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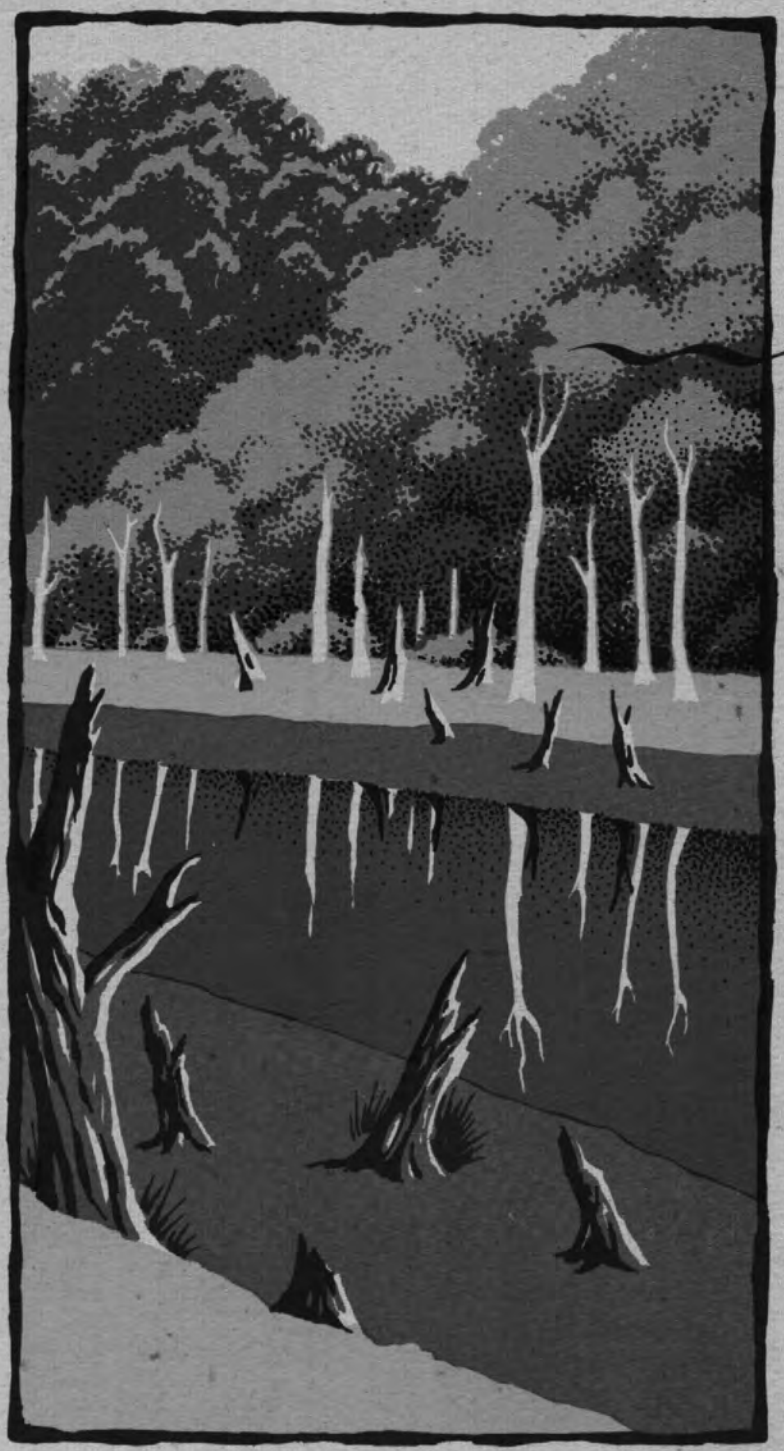

MOUNT LYELL REMEDIATION

Remediation options for tailings deposits in the King River and Macquarie Harbour

Christina Giudici, Andrew Scanlon, John Miedecke, Tim Duckett, Peter Burgess, Arthur Love, Ian Irvine, John Canterford & Peter Waggitt

Mount Lyell Remediation Research and Demonstration Program

a Tasmanian and Commonwealth Government initiative

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A joint program between the Supervising Scientist and the Department of Environment and Land Management, Tasmania.

This report describes research that is part of the Mt Lyell Remediation Research and Demonstration Program, a joint program between the Supervising Scientist and the Department of Environment and Land Management, Tasmania.

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Executive summary

The lower reaches of the King River contain approximately 100 million tonnes of overbank, river bottom and delta deposits consisting of tailings discharged by the Mount Lyell Mining and Railway Company since early this century. These discharges ceased in December 1994. The tailings deposits create a range of short and long term environmental problems.

The main problems associated with the tailings deposits are:

- the impact on water quality in the lower King River and Macquarie Harbour, and associated potential toxic effects on aquatic life, due to the continuing availability of high concentrations of metals and acid released from the tailings;
- reduced amenity for local residents and visitors due to the limitations placed on surrounding land use and activities in the lower King River and Macquarie Harbour; for example dust storms, and poor navigation through the delta area;
- poor aesthetics resulting from dead rainforest vegetation next to the river, tailings banks bare of vegetation and the large expanse of desert-like delta at the mouth of the King River. This issue is of particular significance considering the area's importance as a tourist destination.

Four possible strategies are available for dealing with the tailings deposits—do nothing, remove the tailings, treat or stabilise them on site, or some combination of removal and in situ treatment/stabilisation. The 'do nothing' option does not address any of the environmental problems created by the presence of the tailings and is not recommended. However, it is noted that other studies have demonstrated that the river bank and delta tailings deposits probably only contribute in the order of 1–5% of the metal loads and that priority should be given to the lease site for water quality objectives.

