Section 2

Description of the Amended Project

Preamble

This section outlines the Applicant's objectives and plans for the proposed development and operation of the amended Project. The coal resource is described and the mining operation, its sequence and amended plans for its transportation to the Stratford Mining Complex, are detailed. This section also describes the amended Project with respect to hours of operation, infrastructure and services, site security, waste management and rehabilitation. The section concludes with an overview of the various alternative components and/or activities considered during the design of the amended Project.

The amended Project is described in sufficient detail to provide the reader with an overall understanding of the nature and extent of activities proposed; how the various activities would be undertaken, and to enable an assessment of the potential impacts on the surrounding environment.

Details of the safeguards and mitigation measures that the Applicant would implement to protect and manage noise, air quality, visibility, surface water, groundwater, Aboriginal heritage, flora, fauna, soils and other components of the local environment are detailed in Section 4 of this document.

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2.1 INTRODUCTION

2.1.1 Objectives

The principal objectives of the proposed amended Rocky Hill Coal Project ("the amended Project") are to:

1. maximise coal recovery and the efficiency of mining and processing operations, focussing upon the recovery of coking coal, also referred to as metallurgical coal;
2. undertake all activities in an environmentally responsible manner to ensure compliance with relevant criteria/goals, reasonable community expectations and to the extent practicable, the objectives of Gloucester LEP 2010;
3. create a final landform that is safe, stable, visually and topographically sympathetic and similar in form to the existing landform, and amenable to the resumption of grazing activities and nature conservation;
4. provide a stimulus to the Gloucester and district economies through employment opportunities and the supply of services required for the development and operation of the amended Project; and
5. achieve the above objectives in a cost-effective manner to ensure the amended Project is viable.

2.1.2 Overview of the Amended Project

The proposed amended Project comprises three principal components (see **Figure 2.1**).

1. The "Mine Area" incorporating three contiguous open cut pits, a ROM pad with a breaker station and sized coal bin, amenity barriers, overburden emplacements and an administration area with site offices, amenities, workshop, water treatment plant and ancillary facilities.
2. The "private haul road", i.e. a 4.4km sealed road to be used for the transportation of sized coal from the Rocky Hill Mine Area to the Stratford Mining Complex for washing and despatch to the Port of Newcastle. The private haul road extends from the southern boundary of the Rocky Hill Mine Area to the northern boundary of the Stratford Mining Complex, owned by Stratford Coal Pty Limited.
3. Two "power line corridors" incorporating a re-located 132kV power line and a new low voltage (11kV or as nominated by Essential Energy) power line external to the Rocky Hill Mine Area. For the purpose of this document, and all documents in the *Specialist Consultant Studies Compendium*, the low voltage line is referred to as the 11kV line.

Each of these components are located in an area referred to as "the Site".

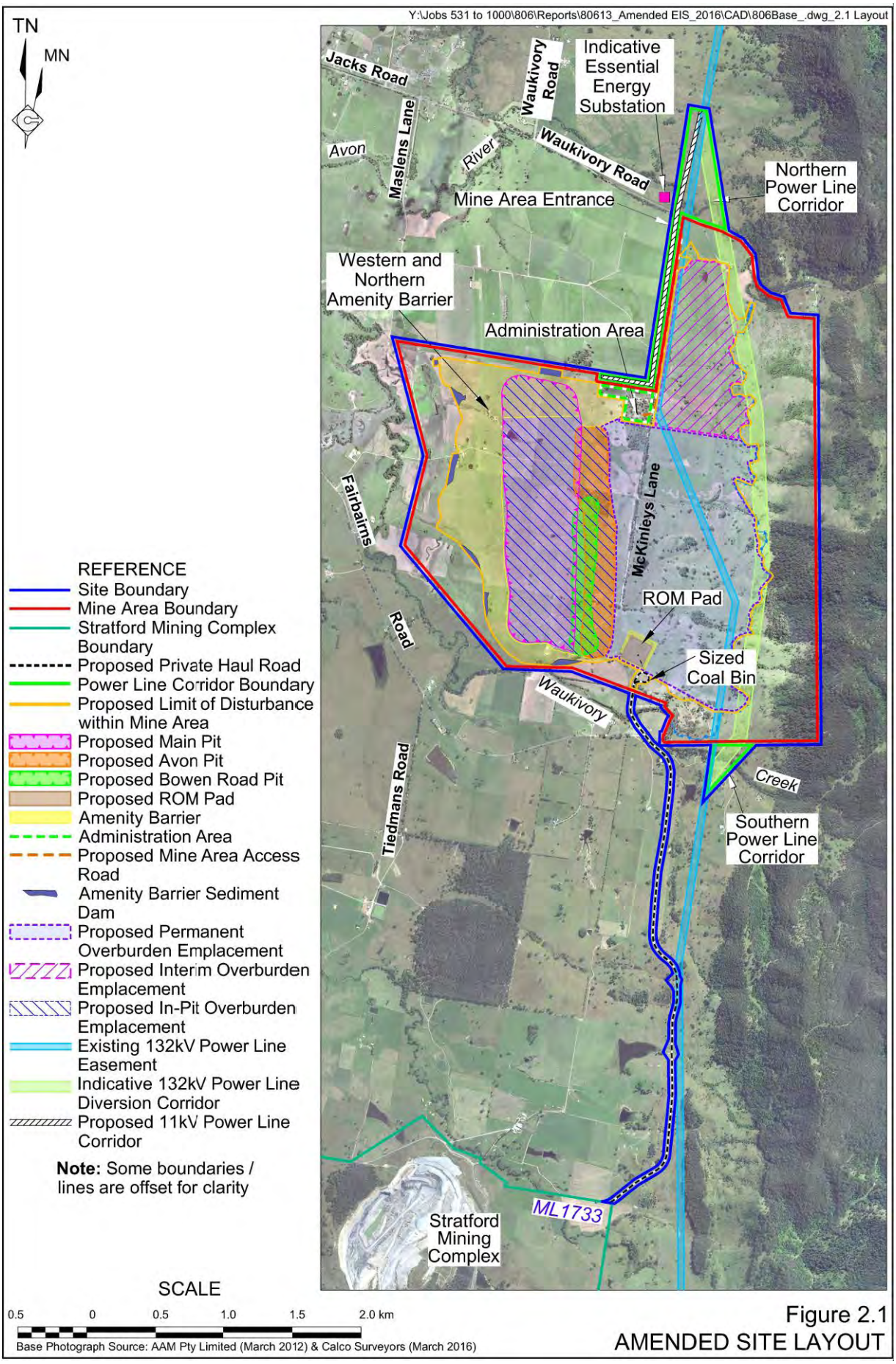


Figure 2.1
AMENDED SITE LAYOUT

Figure 2.1 displays the conceptual layout of the Site, including the following major components. Details of these components are presented in subsequent subsections.

- The Mine Area entrance off McKinleys Lane, approximately 50m south of the intersection with Waukivory Road.
- An administration area, incorporating site offices, amenities, workshop, water treatment plant and ancillary facilities. The administration area is located on land off McKinleys Lane and would be accessed by a private road, referred to as the Mine Area access road, which would be aligned generally parallel to and immediately east of McKinleys Lane.
- Three contiguous open cut pits (Avon, Bowen Road and Main) varying in depth from approximately 80m to a maximum of approximately 220m. Though based on current planning, the open cut pit depths nominated are approximate only given the steeply dipping nature of the coal seams, the extent of geological knowledge, and the potential effects of changes in controlling economic factors. The ultimate depths of development in each open cut pit would reflect the optimisation of coal quality, the outcomes of detailed planning as coal extraction progresses and market factors.
- A long-term amenity barrier and two interim amenity barriers to visually screen areas of activity and/or to provide for noise mitigation. The upper surfaces of the barriers would either mimic the existing underlying landform or provide a variable comparatively natural appearance. The barriers would either be stand-alone structures (i.e. the western and northern amenity barrier) or comprise the northwestern faces within the developing permanent overburden emplacement, i.e. interim amenity barriers.
- A consolidated in-pit overburden emplacement and permanent out-of-pit overburden emplacement extending to the east of the open cut pits. Overburden would also be placed in an interim overburden emplacement which would be located to the north of the permanent overburden emplacement but removed at the cessation of coal extraction to provide some of the backfill for the final void in the Main Pit.
- A ROM pad and associated breaker station comprising a feed conveyor, rotary breaker, a reject (stone) conveyor, a sized coal conveyor and a nominal 500t capacity overhead sized coal bin from which 60t nominal capacity road-registered trucks would be loaded. The ROM pad would have a capacity to store approximately 80 000t of coal awaiting processing through the breaker station, i.e. sufficient capacity for approximately two weeks production at the maximum scheduled production rate.
- A 5km section of re-located 132kV power line and a new 11kV power line providing power for the on-site operations.

Figure 2.1 displays the alignment of the 4.4km private haul road to be constructed with a minimum 7m seal on a 10m formation between the sized coal bin and the boundary of ML1733, the northern extent of the Stratford Mining Complex. The private haul road would link with a

section of new road to be constructed within ML1733 and then into the existing on-site haul road system within the Stratford Mining Complex. Proposed activities within ML1733 and elsewhere within the Stratford Mining Complex are the subject of an application to modify the Stratford Extension Project development consent (SSD 4966) being lodged concurrently by Stratford Coal Pty Ltd.

Mining operations would involve the sequential activities of vegetation clearing, soil stripping, overburden/interburden removal and coal recovery with progressive temporary or permanent rehabilitation of all areas of the interim and final landform.

Approximately 126 million bank cubic metres (bcm) of overburden and interburden (collectively referred to hereafter as "overburden") would be removed to gain access to the targeted coal seams within the individual open cut pits. The overburden would be removed by a combination of scrapers, and excavators and trucks with or without prior blasting, and be used to initially create the amenity barriers, with the remainder emplaced out of, in or over the exhausted pits either permanently or temporarily and used to form the final landform. The overburden would be placed in four separate areas, namely:

- the western and northern amenity barrier (95ha);
- a permanent overburden emplacement incorporating interim amenity barriers (185ha);
- an interim overburden emplacement (60ha); and
- an in-pit overburden emplacement (142ha).

The coal exposed in each open cut pit would be removed by excavator and transported by haul truck to the ROM pad adjacent to the breaker station. Scheduled annual ROM coal production would progressively increase from 0.2 million tonnes per annum (Mtpa) in Year 1 to 1.8Mtpa in Years 11 to 14. Approval is being sought to extract a maximum of 2Mtpa. In the event this quantity of coal is extracted, the quantity of overburden extracted would decrease by an equivalent amount during that year of operation. All ROM coal would be processed at the breaker station with the sized coal, transferred to the sized coal bin and the breaker reject (approximately 10% of the ROM coal) disposed of within the active overburden emplacement.

Transportation of sized coal from the sized coal bin would occur via the private haul road to the Stratford Mining Complex where it would be placed on the ROM pad adjacent to the Stratford Coal Handling and Processing Plant (CHPP), processed (washed) through the CHPP, stockpiled in the product stockpile areas and subsequently despatched by train to the Port of Newcastle. With the exception of the extension of the ROM pad, all of the above components within the Stratford Mining Complex to be used for the processing and despatch of coal from the Rocky Hill Mine Area are already constructed and operational and/or approved under SSD 4966. The private haul road would be sealed within the Site and within the Stratford Mining Complex to near the eastern boundary of ML1528.

Stratford Coal Pty Ltd is proposing to modify SSD 4966 to enable the existing ROM pad to be extended to separately stockpile the sized ROM coal from the Rocky Hill Mine Area from that mined within the Stratford Mining Complex.

The amended Project would also involve other ancillary activities including equipment maintenance and establishment of a 267ha Biodiversity Offset Area on GRL-owned land east of the proposed Mine Area disturbance.

GRL proposes to commence the approximately 10 month site establishment and (pre-mining) construction stage for the amended Project following the receipt of development consent and other requisite approvals required before the commencement of the mine-related activities.

Mining would commence immediately following the site establishment and construction stage and, based on current schedules, would continue for approximately 16 years. The remaining site rehabilitation activities, including backfilling the final open cut void would be completed within approximately 3 years. However, given the range of circumstances that may cause one or more activities to occur over a longer period, GRL has nominated an overall 21 year life for the amended Project, i.e. from the commencement of the site establishment and construction stage.

2.1.3 Environmental and Planning Approvals Required

Based upon the design of the amended Project and detailed understanding of relevant environmental issues, the following environmental and planning approvals would be required for the amended Project to proceed.

1. Development consent under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979* as the amended Project, being for coal mining, is recognised as State significant development under *State Environmental Planning Policy (State and Regional Development) 2011* for which approval is required from the Minister for Planning or, under delegation, by the Planning Assessment Commission. It is noted, that for the amended Project to proceed, approval of a modification to the Stratford Extension Project Development Consent SSD 4966 would also be required. Details of the modification are presented in a separate application and accompanying documentation submitted by Stratford Coal Pty Ltd.
2. Mining leases under the *Mining Act 1992* for the areas nominated on **Figure 1.3**. The issuing authority would be the Minister for Resources and Energy.
3. An environment protection licence under the *Protection of the Environment Operations Act 1997*. The issuing authority would be the Environment Protection Authority (EPA).
4. A water access licence or licences under the *Water Management Act 2000* for the water "taken" from the alluvial groundwater source covered by the *Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources*. The Applicant already holds the required licences relating to the alluvial groundwater sources.
5. A water access licence or licences under the *Water Management Act 2000* for the groundwater inflows to the open cut pits from the Permian coal measures in accordance with the *Water Sharing Plan for the North Coast Fractured Rock and Porous Groundwater Source*. The Applicant would need to acquire these licences through purchase and/or trading.

6. A series of permits under the *Roads Act 1993* to construct the proposed road and intersection works and improvements for the amended Project, together with the private haul road beneath Fairbairns Road and the construction/re-location of power lines across Waukivory Road. Following the receipt of development consent, the Applicant would apply for the necessary approvals for:

   i) the closure of the section of McKinleys Lane south of the Mine Area entrance (see **Figure 1.2**);

   ii) the closure of the section of the unformed east-west oriented Faulkland Road extension road reserve east of Waukivory Creek and adjacent to Lot 129 DP979859 and the north-south road reserve adjacent to Lot 21 DP1048749 within the Site (see **Figure 1.2**);

   iii) the construction of the private haul road underpass at Fairbairns Road[1]; and

   iv) the construction of the private haul road across a Council Road Reserve adjacent to the Stratford Mining Complex.

   Mid-Coast Council would be the issuing authority for the required permits and road closures.

   It is noted that the issuing of a development consent as identified in 1. above is a pre-requisite for the receipt of approvals identified at 2 and 3 above.

   Following receipt of development consent, the Applicant would also seek the necessary approvals from Mid-Coast Council for the construction of buildings, structures and appropriate sewage treatment systems for the amended Project.

The Applicant has previously referred the Rocky Hill Coal Project to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) to establish whether the 2013 Project (as defined in the 2013 *Environmental Impact Statement*) was a controlled action under the *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999*. DSEWPaC notified the Applicant on 11 May 2012 that the Rocky Hill Coal Project as identified at that date was not a controlled action. It remains the Applicant's position that the amended Project is not a controlled action and further referral under the EPBC Act is not required. Further detail regarding the EPBC Act referral is provided in Section 3.2.3.2.

2.1.4 Project Timetable

The Applicant proposes to commence the approximately 10 month site establishment and construction stage for the amended Project following the receipt of development consent, the receipt of other requisite approvals (see Section 2.1.3) and the approval of any of the relevant management plans and related documents required before the commencement of the individual activities. Activities to be undertaken during this period are described in Sections 2.5 and 2.6.

Mining would commence immediately following the site establishment and construction stage and, based on current schedules, would continue for approximately 16 years. However, any reductions in coal production rates below those scheduled would result in the operational life of

[1] It is noted that the construction of the intersection of the private haul road and Wenham Cox Road would form part of the modification of SSD 4966 as this intersection lies within the Stratford Mining Complex.

the amended Project being extended. Once coal extraction ceases, the Applicant would commence the construction of the areas of the final landform which could not be progressively developed to their final form during the operation of the mine. This would include backfilling the remaining open cut void together with the associated subsoil and topsoil replacement and revegetation activities, all of which would be completed within approximately 3 years.

The amended Project is estimated to be developed, operated and rehabilitated in a period of approximately 20 years, i.e. from the commencement of the site establishment and construction stage. However, given the range of circumstances that may cause one or more activities to occur over a longer period, the Applicant has nominated an overall 21 year life for the establishment and construction stage as well as operations of the amended Project. Rehabilitation activities could potentially continue following the completion of mining in accordance with an approved Mining Operations Plan. This is consistent with other mining operations and development consents of this nature.

2.2 GEOLOGICAL SETTING AND COAL RESOURCES

2.2.1 Regional Geology

The Site is located within the Gloucester Basin, a north-south trending synclinal structure approximately 40km long and 10km wide which contains two Late Permian coal measures, namely the Gloucester Coal Measures and the underlying Dewrang Group. In general, the strata within the basin are folded and dip steeply along the eastern and western margins and are near horizontal towards the centre. Regionally, the strata have been affected by reverse and normal faulting throughout the basin. **Figure 2.2** displays the simplified surface geology of the Gloucester Basin.

On the basin's eastern margin, the Gloucester Coal Measures are generally interbedded with over 50 generally thin coal seams subcropping at the surface and dipping at up to more than 50º. A few of the coal seams are thick and traceable over almost the entire eastern margin of the basin and these are of most economic importance. The economically important seams identified within the Mine Area are the Cloverdale, Roseville, Marker 1, Bowen Road, Glenview and Avon Seams, together with associated marker and minor seams. **Figure 2.3** displays the stratigraphic sequence of the Gloucester Basin and identifies the coal seams proposed to be extracted as part of the Applicant's amended Project.

2.2.2 Mine Area Geology

The detailed geology of the Mine Area has been defined from a number of programs undertaken by the Applicant and others including the following.

- 2009 – initial Stage 1 exploration program. This program, which comprised 44 open holes of which some were geophysically logged and the collection of chip samples from seven holes, was undertaken under the previous management of GRL.
- 2010/2011 – an extension to the Stage 1 exploration program comprising 184 open holes, 28 cored holes and the analysis of approximately 220 samples for coal quality or reject characterisation. This program was undertaken under the current company management.

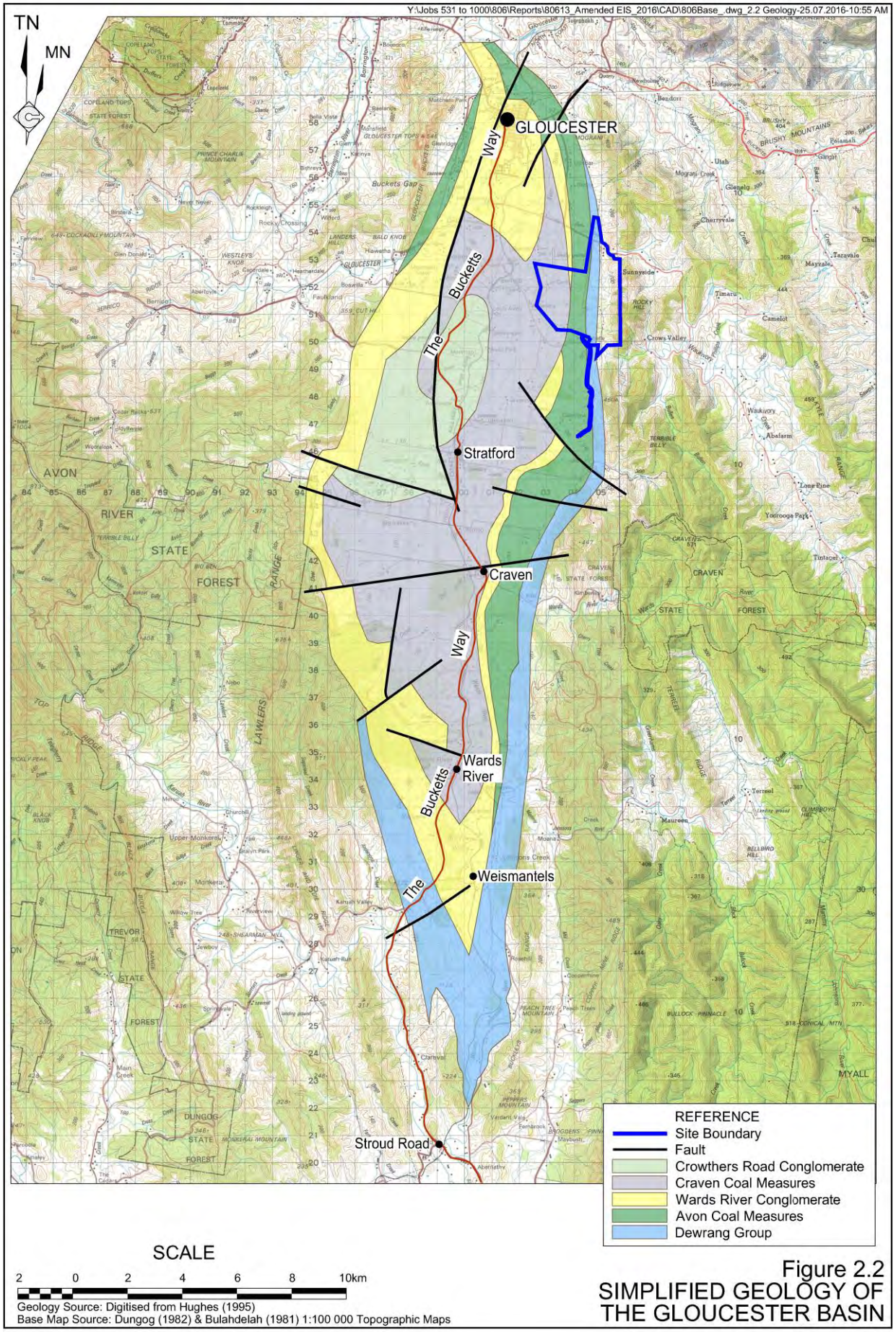


Figure 2.2
SIMPLIFIED GEOLOGY OF THE GLOUCESTER BASIN

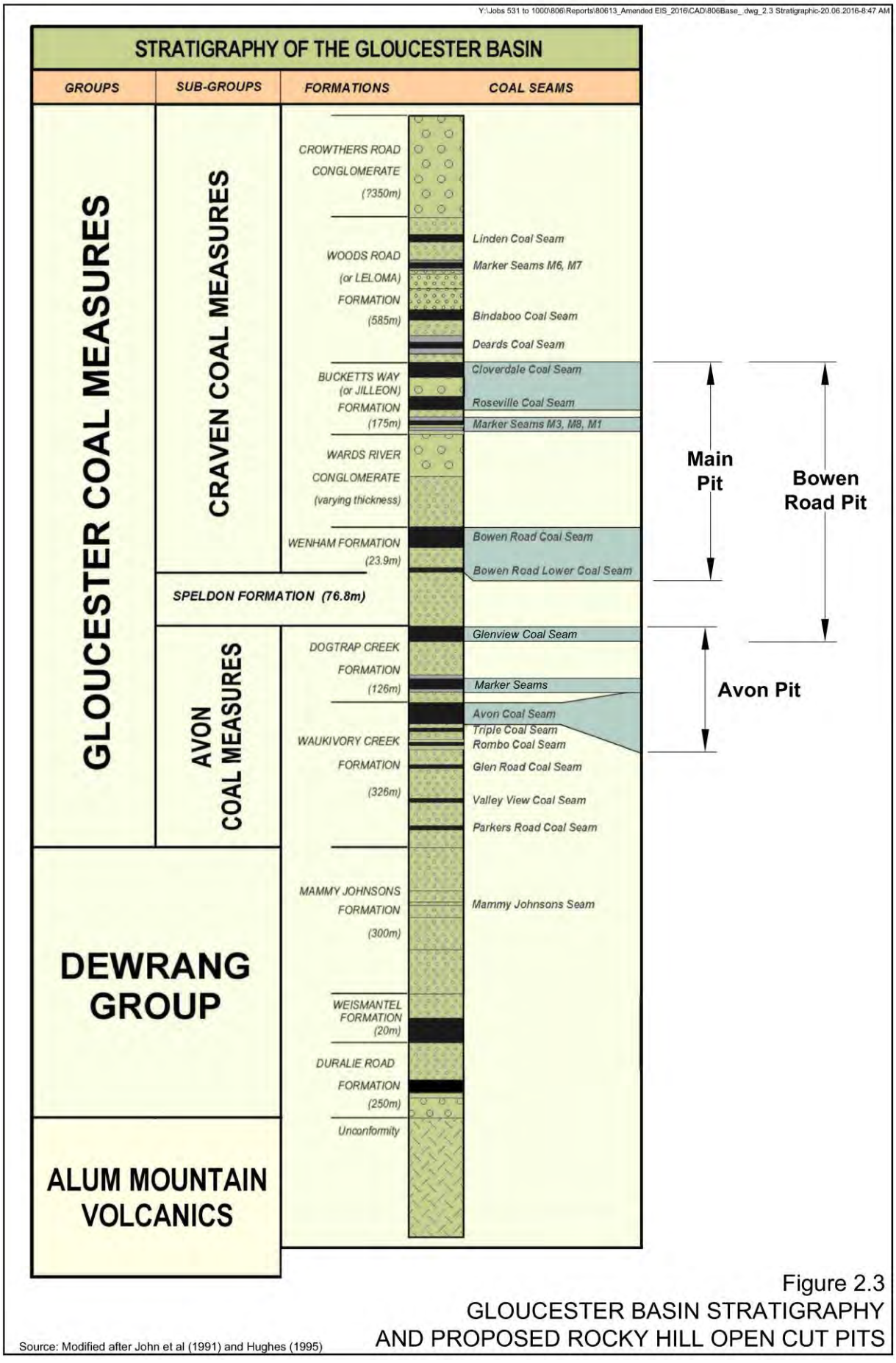


Figure 2.3
GLOUCESTER BASIN STRATIGRAPHY
AND PROPOSED ROCKY HILL OPEN CUT PITS

Source: Modified after John et al (1991) and Hughes (1995)

- 2010 – a three-dimension seismic survey over a 10km^2 area in the southeastern corner of EL 6523. This program, undertaken by Velseis, was conducted on behalf of AGL.
- 2014 – a small scale ground magnetic survey (<2km^2) over the northern section of the Mine Area to identify or confirm the absence of igneous bodies which had been identified as potentially occurring in isolated holes during the previous drilling programs.

