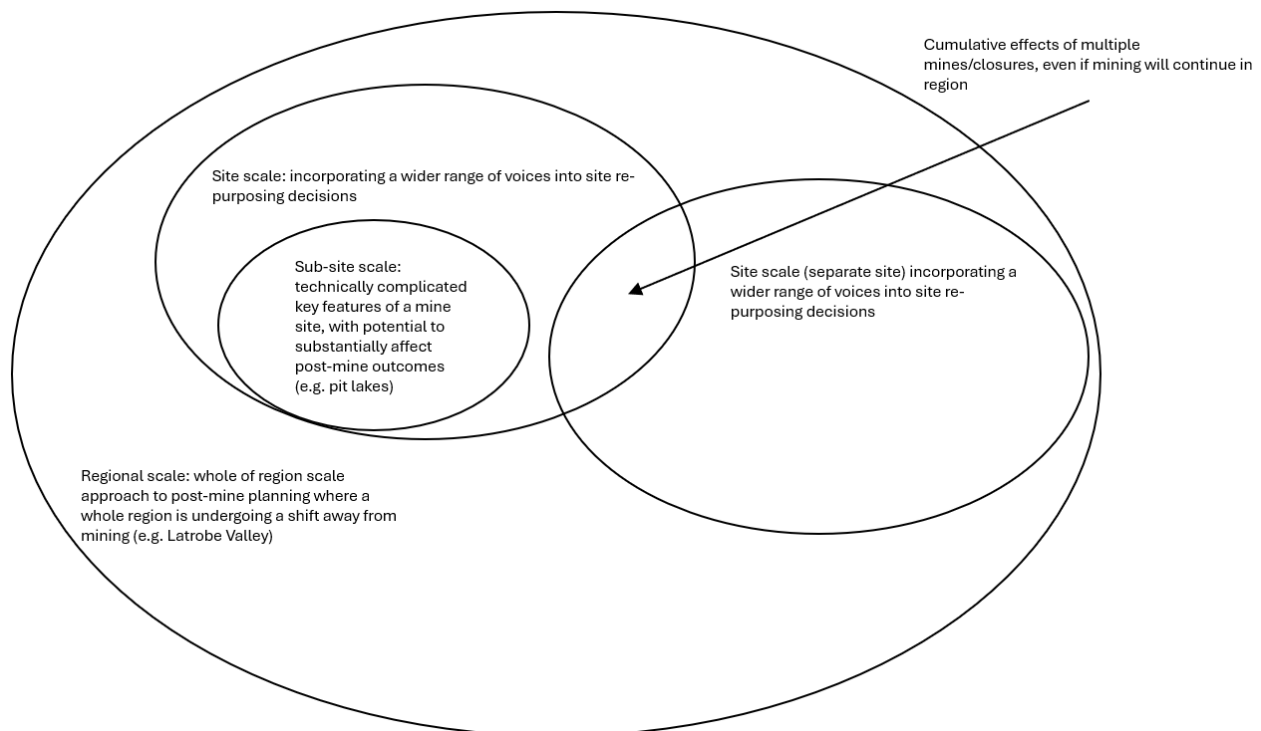


Figure 1 Spatial scales of frameworks, approaches, methods and tools for collaborative planning presented in this paper

Approaches that have been developed on smaller spatial and temporal scales can still be incorporated into projects focusing on larger scales. For example, when focusing on the whole-of-region scale, it is likely that some aspects of decision-making will relate to the site scale or the sub-site scale and vice versa.

2 The importance of values in collaborative planning towards post-mining transitions

Achieving acceptable post-mining transitions depends on recognising the essential importance of understanding and respecting the range of values in different contexts (Foran et al. 2024). Incorporating diverse tangible and intangible considerations across social, cultural and economic dimensions is crucial to effective and just collaborative post-mining planning (Measham et al. 2021). To position a region well for post-mining transformation, understanding and respecting diverse values should occur well in advance of closure time frames.

In determinations related to mining projects, the right of Indigenous Australians to express their values is recognised in the *Aboriginal Land Rights (Northern Territory) Act 1976* (Commonwealth of Australia 1976), as well as in the *Native Title Act 1993* (Commonwealth of Australia 1993). Such rights may also be recognised when (pending formal ratification by the Australian Government) companies voluntarily adopt the *United Nations Declaration on the Rights of Indigenous Peoples* (United Nations 2011).

