HANCOCK GALILEE PTY LTD

Kevin’s Corner Project Environmental Impact Statement

26 Decommissioning and Rehabilitation

Section 26 Decommissioning and Rehabilitation

The following section of the EIS presents a framework for the decommissioning and rehabilitation of the Kevin's Corner Project (the Project). It provides details on the relevant regulatory requirements, proposed decommissioning activities required for infrastructure at closure, and describes the options, strategies and methods for progressive and final rehabilitation of the environment disturbed by the Project.

26.1 Regulatory Compliance

26.1.1 Queensland Legislation and Guidelines

The Queensland Department of Environment and Resource Management (DERM) require that land disturbed by mining is rehabilitated to achieve stable and beneficial agreed uses. The three mandatory rehabilitation requirements stipulated by DERM include landform stability, beneficial use and protection of water quality. These elements are further defined as:

- Stable landform – includes both erosional and geotechnical stability. Erosional stability is typically achieved through the appropriate placement spoil to an agreed final landform design, followed by adequate topsoiling, revegetation and surface water management. Geotechnical stability is typically achieved through the correct design of low wall and high wall slopes and batters and the correct placement of spoil materials during the mine life.
- Beneficial use – refers to the final land use being beneficial to the community from an ecological and/or agricultural perspective. It may include sustainable native bush land or grazing with no ongoing liability to the community.
- Preservation of downstream water quality – existing and future use of the downstream water is not to be compromised. Silts, salts and acids are not to be released from spoil or voids to groundwater or surface water.

The progressive and final rehabilitation strategies and methods outlined for disturbed areas comply with the rehabilitation goals and objectives of the EPA Guideline 18: Rehabilitation requirements for mining projects. More specifically, they provide intergenerational equity, protection of biodiversity and maintenance of essential ecological processes.

26.1.2 Terms of Reference – Kevin's Corner Project

Prepared with specific reference to the Kevin's Corner Terms of Reference issued by the Co-ordinator General in February 2010, this decommissioning and rehabilitation strategy includes the following information:

- Details on the proposed decommissioning activities for the project including the removal of structures, buildings and equipment, and proposed methods for stabilisation of the affected areas;
- Disposal options and/or methods for waste resulting from infrastructure demolition;
- The rehabilitation strategy should minimise the amount of land disturbed at any one time;
- Figures should provide details of the final topography of any excavations, waste disposal facilities, dam sites and subsidence areas;

- Future land tenure arrangements post decommissioning of the project should be detailed; and
- An overview of any infrastructure that is not intended to be decommissioned and details of the entity to which the infrastructure is intended to be transferred along with environmental management regimes.

26.2 Decommissioning of Infrastructure, Plant and Buildings

This section outlines the overall decommissioning strategy for the project including the planning process and management of waste resulting from infrastructure demolition.

26.2.1 Post Closure Monitoring and Environmental Management

Following closure of the mine the environmental monitoring program established for the operations phase of the project will be maintained until all decommissioning and rehabilitation works have been completed. Notwithstanding this, there may be the need to establish some additional monitoring sites depending on the nature of the decommissioning works and also in response to finding possible sources of environmental pollutants.

The type and location of this monitoring will be determined by the outcomes from the Phase 1 and/or Phase 2 contamination assessment (see Section 26.2.5 for further information), and other relevant inputs identified during the closure planning and decommissioning phase of the site.

26.2.2 Planning for Decommissioning

A decommissioning and demolition strategy will be developed for the site at closure by suitably qualified personnel. This would include engaging structural engineers, appropriate technical experts and the application of relevant standards and guidelines. A detailed investigation of all structures would be completed to determine the appropriate techniques, equipment required, and the sequence for decommissioning and removal.

26.2.2.1 Investigation of the Site

An investigation of the site will be conducted to confirm the following:

- The type, location and extent of underground services such as conduits, cables, pipe work;
- The location and extent of underground structures to be retained and those to be removed;
- The location, type and extent of overhead services and structures such as power cables, conveyors, light poles and pipe work, etc;
- The location and condition of all tanks and vessels (with emphasis on remaining combustible materials and methods required for their removal);
- The presence of contaminated and hazardous materials and the classification and disposal of these materials;
- The general condition of adjacent structures; and
- Any infrastructure to remain (including roads and tracks) following decommissioning.

26.2.2.2 Investigation of the Structures

An investigation of the structures will be completed to identify the following:

- The structures' current condition with regard to their state of disrepair or deterioration;
- The presence of heavy steel within structures that may require specialized demolition equipment and/or techniques;
- Potential imposed loads or changes in the centre of gravity of structures during demolition works; and
- Confined spaces and/or techniques required to be implemented in order to avoid entering such spaces.

26.2.3 Site Preparation

Prior to the commencement of any demolition activities the following tasks will be undertaken:

- All sumps will be dewatered and the excess coal material removed from around the CHPP;
- All items will be decommissioned, de-oiled, depressurised and isolated; and
- All hazardous materials will be removed and transported to appropriately licensed disposal facilities.

26.2.4 Site Services

All sumps will be de-watered and the excess coal removed prior to the commencement of demolition. In addition all items of equipment will be de-oiled, degassed, depressurised and isolated and all hazardous materials (HAZMATs) removed from the site.

All buildings, including the main administration building, workshop, CHPP and fixed plant (including stacker / reclaimers, reclaim tunnels, conveyors & gantries, transfer points, thickener tank, coarse reject hopper, vehicle wash, etc) and other surface infrastructure (including vent fans, adits/portals, services to the underground mine, traffic control structures and signs etc) will be demolished and disposed of in a suitable location (i.e. within voids on-site, or an approved landfill off-site). Opportunities for the sale and/or re-use of assets and recycling of scrap steel will be maximised where possible.

Concrete footings and pads will be broken up to at least 1.5 m below the surface and removed. Options for the re-use of this material (i.e. crushed and used as for road and track stabilisation) will be investigated as the operation approaches closure. If re-use/recycle opportunities aren't available, all "non-contaminated" waste material will be disposed of in a suitable location (i.e. within voids on-site, or an approved landfill off-site).

26.2.5 Contaminated Materials

At closure, a preliminary sampling and analysis program (Phase 1) will be implemented to determine whether an assessment (Phase 2 – detailed investigation of contamination involving drilling, etc) should be conducted to quantify the amount of contaminated material that will need to be bio-remediated on site.

26.3 Additional Decommissioning Works Prior to Rehabilitation

At the cessation of operations, decommissioning activities are required in the following areas prior to rehabilitation works and revegetation:

- Infrastructure areas (including hardstands, parking areas, airstrips etc).
- Roads and tracks including diversions;
- Stock route diversions;
- Dams and Creek diversions;
- The control and management of mine waste (i.e. overburden, coarse and fine reject (tailings));
- Open cut mining areas;
- Shafts, portals/adits and boreholes; and
- Underground mining and subsidence areas.

The specific activities required for each area are covered in greater detail in the following sections.

26.3.1 Stockpile Areas

The carbonaceous material on the base of the ROM and product stockpile areas will be stripped to a depth of at least 0.5 m and buried in the low wall of the open cut void. Where possible the material will be considered for reprocessing prior to the cessation of CHPP operations.