The data from these programs has been interpreted and used to assist in the generation of the geological model for the Mine Area and in detailed mine planning.

Eight main coal seams have been identified within the Mine Area of which the six identified in **Table 2.1,** together with some additional marker and minor seams, are considered recoverable as part of the amended Project. The Clareval Seam, though occurring within the Mine Area and recovered at both the Stratford Mine and Duralie Coal Mine approximately 26km to the south, dips at approximately 75º, is heavily banded, low yielding and consequently, uneconomic. The Weismantel seam, which also occurs within the Mine Area and is mined at the Duralie Coal Mine, is no longer considered to be economically recoverable due to the low predicted yields, the high proportion of uneconomical thermal coal and the difficult to mine, steeply dipping seam and narrow pit geometry.

Table 2.1
Main Coal Seams and Marker Seams within the Mine Area

Seam Name *[1]	Average True Thickness *[2] (m)	Average Seam Dip (degrees)
Cloverdale (1, 2, 2B and 2C)	7.8	44
Roseville	3.7	45
Marker (1, 1A, 1B, 1C, 1D and 1E)	4.9	46
Bowen Road (1A, 1B, 2, 3, 4 and Lower)	9.2	47
Glenview	1.2	48
Avon (1, 2, 3, 4A, and 4B)	6.9	51

*[1] Identifiers in ( ) indicate named plies within each seam.

*[2] Based upon grid models created from the borehole intersections. The average thickness nominated is an accumulation of the average thickness of all coal plies within each seam.

Table 2.1 shows that the coal seams proposed to be mined dip to the west at angles of approximately 44º to 51º, with the dips increasing from west to east towards the basin's eastern margin. **Figure 2.4** shows the dipping coal seams in a 3-dimensional view from the geological model, with a line at 150m depth below natural ground level to provide a vertical context.

Further information relating to the geology of the local area is presented in Section 4.6.3.2, particularly as it relates to groundwater systems within and in the vicinity of the Mine Area.

The geological investigations undertaken across the Mine Area have also established the following.

- The depth of weathering varies from approximately 4m to 37m and averages approximately 11m. The weathered material would potentially be amenable to extraction using scrapers or free digging, i.e. removal using excavators and trucks without the need for blasting.

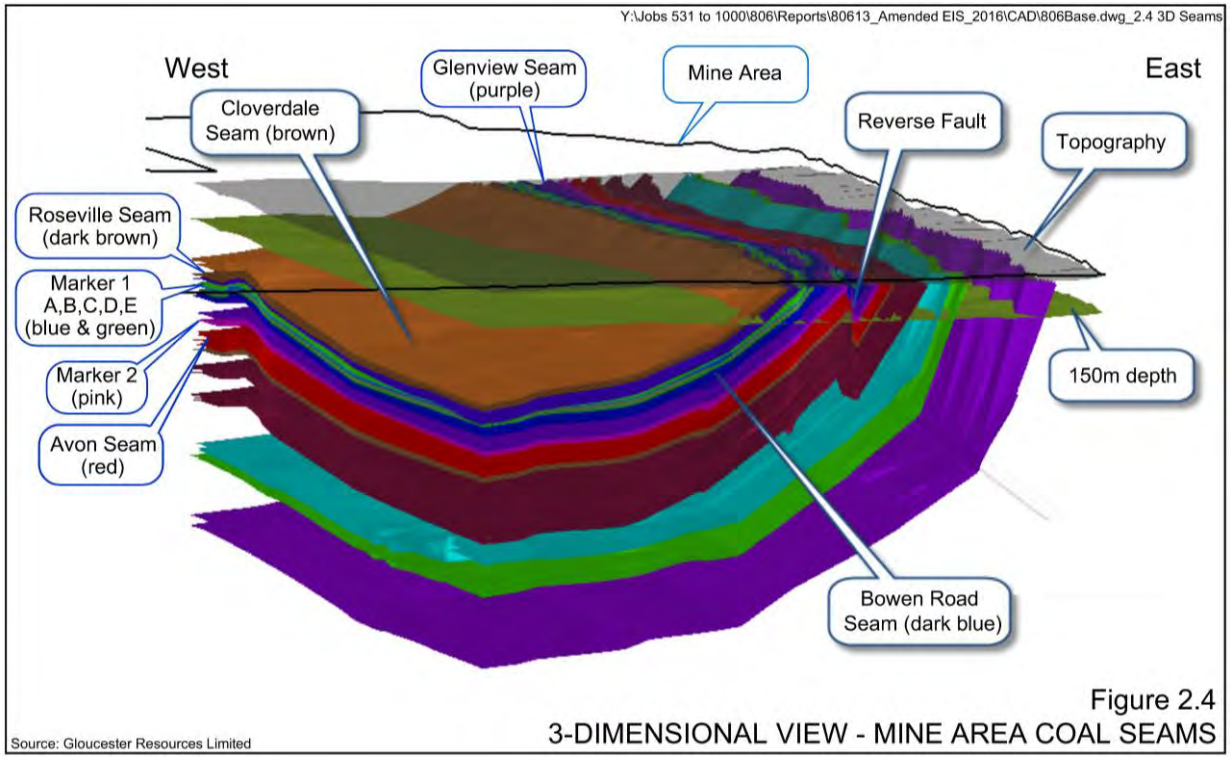


Figure 2.4
3-DIMENSIONAL VIEW - MINE AREA COAL SEAMS

- The occurrence of one large reverse thrust fault with a horizontal displacement of approximately 150m to 200m (**Figure 2.4**). Though the seismic data identified more complex faulting (both normal and reverse) across the Mine Area, this has not been validated by drilling.
- Intersections of intrusions or basalts in 16 of the 212 holes drilled (most of which were within the eastern side of the Mine Area where the holes were located specifically to delineate the subcrop of the basement volcanics) with only four holes identified with potentially intruded coal seams. The 2014 ground magnetic survey has shown these intrusions are unlikely to be a significant constraint to the design or planned operations for the amended Project.
- Based on the data available from the clean coal composites of each seam obtained from the cored holes, most of the seams analysed contain substantial quantities of bright coal with vitrinite ranges of 85.6% to 91.1%. Vitrinite is the constituent of the coal that undergoes fluidisation on heating, with the higher the vitrinite %, the higher fluidity and better coke making quality of the coal. Coal rank, a measure of the degree of coalification of the original plant material, was also determined from the clean coal composites of each seam, with RVmax varying from 0.79 to 0.93 in "V Steps" between 7 and 10 and verifying the coke making potential of the coal.

2.2.3 Coal Resources and Reserves

The six main coal seams and marker seams identified within the Mine Area have each been assessed as mineable on the basis of their occurrence, quality and potential for recovery by open cut methods. It is acknowledged, however, that the ultimate extent of development of the various open cut pits, including the depths achievable, would depend upon the sale price for the

coal products which, in turn, would determine the maximum economic overburden to coal stripping ratios. Based upon the geological modelling, design of the open cut pits and coal quality information, approximately 21 million tonnes of ROM coal would be recovered within the Mine Area.

2.2.4 Further Resource Drilling Operations

Throughout the life of the amended Project, the Applicant would undertake further resource drilling programs within the Mine Area to enable the exact boundaries of the open cut pits to be defined so as to optimise coal recovery without excessive overburden/interburden removal.

2.3 OPEN CUT PIT PLANNING

2.3.1 Introduction

The open cut pit planning process for the amended Project considered economic, geological, geotechnical and environmental factors to establish the most appropriate and viable design for the individual open cut pits. The following sections summarise each of these considerations and how they have influenced the design of the open cut pits.

2.3.2 Economic Considerations

2.3.2.1 Strip Ratio

Each of the proposed open cut pits within the Mine Area has been designed to satisfy a defined overall economic strip ratio cut off, that is, the amount of non-coal material (overburden, interburden and banding) that must be excavated, transported and emplaced within an overburden emplacement per tonne of ROM coal extracted. The incremental strip ratio cut-off generally limits the depth of any given open cut pit and, with steeply dipping coal seams, therefore defines the lateral extents of the pits within the Mine Area.

2.3.2.2 Equipment Selection and Mining Method

The coal resource within the Mine Area is heavily banded and interbedded with non-carbonaceous material. This feature of the coal seams has been reflected in the mobile earthmoving/mining equipment and mining method selected, and has generally led to the selection of equipment of various sizes to accommodate a selective mining method. The selected equipment fleet has also been optimised to minimise noise generated under various meteorological conditions. The economic benefit of this more selective mining method (as opposed to bulk excavation) has impacted upon the shape and dimension of the individual open cut pits.

2.3.2.3 Coal Quality, Washability and Anticipated Yields

Each of the seams and plies have differing coal quality attributes which affect the overall product specification and hence its saleability. The Applicant has evaluated the various seams and plies through laboratory analysis to assess relevant coal quality attributes, washability and

anticipated CHPP yields. These seam attributes were considered in the open cut pit planning process to ensure that the seams targeted for extraction are of suitable saleable quality and would yield economically viable, predominantly coking coal products.

2.3.2.4 Scheduling and Sequencing

The coal products produced from the various seams and proposed open cut pits and their varying qualities have driven the overall planning sequence from a marketability and saleability perspective.

2.3.3 Geological and Related Considerations

2.3.3.1 Geological Considerations

The basement volcanics are located on the eastern side of the Mine Area, with coal seams sub-cropping and dipping to the west towards the basin centre. The target seams generally strike in a north-south direction which has largely influenced the proposed open cut pit geometry. It follows that the pits are similarly orientated in a north-south direction with the width and depth of each pit dictated by the relevant thickness and/or orientation of each seam, and how many seams occur within practicable proximity of one another and can be extracted within the one open cut pit. The major reverse thrust fault defined within the Mine Area (**Figure 2.4**) has resulted in a local duplication of seams, which has been exploited in the design of the open cut pit layouts.

2.3.3.2 Geotechnical Considerations

The pit design parameters adopted during the mine design are typical of those adopted in the Hunter Valley and Gloucester Basin. Nevertheless, the Applicant recognises that local geotechnical conditions as a consequence of the steep dips of the coal seams have the potential to affect the detailed design and day to day operations, particularly on the eastern sides of the open cut pits where bedding planes with a similar dip to the batters may increase the potential for wedge and block failures to occur. As a consequence, the eastern slopes of the open cut pits have been designed with a lower overall angle than the other slopes. Geotechnical stability issues would be addressed as the mine develops, with geotechnical advice and monitoring of slope stability in sensitive areas undertaken to verify if the adopted design parameters are appropriate for local materials and conditions.

2.3.3.3 Materials Characterisation

The physical and chemical characteristics of the overburden and breaker station rejects have been established by RGS Environmental (2016) through a comprehensive suite of analyses and investigation. The materials analysed included a total of 87 overburden/interburden samples and five composite samples of coarse rejects, conservatively representing breaker rejects, obtained from nine boreholes across the Mine Area. It should be noted that in 2011, a total of 11 boreholes (including two holes that intersected the Clareval and Weismantel Seams) were sampled for the geochemical test program when the Applicant was considering four open cut pits. Subsequent geological and coal quality investigations concluded that targeting the Clareval and Weismantel Seams would not be economically viable due to the low quality of the coal and this option was not pursued.

Static and kinetic analysis data for samples directly associated with the Clareval and Weismantel Seams (coal and interburden) have therefore been removed, where possible. However, it is noted that some of the composite samples used in the kinetic leach column (KLC) tests comprised some material from these two drill holes which could not be separated out and hence, the KLC test results include some contribution from these boreholes.

Overburden

The geochemical investigations by RGS Environmental (2016) established that the bulk (96.5%) of overburden materials have a low (<0.2%) oxidisable sulphur content and an excess Acid Neutralising Capacity (ANC), resulting in their classification as Non-Acid Forming (NAF) materials. Only two overburden samples (an uneconomic coal sample and a coal seam floor sample) displayed a Potentially Acid Forming (PAF) result. From an acid-base perspective, the overburden material tested can be regarded as a NAF unit containing excess neutralising capacity. Therefore, no specific selective handling and placement management program is warranted for the limited PAF overburden materials. However, as a precautionary measure, all uneconomic coal seams and coal seam roof and floor materials would be managed in a similar manner to breaker rejects.

Samples of overburden were also tested for the presence of salinity and trace metals, as well as assessing their susceptibility to erosion and dispersion. The results of this testing established that the majority of overburden materials exhibited low salinities and low concentrations of trace metals, with water quality issues unlikely to be experienced as a result of surface water interactions or infiltration. Testing of trace metals established that most are sparingly soluble at the near neutral to slightly alkaline pH of surface runoff/seepage and that dissolved concentrations are expected to be low when compared to the applied water quality guideline criteria (ANZECC & ARMCANZ, 2000).

Six out of 11 overburden samples tested for exchangeable sodium percentage were classified as moderately sodic and one sample as strongly sodic and therefore potentially susceptible to dispersion and erosion. As a consequence of this, sodic overburden would be covered with non-sodic overburden and/or subsoil and topsoil as part of final rehabilitation activities to limit the risk of dispersion and erosion of surface materials.

Breaker Station Rejects

The samples of coarse rejects subjected to KLC testing displayed higher sulphur contents and a reduced factor of safety than the overburden materials and could potentially generate acidic leachate upon exposure to oxidising conditions. It is noted that the proportion of breaker rejects that are considered PAF would likely be lower than that indicated by the coarse reject samples given that the materials containing pyrite would tend to pass through the breaker station into the sized ROM coal transported to the Stratford CHPP. Further detail is provided within the Overburden and Reject Characterisation Assessment, Volume 3 Part 6 of the *Specialist Consultant Studies Compendium*.

In any event, any PAF breaker reject could, without appropriate management, result in elevated salinity and concentrations of some trace metals in runoff and seepage which would increase with ongoing exposure to atmospheric conditions.

Implications on Open Cut Pit Planning and Operations

The results of the characterisation of the overburden and coarse (breaker station) reject has assisted in the planning for the permanent overburden emplacement and backfilling of the open cut pit voids. The key measures to be adopted to avoid the potential for acid generation would include the following.

- Combining or blending the NAF, PAF and sodic overburden materials within the permanent and in-pit overburden emplacements and appropriately rehabilitating these emplacements with a cover of at least 2m of non-sodic material.
- Disposal of breaker reject materials within the open cut pit (where possible). If there is limited capacity in an open cut pit to accommodate breaker reject, these materials would be randomly blended with overburden materials and encapsulated in reduced permeability overburden materials within the western and northern amenity barrier and permanent out-of-pit overburden emplacement at least 5m from the final batters or upper surfaces.
- As a precautionary measure, all uneconomic coal seams and coal seam roof and floor materials reporting to storage areas would be managed in a similar manner to breaker reject materials.
- No breaker reject or uneconomic coal seam strata would be stored within the interim overburden emplacement.

In addition to visual monitoring for pyritic material, geochemical testing of representative samples of overburden and breaker rejects would be undertaken throughout the operational stages of the amended Project to ensure the method of placement of both materials is achieving the required environmental outcomes. Monitoring of surface runoff reporting to the ROM pad sump and seepage reporting to sediment dams from areas of placed overburden and breaker rejects would also be undertaken on a regular basis to ensure that key water quality parameters remain within appropriate criteria, in the event discharge is contemplated.

2.3.4 Environmental Considerations

In addition to the economic and geological factors, a number of environmental considerations were important in the design of the amended Project, including, but not limited to the following.

Visibility

The proposed open cut pits lie on the eastern and northern side of Waukivory Creek where they would potentially be visible from a range of locations to the west through to the north (see Section 4.5). The amended Project has been designed to minimise views of active mining operations as much as practicable through the construction of a long-term amenity barrier – the western and northern amenity barrier (see **Figure 2.1**) and two short-term barriers within the out-of-pit permanent overburden emplacement. Each barrier would be constructed with a surface which mimics the existing landform, or that of the background, to minimise any potential visual impact and reduce visibility and noise levels when earthmoving equipment is travelling behind the barrier during subsequent operations.

The construction of the permanent out-of-pit overburden emplacement would be undertaken in a manner that involves the initial construction of interim amenity barriers which would effectively provide a short-term barrier to visually shield, and to reduce noise associated with, the transfer of overburden to other areas within the permanent overburden emplacement. Further detail of the interim amenity barriers and their progressive rehabilitation is presented in Section 4.5.

The outer visible slopes of each amenity barrier would be covered with sufficient topsoil and/or subsoil to support the growth of pasture grasses and/or trees and shrubs to limit the visual impact of the barriers themselves. Where additional quantities of topsoil and/or subsoil are available, the thickness of these materials placed on the outer slopes would be increased as they would effectively duplicate as soil stockpiles until the soil materials are required for use on the final landform. The internal, non-visible components of the barriers would have slopes of approximately 35º, i.e. the angle of repose of the material as emplaced. The internal slopes of the barriers would not be vegetated and any sediment-laden runoff from these slopes would be managed through the on-site sediment dam network.

Flooding/Surface Water Management

The western limit of the western and northern amenity barrier has been positioned in a location generally parallel to the 1 in 100 year flood level (see Section 4.7.2.4) so as to have negligible impacts on flood flows within the Avon River or Waukivory Creek and also protect the southwestern corner of Main Pit from inflows during a flood with a recurrence interval in excess of 1 in 100 years. The southern limit of each open cut pit would be protected by a section of the western and northern amenity barrier adjacent to Waukivory Creek and/or retained in situ material to prevent floodwaters from the creek entering the pits.

An important consideration when designing the components within the Mine Area has been the re-direction of clean water from the slopes east of the Mine Area to minimise the quantity of surface water to be managed on site. Further details of the diversion of the upslope runoff around the active components of the Mine Area are provided in Section 4.7.4.2.

Noise

As well as restricting the visibility of the mining operations and disturbed mine areas, the amenity barriers would also reduce the propagation of noise generated by mining equipment towards otherwise exposed residences, particularly when the mining equipment is operating near the upper parts of the open cut pits.

Compliance with the noise-related conditions or criteria at privately-owned residences is fundamental to operating the amended Project in an environmentally acceptable manner. Noise was a key factor in establishing what earthmoving equipment could be used at various times throughout the day and evening periods, particularly under the site-specific meteorological conditions.

Other noise-related issues considered during the overall mine planning process involved the locations, alignment and gradients of exit ramps from the open cut pits, of the more elevated internal haul roads within the open cut pits and of the haul roads on or near the land surface so as to minimise the requirement for truck gear changes and enable the trucks to operate in higher gears and lower engine speeds. Whenever required, haul roads would be provided with additional acoustic shielding through the judicious placement of subsoil stockpiles or earth bunding.

Noise and vibration from blasting would be minimised to the extent possible by sequencing the mining operations from south to north in all three open cut pits. This approach would allow the blast envelope to be focussed southwards and thereby reduce impacts in a northerly direction, i.e. towards Gloucester and the Forbesdale, Avon River and Thunderbolt rural residential estates.

Ecology

While the bulk of the Mine Area is cleared grazing land, the Applicant has nevertheless achieved the retention of remnant native vegetation along a substantial length of McKinleys Lane and in the area of the proposed administration area. Similarly, clearance or trimming of riparian vegetation would be kept to a minimum through the location and design of the bridge crossing of Waukivory Creek, the re-located 132kV power line and the construction of the new 11kV power line.

Final Landform and Land Use

An important component in the planning process for the amended Project has been the objective to progressively create and rehabilitate/revegetate a post-mining landform which:

- is similar in form and appearance to the existing landform, i.e. exhibits a series of ridges and valleys with a mixture of open woodland, grazing land with individual trees or tree lots, and denser stands of vegetation;
- does not include a final void;
- has a soil and land capability comparable to the existing landform; and
- maintains the scenic amenity of the area recognised in the E3 – Environmental Management Zone which covers part of the Mine Area.

2.3.5 Security and Safety Considerations

A range of security and safety considerations pertaining to the workforce, visitors and public have been reflected in the design and planned operation of the amended Project, including the following.

- The provision of a single public access to the Mine Area (via the Mine Area access road) which would necessitate all traffic travelling to the administration area. Access to the private haul road for the movement of mining equipment and sized ROM coal haulage operations would be via the Stratford Mining Complex and be undertaken in accordance with the access protocol applying to the complex.
- The location of the Mine Area and private haul road corridor within land owned by the Applicant or a Yancoal related entity.
- In the case of the Mine Area, its location within a substantial buffer contained within land owned by the Applicant.

- The placement of the private haul road beneath Fairbairns Road, thereby avoiding any interaction with non-Project related traffic.
- Hours of operation and associated shift arrangements which, together with a preferential local employment policy, would aid fatigue management.

A comprehensive Health, Safety and Environmental Plan would be prepared and regularly reviewed and updated to accommodate the progressive development of the Site – see Section 2.15.

2.3.6 Justification of Mine Area Layout

The overall layout of the Mine Area for the amended Project has been planned to accommodate a wide range of factors that are environmentally responsible, safe and viable. The proposed Mine Area layout is justified through the Applicant's commitment to recover as much high quality coking coal as possible in a manner that has least environmental impact.

2.4 DESIGN OF KEY MINE AREA COMPONENTS

2.4.1 Introduction

From the outset, the Applicant has focussed upon designing the various components of the amended Project in a manner that is consistent with the mining industry's best practice and, similarly, addresses the range of issues raised by the local community and representatives of government agencies, thereby avoiding or substantially reducing the potential impacts of those components or activities within the Site. Importantly, emphasis has also been placed upon achieving a design which, when assessed, satisfies relevant criteria and guidelines to the extent practicable. This process was adopted throughout the preparation of the 2013 EIS and has again been adopted throughout the design phase for the amended Project, i.e. in conjunction with consideration of the matters raised in government agency and public submissions regarding the 2013 Project and the results of ongoing community consultation.

2.4.2 Mine Area

The design of the Mine Area components principally reflects the geotechnical, environmental and safety considerations outlined in Section 2.3. The Mine Area would incorporate three open cut pits as shown in **Figure 2.5**, namely:

- Avon Pit;
- Bowen Road Pit; and
- Main Pit.

The areas and range of depths to the floor of each open cut pit are set out in **Table 2.2**. Opportunities may also arise from time to time to recover additional coal from beneath the lowest floor level of the open cut pits by excavating coal to the maximum depth of the excavator arm. The other key components within the proposed Mine Area are the overburden emplacements which are discussed in Section 2.7.2.4.