Traditional Owners and Traditional Custodians, as rightsholders, have both a unique connection with, and an obligation to care for, Country. Therefore, Indigenous-led and co-led projects are a crucial part of the research agenda put forward in this paper (per Miller-Sabbioni et al. 2023). To understand values, we need strong relationships, particularly with Traditional Owners and Traditional Custodians, and a commitment to open dialogue. In addition, non-Indigenous host communities commonly have developed an identity and sense of purpose associated with the mining industry, which should also be acknowledged in planning for post-mining futures.

3 Incorporating values into planning: focusing on pit lakes

One way to increase consideration of values in post-mining planning is to explore social asset values as part of an integrated approach to repurposing particular aspects of mining operations. For example, mine pit lakes (which are a key component of mine sites) can be repurposed to support regional outcomes. Sagar et al. (2025) categorised pit lake social asset values into 5 classes: public health and safety, alternative land uses, energy and water security, social and cultural value, and environmental value. However, the feasibility of any pit lake PMLUs is impacted by technical parameters and regulatory requirements. The CRC TiME Pit Lakes Project thus aims to ensure that technical research and regulatory advice is responsive to the values and aspirations of actors who are collectively grappling with the complex problem of how to steward pit lake futures.

The Pit Lakes Project highlights that decisions required to render a pit safe, stable and non-polluting in accordance with regulatory requirements are typically dependent on ideas about the site's future. If the closure process is conceived as strictly linear and relatively short-term, an impasse emerges – the pit must be rendered safe, stable and non-polluting *before* its future can be decided; but oftentimes the definitions of 'safe', 'stable' and 'non-polluting' cannot be determined *until* its future has been decided. Further, the complexity of decision-making increases when an individual pit is considered as part of a regional hydrogeochemical and social system. The greater the temporal (years to millennia) and geographical (local to continental) scales across which a pit lake, and its future, are viewed, the greater the scope and challenges facing responsible decision-making. Additionally, different potential futures will realise different values for the site. Planning must therefore find ways to intersect consideration of diverse futures and the values they represent, with existing regulatory processes that determine minimum closure requirements.

In Australia, the principal actors engaging with pit lake futures are mining industry professionals, government regulators and Traditional Owners. Depending on the situation, other actors may include local residents, local governments, local businesses, farmers, state and federal government agencies, industry proponents of PMLUs, tourists, and communities both proximal to, and distant from, a mine site. In practical terms, this social complexity means that diverse actors need to become more effective at navigating differences among themselves if values are to be secured equitably: at the level of values, in terms of how they identify and conceptualise potential pit lake futures; and at the level of social process, regarding the behaviours they employ among themselves to shape those futures. Rather than attempting to reduce complexity and difference to minimise uncertainty (typically through reducing the influence of actors beyond mining companies and government), we seek to enhance rightsholders' and stakeholders' awareness of, and tolerance for, the complexity, dynamism and hence uncertainty, of their relationally shared ground for the painstaking work of PMLU decision-making.

In fieldwork conducted for the Pit Lakes Project, the emphasis is on co-designing 2 complementary tools with 3 key groups: mining personnel, Traditional Owners and government regulators. Through a development and testing process which continually assesses how diverse actors can communicate constructively, equitably and effectively in contexts of uncertainty, the team is building a desktop tool which 'reveals' pathways to pit lakes futures and integrates with a 3D tool for 'visualising' those pathways. Through this process, actors associated with the case studies are gaining a deeper appreciation for the complexity of their PMLU opportunities. However, it is hoped that actors are also gaining an experience of working in a more collaborative and creative way that will build their capacity to continue stewarding the conversation in the longer term. This could be through identification of PMLUs for pit lakes that are of broad mutual interest; through developing new modes of governance that arise from their interactions; through adjustment of existing regulatory requirements; or through some other pathways that are still emergent (Meadows 2008). At best, the actors are being supported to realise pit lake futures that incorporate much broader perspectives – including a deeper consideration of values – than the technical regulatory parameters which currently limit governance in this space.