The entire CHPP and infrastructure areas will be trimmed and reshaped, rock raked to remove all surface rocks to a size of less than 0.5 m and ripped to a depth of at least 1 m. Surface water management structures (contour banks, drains and settlement ponds) will also be constructed to facilitate the appropriate drainage of surface runoff from the site.

26.3.2 Roads, Tracks, Hardstands and Haul Roads

Bitumen roadways, car parks and hardstand areas around the site (CHPP, workshop, administration areas etc) will be scalped to approximately 0.5 m below the surface to remove stabilised and compacted material. The inert waste will be disposed of in a suitable location (i.e. within voids on-site, or an approved landfill off-site).

Contaminated, carbonaceous or unsuitable material (gravel, etc) will be removed from the haul roads and hardstand surfaces and disposed of and covered in the low wall area. Minor reshaping work will be undertaken to ensure surface level consistency with the surrounding areas. Any creek crossings (i.e. culverts, etc) will be removed and the pre-existing drainage line re-instated (where practicable). The site will be rock raked to remove all surface rocks to a size of less than 0.5 m and ripped to a depth of at least 1 m.

A light vehicle access road is to be retained to enable inspections of the site following closure of the mine.

Extensive consultation with the DERM has identified a series of objectives for stock route diversions within the Project area. The design for the stock route diversions will:

- Ensure adequate alternatives are proposed to protect existing start and end points and to ensure there is no net loss of connectivity for the network;
- Where applicable, provide new alignments that share similarities between the existing reserve width and infrastructure provisions such as bores/windmills/holding yards;
- Ensure the newly proposed alignments are suitable for the purpose intended;
- Ensure the safety of stock and people utilising the proposed realignments; and
- Ensure topography and country being traversed is adequate to travel and agist stock.

By the cessation of operations these diversions are expected to be well established and stable and therefore require no further works.

26.3.3 Dams and Surface Water Features

All sedimentation dams which assist in the management of surface water flow from the final rehabilitated surface will be retained following mine closure. The other dams will be decommissioned or removed, and where possible the original drainage paths will be re-established.

The Tailings Storage Facility (TSF) cap will be designed and constructed so that the surface will be free draining. The tailings will be capped with a layer of compacted clay or similar impermeable substance over which a layer of free draining material will be placed. Topsoil will then be used to resurface the area which will then be revegetated. This will inhibit the ponding and infiltration of surface water and minimise the potential for leachate.

Creek diversions established during the construction and/or operations phase of the project are assumed to be stable by the time of decommissioning and closure of the mine.

26.3.4 Management of Mining Waste

Waste generated through mining (overburden) and coal processing (coarse and fine rejects) has been defined for the EIS as mining waste. Volume 1, Section 16 provides an assessment of the geochemical characteristics of the Project mining wastes and their management with a detailed geochemical report provided in Volume 2, Appendix Q1.

Current planning estimates that the average yield for the reserve is for every 100 tonne of Run of Mine (ROM) coal, 75 tonnes of product coal, 17 tonnes of course rejects and 8 tonne of fine rejects or tailings (i.e. estimated yield of 75%). Following development of the initial open pit boxcut area, the coarse rejects will be co-disposed with overburden in the in-pit overburden emplacement area. Fine coal reject (tailings) from the Coal Handling and Preparation Plant (CHPP) will report to the purpose-built tailings storage facility (TSF) located to the north of the northern open cut pit. Longer term tailings management for the Kevin's Corner project includes the northern pit void with a range of alternatives currently being investigated.

Overburden will be predominantly stored within the open pit. Initially, the overburden produced by mining the box-cut area will be stored at an out-of-pit overburden emplacement area adjacent to the eastern side of the open pit. Some of the overburden has the potential to be saline and/or sodic and any out-of-pit overburden will be managed to ensure that saline and/or sodic materials do not report to final top and bench surfaces and batters. During the first year of operation if there is insufficient capacity within the in-pit overburden piles, coarse reject material will be encapsulated in the out-of-pit emplacement area.

Saline and/or sodic materials will be placed within the core of the overburden emplacement area, where possible, before covering with benign material. This will be followed by reshaping, topsoiling and re-vegetation as part of the staged rehabilitation process. Rock mulching may be used on final batters to limit the potential for erosion from surface runoff. The requirement for any additional stabilisation works will be assessed during rehabilitation field trials.

During the first year of mining, the coarse rejects will be truck-hauled adjacent to the low-wall edge of the boxcut area. Coarse rejects placed at the low wall edge of the boxcut area will be clay encapsulated before being further encapsulated with at least 5 m of spoil. Once adequate storage capacity is available in-pit, the coarse reject material will be placed in the in-pit voids. Coarse reject placement will be sequenced such that capping of the rejects will be completed progressively as the working face progresses down dip.

Where possible, coarse reject material placed in the in-pit voids will be compacted (during truck placements) in 1-2 m layers, and capped with a clay cover prior to covering with at least 10 m of spoil before re-profiling and topsoiling.

Fine coal reject (tailings) will report to a purpose-built Tailings Storage Facility (TSF) in a slurry form. Given the arid climate of the region, the tailings surface is expected to dry out relatively quickly and form a dense compact solid material, which will facilitate a cover placement and rehabilitation at the end of mine life. It is expected that an enhanced 'store and release' cover system will be most appropriate for final closure of the TSF. Opportunities for the storage of tailing in the underground voids are also being investigated. The TSF design is detailed in Volume 1, Section 16 and Volume 2, Appendix Q2. The design criteria for the above ground TSF includes:

- An operational design life of five to seven years;
- An indefinite long term life once closed and rehabilitated;
- Negligible seepage of the contained water to the surrounding surface and subsurface environments;
- Adequate flood storage to alleviate the risk of discharge from the tailings dam cells and the decant pond to the environment;
- An emergency spillway;
- Efficient reuse of process water; and
- All embankments and slopes designed for stability and strength to commonly recognised and legislated guidelines/standards.

The TSF will be designed to minimise any adverse environmental effects due to seepage from the impoundments via compaction of existing soils, a liner system, appropriate embankment drainage, an underdrainage system, and recovery of surface water and management of tailings deposition.

In order to minimise the potential for non-contact water entering the tailings management facilities, upstream non-contact water cut-off drains will be constructed to divert water around these areas into natural watercourses downstream of the embankments. These drains will be phased to tie in with the proposed staged development of the tailings cells. Cut-off drains will be designed to minimise surface water entering the tailings storage.

The drains will be topsoiled and grass seeded with rock protection provided at significant bends. In addition, all outlets from the drains to the natural surface will contain rock protection to minimise scour and assist in dissipating the runoff.

26.3.4.1 Tailings Storage Facility Decommissioning

External embankment slopes

The proposed concept of rehabilitation of the external slopes of the Tailings Storage Facility (TSF) embankments is to establish naturally occurring halophytic vegetation without cultivation or irrigation. This will be achieved by developing a select fill layer on the outer face of the embankments and covering it with a layer of approximately 0.2 m of topsoil. The external slopes will be designed to allow access for any future planting and maintenance and to comply with regulatory requirements. Rock armouring will also be considered if required to prevent excessive slope erosion.