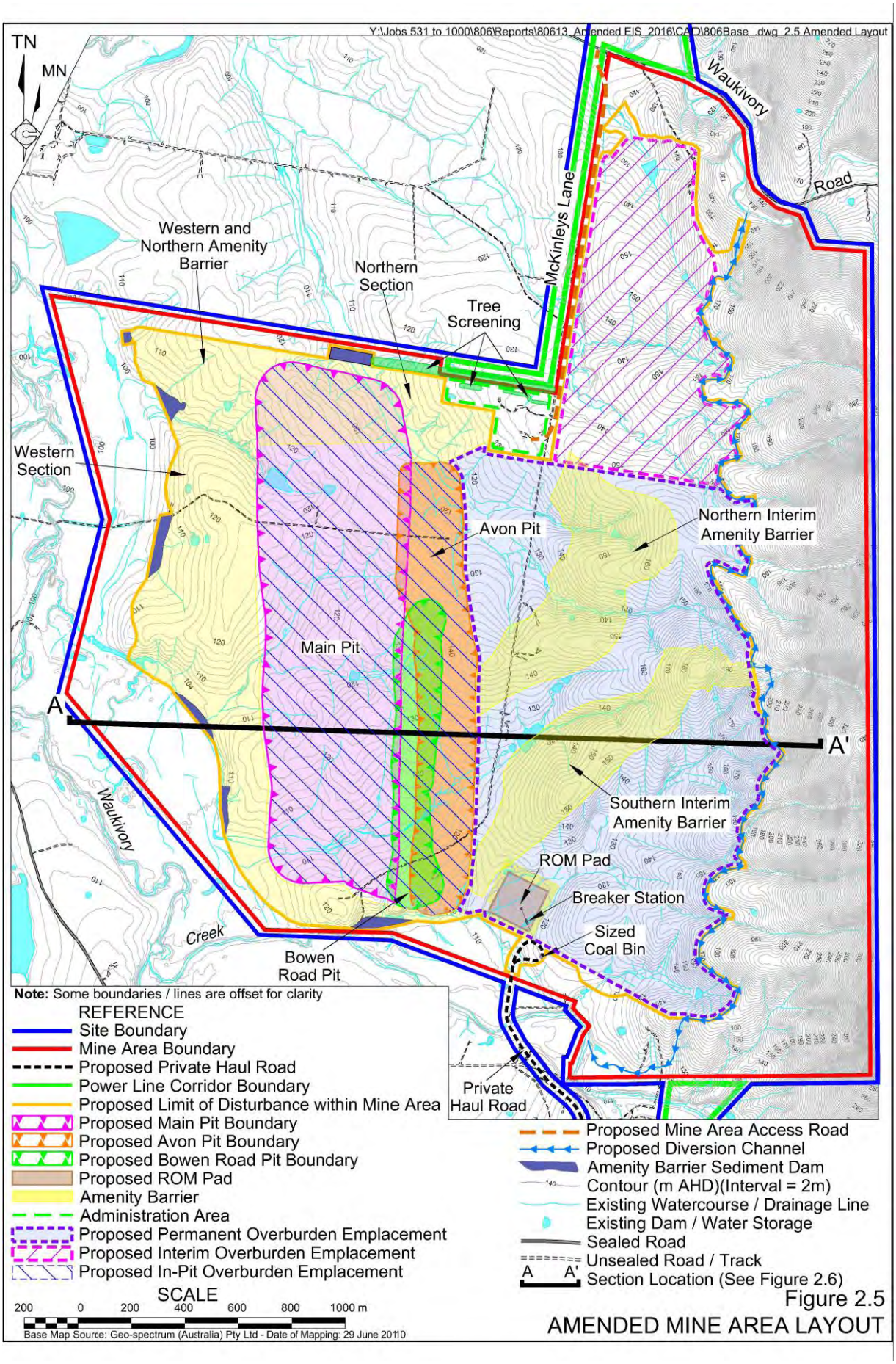


Figure 2.5
AMENDED MINE AREA LAYOUT

Table 2.2
Open Cut Pit Areas and Depths

	Avon Pit	Bowen Road Pit	Main Pit
Area (ha)	38	19	101
Pit Depth (below surface)	110m-130m	80m-110m	200m-220m

As noted in Section 2.3, the design of the open cut pits has been based on considerations including typical batter slopes and bench configurations used in the Hunter Valley and Gloucester Basin; the geology of the deposit including faulting and coal deposits; the topography; land holdings and flexibility to cope with changing commercial conditions, with the investigations into the particular rock strengths, structural block planes, material properties and other localised geotechnical aspects to form part of the detailed open cut pit design that would be routinely undertaken throughout the life of the amended Project. Before deep excavations are undertaken, it would need to be established that the mine design provides sufficient factors of safety to mitigate the risk of larger geotechnical failures occurring such as a deep seated slip circle.

Based on the Hunter Valley and Gloucester Basin experience, individual pits have been designed with side slopes of 45° to the base of weathering, with a 30m wide catch bench and haul road at this approximate level. Below the base of weathering, on the end walls, the design generally incorporates nominal 10m wide benches at 30m vertical intervals with slope angles of 15° from the vertical, giving the end walls an overall angle of approximately 31° from the vertical.

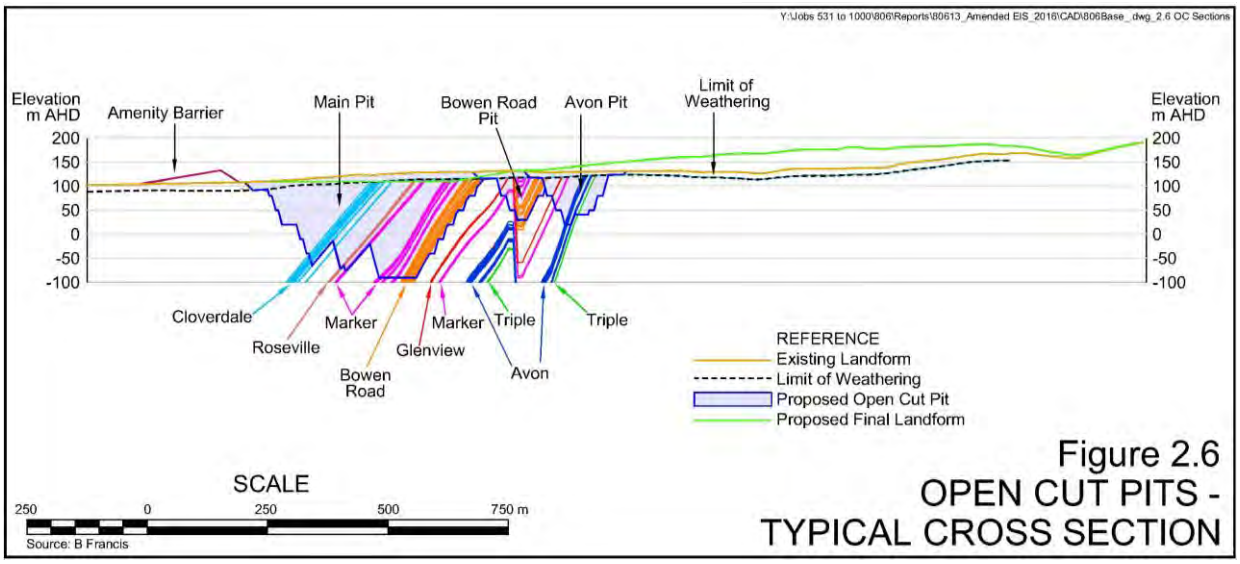
The eastern walls have slopes which are partly aligned with seam dips but interspersed with varying slopes and benches giving an overall eastern slope angle (excluding haul roads) that is similar to the last coal seam to be mined (varies between approximately 45° and 50°). This angle, which can be close to the bedding plane angle, would be the subject of detailed geotechnical analysis as the mine progresses, including regular monitoring of slope stability. Along the western wall, which is potentially the most stable as the dip is into the wall, the benches have been reduced to a width of 5m for an overall angle of 24° from the vertical. However, there would be a 30m wide bench retained at 20m AHD to provide a direct haul route from the areas of overburden extraction to the areas available for in-pit overburden emplacement. This would limit the extent of the steeper slopes and result in a lower overall angle of slope.

Where appropriate, wider benches and/or flatter wall angles than proposed above, and pre-splitting, would be used to cater for adverse geotechnical, geological and working conditions.

At the base of the open cut pits, higher walls without benches are proposed to enable the extraction of additional coal in locations which would be open for relatively short periods before backfilling, are limited in length and where there is no requirement to have personnel or equipment on the floor directly below the walls.

A slope stability plan for the open cut pits would be developed and implemented on the basis of the operational geotechnical assessments.

Figure 2.6 displays a typical cross-section through the three open cut pits showing the nominal elevations to the main (final) floor level in each. As noted in Section 2.2.3, the ultimate extent of development of each of the open cut pits, including the depth and hence the width at ground level, would depend on a range of variables over time including product mix, coal sale price and mining costs, all of which would determine the overall economic strip ratio cut-off.



2.4.3 ROM Pad and Breaker Station

The breaker station would be located on a 3ha ROM pad near the southeastern end of the Avon Pit, adjacent to the southeastern exit point from the open cuts. This location is distant from surrounding non-Project related residences and receivers and positioned in an area sufficiently low in the topography to ensure the 10m high acoustic barriers around the ROM pad are effective in reducing the noise arising from the delivery of the ROM coal, and its loading, breaking/sizing and transfer to the sized coal bin. The ROM pad and its acoustic barriers would ultimately be incorporated within and/or reshaped as part of the permanent overburden emplacement final landform, i.e. following the cessation of coal extraction.

2.4.4 Site Infrastructure and Buildings

Site Access

Initial access to the Mine Area during the site establishment and construction stage would be via McKinleys Lane, i.e. until the long-term Mine Area access road is constructed. Subject to the timing for the relocation of the TransGrid 132kV power line which is aligned, in part, parallel to McKinleys Lane (see Section 2.10.1), and TransGrid's easement access arrangements, an interim Mine Area access road may initially be constructed to the east of the final access road alignment for use by heavy vehicles undertaking equipment deliveries which could not use McKinleys Lane without damaging roadside and overhead vegetation. Interim localised elevations or lifting of the power line may be required to enable access beneath the existing 132kV power line, subject to negotiations with TransGrid regarding required clearances for safe access beneath the existing line.

Long-term access to the Mine Area from the public road network would be provided via an approximately 50m long section of McKinleys Lane and the new Mine Area access road to be constructed immediately to the east of, and generally parallel to, the retained section of McKinleys Lane. The existing vegetation within the McKinleys Lane reserve extending to the administration area would be retained to visually screen construction activities, vehicle movements on the Mine Area access road and the development of western section of the interim overburden emplacement from residences and public vantage points from the west through to the north. The Mine Area access road would be sealed following an initial stabilisation period.

Access for the nominal 60t road-registered coal haul trucks and the transportation of all large mining equipment to and from the Mine Area, would occur via the Stratford Mining Complex.

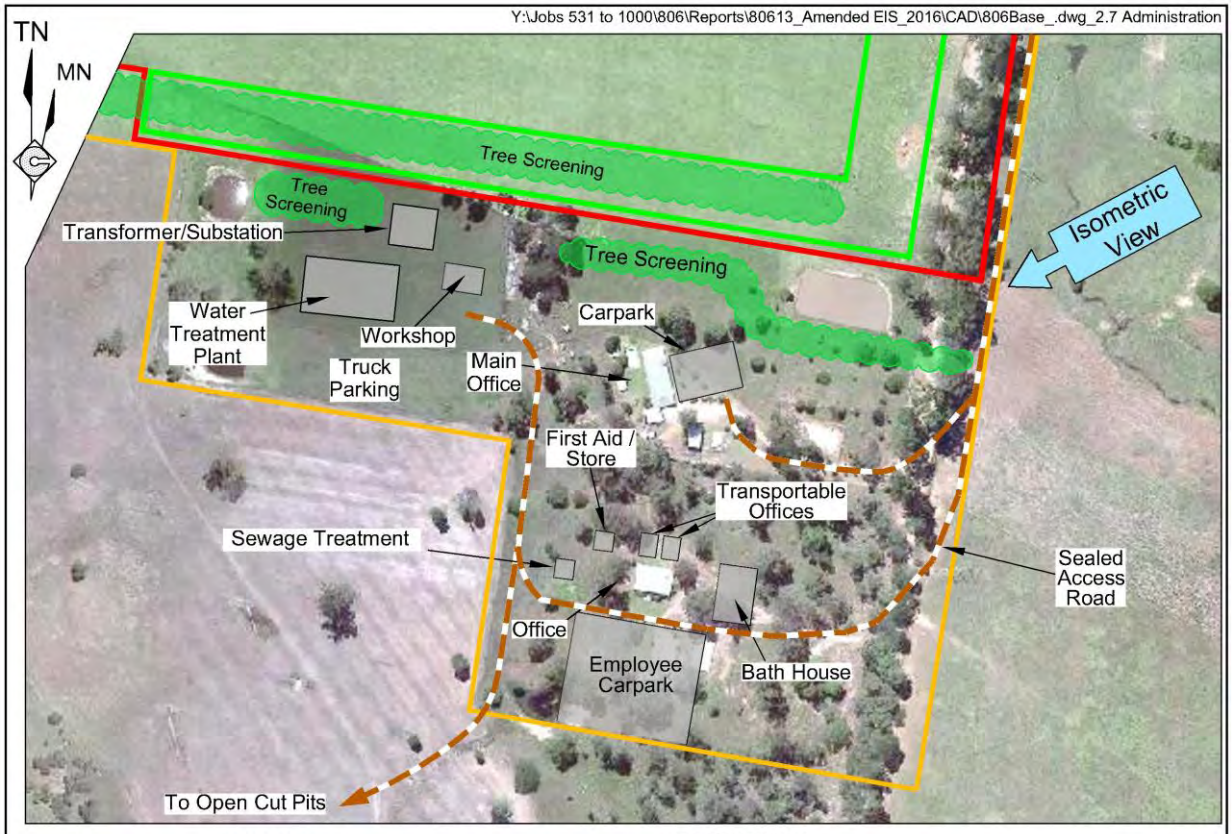
On-Site Road Network

The Applicant would maintain a network of internal light and heavy vehicle roads to permit access between the administration area and workshop and the various activity areas within the Mine Area.

A series of haul roads would be constructed to enable haul trucks to transfer overburden from the active open cut pits to the designated emplacement areas, and ROM coal from each of the active open cut pits to the ROM pad. Depending on their function, the internal roads may be semi-permanent, i.e. retained for months or years, or temporary, i.e. periodically re-located, as required, to maintain minimum road lengths and optimum grades, while at the same time maximising the acoustic and visual screening provided by the amenity barriers, open cut pit walls or other areas of cut, or the local topography. In-pit roads would generally be designed and constructed to a maximum gradient of 10%, with all two-way traffic roads designated for use by mining equipment constructed with a travelling width of three times the maximum width of the largest vehicle to be using these roads, plus berms and drainage, as required. Isolated haul roads within the lower-most extent of the Main Pit would, by necessity, be constructed with a grade of up to 12% as required and in sections may be reduced in width necessitating smaller trucks or one way traffic.

Buildings

In order to control the interface between mining operations and private vehicles, the Applicant would establish its administration area, workshop and associated facilities on land adjacent to McKinleys Lane, utilising the existing building, and additional transportable structures, with the additional buildings placed within existing cleared areas, where possible. Car parking for the workforce and visitors would also be provided generally amongst the mature trees in that area. **Figure 2.7** presents a conceptual layout of the administration area showing the existing and proposed buildings. The workshop and associated support facilities such as a fuel bay, service bay, wash pad and tyre pad would be constructed to the west of the site offices (see **Figure 2.7**). The workshop would be approximately 20m x 20m x15m high. The proposed water treatment plant would be positioned to the west of the workshop.

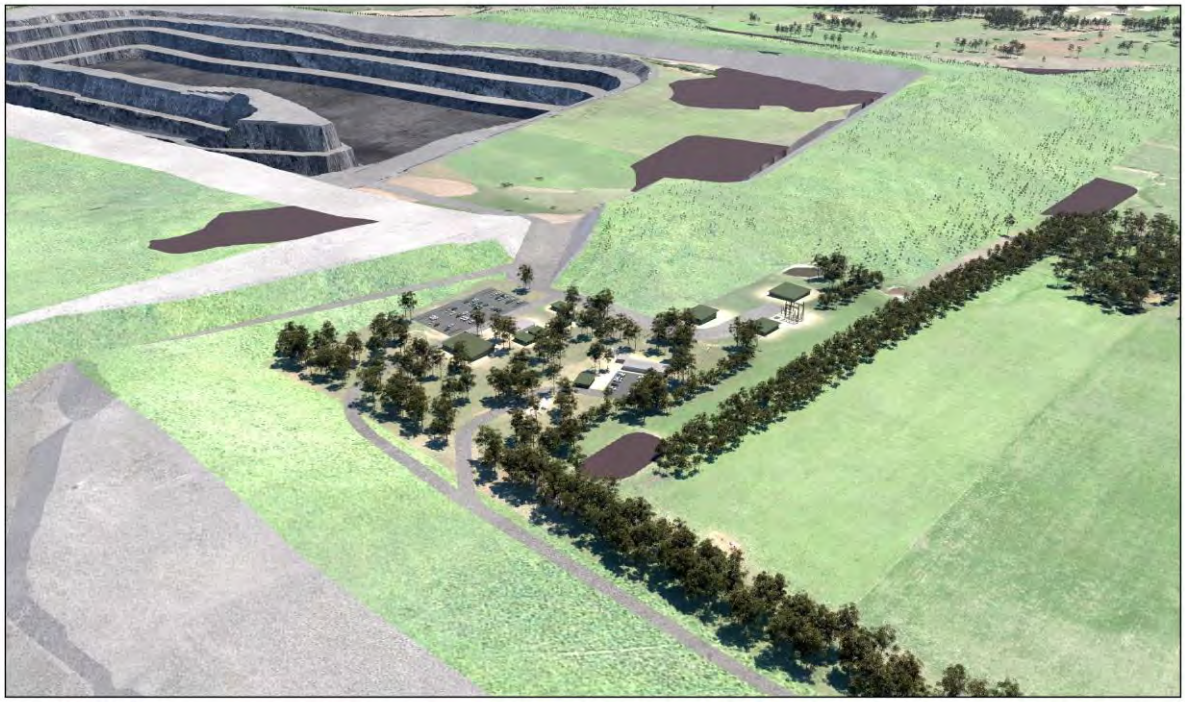


SCALE

50 0 50 100 150 200 m

Base Photograph Source: AAM Pty Limited (March 2012) & Calco Surveyors (March 2016)

REFERENCE
- Mine Area Boundary
- 11kV Power Line Corridor Boundary (Offset for Clarity)
- Proposed Area of Disturbance within Mine Area
- Internal Road
- Tree Screening



Isometric View

Source: Cambium Group

Figure 2.7
ADMINISTRATION AND WORKSHOP AREAS

2.5 PRIVATE HAUL ROAD

2.5.1 Introduction

The private haul road would enable sized ROM coal from the Rocky Hill Mine Area to be transported to the Stratford Mining Complex for processing and despatch to the Port of Newcastle. **Figure 2.8** displays the proposed location of the private haul road between the sized coal bin within the Rocky Hill Mine Area and northern boundary of the Stratford Mining Complex, i.e. coinciding with the boundary of ML 1733. After entering the Stratford Mining Complex, trucks transporting coal from the Rocky Hill Mine Area would travel on an extension of the private haul road to be constructed within ML 1733, ML 1577 and ML 1528, and then on existing internal roads to the extended ROM pad adjacent to the Stratford CHPP. **Figure 1.5** displays the location of the Stratford CHPP and the nearby rail load-out facility.

This subsection reviews the factors considered in selecting the location of the private haul road and presents key components of its design. A description of the activities involved in the construction of the road is presented in Section 2.6.5.

2.5.2 Route Selection

The alignment of the private haul road within the Site has been established following the consideration of the following factors.

- Land Ownership

  The private haul road corridor would be located wholly within land owned either by GRL (or associated companies) or Yancoal Australia Limited (or associated companies), i.e. excluding the one formed public road traversed by the haul road, namely Fairbairns Road and an unformed Council road immediately north of ML 1733. It is noted that the construction of the new section of the haul road within the Stratford Mining Complex and the intersection of the private haul road and Wenham Cox Road would form part of the Modification 1 of SSD 4966 as this section of road and this intersection lie within the Stratford Mining Complex.

- Topography

  The alignment and design of the private haul road have been selected to minimise the size (depths and elevations) of cuts and fills whilst also achieving the lowest practicable road grades, thereby minimising truck gear changes and the use of low gears and associated noise, as well as reducing fuel consumption. The maximum gradient on any section of the road is less than 5% and commonly in the range of 1%-2%.

- 132kV Power Line

  The location of the private haul road corridor has accounted for the presence of the north-south oriented Stroud to Taree 132kV power line. The private haul road and associated earthworks would be aligned to avoid towers, enable continued access to the line for inspections and maintenance purposes and to maintain safety clearances beneath and adjacent to the lines.