The other three strategies include a range of different options which are examined on the basis of feasibility, cost and degree of mitigation of environmental problems.

Removal of the tailings from the river banks and delta best addresses the on-going problem of poor water quality resulting from high levels of metals and acid. There are significant problems, however, with relocating the tailings to a secure area, and the sheer volume of material creates unacceptably high costs if all of the tailings are removed. Methods of removal or reducing the surface area of tailings include dredging, dynamic compaction and use of explosives.

Dredging is the most versatile of these methods; removal to a tailings dam or disposal on the floor of Macquarie Harbour are the two associated relocation options. The other methods lower or remove sections of the delta to adjacent deeper water in Macquarie Harbour. For river bank deposits removal strategies involve pushing parts or all of the bank into the river during high flow conditions. This would allow successful revegetation of the remaining bank areas. The problem of the removed tailings would be transferred further downstream where they would be removed or treated by strategies being employed on mitigating problems with the delta.

It is recommended that any dredging of the tailings on the delta remove approximately the top 1.5 metres. This would lower the dredged parts of the delta beneath low water level and greatly reduce the problems associated with oxidation and acid generation in the tailings. This process has a number of environmental risks that need careful management. Appropriate dredging technology, such as use of a cutter suction dredge and silt curtains around the dredged areas, will reduce these risks.

Disposal of dredged tailings to deeper areas in Macquarie Harbour is technically feasible and would be significantly cheaper than disposal to a purpose-built tailings dam. Both of these disposal options require more detailed assessment of the possible environmental impacts, particularly in relation to water quality. For harbour disposal these studies would include grain-size analysis, hydraulic testing, tidal current studies, elutriate testing for metal availability and ecological risk assessments. Additional studies prior to construction of a tailings dam would include environmental assessment of potential dam-sites and access routes, and detailed design investigations to ensure appropriate drainage characteristics of the tailings dam. Following construction and placement of tailings, rehabilitation would be required as well as on-going monitoring and possible treatment of leachate.

A range of options exist for treatment or stabilisation of tailings deposits. The volume and nature of the tailings make a number of these options unrealistic—both from a cost and technical perspective. These include various thermal and physical/chemical treatments such as vitrification, oxidation/reduction and solidification. Mineral reprocessing is a form of physical/chemical treatment that aims to extract any valuable metals from the tailings. On the basis of metal content, and technical and environmental problems associated with extraction, relocation and rehabilitation processes, this option is considered non-viable.

Stabilising the tailings by capping or covering with imported material requires significant engineering works to ensure its success. These and associated transport requirements result in costs of hundreds of millions of dollars and rule it out as a viable option. Likewise stabilising the tailings by diverting the King River away from the delta area is a very costly exercise with significant environmental risks and a high level of uncertainty in relation to mitigation of existing environmental problems. It can also be ruled out as an option.

A series of trials were conducted to investigate a range of revegetation techniques and their utility as a means of stabilising the tailings. These trials indicated that a combination of treatments, appropriate to local site characteristics, are likely to result in successful revegetation and stabilisation. Revegetation will mitigate, to a degree, all three environmental problems presently associated with the tailings. This is particularly the case in regard to aesthetics and amenity.

After consideration of all these options a combination of removal, relocation and revegetation is recommended as the most appropriate strategy for remediation of the tailings. Since there remains considerable uncertainty in the effects on water quality of the tailings as they exist today and as both the improvement of water quality in both the King River and within the harbour is one of the primary objectives of remediation, this information is critical to the final remediation strategy selected. If unacceptable effects on water quality are identified as a consequence of leaving the tailings in situ, there will be little alternative other than removal of tailings above the water table to prevent ongoing oxidation and metal load generation. Revegetation, while it can fulfil most of the remediation objectives considered in the study, is not expected to be effective in achieving marked improvement in water quality.

The recommended approach to remediation of the tailings deposits is to use a combination of the removal and relocation with revegetation of the tailings in situ. This enables the most suitable treatment to be applied to a given area, and takes account of the unique and variable characteristics of the deposits. The remediation can also be staged as funds become available and information from monitoring provides the necessary information on remediation needs and goals. Cost effective revegetation could be implemented quite rapidly and targeted where a high probability of success is likely. As the need is demonstrated, more costly remediation such as dredging and relocation could be considered.

The recommended treatment of river banks varies according to their characteristics. Options range from encouraging natural colonisation by fertiliser application, replanting with local wetland or rainforest species, excavation of tailings to create permanent wetlands, and removal of some tailings followed by capping with original levee bank material and revegetation. In order to encourage revegetation, surface stabilisation and shelter can be improved with short-lived exotic grasses, wind-proof fencing and/or the placement of tree branches and slash.

The delta has been divided into a number of zones according to the likely success of revegetation treatments. Progressive revegetation is recommended for the perimeter and other areas amenable to revegetation. Dredging of the top 1.5 metres is recommended for the rest of the delta area. This is regarded as the best option to improve water quality but will need to be done after further environmental studies, particularly in relation to relocation issues.

Cost estimates for the recommended strategies are approximately $600,000 for the river banks, $400,000 to $1.9 million for various revegetation options for the delta, and $15 million to $30 million dollars for dredging and relocation of delta tailings.

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