ACARP project C25032

Report 4

Assessing the convergence of stakeholder views on post-mining lands uses in the Bowen Basin

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Research Ethics

This study was approved by the CQUniversity Human Research Ethics Committee (Approval H16/11-305) according to the National Statement on Ethical Conduct in Human Research.

1. Introduction

Mine closure is a standard part of a mining cycle, yet it has received much less attention in Australia than approval and development of new mines. Reasons for this include that, to date, many more mines have been developed than have closed, that the key debates about incurring and managing the benefits and the costs of mines typically occur prior to approval, and that under the extended life-cycle planning that underpins Environmental Impact Statement (EIS) processes, rehabilitation and closure are already incorporated into mine planning. However, there is emerging evidence of more specific attention on mine rehabilitation and closure, at least in Queensland (Queensland Government 2017). It appears that there is specific interest in mine closure policy as a separate topic because (a) more mines are reaching end of mine life, (b) community standards about what is appropriate rehabilitation and closure may have changed since many mines were first approved, (c) regulations outlining the conditions for rehabilitation and closure are not as specific for older mines compared with younger mines, and (d) rates of progressive rehabilitation of mined areas have been slower than required.

A notable trend in the regulatory requirements for end-of-mine planning are increased requirements for community and stakeholder consultation to ensure that the processes for mine closure and the post-mining land use change meet community expectations. For example, the Queensland Government (2017) proposes increased requirements that the community will be consulted on life-of-mine plans, and that existing mines will transition to life-of-mine plans and a community consultation process. As well, there are also calls for stakeholder and community involvement in all key stages of a life-of-mine plan, including closure. While the expectations of increased consultation are explicit, there is little guidance offered around which are relevant stakeholders and communities to involve, the process for consultation, and identifying when the goals of consultation have been achieved.

Stakeholder involvement in decisions about environmental management and planning have become very closely embedded into policies at local, national and international levels (Raymond et al. 2010; Reed 2008). Approaches to stakeholder involvement have taken different forms, including awareness raising in the late 1960s, incorporating local knowledge in the 1970s, participation as a 'norm' in the sustainable development agenda of the 1990s, and a 'post-participation' consensus in more recent decades (Reed 2008). Key reasons for involving community and stakeholders in consensus approaches include a greater diversity of knowledge and values, ability to adjust to dynamic situations, greater transparency of decision-making processes, improved quality of decision processes, and improved negotiation of political solutions between competing interest groups. There are some variations in how participation can occur, driven by heterogeneity of stakeholders and the complexity of decision-making processes (Luyet et al. 2012), so that no single approach to participation appears optimal. Instead, Raymond et al. (2010) argue that successful participation focuses on the processes to engage participants around problems and the integration of knowledge to solve them.

There are a number of challenges to increasing the use of stakeholder and community consultation around life-of-mine planning, particularly around rehabilitation and mine closure issues. Currently, there are requirements for community consultation in the planning and approval stages for larger mines through the environmental impact assessment (EIA) process. Many mining companies also have processes to engage with local communities and neighbouring landholders to foster and maintain good relationships. However there are very limited examples of how communities and stakeholders could be more formally involved ongoing decisions about rehabilitation standards and closure plans.

One example for a consultative approach in relation to rehabilitation standards has been reported by Owen and Middlin (2010). This built on the research findings of ACARP Project C15035, which tested the appraisal by stakeholders as a method of evaluating land rehabilitation and demonstrating that a mining company had achieved the rehabilitation objectives for a particular site. Owen and Middlin (2010) documented the formation of a reference panel for a future mining operation, inviting members from four sectors: traditional owners, landholders/neighbours, interest groups, and local government. The process involved the panel meeting at regular intervals, and through an iterative process of issue identification, sourcing expert information and group work, developing consensus opinions about appropriate standards.

One challenge in moving to a more consultative model such as demonstrated by Owen and Middlin (2010) is that the current process in the Bowen Basin is framed around regulatory relationships between the mining companies and state government departments (the regulators). Mining activities in Queensland are regulated by the Government through the Department of Natural Resources and Mines (DNRM) which issues mining leases, whereas the Department of Environment and Science (DES) issues the environmental authority specifying conditions under which a mine must operate. A financial assurance system operates, where companies provide an environmental bond to the government as security to cover any remaining rehabilitation obligations on a mine site. Companies wishing to close a mine have to first receive certification from DES that the environmental conditions linked to the environmental authority have been met, and then apply for relinquishment of the mining lease from DNRM. The four goals to be achieved for relinquishment can be briefly expressed as: 'Safe, stable, non-polluting and sustains an agreed land use' (DEHP, 2014, p. 13-16). There are annual reporting and compliance mechanisms within this framework, which means that the current process is highly focused on meeting regulatory requirements.

A second challenge in moving towards a more consultative model is that it may create greater uncertainty about the goals for mine rehabilitation and subsequent land use. Currently the mining companies nominate the types and standards of rehabilitation activities as well as the final land uses, and then submit them through the annual Plan of Operations in the environmental authority for regulatory approval (or amendment). While mine planning may change over time, as reflected in changes in the plans of operations that are submitted over time, the system is generally consistent with a life-of-mine planning framework that provides some certainty to companies and regulators about what will be achieved. However, if some of the power over decisions is transferred to communities and stakeholders, as is implied with a consultative model, then this may result in a corresponding diminution of the authority of companies and the regulator, balanced by increasing acceptance of and support for post-mining land uses by local communities.

The focus of the research reported in this paper was to test if there were large variations in attitudes towards mine rehabilitation and closure issues amongst the key groups that could be involved in a stakeholder consultation process. The case study setting was the Bowen Basin in Queensland, where a number of mines are likely to reach the end of their operating life in the next decade or so. The research involved a series of interviews with industry, government and stakeholder groups to identify key issues of interest, and then an online survey-based data collection process to identify key attitudes.

2. Methods

The first stage of this project was an initial review identifyingd previous work in this field; including that residing in the academic literature and in reports such as previous ACARP projects on related topics. ACARP projects included:

- ACARP Project C14053, which assessed the risks of grazing as a final end use of mining lands in the Bowen Basin. This project identified that grazing is expected to be the preferred end land use in the Bowen Basin, and identified a number of the factors and risks relevant to transferring land back to grazing enterprises (2006).
- ACARP Project C15035, which tested the appraisal by stakeholders as a method of evaluating land rehabilitation and demonstrating that rehabilitation objectives had been achieved (2007)
- ACARP Project C9038 which assessed sustainable grazing on rehabilitated lands in the Bowen Basin (2007).
- As well, an industry report of note was Owen and Middlin (2010), who documented the formation of a reference panel to inform a future mining operation, inviting members from traditional owners, landholders/neighbours, interest groups, and local government.

In the second stage, individual and group interviews were conducted during 2016 with about 20 stakeholders in Central Queensland and Brisbane, including

- the mining sector;
- government agencies; and
- regional stakeholders, including environmental groups and landholders.

These served to identify relevant issues relating to post-mining land use, the process to close mining operations and transfer ownership to other industries, and opportunities for a consultation process with relevant stakeholder and community representatives to generate shared agreement about future land uses and the processes to achieve them.

The third stage involved data collection from participants at workshops, that were run in the form of reference-style panels where participants had a specific interest in mining land-use change issues and the process to generate stakeholder support for final land use changes. Participants involved in this study attended half-day workshops in Blackwater (in the centre of the Bowen Basin) in 2017, and data were collected either during the workshops or via follow-up online surveys. Participants had been invited to the workshops on the basis that they could be involved in a consultative process to improve post-mining land use change, so had been specifically targeted to come from one of the following groups:

- agricultural producers who were neighbours to or who had direct involvement with mining activities;
- mining company representatives dealing with environmental and land use issues and community engagement;
- government regulators relevant to the mining issues in the Bowen Basin; and
- key stakeholder interests including the natural resource management (NRM), Environment and Business sectors.

3. Key issues identified from review, interviews and workshops

Previous research

Previous research, including Maczkowiack et al. (2007), has illustrated that the relevant factors that graziers in the Bowen Basin have identified for post-mining land use transfer are:

- the form of caveats or ongoing controls and monitoring over management post-mining (most landholders thought that some form of ongoing monitoring should occur);
- the length of a trial period that might occur before full conversion to permanent grazing tenure (landholders suggested up to five years would be appropriate);
- who the land is transferred to, with key options including (a) original owners (b) owners of adjoining properties (c) nearby property owners and (d) open tender;
- alternative land uses of post-mining land where grazing was not appropriate included native vegetation (bushland), recreational uses, forestry or feedlots;
- extent of the available land holding (larger sizes are more financially attractive); and
- layout and facilities (paddocks should be of an appropriate size and have dedicated watering facilities, plus other considerations such as fencing and access roads).