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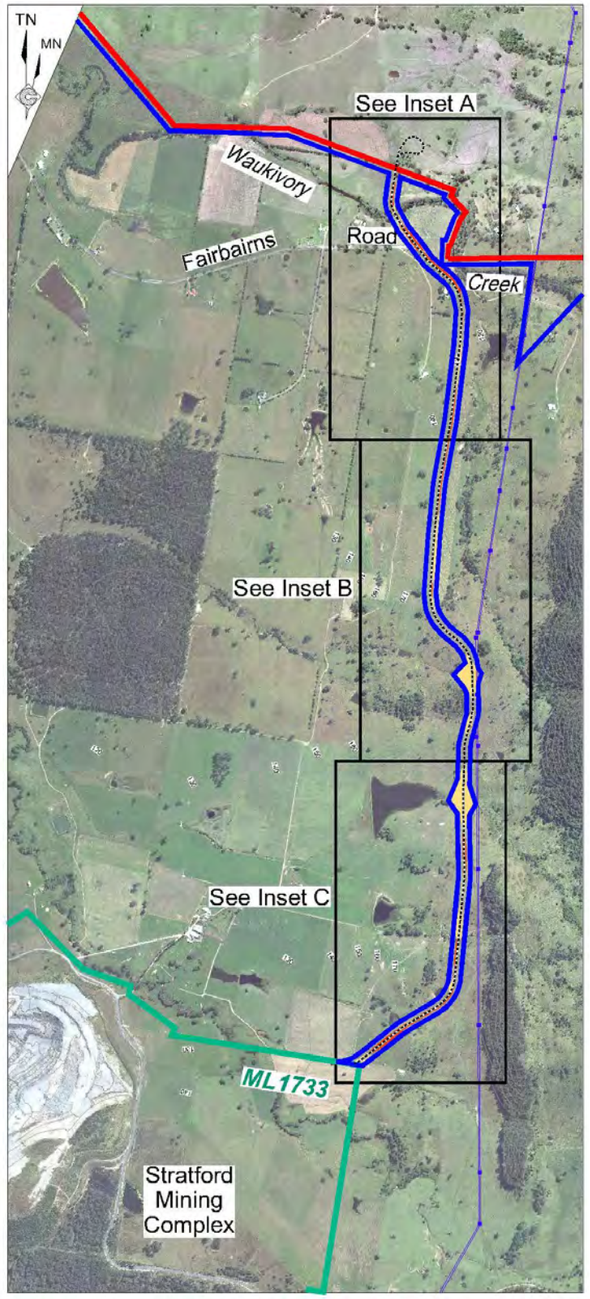

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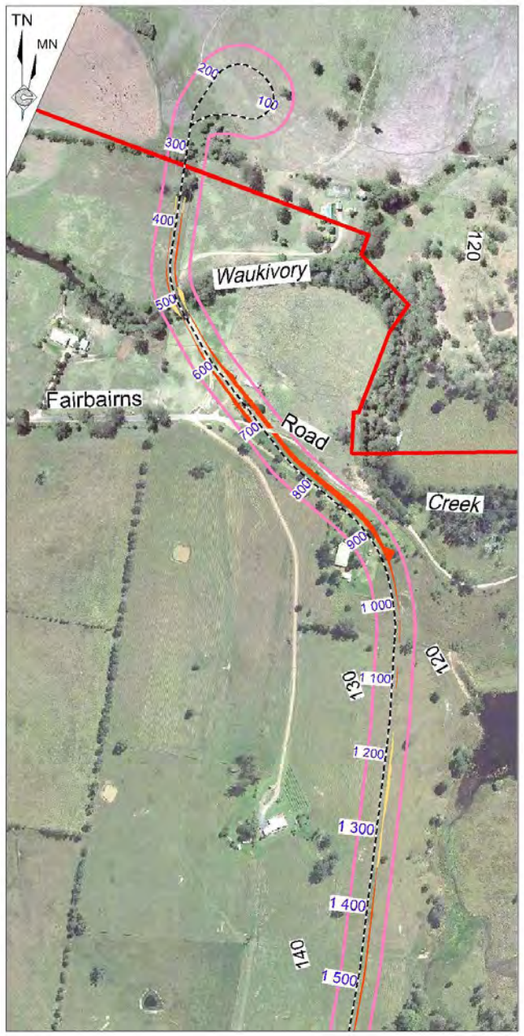
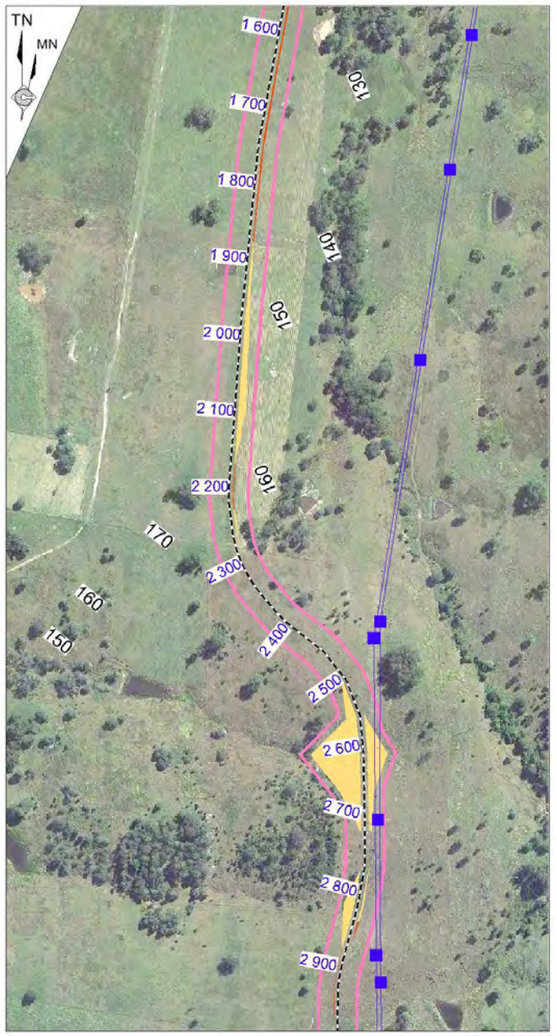
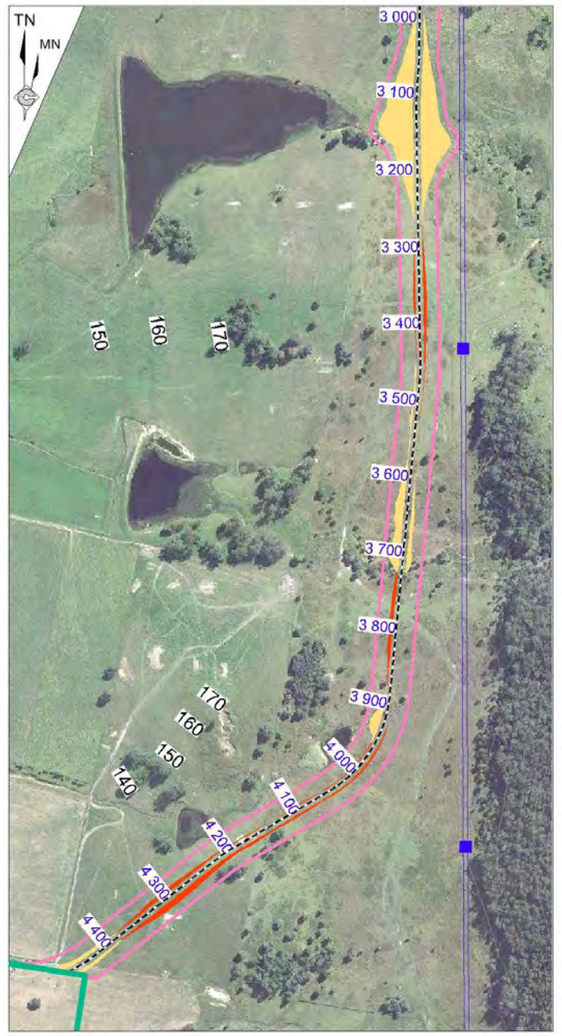


Inset A



Inset B



Inset C

INSET SCALE
100 0 100 200 m

REFERENCE
- Site Boundary
- Mine Area Boundary
- Stratford Mining Complex Boundary
- Private Haul Road (and Corridor)*
- 150 Contour (mAHD) (Interval = 10m)
- 132kV Power Line & Stanchion
- Proposed Road Cut
- Proposed Road Fill
- 3 800 Road Chainage (m)

Note *: The Corridor Boundary is coincident with the Site Boundary

Figure 2.8
PRIVATE HAUL ROAD LAYOUT

Base Photograph Source: AAM Pty Limited (March 2012) & Calco Surveyors (March 2016)

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- Existing Public Roads
  The alignment of Fairbairns Road across the proposed private haul road required consideration of avoiding interaction with traffic travelling along Fairbairns Road and the coal trucks travelling to and from the Rocky Hill Mine Area. It is noted, however, that the daily traffic on Fairbairns Road is extremely low to the east of the proposed underpass, servicing approximately five residences or properties, most of which are owned by the Applicant. The Applicant has determined that given the location and natural topography in the areas and elevation of Fairbairns Road relative to the Waukivory Creek, it would be appropriate for the private haul road to be constructed as a crossing beneath Fairbairns Road.

- Visibility
  The private haul road would be located as much as possible along the eastern side of a north-south oriented ridge that would prevent the road construction works and coal trucks travelling on the road being seen from The Bucketts Way (a distance of approximately 5km) and privately-owned properties. The effectiveness of this design feature is discussed further in Section 4.5.

- Agricultural Land Uses
  Emphasis was placed upon avoiding areas of higher productive agricultural land such as within the Denyer Dairy, on land owned by Yancoal immediately north of the Stratford Mining Complex.

- Terrestrial Ecology
  Biosis Pty Ltd was commissioned by the Applicant to initially review the terrestrial vegetation within a study corridor in which the road could be located and identify any threatened plant species or communities, or habitat of any threatened fauna species that should be avoided by the road. The selected alignment of the private haul road largely follows cleared grazing land of low or very low conservation significance and to the extent practicable, avoids areas identified as being as high or moderate conservation significance. Details of the terrestrial ecology within the study corridor considered for the road are provided in Biosis (2016) and discussed in Section 4.12.

- Watercourses and Aquatic Ecology
  The private haul road would traverse Waukivory Creek approximately 300m south of the sized coal bin. The proposed Waukivory Creek crossing would be positioned immediately adjacent to an existing single lane wooden bridge used by both the former landowner and the Applicant to traverse the creek. The crossing would be located in an area of minimal riparian vegetation and width between embankments. Details of the riparian vegetation and aquatic ecology in the vicinity of the proposed crossing are recorded by Cardno (2016) and discussed in Section 4.13.

- Aboriginal Heritage
  Archaeological Surveys and Reports (ASR) was commissioned by the Applicant to survey the proposed alignment of the private haul road (in conjunction with a number of Aboriginal stakeholders) to ensure that any identified Aboriginal

heritage artefacts or places are either avoided during construction of the road or appropriately recorded and salvaged prior to construction. Two artefacts were located during the survey, both of which would need to be salvaged prior to the commencement of road construction.

2.5.3 Road Design

Figure 2.8 displays the design features of the private haul road. The road commences with a one-way (clockwise) loop around the on-ground stockpile area and beneath the sized coal bin and then continues for a distance of approximately 4.4km to the northern boundary of the Stratford Mining Complex. Key design features along the road are as follows.

1. A prefabricated steel frame bridge crossing of Waukivory Creek at Chainage 500m.
2. An underpass of Fairbairns Road, necessitating a slight re-alignment of Fairbairns Road at Chainage 700m.
3. A series of excavations (cuts) and filled embankments (fills) along its length. The overall cut and fill would be balanced with the quantity of cut and fill each approximating 150 000m^3.

The prefabricated steel frame bridge crossing of Waukivory Creek would replace an existing bridge in this location. The bridge, which would be designed and constructed to carry the heaviest vehicles travelling to and from the Mine Area, would be constructed such that the pylons would avoid the normal flow channel. The bridge height would be approximately 3.0m above the creek bed, i.e. slightly higher than the height of the existing bridge. Increasing the height and avoiding pylons within the creek channel in this manner would be beneficial to water flow and limit the build-up of flood debris.

The road would be comparable in design to a public road with a sealed surface at least 7m wide, 1.5m wide unsealed shoulders and roadside drainage. Roadside fill batters would generally be 1:4 (V:H) (14º) to minimise the requirement for guardrail installation. Cut batters would be excavated typically with 1:1 (V:H) (45º) slopes. The road has been designed with a vertical and horizontal alignment to enable vehicles to safely travel at 80kph, although truck speeds along the road would be restricted to a maximum of 60kph.

The construction of the road would disturb a total of 13.8ha comprising 11.2ha for the roadway and 2.6ha for the required cut and fill batters.

2.6 SITE ESTABLISHMENT AND CONSTRUCTION ACTIVITIES

2.6.1 Introduction

Following the receipt of development consent and all requisite approvals for the particular activities, the Applicant would commence its site establishment and construction activities to prepare the Site for mining, initial processing and despatch of the sized coal. For the purposes of this document, the site establishment and construction activities comprise those activities on and off the Site which are to be undertaken prior to the commencement of any mining activity within the Avon Pit.

The key site establishment and construction stage activities to be undertaken would comprise the following.

- Construction of the Mine Area access road from near the intersection of McKinleys Lane and Waukivory Road to the administration area.
- Installation/construction of required additional offices and amenities, light vehicle car parks and associated infrastructure and demolition of existing buildings within the Mine Area not required for the amended Project during the initial 3 years of mining operations.
- Construction of the key site water management structures required prior to the commencement of the construction and mining activities.
- Construction of the workshop and associated infrastructure, namely fuel bay, wash down, store, etc. and preparation of the mobile equipment parking area.
- Construction of the ROM pad. Erection/installation of the breaker within the ROM pad would likely be undertaken during the latter months of the site establishment and construction stage or potentially soon after the commencement of mining operations such that it is installed and commissioned prior to first ROM coal production in the latter part of Year 1 mining operations.
- Construction of the private haul road, Waukivory Creek crossing and Fairbairns Road underpass including the access ring road and overflow on-ground stockpile area (see Section 2.5).
- Installation of a power generation unit and/or the reticulated power supply. Installation of communications infrastructure.

Off-site construction activities such as public road, bridge and intersection upgrading work would be undertaken concurrently with the on-site site establishment and construction activities (see Section 2.6.6).

Table 2.3 displays the indicative schedule for all construction activities.

2.6.2 Mark Out and Fencing

During the latter stages of the site establishment and construction stage, the Applicant would mark out the boundaries of the areas to be disturbed during the first 2 years of mining operations. Key boundaries and locations would be marked with painted posts, all of which would be noted on site plans and within relevant operational procedures.

During the site establishment and construction stage, some fencing within the planned areas of disturbance would be removed, with suitable materials salvaged for use elsewhere within the Applicant's or Yancoal's landholdings or recycled in accordance with waste handling and storage provisions of the POEO Act. Other operational areas would be fenced off from adjoining areas that are to be used for ongoing agricultural activities during the course of the mining, or for security purposes.

Table 2.3
Indicative Site Establishment and Construction Timetable

Construction Activity	Month									
	1	2	3	4	5	6	7	8	9	10
On-Site										
Creek Crossing										
Waukivory Creek										
Private Haul Road										
Bulk Earthworks*[1]										
Fairbairns Road Underpass										
Sub-base/unsealed pavement*[2]										
Miscellaneous										
Equipment delivery to Mine Area and Commissioning										
ROM pad and Breaker Station Initial Earthworks										
Workshop Area Construction										
Administration Area Development										
Mine Area Access Road										
Off-Site										
Mine Entrance										
Intersection Upgrades										
Road Widening										
Jacks Road Bridge										

*[1] Sufficient to allow access/movement of mining equipment.
*[2] Sealing to be undertaken prior to commencement of coal haulage activities.

2.6.3 ROM Pad and Breaker Station

The ROM pad would be constructed principally by cut and fill methods and with suitable materials recovered from on-site borrow pits established within the proposed limit of disturbance. Topsoil and subsoil stripped from the ROM pad footprint would be stockpiled nearby for rehabilitation of the early sections of permanent overburden emplacement once it is constructed to its final elevations. It is noted that the 10m high acoustic barriers around the ROM pad would be constructed during the early stages of mining within the Avon Pit.

Structural elements and components required for the construction/installation of the breaker station would, to the extent practicable, be fabricated or assembled off site and delivered to the Site in modular form for erection/installation near the end of the site establishment and construction stage or during the initial year of mining operations.

2.6.4 Workshop

The area required for the workshop and associated equipment facilities (fuel bay, service bay, wash pad, tyre pad, truck parking area, etc.) would be stripped of its topsoil and the underlying surface shaped, compacted and covered with crushed rock to form a serviceable hardstand area. The structural elements of the workshop would also be fabricated off site and delivered to the Mine Area in modular form for erection/installation. This would involve the delivery of

approximately 20 loads of prefabricated structural components and approximately 300m^3 concrete (approximately 50 agitator truck loads). Construction and commissioning of the workshop is projected to take up to 5 months.

2.6.5 Private Haul Road

The private haul road would be constructed in a manner comparable with any public road through the adoption of the following.

1. The alignment of the road would be marked out by a surveyor with a centreline and pegs for the top of cut and toe of fill batters.
2. The Applicant proposes to construct the road generally from south to north, initially to a standard sufficient to enable the mining equipment required to be delivered to the Rocky Hill Mine Area by low loader via the Stratford Mining Complex for assembly.
3. Priority would, however, be given to the construction of the bridge across Waukivory Creek and the construction of the Fairbairns Road underpass. The bridge would satisfy the Policy and Guidelines for the fish habitat conservation and management (DPI, 2013). The Fairbairns Road underpass would comprise an excavation to approximately 5.5m below the existing road level over which a pre-fabricated galvanised steel truss (or equivalent) structure would be placed supported by steel or concrete columns. The two-way traffic overpass structure would have a carrying capacity of approximately 70t, a capacity that exceeds that which can be carried on other bridge structures along Fairbairns Road. Bridge construction would commence early in the overall program to ensure the bridge is fully completed by the time the road sections are constructed near the bridge and the road is available for the equipment deliveries to the Mine Area.
4. All required erosion and sediment controls would be installed progressively along the alignment of the road prior to any disturbance within the road corridor itself.
5. Bulk earthworks involving topsoil and selected subsoil stripping, excavation in areas of cut and placement and compaction of materials in areas of fill would occur progressively along the alignment of the road. Based on observations within the haul road corridor and similar topographic areas within the Rocky Hill Mine Area, minimal blasting (if any) is expected during the excavation in areas of cut. Any sub-grade materials encountered during the excavation of the cut sections that are suitable as a sub-base would be stockpiled within the alignment of the road for later use. All topsoil recovered, and not required for stabilising roadside batters, would be placed in a series of small longitudinal mounds of the upslope side of the road and revegetated. These vegetated stockpiles would remain in place for the full duration of the amended Project.
6. Following the completion of the bulk earthworks to the design levels, a sub-base material would be placed and compacted along the full length of the road. The sub-base material would be preferentially sourced from within the road alignment itself, from borrow pits within the disturbance footprint within the Rocky Hill Mine Area or from active mining areas or un-rehabilitated overburden

emplacements within the Stratford Mining Complex. A base course layer comprising sized material would be placed over the sub-base, compacted and allowed to settle/compact for a period until the road is sealed. If not available on site, the base course material would be sourced from suitable quarries within the local area. Sealing would be completed prior to the commencement of coal haulage activities.

7. Prior to sealing, the base course layer would be trimmed and repaired, if necessary. The road would be sealed with a two-coat seal.
8. All required roadside guideposts and advisory signs would be installed.

2.6.6 Off-site Construction Activities

The principal construction activities to be undertaken outside the Rocky Hill Site would involve the following.

- The construction of an upgraded intersection at the corner of Jacks Road and The Bucketts Way to provide deceleration lanes approaching the intersection.
- Upgrading and widening the pavement along the full length of Jacks Road.
- Construction of a new bridge across the Avon River on Jacks Road.
- Upgrading the 1.3km section of Waukivory Road from Jacks Road to McKinleys Lane.
- Construction of an upgraded intersection at the junction of Jacks and Waukivory Roads.
- Upgrading the intersection of Waukivory Road and McKinleys Lane and the approximately 50m section of McKinleys Lane to the Mine Area access road.

The locations of all off-site construction activities are displayed on **Figure 2.9**.

2.6.7 Site Establishment and Construction Hours

The proposed core site establishment and construction hours would be:

- 7:00am to 6:00pm Monday to Friday; and
- 8:00am to 1:00pm Saturdays.

Although activities would generally be undertaken within the core hours, limited activities may be required between 6:00pm and 10:00pm Monday to Friday:

- in the event of periods of unfavourable weather which delay critical path construction activities;
- to allow for the receipt of components and/or to enable the completion of particular phases of installation or commissioning activity that cannot be readily terminated mid-stream; or
- for activities that are not audible at any privately-owned residence.

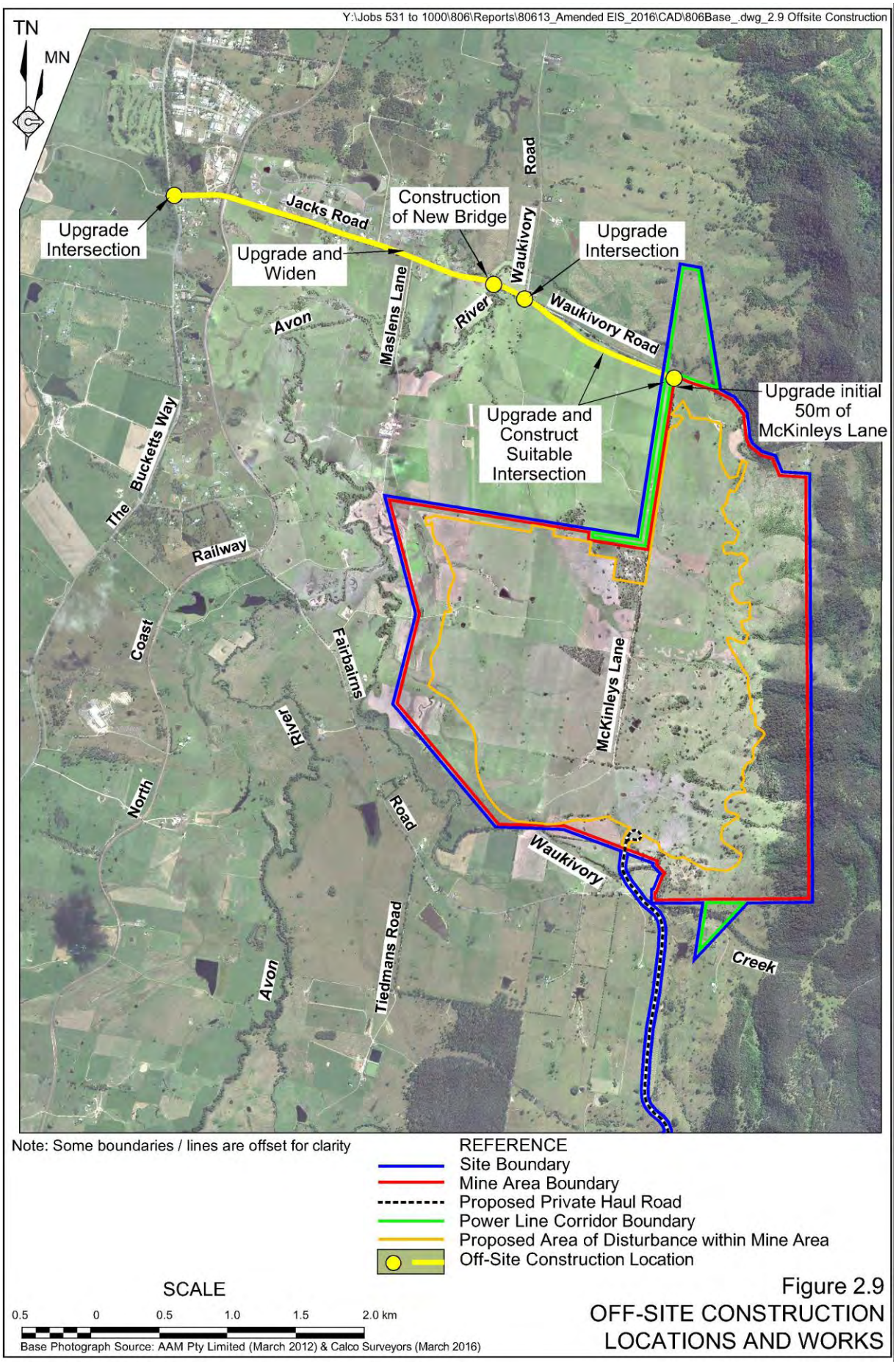

Figure 2.9
OFF-SITE CONSTRUCTION LOCATIONS AND WORKS

2.7 MINING OPERATIONS

2.7.1 Introduction

Mining would be undertaken using conventional open cut mining methods, albeit adjusted to reflect the steeply dipping nature of the coal seams across the Mine Area. Mining would involve a series of activities including marking out, vegetation clearing (where required), topsoil and subsoil removal, overburden/interburden management and coal recovery. This section provides a description of each component activity.

2.7.2 Mining Operations

2.7.2.1 Mark Out

The boundaries of the areas to be disturbed beyond those identified during to the commencement of the site establishment and construction stage would be marked out in the field prior to the commencement of vegetation clearing and/or soil stripping in those respective areas.

2.7.2.2 Vegetation Clearing

The bulk of the proposed areas of disturbance within the Mine Area comprise cleared grazing land with isolated trees and would not require any substantial tree clearing. Throughout the life of the amended Project, clearing of vegetation within three native vegetation communities would be undertaken over an area of 51.8ha causing the effective removal of 41.5ha of trees and shrubs. The 41.5ha would comprise approximately 36.6ha of effective clearing of low, moderate and good condition Dry sclerophyll forest, 4.2ha of remnant rainforest and 0.7ha of riparian forest. The clearing would be required principally along the southern section of McKinleys Lane, within the footprint of the Avon and Bowen Road Pits, and within the footprint of the permanent overburden emplacement.

Any trees suitable for agricultural purposes (e.g. fence posts) would be felled and removed prior to commencement of each clearing campaign. Clearing of the remainder of the larger vegetation would be undertaken by chainsaw and/or a bulldozer operating with the blade positioned just above the ground in a manner to minimise soil disturbance. Once felled, the trees and branches would be managed using one or a combination of the following methods.

- Cut or broken and immediately placed on the available reprofiled and topsoiled surfaces within the Mine Area, particularly the areas designated as fauna corridors or open woodland, or stockpiled for subsequent placement in those areas.
- Placed within the Biodiversity Offset Area.
- Mulched and subsequently incorporated into the topsoil to provide biomass.

Large stumps would be stockpiled and subsequently placed within exhausted open cut pits. Hollow-bearing trees would not be broken or mulched but rather, retained to provide fauna habitat within the Biodiversity Offset Area or the appropriate areas of the post mining landform.

The smaller vegetation, i.e. pasture and/or shrubs, would be retained and collected with the topsoil during the topsoil stripping activities to ensure the retention of the seed bank and nutrients, as well as minimise opportunities for erosion and dust generation between clearing and soil stripping.

