



Tiwest Pty Ltd

**Cooljarloo Mine: Falcon Extension
M790**

Year 2 Performance Review

2009-2010



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1. INTRODUCTION

This report reviews the performance outcomes of environmental management conducted in accordance with Ministerial Statement 790 and associated Proponent Management Commitments during 2009 and 2010. This specifically relates to the Tiwest Cooljarloo Mine Falcon Extension, a minor extension of the dry mining operations at the Cooljarloo Mining lease (ML 268SA). In doing so it seeks to fulfil Ministerial Conditions M5.1 and M5.2 as stated below.

790:M5.1 The proponent shall submit to the CEO of the Department of Environment and Conservation Performance Review Reports at the conclusion of the second and fourth years after the start of productive mining and then, at such intervals as the CEO of the Department of Environment and Conservation may regard as reasonable, which addresses:

- 1. the major environmental risks and impacts; the performance objectives, standards and criteria related to these; the success of risk reduction/impact mitigation measures and results of monitoring related to the management of the major risks and impacts;*
- 2. the level of progress in the achievement of sound environmental performance, including industry benchmarking, and the use of best available technology where practicable; and*
- 3. significant improvements gained in environmental management which could be applied to this and other similar projects.*

790:M5.2 The proponent shall make the performance review reports required by condition 5-1 publicly available in a manner approved by the CEO of the Department of Environment and Conservation



1.1 PROJECT DESCRIPTION

Tiwest Cooljarloo Mine Site

Tenement M268SA
Brand Highway
DANDARAGAN WA 6507

The Cooljarloo Mining Lease (ML 268SA) encompasses the Tiwest owned Mullering Farm and unallocated Crown Land (Figure 1), as granted in accordance with the *Mineral Sands (Cooljarloo) Mining and Mineral Processing State Agreement Act 1988*.

The lease is located approximately 12 kilometres north of Cataby on the Brand Highway. The lease is approximately 9,000 hectares comprising of Mullering farm (1,026 hectares), third party freehold land (42 hectares) and the remainder unallocated Crown Land. The Falcon Extension lies within the north western most extremity of M268SA. It encompasses the 25,000 and Lone orebodies, and minor portions of the 13,000 orebody as shown in Figure 2.

The ore bodies at Cooljarloo are dredge mined and dry mined in the northern area of the lease. The Falcon Extension is exclusively dry mined.

Cooljarloo is certified to the ISO 14001:2004 Standard for Environmental Management Systems. This system ensures that continual improvement in environmental performance is driven by the sequential setting and achievement of performance targets. Performance targets are set annually by the Senior Management team to:

- improve previous performance;
- meet environment and community relations policy commitments;
- meet legal requirements; and
- mitigate significant environmental and community relations risks.

1.2 KEY FACTORS AND ASSOCIATED RISKS

EPA Report 1299 set out EPA's findings regarding the environmental effects of the Falcon Mining proposal. This found that, in the EPA's opinion, the following key environmental factors were relevant to the proposal and required evaluation:

- (a) Flora and Vegetation
- (b) Groundwater
- (c) Rehabilitation and Closure

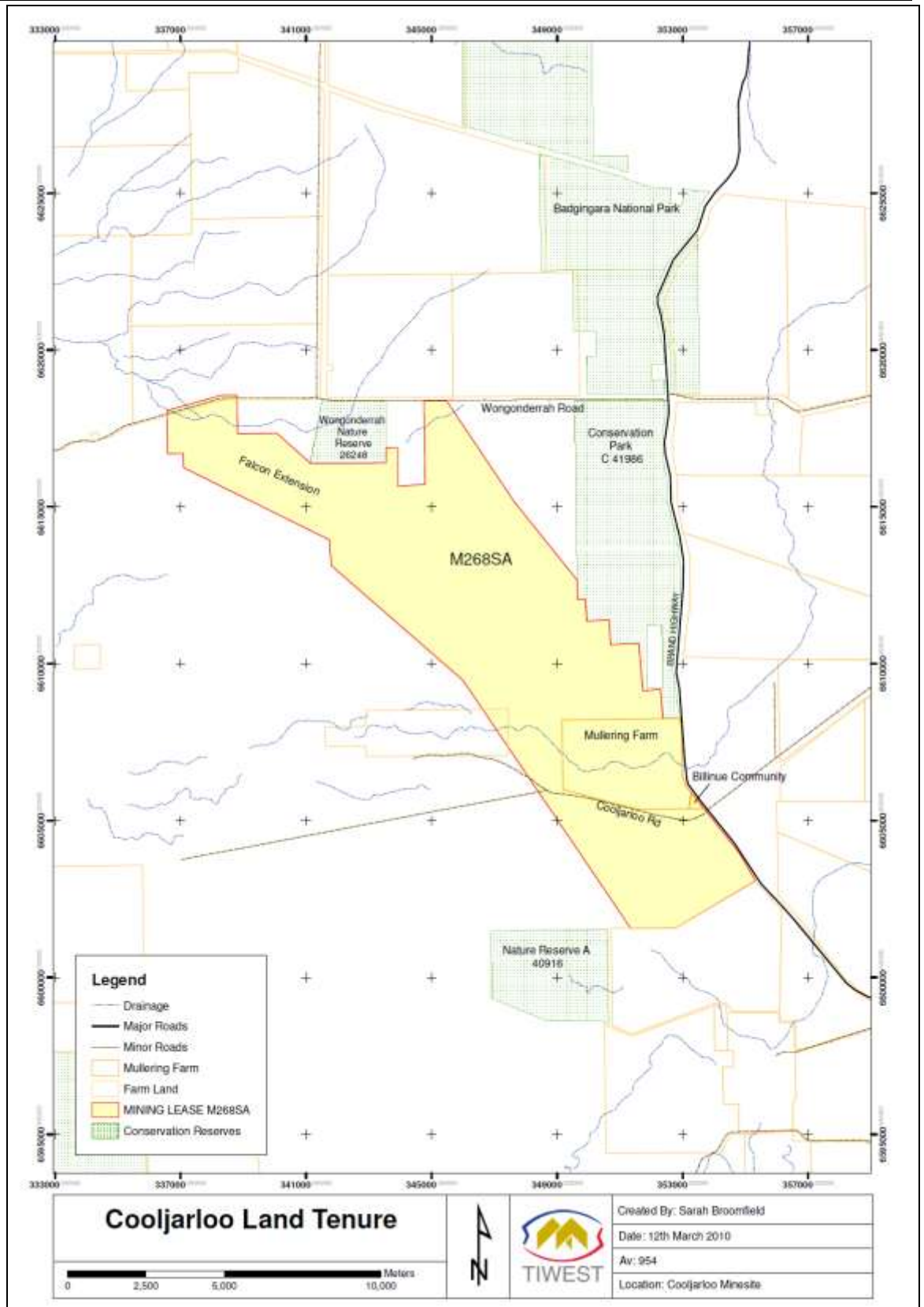


Figure 1: Cooljarloo Mine Location

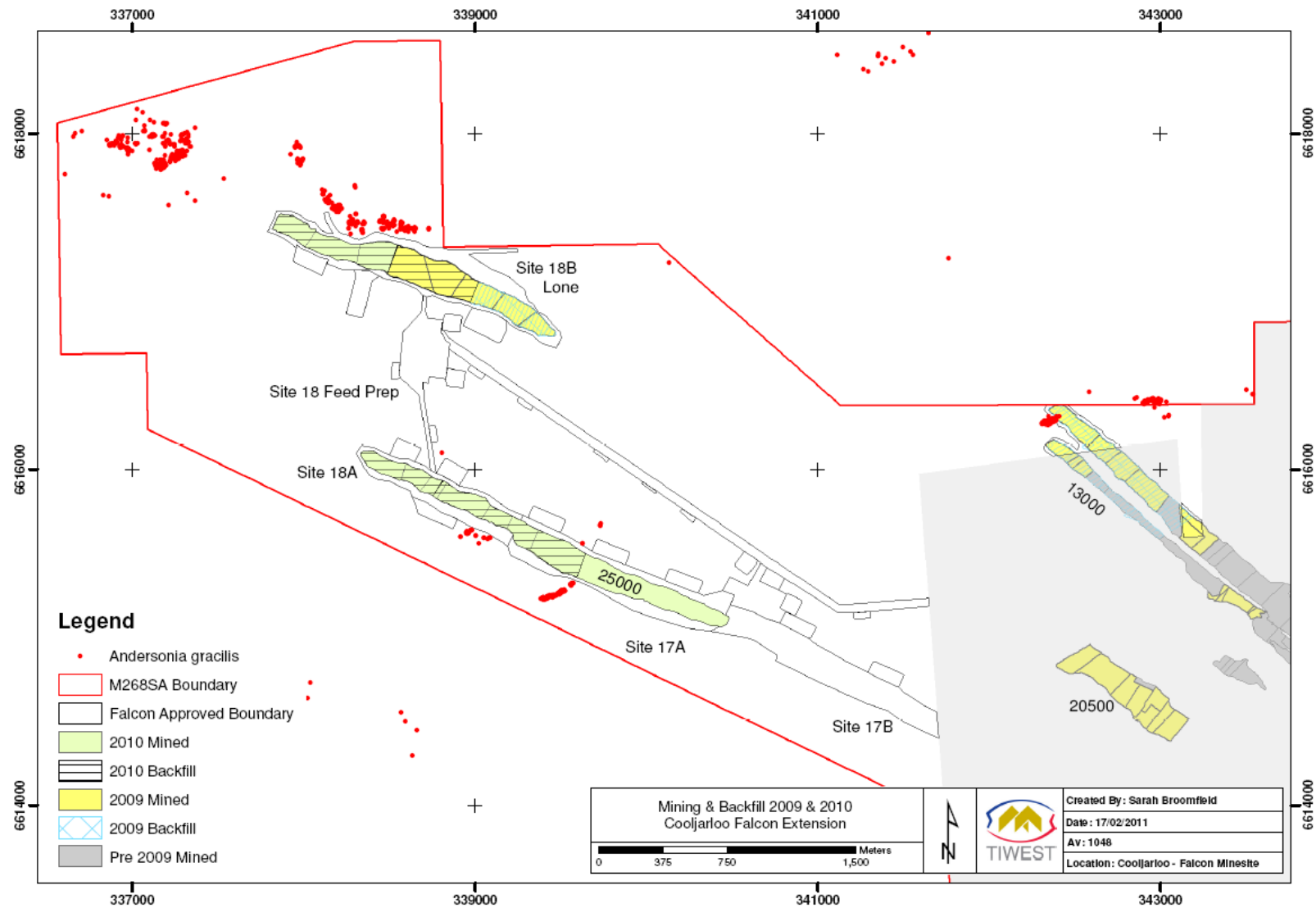


Figure 2: Falcon Orebodies and Progress as at End of 2010



PROJECT STATUS

The Falcon Extension received environmental approvals during March 2009. Mining (removal of ore) within portions of the 13000 orebody within the Falcon Extension area commenced during May 2009. Since this time mining and backfill has been completed in the Lone and segments of the 13000 deposits, and mining has progressed through the north western half of the 25000 orebody. Backfill of the 25000 orebody has commenced. Areas of the 13000 and Lone deposits have been rehabilitated. Progress in mining and backfill is also shown in Figure 2.

Mining is expected to be completed in the 25000 deposit during the first half of 2011. Backfill, landforming and rehabilitation of the remaining disturbed areas will follow.



3. PERFORMANCE REVIEW

This section (3) provides commentary on environmental management performance as required under M790:5-1.

Detailed commentary regarding the management of the key risks as identified in EPA Report 1299 is provided in the Tables within Section 3.1 to 3.3. These address:

- Management of major environmental risks
- Level of progress in achieving sound environmental performance
- Significant improvements gained in environmental management

This report compliments information provided in the annual Falcon Environmental Compliance and Monitoring Reports (Tiwest 2010, 2010a, 2011 and 2011a) and site wide Annual and Triennial Environmental Reports (Tiwest 2010b and 2011b).

In general, environmental management measures have been implemented in accordance with the proposal documentation. Key areas of success include:

- Tiwest has maintained an ISO14001 certified Environmental Management System throughout implementation of this proposal. External audits are conducted annually and no major non-conformances have been noted during 2009 and 2010.
- Groundwater drawdown and vegetation impacts associated with the Falcon Proposal have been less than predicted in the EPS and associated technical studies. This is primarily attributed to the significant ongoing efforts made in implementing mitigation measures by Tiwest. In addition it is recognised that the drawdown modelling and ecological risk assessment overestimated the risk of vegetation impact.
- Ongoing investigation into the response of vegetation to groundwater drawdown including post impact recovery and fire response.
- The ongoing application of management hierarchy during mine plan refinement allowed the majority of *Andersonia gracilis* populations to be avoided.
- Continued significant contributions into the development of measures for the detection, containment and treatments of *Phytophthora Dieback*.