Surface capping – Purpose built tailings storage facility

Progressive rehabilitation of the TSF will be required to ensure it is effectively managed. Rehabilitation of a particular cell will only start once the tailings discharge operation is complete within that cell (Volume 2, Appendix Q2). Rehabilitation will be progressive with works to start on the first available cell once tailings disposal ceases and sufficient drying is achieved. This will commence once the in-pit (northern open cut pit void) is available for tailings storage.

In short-term (five to seven years) tailings from the CHPP will report to a purpose-built TSF located to the north of the northern open cut pit. Subsequently (after five to seven years), tailings will be contained within a TSF constructed in the northern open cut pit. Further assessment work on this is ongoing. The Proponent has identified other above ground TSF sites that may be used as potential back up tailings disposal areas should they be required. Design concepts for the initial TSF structure and in-pit disposal have been developed and are presented in Volume 2, Appendix Q2.

The target design life of the purpose built TSF is five to seven years. After this period, the structure will be decommissioned as per applicable regulatory guidelines. A closure strategy will be developed in consultation with the State regulators. Key objectives of the closure strategy will include:

- Providing a stable landform;
- Providing a landform surface that is resistant to erosion;
- Providing a surface cover that minimises the risk of infiltration, promotes shedding of surface water and promotes growth of vegetation; and
- Minimises the risk of environmental harm from seepage

Surface capping – In-pit tailings storage

The northern open cut pit will be decommissioned as per applicable regulatory guidelines. A closure strategy will be developed in consultation with the State regulators. Key objectives of the closure strategy will include:

- Providing a stable landform;
- Providing a landform surface that is resistant to erosion;

- Providing a surface cover that minimises the risk of infiltration, promotes shedding of surface water and promotes growth of vegetation; and
- Minimises the risk of environmental harm from seepage

The operational performance of the in pit tailings and decant water management will have a significant influence on the final strength and consolidation properties of the in pit tailings materials. Strategies that will be further considered during development of rehabilitation plans for the in pit disposal area to address these issues will include:

1. Progressive placement of overburden in horizontal lifts at the completion of tailings disposal to allow pore pressures to dissipate with time and to minimise the risk of instability of the final landform. However this is likely to significantly extend the post mining attendance that would be required to achieve successful rehabilitation of the landform.
2. Installation of wick drains or similar measures to promote drainage of the tailings under the overburden materials and therefore speed up the initial primary settlement within the tailings. Drainage control measures within the tailings would aim to reduce the period required to achieve successful rehabilitation of the landform.
3. On-going monitoring and maintenance of the final landform to assess the rate of ongoing settlement and to maintain the surface integrity of the landform surface.
4. Design the landform surface to promote sheet flow of surface water to eliminate the need for engineered drainage structures across the final landform surface. This requirement will likely limit the maximum final height of the landform above the original ground surface level. However it will also limit the impact of ongoing surface settlement on the drainage and integrity of the final landform.

26.3.5 Void Management

On closure of the mine, a void management strategy will be implemented targeting several key environmental issues for the long term management of the void. These are outlined below.

26.3.5.1 Void Management Objectives

The primary objectives of the void management strategy are to:

- Propose mitigation measures to minimise potential impacts associated with the final void;
- Propose measures for the management and monitoring the potential impacts of the void over time; and
- Present options for the final land use of the void following the cessation of mining.

26.3.5.2 Void Management Objectives

Void Slope Stability – High Wall

To ensure the safety of the final void, the surrounding final slopes will be left in a condition where the risk of slope failure is minimised.

The following will need to be considered when assessing the geotechnical stability of highwalls:

- Long term groundwater levels;
- Long term final void water levels;
- Height and inclination of slope and number and spacing of intermediate benches;
- Shear strength of the highwall soils and rocks;
- Density and orientation of fractures, faults, bedding planes, and any other discontinuities, and the strength along them; and
- The effects of the external factors, such as surface runoff.

Prior to closure, further investigations will be undertaken to confirm the criteria above and appropriate action will be taken to ensure effective long term safety, stability and management of the void.

Void Slope Stability – Low Wall

Stability of the low wall will be achieved through implementation of the following measures:

- The low wall will be battered back from the angle of repose to ensure the long term geotechnical stability of the face. Determination of geotechnical stability will be based on an assessment of the spoil material, the likely degree of settlement, and the degree of weathering expected over the long term. Subject to this assessment, the sides of the final void will be battered back to 17° where required;
- Drainage on and over the low wall will be minimised through the construction of drainage control structures;
- Erosion of the low wall will be controlled by limiting the length of slope, minimising the degree of slope, and by the establishment of suitable vegetation;
- Battering of the low wall against the bottom of the high wall will enhance stability; and
- Benching of the spoil material may need to be considered in some areas in order to achieve geotechnical stability and to minimise erosion.

Spontaneous Combustion

Spontaneous combustion above ground commonly occurs in waste dumps containing reject coal material, in unconsolidated heaps where oxygen can come into contact with the coal and heat can't dissipate. The problem is compounded when rainfall events cause erosion, progressively exposing the coal.

Spontaneous combustion may also occur in the coal seam exposed in the remaining highwall of the final void.

The following will be undertaken to reduce the potential for spontaneous combustion to occur:

- Accumulations of coal material, particularly pyritic, will be buried under inert spoil;
- Any remaining coal spalling will be removed from the highwall where possible;
- If any coal on the highwall face is prone to spontaneous combustion, it will be sealed with water, clay or inert soil where possible; and

- Should any outbreaks of spontaneous combustion occur in the final void, details on the materials involved, presence of pyrites, location, date, time and climatic conditions will be recorded. This will be undertaken as part of the ongoing inspection and monitoring post closure of the mine.

Control of Surface Inflow

Surface water flow can cause slope deterioration and ultimate failure. The control of surface inflow into the final void is essential for the long term management of water quality within the pit and will also aid in the control of erosion to low walls and high walls.

Drainage will be directed away from the highwall face through the construction of interceptor channel drains around the perimeter of the highwall and spoon drains will be utilised on the upslope side of all benches. Water will then be directed to the void in a controlled manner. This will allow voids to only collect water direct from rainfall and runoff from rehabilitated areas through the surface water management system.

Drainage over the low wall will be minimised through constructing surface water diversions, and drainage on the wall will be limited and controlled to reduce the erosion potential. The regraded low wall area will be stabilised with structural soil conservation earthworks (banks, drains, drop structures, etc), and appropriate vegetation. Pasture establishment will provide sufficient ground cover to minimise low wall erosion.

Low wall slopes with gradients of 17° or less will be sown conventionally via ground broadcasting. Low wall slopes exceeding 17°, and where structural soil conservation earthworks cannot be used, will be hydromulched to enhance the surface stability of the slopes by hastening vegetative germination and establishment.

Void Water Quality

Modelling of the final void (Volume 2, Appendix N) will allow for predictions of the water quality within the void. Current modelling indicates that the final void will act as a sink based on negative climate balance, thus the risk of impacting the regional groundwater system is considered negligible. On completion of modelling, actions will be taken during the closure process regarding the control of external sources of water into the void. Risks of decant and uncontrolled discharge to the surface water system will be assessed and managed.