Use of vegetation by each of the above methods would assist in reducing erosion, aid vegetation re-establishment and/or encourage the use of the Biodiversity Offset Area, corridors or other appropriate areas by fauna through the provision of habitat.

Following the initial site establishment and construction stage, clearing of the vegetation within the Mine Area would be preferentially undertaken using a progressive annual campaign approach, with the extent of clearing undertaken in any campaign being sufficient for the subsequent year of planned mining and related activities.

The limited areas carrying a cover of predominantly native grasses would be identified and, subject to seed presence at the time of topsoil removal and equipment limitations, would be stripped and the seed-bearing mulch applied directly to areas being rehabilitated.

Where practicable, the clearing campaigns, particularly the removal of trees, would be scheduled for the late summer to autumn period in order to minimise potential impacts on fauna that might be nesting, roosting or otherwise utilising the areas scheduled for disturbance, and to maximise the opportunity for the collection of viable seed. Additionally, a visual inspection of trees to be removed would be undertaken and any threatened fauna appropriately re-located. The inspection for fauna would be undertaken immediately prior to the clearing operations or, alternatively, procedures would be adopted to ensure any hollows are not occupied between the time of the visual inspection and commencement of tree clearing operations.

When appropriate, and where environmental weeds are sufficiently dense in areas to be cleared, weed spraying or other appropriate measures would be undertaken prior to the topsoil stripping activities to avoid their proliferation on stockpiles or in subsequently rehabilitated areas.

In order to prevent erosion and sedimentation, where warranted, the following activities would be undertaken prior to any major clearing or surface disturbance activities.

- Construction of an interim diversion bank on the upslope boundary of the area to be disturbed/cleared. The diversion bank would divert clean water from upslope areas into natural watercourses or to designated storages within the Mine Area.
- Construction of one or more catch drains or banks on the downslope boundary of the area to be disturbed/cleared. Runoff collected by the catch drains or banks would be directed to sediment dams and released off site once of a suitable quality, i.e. unless it is required for dust suppression purposes.

The size and location of these structures would vary depending on the surface area and location of the planned disturbance but would be based on the structure designs and construction notes in DECC (2008). Greater detail on surface water management is presented in Section 4.7.

2.7.2.3 Soil Removal

Topsoil and subsoil would be separately stripped in accordance with the recommendations of GCNRC (2013a) and preferentially placed on either interim or permanent landforms. When no suitable landforms are available, the topsoil and/or subsoil would be stockpiled in key strategic areas within the Mine Area until the sequence of mining allows the direct transfer of topsoil and subsoil onto the final landform.

All topsoil, irrespective of thickness, would be recovered from all component areas within the Mine Area to be disturbed, including within the footprint of the western and northern amenity barrier and interim overburden emplacement (**Figure 2.5**). Nominally, between 10cm and 15cm of topsoil would be stripped from within each identified soil mapping unit (SMU) (see **Table 2.4**) although, where topsoil thickness is greater, all topsoil would be recovered. Subsoil would be stripped for a further 60cm (in SMU1) to 85cm (in SMU3) following the removal of topsoil. The occurrence and nature of each soil mapping unit is described in detail in Section 4.8.3.

Use of topsoil stockpiles would be minimal. Rather, emphasis would be placed upon 'storing' topsoil (and subsoil) where appropriate on the long-term western and northern amenity barrier and short-term interim amenity barriers (see Section 2.7.2.4). Some areas on the constructed final landform may also be used for topsoil storage until further areas are completed and require the placement of topsoil. Topsoil would typically be 'stored' at thicknesses of at least 0.5m and limited to a maximum height of approximately 2m to retain the viability of the soil until it is used for rehabilitation purposes.

Table 2.4
Indicative Soil Stripping Depths

Soil Mapping Unit (SMU)	Topsoil* (cm)	Subsoil (cm)
1	10	10-70
2	15	Nil
3	15	15-100
* Localised areas may contain thicker topsoil.		
Source: GCNRC (2013a) – Section 8		

Subsoil stripping and stockpiling (if necessary) would generally be limited to the footprint of the open cut pits and permanent overburden emplacement and subsequently replaced onto the reshaped final landform to re-establish a soil profile suited to pasture growth or woodland vegetation. The indicative thicknesses of subsoil to be recovered in the various SMUs are also set out in **Table 2.4**. GCNRC (2013a) recommends no salvage and stockpiling of subsoils from SMU 2 areas because of their salinity potential. Stripped subsoil would either be 'stored' in a similar manner to the topsoil on barriers within the Mine Area or within dedicated stockpiles. All subsoil stockpiles would generally be limited to a height of approximately 4m except for the section of the northern amenity barrier that would be constructed largely of subsoil.

In order to minimise excessive soil (topsoil and subsoil) deterioration during stripping, transportation and stockpiling, the following procedures would be adopted.

- Topsoil and subsoil would be stripped strictly in accordance with the stripping depth recommendations for individual soil mapping units presented in GCNRC (2013a) and identified in **Table 2.4**.
- Topsoil would be maintained in a slightly moist condition during stripping and would not be stripped when in an excessively wet or dry condition.
- Less aggressive soil handling systems such as open bowl scrapers or pushing into windrows for subsequent collection by excavators and trucks would be undertaken wherever practicable to minimise damage to the soil structure.
- The surface of stockpiles would be left in as coarsely textured condition as possible in order to promote water and air penetration, minimise erosion prior to vegetation establishment and to prevent anaerobic zones forming.
- Where the subsoil is placed on barriers as a growth medium or in the event that soil stockpiles are planned to be retained for in excess of 3 months, they would be seeded with seasonally appropriate cover crop species and fertilised to provide stability and minimise erosion losses.
- Prior to respreading previously stockpiled topsoil materials onto the reshaped landform, particularly those areas where native vegetation establishment is a priority, an assessment of weed infestation on the stockpiles would be undertaken to determine if individual stockpiles require herbicide application and/or scalping of weed species prior to spreading.

An inventory would be maintained identifying the volume of topsoil and subsoil stripped and located in each stockpile, together with a record of the source soil mapping unit, to ensure adequate materials are available for planned rehabilitation activities as mining nears completion. The inventory would be progressively updated to reflect materials removed and re-spread throughout the life of the amended Project. Locations and details of soil storage or individual stockpile locations would also be identified on operational plans.

The Applicant proposes to strip sufficient topsoil on an annual basis from the proposed areas of disturbance to enable subsequent overburden removal or placement in the following year. **Figure 2.10** displays the indicative annual sequence of surface disturbance throughout the first 11 years of mining. The area stripped of topsoil during Year 1 would be approximately 136ha. Thereafter, the area stripped on an annual basis would vary from approximately 102ha in Year 3 to approximately 7ha in Year 11.

2.7.2.4 Overburden Management

Overburden is required to be removed to gain access to the target coal seams within the individual open cut pits. Based on the drilling results, it is anticipated that the upper weathered section of the profile within each open cut pit would be amenable to free-digging or removal by scrapers, with the underlying consolidated material requiring blasting prior to its removal.

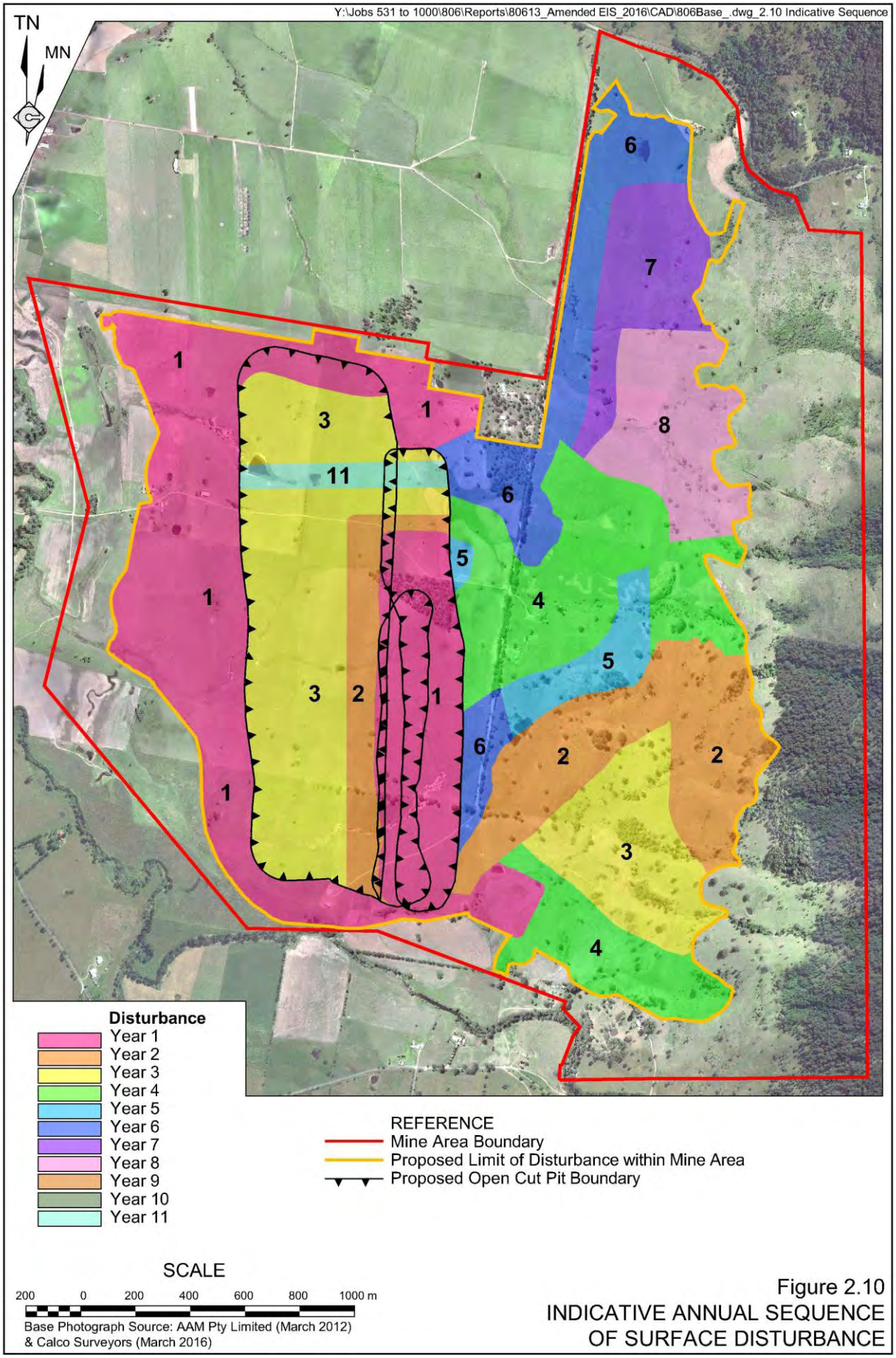

Figure 2.10
INDICATIVE ANNUAL SEQUENCE
OF SURFACE DISTURBANCE

The overburden principally comprises sandstones, siltstones and occasional conglomerates, the majority of which has been confirmed by geochemical testing to be non-acid forming (NAF) and contain excess neutralising capacity. The testing has also established that only two overburden samples (an uneconomic coal seam and a coal seam floor sample) were classified as PAF material. Based on the testing undertaken, from an acid-base perspective, the overburden material can be regarded as a NAF unit containing excess neutralising capacity. Therefore, a specific selective handling and placement management program for the limited potentially acid forming (PAF) overburden materials is not warranted. As a precautionary measure, all uneconomic coal seams and coal seam roof and floor materials would be emplaced in a similar manner to PAF breaker reject materials (see Section 2.8.4), i.e. blended with overburden and placed at least 5m from the final batters and upper surface.

For mine planning purposes, it has been conservatively assumed that the excavation of the overburden would cause an increase in volume (or swell factor) of approximately 25%, i.e. a total of approximately 126 million bank cubic metres (Mbcm) of overburden would be removed from the open cut pits which would generate approximately 158 million loose cubic metres (Mlcm).

Adoption of this conservative swell factor estimate would ensure that an adequate area has been identified for overburden placement in the manner proposed. In the event the swell factor is less than 25%, the area of land required for the interim overburden emplacement would be less than that displayed on **Figure 2.5**, i.e. the northern limit of the emplacement displayed on **Figure 2.5** may not be reached.

Blasting of overburden would involve the drilling of 229mm diameter holes (or similar) with nominally 80 to 160 holes per blast and hole depths of either approximately 15m or 30m. Due to the steeply dipping nature of the target coal seams, 30m blast holes would predominantly be used to fracture the thicker overburden sections in the upper western part of the Main Pit above the target seams and in the thicker sections between the seams. Blast holes up to 15m deep would be predominantly used in the vicinity of the coal seams, to fracture the thinner sections between seams and towards the base of each open cut pit.

Emulsion blends would be used in wet holes with Ammonium Nitrate Fuel Oil (ANFO) to be used in dry holes. The powder factor for all blasts would average approximately 0.8kg/bcm.

It is proposed that the maximum instantaneous charge would generally vary from 414kg to 828kg (or larger in more distant areas where application of larger MICs could readily satisfy the blasting amenity criteria). All blasts would be initiated with either an electronic or a non-electric (NONEL) system. All blasts would be designed to ensure the airblast or ground vibration criteria are not exceeded at any privately-owned residence or receiver. Whenever necessary, MICs would be reduced by, for example decking the individual blast holes (see Section 4.3). Each 30m blast would result in up to approximately 260 000bcm being fragmented while each 15m blast would fragment up to approximately 130 000bcm of overburden. As discussed in Section 2.3.4, the south to north direction of mining in each open cut pit would result in most blasts being directed southwards with the blast envelope also focussed in that direction.

Blast size and blasting frequency would be determined by the number and size of the active work areas and their position within the confines of each pit, with up to approximately 120 blasts initiated in any one year and a likely maximum of four production blasts per week, unless required for safety reasons, e.g. in the event of a misfire.

The bulk of the western and northern amenity barrier would be constructed using overburden mined during the first 2 years of the mining operations in order to obstruct views of, and limit noise from, the mining operations within the Avon Pit and Bowen Road Pit initially, and subsequently within the Main Pit. The construction of the barrier would be completed early in Year 3. The barrier would be constructed progressively to provide noise protection as it is constructed. By the end of Year 1, both the western and northern sections of the barrier would be constructed to their full lateral extent and generally to an elevation of approximately 130m AHD to 135m AHD. The upper section of the western section of the barrier would be constructed in Year 2 to approximate elevations between 145m AHD and 156m AHD. Parts of the upper surface of the northern section of the barrier would be completed up to 160m AHD by early in Year 3.

The western section of the western and northern amenity barrier would rise above the natural ground level by between 20m and 34m whereas the upper surface of the northern section would be 10m to 40m above natural ground level. The visually exposed western slopes of the barrier, which would remain in place for the duration of coal extraction activities, would be constructed with outer slopes generally of approximately 10º, with isolated areas of up to 14º to provide a more natural and varied appearance to the overall slope. The northern section of the western and northern amenity barrier which, to some extent, would similarly remain in place for the duration of coal extraction, would be constructed with outer slopes generally of 10º or less in the western areas and up to 18º along the central northern face. Variations in slope would be constructed in a manner to introduce a more natural appearance rather than an engineered slope. Further details of the method of barrier construction and its progressive rehabilitation are presented in Section 4.5.

The inner slopes of both sections of the western and northern amenity barrier would be approximately 35º, i.e. the angle of repose of the emplaced materials. The external slopes would be progressively revegetated in small sections as the final surface is completed, with a mixture of grasses, shrubs and small trees, with tree and shrub planting densities also varied to provide a more natural appearance consistent with that in surrounding areas. In Year 14 of mining operations, the bulk of the northern section of the western and northern amenity barrier would be removed to expose the final area within the Main Pit to be mined. A 10m to 15m high section of the barrier would be retained adjacent to the northern boundary of the Mine Area to continue to provide both visual and noise protection for the relatively short period that earthmoving equipment is operating at or near ground level in the northern end of the Main Pit adjacent to the retained section of the barrier.

Following the initial overburden placement within the western and northern amenity barrier, overburden would be placed within either a permanent or interim out-of-pit emplacement from Years 3 to 8 or within the open cut pits (in-pit emplacement) thereafter. The permanent overburden emplacement would be constructed with two interim amenity barriers within the emplacement footprint to assist in reducing both noise and visibility during the construction of the emplacement – see Section 4.5.4.3 for further details. The out-of-pit and in-pit overburden would be placed in a manner that would ultimately create a single landform within the footprint of disturbance.

The interim overburden emplacement, covering up to approximately 60ha and potentially containing approximately 13Mlcm of overburden, would be located on the northern end of the permanent overburden emplacement and would be removed following the completion of all coal extraction activities, with all overburden placed into the void remaining within the Main Pit.

It is noted that limited in-pit placement of overburden would commence in Year 4 in the former Avon Pit during the evening mining operations when winds are predominantly from the southern quadrant.

The final surface of the permanent overburden emplacement would be constructed with slopes and form similar to those of the existing landform, i.e. slopes of less than 2º to 14º and a landform comprising ridges and valleys (see Section 2.16.5).

2.7.2.5 Coal Recovery

The coal exposed in each open cut pit would be removed by excavator and transported by haul truck to the ROM pad. Some coal may be pushed off in areas where the dip of the seams permits the safe operation of a bulldozer. Given the steep dip of the coal seams, limited low energy blasting may also be undertaken to fracture the coal exposed in the pit floor once the main floor level is achieved, thereby potentially enabling the extraction of further coal down the dip of the seam without any additional overburden removal.

2.7.3 Mining Sequence

Figure 2.11 displays the development status at the end of Years 1 to 4 while **Figure 2.12** displays the development status at the end of Years 5, 7, 8, 10, 13 and 16. The end of Year 16 represents the cessation of coal extraction immediately prior to the commencement of back filling the residual void within the Main Pit.

Plate 2.1 presents a set of isometric views showing the development sequence of the Mine Area at Years 0.5, 1, 3, 7, 10, 16 and following the completion of all rehabilitation activities.

2.7.4 Overburden Removal and Coal Extraction Rates

Table 2.5 presents the estimated annual overburden production and ROM coal quantities. This estimate is based upon the production of approximately 21 million tonnes of ROM coal over a 16 year period.

During Years 17, 18 and 19, approximately 23Mlcm of overburden would be replaced within the final open cut void within the Main Pit.

Based on the current planning, the Applicant expects to extract up to approximately 1.8 million tonnes of ROM coal per year, commencing at a rate of approximately 0.2 million tonnes in the fourth quarter of Year 1 and ramping up to full production over subsequent years. Notwithstanding the above, the Applicant is seeking approval to extract up to 2.0Mtpa to reflect, for example, variations in the schedule which may result in less coal production in one year but the exposure or availability of more coal in the subsequent year, or the occurrence of further seam duplications as have been identified by drilling in the area of the proposed Bowen Road Pit. Any increase in ROM coal production beyond that scheduled would be offset by a reduced quantity of overburden removed in that production year. **Table 2.5** shows that the estimated rate of overburden removal would vary throughout the life of the amended Project from approximately 4.7 million bcm during the first year of operation to approximately 9.8 million bcm in Years 5 to 10.

