25 REHABILITATION AND DECOMMISSIONING

25.1 INTRODUCTION

This chapter describes the strategies and methods for progressive and final rehabilitation of areas disturbed by mining and associated infrastructure activities, expected final landforms and the proposed final land uses. The chapter also describes the decommissioning plan and preferred rehabilitation strategy for the mine, as well as the gas supply pipeline.

Whilst general information regarding rehabilitation and decommissioning is provided in this chapter, specific rehabilitation and decommissioning measures to avoid or minimise any impacts will be identified in the Wandoan Coal Project (the Project) Environmental Authority, supporting regulatory documents (Environmental Management (EM) Plan and Plan of Operations), and Mine Closure Plan.

25.2 GAS SUPPLY PIPELINE

As soon as practicable following completion of construction, the underground gas pipeline easement will be rehabilitated in accordance with the pre-existing landform, and if necessary, appropriate erosion control measures will be installed. Topsoil will be respread and the stockpiled vegetation will be reapplied. If necessary, seed may also be sown to assist with revegetation.

25.3 MINE CLOSURE OBJECTIVES

The overriding mine close objective for the WJV is “to attain operationally and economically feasible closure while taking into account community priorities, environmental aspects and sustainability of not only the rehabilitation but the final land use” (Xstrata Coal 2008 p13).

In keeping with the objective of ecologically sustainable development (ESD) as required by the *Environmental Protection Act 1994* (EP Act), the fundamental objective of mine closure is to attain operationally and economically feasible closure while taking into account community priorities, environmental requirements and sustainability of not only the rehabilitation, but of the final land use.

Rehabilitation and decommissioning strategies will be implemented to ensure that Project areas which have been mined, affected by mining operations and/or affected by activities ancillary to mining operations are left:

a) tidy and safe, with public safety risks reduced to acceptable levels

b) with final landforms that are stable and resistant to erosive processes

c) suitable for the post-mining land uses agreed with relevant government agencies

d) within the limits of appropriate and agreed levels of contamination

e) in a condition which satisfies community, agency and landowners expectations

f) in a condition that meets the agreed discharge licence conditions

g) where required, with a site specific acceptable Site Management Plan in place

h) in compliance with all EM Plan and Plan of Operation commitments.

Further to the information presented here, the WJV will, when necessary, prepare a Mine Closure Plan which will list the specific operational activities required to be undertaken in order to complete rehabilitation and decommissioning of the Project.

25.4 REHABILITATION

Xstrata Coal Pty Ltd is a signatory to 'Enduring Value — the Australian Minerals Industry Framework for Sustainable Development' (Enduring Value). Element 6.3 of Enduring Value states 'Rehabilitate land disturbed or occupied by operations in accordance with appropriate post-mining land uses'.

Progressive rehabilitation will be undertaken in accordance with Xstrata Coal's Mine Rehabilitation Review Procedure (HSEC STD10.2), which has the purpose to ensure all Xstrata Coal mines have suitable rehabilitation practices and are making progress regarding these practices.

Final rehabilitation and decommissioning of the mine will be undertaken in accordance with Xstrata Coal's Mine Closure Planning Policy (HSEC STD3.1)

The following sections provide the general rehabilitation goals, objectives and strategies of the Project rehabilitation strategy, and have been developed with consideration given to the EPA's *Guideline 18 Rehabilitation requirement for mining projects* (EPA 2007) (Guideline 18) and *Leading practice sustainable development program for the mining industry: Mine Rehabilitation* (Commonwealth Department of Industry, Tourism and Resources 2006).

The indicative Year 30 landform is shown and discussed in Chapter 6 and illustrates areas of proposed final landform and some other areas still under mining which when complete will meet final landform criteria.

25.4.1 REHABILITATION HIERARCHY

The Environmental Protection Agency (EPA) has developed a rehabilitation hierarchy, similar to the waste management hierarchy (EPA 2008). The rehabilitation hierarchy, in order of decreasing capacity to prevent or minimise environmental harm is:

1. Avoid disturbance that will require rehabilitation.
2. Reinstate a 'natural' ecosystem as similar as possible to the original ecosystem (where the project is occurring on previously natural vegetated land).
3. Develop an alternative outcome with a higher economic value than the previous land use.
4. Reinstate the previous land use (e.g. grazing or cropping).
5. Develop lower value land use.

6. Leave the site in an unusable condition or with a potential to generate future pollution of adversely affect environmental values.

