STRATFORDCOAL
Part of the Yancoal Australia Group

Stratford Extension Project
Environmental Impact Statement






SECTION 5

REHABILITATION STRATEGY

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5 REHABILITATION STRATEGY

5.1 REHABILITATION AT THE STRATFORD MINING COMPLEX

The MOPs for the Stratford Mining Complex describe site activities and the progress toward environmental and rehabilitation outcomes required under the mining lease conditions and the Development Consents (DA 23-98/99 and DA 39-02-01).

A summary of rehabilitation activities undertaken at the Stratford Mining Complex and relevant rehabilitation monitoring results are documented in the Annual Review.

Where relevant the existing objectives would be modified or built upon for the Project (Section 5.2). A summary of the current objectives for rehabilitation, and rehabilitation progress to date for the Stratford Mining Complex is provided below.

5.1.1 Stratford Coal Mine

To date, the general objectives of the SCM rehabilitation programme have been the minimisation of erosion and general reinstatement of pre-mining land capability (SCPL, 2010a). Section 4.3 provides a discussion on rural land capability and agricultural suitability in the Project area and surrounds.

Other objectives of rehabilitation are (SCPL, 2010a):

- the generation of a final rehabilitated landform which is consistent with general landforms in the area and which would blend in with the hills to the east;
- to provide a landform which is suitable for the primary final land uses of grazing, forestry and fauna habitat enhancement;
- to plan mining and overburden handling operations to minimise rehandling, reshaping and contouring;
- to minimise the amount of disturbed land awaiting rehabilitation; and
- to provide for the safe and environmentally acceptable disposal of CHPP rejects.

Rehabilitation goals for the SCM are set by Condition 35, Schedule 3 of DA 23-98/99 (Table 5-1).

Table 5-1
SCM General Rehabilitation Goals

Feature	Objective
Mine site as a whole	Safe, stable and non-polluting.
Other land affected by the development	Restore ecosystem function, including maintaining or establishing self-sustaining eco-systems comprising: • a wildlife corridor; • local native plant species; and • a landform consistent with the surrounding environment.
Final voids	Safe, stable and non-polluting.
Community	Minimise the adverse socio-economic effects associated with mine closure.

A summary of the key mine landforms, their rehabilitation status and current rehabilitation concepts are provided below.

Stratford Waste Emplacement

The Stratford Waste Emplacement (Figure 2-1) was generally constructed with an overall outer batter slope of 1V:5H with selected areas constructed with slopes of 1V:6H to 1V:4H. The waste rock was covered with 150 to 200 mm of topsoil followed by site preparation works (e.g. chisel ploughing) and progressive revegetation with a pasture cover crop and endemic shrubs and trees.

Rehabilitation works on the Stratford Waste Emplacement (Figure 2-1) have been effectively completed (Figure 2-6 and Plates 5-1 and 5-2).

A portion of the rehabilitated emplacement is supporting approximately 70 head of cattle, and some of the grazed area is irrigated by a pivot irrigation system, utilising water from the Stratford East Dam (Plate 5-2). The irrigation area is within a contained catchment, where all rainfall runoff from the irrigation area reports back to the Stratford East Dam (i.e. not off-site).

Roseville Pit

The Roseville Pit (Figure 2-1) was an open cut that was used for the co-disposal of CHPP rejects and water storage prior to being capped with mine waste rock and topsoiled. The Roseville Pit emplacement is being revegetated with pastures and native woodland species.

Plate 5-1: Stratford Waste Emplacement Looking West

Plate 5-2: Stratford Waste Emplacement - Rehabilitated Agricultural Areas

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PLATES 5-1 and 5-2
Stratford Waste Emplacement

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Roseville Extended Pit

The Roseville Extended Pit void (Figure 2-1) will ultimately be backfilled to approximately natural ground level in the south and 116 m AHD in the north, which is level with the existing flood/noise bund. On completion of waste rock placement the landform will be topsoiled and revegetated with native woodland and pasture species.

Roseville West Pit

The Stratford Coal Mine – July 2010 Modification Environmental Assessment (SCPL, 2010a) describes that following the completion of mining, the Roseville West Pit void (Figure 2-1) will either be backfilled with waste rock from future development pits (subject to future approvals) or remain as a final void.

If it remains as a final void, in accordance with the requirements of DA 23-98/99, the Roseville West Pit will be required to be safe, stable and non-polluting.

Stratford Main Pit

The Stratford Main Pit (Figure 2-1) is currently used for waste rock backfill, co-disposal of CHPP rejects and water storage. However, currently approved mining operations at the Stratford Mining Complex will not result in the complete backfilling of the Stratford Main Pit.

In accordance with the requirements of DA 23-98/99, the Stratford Main Pit will be required to be safe, stable and non-polluting if it is retained as a final void.

Stratford East Dam

The Stratford East Dam (Figure 2-1) will most likely be retained after mine closure. It is anticipated that the water storage would be a significant farm dam post-mining.

Western Co–disposal Area and Return Water Dam

The reclaim of previously co-disposed CHPP rejects from the western co-disposal area (Figure 2-1) is ongoing to recover thermal coal products. The return water dam is a turkey's nest dam that adjoins the co-disposal area.

Rehabilitation concepts for the western co-disposal area (following the completion of recovery of thermal coal) and return water dam include reshaping the remaining *in situ* material and embankments, capping with a layer of coarse reject material and topsoiling for revegetation with pastures or selected native woodland species.

Parkers/Bowens Road West Pit

Rehabilitation concepts for the Parkers/Bowens Road West Pit void (Figure 2-1) are to backfill the void to approximate pre-mining surface levels and revegetate to grazing land use.

Infrastructure Areas

SCM infrastructure, including the CHPP, buildings and electricity transmission lines (Figure 2-1), will be removed and the sites ripped and seeded as required. Some concrete hardstands, site access roads and water management structures may be retained for alternate post-mining uses.

Permanent Up-catchment Diversion Structures

Permanent up-catchment diversion structures constructed at the Stratford Mining Complex have been designed and constructed to be stable in the long-term and would be retained post-mining.

5.1.2 Bowens Road North Open Cut

Waste Rock Emplacements

Rehabilitation of the BRNOC out-of-pit Northern Waste Emplacement and Southern Waste Emplacement (Figure 2-1) has been undertaken progressively since the commencement of mining operations in 2003. Rehabilitation to date has focussed on re-contouring the waste emplacements to batter slopes of 1V:4H and establishment of endemic woodland shrubs and trees (Plates 5-3 and 5-4).

Plate 5-3: BRNOC Southern Emplacement Rehabilitation

Plate 5-4: BRNOC Northern Emplacement Rehabilitation

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PLATES 5-3 and 5-4
BRNOC Waste Emplacement Rehabilitation

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BRNOC Final Void

The rehabilitation principles for the BRNOC final void are outlined in the BRN EIS. The principles include:

- re-establish drainage into the void, resulting in the accumulation of groundwater inflows and surface waters;
- once filled, the void will overflow to Avondale Creek; and
- the final void waterbody and drainage pathway will be bordered by wetland and woodland rehabilitation.

5.1.3 Wildlife Corridor

An area designated as a wildlife corridor was proposed as part of the Stratford Coal EIS (SCPL, 1994a). It was proposed to link existing areas of vegetation within the mining lease with larger areas of natural vegetation to the east.

The original SCM wildlife corridor was modified and augmented by SCPL to incorporate various modifications to the SCM and the BRNOC. The current layout of the wildlife corridor is shown on Figure 2-6.