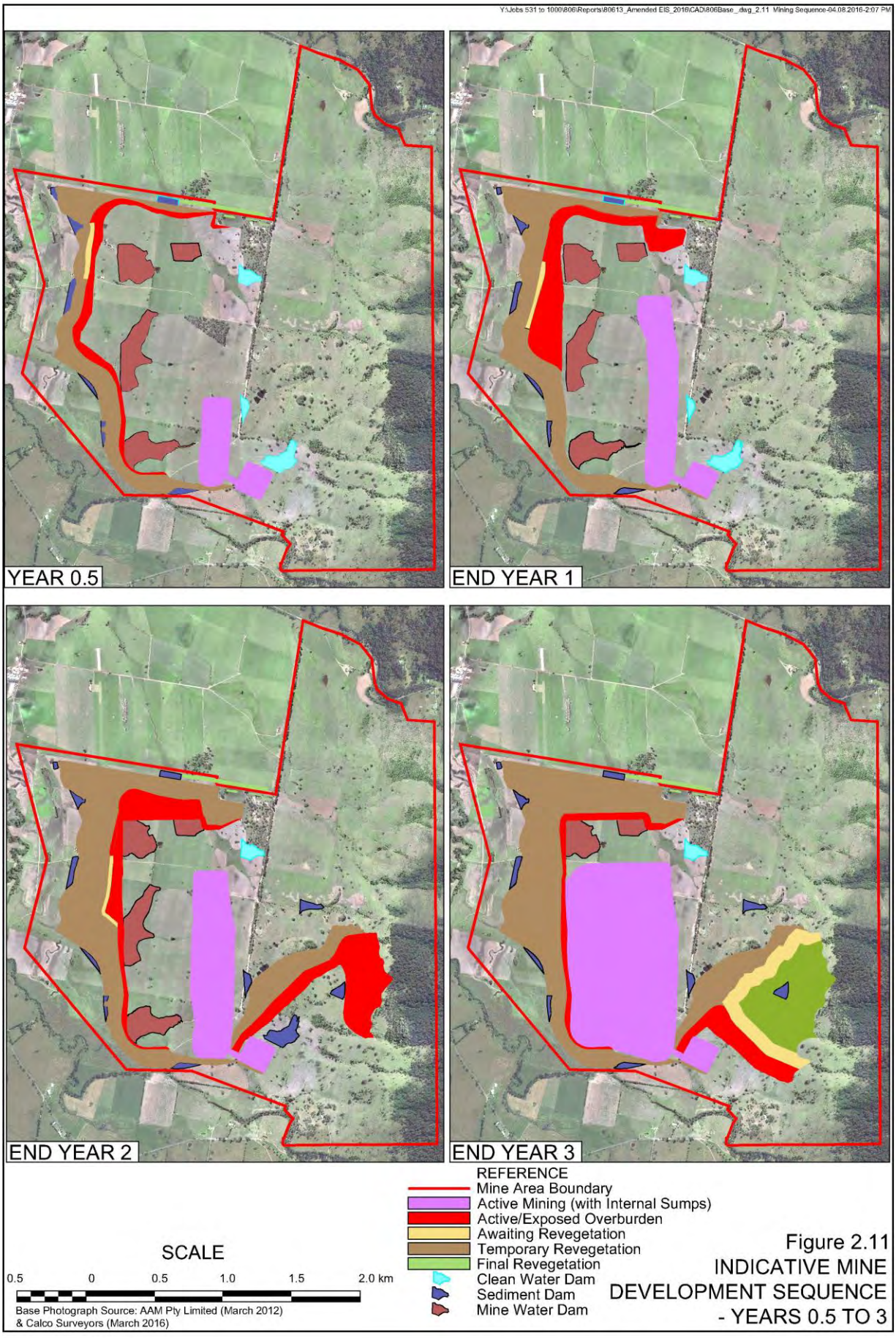

Figure 2.11
INDICATIVE MINE DEVELOPMENT SEQUENCE - YEARS 0.5 TO 3

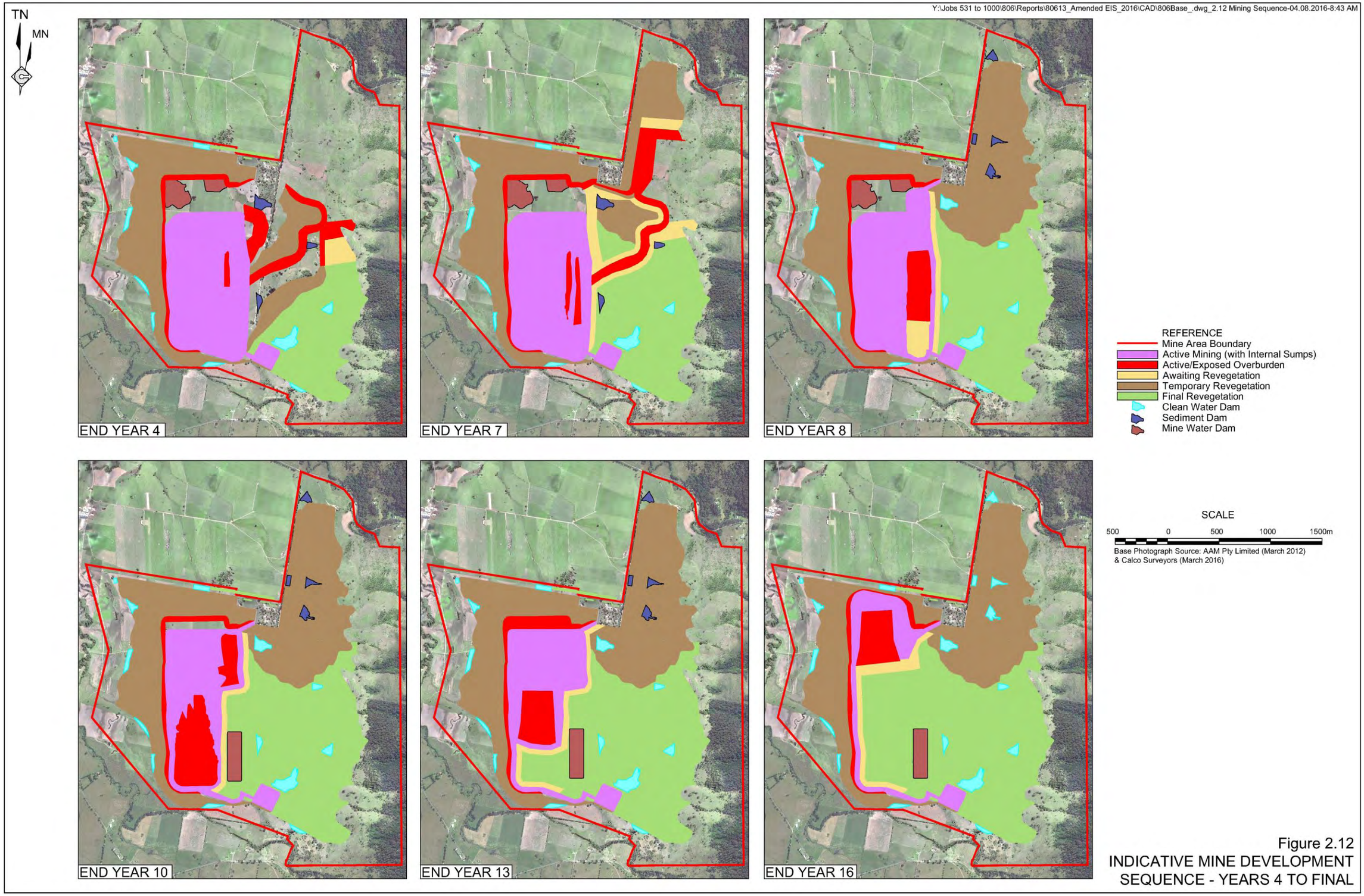

Figure 2.12
INDICATIVE MINE DEVELOPMENT SEQUENCE - YEARS 4 TO FINAL

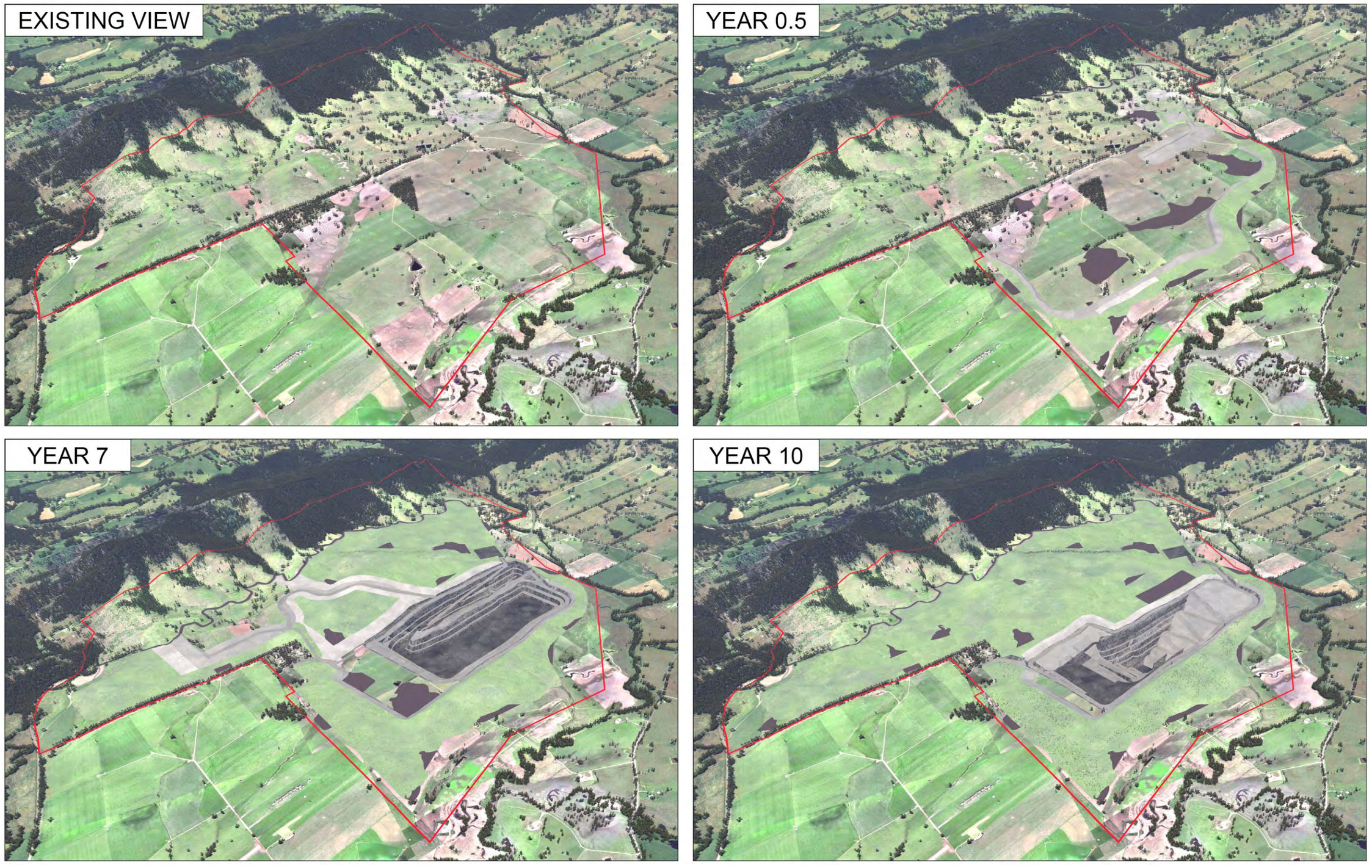

Plate 2.1 Development Sequence Isometric Views

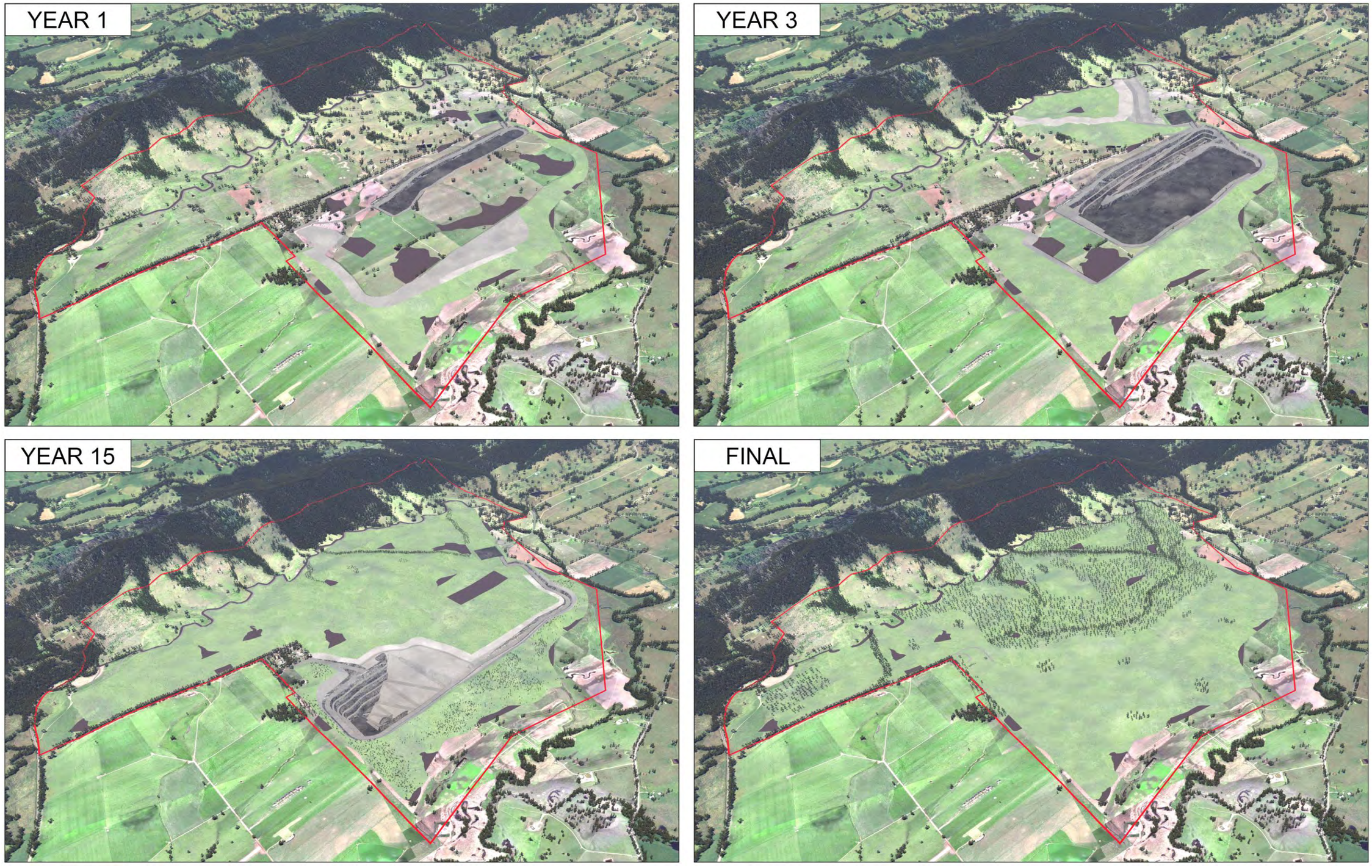

Plate 2.1 Development Sequence Isometric Views

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The mining sequence and rate of mining would continue to be subject to review on the basis of market conditions or unforeseen change to mining conditions. Relevant changes to the mining sequence, mining activities and mine landforms would be approved by the NSW Department of Industry (Division of Resources and Energy) via revision of the Mining Operations Plan, as required.

Table 2.5
Indicative Annual Overburden and ROM Coal Production

Year	Total Overburden		Total ROM Coal (Mt)[1]
	Mine Production (Mbcm)[1]	Final Void Backfill[2] (Mlcm)[1]	
1	4.7	-	0.2
2	4.7	-	0.5
3	4.7	-	0.5
4	6.4	-	1.1
5	9.8	-	1.4
6	9.8	-	1.4
7	9.8	-	1.4
8	9.8	-	1.6
9	9.8	-	1.6
10	9.8[3]	-	1.7[4]
11	8.8[3]	-	1.8[4]
12	8.8[3]	-	1.8[4]
13	8.8[3]	-	1.8[4]
14	8.8[3]	-	1.8[4]
15	5.7	-	1.0
16	5.7	-	1.4
17	0.0	9	0.0
18	0.0	9	0.0
19	0.0	5	0.0
Totals	**125.9**	**23**	**21.0**

Note 1: Mbcm = million bank cubic metres; Mlcm = million loose cubic metres; Mt = million tonnes.
Note 2: Overburden backfill to final void.
Note 3: Overburden production would be reduced marginally during this year if the 2.0M of ROM coal production is achieved.
Note 4: Coal production may be increased to 2.0Mt in this year.

2.7.5 Mobile Equipment

Table 2.6 presents an indicative list of the principal proposed mobile equipment the Applicant intends to use for its mining and coal sizing operations. The type and size of equipment has been selected to be sufficient for the material movement requirements in any year and sufficiently flexible to enable the mining of steeply dipping coal seams in constrained areas. The nominated equipment manufacturer is also indicative although the equipment models nominated are those used for the noise assessment (see Section 4.2.6.3). The Applicant recognises that the combined noise level of the entire fleet on site is the important factor in achieving compliance with noise criteria. Consequently, adjustments to the number of items or equipment models may be implemented from time to time to reflect production requirements or improvements in equipment noise attenuation, provided the combined noise level of the fleet still satisfies the relevant noise criteria at individual residences or receivers as presented in Section 4.2.

Table 2.6
Indicative Mobile Equipment List

		Year 1	Years 2-3	Year 4		Years 5-10		Years 11-14		Years 15-16		Years 17-18		Year 19	
Overburden Moved (Annual)[1]		4.7	4.7	6.4		9.8		8.8		5.7		9.0		5.1	
Coal Extracted (Annual Mt)		0.2	0.5	1.1		1.6		1.7		1.1		0.0		0.0	
Type	**Model**[2]	**D**	**D**	**D**	**E**	**D**	**E**	**D**	**E**	**D**	**E**	**D**	**E**	**D**	**E**
Drill	Terex (SKF12)	2	2	2	0	2	2	2	2	2	2	0	0	0	0
Excavator	70t (PC850)	0-1	1	1	0	1	0	1	0	1	0	0	0	0	0
	120t (PC1250)	0-1	2	2	1	2	2	2	2	2	2	0	0	0	0
	200t (994-200)	1	1	1	1	1	1	1	1	1	1	1	1	0	0
	350t (EX3600)	1	1	1	1	2	2	2	2	1	1	2	2	2	2
Haul truck	Cat (789XQ)	3	5	5	5	9	9	9	9	6	6	8	8	7	7
	Haulmax (3900 EQ)	5	6	6	6	9	6	9	9	9	9	3	3	0	0
Scraper	657G	2	2	2	0	2	0	2	0	2	0	2	0	3	0
Grader	16H	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Front-end Loader	Cat 992	0-1	1	1	0	1	0	1	0	1	0	0	0	0	0
Bulldozer	D10XQ	1	1	1	1	1	1	1	1	1	1	0	0	0	0
	D11XQ	2	2	2	2	3	3	3	3	3	3	4	4	3	3
	Rubber Tyred Dozer 690RTD	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Water Cart	Road Truck	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Cat 777XQ	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Fuel Truck		1	1	1	1	1	1	1	1	1	1	1	1	1	1

D = Day E = Evening
Note 1: Overburden moved in Years 1 to 16 are Mbcm and in Years 17 to 19 would be Mlcm.
Note 2: Equipment models subject to change.

The use of mobile earthmoving equipment nominated in **Table 2.6** during the evening period (6:00pm to 10:00pm) would be concentrated within the open cut pits and then at elevations typically lower than approximately 40m below the natural ground surface when winds are predominantly from the southern quadrant.

2.8 PROCESSING OPERATIONS, STOCKPILES AND PRODUCTS

2.8.1 Introduction

ROM coal from the Rocky Hill Mine Area would undergo preliminary processing, i.e. sizing, prior to being transported to the Stratford Mining Complex for preparation (washing). This section describes the storage area for the ROM coal, i.e. the ROM pad, and the layout and operation of the breaker station and the sized coal storage and stockpiles.

2.8.2 ROM Pad

The ROM pad would be located to the southeast of the Avon Pit, the initial and easternmost pit to be developed, and would be constructed over an area of approximately 3ha to an elevation of approximately 114m AHD using cut and fill methods. With the exception of the entry road

from the open cut pits, the ROM pad would be encircled by a minimum 10m high barrier wall formed during the initial period of mining within the Avon Pit. With the progressive development of the permanent overburden emplacement, the effective height of this barrier to the west, north and east would increase. **Figure 2.13** displays the conceptual layout of the ROM pad including the indicative location for a sump for management of rainfall runoff within the ROM pad area.

The ROM pad would have a nominal storage capacity of approximately 80 000t coal, i.e. two weeks production at the maximum ROM coal production rate of 2Mtpa for which approval is sought. The ROM coal would be stockpiled to a maximum height of 7m.

The sump would be compacted to provide a relatively impermeable surface consistent with construction of sediment dams within the Mine Area. Water within the sump would be periodically removed/pumped out and used for dust suppression at various locations dependent on the stage of mine development and would not be discharged from the Mine Area.

2.8.3 Breaker Station

The breaker station, identified conceptually on **Figure 2.13**, would comprise four principal elements within the southeastern corner of the ROM pad, namely:

- a feeder and hopper;
- a grizzly;
- rotary breaker; and
- associated conveyors.

The principal function of the breaker station would be to reduce the size of the extracted coal into lumps less than approximately 120mm, and in doing so, remove the majority of the hard rock contamination. This material, referred to as ‘breaker reject’, would originate principally from the floor or roof of the coal seams and the thin stone bands interbedded between the plies within the coal seams that could not be selectively removed during mining.

Figure 2.14 displays the indicative flowsheet for the process within the breaker station area.

ROM coal delivered from the active open cut pit(s) would be unloaded onto the ROM pad from where it would be loaded by front-end loader into an above-ground feeder. From the feeder, the coal would be conveyed to a hopper and then over a grizzly. The grizzly, comprising a number of near parallel steel rails, would be designed to enable ROM coal less than a nominated size (approximately 120mm) to by-pass the rotary breaker and fall directly onto the conveyer feeding the sized coal bin. The proportion of coal by-passing the breaker would vary but is expected to average approximately 50% of throughput. Oversized ROM coal, i.e. coal not falling through the grizzly, would be fed into the rotary breaker, a rotating drum or “trommel” with apertures set to approximately 120mm, the optimum maximum size for delivery into the CHPP at the Stratford Mining Complex. The breaker would be positioned approximately 4m above the level of the ROM pad.

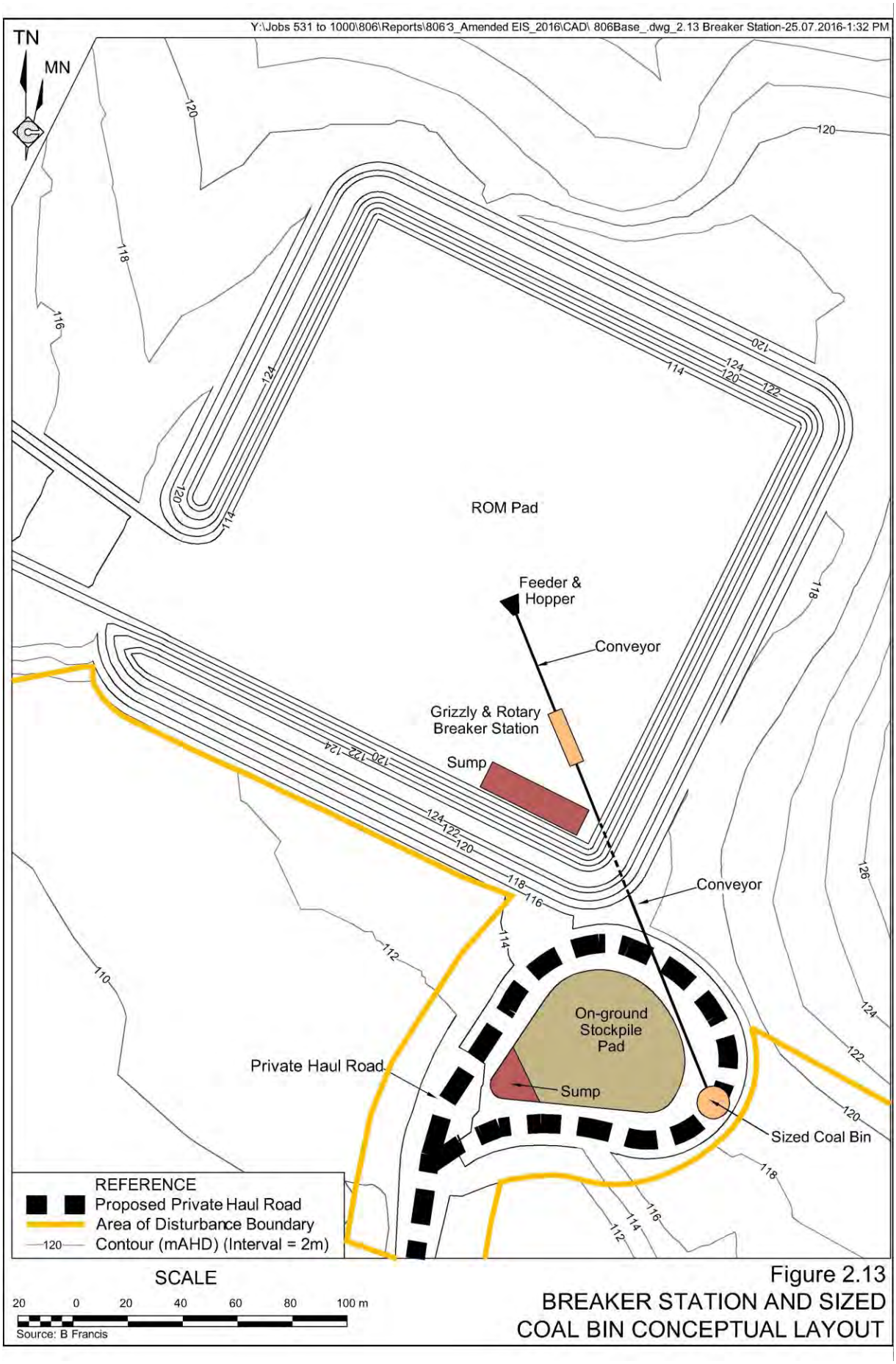


Figure 2.13
BREAKER STATION AND SIZED COAL BIN CONCEPTUAL LAYOUT

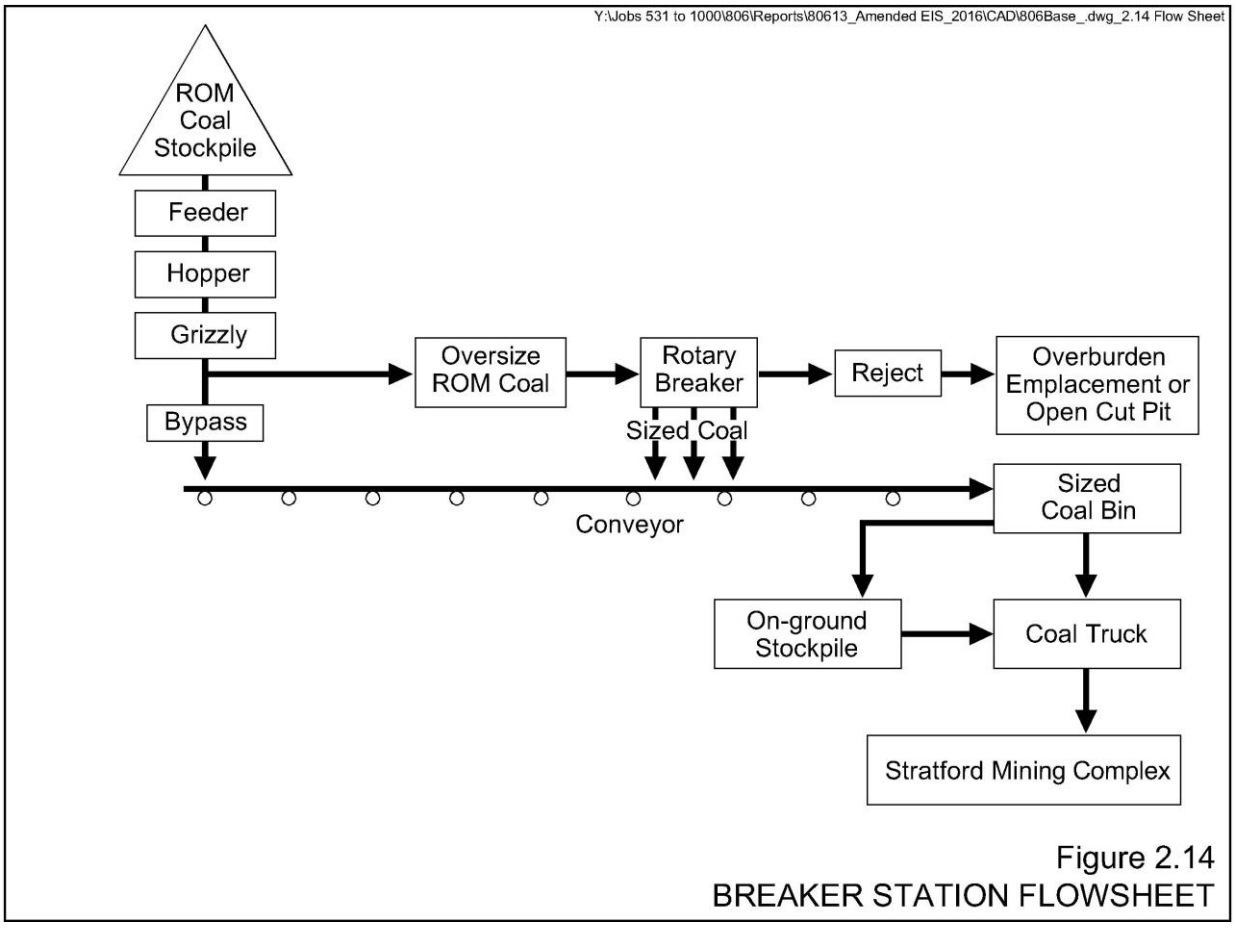


Figure 2.14
BREAKER STATION FLOWSHEET

Within the rotary breaker, the ROM coal would be repeatedly raised by lifters and dropped onto the floor of the drum, with any dust generated contained by the housing surrounding the drum. Coal, being relatively soft, would break along natural cleavage and bedding lines and pass through the apertures in the drum to a collection hopper from which it would pass onto the same conveyor that collects the by-pass coal for delivery to the sized coal bin. Hard rock and any other uncrushable debris within the ROM coal would continue to the discharge end of the drum where it would be removed continuously by a refuse plough and discharged via a shute to a reject stockpile for subsequent collection and disposal within the active overburden emplacement. The amount of reject generated would be a function of the extent of ROM coal dilution during coal extraction and the nature and extent of internal rock banding within the individual seams. However, it is envisaged that an average of approximately 10% of ROM feed would be rejected during this process.