Generally, strategies lower on the list will have a higher risk of causing environmental harm after the mine closes. However, a 'lower value' land use may be more sustainable in preventing off-site impacts.

25.4.2 REHABILITATION GOALS

The four general rehabilitation goals of Guideline 18 are rehabilitation of areas disturbed my mining to result in sites that are:

- safe to humans and wildlife
- non-polluting
- stable
- able to sustain an agreed post mining land use.

In addition to these general goals, the Project rehabilitation strategy will be guided by Xstrata Coal's aim that rehabilitation practices achieve leading industry practice and are of an appropriate standard to ensure that post mine land use objectives meet regulatory and other stakeholder expectations.

25.4.3 REHABILITATION OBJECTIVES

The objectives for rehabilitation throughout the construction, operational and decommissioning phases of the Project are to:

- return the land to a post-mine land use that will be stable, self-sustaining and require minimal maintenance
- create stable landforms with rates of soil erosion not exceeding the pre-mine conditions
- maintain downstream water quality, during the construction, operational and post operation phases of the project.

25.4.4 REHABILITATION INDICATORS

In order to ensure that the objectives of mine closure, decommissioning and rehabilitation (both progressive and final) are achieved, it is important to set criteria or indicators which, once achieved, demonstrate that decommissioning and rehabilitation strategies have been undertaken successfully and that respective objectives have been achieved.

The EM Plan and Plan of Operations will establish in detail, indicators which will demonstrate the successful completion of the closure process and provide timeframes within which completion is to be achieved. Indicative performance indicators for rehabilitation are included in (but not limited to) Table 25-1.

Successful mine closure, decommissioning and rehabilitation occurs when conditions within the Project area meet the pre-determined performance indicators to the satisfaction of regulatory authorities and tenement relinquishment is obtained.

25.4.5 COMPLETION CRITERIA

The ultimate aim of the defined objectives is to create sustainable landforms that "require no more resources to maintain than a similar landuse in an area that has not been mined". (Environmental Protection Agency 2004).

Rehabilitation success is defined as the achievement of objectives set out in Section 25.4.3, based on the indicators above. Completion criteria are used to define the successful rehabilitation, and relate specifically to the environmental, social and economic context of the Project site.

Completion criteria will be developed in consultation with landowners, indigenous groups, community groups and State departments closer to the time of mine closure and presented in a Final Rehabilitation Plan. The completion criteria will be based on field trials and monitoring program findings, industry research and the standards of the day, which will be at least equitable to current completion standards.

25.4.6 REHABILITATION ACTION PLANS

Progressive rehabilitation of worked areas will be undertaken within two years of becoming available or as soon as practicable thereafter.

Details of the final design for each domain are dependent of the geology, groundwater and surface water hydrology and ecology of the site, as discussed in Chapter 9, 11 and 17, and are summarised here.

Action plans will be prepared for each domain (part) of the mine to guide the rehabilitation of these areas, and are discussed in the following sub-sections. These action plans will be incorporated into the Project's Plan of Operations.

The Year 30 landform is indicated in Figures 6-11-V1.3 and 6-12-V1.3. Note that figures with numbering ending in V1.3 refer to figures contained in Volume 1, Book 3 of the EIS.

As previously noted, refinements and/or amendments will occur as the Project develops.

Final land uses proposed for each domain have been based on a land suitability assessment in accordance with the *Technical Guidelines for Environmental Management of Exploration and Mining in Queensland* (Department of Mines and Energy 1995), as described in Chapter 9.

An investigation into the rehabilitation of disturbed areas will be undertaken and a report will be submitted to the administering authority proposing acceptance criteria for landform design and final land use. The timing of the report will be agreed with the administering authority

Final voids

Typically, a single final void will remain after completion of mining for each pit. The banks of the final void (i.e. the highwall, lowwall and endwalls) will be reshaped to achieve long term geotechnical stability. Ramps will be levelled to similar grades as the surrounding wall slopes.

The final slope gradients of each void, including the outer boxcut spoil slopes, low wall of the final voids, and highwall slopes will be assessed and recommended by a suitably qualified person based on the risk of long term geotechnical instability. This assessment will be based on the preliminary investigations undertaken by Golders Associates (2008) as discussed in Chapter 9 Geology, Mineral Resources, Overburden and Soils.