Interviews with the mining industry

In this project, interviews with the mining sector revealed that there is a general desire to facilitate more streamlined closure and relinquishment processes in the Bowen Basin. There is some variation in approaches across companies; for example some companies have diversified into grazing enterprises as well as mining, whereas others make little systematic use of undisturbed and graze-able land. The issues are also different for different domains of the mining lease and for different types of mines (e.g., open cut compared with underground).

Most mining companies have a proportion of their mines where grazing is nominated as the subsequent land use, but the other major alternative nominated by industry was to return mining lands to bushland/native vegetation. Rather than a uniform approach to the whole lease area, most company interviewees preferred a “mosaic”approach for final land use. This involves a proportion of the land being converted for conservation purposes, some to bushland/ remnant vegetation, and some to grazing (or other agricultural pursuits),allowing for variations across mine domains (e.g. dealing with pit voids has the most uncertainty) and taking into account cost, residual risk/ liability and the range of land use options.

There is no common definition of rehabilitated mine land, as individual companies use separate systems, different monitoring and metrics and adopt different time intervals, baselines, thresholds and target conditions. Despite the potential to provide early access to post-mining land for subsequent users, there has been generally slow progress on rehabilitation during operations for various reasons:

- typically around 40% of disturbed area on a minesite is needed for ongoing operational activities (e.g. haul roads, processing plants), so it is not available for rehabilitation;
- some areas that have been rehabilitated will be monitored for 10 years or more to ensure they have reached the certification standard;
- other rehabilitated areas will be in-between mining sites, requiring on-going maintenance, or (in some areas that have failed) will need re-working;
- other areas may be kept in case technological advances make the remaining resource (deeper seams) an economic proposition in future; and/or

- some areas where rehabilitation work has not yet started.

Mining interviewees identified a lack of clarity, particularly from the regulators, about the standards/ indicators/completion criteria required for certification of rehabilitation. The four broad goals for post-mining lands of 'safe, stable, non-polluting and a sustainable land use' were seen as too ambiguous, especially those where science can't set the standard (e.g. non-polluting may be scientifically defined but 'self-sustaining under an acceptable land use' is much harder to demonstrate through scientific measures). It was argued that the completion criteria are currently too broad to demonstrate they have been met (e.g. what are the criteria for 'self-sustaining').

Mining companies appear to have little incentive to engage with potential subsequent land-users throughout rehabilitation stages. In the words of one interviewee, 'this would require graziers and government personnel to conceive of the stewardship being passed to them and think strategically about how rehabilitation should be done and what conditions provide protections and value propositions'. According to interviewees, there is more focus in the industry on operations and rehabilitation, but limited understanding in the industry about the final goal of relinquishment and associated subsequent land use requirements.

Many areas of mining leases (particularly buffer zones or untouched sections) are commonly grazed or sub-leased. Mining company interviewees agreed that decisions about future land uses should not be made in isolation but should incorporate local insights and understanding of land capability to identify 'what the land is best suited for' from various perspectives. It was suggested that this probably needs to be at a regional scale rather than at a single property or lease level. This will involve understanding the range of views on/ measures of 'acceptability' and the factors likely to shape a 'value proposition' to make land suitable for post-mining uses.

Different options were suggested for the transfer of mining lands. Currently there are provisions for transfers *for the same use* (e.g. sale to another mining company) where all liabilities and residual risks are passed on with transfers of the relevant mining lease, environmental authority and financial assurance responsibilities. However there appear to be no established mechanisms for selling the sites, and associated site-based management plans, to someone intending to transition the property to different land use(s). Key options mentioned by industry include:

- Land ends up as a perpetual mining lease perhaps wholly dedicated to biodiversity outcomes (without considering long-term unintended flow-on effects of that and whether it is in fact sustainable to have large tracts of unproductive land locked up in hands of mining companies with little motivation for stewardship beyond basic care and maintenance).
- Split lease up and transfer most suitable sectors to agriculture, with unsuitable sections (e.g. voids) remaining held and managed by companies or government (potentially in perpetuity).
- Transfer land with conditions over the management of rehabilitated lands (covenants, easements, encumbrances etc).
- Long term lease to agricultural operators (with first option to buy) of rehabilitated land until residual risk is low enough to release for unencumbered purchase options.

Interviews with government agencies

Iinterviews with staff from the government agencies revealed that there are some variations in approaches taken towards land rehabilitation and mine closure issues. Mining companies define rehabilitation in different ways, vary in the extent to which rehabilitation progresses as planned, and vary in their monitoring approaches and assessment. Residual risk was identified as the key issue to deal with in a mine closure process; it was argued that any remaining adverse environmental effects should remain the responsibility of the mining company. Staff suggested that consideration of residual risk and land use change should occur much earlier in the process of mine closure than

currently occurs, but noted that treatment of environmental standards and residual risk has not necessarily been consistent over time.

Government department officers noted that mine closure and post mining land use should be decided at the Environmental Impact Assessment approval stage and should be consistent with regional plans. For both disturbed land and land within the buffer zone, land rehabilitation is the first step to the mine closure. Interviewees held that land rehabilitation must be based on scientific tests of water, soil and other factors, rather than on company-driven pilot trials. Assessment frameworks, such as for sustainable land suitability, should be used for post mining land use change.

The *Progressive Certification Legislation 2006* provides a certification process for progressive rehabilitation of mined land, with associated incentives such as reductions in financial assurance (and hence bond fee). Interviewees suggested that land ownerships changes (e.g. partial relinquishment and change) should not be on a progressive basis (i.e., by successive parts of the mining area) until completion of all progressive certifications. However, there were some concerns that the required standard of rehabilitation and progressive certifications may vary over time, complicating this process.

Different views about land transfer and land use change to agriculture were identified. These included:

- transfer of post-mining land to national park use or some other environmental conservation purposes that can bring better biodiversity outcomes for the associated ecosystems;
- land use change to agricultural land or conservation, after a long period of time to achieve post-certification. The relevant time frame is unclear, but could be up to 25 years; and
- transfer post-mining lands to agricultural use before final lease relinquishment under the ongoing monitoring and regulatory requirements, together with mechanisms to assign any residual risks to mining companies.

It was noted that the mining lease and land tenure types are two different legal entitlements. In the Bowen Basin the mining companies hold freehold title for most coal mines. The land title can be sold or transferred at any stage, although most companies are likely to only be interested in transferring land after the mining lease had been lifted. There was recognition that there may be some legal complexities of land use transfer to manage the risks associated with the rehabilitated and other mining areas. The government agencies require the mining companies to nominate the post-mining land use and the standard of rehabilitation in the processes to achieve certification. This wass acknowledged as a bit of a “grey area”; companies are asking what is required, while the agencies would prefer the companies to outline the plans and then provide an assessment.

Views of stakeholders in the workshops

There was some large variations in views about what would be a suitable end land use, although the dominant preferences were for returning land to its original agricultural use, typically a combination of grazing and ‘conservation’ (or managed bushland). However there were also a number of suggestions for other uses such as carbon sinks, growing corn/forage crops and by-product compost, or commercial timber. However some stakeholders argued that grazing was the only viable alternative and that other ‘cottage’ industries would not be practical.

While there was often agreement that developing a (viable) business enterprise (around grazing) could be possible on post-mining lands, there were variations in opinion about what proportion of post-mining land would need to generate commercial value (i.e. should pastures be suitable for grazing) and how viable the post-mining land use would be. Many of these issues were considered to be very site-specific and only able to be negotiated between individual purchasers and the mining companies.

The level of rehabilitation on spoil areas was identified as a key issue, with some variations in the standards of rehabilitation that was expected, from full return to a natural landscape to other options such as mixes of flatter and steeper areas and fencing out unusable areas. There was a general view that the quality of land is not the same post-mining because of differences in the water holding capacity of soils, fertility and aquifers, but there were also variations in the extent to which stakeholders thought land could be productive. Some stakeholders had reservations about using rehabilitated spoil areas for grazing because of concerns about lower productivity and additional management constraints (associated with avoiding environmental damage).

Water supplies were seen as crucial, especially secure access to water of satisfactory quality. The vegetation cover was of interest, with varying views about the amount of native bushland that would be desirable for shelter, conservation and other functions and the proportion that would be undesirable because it could limit pasture production, harbour pests and weeds and make mustering more difficult. Other issues identified as important for post-mining land use included issues of site layout, access and existing infrastructure.