A trestle-supported conveyor, approximately 1.2m wide and approximately 120m long, would deliver sized coal from the grizzly and breaker to the sized coal bin. The conveyor would be covered and have a gradient of up to 15º. The conveyor cover and trestles would be painted in a "wilderness" greyish-green hue similar in appearance to the canopy of the existing vegetation in the locality.

2.8.4 Management of Breaker Rejects

Materials rejected from the breaker would be collected from the reject stockpile and backloaded by ROM coal delivery haul trucks to the active overburden emplacement where they would be mixed randomly with the overburden from the active open cut pit(s). This would enable any potentially acid forming (PAF) materials within the rejects to be blended and buffered by the predominantly non-acid forming (NAF) overburden which exhibits excess neutralising capacity. Breaker reject material would be blended with NAF overburden material within 1 week and placed at least 5m from the final batters or upper surface of the area where they are emplaced. It is noted that breaker rejects would comprise a very small fraction (<0.7% by weight) of the total quantity of overburden and breaker rejects.

Given that some breaker reject materials may be potentially acid forming, regular visual monitoring for pyritic material and geochemical testing of representative samples of breaker reject would be undertaken. Additionally, monitoring of surface runoff reporting to the ROM pad sump and seepage reporting to sediment dams and the sumps within the open cut pits from areas of placed overburden and breaker rejects would be undertaken on a regular basis.

2.8.5 Sized Coal Bin

A nominal 500t capacity sized coal bin would be positioned approximately 120m southeast of the breaker station above the loop at the northern extremity of the private haul road. The base of the nominal 12m diameter bin structure would be located at approximately 114m AHD and rise approximately 23m above the haul road loop, with sufficient clearance beneath it to enable the passage and loading of the coal trucks. The sized coal bin would be also painted in a "wilderness" greyish-green hue to blend with the background vegetation. A 3 000m^2 on-ground stockpile pad area would be established at ground level within the haul road loop adjacent to the sized coal bin to stockpile excess sized coal when the bin is full (see **Figure 2.13**). The sized coal would be directed to this pad from an overflow shute near the delivery point at the top of the sized coal bin. Surface runoff from the stockpile pad area would be collected in a sump and used for dust suppression within the Mine Area.

The sized coal stockpile would only be used in the event that the coal delivery rate to the bin exceeds the truck despatch rate to the Stratford Mining Complex. The pad for the excess coal would have a maximum capacity of 16 000t. Coal temporarily stored within the stockpile would be loaded into the coal trucks using the breaker station front-end loader.

2.9 SIZED COAL HAULAGE TO THE STRATFORD MINING COMPLEX

2.9.1 Introduction

All sized coal from the breaker station would be transported by multi-combination trucks travelling on the private haul road from the sized coal bin to the existing approved Stratford Mining Complex. At the Stratford Mining Complex, the coal would be placed on the extended ROM pad, reclaimed and processed through the CHPP, stockpiled and subsequently loaded onto trains and despatched by rail to the Port of Newcastle. With the exception of the proposed extension of the ROM pad, all of the above components within the Stratford Mining Complex

are already constructed and operational and/or approved under SSD 4966, i.e. there would be no need to obtain approval for an increase in the amount of coal processed at or despatched from the Complex.

Processing, loading and despatch of Rocky Hill product coal using the existing approved Stratford Mining Complex facilities is addressed within the Statement of Environmental Effects for the Modification of Stratford Extension Project (SSD 4496).

2.9.2 Coal Haulage

It is proposed that each coal haulage truck would comprise a road registered Euro 5 standard compliant prime mover, two 10m triaxle trailers and a dolly, with each combination having a nominal carrying capacity of 60t of coal. **Plate 2.2** displays a truck configuration similar to that proposed for use in hauling sized ROM coal to the Stratford Mining Complex.

Plate 2.2 A typical multi-combination truck (Ref: E806P_003)

Coal haulage would be routinely undertaken between the hours of 7:00am and 6:00pm, Monday to Friday, with haulage only undertaken on a Saturday in exceptional circumstances, e.g. haul road flooding during the routine haulage days. There would be no haulage of coal on Sundays or Public Holidays. Coal haulage between the hours of 7:00am and 6:00pm is generally consistent with the approved operational hours for the Bowen Road North Pit and Roseville West Pit Extension under SSD 4966 (for the Stratford Extension Project).

The number of coal trucks involved in the coal transportation activities would vary over the life of the amended Rocky Hill Coal Project depending on the rate of sized ROM coal production.

Table 2.7 presents the projected maximum number of trucks to be involved in the coal haulage activities based on the scheduled annual ROM coal production rate presented in **Table 2.5** assuming a consistent coal delivery rate to the Stratford Mining Complex, a conservative 10% reject production at the breaker, and a conservative allowance of 55 minutes for each 19km round trip. The maximum number of 10 trucks would be adequate for the haulage of up to 1.8Mt of sized ROM coal per year, i.e. the quantity produced should a production level of 2.0Mtpa of ROM coal be attained.

The weight of coal hauled for processing at the Stratford Mining Complex would be verified by a weighbridge located either at the Stratford CHPP or installed at the Rocky Hill haul road loop.

Table 2.7
Proposed Coal Truck Fleet

Year	ROM Coal (Mt)	Sized Coal (Mt)	Maximum No. of Trucks
1	0.2	0.2	2
2	0.5	0.5	4
3	0.5	0.5	4
4	1.1	1.0	7
5	1.4	1.3	9
6	1.4	1.3	9
7	1.4	1.3	9
8	1.6	1.4	9
9	1.6	1.4	9
10	1.7	1.5	10
11	1.8	1.6	10
12	1.8	1.6	10
13	1.8	1.6	10
14	1.8	1.6	10
15	1.0	0.9	7
16	1.4	1.3	8

2.10 SERVICES

2.10.1 Power

Annual electrical power consumption within the Rocky Hill Mine Area would vary with production (and the progression of the mine's development), with the principal power consuming facility being the water treatment plant which would commence operations in Year 4. The power requirements for the breaker station, workshop and offices would be comparatively small.

The Applicant estimates that the annual power consumption would be up to 81MW per year during the first 3 years increasing to approximately 22 000MW per year in Year 4 after the commencement of water treatment plant operations. The total power consumption throughout the operational life of the amended Project would be approximately 290 000MW hours. Discussions with electricity service providers have established that electrical power could be provided to the administration area including the site offices, amenities, workshop, water treatment plant and associated facilities through the existing network or from a new take-off point from the 132kV TransGrid high voltage power line that traverses the eastern side of the Mine Area and an associated Essential Energy-owned substation and a new low voltage (11kV or as nominated by Essential Energy) aerial feed to an on-site transformer/substation and the various usage areas and associated infrastructure (see **Figure 2.15**). Further discussion on the planned power network is provided in Section 4.15.2.2.

Power to the breaker station would initially be supplied via a silenced generator, i.e. until a permanent supply is provided via an upgrade of the existing service along Fairbairns Road or an extension of the line supplying the administration area.

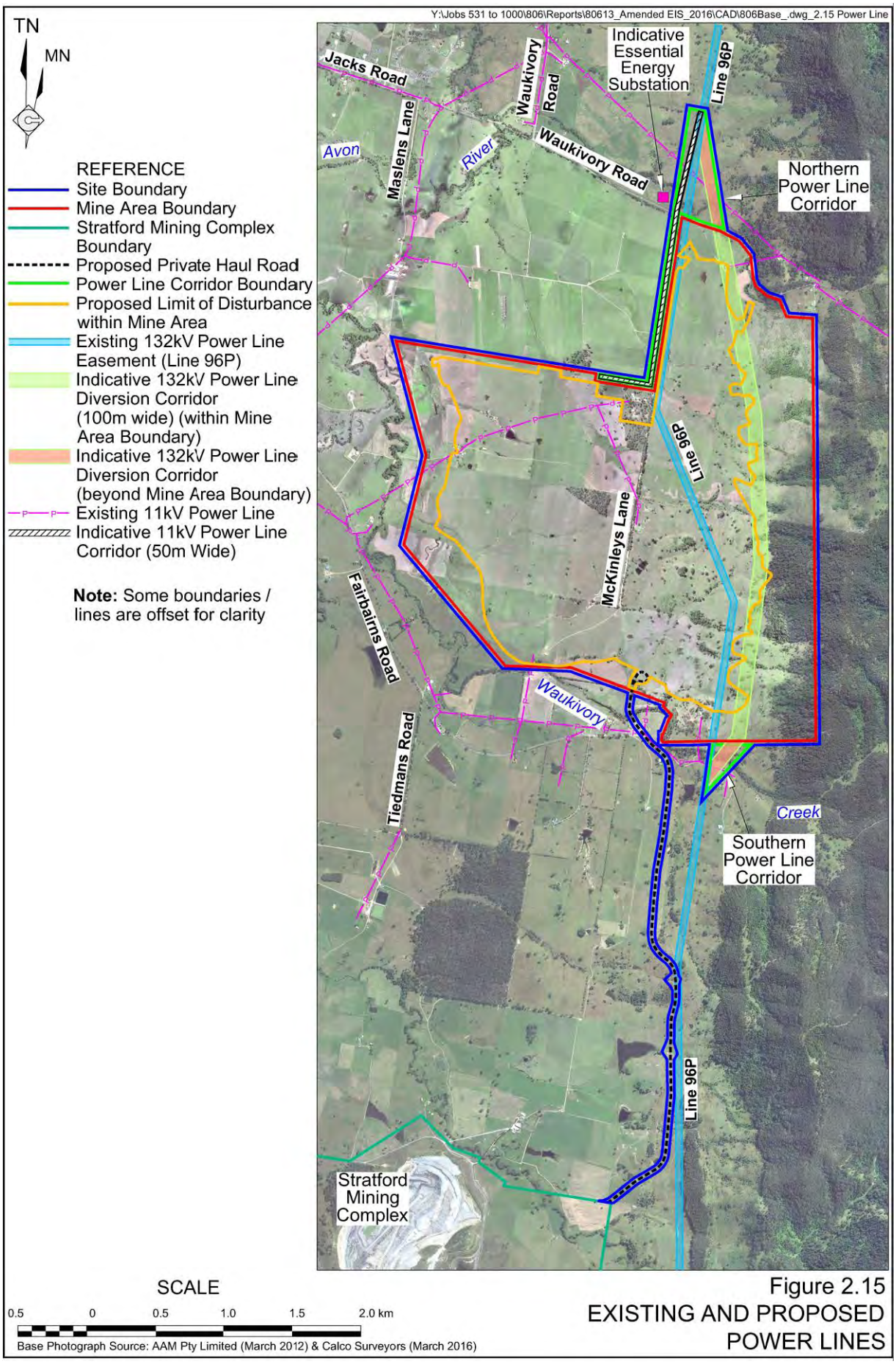


Figure 2.15
EXISTING AND PROPOSED POWER LINES

The existing 132kV power line that traverses the eastern side of the Mine Area (**Figure 2.15**) would be re-located prior to any substantial disturbance within the existing power line easement. Preliminary planning for re-location of the power line has been undertaken with an indicative 100m wide corridor for the re-located 132kV feeder displayed on **Figure 2.15**. TransGrid has previously indicated its satisfaction with the proposed corridor alignment, an alignment that would also satisfy its requirements should it proceed with Option 1 of the long-term 330kV Stroud Road-Lansdowne Project. It is noted, however, that due to a slower than projected growth in maximum demand, TransGrid has advised that the Stroud Road to Lansdowne transmission line is now unlikely to proceed until at least 2040, i.e. beyond the life of the amended Rocky Hill Coal Project.

2.10.2 Water

Water for the mining operation would be obtained from the following sources listed preferentially in order of use (with appropriate licences in place, where required).

1. Groundwater and surface water accumulating within the various open cut pits throughout the life of the amended Project.
2. Surface water drawn from on-site environmental or sediment dams.
3. Water drawn from the on-site water treatment plant (see Section 2.11.5).
4. the Avon River and/or Waukivory Creek within the limitation of the Applicant's existing licences.

Potable quality water would be supplied by a local contractor and stored in tanks within the administration area. Where appropriate, small quantities of water would be captured from the roofs of buildings within the administration area.

Projected water usage on site would vary throughout the life of the amended Project depending on the nature or mix of activities being undertaken, i.e. site establishment/construction or operations, overburden and ROM coal production rates, employment level, and the extent of area disturbed and not rehabilitated and therefore a potential source of dust lift-off and dispersal.

During the on-site establishment and construction stage activities, i.e. within the Mine Area and private haul road corridor, the Applicant would draw upon water from existing dams or new dams within the Mine Area and, if necessary, pump water from the Avon River or Waukivory Creek. Any water pumped from the Avon River or Waukivory Creek would be in accordance with the currently held water access licences (see Table 1.2 in WRM (2016)).

At maximum production, the Applicant estimates the on-site water usage for operational purposes would be as follows.

- Dust suppression (roads, stockpiles, exposed surfaces on overburden emplacements, breaker station, conveyor transfer points, etc.) – a minimum of 425MLpa.
- Administration area 5MLpa (i.e. 0.04ML per person/year).

The water balance prepared for the amended Project has established that the water requirements for dust suppression in all operational areas could be readily satisfied through the use of the saline water/surface water accumulating in the open cut pits. Additional water would also be available to reduce dust lift-off from exposed surfaces on overburden emplacements.

2.10.3 Fuel

The mining equipment fleet would be diesel-fuelled with bulk diesel stored adjacent to the workshop in three self bunded above-ground tanks with a total capacity of approximately 330kL, i.e. sufficient for 1.5 weeks maximum overburden and coal production. The more mobile equipment such as the haul trucks would be refuelled adjacent to the tanks on a self bunded concrete refuelling pad while the less mobile equipment such as the bulldozers, excavators and drills would be refuelled in pit or elsewhere within the Mine Area using a mobile fuel truck. A supplementary bunded above-ground diesel tank of approximately 10kL may also be provided in the vicinity of the sized coal bin for refuelling of the coal transport trucks, i.e. if the existing facility at the Stratford Mining Complex cannot be used.

During the 10 month site establishment and construction stage, fuel usage would be less than 0.5ML. **Table 2.8** presents the projected estimated annual fuel usage for all mining-related activities and sized coal transportation based on the production schedule presented in **Table 2.5** and expected coal haulage fleet presented in **Table 2.7**. Annual diesel fuel usage is projected to increase from approximately 4.3ML during Year 1 of mining operations to between approximately 10ML and 10.7ML in Years 5 to 14.

Table 2.8
Estimated Annual Fuel Usage (ML)

Year	Fuel Usage (ML)	Year	Fuel Usage (ML)	Year	Fuel Usage (ML)
1	4.3	8	10.6	14	10.0
2	4.7	9	10.6	15	5.9
3	4.7	10	10.7	16	6.4
4	7.0	11	10.1	17	7.2
5	10.3	12	10.0	18	7.2
6	10.3	13	10.0	19	4.0
7	10.3				

Fuel would be delivered in semi-trailer tankers at a rate ranging from approximately four tanker loads per week during Year 1 of mining operations to approximately nine tanker loads per week in Years 5 to 14.

2.10.4 Communications

Underground cables would be laid to the administration area for the telephone, internet and data transfer requirements for the amended Project. Mobile phones and 2-way radio would also be used.

2.10.5 Explosives

Explosives would be used within the Mine Area to fracture the overburden that cannot be removed economically by free digging, with NONEL or electronic detonators used for blast initiation. An emulsion blend would be used in wet holes and ANFO used in dry holes. The ammonium nitrate pril, emulsion, diesel and other blasting requirements would be stored within an on-site explosives compound containing an emulsion tank, diesel tank, 1.2t pril bulka bags and one or more shipping containers.

Detonators and boosters, would generally be transported to the Mine Area within 24 hours of each blast and stored until used in two licenced magazines, one designated for the storage of boosters and the other for detonators.

Transportation and storage facilities of explosives components would be undertaken in accordance with the relevant standards and guidelines, including AS 2187.2 – 2006 *Explosives – Storage, Transport and Use, Part 2 Explosives* and, as required, covered by a relevant dangerous goods licence.

During the initial years of the amended Project, the explosives compound would be positioned within the area assigned for interim overburden emplacement and located at a distance at least 750m from the boundary of any public or privately-owned land, i.e. a distance that readily satisfies the minimum proximity requirements identified in SEPP 33 (see **Appendix 5**). Beyond that time, the compound would be re-located to the southern part of the rehabilitated permanent overburden emplacement.

2.10.6 Chemicals/Hazardous Materials

In addition to diesel and explosives, a range of other chemicals or products would be stored on site at the workshop, or at the offices, including:

- batteries;
- coolants;
- grease;
- oils (in 4 000L transtanks);
- gases (including oxygen, acetylene, nitrogen, butane-propane);
- degreasers;
- spray paints; and
- sealants and adhesive compounds.

The Applicant would develop a chemicals management system and utilise the Chemalert system or similar, with Safety Data Sheets (SDS) retained for all chemicals used on the Site.

Transportation, storage and handling of all chemical products would be undertaken in accordance with the relevant codes of practice such as *Transport – Storage and Handling of Dangerous Goods Code of Practice 2005* and *National Work Health and Safety Act 2011*. The relevant procedures within the system would also address the planning required for the management of any emergencies that may arise from the use of any chemicals or hazardous materials on site.

2.11 WASTE MANAGEMENT

2.11.1 Introduction

Wastes that would be generated throughout the life of the amended Project would include the following.

- General domestic type wastes from the administration area.
- Routine maintenance consumables and waste oil.
- Sewage.
- Scrap steel and other wastes remaining from equipment maintenance such as waste tyres.
- Excess saline water.
- Demolition materials from existing buildings and structures.

Further detail on the management of wastes would be included in a Waste Management Plan prepared following receipt of development consent.

2.11.2 Domestic Type Waste

Wastes originating from the administration area, together with selected waste from the workshop, would be treated as general waste. Two collection streams would be provided with recyclables separated and placed in skips for independent collection. The principal recyclables collected would be steel, aluminium, glass, paper and cardboard. Closed garbage bins would be located adjacent to buildings and the contents transferred to skip bins for collection by licensed waste contractors and disposal at the Gloucester Waste Depot, west of Gloucester.

The Applicant estimates approximately 250m^3 of domestic mixed solid waste and 125m^3 of recyclables would be produced annually with an average of one skip truck delivery/collection each week.

2.11.3 Maintenance Waste

Routine maintenance of mobile mining and earthmoving equipment would be undertaken within the on-site workshop or, in the case of any major refurbishment activities which cannot be undertaken on site, at equipment maintenance facilities away from the Site.

Waste oil would be stored in 4 000L self-bunded transtanks from which it would be collected and removed from site for disposal/reuse by an appropriately licensed waste recycler. All other waste hydrocarbons associated with equipment maintenance would be stored in an appropriately designed concrete bunded area, with storage capacity 10% greater than the volume being stored, to await collection. At the maximum proposed production rate, up to two waste oil collections could occur each week.

All routine maintenance consumables would be treated as general mixed solid waste. Separate collection skips would be maintained at the workshop for cardboard and metals.

2.11.4 Sewage

It is proposed to construct and operate a three tank sewage management system adjacent to the site offices capable of managing sewage from up to 120 persons. The tanks would comprise five zones, namely a balance zone, primary zone, extended aeration zone, clarification zone and disinfection/irrigation chamber. All water treated through the system would be irrigated on suitable vegetated areas surrounding the administration area or onto adjacent vegetated areas, including the northern section of the western and northern amenity barrier. All irrigation from the sewage management system would be undertaken in accordance with Environmental Guidelines: Use of Effluent by Irrigation (DEC, 2004).

2.11.5 Saline Water

The site water balance for the amended Project (see Section 4.7.4.6) has identified that from Year 4 onwards, the saline water within the Mine Area in excess of that which can be stored or used on site would need to be treated. WRM (2016) suggest that a treatment plant capable of treating an average of approximately 2.5ML/day would be appropriate. The plant throughput requirement would initially be established during the second and third year of mining operations when monitoring of groundwater inflows confirms the likely sustainable daily inflow rate.

The Applicant proposes to construct the water treatment plant adjacent to the workshop in the administration area. The plant would comprise a series of containerised and/or skid-mounted units with pipework between them and a shed for storage of the produced salt. Overall, the plant would occupy an area of approximately 1 500m^2.

Treatment Plant Process

Figure 2.16 displays the conceptual process flow diagram for the plant. An overview of the treatment steps is as follows.

Pre-treatment – The saline mine water would be pre-treated to remove or reduce suspended solids, biological contaminants, hardness and other constituents that would reduce the efficiency of the reverse osmosis unit.

Ultrafiltration – The pre-treated water would be passed through an ultrafiltration membrane system to remove suspended soils and biological contaminants.

Reverse Osmosis – The filtered water would be passed through a reverse osmosis membrane system which removes dissolved metals, and inorganic dissolved solids such as (hardness) sodium and chlorides to produce a product with an acceptable level of salinity.

Brine Concentration and Salt Crystallisation – The highly saline concentrate from the reverse osmosis plant would be fed into a brine concentrator where further water is evaporated. The concentrated brine would then be fed into a salt crystalliser where a further evaporation step removes additional water and produces crystalline salt material which is further dewatered (in a centrifuge) to produce a material (approximately 90% solids) suitable for handling and disposal.