The voids will be externally drained so that water from the overburden piles drains away from the voids. Final void modelling will be conducted to establish the required parameters for long term void stability and water quality. A Final Void Plan will be prepared prior to completion of mining in the first pit, based on the final void modelling and detailing the design parameters for each final void. The Final Void Plan will include assessment of groundwater hydrology and properties, surface water hydrology and pit wall stability.

These studies will be undertaken during the life of the mine, and include detailed research and modelling. In the final five years of mine life, the capability of the void to support native flora and fauna will be ascertained.

Final voids are unlikely to be suitable for agricultural use, and will be investigated for alternative beneficial uses such as wetlands.

At the end of the mine life, the final voids remaining at the end of the Project life will be bunded and fenced around the crest of the pit to inhibit access to the area. The integrity of the bund will be the responsibility of the subsequent landowner.

An investigation into residual voids will be undertaken by the Wandoan Joint Venture (WJV) and a report will be submitted to the administering authority proposing acceptance criteria for final voids. The timing will be agreed with the administering authority.

Infrastructure areas

Following decommissioning, infrastructure areas will be returned to the pre-mining landform, where practicable. Where this is not practicable, bench cuts will be removed, any steep grades reduced and the landform returned to a profile similar to landforms in the region.

Land used for infrastructure components will be returned to improved pasture grazing land or dry land cropping land as occurred pre-mining, and will generally be able to be used for beef cattle grazing or fodder cropping.

Building end use will be assessed at the time of closure as alternative uses may be available.

Overburden stockpiles

The following measures apply to both the in-pit overburden placed by dragline, and elevated out of pit overburden stockpiles.

Overburden stockpiles will be progressively rehabilitated over the life for the mine, and rehabilitation will commence within two years of the land becoming available for rehabilitation. Progressive rehabilitation will function to reduce erosion potential and improve the water quality runoff from overburden stockpiles. Runoff from overburden stockpiles will pass through sediment dams in the Water Management System as detailed in Chapter 11 Water Management.

Overburden stockpiles will be reshaped to stable landforms in accordance with Chapter 9 (Section 9.6). The stockpiles will be designed to reduce the catchment area and drainage ways through the overburden.

Low gradient sections of overburden stockpiles will be returned to grazing land, and generally be able to be used for low stock rates of beef cattle grazing, or alternatively for nature conservation.

Steeper gradient overburden stockpiles, and overburden stockpiles which trials show are unsustainable for cattle grazing, will be used for nature conservation.

Creek diversions and levee banks

Creek diversions will be retained following mine closure, as they will have been designed though best-practice measures to provide stable landform and by mine closure, would be established with long-term riparian vegetation and aquatic habitat. At the conclusion of mining, the creek diversions will be left in a stable and sustainable condition in line with the creek diversion rehabilitation plan. The levee banks of the seven constructed diversions (ie Spring, un-named creek tributary of spring creek, Mount Organ, Mud Creek, two diversions on un-named creek (tributary of Woleebee Creek), Woleebee Creek and Wandoan and Black Ant Creek, and Frank Creek) will be maintained and landforms merged in with overburden stockpiles.

Post-mining, the creek diversions will be retained in a nature conservation land use.

Water storage dams

Water storage dams will either be retained for the subsequent agricultural use or rehabilitated.

The rehabilitation process will entail dewatering, removal of any embankments, revegetation and monitoring. Rehabilitation will also vary depending on the storage history. Dams that have contained saline water may require remediation. These dams will have a membrane liner which will be removed along with the saline material inside the dam during rehabilitation. The material will be disposed of by appropriate methods in accordance with the management of saline overburden material.

If not retained as water storages, water storage dams will be rehabilitated and returned to improved pasture grazing land or dry land cropping land as occurred pre-mining, and will generally be able to be used for beef cattle grazing or fodder cropping. Dams that have contained saline water are likely to only be returned to cattle grazing land.

Tailings dam

Opportunities for coal recovery from tailings (reprocessing of the tailings to extract additional coal) will be investigated during the life of the mine. If recovery is not viable, the tailings dam will be rehabilitated.

Tailing dam rehabilitation will be undertaken after drying of the dam. The tailings surface will be covered and capped with benign overburden material to prevent further rainwater ingress into the tailings, and will be topsoiled and vegetated.

The cover will be designed to provide a relatively flat low gradient final landform. The rehabilitated tailings dam will be vegetated with deep rooted grass species or alternately native vegetation and will be placed on the EPA's Environmental Management Register.