This approach can help raise awareness about the multi-faceted nature of values, even when focusing on a single crucial aspect of mine sites, such as pit lakes, which have multiple potential uses and are a critical part of planning for post-mining outcomes. However, attention to values for critical elements such as pit lakes is only one component of effective post-mine planning. Zooming-out from individual pit lakes, it is also important to consider the whole mine sites and the wider regional scale.

4 Multi-stakeholder and rightsholder participation framework

One of the fundamental lessons from both the values research presented in Section 2 and the Latrobe Valley case study presented in Section 5 is the importance of involving a wider range of voices in decisions about PMLUs than is typically required under legislative and regulatory arrangements. In response to this need, an additional project was contracted to develop a framework that enables First Nations groups, community organisations, the mining industry, government agencies, investors and other actors to identify, consider and engage with potential repurposing options. The framework shown in Figure 2 was developed as a desktop exercise, informed by a multi-stakeholder and rightsholder workshop, and a subsequent stage would involve piloting and refining the framework at one or more mine sites. The framework can be a standalone resource or used in conjunction with other resources (Parmenter et al. 2026; Holcombe et al. 2026).

Given the diversity of mining contexts, regulatory settings and community circumstances, the framework was designed to be flexible, allowing users to adapt the process to their particular circumstances. The framework has also been designed to accommodate different regulatory environments. At the heart of the framework is understanding the diversity of views among rightsholders and stakeholders, not only on post-mining outcomes but also to support decision-making processes. The framework adopts a Seven Capitals perspective (Emery & Flora 2006), recognising that a post-mining transitions extend beyond environmental rehabilitation or restoration and involve broader social, economic, cultural, human and built capital transformations that collectively influence long-term regional wellbeing.

The framework links high-level repurposing principles with on-ground realities and takes local/regional interests and regulatory requirements into account. It has 5 phases, each with an objective and a set of steps. We have called the pre-planning Phase 0 to recognise that pre-planning pre-dates the other activities. The overarching goal for each phase is as follows:

- **Phase 0 - Pre-planning:** this phase lays the groundwork for an inclusive, just and effective mine repurposing process. It may be led by any party, but typically requires support from the mining company or government, alongside internal company pre-planning.
- **Phase 1 - Governance and process set up:** strong governance and a clear implementation vision and Theory of Change are essential to manage risk, align rightsholders and stakeholders, and deliver a sustainable long-term transition.
- **Phase 2 - Visioning:** this phase enables inclusive and collaborative decision-making, ensuring that people engage meaningfully when the process is designed *with* them, not *for* them.
- **Phase 3 - Options development:** this phase focuses on developing repurposing options, drawing on the Seven Capitals framework as a holistic decision-making model that evaluates projects or options across 7 interconnected forms of capital to ensure balanced, sustainable outcomes.
- **Phase 4 - Project preparation:** this final phase develops a site-specific prospectus that includes a consideration of community acceptability risks, providing confidence to potential investors.