Dealing with environmental risks and the potential for an unanticipated future issue (such as subsidence, contamination etc) were identified as very important. There was some diversity of views about how to manage sensitive or contaminated areas, from complete exclusion through fencing through to better remediation to avoid problem existing at the transfer point. What happens with the final voids was raised as an issue, with views on treatment ranging from complete rehabilitation to fencing off or exclusion.

Risk and mechanisms to handle risk were identified as critical issues for any arrangements with graziers to take over post-mining land. Stakeholders required clarity about responsibility for major legacy issues and residual risks. This particularly related to the tailings dam as a domain perceived as high risk. Due diligence was identified as important before transferring the land use and land ownership with scientific assessment required on tailings dams, water quality, soil quality, slope and vegetation. Key examples of environmental risks nominated to remain with the mining company (or some specific management arrangement like a 'contaminated lands authority'/ bonding or insurance scheme) included:

- contamination and leakage;
- extensive infrastructure damage by subsidence; and
- weed and pest infestation.

There was some diversity of views around how the environmental risks on post-mining lands could be managed. The main concerns were about who will monitor, where various responsibilities will lie, and what mechanisms will exist to cover unexpected events. Stakeholders expected that due diligence would need to be done by the departments and there would need to be careful management by the subsequent land user. Some argued for an ongoing role for government, through a framework of expert standards and regulations. There was also strong endorsement of a

voice for stakeholders in the process, and stakeholder driven working group formats were welcomed as a suitable process in general terms.

4. Results of specific survey questions

The results of the review and consultation stages of the project, covering both interviews and workshops, helped to identify a number of issues relevant to post-mining land use change. It also identified some diversity of opinions about the issues, both across stakeholder groups and between individual stakeholders (including within the same group). Issues of interest then are to identify how much views differ across various issues relevant to the case study, and whether those views differ systematically across stakeholder groups.

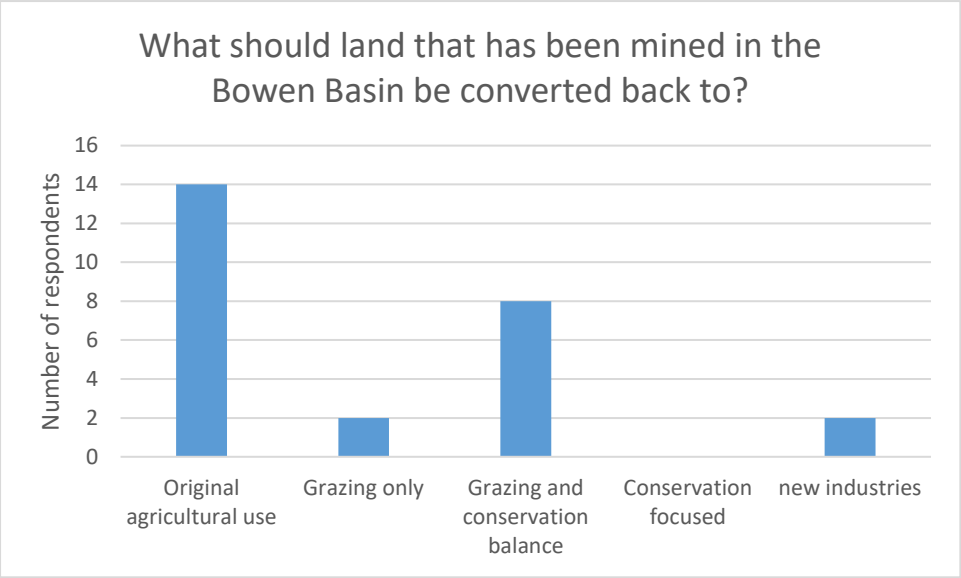
Answers to these questions help to identify the challenges for consultation processes. If there is no diversity of opinions, then no processes to generate engagement or consultation are required. Conversely, if there are very extreme and entrenched differences of opinion between stakeholders and stakeholder groups, then it will be very difficult to achieve consensus views.

To assess this, data was collected from a sub-sample of participants in the workshops (n=26) on a range of relevant questions. The questions were generated from the initial stages of the project, drawing in particular on the results of Maczkowiack et al. (2007) and the interview outcomes to identify key questions of relevance. The data were collected by direct questionnaires in Workshop 1 (14 respondents), a web-based survey after Workshop 2 (6 respondents), and another web-based survey after Workshop 4 (6 respondents). Responses were collected from 6 different stakeholder groups:

- Business sector (2 respondents)
- Landholders (6 respondents)
- Mining (5 respondents)
- Conservation (3 respondents)
- NRM (7 respondents)
- State Government (3 respondents)

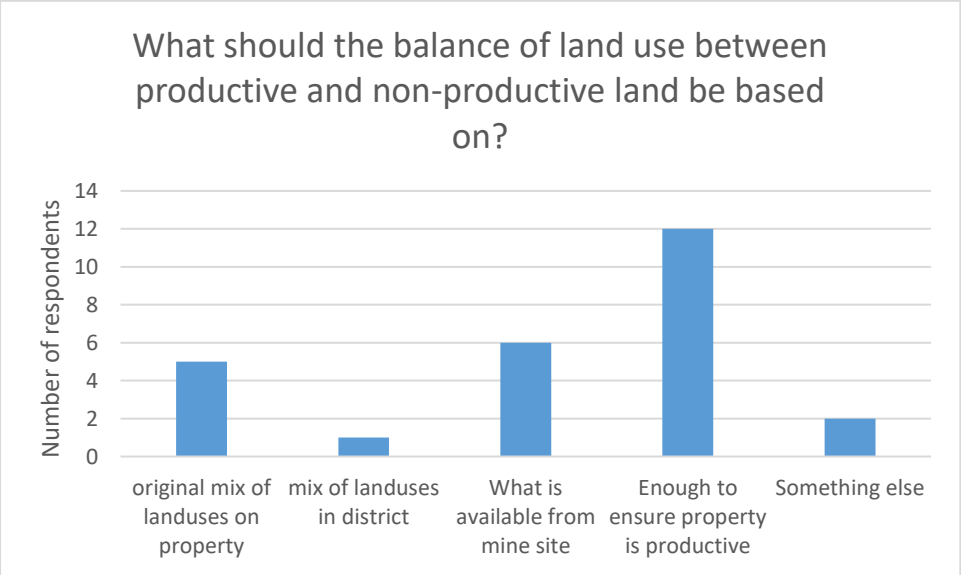
The data are first presented in terms of summary responses to each question (in this section), and then the summary data and statistical tests of differences follow in the next section.

Figure 1: Post mining land use options.



The landholders in the study all supported the 'original agricultural use' option, while the mining sector participants supported either 'grazing only' or 'grazing and conservation balance'. It was only participants from the NRM and conservation sectors who supported the 'new industries' option.

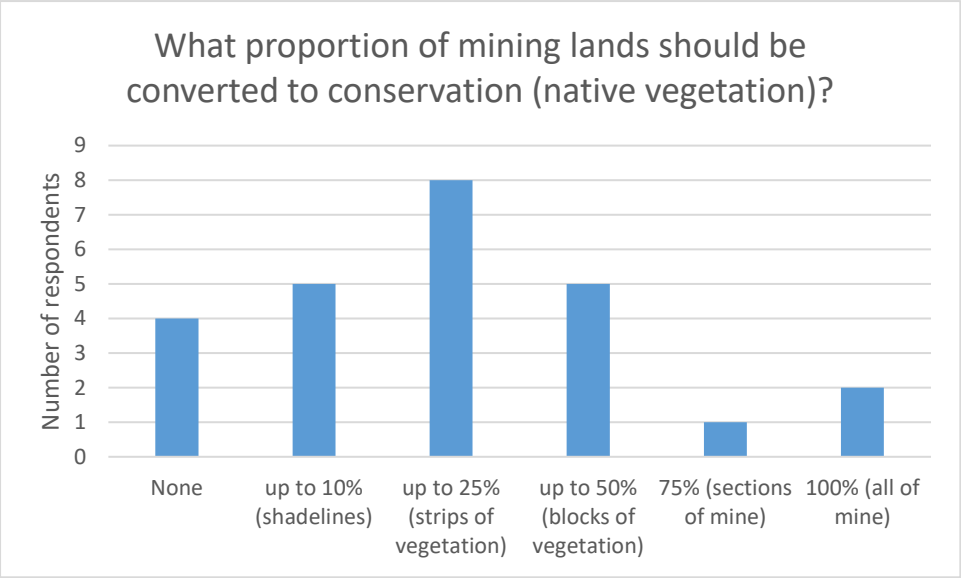
Figure 2: The balance of land use between productive and non-productive land



For this question there was no particular difference in support identified across the different sectors. Other feedback received was:

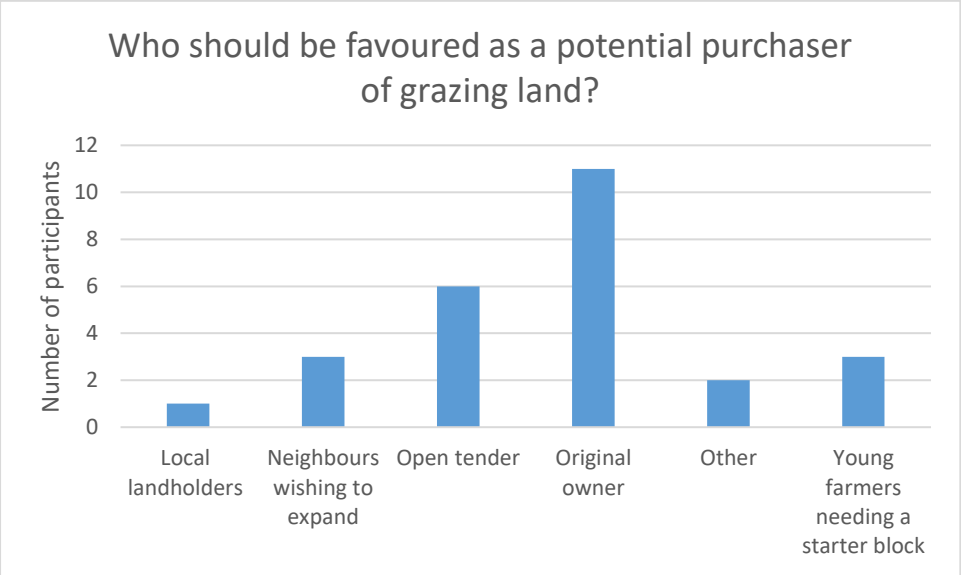
- *The options are not mutually exclusive and the answer would depend on the state of the land*
- *This something else=no use, but carbon farming?*
- *If possible it should be 100% productive*

Figure 3: The proportion of post-mining = land to be converted to native vegetation



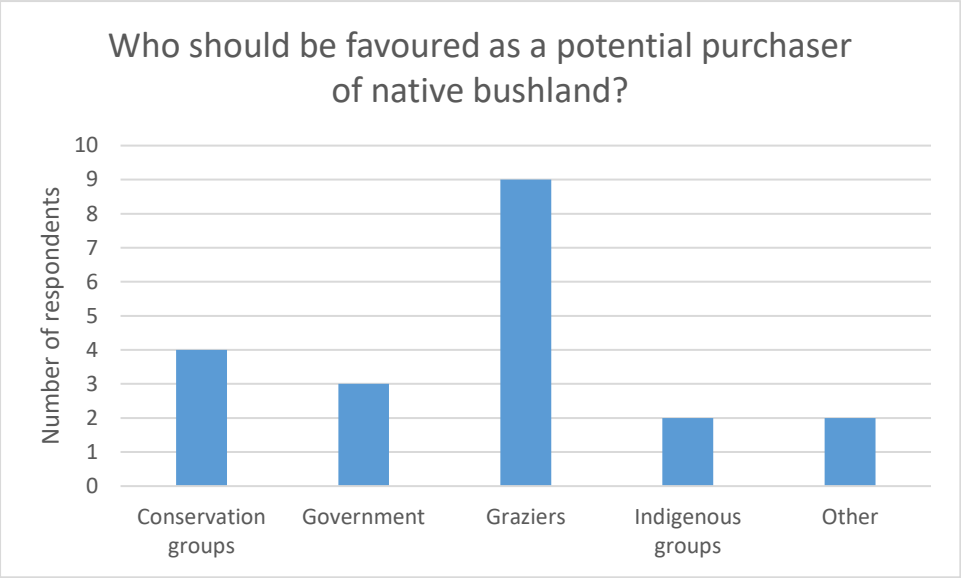
For this question there was no particular difference in support across the different sectors. There appears to be very little support for widespread conversion of post-mine lands back to native vegetation.

Figure 4: Who should be targeted to purchase the land



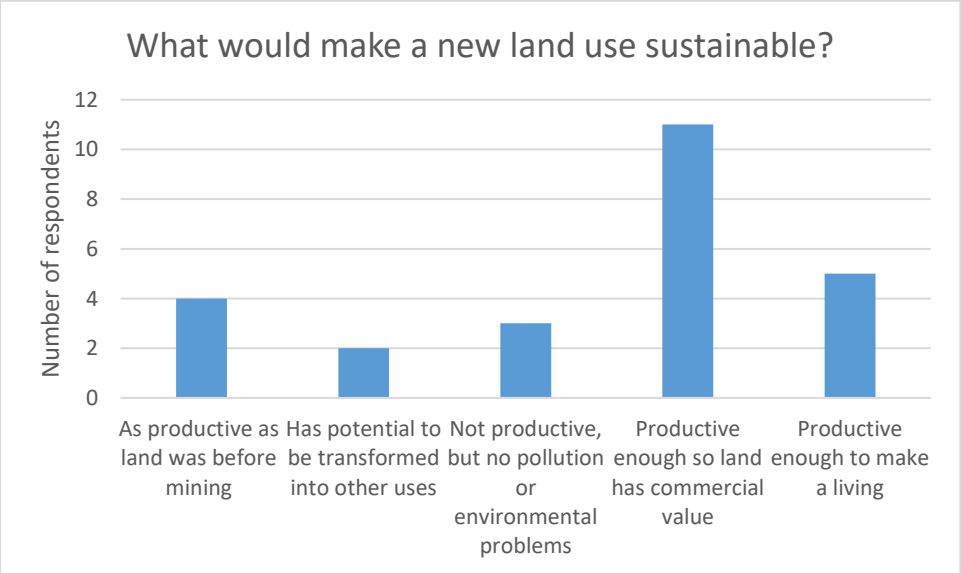
The issue of who would be the purchaser of post-mining land was previously raised by Maczkowiack et al. (2007). In this study, landholders and State Government participants largely favoured the option to sell land back to the original owner, whereas views of other participants were mixed. The other suggestion that was put forward was to ballot the land. It is worth noting that while participants at the workshops identified the 'original owner' as a desirable outcome, there was also awareness that this was not an option for many of the longer term mines where land transfers occurred many years ago.

Figure 5: Who should be targeted to purchase native bushland



There were some small difference across stakeholder groups for this issue: 80% of landholders and 50% of other stakeholders supported graziers being the purchaser of native bushland on rehabilitated mine lands.

Figure 6: What would make a new land use sustainable

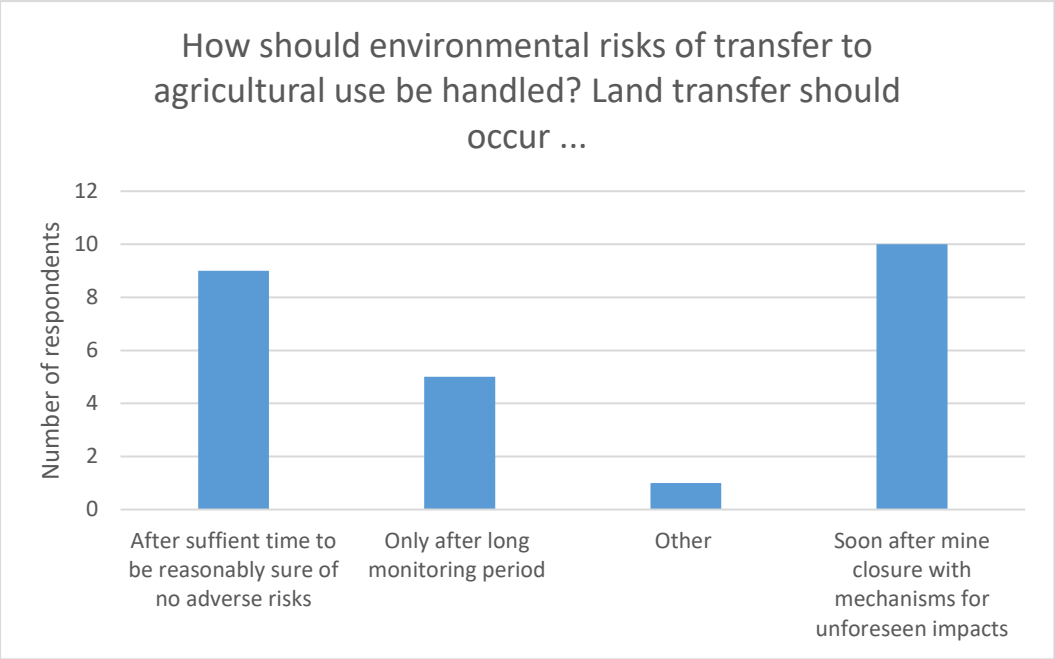


One of the issues identified in the interviews was the lack of a common understanding about what would be a sustainable use of post-mining land. The responses here identify that the land should be productive enough (e.g. for grazing) to generate a commercial value, i.e. operations on the post-mining land have to be profitable. The majority of landholders identified a sustainable land use to be 'as productive as land was before mining', while the majority of stakeholders from mining and NRM groups preferred 'productive enough so that land has commercial value'.