3.1 Flora and vegetation

- Protect DRF, Priority flora and other species of conservation significance, consistent with the provisions of the *Wildlife Conservation Act 1950*.
- Maintain the species abundance, diversity, geographic distribution and productivity of floristic communities.

Risks	Management Methods	Key Outcomes	Initiatives and Improvements
<p>Mine Clearing</p> <ul style="list-style-type: none"> • Populations of DRF and other conservation significant flora located within and adjacent to the mine footprint. 	<ul style="list-style-type: none"> • Limit Clearing to 185ha • Avoid removal of whole populations of <i>A. gracilis</i>. • Restore portions of <i>A. gracilis</i> populations through topsoil translocation. • Rehabilitation of all areas disturbed. • Return of conservation significant flora in rehabilitation. 	<p>Actual mine clearing impacts to this species were lower than predicted in the EPS as a result of changes to the mine plan – only one of four populations of <i>A. gracilis</i> was disturbed during mining. Topsoil removed from the population disturbed was stockpiled separately and return to the same area post backfill within 12 mths of stripping. Seed has also been collected from <i>A. gracilis</i> for investigative and rehabilitation purposes.</p> <p>Management of other conservation species has followed the approach taken for <i>A. gracilis</i>. In the first instance, where avoidable, individuals have been avoided during the mine planning phase. Where unavoidable, their return in rehabilitation will be tracked. Return in rehabilitation is being attempted through targeted topsoil handling and placement.</p> <p>Results regarding return of <i>A. gracilis</i> and other conservation significant species in rehabilitation are not yet available as rehabilitation is either too young or not yet complete.</p>	<p>Tiwest, in association with the WA Herbarium and University of Western Australia, has supported detailed study into:</p> <ul style="list-style-type: none"> • <i>Isopogon sp. Badgingarra</i> (complete) • <i>Acacia saligna</i> subsp. <i>O'sullivaniana</i> (complete) • <i>Grevillea thelemanniana</i> subsp. Cooljarloo (in progress) <p>This work appears to have been an efficient and effective method of improving knowledge regarding these conservation significant species.</p>
<p>Groundwater Drawdown</p> <ul style="list-style-type: none"> • Potential impacts to phreatophytic vegetation within mine dewatering related zones of drawdown. • DRF within close proximity. • Thirteen priority species within close proximity. • No impacts to Wongonderrah NR expected. 	<ul style="list-style-type: none"> • Quarterly assessment of vegetation health. • Time dewatering within the impact risk zone with winter to reduce risk of vegetation stress. • Cessation of activities if monitoring indicates excessive drawdown. • Artificial recharge of aquifers if drawdown causes stress on vegetation. • Monitoring vegetation to ensure a return to pre-impact composition. 	<p>Drawdown in the superficial aquifer resulting from mine dewatering via in-pits sumps is managed to minimise impact on groundwater dependant ecology, most notably vegetation.</p> <p>In implementing the Falcon Proposal, thresholds for drawdown set out within the ministerial conditions were exceeded. However, drawdown has not been excessive and little impact to vegetation and no impact to conservation significant species has been observed. This is mainly the result of: the thresholds being incorrect (as described in Tiwest 2010 and 2011); active management of drawdown by Tiwest; and the framework for setting the thresholds being ecologically conservative (overestimating the likelihood of a moderate or greater impact occurring).</p> <p>Furthermore, actual drawdown has remained less than that predicted by the groundwater modelling that was undertaken as part of the impact assessment. This is considered to be due to the model over estimating drawdown and the positive impact of efforts made to reduce drawdown. Tiwest's approach of applying adaptive management in addressing drawdown appears to have been effective. This approach was described in the management plan presented with the EPS (Tiwest 2008).</p> <p>In practice, Tiwest has mainly relied on the modification of water handling practices and to a lesser extent, mining/backfill sequence. Water handling offers significantly greater flexibility and response times than modification of mining location or sequence. The linear nature of the deposits, make relocation of mining activities a higher cost, lower effective outcome option.</p>	<p>Vegetation monitoring plots have been established in areas displaying water stress that are outside the Falcon extension area. This will collect information to contribute to the understanding of the response of vegetation post stress events. Furthermore, in consultation with regional DEC, some of these areas have been subject to controlled burns to determine if fire has a significant bearing on the timing and extent of recovery. Results from these investigations are expected in coming years.</p> <p>Tiwest continue to consult with relevant experts (e.g. Dr Ray Freund) regarding refining the management of drawdown related risks.</p>
<p>Weeds and <i>Phytophthora cinnamomi</i></p> <ul style="list-style-type: none"> • Mining activities could increase weeds and introduce <i>Phytophthora cinnamomi</i>. 	<ul style="list-style-type: none"> • Restrict vehicles to established roads. • Vehicle washdown facilities. 	<p>Equipment hygiene and site access has been controlled in accordance with Tiwest Dieback Management Plan. This was revised during 2008/9 in response to the identification of a <i>P. cinnamomi</i> infestation in the wider tenement area (some kilometres southeast of the Falcon extension). Some minor breaches of hygiene practices have occurred and been reported in internal incident reporting systems. These generally relating to failure to stop in the automatic wash station or unauthorised access to the tenement.</p> <p>Site wide monitoring of P.c. status via risk based sampling and interpretation has not identified any additional infestation and none within the Falcon Extension Area.</p> <p>A baseline assessment of weed densities within the Falcon area was completed during 2008/9 to provide reference information for rehabilitation. This will be considered in setting rehabilitation criteria in accordance with M790:8-3.1(3).</p> <p>Preliminary early establishment monitoring of rehabilitation completed to date indicates weed levels are in line with expectations.</p>	<p>Tiwest support consultation, development and research into the management of P.c Dieback. Within the tenement area main activities are centred on the management of the identified infestation and include collaboration with CPSM on containment and eradication activities.</p> <p>Support of other <i>Phytophthora</i> activities provided by Tiwest includes:</p> <ul style="list-style-type: none"> • MERIWA Project M399: Susceptibility to <i>Phytophthora cinnamomi</i> and Sensitivity to Phosphate in Native Australian Plants: Why are they Linked? Currently in Yr 2 of a 5 yr programme. • Other minor projects with CPSM, Curtin