The post-mining land use of tailings dam areas is proposed to be beef cattle grazing, or native vegetation in areas in which trials show cattle grazing is unsustainable.

If coal recovery is undertaken, following the coal recovery, the tailings dams will be filled and then closed, capped and rehabilitated.

Haul roads and access tracks

A number of the haul roads may be retained for use by future landowners post mine closure and rehabilitation. Some haul roads will also be temporarily retained following rehabilitation as access roads for rehabilitation monitoring purposes. This will be determined in consultation with stakeholders and local council.

The majority of haul roads and access tracks across the Project area will be highly compacted. Rehabilitation where required will accordingly require deep ripping, profiling, topsoiling and seeding. Drainage construction will be applied where necessary.

It should be noted that haul roads or access tracks which are selected to remain at the Project site post mine closure may require sediment containment measures to minimise potential erosion and sediment entering into waterways.

Land used for roads that are not required by future landowners will be returned to improved pasture grazing land or dry land cropping land as occurred pre-mining, and will generally be able to be used for beef cattle grazing or fodder cropping.

25.4.7 IMPLEMENTATION OF REHABILITATION STRATEGY

Program

A Plan of Operations will be developed for the mine to guide implementation of progressive rehabilitation.

The Plan of Operations will include a schedule of rehabilitation activities which are proposed within the life of the Plan of Operations. Based on the approved mine plan, detail will be provided regarding the types and areas of land that will be disturbed within the Project area for the term of the Plan of Operations, along with proposed rehabilitation activities.

Risk assessment

A formal risk assessment will be undertaken to identify the potential hazards at the mine that need to be addressed during rehabilitation which will be reviewed periodically over the operating life of the mine.

A risk assessment of rehabilitation programs and objectives will be conducted, such as by the tool developed under ACARP Project C8039 Risk Management Strategies for the Surrender of Open Cut Coal Mine Spoil Areas in the Bowen Basin Coalfields of Central Queensland, Australia (Williams 2001).

Rehabilitation monitoring

Monitoring and assessment of progressive rehabilitation processes will be undertaken throughout the planning, construction, operational and decommissioning phases of the Project. If monitoring and assessment results indicate that the rehabilitation objectives may not be achieved, then the rehabilitation strategy will be modified.

Non-compliance with the established objectives will trigger a review of processes such as planning and design, and/or repair and maintenance of failed rehabilitation work.

As rehabilitation technologies, strategies and monitoring techniques change and/or are improved over time, the WJV will regularly review and update the Project's rehabilitation and monitoring procedures to include the most effective processes and strategies.

Rehabilitation maintenance

Two types of rehabilitation maintenance will be performed in rehabilitated areas:

- progressive maintenance (on a planned basis)
- failure mitigation maintenance (conducted as ongoing required).

Progressive maintenance is planned as part of rehabilitation scheduling. It will comprise repairs that are necessary following the initial construction and adjustment of planning processes if needed.

Following initial rehabilitation, new processes such as erosion, soil formation, vegetation cover and infiltration rates will develop on the modified landform. These processes may be sustainable in the long term, or more likely they may represent an intermediate stage before final landforms/ecosystems are achieved.

Progressive maintenance activities will be scheduled to transfer intermediate landforms into permanent, long term stable landforms. The type of construction maintenance activities that will achieve this outcome will include removal of graded banks, and repair of areas where excessive erosion has removed the protective capping and exposed spoil.

Rehabilitation failure mitigation will be carried out where the established landforms are not achieving the rehabilitation objectives. The aim of the monitoring and maintenance program will be to identify any systematic issues that may result in broad scale failure of rehabilitated areas. Failure in this sense is defined as non-achievement of the rehabilitation objectives as outlined above.

25.5 DECOMMISSIONING

25.5.1 DECOMMISSIONING STRATEGIES

The following decommissioning strategies are proposed for various remaining structures post-mine closure.

All infrastructure will be removed unless agreed with the subsequent post-mining landowner. This includes:

- a contaminated land assessment of relevant locations
- removal (or sale and removal if appropriate) of all items of the mine infrastructure area, and any temporary buildings and facilities
- remediating land from any contamination
- ripping, topsoiling, and seeding of this land
- establishing safety bunds and fencing of final void areas.