Existing BRNOC and proposed Project biodiversity offsets are described in Sections 4.9.4, 4.10.4 and 4.11.4.

5.1.4 Existing Rehabilitation Monitoring and Management

SCM Development Consent (DA 23-98/99) Condition 37 of Schedule 3 requires the preparation of a Rehabilitation Management Plan for the Stratford Mining Complex.

The *Stratford Mining Complex Rehabilitation Management Plan* (SCPL, 2011d) describes:

- rehabilitation objectives and principles;
- completion criteria;
- rehabilitation processes; and
- rehabilitation monitoring, management and reporting.

5.2 REHABILITATION OF THE PROJECT

As a component of Project planning, SCPL has reviewed mine closure and rehabilitation objectives, rehabilitation practices for the Stratford Mining Complex, and the opportunity for integration of mine rehabilitation areas with the biodiversity offsets for the Project.

This review considered the *Leading Practice Sustainable Development Program for the Mining Industry – Mine Rehabilitation* (Commonwealth Department of Industry, Tourism and Resources [DITR], 2006a) and the *Strategic Framework for Mine Closure* (Australian and New Zealand Minerals and Energy Council and Minerals Council of Australia, 2000).

The review has also made use of extensive SCPL operational rehabilitation experience and this has resulted in some alteration and updates to aspects of the Stratford Mining Complex rehabilitation planning and practices (refer to sub-sections below and Section 5.3).

5.2.1 General Rehabilitation and Mine Closure Goals for the Project

The Project would require the progressive removal of approximately 105 ha of native vegetation communities and 195 ha of introduced or planted vegetation.

Table 5-2 describes the general rehabilitation and mine closure goals for the Project. The rehabilitation and revegetation concepts described within this section build upon, and are consistent with, these goals.

The SCPL mine closure goal for the Project is to achieve relinquishment to the satisfaction of the relevant Minister(s), meeting relevant mining lease and Development Consent conditions.

Rehabilitation of mined lands would be considered suitable when the nominated standards and/or completion criteria for land use, landform stability, revegetation, and beneficial use have been met, or if the relevant Minister(s) otherwise accepts the rehabilitation status.

Table 5-2
General Rehabilitation and Mine Closure Goals for the Project

Short to Medium-term	Long-term
• Restrict clearing to the minimum disturbance areas required and recover vegetation and fauna habitat resources (e.g. trees, hollows) during clearing activities for re-use in rehabilitation areas. • Minimise the time soil is stored in temporary stockpiles before being re-used, and where practicable use stripped soil directly for rehabilitation. • Progressively rehabilitate disturbance areas as they become available. • Reshape completed backfilled open cut areas and waste rock emplacements progressively to their final landform shape, so that revegetation is staged. • Sow cover crops on completed operational disturbance areas and final profile mine landforms as soon as possible after completing earthworks and placement of topsoil, to minimise the potential for soil erosion. • Establish endemic woodland/open forest species and/or pasture in the rehabilitation areas in accordance with the Project rehabilitation goals.	• Create stable mine landforms that are non-polluting and integrate with the adjoining ridgeline to the east and existing waste rock emplacements. • Construct final mine landforms that drain in a stable manner to Avondale Creek, Dog Trap Creek and their associated tributaries. • Revegetate mine landforms to include endemic woodland/open forest species. • Revegetate mine landforms to include agricultural land (e.g. Class 4 lands under the Agricultural Suitability classification system). • Backfill the Stratford Main Pit and BRNOC as part of the Project. Incorporate three final voids at the cessation of the Project (Stratford East Open Cut, Avon North Open Cut and Roseville West Pit Extension). • Enhance the habitat values and biodiversity values of the Project area (including endemic woodland/open forest areas) at relinquishment of the mining leases. • Woodland/open forest areas are self-sustaining and on a path towards obtaining comparable flora and fauna values with unmined control sites of remnant vegetation.

5.2.2 Post-Mining Land Use and Conceptual Final Landform

Post-Mining Land Use

Post-mining the Project area would comprise a combination of grazing and nature conservation (woodland/open forest) land use areas. Figures 5-1 and 5-2 illustrate the Project conceptual final landform rehabilitation. It is anticipated that the nature conservation areas would be included in a voluntary conservation agreement or other similar title covenant or restriction, that would preclude them being cleared in the long-term.

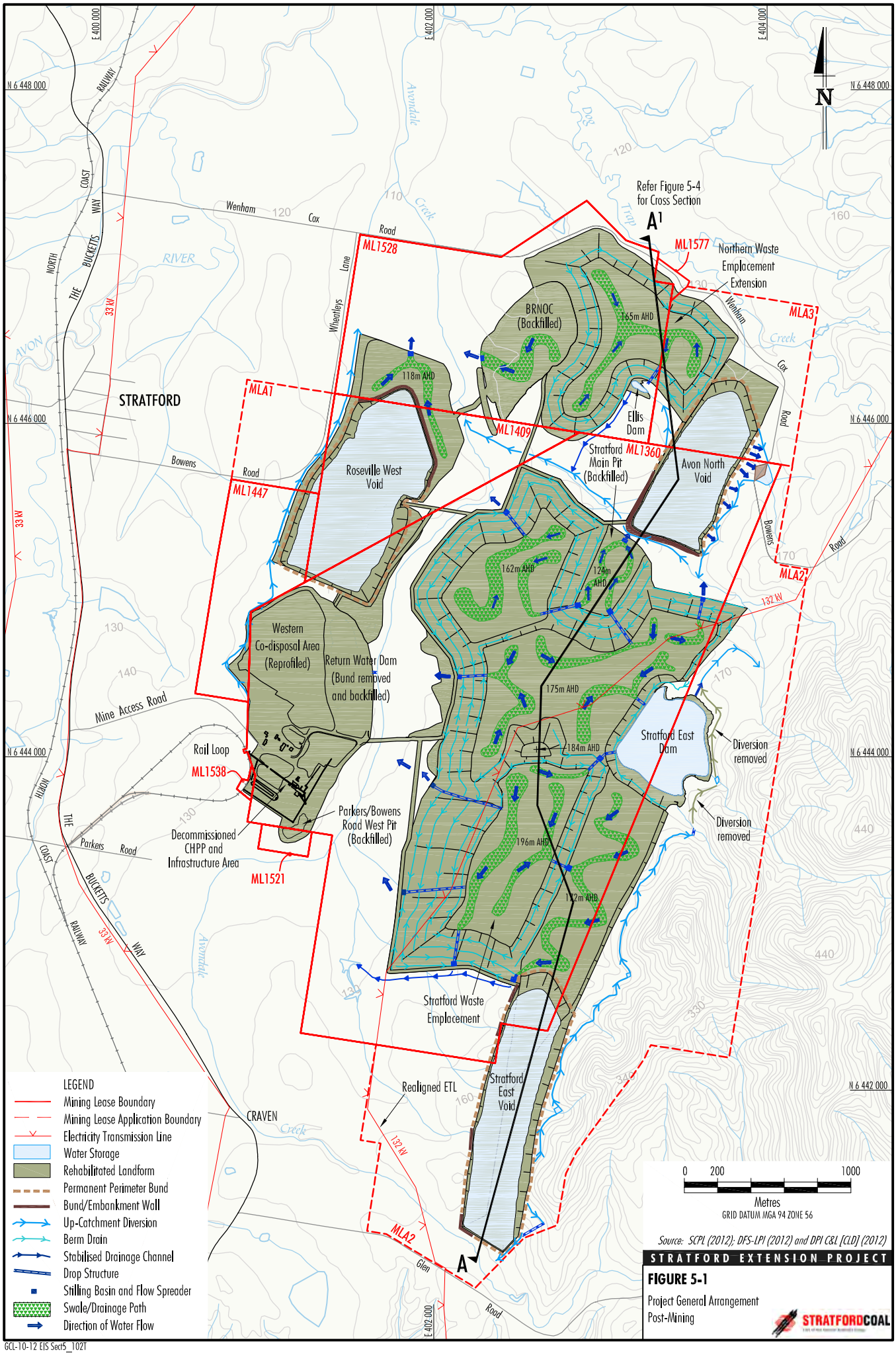
Conceptual Final Landform

Figure 5-1 shows the conceptual final landform. Key features of the final landform include:

- final voids located in the Stratford East Open Cut, Avon North Open Cut and Roseville West Pit Extension;
- elevated mine landforms associated with the Stratford Waste Emplacement and Northern Waste Emplacement that are broadly integrated with the surrounding landforms;
- landforms at grade or only slightly elevated above pre-mining topography associated with areas of the backfilled open cut pits, the rehabilitated infrastructure area and western co-disposal area; and
- permanent Stratford East Dam water storage structure and various water management structures to direct the flow of water from the mine landforms to Avondale Creek, Dog Trap Creek and their associated tributaries.

Further detail on the final landforms is provided in the domain by domain discussion in Section 5.2.3.

Figure 5-3 provides a cross-section illustrating the final Project landforms, including two of the three final voids.


E 400 000
E 402 000
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Refer Figure 5-4 for Cross Section
A1
A
ML1577
Northern Waste Emplacement Extension
ML1528
ML1409
ML1360
ML1447
ML1538
ML1521
MLA1
MLA2
MLA3
BRNOC (Backfilled)
165m AHD
118m AHD
Ellis Dam
Stratford Main Pit (Backfilled)
Roseville West Void
Avon North Void
162m AHD
124m AHD
175m AHD
184m AHD
196m AHD
192m AHD
Western Co-disposal Area (Reprofiled)
Return Water Dam (Bund removed and backfilled)
Mine Access Road
Rail Loop
Parkers/Bowens Road West Pit (Backfilled)
Decommissioned CHPP and Infrastructure Area
Stratford East Dam
Diversion removed
Diversion removed
Stratford Waste Emplacement
Stratford East Void
Realigned ETL
STRATFORD
CRAVEN
Wenham Cox Road
Bowens Road
Parkers Road
Wheatleys Lane
Mine Access Road
Glen Road
Avondale Creek
Wenham Cox Creek
Dog Trap Creek
NORTH BUCKETTS WAY
THE COAST RAILWAY
HUNTER RIVER
AVON RIVER
33 kV
132 kV
LEGEND
Mining Lease Boundary
Mining Lease Application Boundary
Electricity Transmission Line
Water Storage
Rehabilitated Landform
Permanent Perimeter Bund
Bund/Embankment Wall
Up-Catchment Diversion
Berm Drain
Stabilised Drainage Channel
Drop Structure
Stilling Basin and Flow Spreader
Swale/Drainage Path
Direction of Water Flow
0 200 1000
Metres
GRID DATUM MGA 94 ZONE 56
Source: SCPL (2012); DFS-LPI (2012) and DPI C&L [CLD] (2012)
STRATFORD EXTENSION PROJECT
FIGURE 5-1
Project General Arrangement Post-Mining
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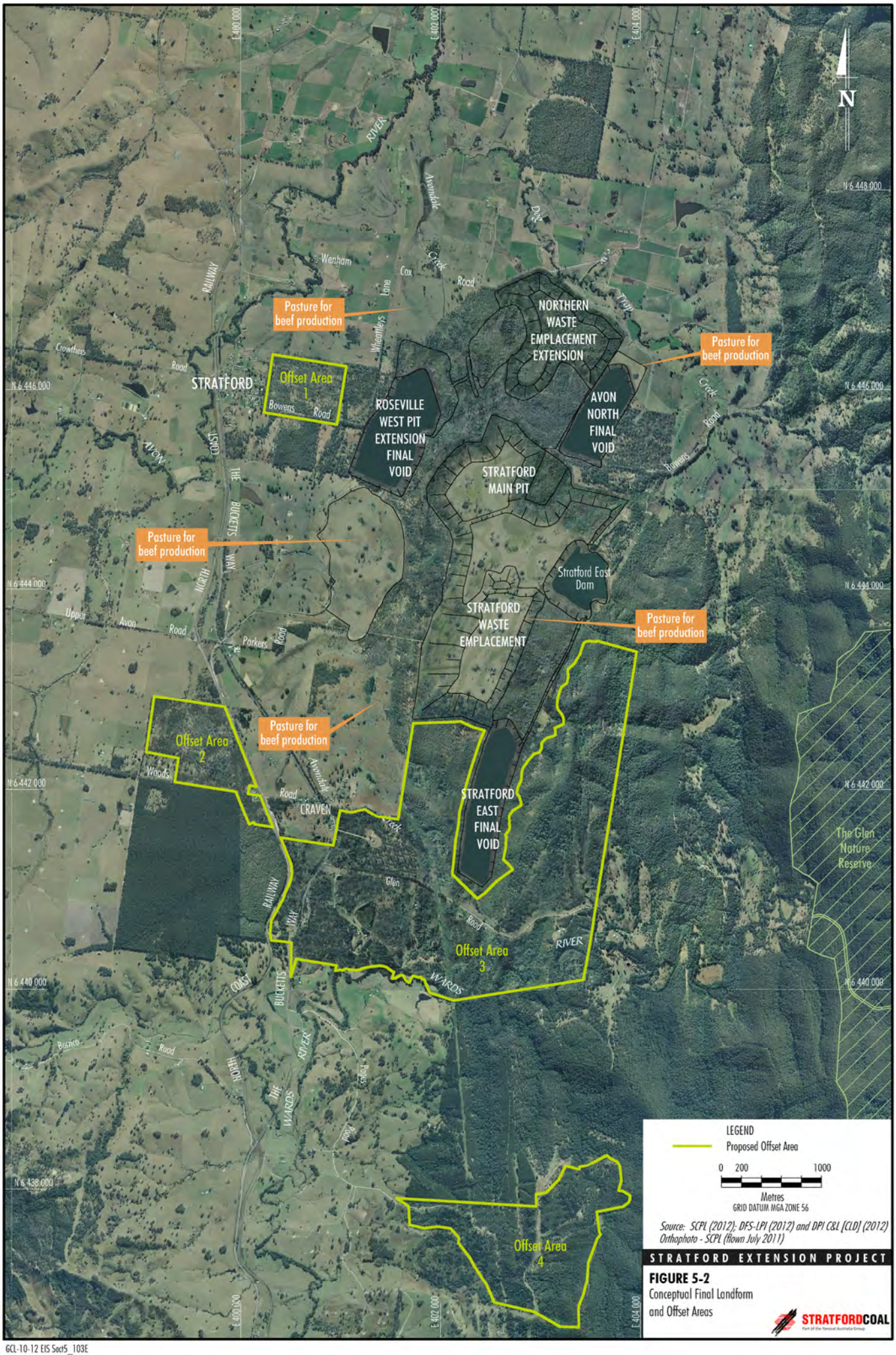