Figure 7: Post-mining land on only part of a grazing property

For this question there was no particular difference in support across the different sectors. The most preferred standard was that post-mining land should have 'at least no pollution or environmental problems', indicating that not all areas have to be productive.

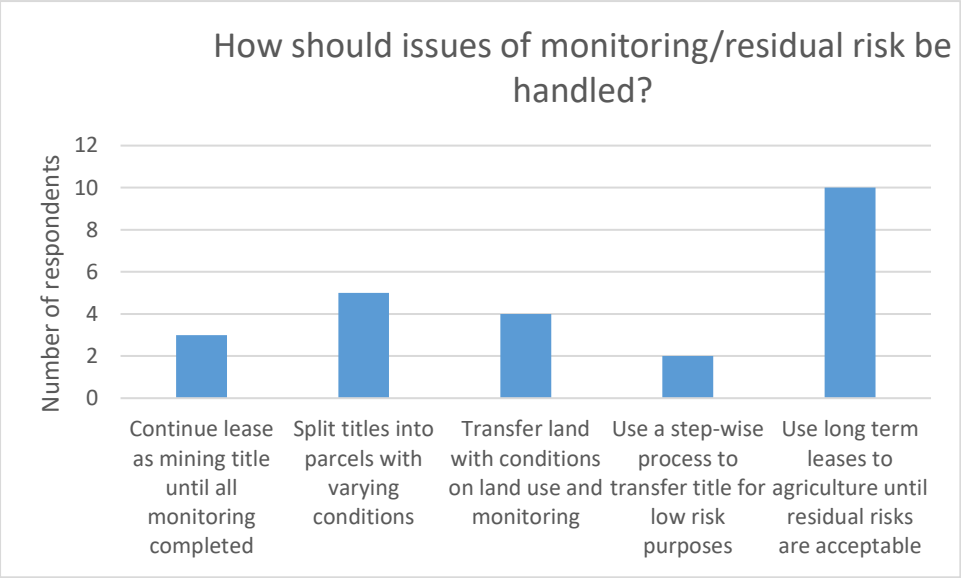
Figure 8: Managing environmental risks when transferring to grazing



The responses to this question revealed that the majority of respondents did not prefer the more cautious approach to land transfer ('only after a long monitoring period'), but instead preferred land transfer to occur soon after mine closure, so long as there mechanisms to assign responsibilities for unforeseen impacts. There was little difference across respondent groups, but 60% of both landholders and mining representatives preferred the option to transfer land soon after mining was completed. Other feedback received was:

- *Off site impacts [should be] handled by government*
- *The risk should always be the responsibility of the miner*
- *[Risks should be managed] by the use of covenants and agreements*

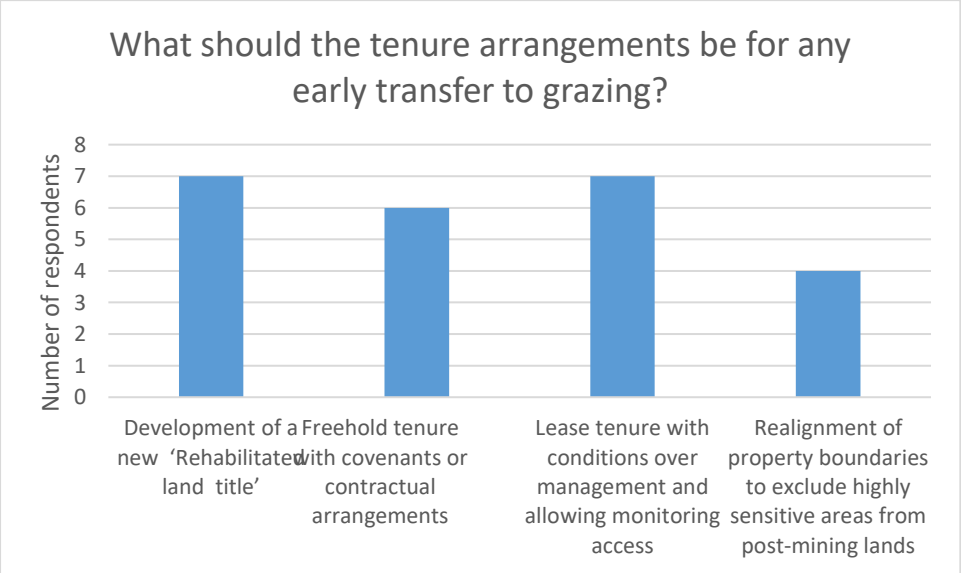
Figure 9: How should residual risks be handled



Maczkowiack et al. (2007) have previously discussed the importance of dealing with risk issues in the transfer of post-mining land back to grazing. The survey results in this project indicated that participants preferred a staged approach where mining lands could be first leased to graziers, and then transferred once risks were at an acceptable level. For this question there was no particular difference in support across the different sectors. Other feedback received was:

- *Onsite risks [should be] identified for sale tender.*
- *[Should be] handled by landholder under mine site previous owner agreement.*
- *The order would be site specific and depend on the severity of risk.*

Figure 10: What should the tenure arrangements be for early transfer to grazing



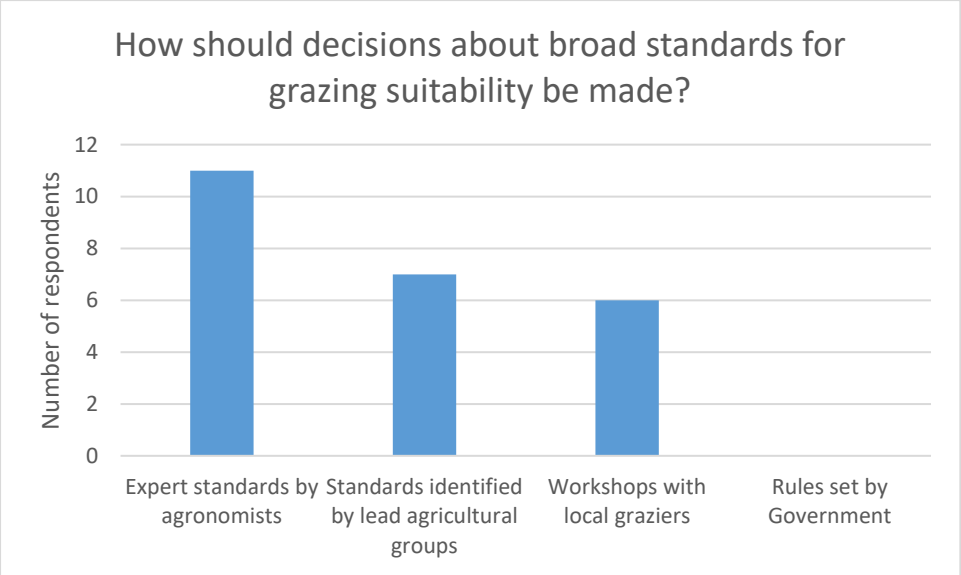
Maczkowiack et al. (2007) have previously discussed tenure issues in relation to land transfers to grazing, recommending that some forms of management constraints and ongoing modelling be a condition of land transfers. This option received equivalent priority support in this study, but there

was also support for the other options presented. For this question there was no particular difference in support across the different sectors.

Figure 11: The decision process for regional land use issues

The purpose of this question was to identify preferred processes to generate consistency in the outcomes of post-mining land uses. Of particular note is that some form of a regional planning or workshop process was preferred over a government-driven regulatory process. For this question there was no particular difference in support across the different sectors.