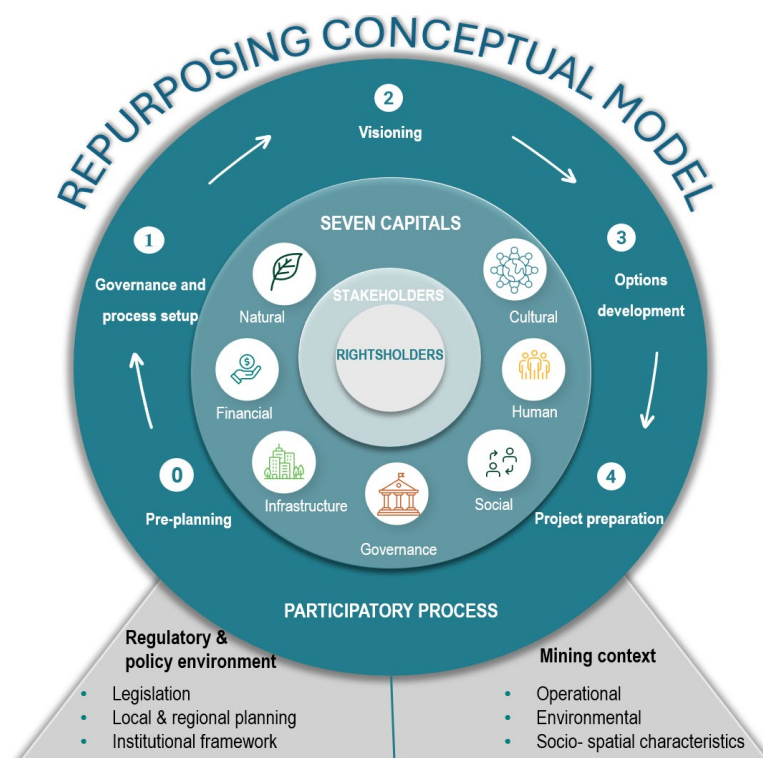


Figure 2 Conceptual model for participatory mine repurposing (Parmenter et al. 2026)

5 Regional-scale collaborative planning: case study of Latrobe Valley

The Latrobe Valley Collaborative Planning research project ran from February 2023 to June 2025 to develop an agreed vision for the future use of the valley's mined lands after mining ceases and coal-fired power stations are closed. Coal mining has been a core focus of the Latrobe Valley for decades, engaging a substantial workforce and contributing to regional identity (Foran & Reeves 2026).

The project was designed and conducted in 2 stages. Stage 1 (2023–2024) convened a multi-stakeholder steering committee comprising mine and power station operators, local council, relevant state government

authorities, the Registered Aboriginal Party for the region, and relevant community organisations to inform the project scope.

For participatory visioning to proceed, the steering committee had to agree on a spatial scope acceptable to its members. During Stage 1, it debated on whether visioning encompass the entirety of the 3 mines (~14,198 ha) or focus on future uses of land surrounding the pit voids (~9,559 ha). The future of the pit voids was a topic of previous and ongoing controversy. Although the licencees and many geotechnical experts considered water-filled voids as the only practicable means of rehabilitation, other experts and organisations voiced concerns about downstream ecological impacts of allocating surface water from the Latrobe River system and groundwater to create pit lakes totalling 2,389 GL (Hale et al. 2020).

Decisions by the state government to allow mine licencees to access surface and groundwater for future pit lakes would be taken in the future, closer to rehabilitation. The prospect of a determination in favour of water-filled voids was therefore not assured. Notwithstanding such uncertainty, the committee ultimately agreed that participatory visioning for land *surrounding* the pit voids was a worthy objective. Such land was in proximity to regional settlements and comprised two-thirds of the total licensed land. Once this spatial scope rule had been determined, committee members shared essential unpublished knowledge to support meaningful community deliberation in Stage 2.

During Stage 2 (2024–2025), 3 separate panels were convened to deliberate on preferred futures for the Latrobe Valley's land currently under mining lease. The panels comprised secondary school youth (Reeves et al. 2025b), Indigenous Peoples (Reeves et al. 2025a), and non-Indigenous adult residents of the Latrobe Valley (Foran et al. 2025). The rationale for conducting 3 separate panels was to offer activities that enabled participation by matching the interests and capacities of each of the 3 groups. We prepared a synthesis of the 3 panels' contributions, presented as a community vision for PMLUs which included community values, principles for future land use development and visual renders of components of a future vision (Reeves et al. 2025c).

The research found that community supports future land uses on the mine land consistent with the areas of competitive advantage for the Latrobe Valley region, including new energy generation, biodiversity enhancement, novel food and fibre production and non-polluting industrial development (Reeves et al. 2025c). In addition, many aspects of enhanced liveability, such as sustainable and affordable housing, enhanced connectivity of landscape, accessibility through public and active transport, a prioritisation of cultural and arts spaces and diverse recreation opportunities were strongly endorsed by all 3 panels. Importantly, the community want to see a positive future for all in the Latrobe Valley, that both encourages young people to stay and attracts newcomers, lifting the sense of stigma and socio-economic disadvantage and closing the gap for Traditional Owners and Traditional Custodians (Reeves et al. 2025c).