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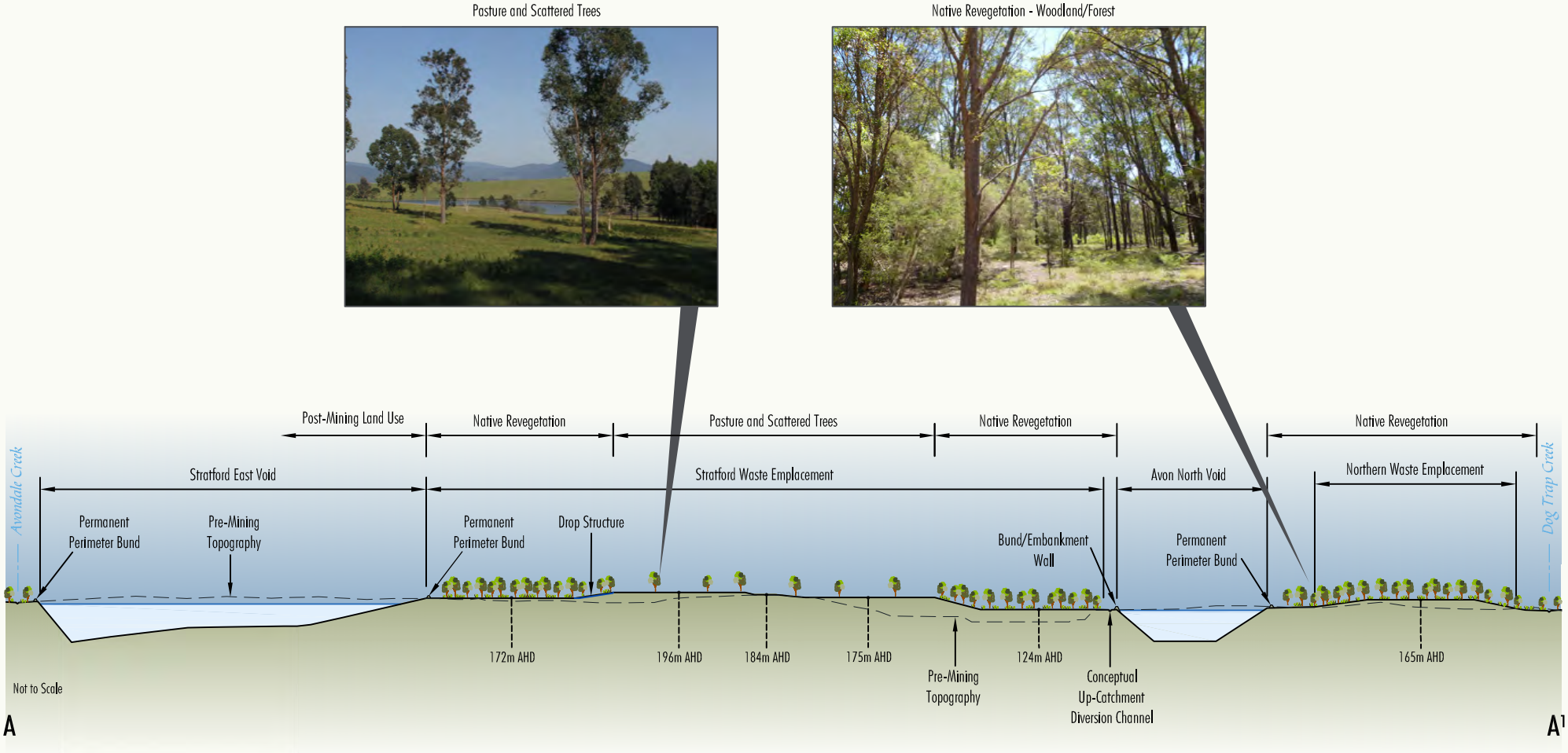

Section A - A1

(Refer Figure 5-1)

STRATFORD EXTENSION PROJECT

FIGURE 5-3

Conceptual Cross Section of the Rehabilitated Project Mine Landform

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5.2.3 Rehabilitation Domains and Conceptual Domain Objectives

For mine closure and rehabilitation planning it is useful to break the Project site into smaller domains. Project conceptual rehabilitation domains are shown on Figure 5-4. The conceptual domains are as follows:

- Infrastructure (A);
- North-west (B);
- North-east (C);
- Central Waste Rock Emplacement (D);
- South-east (E); and
- Central Vegetation Management Area (F).

Key Project features within these domains and the domain goals and objectives are described below.

Refinement of these goals, objectives and domains would be presented where relevant in the Rehabilitation Management Plan, Biodiversity Management Plan and MOPs/Mine Closure Plan.

Infrastructure Domain (A)

This domain is dominated by the infrastructure associated with coal handling, processing and railing and general supporting infrastructure.

The infrastructure domain can be further subdivided on the basis of Project use:

- Coal handling areas:
  - CHPP;
  - ROM coal handling and stockpile areas;
  - product coal handling and stockpile areas;
  - train unloading and loading infrastructure; and
  - rail loop.
- Workshops and fuel farm.
- Mine access road, administration and carparks.
- CHPP reject disposal areas:
  - western co-disposal area; and
  - Parkers/Bowens Road West Pit.
- Return water dam.

Conceptual mine closure and rehabilitation objectives for the infrastructure domain are as follows:

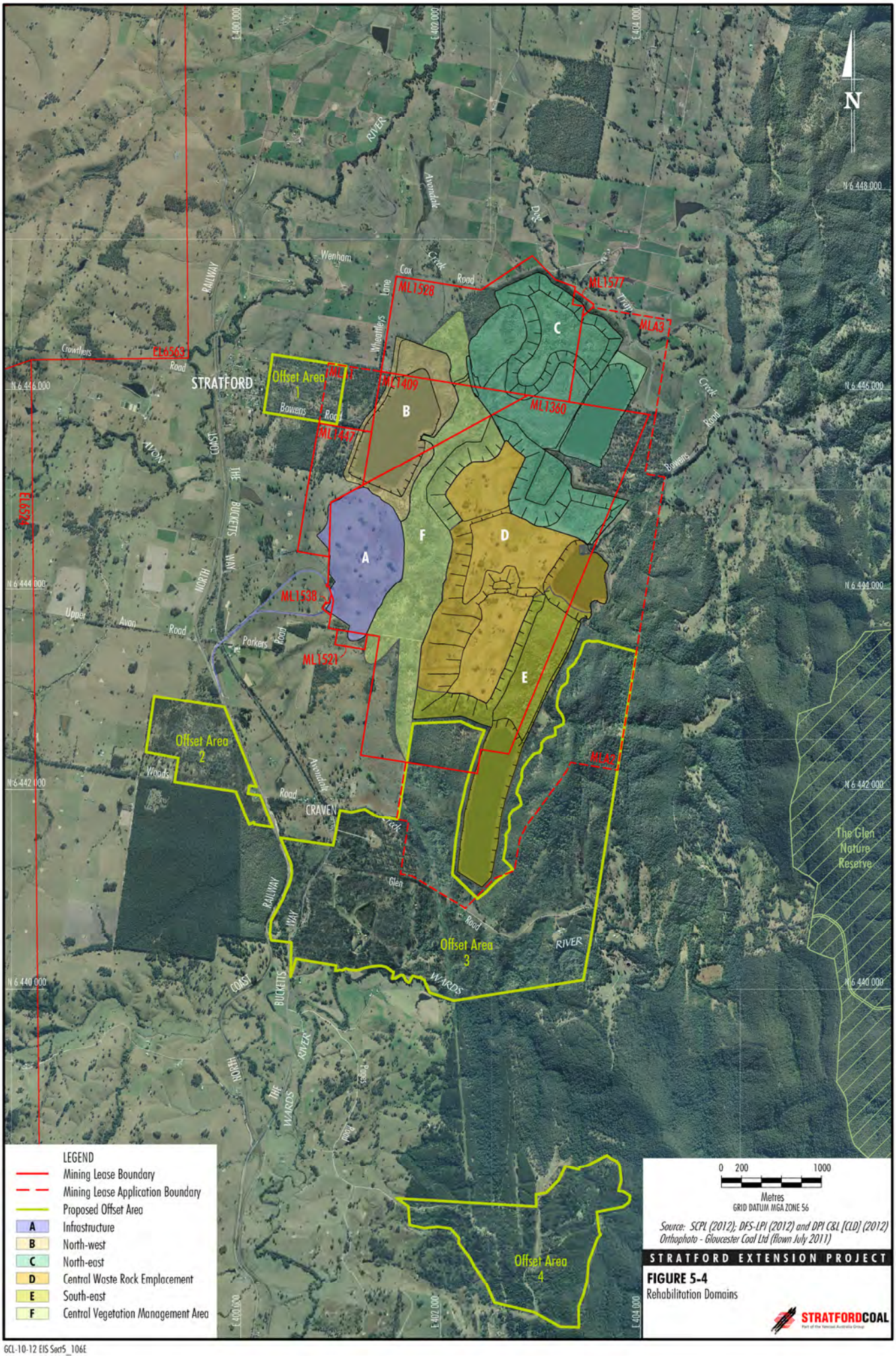
- The mine access road and select hardstand areas would be retained for future agricultural use.
- All other infrastructure would be decommissioned and removed, unless otherwise agreed by the determining authority (e.g. removal of the CHPP, conveyors, coal handling and stockpile infrastructure).
- If there are any contaminated soils associated with the site workshops or contaminated sediments in the return water dam, these would be identified and remediated in accordance with the requirements of the NSW *Contaminated Land Management Act, 1997*.
- Remaining CHPP reject material in the western co-disposal area would be encapsulated in accordance with the requirements of the *Stratford Coal Mine Life of Mine Rejects Disposal Plan* (SCPL, 2009).
- CHPP reject material in the Parkers/Bowens Road West Pit would be capped in accordance with the requirements of the *Stratford Coal Mine Life of Mine Rejects Disposal Plan* (SCPL, 2009).
- The domain would be profiled to a free-draining landform, with runoff reporting to Avondale Creek (Figure 5-1);
- The domain would be revegetated to pasture, with scattered endemic woodland/open forest trees (Figure 5-2); and
- Following rehabilitation, the majority of the domain would be suitable for grazing (e.g. Class 4 lands under the Agricultural Suitability classification system).

Further detail on the proposed management of the western co-disposal area and Parkers/Bowens Road West Pit is provided below.

Western Co-Disposal Area

In accordance with the *Stratford Coal Mine Life of Mine Rejects Disposal Plan* (SCPL, 2009) any remaining CHPP reject material in the western co-disposal area at the end of the mine life (i.e. CHPP rejects that are not mined) would be encapsulated as follows:

- placement of a suitably well-drained layer of material to act as a capillary breaking layer between the reject material and the overlying cover;



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- placement of a combined subsoil and topsoil cover of a nominal thickness of 0.9 m (nominally including 0.6 m of compacted clay overlain by 0.3 m of topsoil); and
- establishment of a vegetative cover of shallow rooting grasses and shrubs.

For portions of the western co-disposal area where the CHPP reject material has been reclaimed, rehabilitation would be consistent with other general infrastructure disturbance areas.

Parkers/Bowens Road West Pit

The Parkers/Bowens Road West Pit has historically been used for both CHPP reject disposal and containment storage for surface water runoff from infrastructure areas. It is envisaged that the Parkers/Bowens Road West Pit would be backfilled with waste rock prior to, or as a component of, mine closure.

In accordance with the *Stratford Coal Mine Life of Mine Rejects Disposal Plan* (SCPL, 2009), the Parkers/Bowens Road West Pit void would be backfilled during Project rehabilitation activities to approximate the pre-mining elevation, and would be revegetated appropriately for grazing post-mining land use.

In addition, with respect to backfilling of the void:

- CHPP reject would not be deposited at levels higher than the final groundwater level (Appendix A); and
- a minimum cover of 1.5 m of inert material would be placed above the CHPP reject.

This is the same methodology implemented for the successfully rehabilitated Roseville Pit (Section 5.1.1) (SCPL, 2009).

Section 5.3.9 describes design criteria and stabilisation measures for permanent up-catchment diversion structures.

North-west Domain (B)

The north-west domain can be further subdivided based on the following features:

- backfilled Roseville West Pit Extension;
- Roseville West Pit Extension final void; and
- vegetation management areas.

As described in Section 2.7.2, the mining of the Roseville West Pit Extension would require the excavation of the previously mined and backfilled Roseville Pit. Over-excavation of the previously backfilled Roseville Pit would occur to maintain geotechnical stability of the pit walls.

Conceptual mine closure and rehabilitation objectives for the north-west domain are as follows:

- the catchment area of the Roseville West Pit Extension final void would be minimised with provision of permanent perimeter bunds (Figure 5-1);
- the backfilled open pit would be profiled to a free-draining landform, with runoff reporting to Avondale Creek; and
- the backfilled waste rock emplacement would be revegetated using endemic woodland/open forest species.

Further detail on the proposed management of final voids including safety requirements is provided in Section 5.3.8.

A discussion of the native plant species for revegetation is provided in Section 5.3.3.

Section 5.3.9 describes design criteria and stabilisation measures for permanent up-catchment diversion structures.

North-east Domain (C)

The north-east domain can be further subdivided based on the following features:

- Northern Emplacement waste rock emplacement area (including a portion of the backfilled BRNOC);
- at grade backfilled portion of BRNOC in the south;
- a portion of the backfilled Stratford Main Pit CHPP reject co-disposal/waste rock emplacement area;
- Avon North Open Cut final void (including CHPP reject co-disposal area);
- a portion of the relocated TransGrid 132 kV electricity transmission line (Figure 2-1); and
- vegetation management areas.

Conceptual mine closure and rehabilitation objectives for the north-east domain are as follows:

- CHPP reject material in the Stratford Main Pit would be capped in accordance with the requirements of the *Stratford Coal Mine Life of Mine Rejects Disposal Plan* (SCPL, 2009);
- the Northern Emplacement, at grade backfilled BRNOC, backfilled Stratford Main Pit and backfilled Avon North Open Cut would be profiled to free-draining landforms, with runoff reporting to Dog Trap Creek and Avondale Creek;
- the Northern Emplacement, at grade backfilled BRNOC and backfilled Stratford Main Pit would be revegetated using endemic woodland/open forest species (Figure 5-2);
- the backfilled Avon North Open Cut CHPP reject co-disposal area would be revegetated with pasture and scattered endemic woodland/open forest trees for grazing use (e.g. Class 4 lands under the Agricultural Suitability classification system); and
- the catchment area of the Avon North Open Cut final void would be minimised with provision of permanent perimeter bunds, up-catchment diversions and/or bunds/embankment walls (Figure 5-1);
- vehicular access to the TransGrid 132 kV electricity transmission line alignment and tower sites would be maintained, and revegetation along the corridor would be restricted to low growing species and/or pasture in accordance with TransGrid requirements.

With respect to backfilling of the Stratford Main Pit void:

- CHPP reject would not be deposited at levels higher than the final groundwater level (Appendix A); and
- a minimum cover of 1.5 m of inert material would be placed above the CHPP reject.