Figure 12: The decision process for judging grazing suitability



The purpose of this question was to identify what processes stakeholders thought should be used to judge that rehabilitated land was appropriate for grazing. Of particular note is that some form of expert opinion (whether by agronomists or landholders) was preferred over a government

regulatory process. Some differences by respondent type were identified for this question. Landholders preferred the option 'workshops with local graziers', the mining company participants preferred the option 'expert standards by agronomists', and NRM representatives preferred the option 'standards identified by lead agricultural groups'. Another suggestion received was:

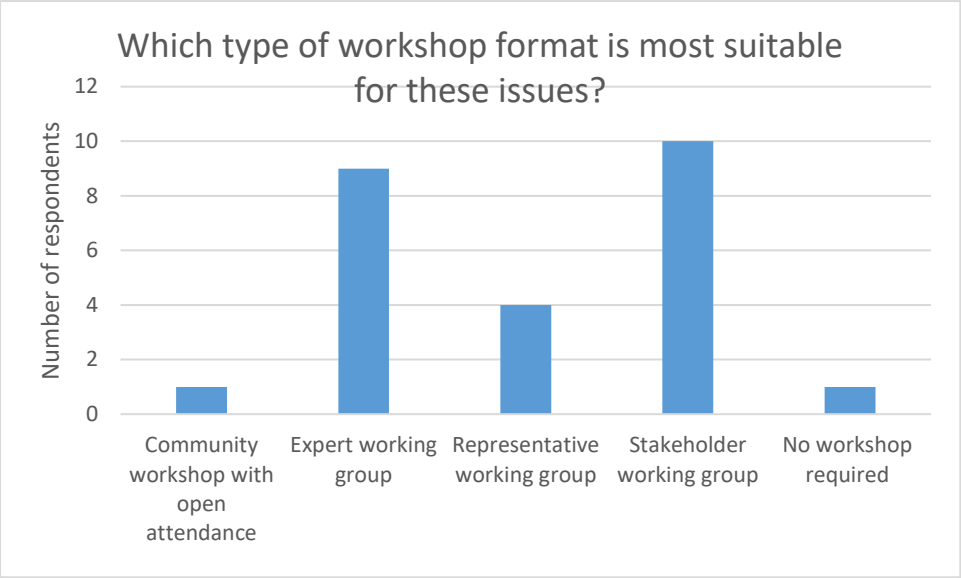
- *Workshop with landowners that have set a high industry standard*

Figure 13: How should decisions about individual mine site conversion to grazing be made

A key challenge that was identified through the interviews, and again in the workshops with stakeholders, was identifying which decisions about transferring land back to grazing could be made through planning and consultation processes, and which needed to be made with the individual(s) who would take over the land. The results of this question identified more support for individual landholder to have the greatest involvement. Some slight differences by respondent type were identified for this question. Landholders and miners preferred the option 'individual negotiations between mining companies and graziers', while the NRM representatives preferred the option 'workshops with regional stakeholders'. One other comment was:

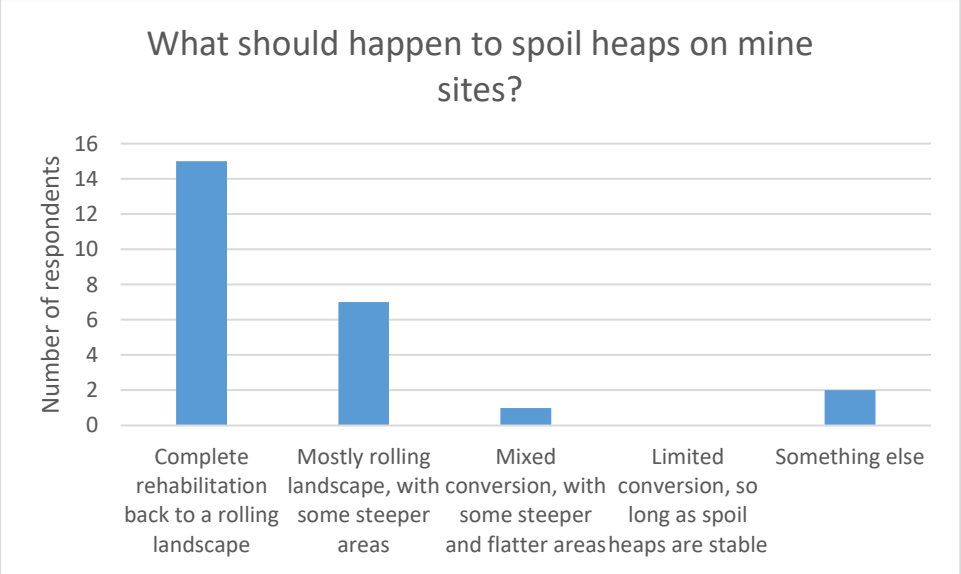
- *Immediate neighbours [should be consulted]*

Figure 14: What type of workshop formats are most suitable for post-mining land change issues



When asked about which type of workshop formation would be best suited to address the post-mining land use planning issues, the most supported types were a 'stakeholder working group' (where stakeholders are the people most likely to be affected by the relevant decisions), and the 'expert working group' (where experts are people who have particular expertise in relevant areas. The 'representative working group' (where members are representatives of key interests and organisations) received much lower support. The type of stakeholder had little influence on the choices made; landholders tended to support the 'expert working group' and mining stakeholders tended to support the 'stakeholder working group' model.

Figure 15: What should happen to spoil heaps on mines

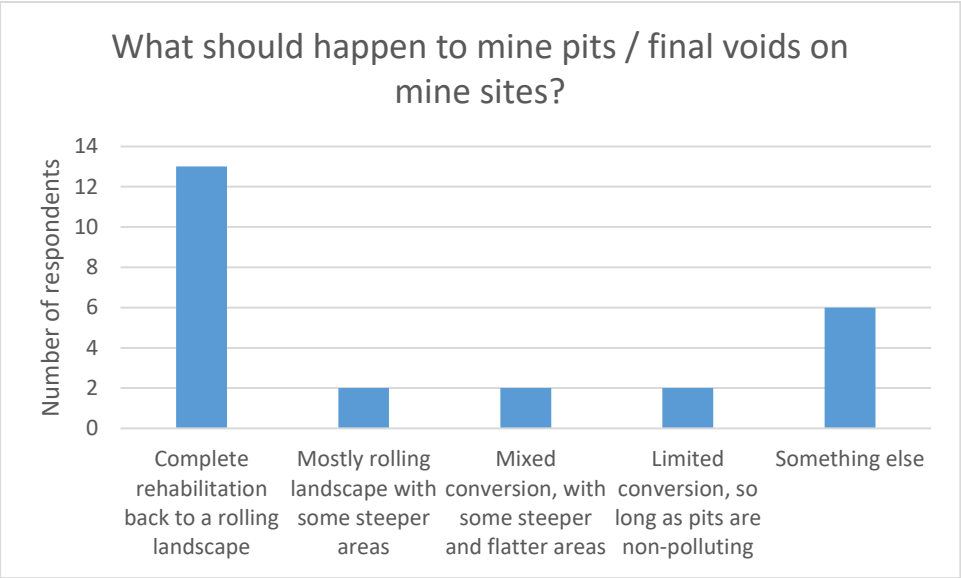


The choices made about rehabilitation of mine domains are closely linked with the subsequent suitability for grazing. Views on these issues are assessed with three questions (Figures 15 and 16). When asked what level of rehabilitation should happen with spoil heaps on mine sites, there was

very strong support for 'complete rehabilitation back to a rolling landscape' (i.e., no steep slopes left). This was the preferred outcome for all stakeholder groups except the mining stakeholders, who preferred 'mostly rolling landscape, with some steeper areas'. Another suggestion received was:

- *Ideally return to original appearance before mining.*

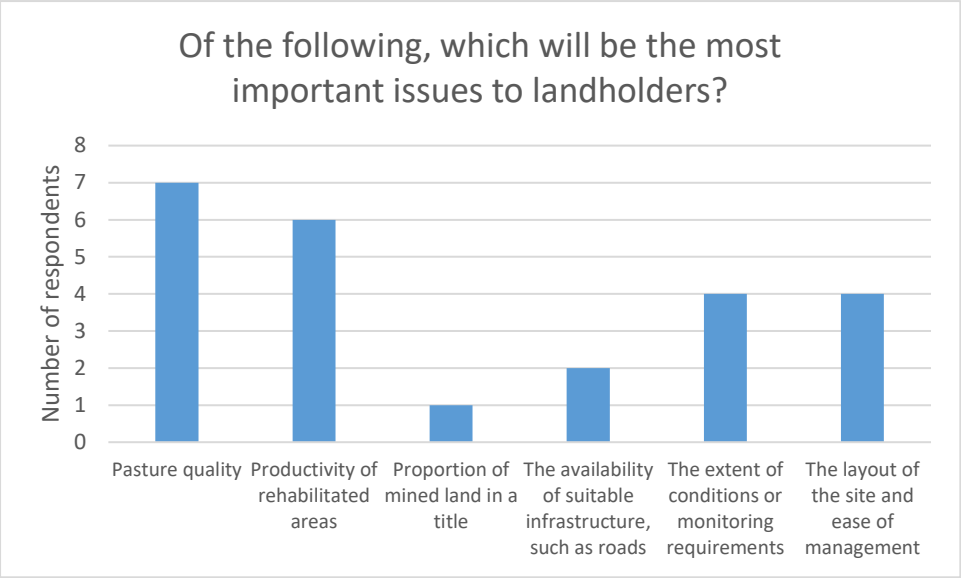
Figure 16: What should happen to mine pits and final voids