The following aspects need to be considered with respect to managing final void water quality:

- Stratification of water column (pseudo static pit water level);
- Dissolved salt concentrations from run-off, direct rainfall, groundwater ingress and evaporation;
- Control of clean water in-flow into the void (i.e. the construction of clean water diversion banks etc);
- Determination of recharge rates through the backfill/spoil;
- Groundwater inflows; and
- Rainfall and evaporation

All of the above have the potential to impact on the water quality of the final void and its potential end use. Depending on the agreed final void use, an ongoing water monitoring program may be required to confirm the modelling predictions.

Safety

At mine closure, one of the main priorities for the void will be to render it safe in terms of access by humans, livestock and wildlife. The following will be considered at the time of closure to ensure that the void is left in a safe manner. These include:

- Instability of the high wall and low wall can induce failures or mass movement. To ensure the stability of the high walls and low walls they will be battered back to a stable slope angle as required;
- Exposed coal seams will be covered with inert material to prevent ignition either from spontaneous combustion, bush fires or human interference;
- A barrier at a safe distance from the perimeter of the void to prevent human access will be constructed. The highwall areas will be secured by the construction of a trench and a 2 m safety berm, as well as a 2.1 m security fence along the entire length of the remaining high wall. This is to provide an engineered barrier between the pit and the surrounding area. The trench and berm is to be constructed in such a way that it will physically stop most vehicles;
- Suitable signs, clearly stating the risk to public safety and prohibiting public access will be erected at 50 m intervals along the safety fence;
- Surface runoff from land surrounding the void will be diverted from entering the void so as to prevent flooding of the pit and potential development of instability of the void walls; and
- Shrub and/or tree planting along the outside edge of the bund wall will be implemented where practicable to lessen the visual impact of the wall, and will be in accordance with the agreed post-mining rehabilitation criteria and land use.

Final Void Use

Final voids represent a potential risk to people, native wildlife and stock, as well as a possible source of environmental pollution from water accumulation.

Subject to an additional environmental assessment and an associated mining application, continued open cut mining may be a viable future use. The highwall may also be considered as an underground mine entry point for future mining. Should mining be discontinued at year 30, the final void will be left in a safe condition if backfilling is not reasonably practical. Available options for post mining land use are mainly determined by the location and nature of the void.

Long term mine planning will seek to infill the void with overburden, reject and tailings to the maximum practical extent; however the void will remain at the end of mine life. Final voids will essentially serve to negate potential for downstream pollution and will potentially form a water storage facility that may be suited to limited stock use.

26.3.6 Surface Infrastructure to Support Underground Mining

The decommissioning (sealing/capping/grouting) of vent fan shafts, service boreholes, dewatering and monitoring boreholes will be completed in accordance with relevant standards and guidelines. Surface infrastructure servicing the underground mining area will be decommissioned and removed as outlined in Section 26.2.

26.3.7 Subsidence Affected Areas

The 3 proposed underground longwall mines for the Kevin's Corner project are referred to as the northern, central and southern underground areas. Subsidence modelling of each of these areas predicts the maximum slope in the final topography over the longwall panels after subsidence to be 400 mm/m, 260 mm/m and 320 mm/m respectively. The maximum subsidence expected for the northern underground is 1.95 m, with 2.93 m of subsidence predicted in the central and southern undergrounds. These maximums are restricted to the areas of shallow cover within the eastern section of the proposed underground operations, which will be mined and rehabilitated early in the mining sequence.

The final surface profile resulting from subsidence as a result of underground mining is expected to impede the flow regime of a number of ephemeral water courses on site which may result in ponding after rainfall events. This is due to limited subsidence above the chain pillars and gate road sections of the underground. Remedial activities required during operations will include excavations through these areas to re-establish the channel. The monitoring and maintenance to ensure long term stability of these areas will be included in the surface water management plan.

The EIS Surface Water Report (Volume 1 Section 11) provides additional information for the management of subsidence including details in the following areas:

- Mitigation of surface ponding;
- Mitigation of surface cracking;
- Mitigation of subsidence impacts on natural channels;
- Mitigation of subsidence impacts on the diversion channel; and
- Mitigation of subsidence impacts on levees.

The likelihood of other surface expressions (e.g. sink holes) requiring significant management and/or rehabilitation as a result of mining related subsidence is minimised due to the plasticity of the underlying materials. Therefore, it is anticipated that only minor remedial works will be required for the management of subsidence related impacts.

26.4 Rehabilitation and Revegetation Strategy

This rehabilitation strategy provides details on the proposed final land form and planned rehabilitation activities for the entire Kevin's Corner project area. This section covers the following key activities relating to mine site rehabilitation:

- Proposed post mining land use;
- Proposed post mining land classification;
- Landform design and planning;
- Rehabilitation principles;
- Staged/progressive rehabilitation;
- The management of topsoil resources for use in rehabilitation of the site;

- The proposed revegetation strategy for the project area;
- Weed management;
- Rehabilitation success criteria; and
- Rehabilitation monitoring and maintenance requirements which will apply.

These aspects are discussed further in the sections below.

26.4.1 Proposed Post Mining Land Use

Prior to mining, the project site has been used mainly for agricultural use, typically low density cattle grazing. Much of the area has been partially cleared. Several isolated areas have been enhanced for fodder species to supplement grazing on native and introduced pastures.

Rehabilitation of the project disturbance area will return a stable landform capable of uses similar to those prior to disturbance. To achieve this, the nominated post-mine land use for the site is a mixture of bushland and grazing. Current planning is to link remnant native vegetation where possible and will aim to return some conservation values. In terms of soil conservation and agricultural land suitability, the proposed impacts are considered manageable and the proposed post-mining land use of low density cattle grazing is considered achievable.

In order to sustain the desired land use without degradation, it is important that the land (post-mining) only be used in accordance with the limits of the agricultural suitability class. Soil conservation practices such as stocking rate control and establishment or re-establishment of permanent pasture will be implemented for areas of mining impact where the proposed post mining land use will be grazing. The overriding principle is to maintain an optimum sustainable future landuse, with consideration for the limiting factors of the region including soil quality and climate.

The proposed post-mining grazing land will provide:

- Sufficient nutritious forage;
- The capacity to access and manage livestock;
- Flood free and relatively dry ground conditions;
- Adequate stock drinking water and shelter; and
- Stock routes throughout the land,

26.4.2 Proposed Post Mining Land Classification

26.4.2.1 Land Suitability

The suitability of rain-fed broad-acre cropping as a land use on the project site is mostly limited by nutrient deficiencies in the soil profile. It is anticipated that several of the soil units are shallow and/or have sodic subsoil. If correct, these soils may also be limited by their plant available water capacity. Soils in the steeper areas of the project site are most likely to have additional limitations in respect to rockiness and erosion.

The suitability of beef cattle grazing on the project site is also mostly limited by nutrient deficiencies within the soil. Water erosion and poor water availability, primarily due to the shallow nature of the soil and regional climate, are also considered limiting factors within some soils. The land is suitable to marginally suitable to beef grazing and has moderate to severe limitations.