Risks	Management Methods	Key Outcomes	Initiatives and Improvements
			<p>(Elaine Davidson).</p> <ul style="list-style-type: none"> • Collaboration via the Dieback Consultation Council/Northern Sandplains Dieback Working Party networks. • Research into containment and eradication measures in association with CPSM within the mine lease. • Sponsorship and attendance of Dieback Information Group annual conference. • Investigation into the use of remote sensing and aerial photography to aid in field interpretation, sampling and diagnosis over large area in collaboration with Glevan Consulting.
<p>Dust</p> <ul style="list-style-type: none"> • Proposed mining activities have the potential to generate excessive dust which could have detrimental impacts on flora and vegetation. 	<ul style="list-style-type: none"> • Implementation of Dust management measures as per Part V licence. 	<p>Management of dust has been managed in accordance with the management plan (refer to Attachment 3 of the Cooljarloo Site Environmental Licence L5319/1988/10) and monitoring results suggest that this is effective. All Falcon sites remain below the internal target (for lease boundary) of <math><10\text{g}/\text{m}^2/\text{mth}</math> measured at depositional gauges. Topsoil stripping and placement have been occasionally halted due to high wind conditions.</p>	<p>Investigation into alternative methods and materials to be used in site stabilisation (especially rehabilitation) is ongoing. To date, mulch, oats cover crop and slimes (clay tailings) have proven effective for different applications. Other polymer based chemical stabilisers have generally demonstrated limited success for general site stabilisation.</p>



3.2 Groundwater

EPA Objectives

- maintain the quality and quantity of groundwater so that existing and potential uses, including ecosystem maintenance are protected.