25.5.2 DECOMMISSIONING ACTION PLANS

The following action plans (based on the above strategies) will be undertaken:

Mine industrial area, conveyors, accommodation facilities

All items of the infrastructure area and including conveyors, including any temporary buildings and facilities will either be:

- dismantled for sale and removal
- prepared for demolition and removal
- retained for the landowner (if agreed).

After all external structures, concrete bases and footings have been removed, these areas will then be investigated for contamination and remediated where necessary, ripped, profiled, topsoiled and seeded. Protection of these areas from re-compaction (i.e. vehicles or grazing animals) after ripping is required to allow the soil structure to reform. Drainage control through ripping, profiling or the provision of erosion control structures will also be undertaken.

Airstrip

It is assumed that the proposed airstrip at Wandoan, if constructed, will be retained for public use.

CSM gas and CSM water supply pipelines

Decommissioning will include the following options:

- abandonment — where the pipeline is purged, and physically disconnected from the point of supply, and sealed (capped) at both ends
- removal — where pipelines are purged and removed in entirety from the pipeline easement
- beneficial re-use — where sale or donation of the infrastructure to a third party occurs for other beneficial use.

International best practice recognises that removing pipelines, particularly underground pipelines, is unlikely to be a commercially or environmentally viable option. Therefore, it is unlikely that this decommissioning option will be considered for this pipeline and that either abandonment (after capping) or beneficial re-use options will be undertaken.

Regardless of the decommissioning option for the pipeline, the metering and gas delivery station, which will be located above ground, will be dismantled and removed unless a beneficial re-use can be identified.

Power station and powerlines

The power station will be dismantled and removed off site unless a beneficial re-use can be identified. The power lines/power poles may be retained for future use by local government and a position will be negotiated at that time. As a component of the power station decommissioning, a contaminated land assessment of the fuel storage area to identify any potential contamination.

Rail spur

The use of the rail spur post-mining will be determined based on the proposed future use of the land.

Waste management facility

If the option to establish a landfill within the MLA areas (as discussed in Chapter 6 — refer Section 6.8.1) is undertaken, then the landfill will be decommissioned at the conclusion of mining, and a contaminated land assessment (which will include mitigation measures) consistent with the requirements of the *Environmental protection Act 1994* will be undertaken on the landfill site.

Table 25-1: Indicative performance indicators for decommissioning and rehabilitation

Mine domain/ infrastructure	Value	Performance indicator
Final voids	landform	Benches and faces stable, minimal evidence of erosion, revegetation successful
	safety	Perimeter and/or access barriers installed to prevent entry if required
	surface water quality	Water quality in local waterways not to be adversely affected by mining activities (if discharge evident from final voids). Monitoring program implemented
	groundwater quality	Local groundwater quality not to be adversely affected. Monitoring program implemented
Overburden and waste rock dumps	landform	Landform stable, minimal evidence of erosion
	safety	Perimeter and/or access barriers installed to prevent entry if required
	revegetation	Revegetation of dumps successful (refer to following sections for criteria), undergoing monitoring and maintenance program
Tailings dams	landform	Landform stable, minimal evidence of erosion
	safety	Perimeter and/or access barriers installed to prevent entry if required
	surface water quality	Water quality in local waterways not to be adversely affected by mining activities (if discharge evident from final voids). Monitoring program implemented
	groundwater quality	Local groundwater quality not to be adversely affected. Monitoring program implemented
	revegetation	Revegetation works successful (refer to following sections for criteria), undergoing monitoring and maintenance program
Mine industrial area and conveyors	removal	all items of the CHPP plant, mine related infrastructure and temporary buildings and facilities dismantled for sale (if relevant) and removed from the Project site
	revegetation	Revegetation works successful, undergoing monitoring and maintenance program
Water storage dams	landform	Landform stable and showing minimal signs of erosion. Water storage dams retained for post-mining land use if required
	safety	Perimeter and/or access barriers installed to prevent entry if required

Mine domain / infrastructure	Value	Performance indicator
	water quality	Water quality in local waterways not to be adversely affected by mining activities (if discharge evident from final voids)
Accommodation facilities	removal	All buildings and structures dismantled for sale (if relevant) and removed from the Project site
	revegetation	Revegetation works successful, undergoing monitoring and maintenance program
Haul roads and access tracks	landform	Landform stable, minimal evidence of erosion. Erosion and sediment control devices installed and being monitored.
	revegetation	Revegetation works successful, undergoing monitoring and maintenance program

25.6 REFERENCES

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