The agricultural land suitability classification for the proposed disturbance area is anticipated to range from class C2 (rehabilitated overburden emplacements) to Class D (final voids and highwalls). The distribution of these land suitability classes is provided in the Soils and Land Suitability Assessment, Volume 1, Section 5 and Volume 2, Appendix I.

The post mining landform will be constructed and rehabilitated to ensure that a similar proportion of land suitability classification as the pre-mining landscape is attained.

26.4.2.2 Good Quality Agricultural Land

Based on the Queensland strategic cropping land trigger maps, good quality agricultural land has not been identified within the Kevin's Corner project boundary. However, the proposed Phase 2 soils survey scheduled for May 2011 will identify the presence of additional land considered to be appropriate for rain-fed cropping.

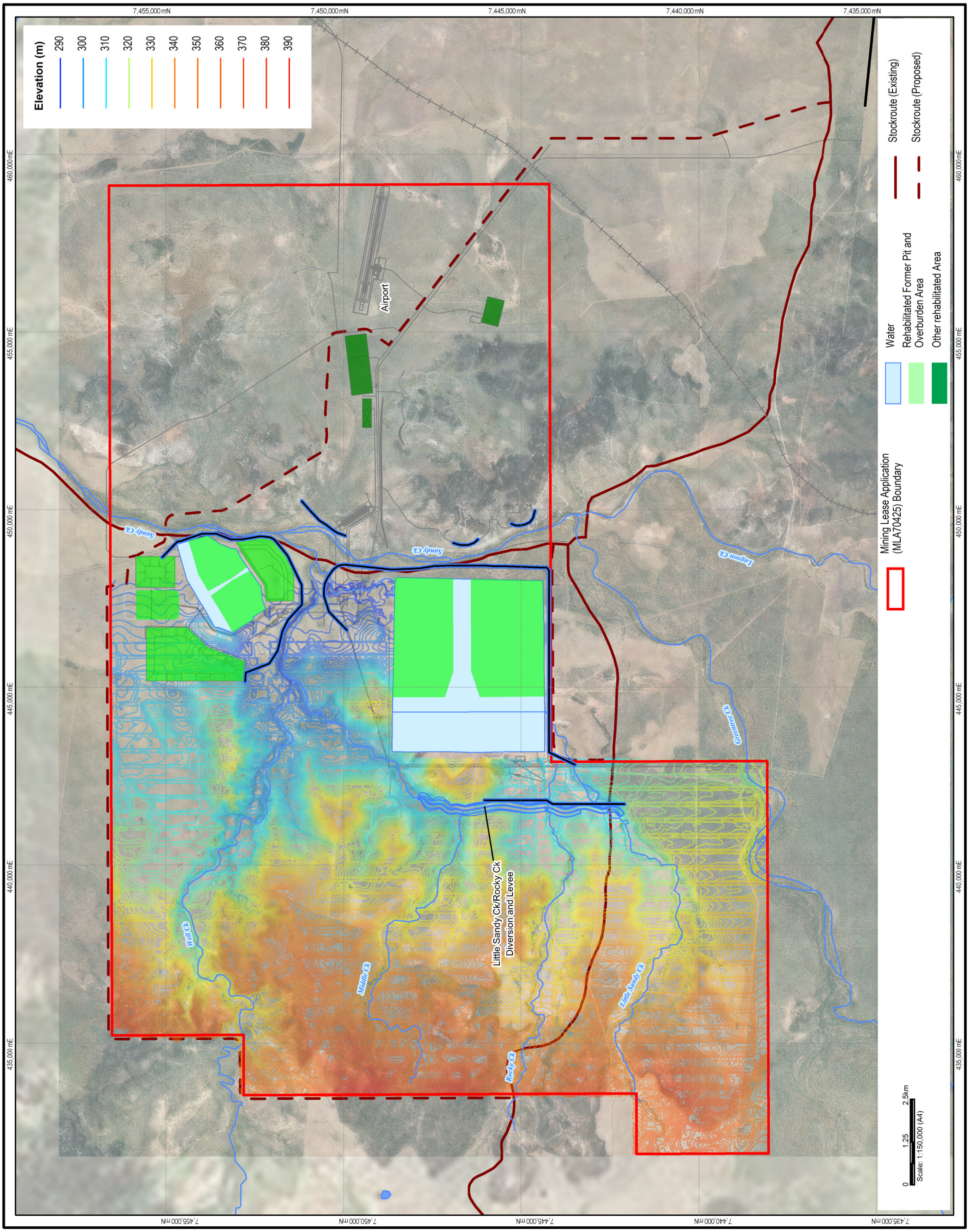
26.4.3 Landform Design and Planning

Rehabilitation planning at the Project site will aid in minimising the total area of disturbance at any one time, so reducing the potential for wind-blown dust, visual impacts and increased sediment-laden run-off.

Rehabilitation will be designed to achieve a stable final landform compatible with the surrounding environment. This will involve the reshaping of the majority of overburden emplacement slopes to 10° or less. Should slopes exceed 10° an assessment will be made as to whether additional drainage and revegetation works are required. These control measures will help to prevent erosion and aid in groundcover establishment.

Treed vegetation along the toe of rehabilitation areas will not be cleared unless an unacceptable safety or erosion risk remains.

Where possible, rehabilitation planning will attempt to maximise opportunities for a diverse post-mining landscape and land-use. It is presently proposed that the final land-uses of the rehabilitated site will include a mixture of grazing and bushland. Creek diversions within the site will have riparian areas rehabilitated to a post-mining standard to include a diverse vegetative community of native trees, shrubs and grasses. Monitoring will be undertaken to ensure that objectives are being met. A conceptual final landform and rehabilitation plan is shown as Figure 26-1.



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HANCOCK GALILEE PTY LTD

Kevin's Corner Project
Environmental Impact Statement

Datum: GDA94, MGA Zone55

FINAL INDICATIVE LANDFORM

Job Number | 4262 6660
Revision | C
Date | 12-09-2011

Figure: 26-1

File No: 42626660-g-1147.wor

26.4.4 Rehabilitation Principles

Rehabilitation of the disturbed land associated with mining will proceed as soon as practicable after the areas becoming available for rehabilitation. In some situations however, rehabilitation may be delayed due to interactions with other nearby areas that are unavailable for rehabilitation. Where this is the case, temporary rehabilitation methodologies may be applied to provide short-term stabilisation of the areas.

The rehabilitation of disturbed land at the mine site will be conducted so that:

- Suitable vegetation species are used to achieve the nominated post-mine land uses;
- The potential for water and wind induced erosion is minimised, including the likelihood of environmental impacts being caused by the release of dust;
- The quality of surface water released from the site is such that releases of contaminants are not likely to cause environmental harm;
- The water quality of any residual water bodies (other than the final void) is suitable for the nominated use and does not have the potential to cause environmental harm; and
- The final landform is stable and not subject to slumping or erosion which would result in the agreed post mining landform not being achieved.