This is the same methodology implemented for the successfully rehabilitated Roseville Pit (Section 5.1.1) (SCPL, 2009).

Further detail on the proposed management of final voids including safety requirements is provided in Section 5.3.8.

A discussion of the native plant species for revegetation is provided in Section 5.3.3.

Central Waste Rock Emplacement Domain (D)

The central waste rock emplacement would become an area that would be designed and rehabilitated specifically for grazing post-mining use.

The central waste rock emplacement domain can be further subdivided based on the following features:

- the majority of the upper surface and the majority of the western batters of the Stratford Waste Emplacement;
- the Stratford East Dam; and
- a portion of the relocated TransGrid 132 kV electricity transmission line (Figure 2-1).

Conceptual central waste rock emplacement mine closure and rehabilitation objectives for the domain are as follows:

- the domain would be profiled to a free-draining landform, with runoff reporting to Avondale Creek and the Stratford East Dam;
- the Stratford East Dam would be retained for future agricultural use;
- the waste rock emplacement area would be revegetated with pasture, with scattered endemic woodland/open forest trees and/or small stock shelter woodlots (Figure 5-2);
- vehicular access to the TransGrid 132 kV electricity transmission line alignment and tower sites would be maintained; and
- following rehabilitation, the majority of the domain would be suitable for grazing (e.g. Class 4 lands under the Agricultural Suitability classification system).

A discussion of the native plant species for revegetation is provided in Section 5.3.3.

South-east Domain (E)

The south-east domain can be further subdivided based on the following features:

- Stratford Waste Emplacement southern batter; and
- the Stratford East Open Cut final void.

Conceptual mine closure and rehabilitation objectives for the south-east domain are as follows:

- the southern batter of the Stratford Waste Emplacement would be profiled to a free-draining landform, with runoff reporting to Avondale Creek;
- the southern batter of the Stratford Waste Emplacement would be revegetated using endemic woodland/open forest species (Figure 5-2); and
- the catchment area of the Stratford East Open Cut final void would be minimised with provision of permanent perimeter bunds, up-catchment diversions and/or bunds/embankment walls (Figure 5-1).

Further detail on the proposed management of final voids including safety requirements is provided in Section 5.3.8.

A discussion of the native plant species for revegetation is provided in Section 5.3.3.

Central Vegetation Management Area Domain (F)

The Central Vegetation Management Area has been identified as a separate domain, as it is primarily outside of the Project disturbance area and would be subject to revegetation works and the exclusion of stock for the re-establishment of native flora and provision of fauna habitat.

The Central Vegetation Management Area includes a range of landforms associated with the lower slopes and floodplains of Avondale Creek that are currently vegetated with introduced pastures with scattered native trees, Cabbage Gum open forest or woodland on flats of the North Coast and New England Tablelands, Spotted Gum-Grey Ironbark dry open forest of the lower foothills of the Barrington Tops, North Coast and artificial wetlands (Figure 4-21).

Conceptual mine closure and rehabilitation objectives for this domain are as follows:

- the vegetation management area would be revegetated using endemic tree and wetland species to provide wildlife habitat;
- existing access roads (e.g. Parkers Road, Bowens Road) through the wildlife corridor would be retained for future agricultural use (e.g. stock access to and from the agricultural areas in Domains A and D); and
- vehicular access to the TransGrid 132 kV electricity transmission line alignment and tower sites would be maintained, and revegetation along the corridor would be restricted to low growing species and/or pasture.

A discussion of the native plant species for revegetation is provided in Section 5.3.3.

5.2.4 Integration of Project Rehabilitation and Biodiversity Offset Areas

The proposed Project rehabilitation strategy would result in the integration of the rehabilitated Project landforms in Domain E with the Project Offset Area 3 and would result in the establishment of a native vegetation connection between Offset Area 3 and Offset Area 1 via the vegetation management areas and mine landform revegetation. Figure 5-2 illustrates the Project conceptual final landform rehabilitation and how it would integrate with the Project biodiversity offset areas.

Additional detail on the Project biodiversity offset areas are provided in Sections 4.9.4, 4.10.4 and 4.11.4.

5.2.5 Strategic Rehabilitation Completion Criteria

Strategic rehabilitation completion criteria have been developed for the Project. These criteria have been developed with regard to *Leading Practice Sustainable Development Program for the Mining Industry – Mine Closure and Completion* (DITR, 2006b).

It is appropriate that the criteria described below remain at the strategic level for this EIS. Over the life of the Project, rehabilitation completion criteria would periodically be updated and refined in consultation with relevant stakeholders to include additional quantitative criteria and reflect evolving site rehabilitation practices and standards.

It is expected that the Rehabilitation Management Plan and/or Mine Closure Plan would describe the rehabilitation completion criteria including quantified criteria where applicable.

Decommissioning

1. Project infrastructure is to be decommissioned in accordance with the Mine Closure Plan to the satisfaction of the regulating authorities.
2. Any potentially contaminated areas are to be tested and where required, remediated, in accordance with the *Land Contamination Management Act, 1997* following infrastructure decommissioning.

Landform Establishment

1. After the completion of bulk materials handling in each domain, finalised landform areas (e.g. waste rock emplacement batters) are to be re-profiled to final slopes, and drainage structures installed consistent with the requirements of the Rehabilitation Management Plan.
2. Final landform elevations and slopes are to be surveyed to determine compliance with the specifications (landform slopes, final elevations, etc.) set out in the Rehabilitation Management Plan prior to the placement of growth media.

Growth Media Development

1. Specific soil stripping depths and soil amelioration requirements for each domain are to be based on detailed pre-stripping surveys.
2. Suitable and sufficient topsoil and subsoil growth media is to be stripped, and where necessary, suitably stockpiled for use in rehabilitation. Annual reporting of the site soil balance is to be provided in the Annual Review.
3. Soil application depths, amelioration requirements and soil application equipment on rehabilitated landforms are to be in accordance with the Rehabilitation Management Plan.
4. Suitable soil preparation (e.g. ripping on contour or tilling) is to be undertaken prior to establishment of vegetation.

Ecosystem Establishment

1. After placement of growth media on profiled landforms, a sterile cover crop is to be sown to stabilise the growth media and minimise soil erosion.
2. Unless in declared drought conditions, after the placement of growth media on profiled landforms, a suitable combination of pastures and/or endemic woodland/open forest species is to be established in accordance with the nominated post-mining use for the domain (i.e. sowing and/or planting of tube-stock).
3. After revegetation establishment in a domain, representative rehabilitation monitoring transects are to be established in that domain and in corresponding representative control sites in accordance with the requirements of the Rehabilitation Management Plan.

Ecosystem Development

1. Monitoring of native vegetation rehabilitation is to be undertaken in accordance with the Rehabilitation Management Plan at intervals no longer than biannually, and the results reported in the Annual Review.
2. In the native vegetation rehabilitation areas, monitoring is to include the use of Landform Function Analysis[1] (LFA) or a similar systems-based approach to determine progress towards a self sustaining ecosystem and compare the condition of the revegetated Project areas with representative control sites in remnant native vegetation.

5.3 GENERAL REHABILITATION PRACTICES AND MEASURES

General rehabilitation practices and measures that would be implemented at the Project are described in the following sub-sections.

Rehabilitation progress and rehabilitation activities would regularly be re-evaluated and the results would inform future rehabilitation initiatives and refinement, and amendment to the practices and measures described below.