A key benefit of the project design was the independence of the project; the project was supported by a research organisation (CRC TiME) rather than being commissioned by government or industry. This provided a level of trust and transparency for participants. In addition, detailed community knowledge and lived experience were shared through the research team, steering committee and project partners, to ensure the project design was well-grounded and responsive to local conditions (Foran & Reeves 2026).

The outcomes of this work are being used to inform the concept plans and declared mine rehabilitation plans for the 3 mines, as well as the Traditional Owners' position statement on mine rehabilitation for the Latrobe Valley. A third stage of this project is now being supported to map planning and policy pathways to implementation.

Looking forward, we expect that whole-of-region planning will involve great connectivity with site decision-making and even sub-site decision-making, given the importance of certain sites or features within a region. What happens to particular mine voids, e.g. whether they become a recreational lake, or used for aquaculture or something else, can have substantial effects in the surrounding region. Further work is planned, focused on pathways to implementation, linking with other CRC TiME projects, including evaluation tools for comparing different PMLU options.

6 A focus on cumulative regional effects and management

So far in this paper, we have focused on the importance of recognising diverse values for crucial aspects of the mining landscape that can greatly affect post-mining outcomes (such as the importance of pit lakes), the need to take a collaborative approach to mining at the regional scale, and developing frameworks that open up participation in decision-making while being adaptable to diverse geographies and regulatory contexts. The last aspect we wish to focus on in this paper is to emphasise the importance of cumulative effects at the regional scale. As part of its portfolio of projects, CRC TiME researchers developed a multi-stage series of projects on regional cumulative effects assessment and management (RCEAM) to support transitions in mining economies. In this first stage of this project, a review of approaches to conducting cumulative effects assessment was completed. An important consideration was considering ways of integrating different knowledge types, particularly for bringing together Western and Indigenous Knowledge (Pope & Young 2024).

The second stage of the project had 4 components

- assessing governance and decision-making needed to enable RCEAM in Australia
- synthesising current research and global best practice on Indigenous involvement in RCEAM
- identifying a suitable region to pilot new approaches to RCEAM
- developing a roadmap and toolkit to support RCEAM implementation across Australian mining regions.

The findings of the project emphasise that regional readiness is essential, and therefore having a common understanding of, and assessing, readiness is crucial prior to commencing RCEAM. The project identified readiness criteria to help determine which mining regions are suitable for trialling RCEAM. It also outlined steps for building collaborative governance capacity and pathways for building on existing collaboration, expanding over time with support from intermediaries and champions. In addition, it developed a process for an Indigenous-led RCEAM, which provides a separate space for Traditional Owners and Traditional Custodians to identify and assess the cumulative effects most pertinent to them and determine both appropriate metrics to evaluate change and their own priorities for future management. The next stage of the project will focus on implementing the methodologies in pilot regions.

7 Conclusion

Collaborative planning for mine land repurposing is crucial to achieving post-mining outcomes. From the foundational work of CRC TiME, a key consideration is that post-mining outcomes should be net-positive – i.e. that regions are better off overall following mine closure – from a diverse range of perspectives. In this paper, we have highlighted the importance of key elements of mining landscapes that can strongly influence post-mining outcomes, such as pit lakes and the diverse ways in which they can be valued and contribute to regional outcomes. Furthermore, we have shown different approaches for particular scales as shown in Figure 1. These approaches can be used individually or in combination, depending on the context. In addition, we have shown how collaborative planning can play out on the ground, as demonstrated in the Pit Lakes Project and the case study of the Latrobe Valley region. Prior to the project there was an elevated level of friction in Latrobe Valley, and the collaborative planning process was central to moving forward for the region.

All regions have distinct characteristics; therefore, it is important to have frameworks, approaches and methods that can be used to incorporate wider voices into post-mine planning while being adaptable to different regional contexts. In this paper, we presented a project which has developed such a framework in an accessible and flexible format. Finally, we have emphasised the importance of planning for managing cumulative effects at the regional scale. Achieving RCEAM is both a challenge and an opportunity for mining regions. Here we highlight that assessing the readiness of regions and governance systems to undertake RCEAM is key to realising this opportunity. Together the frameworks, approaches, methods, tools and case

studies, developed through the support of CRC TiME, provide a suite of resources suitable for transformations in mining economies.

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