26.4.5 Staged Rehabilitation Approach

Rehabilitation will be progressively undertaken on areas that cease to be used for mining or mine-related activities within two years of becoming available. This will reduce the amount of disturbed land at any one time and minimise the amount of contact water to be managed on site. Results of progressive rehabilitation will be used to refine rehabilitation methods for future application such as the selection of appropriate drainage measures and plant species for re-establishment. Areas available for progressive rehabilitation and the types of disturbance at those sites will be detailed in the Mine Plan of Operations.

Table 26-1 below shows the total area of progressive rehabilitation throughout the life of the project.

Table 26-1: Progressive rehabilitation throughout the life of the Kevin's Corner Coal Project (Mine)

Year from commencement of operations	Total area of rehabilitation completed (ha)
Year 6	319.5
Year 11	464.2
Year 16	147.3
Year 21	198.9
End of Mine Life	714.0

26.4.6 Topsoil Management

The Proponent recognises the importance of appropriate soil identification, stripping and management practices for successful mine rehabilitation and the achievement of the desired post mining land use(s). To achieve these outcomes the Proponent will implement measures to effectively manage topsoil through the mining and rehabilitation process. Detailed site soil management plans will be developed prior to the commencement of mine construction. These will include a Topsoil Management Plan (TMP) and an Erosion and Sediment Control Plan (ESCP).

The TMP will specifically address topsoil stripping, stockpiling (includes specific locations), the development of topsoil inventories for the Project site, handling, re-spreading, amelioration and seedbed preparation.

26.4.6.1 Soils Resource

A detailed description of the identification of appropriate topsoil resources within the project site and their management is included in the Soils and Land Suitability Assessment, Volume 1, Section 5 and Volume 2, Appendix I. An inventory of available soil will be maintained to assist in the management of topsoil materials for planned rehabilitation activities.

Based on available background information and a reconnaissance survey, 22 soil units were identified within the project site. These units were associated with the Cudmore, Colorado, Southern Plateau, Joe Joe, Lambton Meadows, Degula, Lagoon Creek, and Desert land systems. Further details on the individual characteristics of these soil units are provided in the Soils and Land Suitability Assessment, Volume 1, Section 5 and Volume 2, Appendix I.

Suitable stripping depths for the relevant soils types will be determined during the proposed Phase 2 soils survey scheduled for May 2011.

26.4.6.2 Topsoil Stripping and Handling

The Topsoil Management Plan (TMP) will include detailed protocols for soil stripping and handling. In the open cut mining areas the following proposed techniques will be adopted to prevent excessive soil deterioration as a result of soil stripping and stockpiling:

- Topsoil will be maintained in a slightly moist condition during stripping. Where possible, material will not be stripped in either an excessively dry or wet condition;
- Stripped topsoil will be placed directly onto regraded overburden or other disturbed areas and spread immediately (if mining sequences, equipment scheduling and weather conditions permit) to avoid the requirement for stockpiling;
- Where stockpiling is required soil will be graded or pushed into windrows with excavators, graders or dozers for loading into rear dump trucks by front-end loaders. This is the preferred method as it minimises compression effects of the heavy equipment that is often necessary for economical transport of soil material;
- The surface of soil stockpiles will be left in as coarsely textured a condition as possible in order to promote infiltration and minimise erosion until vegetation is established, and to prevent anaerobic zones forming;

- Where possible, a maximum stockpile height that prevents biological and structural degradation will be maintained. Clayey soils will be stored in lower stockpiles for shorter periods of time compared to soils that have a coarser texture;
- Free-draining stockpiles will be created to minimise the formation of anaerobic zones. Stockpiles will be formed in a "chevron" profile with batters graded to achieve slopes approaching 18°, where practicable;
- If long-term stockpiling is planned (i.e. greater than 12 months), stockpiles will be seeded and fertilised. An annual cover crop species that produce sterile florets or seeds will be sown. A rapid growing and healthy annual pasture sward provides sufficient competition to minimise the emergence of undesirable weed species. The annual pasture species will not persist in the rehabilitation areas but will provide sufficient competition for emerging weed species and enhance the desirable micro-organism activity in the soil;
- Prior to re-spreading stockpiled topsoil onto regraded overburden or other disturbed areas (particularly onto designated tree seeding areas), an assessment of weed infestation on stockpiles will be undertaken to determine if individual stockpiles require herbicide application and / or "scalping" of weed species prior to topsoil spreading; and
- Topsoil will be spread to a nominal depth range of 0.1 m (steep slopes) to 0.2 m (flatter areas). Soil respreading on steep slopes at depths exceeding 0.1 m can be deleterious because of the "sponge" effect which can cause slippage of the topsoil from the slope.

26.4.6.3 Topsoil Respreading and Seedbed Preparation

Where possible, suitable topsoil will be re-spread directly onto reshaped disturbance areas and where topsoil resources allow, topsoil will be spread to a nominal minimum depth range of 0.1 to 0.3 m on all rehabilitation areas. Specific topsoil respreading depths for different post mining landform elements will be specified in the project's Topsoil Management Plan and Erosion and Sediment Control Plan (ESCP).

The spreading of topsoil, addition of soil ameliorants and application of seed will be carried out in consecutive operations to reduce the potential for topsoil loss to wind and water erosion.

Thorough seedbed preparation will be undertaken to ensure optimum establishment and growth of vegetation. All topsoiled areas should be lightly contour ripped (after topsoil spreading) to create a "key" between the soil and the subsoil/capping materials. This process will be undertaken on the contour and the tynes lifted for approximately 2 m every 200 m to reduce the potential for channelized erosion. Where possible it will be undertaken when the soil is moist and immediately prior to sowing for best results. The respread topsoil surface will be scarified prior to, or during seeding to reduce run-off and increase infiltration.

Some of the soils in the project site may exhibit sodic properties. Sodic soils are not optimal for rehabilitation works as the clay particles tend to disperse and swell producing poor physical soil conditions. These conditions include water-logging and hard-setting crusts which in turn negatively affect infiltration rates, plant-available water capacity, seedling emergence and root development. Topsoil resources for rehabilitation works will be selected to minimise potential soil sodicity effects (Volume 1, Section 5). For some soils, the application of soil ameliorants that decrease soil dispersibility and increase soil aggregate stability will be an important soil rehabilitation management tool.

Soil organic matter increases soil aggregate stability and adding carbon as a soil ameliorant will improve soil structure. Carbon ameliorants such as mulch will be beneficial for rehabilitated landforms within the Project site. Organic amendments will supplement elevated organic carbon levels in the project site's soils to improve structural stability. Fertiliser additions will be undertaken upon routine receipt of soil test results during a proposed progressive soil testing programme.

The presence of acid sulphate soils within the Project area will be assessed in the Phase 2 soils survey scheduled for May 2011. Given that the project falls outside "low-lying coastal areas" in accordance with State Planning Policy 2/02 - Planning and Managing Development Involving Acid Sulphate Soils (Department of Infrastructure and Planning, 2002), an assessment of the risk of acid sulphate soils is not anticipated to be required for the site's soil survey.