There were similar responses to the question about what standard of rehabilitation was required for final voids. More than 50% of participants wanted 'complete rehabilitation back to a rolling landscape', although there were some suggestions that the voids could be left for water storages. In a similar question about tailings dams, more than three-quarters of participants indicated that tailings dams should be fully rehabilitated. Other comments provided were:

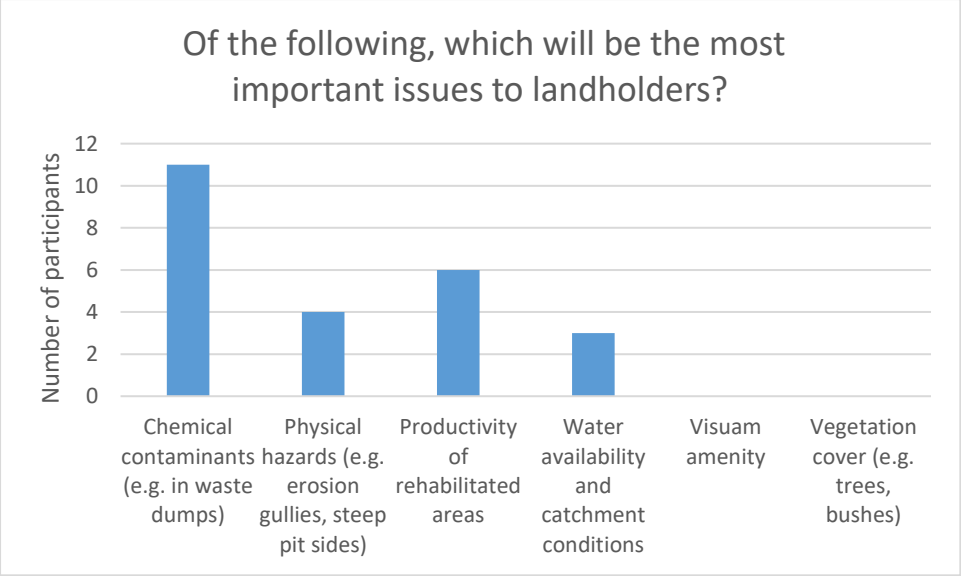
- *In strip open cut, final void [should be] left as a sediment trap, and water storage.*
- *Sealed, non-polluting and used as water storage*
- *Ideally return to original appearance before mining.*
- *As long as safe, stable and non-polluting*
- *Mixed conversion so long as pits are non-polluting*

Figure 17: What are the most important production and management issues for landholders



This question asked participants to identify from the options which would be the most important production and management issues for a landholder taking over previously mined land. The most important factors identified related to pasture production ('pasture quality' and 'production of rehabilitated areas'). These two categories were also the most relevant ones to the landholders and mining stakeholders.

Figure 18: What are the most important landscape and environmental issues for landholders



This question asked participants to identify from the options which would be the most important landscape and environmental issues for a landholder taking over previously mined land. Responses revealed that potential contaminants were the biggest issue of concern, outpolling the productivity aspects, which in turn were more important than physical hazards and water availability. The landholders and conservation stakeholders identified the potential for contaminants as the most

serious issue, while the mining stakeholders identified 'productivity of the rehabilitated areas' as the most important issue. A comment given by one stakeholder noted:

- *I think that the confining of the discussion to a grazing future predetermines the outcome, and doesn't allow for innovative ways of dealing with disturbed land.*

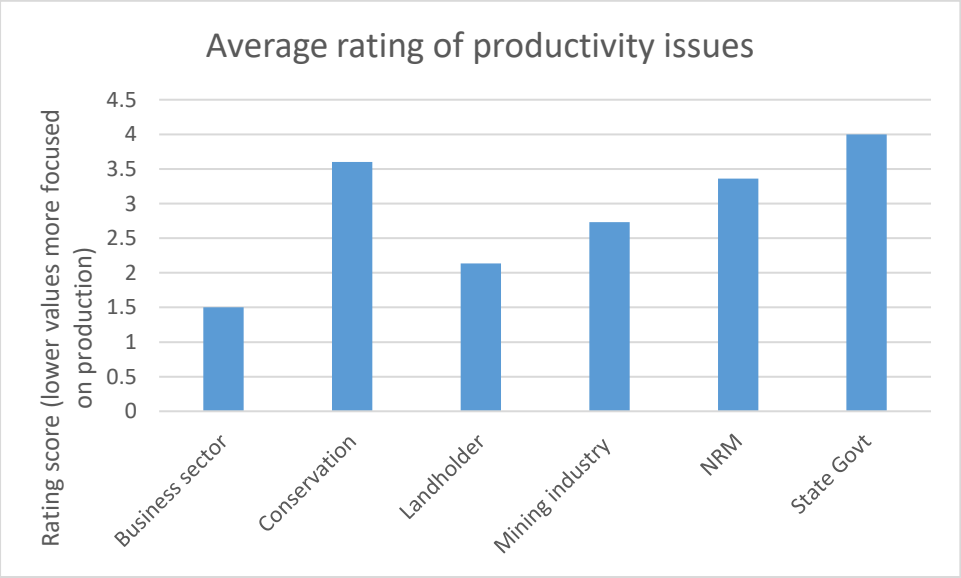
5. Testing differences in responses by sector

An important focus of this research was to determine if there were significant differences in the views on relevant issues across sector groups. Little indication of major or systematic differences could be identified from responses to individual questions. However, the small sample size (as expected from working with a stakeholder group) limits the ability to test this across questions. However, tests can be conducted by combining results of different questions.

Productivity issues

There were three questions on productivity-related issues in the study that have been pooled together, as responses were roughly ordered by tradeoffs between increasing productivity or other factors such as native vegetation and sustainability. The results in the figure below show that the differences in responses are limited, with the business sector placing most emphasis on productivity and the State Government sector placing the least emphasis.

Figure 19: Average rating of productivity questions by stakeholder groups



Statistical tests identified that approximately one-third of the comparisons between the sectors were significantly difference (ANOVA F test = 6.122, significance = 0.000). Tukey post-hoc tests identified significant differences in the responses between:

- Business and conservation sectors
- Business and NRM sectors
- Business and State Government sectors

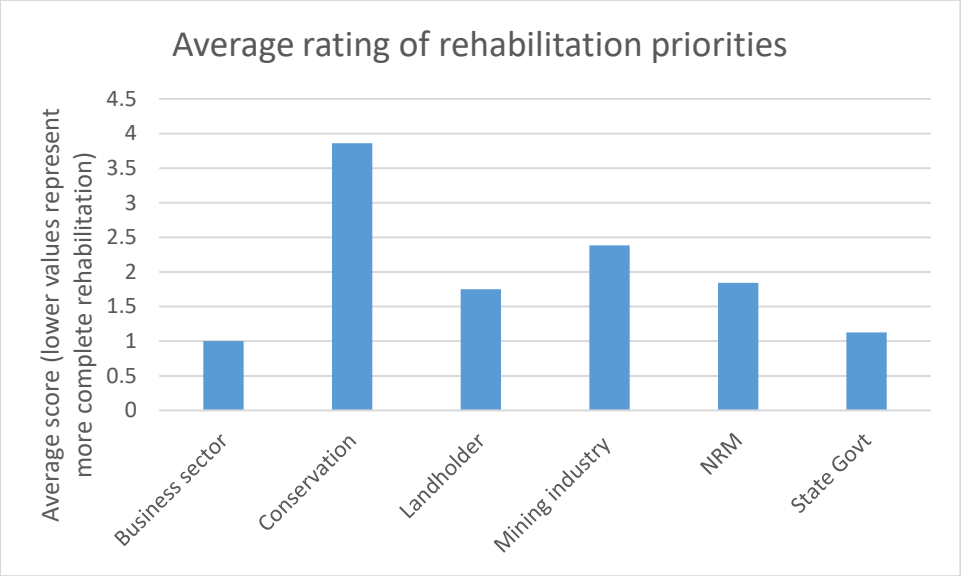
- Landholder and NRM sectors
- Landholder and State Government sectors.

There were no significant differences in responses between the mining sector and other sectors.