5.3.1 Vegetation Clearing Measures

The Project clearance of vegetation would be undertaken progressively, with the area of native remnant vegetation cleared at any particular time generally being no greater than that required to accommodate projected development activities for the next 12 months.

[1] LFA is a Commonwealth Scientific and Industrial Research Organisation (CSIRO) developed method used to provide indicators of rehabilitation success and allows the assessment of landscape processes. LFA aims to measure the progression of rehabilitation towards a self-sustaining ecosystem through the assessment of landscape function.

Vegetation clearance protocols would be documented in the Biodiversity Management Plan (Section 4.9). Key components of the vegetation clearance protocols would include aspects such as the clear delineation of native remnant vegetation areas to be cleared, timing and methods to be used for clearing, pre-start clearing inspections by a suitably qualified ecologist, and re-use of cleared vegetation debris in Project revegetation.

Further detail on management of potential impacts on flora and fauna is provided in Sections 4.9.2 and 4.10.2.

5.3.2 Soil Stripping and Handling Measures

Soil Management Strategies

The following management measures would be implemented for the stripping of soils at the Project (Section 4.3.3):

- Vegetation disturbance, and associated soil stripping, would undertaken progressively, to reduce the potential for erosion and sediment generation, and to minimise the extent of topsoil stockpiles and the period of soil storage.
- Areas of disturbance requiring soil stripping would be clearly defined following vegetation clearing.
- Wherever practicable, soil would not be trafficked, deep ripped or stripped in wet conditions to avoid breakdown in soil structure.

Long-term soil stockpiles would be managed to maintain long-term soil viability by the following key management practices:

- Topsoil and subsoil stockpiles would be limited to a maximum height of 3 m.
- Soil stockpiles would be constructed to minimise erosion, encourage drainage, and promote revegetation.
- Stockpiles would be sown with a stabilising cover crop once established.
- Where additions such as lime, gypsum or fertiliser are needed to improve the condition of stripped soil, they would be applied to the soil stockpiles as a component of soil stockpiling activities.

Soil Reserves

McKenzie Soil Management (2012) has completed a preliminary material balance to determine the quantity of soil available for rehabilitation (Appendix K). The results of these calculations are summarised in Table 5-3 and indicate that there would be sufficient soil available to meet the Project rehabilitation concepts (Appendix K).

Details of available soil resources, stripping and application schedules, and soil stockpile inventories would be included in the MOP, and a summary of soil management activities would be provided in the Annual Review.

Table 5-3
Preliminary Soil Balance

Recommended Stripping Depth	Approximate Stripping Area	Approximate Volume (m^3)
0.15 m	500 ha	750,000
Currently Stockpiled	-	250,000
Total	**-**	**1,000,000**

Source: After Appendix K.
m^3 = cubic metres.

5.3.3 Selection of Native Plant Species for Revegetation

Disturbed areas to be revegetated with native vegetation would initially be stabilised with a non-persistent crop cover. Suitable native tube stock and/or seeds would then be planted/sown.

Native species to be planted in revegetation areas would be selected on a site by site basis depending on nearby remnant vegetation associations, soil types, aspect and site conditions.

The list of suitable native plant species to be used in the revegetation of Project disturbance areas and the wildlife corridor would be documented in the Rehabilitation Management Plan and MOPs/Mine Closure Plan.

Revegetation of native woodland/open forest areas would include the planting of species characteristic of the existing remnant vegetation (Figure 4-21) in areas with suitable soil, slope and aspect.

It is estimated that approximately 350 ha of woodland/open forest vegetation would be established as a component of the Project revegetation programme (Section 4.9.3).

5.3.4 Establishment of Agricultural Land

Mine landforms in the Stratford area can be effectively rehabilitated to grazing use post-mining, as SCPL has demonstrated on the Stratford Waste Emplacement (Plates 5-1 and 5-2).

The physical and chemical properties of the soils in the Project area indicate that with the implementation of appropriate management measures and with suitable amelioration, soils in the Project disturbance areas would be a suitable rehabilitation medium for grazing use post-mining (Appendix K).

As a component of developing the conceptual Project rehabilitation domains (Section 5.2.3) land for grazing use has been set aside on the upper surface of the Stratford Waste Emplacement and associated western embankment (Domain D), and in the decommissioned infrastructure area (Domain A).

Based on the areas described above, approximately 300 ha of grazing lands would be re-established with a combination of pastures and scattered endemic trees (e.g. Class 4 Agricultural Suitability classification).

5.3.5 Biodiversity Enhancement Area

The Stratford Mining Complex Biodiversity Enhancement Area covers approximately 240 ha (Section 4.9.3).

The following measures would be implemented within the Biodiversity Enhancement Area:

- planting of suitable tree species currently occurring on the Project area from local seed;
- exclusion of stock via maintenance of perimeter fencing around the area undergoing revegetation;
- weed and exotic animal control; and
- implementation of a nest box programme (Section 4.10.4).

Further detail on the tree species, revegetation methods and land management measures to be employed within the vegetation management area would be described in the Biodiversity Management Plan.

Where relevant, the NOW's *Guidelines for Riparian Corridors* (NOW, 2011) and *Guidelines for Vegetation Management Plans* (NOW, 2010e) would be considered.

5.3.6 Erosion and Sediment Control Works

Erosion and Sediment Control Plans would be progressively developed and approved as part of the Water Management Plan. Sediment and erosion controls would periodically be updated and regularly reviewed.

Operational sediment and erosion control works would be maintained during the establishment of revegetation. However, once self-sustaining stable final landforms have been achieved within an area, key elements of the operational sediment control structures would either be left as passive water control storages or would be removed and the area would become free-draining.

To minimise retention of water in the operational water management system, where self-sustaining and stable areas adjoin active areas, temporary drainage structures (e.g. drop down structures) would be constructed as required.

5.3.7 Waste Rock Emplacements – Outer Batter Design

The Stratford Waste Emplacement batters have primarily been built at a slope of approximately 1V:5H. Drainage on the outer emplacement batters is facilitated via a series of 10 m wide reverse graded berms located at approximately 14 m height intervals that drain back to natural grade.

The BRNOC waste emplacements have been primarily constructed with slopes of 1V:4H with 10 m wide reverse graded drainage berms located at approximately 10 m height intervals.

The slope of the Project outer waste rock emplacement landforms would be approximately 1V:4H. The width and vertical separation of reverse graded drainage berms on the final Project waste emplacement landforms would vary according to the location and the slope of the landform.

Figure 5-1 shows 10 m wide drainage berms located at vertical intervals of 15 m on the Northern and Stratford Waste Emplacements.

5.3.8 Final Void Management

At the completion of mining, the Project final landform would include three final voids located at the Stratford East Open Cut, Avon North Open Cut and the Roseville West Pit Extension (Figure 5-1). Once mining operations cease, inflows to the final voids would no longer be collected and pumped out, and as a result, the voids would gradually begin to fill with water.

Inflows into the final voids would comprise incident rainfall, runoff within the final void catchment area and groundwater (including waste rock emplacement infiltration). The catchment area of the final voids would be defined by permanent perimeter bunds, diversion channels and/or bunds/embankment walls (Figure 5-1).

The final void catchment areas are estimated to be 49 ha for the Stratford East Open Cut, 24 ha for the Avon North Open Cut and 65 ha for the Roseville West Pit Extension (Appendix B).

Final void water recovery analyses have been conducted as part of the Surface Water Assessment (Appendix B). The assessment is based on predicted groundwater inflows developed as part of the Groundwater Assessment (Appendix A). The final void water recovery analyses also included simulations of the long-term salinity of the final void waterbodies (Appendix B).