26.4.6.4 Erosion and Sediment Control

A detailed Erosion and Sediment Control Plan (ESCP) will be developed prior to the commencement of construction works and the control measures outlined will be implemented for the full project lifecycle (construction, operations and closure). The principle objectives of the ESCP are:

- To minimise erosion and sedimentation from all active and rehabilitated areas, thereby minimising sediment ingress into surrounding surface waters;
- To ensure the segregation of contact water (surface runoff from disturbed catchments (e.g. active areas of disturbance, stockpiles and rehabilitated areas (until stabilised)) from non-contact water (surface runoff from catchments that are undisturbed or relatively undisturbed by project-related activities and rehabilitated catchments), and maximise the retention time of contact water such that any discharge from the project site complies with the appropriate discharge criteria;
- To minimise the volume of water discharged from the project site but, should the discharge of water prove necessary, ensure sufficient settlement time is provided prior to discharge such that suspended sediment within the water meets the objectives identified in the point above;
- To manage surface flows upstream of the project site so that rehabilitation and coal recovery activities are not affected by flooding. Non-contact water diversion channels and creek diversions will be constructed prior to commencement of mining;
- To prevent erosion of the ephemeral watercourses that traverse the site;
- To manage erosion of the remedial works required as a result of subsidence impacts on the surface;
- To develop sustainable long-term surface water features following rehabilitation of the site, including implementation of an effective revegetation and maintenance program; and
- To monitor the effectiveness of surface water and sediment controls and to ensure all relevant surface-water quality criteria are met.

One of the primary design aspects of the project is the prevention of non-contact water in ephemeral drainage channels entering the active disturbance area. This will be achieved through the use of levees, cut-off drains, dams and diversions, as well as the containment of contact water in sediment dams within the active areas of the project to limit any uncontrolled runoff.

Effective erosion and sediment control for the project site will require appropriate activities to be carried out over the life of the project including:

- Construction;
- Operations; and
- Rehabilitation and Closure.

The effectiveness of erosion and sediment controls during the operational and closure stages will be optimised through effective mine planning and design. Suitable strategies will include:

- Designing and operating drainage systems for the life of the mine so that they do not cause erosion. This will involve scour protection of open drains and energy dissipaters located at drain outlets;
- Designing the final mine geometry to create a landform that allows free drainage of surface runoff while minimising erosion. This includes designing an appropriate drainage system that avoids erosion;
- Staging open cut mining to minimise the operational area exposed at any one time. This helps to reduce the potential for erosion and the extent and capacity of erosion and sediment control measures required, especially where the operational area has the potential to drain to a waterway; and

The proposed water management system for the Project is described in Volume 1, Section 11.

Where possible, contact and non-contact water will be segregated to minimise the requirement for on-site storage. This would allow water suitable for direct discharge (e.g. undisturbed catchments) to be diverted and on-site containment of water requiring treatment (e.g. settling suspended sediment).

The clean water system comprises:

- Non-contact water storage dam/s;
- The Adit Pit Water Dams;
- Sandy Creek, Well Creek and Middle Creek;
- Diversion of Rock Creek and Little Sandy Creek within the site boundary;
- Non-contact water catch drains to divert minor catchments in and around the mine site, where practical; and
- Highwall dams and levees upslope of voids, overburden and tailings storage facilities to reduce inflows and velocities from undisturbed catchments.

Contact water from disturbed areas will be captured in sediment dams to allow suspended solids to settle and, if necessary, allow a flocculent to be added to remove fine or dispersive sediment to meet allowable turbidity discharge limits. Opportunities for the use of contact water within the mining operations will be maximised to reduce overall water requirements for the site.

Sediment dams will be constructed to manage runoff from the areas of disturbance (i.e. waste emplacement facilities). The eastern portion of the overburden emplacement drains east, and sediment dams will intercept contact water before it reaches Sandy Creek. The eastern sediment dams overflow to a drain running along the western side of the main haul road. The overflow drain discharges to a final sediment dam, which discharges to Sandy Creek. The western portion of the overburden dump drains to the northern open cut pit, and sediment dams have been provided to intercept contact water before it reaches the pit. Water captured in the western sediment dams will be pumped back to the eastern sediment dams; however the western sediment dams will overflow to the pit during large storm events. A detailed strategy for managing surface water is provided in the Kevin's Corner Surface Water Assessment (Volume 1, Section 11).

26.4.7 Revegetation

26.4.7.1 Revegetation Programme Implementation

A revegetation strategy is proposed for the Project disturbance area that seeks to compliment desirable post-mining land-use objectives whilst maintaining effective erosion and weed controls.

Revegetation activities will be scheduled to occur after the completion of reshaping, re-topsoiling and drainage works. Where possible, the timing of these works will enable a preferred seasonal sowing of pasture and tree seed in autumn or spring.

On prepared surfaces, selected tree, shrub and pasture species will be sown using seed stock and/or planted depending on the species, slope gradients and area to be revegetated. Tree and shrub species will be established at a density and richness consistent with the nominated post-mine ecosystem.

26.4.7.2 Species Selection

Plant selection for areas to be rehabilitated to pre-existing conditions will focus on those species that will successfully establish on the available growth medium, bind the soil and will result in a variety of structure and food/habitat resources. Native species will be established through direct seeding or planting of tube stock/nursery-raised stock from local propagules. Seed will be collected locally where possible to ensure it is adapted to environmental conditions in the area.

Prior to application, some of the tree seed (eg Acacia spp) will be pre-treated (i.e. inoculated and scarified) in order to break dormancy restrictions to promote earlier germination, develop more robust seedlings, wider and more uniform germination and increased germination rates.

Tree and shrub establishment on site will be dominated by the direct seeding method, currently being used at the majority of coal mines located to the east of the Galilee Basin. Revegetation will be achieved by using species from the local plant communities that were identified during the flora assessment undertaken in 2010 (see Volume 1, Section 9), taking into account seed availability and seasonal suitability. Table 26.2 provides an indication of the species likely to be used for revegetation of the disturbance areas at within the Project area.

Table 26-2: Progressive rehabilitation throughout the life of the Kevin's Corner Coal Project (Mine)

Scientific Name	Common Name
Acacia cambagei	gidgee
Acacia coriacea subsp sericophylla	desert oak
Acacia excelsa	ironwood
Acacia harpophylla	brigalow
Acacia holosericea	soap bush
Acacia lazaridis	Lazarides wattle
Acacia leiocalyx	black wattle
Acacia oswaldii	milijee
Acacia salicina	sally wattle
Acacia shirleyi	lancewood
Aeschynomene indica	budda pea
Alphitonia excelsa	red ash
Aristida bigandulosa	dark wiregrass
Aristida sp.	wiregrass
Bothriochloa ewartiana	desert bluegrass
Chloris divaricata	slender chloris
Chrysopogon fallax	golden beard grass
Corymbia dallachiana	Dallachy's gum
Corymbia setosa	rough-leaved bloodwood
Dactyloctenium radulans	button grass
Dichanthium sericeum subsp sericeum	bluegrass
Digitaria brownii	cotton panic grass
Dodonaea lanceolata var. lanceolata	hopbush
Eragrostis sp.	lovegrass
Eremophila latrobei	crimson turkey bush
Eremophila mitchellii	false sandalwood
Eucalyptus brownii	reid river box
Eucalyptus camaldulensis	river red gum
Eucalyptus cambageana	Dawson gum
Eucalyptus coolabah	coolabah
Eucalyptus melanophloia	silver-leaved ironbark
Eucalyptus populnea	poplar box
Eucalyptus tessellaris	Moreton Bay ash
Eucalyptus thozetiana	Thozet's box
Melaleuca tamariscina	weeping bottlebrush
Panicum decompsitum	native millet
Setaria surgens	annual pigeon grass
Themeda triandra	kangaroo grass

A combination of native and introduced pasture species may be used on the disturbance areas to ensure the quick establishment of a continuous groundcover, thereby reducing the risk of erosion. Legumes may also be selected to assist in the supply of bio-available nitrogen to the soil. If the use of introduced grasses and/or legumes is deemed necessary for erosion control in the bushland areas, pasture seed and fertiliser will be applied at a lower rate than for pasture outcomes to reduce competition with tree seed and/or seedlings.