Summary of Outcomes

Risks	Management Methods	Key Outcomes	Initiatives and Improvements
<p>Acid Sulphate Soils</p> <ul style="list-style-type: none"> • Proposed dewatering and mining activities could expose acid sulphate soils (ASS) to oxidising conditions and cause groundwater contamination through the leaching of acidic material. 	<ul style="list-style-type: none"> • Plan pit limits to avoid basement lithological units which are characterised by black colour and increasing clay content. • Return such materials that are within the saturated zone to a similar depth during landform reconstruction. • Monthly monitoring of groundwater quality in piezometers adjacent to active mining areas and in pit water. Monitoring would continue for at least 3 months post backfilling. • Management actions such as capping, blending, relocation or neutralisation of ASS to mitigate impacts if unearthed. 	<p>To date no materials considered potentially acid forming have been encountered. Similarly, groundwater drawdown has remained above levels known to contained potentially acid forming materials.</p> <p>Discussions of management outcomes for drawdown management in general are provided in Flora and Vegetation (Section 3.1).</p> <p>Groundwater quality monitoring has noted some minor changes in key parameters but all are considered within general expected ranges.</p> <p>No ASS ameliorative management actions have been required to date.</p>	<p>Nil to report.</p>

3.3 Rehabilitation and Closure

Rehabilitation and Closure

- ensure that closure and rehabilitation achieves stable, non-polluting functioning landforms which are consistent with the surrounding landscapes and other environmental values; and
- ensure that self-sustaining native vegetation communities are returned after mining, which, in species composition and ecological function are close as possible to naturally occurring analogue sites.

Risks	Management Methods	Key Outcomes	Initiatives and Improvements
<p>Failure of rehabilitation to meet expected outcomes (i.e. rehabilitation objectives).</p>	<ul style="list-style-type: none"> • Progressive mine void backfill and rehabilitation of mine disturbance. • Topsoil management practices. • Seeding, mulching and stabilisation practices. • Selective stripping, handling and placement of landforming resources to ensure return of appropriate soil profiles and landforms. • Targeted return of DRF and other conservation significant species. • Selective stripping, handling and storage of rehabilitation resources including topsoil, seed and mulch. • Monitoring of rehabilitation outcomes • Ongoing development of rehabilitation criteria, methods and practices via continuous improvement processes. 	<p>Progressive rehabilitation has commenced. Landform reconstruction is being undertaken in accordance with the plan and recorded via rehabilitation signoff records.</p> <p>Handling of rehabilitation resources is in accordance with plan and recorded via rehabilitation signoff records.</p> <p>Tiwest revisited baseline rehabilitation data (reference plots) during 2008/9. This included expansion of the dataset to encompass the Falcon Extension.</p> <p>From 2008 to date Tiwest has been consulting with the Minerals Sands Agreement Rehabilitation Coordinating Committee regarding the revision/finalisation of completion criteria. Further detail is provided in initiatives and Improvement columns.</p> <p>All rehabilitation is as yet either not sufficiently developed or not yet completed and thereby is unable to support any performance analysis.</p>	<p>During 2008 Tiwest sought to redraft completion criteria for the Cooljarloo Minesite. This process involved and initial review of rehabilitation processes and proposed a framework for the development of the criteria (the Woodman Nichols Review referred to in M790.8-6). Tiwest then held a workshop with key regulators (MSARCC members) and other stakeholders to consult on the rehabilitation criteria. From the outcomes of this consultation, criteria were then drafted and circulated for discussion. Shortly thereafter Tiwest also completed and circulated a detailed review of existing rehabilitation performance. During 2011 Tiwest circulated a draft Improvement Plan setting out all improvement activities planning in the area of rehabilitation for the coming 5 yrs.</p> <p>Throughout this process Tiwest has consulted with key technical experts on soils, flora and fauna and hydrology as well as rehabilitation techniques. Tiwest also maintains an active information exchange with Iluka Pty Ltd regarding rehabilitation and environmental management practices in general.</p>



4. REFERENCES

- EPA 2008: *Cooljarloo Mine – Falcon Extension Tiwest Pty Ltd Report and recommendations of the Environmental Protection Authority*. EPA Report 1299 August 2008.
- Tiwest 2008, *Cooljarloo Mine (M268SA) Falcon Extension Environmental Protection Statement, (EPS)*. Unpublished report by Tiwest Pty Ltd.
- Tiwest 2010, *Cooljarloo Mine Falcon Extension:M790 Compliance Report 2009*. Unpublished report by Tiwest Pty Ltd.
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- Tiwest 2011: *Cooljarloo Mine Falcon Extension:M790 Environmental Monitoring Report 2010*. Unpublished report by Tiwest Pty Ltd.
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