Figure 5-2 is a simulation of the rehabilitated Project area showing the open cut final voids once the waterbodies have established and reached equilibrium.

The salinity of the three final void waterbodies is predicted to slowly increase over time, reaching some 6,000 to 12,000 µS/cm at the end of the recovery simulations (Appendix B). The final void waterbodies are not predicted to spill under any of the simulated climatic sequences (Appendix B).

Bunds/embankment walls would be constructed adjacent to the lowest side of each final void as indicated on Figure 5-1, in order to confine each final void waterbody in the event of an extreme wet climatic scenario. The bunds would be made from compacted earth (Appendix B).

Each of the final voids would include a highwall. Appropriate safety bunds and/or fencing and signage would be installed around the perimeter of the voids to restrict access for stock and people in accordance with DRE requirements. The geotechnical stability of the final void highwalls would be reviewed to establish a suitable offset distance for the perimeter safety bunding/fencing.

The mining of the Roseville West Pit Extension would require the excavation of the previously mined and backfilled Roseville Pit. Over-excavation of the previously backfilled Roseville Pit would occur to maintain geotechnical stability of the pit walls (Section 2.7.2).

The geotechnical stability of the Roseville West Pit Extension final void would be reviewed by an appropriately qualified and experienced person to identify any additional measures required to achieve long-term stability.

Final void design and mine planning would be periodically reviewed in consultation with the relevant government agencies as a component of the Final Void and Mine Closure Plan which would form part of the Rehabilitation Management Plan (Section 5.4).

Figure 5-3 provides a cross-section illustrating the major Project landforms, including two of the final voids.

5.3.9 Permanent Up-Catchment Diversion and Drop Down Structures

A number of up-catchment diversions would be permanent structures that would remain post-mining (e.g. the up-catchment diversions for the Stratford Waste Emplacement that reports to the Stratford East Dam) (Figure 5-1).

The design of the permanent up-catchment diversion structures would be dictated by the requirement that they are stable in the long-term and would be designed to convey 1:100 ARI intensity rainfall events.

Construction and rehabilitation of these structures would incorporate appropriate channel cross-section designs, low longitudinal gradients (e.g. 0.5%) and channel lining (e.g. grass or rockfill) to limit erosion potential and facilitate their long-term stability (Appendix B). The permanent diversion structures would be designed in consultation with the NOW.

This is the same methodology implemented for the up-catchment diversion structures upslope of the Stratford East Dam have been in service for many years and have been stable during this time (Appendix B).

A section of an unnamed tributary of Avondale Creek would be diverted between the Avon North Open Cut and the Stratford Waste Emplacement (Figure 5-1). Prior to the design and construction of this up-catchment diversion, an investigation (including peak flow modelling) would be undertaken to inform the final design.

To reduce the peak flow rates reporting to the downstream tributary of Avondale Creek, some of the up-catchment runoff reporting to it would be routed through the Stratford East Dam (Figure 5-1) rather than around it via diversions (as would occur during mining) (Appendix B). This would significantly reduce the risk of potential geomorphological changes due to additional catchment post-mining (Appendix B).

A number of permanent drop down structures would also be required post-mining (e.g. batters of waste rock emplacements) (Figure 5-1).

Drop structures would be designed so that they are stable in the long-term. The design and construction of the drop structures would incorporate lining with coarse durable rockfill (or some other form of stable revetment) and appropriate energy dissipation (Appendix B).

5.3.10 Land Contamination Management

Investigations would be undertaken at mine closure to identify and remediate any contaminated soil materials that may exist in accordance with the requirements of the *Contaminated Land Management Act, 1997* (Section 5.2.3).

5.3.11 Weed and Pest Controls

Project weed and pest control measures are described in Sections 4.9.3 and 4.10.3.

5.3.12 Bushfire Management

Bushfire management measures for the Stratford Mining Complex are described in Section 4.3.3.

5.4 REHABILITATION MANAGEMENT PLAN

It is anticipated that a Rehabilitation Management Plan would be required as a component of the Development Consent for the Project. It is expected that the Rehabilitation Management Plan for the Project would include the following (subject to the Development Consent conditions):

- a description of the nature and timing of new rehabilitation works, and management activities in existing rehabilitation areas;
- how the planned rehabilitation works relate to the rehabilitation and mine closure goals for the Project (Table 5-1);
- rehabilitation performance objectives, parameters and completion criteria (Section 5.2.5);
- the rehabilitation monitoring programme (Section 5.5) to be used to evaluate the performance of rehabilitation against the completion criteria;
- the mechanisms to be used to regularly report on the status of the rehabilitation works and the rehabilitation monitoring results; and
- a Final Void and Mine Closure Plan which would include final void designs (Section 5.3.8) and a mine closure strategy (Section 5.6).
- a description of how the Rehabilitation Management Plan relates to the other management plans required for the Project (e.g. Biodiversity Management Plan) and MOPs/Mine Closure Plan.

The Rehabilitation Management Plan would be prepared in consultation with the relevant government agencies, and in accordance with the relevant DRE rehabilitation and mine closure guidelines.

5.5 REHABILITATION AND REVEGETATION MONITORING

Ongoing monitoring and maintenance of rehabilitation areas at the Project would be conducted to assess:

- progress of rehabilitation areas; and
- the effectiveness of the rehabilitation techniques being used.

Monitoring of rehabilitation at the Stratford Mining Complex is currently undertaken through the implementation of programmes outlined in the Rehabilitation Management Plan. A summary of rehabilitation activities and performance is provided in the Annual Review.

The Project rehabilitation monitoring programme would be documented in the Rehabilitation Management Plan, and would describe the methods that would be used to:

- evaluate the application of soil prior to seeding and the behaviour of placed soil over time (i.e. erosion or dispersion, compaction, salting or hard setting);

- assess germination success in native woodland/open forest revegetation areas (including recording of diversity and abundance) and revegetation success over time (e.g. survival rate, plant growth, species diversity, weed content, fauna usage);
- assess pasture establishment success in grazing land use areas and progression towards suitability for grazing, including estimated stock carrying capacity;
- monitor drains and rehabilitated mine landforms for localised failures or rilling and loss of topsoil after rainfall events;
- evaluate potential threats to rehabilitated native woodland/open forest areas and pastured areas (e.g. weed invasion, pest species, erosion);
- assess the stability of rehabilitated mine landforms (including rehabilitated CHPP reject areas); and
- record key rehabilitation information (e.g. taking photographic records, documenting rehabilitation LFA surveys).

Annual surveys of select revegetation areas would be undertaken by an appropriately qualified and experienced person to review the success of rehabilitation and identify any additional measures required to achieve ongoing rehabilitation success. A detailed monitoring report would be prepared annually that includes a summary of previous monitoring results, results of the current year's monitoring and any planned remedial works, if required. The monitoring results would be summarised in the Annual Review.

Key strategic rehabilitation completion criteria would be reviewed and refined as part of the Mining, Rehabilitation and Environmental Management Process (MREMP) (Section 6.4.1).

The specific rehabilitation parameters and completion criteria would be determined in consultation with relevant government agencies and documented in the MOP and Rehabilitation Management Plan.

5.6 CLOSURE STRATEGY

SCPL would develop a Final Void and Mine Closure Plan for the Project which would include details of the mine closure strategy. The mine closure strategy would be developed in consultation with the GSC, the Great Lakes Council, DP&I and the local community, and would include consideration of amelioration of potential adverse socio-economic effects due to the reduction in employment at Project closure.