Rehabilitation issues

There were also three questions on rehabilitation priorities in the study that have been pooled together, as responses were roughly ordered by trade offs between maximum rehabilitation through to minimal rehabilitation. The results in figure 20 below show that the differences in responses are limited, with the conservation sector having very different responses to other sectors (members of this sector tended to emphasis 'other options' for rehabilitation goals). Responses from the other sectors appear to have some similarity (particularly the Landholder, Mining and NRM groups).

Figure 20: Average rating of rehabilitation priorities by stakeholder groups



Statistical tests identified that approximately one-third of the comparisons between the sectors were significantly difference (ANOVA F test = 4.475, significance = 0.002). Tukey post-hoc tests identified significant differences in the responses between:

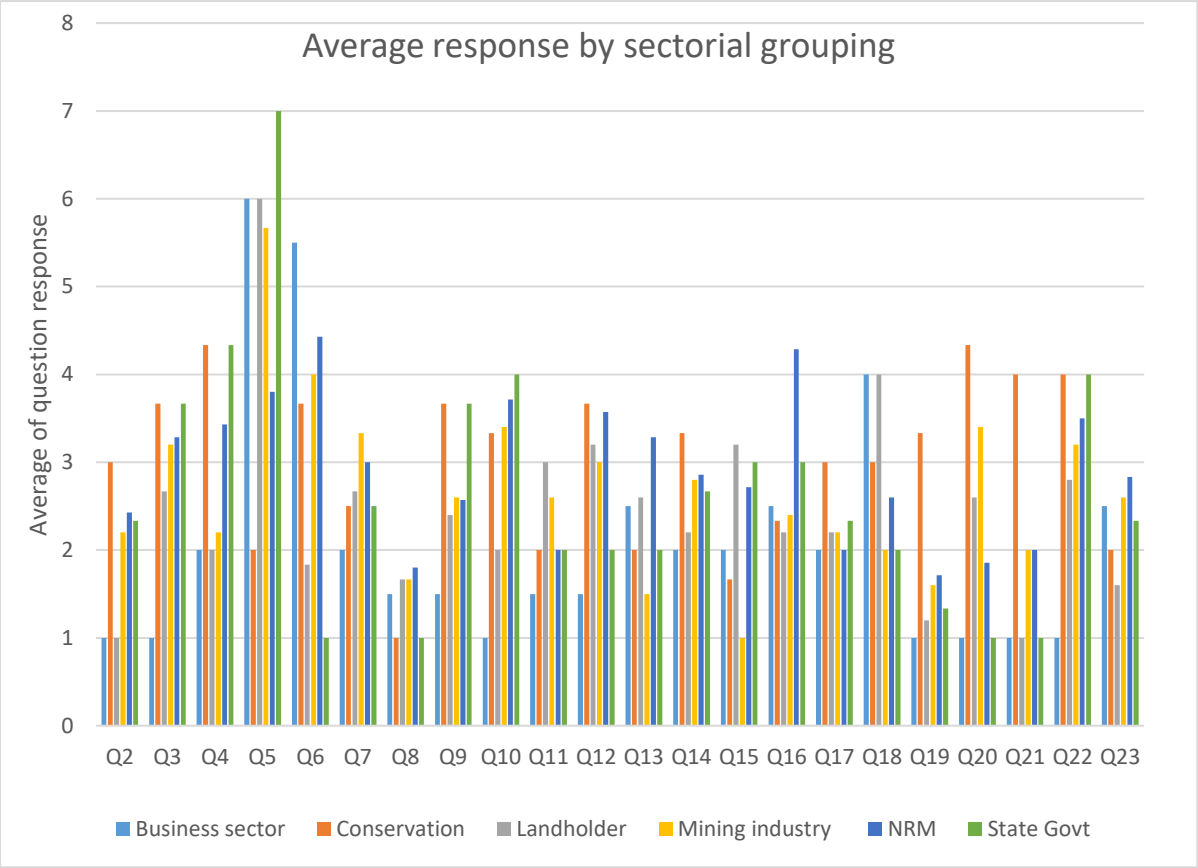
- Business and conservation sectors
- Conservation and landholder sectors
- Conservation and NRM sectors
- Conservation and State Government sectors

There were no significant differences in responses between the mining sector and other sectors.

Full survey

The same analysis can be extended to the full survey, covering both ordinal and nominal data, to identify if there are significant differences in responses across stakeholder groups. A summary of the average answer by sector is provided in the figure below.

Figure 21: Average rating of all questions by stakeholder groups



The data demonstrate that there is no systematic response pattern by stakeholder group (i.e., a particular sector does not always vote for a standard option). The largest variations in responses came from the Business sector and the Conservation sector, while the most consistent responses came from the State Government and Mining sectors. This latter result may simply reflect that these sectors are most familiar with the issues raised.

Statistical tests identified that approximately one-third of the comparisons between the sectors were significantly difference (ANOVA F test = 4.184, significance = 0.001). Tukey post-hoc tests identified significant differences in the responses between:

- Business and conservation sectors
- Business and NRM sectors
- Conservation and landholder sectors
- Landholder and NRM sectors

There were no significant differences in responses between the mining sector and other sectors.

6. Conclusions

The research reported here has generated three important outcomes. The first is that it has identified a number of the issues relevant to converting post-mining lands back to a sustainable land use. While the interviews with mining companies and state government agency staff had revealed some ambivalence about whether grazing or native vegetation conservation would be the major land use, the workshops with stakeholders clearly identified grazing as the preferred land use, with some bushland to be incorporated into grazing properties. A number of other important issues were raised about achieving the final land use change, including issues about managing environmental issues and the risks involved, issues that impact on the potential viability of the subsequent land use, and issues about the process and mechanisms achieve land use change.

The second key outcome is that the diversity of opinions about some of the key issues has been captured through survey data with 26 respondents involved in the workshops. These respondents have been drawn from a cross section of different sectors, including business, conservation, grazing, mining, NRM and state Government sectors. The results provide a guide to the diversity of opinion that might exist in a regional area on mining land-use change issues. This is important baseline information for planning an engagement and consultation processes. If there is no diversity of opinions, then no processes to generate engagement or consultation are required. Conversely, if there are very extreme and entrenched differences of opinion between stakeholders and stakeholder groups, then it will be very difficult to achieve consensus views.

The third key outcome is that the variation in opinion across stakeholder sectors has been tested from the survey data. The results show that there are no significant differences in opinion across the majority of the responses (approximately 73%), but there are some significant differences in opinion between some sectors. Across all survey data, significant differences in opinion were identified between the following sectors:

- Business and conservation sectors
- Business and NRM sectors
- Conservation and landholder sectors
- Landholder and NRM sectors

Significant differences in opinion between the conservation and NRM and conservation and state government sectors were also identified around mine rehabilitation goals, and between the business and state government and landholder and state government sectors over productivity issues. There were no significant differences identified between the mining and other sectors across the survey.

These results provide a very good baseline for more formal engagement and consultation processes, as they suggest that while there are differences of opinion on issues, they only occur for a sub-set of issues and do not apply consistently across stakeholders. The goal of an engagement process will be to negotiate shared agreements among stakeholder groups on these types of issues.

7. References

DEHP (Department of Environment and Heritage Protection). (2014). *Guideline. Resource Activities: Rehabilitation requirements for mining resource activities*. Brisbane: Queensland Government Retrieved from https://www.ehp.qld.gov.au/assets/documents/regulation/rs-gl-rehabilitation-requirements-mining.pdf.

Luyet, V., R. Schlaephfer, R.B. Parlange, and A. Buttler. 2012. A framework to implement Stakeholder participation in environmental projects. Jou*rnal of Environmental Management* 111: 213-219.

Maczkowiack, B., Slaughter, G. and Mulligan, D. 2007. *Integrating economics, social and biophysical factors to assess risks of grazing as a final end use for rehabilitated mine land in central Queensland*, Stage 1 and Stage 2 reports for ACARP Project C14053, Brisbane, Queensland.

Queensland Government, 2017. Better Mine Rehabilitation for Queensland: Discussion Paper, Queensland Government, Brisbane.

Owen, J. and Middlin, K. 2010. *Establishment of a stakeholder panel for land rehabilitation evaluation using visual assessment: Anglo Grosvenor project,* Centre for Social Responsibility in Mining, University of Queensland, Brisbane.

Raymond, C.M., L. Fazey, M.S. Reed, L. Stringer, G. Robinson, and A.C. Everly. 2010. Integrating local and scientific knowledge for environmental management. Journa*l of Environmental Management* 91: 1766-1777.

Reed, M.S. 2008. Stakeholder participation for environmental management: A literature review. *Biological Conservation* 141: 2417-2431.