Where appropriate, native pasture species (warm season perennial, cool season perennial, yearlong green perennial and annual) will be sown where the risk of erosion is less and on the more protected aspects of landforms. Introduced, stoloniferous grass species (eg Rhodes Grass, Indian Couch) will be sown on the steeper slopes as their growth habit provides more extensive coverage in a shorter time. If native species are unsuccessful in areas identified as grazing pasture for final landuse, buffel grass (or other introduced pasture species) may be used on the condition that;

- The area does not border an area allocated for natural area rehabilitation of either woodland, grassland or riparian areas; or
- Border any area of uncleared vegetation (unless this is also buffel pasture).

Aerial sowing and ground broadcasting will be conducted for both tree and pasture seed as the preferred sowing methods and grazing will be restricted whilst the vegetation is establishing.

All revegetated areas will be monitored to ensure long-term groundcover establishment and success. Revegetation techniques will be continually developed and refined over the life of mine through an ongoing process of monitoring at the site and recognition of other industry experiences.

26.4.7.3 Special Treatment Areas

Additional erosion control measures such as the application of 'hydromulch' will be considered, particularly in drainage lines and steeper batter areas (e.g. infrastructure "cut and fill" batters). For example, sugar cane mulch as slurry provides cover for the soil to improve pasture growth, modifying the soil surface to control erosion, or a combination of both. Securely pressed against the surface of the soil, the mulch provides a high degree of erosion control and improves moisture availability to establishing pasture. The mulch also has the effect of protecting the soil surface against raindrop impact, improving the micro-environment for seed germination and establishment by reducing evaporation losses, and assisting in the control of surface erosion caused by raindrop impact and overland water flow.

Opportunities for the use of potential soil ameliorants (biosolids) to accelerate the rehabilitation process will also be investigated as appropriate.

26.4.8 Weed Management

The presence of weed species has the potential to be a major impact on revegetation and regeneration activities. In addition to this, the presence of weed species within the surrounding land has the potential to significantly decrease the value of the native vegetation. Weed management will be a critical component of mine rehabilitation and landscape reconstruction. Weeds will be managed across the site through a series of control measures, including:

- Hosing down at risk equipment in an approved wash down area before entry to site;
- Scalping weeds off topsoil stockpiles prior to re-spreading topsoil;
- Regular inspections of rehabilitation to identify potential weed infestations;
- Identifying and spraying existing weed populations on-site together with ongoing weed spraying over the life of the mine; and
- The use of agricultural herbicides in the areas to be stripped and on topsoil stockpiles.

Weed control, if required, will be undertaken in a manner that will minimise soil disturbance. Any use of herbicides will be carried out in accordance with appropriate state and/or federal regulatory requirements to minimise potential environmental impacts. Records will be maintained of weed infestations and control programs will be implemented according to best management practice for the weed species concerned.

26.4.9 Rehabilitation Success Criteria

Preliminary success criteria (or closure criteria) for the rehabilitation of the mine areas have been provided in the Environmental Management Plan (Volume 2, Appendix W). The success criteria are performance objectives or standards against which rehabilitation success in achieving a sustainable system for the proposed post-mine land use is demonstrated. Satisfaction and maintenance of the success criteria (as indicated by monitoring results) will demonstrate that the rehabilitated landscape is ready to be relinquished from the mine's financial assurance and handed back to stakeholders in a productive and sustainable condition.

The success criteria have been developed to comprise indicators for vegetation, fauna, soil, stability, land use and safety on a landform-type basis that reflects the nominated post-mine land use of bushland and grazing. For each element, standards that define rehabilitation success at mine closure are provided. Based on the generic indicators, each criterion will be further developed to be specific, measurable, achievable, realistic and outcome based, and to reflect the principle of sustainable development. The further development of each criterion will be based on results of research, monitoring of progressive rehabilitation areas and risk assessments. The success criteria will be reviewed every 3 to 5 years with stakeholder participation to ensure the criteria remain realistic and achievable.

26.4.10 Rehabilitation Monitoring

Regular monitoring of the rehabilitation will be required during the vegetation establishment period, to demonstrate whether the objectives of the rehabilitation strategy are being achieved and whether a sustainable landform has been provided.

In addition to rehabilitated areas, reference sites will be monitored to allow a comparison of the development and success of the rehabilitation against a control. Reference sites indicate the condition of surrounding un-mined areas that the rehabilitated disturbance area must replicate. Monitoring will be conducted periodically by independent, suitably skilled and qualified persons at locations which will be representative of the range of conditions on the rehabilitating areas. Annual reviews will be conducted of monitoring data to assess trends and monitoring program effectiveness.

The proposed rehabilitation monitoring programme details are provided in the Environmental Management Plan (Volume 2, Appendix W). Monitoring of the rehabilitated areas will broadly involve the following:

- Ongoing chemical analysis of topsoil;
- Comparison of soil erosion rates and rill and gully dimensions with measurements taken from reference sites;
- Comparison of vegetation measurements with measurements taken from reference sites;
- Ongoing analysis of water quality parameters in accordance with the development consent and environmental protection licence conditions from data collected monthly at water storages, ramps and pits, sedimentation dams and sewage effluent outfalls on-site, and continually from creeks (upstream and downstream of mine); and
- Visual surveillance including the use of digital photogrammetry / low level oblique or vertical aerial photography to monitor changes over time in the rehabilitation (e.g. changes in vegetation structure, erosion rates and landform drainage).

Monitoring of specific parameters will be undertaken to determine the level of achievement of success criteria.

26.4.11 Rehabilitation Maintenance

Maintenance of rehabilitated areas will be undertaken where necessary and in response to results of the monitoring program, to ensure success criteria are met, or in the case of progressive rehabilitation, are projected to be met at the time of mine closure. Depending on the criteria to be achieved, examples of maintenance works could include re-seeding or planting of tube stock of tree and/or shrub species to meet required revegetation parameters, the application of fertiliser, weed management and the implementation of erosion protection measures such as minor remedial earthworks or soil conservation works.

Post-mining surveys of the rehabilitation will be progressively undertaken across the site to determine whether the site meets success criteria and whether the results are maintained over time. Once maintenance and rehabilitation are no longer required, the area will be relinquished to the relevant stakeholders.