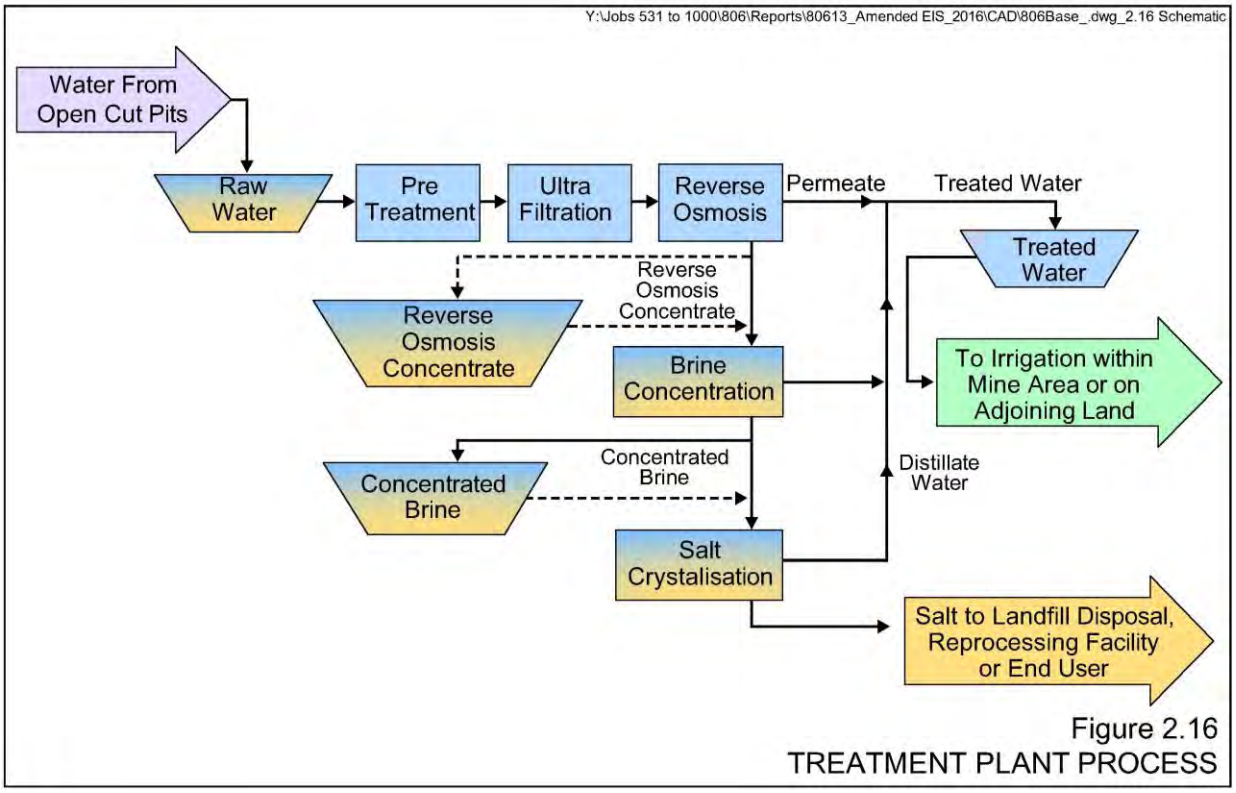


Figure 2.16
TREATMENT PLANT PROCESS

The Applicant anticipates the raw feed water for the water treatment plant would have a total dissolved solids concentration of approximately 3 000 to 4 000mg/L (electrical conductivity of 2 000 to 2 700µS/cm) and that the treated water would have an electrical conductivity of less than 400µS/cm.

Treated Water and Salt Disposal

Approximately 2.5ML of treated water produced daily would be pumped to existing storage dams within the Mine Area for on-site irrigation or to the existing holding dam or other dams on the adjoining Speldon Dairy (i.e. on land owned by the Applicant) from where it would be pumped to the travelling irrigators or other irrigation systems across the dairy or the Applicant's adjacent landholdings. The 905ML of treated water that would be produced for example in Year 4 would be sufficient water to irrigate between 226ha and 181ha of land at a conservative annual rate of 4ML/ha to 5ML/ha respectively. This area of land represents less than 15% of the land owned by the Applicant within and adjacent to the Mine Area. Hence, there would be no difficulties for this proposed quantity of treated water to be irrigated on land within or in the vicinity of the Mine Area.

When treating 2.5ML of saline water per day, the water treatment plant would produce up to approximately 10.8t of solidified salt material daily. However, the plant would not need to be operated at the maximum rate on all days. Overall, an average of 6.9t of solidified salt material would be produced daily from the water treatment plant. The Applicant would consider a range of options for the disposal of salt including transportation off site to a waste facility authorised to accept the material, a reprocessing facility to recover the useful salt species or directly to an end user.

2.12 ROAD TRAFFIC AND TRANSPORTATION

2.12.1 Site Establishment and Construction

Table 2.9 lists the total number of light and heavy vehicle movements that would be likely to be generated during the site establishment and construction stage, together with an estimate of average daily heavy and light movements by route and month. With the exception of the delivery of the mining equipment in the latter months of the site establishment and construction stage, the traffic routes would be determined by the location, timing and nature of the activity on the Site, the status of associated construction activities within the Stratford Mining Complex and the source of equipment or raw materials.

With the exception of larger mining and construction equipment deliveries, heavy vehicles used during the site establishment and construction stage would vary from table top and small tip trucks to trucks and dogs, semi-trailers, and the occasional low loader, depending on the nature of the activity being undertaken and the equipment/materials being delivered.

Table 2.9
Estimated Average Traffic Movements* during the Site Establishment and Construction Stage

	Light Vehicles		Heavy Vehicles	
Route	**Average No. per day**	**Construction Months**	**Average No. per day**	**Construction Months**
The Bucketts Way / Wenham Cox Road	24	2-9	3-15	2-9
The Bucketts Way / Fairbairns Road	20	1-6	2-7	1-6
The Bucketts Way / Jacks Road / Waukivory Road	0-108	2-10	0-14	2-10
The Bucketts Way / Waukivory Road	52-94	4-9	7-19	2-9
The Bucketts Way / Stratford Mining Complex / Private Haul Road	0	0	0-2	2 and 8-10#
* 1 return trip generates 2 movements			# Based on 90 movements over 4 months	
Source: Summary from Constructive Solutions (2016) – Appendix D				

Depending on the status of private haul road construction within the Stratford Mining Complex at the commencement of haul road construction activities within the Site, delivery of the principal items of earthwork equipment required for the construction of the private haul road would be by float either via Wenham Cox Road or the Stratford Mining Complex. Delivery of equipment for the construction of the Fairbairns Road underpass and the Waukivory Creek crossing would be by float or low loader via Fairbairns Road. The similar equipment required for the construction of the Mine Area access road, which would be undertaken prior to the completion of the Jacks Road bridge construction, would be delivered by either the following routes, depending on their point of origin.

- The Bucketts Way, Gloucester Heavy Vehicle by-pass and Waukivory Road (for equipment originating from the south).
- The Bucketts Way and Waukivory Road (for equipment originating from the north and east).

Delivery of the mining equipment required for Year 1 operations would result in a total of approximately 90 movements by a mixture of platform low loaders, floats, semi-trailers and drop-deck semi-trailers, all of which would enter the Mine Area from The Bucketts Way via the Stratford Mining Complex and the private haul road. The requisite permits and escorts would be provided for each movement on the public road network.

Section 4.9.4.2 reviews the potential changes in traffic levels across the local road network as a result of the proposed traffic movements during the site establishment and construction stage.

2.12.2 Operations

Table 2.10 lists the anticipated range in daily light and heavy vehicle movements travelling on the local road network throughout the operational life of the amended Project, with the range being a function of production and hence employee numbers and suppliers' delivery requirements.

Table 2.10
Estimated Traffic Movements[1] Throughout the Life of the Operations

	Light Vehicles (No. per Day) [2]	Heavy Vehicles (No. per Day)
Mine Area (off Waukivory Road)	156-278	10-18
[1] 1 return trip generates 2 movements. [2] Conservatively assuming one employee/person travelling per vehicle)		

Notwithstanding the conservative approach to nominating light vehicle movements, the Applicant would encourage car pooling where possible.

In addition to the heavy vehicle movements identified in **Table 2.10**, there would also be infrequent equipment deliveries by platform loader, float, semi-trailer or drop-deck semi via the Stratford Mining Complex in Years 1 to 5 of mining operations as the mining equipment fleet numbers are increased.

It is expected that the bulk of the light vehicle movements would involve travel to and from Gloucester township with 70% arriving and departing via Jacks Road and 30% arriving and departing via Waukivory Road.

Operations within the Mine Area would be undertaken adopting a range of shifts throughout the week with the workforce operating equipment under the following shift arrangements.

- For day-time period only: 7:00am – 5:30pm
- For the day-time and evening periods: 6:30am – 2:15pm and 2:15pm – 10:00pm.

The light vehicle traffic would be concentrated around shift start and finish times. Essentially, light vehicles would enter and depart the Mine Area during the five half-hour periods prior to and following shift start and finish times. The indicative number of light vehicles arriving at or departing from the Mine Area during each period are outlined in **Table 2.11**.

Additional non employee-related light vehicle movements entering and leaving the Mine Area could be expected to occur at any time between the hours of 7:00am and 5:30pm.

The coal haulage personnel (truck drivers, supervisor and fitter(s)) would each work from approximately 7:00am to 6:00pm.

Table 2.11
Estimated Range in Traffic Movements[1] associated with Operational Shift Times

Arriving				Departing			
Start	**Finish**	**Low**	**High**	**Start**	**Finish**	**Low**	**High**
Mine Area – Year 1 to 3[2]							
6:30am	7:00am	37	40	5:30pm	6:00pm	37	40
Mine Area – Year 4 Onwards[2]							
6:00am	6:30am	22	42	2:15pm	2:45pm	22	42
6:30am	7:00am	15	20	5:30pm	6:00pm	15	20
1:45pm	2:15pm	22	41	10:15pm	10:45pm	22	41
Coal Haulage[3]							
6:30am	7:00am	5	13	6:00pm	6:30pm	5	13

[1] 1 return trip generates 2 movements.
[2] Shift times would vary following the commencement of evening operations within Year 4.
[3] Coal haulage related personnel may enter either via the Stratford Mining Complex entry or the Rocky Hill Mine Area entry depending on the location where the coal trucks have been parked the previous afternoon. The numbers presented in this table conservatively assume all such personnel enter the Mine Area via the Mine Area access road.

Source: Constructive Solutions (2016) - Modified after Table 6.

A detailed breakdown of the number of light vehicles entering and leaving the Mine Area throughout the life of the amended Project is presented in the Transport Assessment in Volume 4 Part 9 of the *Specialist Consultant Studies Compendium*.

2.13 HOURS OF OPERATION AND LIFE OF THE AMENDED PROJECT

2.13.1 Hours of Operation

Table 2.12 lists the proposed operational hours for the range of activities proposed within the Site.

Table 2.12
Operational Hours

Activity	Days*	Hours	Comments
Mining (Year 1 to 3)	Monday – Saturday	7:00am – 6:00pm	During the first three years of operations, mining would be restricted to daytime only (i.e. from 7:00am to 6:00pm).
Mining (Year 4 onwards)	Monday – Saturday	7:00am – 10:00pm	Evening operations (i.e. from 6:00pm to 10:00pm) would commence from Year 4. There would be no mining during the night time period (i.e. from 10:00pm to 7:00am on any day.
Breaker Station Operations	Monday – Saturday**	7:00am – 6:00pm	Hours and days worked to match production.
Coal Despatch (via Private Haul Road)	Monday – Saturday**	7:00am – 6:00pm	Hours and days worked to match production.
Maintenance	Monday – Saturday Sunday Monday – Sunday	7:00am – 10:00pm 8:00am – 10:00pm All other hours	If activities are not audible at privately-owned residences/receivers.

* Public Holidays excluded
**Operations would only occur on a Saturday in the event protracted operational time is lost during week days.

Operations within the Mine Area

Once mining operations commence, mining and related activities would initially be undertaken between 7:00am and 6:00pm Monday to Saturday, public holidays excluded. It is proposed to limit mining and related activities to daytime periods for the first three years of operations until such time as the open cut pits are developed to a suitable depth below either the natural ground surface and/or behind constructed barriers to allow them to occur of an evening in compliance with the noise criteria. This would limit potential noise-related impacts during this initial period. It is the Applicant's intention to concentrate mining, breaker station and coal haulage activities from Monday to Friday within the nominated hours and confine operations on Saturdays to those required to catch up for lost production due to wet weather or major equipment breakdowns.

It is proposed that the preparatory activities including pre-start checks and administration activities (limited personnel) would be undertaken between 6:30am to 7:30am depending on equipment shifts. Mining equipment would not be started prior to 7:00am.

It is proposed that equipment maintenance is undertaken, when required, 24 hours per day, 7 days per week provided maintenance activities "during the night-time period" are not audible at any privately-owned residence or receiver.

2.13.2 Life of the Amended Project

With the recoverable coal resource of approximately 21Mt, the projected ramp-up in production to approximately 1.8Mtpa, with the possibility for occasional annual production approaching 2Mtpa, and continuing favourable economic conditions, coal production would continue for a period of approximately 16 years from the completion of the site establishment and construction stage. A further 3 years would be required at the completion of coal production to undertake rehabilitation activities including backfilling the Main Pit and establishment/revegetation of those components of the final landform in the Mine Area that could not be progressively rehabilitated during mining operations. However, as noted in Section 2.1.4, a 21 year development consent is being sought to accommodate any circumstance(s) that may slow down the mining of coal and to allow for both the site establishment and construction stage as well as the proposed mining activities. In the event that scheduled production rates are required to be revised, rehabilitation activities would be expected to continue after this time in accordance with an approved Mining Operations Plan. This is consistent with other operations of this nature and would ensure rehabilitation is undertaken progressively in a timely manner.

2.14 EMPLOYMENT

2.14.1 Site Establishment and Construction

The workforce during the site establishment and construction stage is projected to peak at approximately 60 persons.

The Applicant anticipates that the site establishment and construction workforce would be drawn from both local and regional centres. The Applicant has committed to employing local people preferentially, wherever possible.

It is expected that contractors from outside the local district would reside in hotels, motels, caravan parks or rental accommodation in the local area for the duration of their activities. There is no intention to establish camp accommodation for the construction workforce.

2.14.2 Operations

The number of on-site operational and management personnel would vary depending on the numbers of items of equipment, production volumes and shift arrangements, increasing from approximately 45 persons in Year 1 to approximately 90 persons in Year 4 and approximately 110 persons from Years 5 to 14. Employment levels would commence to decrease from Year 15.

The operational workforce would be preferentially sourced from the local district. The Applicant has already received considerable interest from persons in Gloucester, the Gloucester area and the local region for employment should the amended Project be approved. Many of those expressing interest in employment have formerly lived in Gloucester but moved away to gain work in the mining or other industries. However, it is likely that some contractors/employees would be based or reside in the Hunter Region and either commute to and from the Mine Area daily or reside in caravan parks or rental accommodation in the local area. It is envisaged that the majority of operational employees sourced from outside the Gloucester area would ultimately move to the local area permanently. The Applicant has committed to employing local people[2] preferentially, wherever practicable, and has set a target for local employment of 50% by the end of the second year and 75% by the end of the third year of operations. The Applicant does not intend to purchase any residences for its workforce although it is noted that the Applicant owns a number of residences that are located on the properties purchased within and in the vicinity of the Site, some of which may be available for employee housing.

2.14.3 Final Rehabilitation Activities

The Applicant expects to employ between approximately 60 and 75 persons during the 3 year period following the cessation of coal extraction and sized coal despatch to complete the final rehabilitation of the Mine Area and decommission the on-site infrastructure.

2.15 SAFETY/SECURITY MANAGEMENT

The Applicant would prepare a Health and Safety Management System (H&SMS) for the amended Project incorporating a Health, Safety & Environmental (HS&E) Plan. The system would include identification of roles and responsibilities, procedures for investigation of near misses and safety incidents, and requirements for a regular and trigger-related review and audit of the system.

[2] Local employment means people already residing in the Gloucester area or relocate to the area and become residents.

The HS&E Plan would incorporate the following components to maintain a level of safety and security appropriate for the proposed activities.

i) Establishment and maintenance of fencing around the perimeter of the Mine Area and private haul road and other fencing as required to isolate grazing stock and unauthorised individuals from site activities.

ii) Use of locked gates to exclude access when site personnel are not working in component areas.

iii) Installation and maintenance of safety signage around the Mine Area and perimeter fencing, where necessary.

iv) Security when there are no authorised personnel on site.

v) A requirement that all visitors entering and departing the Mine Area report to the administration area or other nominated locations for registration including time of arrival and departure, and an induction, if required.

vi) Appropriate controls to ensure that the stability of the highwalls within the open cut pits and other landforms is maintained.

2.16 REHABILITATION, MINE CLOSURE AND LAND USES

2.16.1 Introduction

Rehabilitation of all areas to be disturbed would be an integral part of the amended Project. Emphasis would be placed upon progressively creating the final landform and re-establishing soil profiles and vegetation essential to achieving the preferred land use(s) during the mining operations and following site closure.

Rehabilitation activities within the Mine Area would be planned and undertaken in accordance with a Mining Operations Plan (MOP) to be submitted to the DRE and approved following the issue of development consent and grant of the mining leases, and prior to the commencement of activities within the Mine Area. The MOP would also address any rehabilitation-related requirements nominated in the development consent for the amended Project.

In addition to the rehabilitation commitments in the EIS, rehabilitation would be planned and undertaken with reference to the following documentation.

- Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth Government, 2006).
- Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth Government, 2006).
- Strategic Framework for Mine Closure (ANZMEC, 2000).
- Towards Closure – Mine Rehabilitation in the Australian Minerals Industry (MCA, 2015).

This subsection focusses upon the rehabilitation activities within the Mine Area but also includes relevant rehabilitation activities undertaken during the construction of the private haul road and Mine Area access road.

2.16.2 Rehabilitation Objectives

In the short to medium term, the Applicant's objectives would be to stabilise all earthworks, amenity barriers, watercourses, and disturbed areas no longer required for Project-related activities in order to minimise visual impacts, dust generation and erosion/sedimentation over the period prior to the establishment of the final landform and its revegetation, and during the period until the land is again used for agricultural purposes or for nature conservation.

The Applicant's longer term rehabilitation objectives are that:

- the rehabilitated landform is safe, stable and sustainable, and suitable for long-term agricultural pursuits in the nominated areas;
- components of the final landform are re-instated with native vegetation to specifically provide fauna habitat and corridors;
- the rehabilitated landform requires low levels of maintenance;
- rehabilitation is undertaken in an economically sustainable manner;
- the mining lease(s) over the rehabilitated landform can be relinquished and the security returned within a reasonable timeframe after the completion of all mining and rehabilitation activities.

Within the MOP, the Applicant would detail rehabilitation objectives for each of the rehabilitation domains on site (see Section 2.16.4).

2.16.3 Mine Closure Completion Criteria

The individual rehabilitated areas would be monitored against the following broad completion criteria throughout the life of the amended Project, i.e. both during and following the period of mining operations, with the performance against each considered by the DRE when assessing any subsequent application for the relinquishment of the mining leases covering the Mine Area.

- The rehabilitated landform is clean and tidy, and free of rubbish, metal and derelict equipment/structures.
- Nominated areas of the rehabilitated landform are progressively returned to agricultural production (principally grazing) as soon as practicable.
- The rehabilitated landform is suitable for the proposed subsequent agricultural land use(s) and is compatible (as far as possible) with the surrounding land fabric and land use requirements.
- The uses of the rehabilitated landform are consistent with the capability of that landform.

- The rehabilitated landform is sustainable in terms of the intended land use(s), i.e. is stable and the maintenance needs are no greater than those of similar surrounding lands unaffected by mining activities.
- The rehabilitated landform integrates areas of re-established native vegetation and undisturbed native vegetation specifically to maintain or improve wildlife corridors.
- The rehabilitated landform provides for fauna habitat in nominated areas.
- The rehabilitated landform does not cause unacceptable air or water pollution, or other adverse environmental effects.

Site specific criteria for each of the rehabilitation domains would be detailed in the Mining Operations Plan and rehabilitation plan.

2.16.4 Rehabilitation Domains

Figure 2.17 illustrates the conceptual rehabilitation domains within the Mine Area. The domains and the general approach to rehabilitation in each domain are as follows.

Domain 1 – Open Cut Pits and Permanent Overburden Emplacement

It is proposed that the landform above the open cut pits and the permanent overburden emplacement would be formed as a single, generally elevated landform reflecting, and consistent with, the form/fabric of the existing landform.

Within the area of the former ROM pad, rehabilitation would involve recovery and reshaping of material from the 10m high perimeter barriers and excavation of limited areas of fill used in the construction of the pad to create the final landform that blends with the southern side of the permanent overburden emplacement.

A series of dams constructed as sediment dams throughout the construction of the final landform would be retained within Domain 1 to serve as long-term stock water dams.

Domain 2 – Interim Overburden Emplacement

It is proposed that the overburden emplaced to the east of the retained section of McKinleys Lane would be removed and placed into the completed Main Pit following the completion of coal extraction. This area would be returned the pre-mining landform in that area.

Domain 3 – Western and Northern Amenity Barrier

The area comprising the footprint of the western and northern amenity barrier would be returned to a landform comparable to the existing landform in that area, i.e. following the removal of the barrier to provide material to backfill the void remaining within the Main Pit at the end of mining.

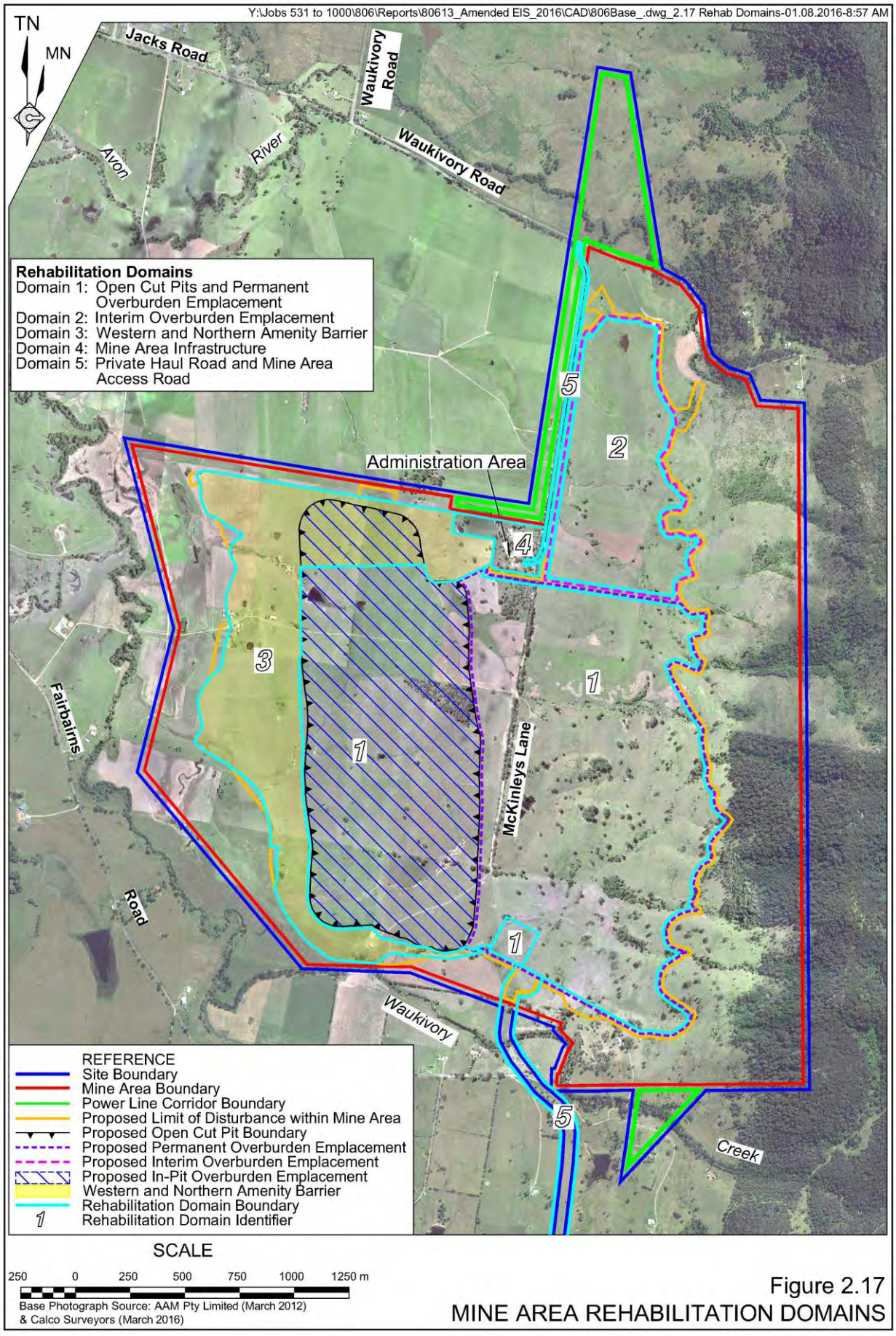


Figure 2.17
MINE AREA REHABILITATION DOMAINS

Domain 4 – Administration Area

The key infrastructure within the Mine Area including transportable offices and amenities, the breaker, conveyors, sized coal bin and water treatment plant would be removed or otherwise decommissioned and the disturbance footprint reshaped and rehabilitated, as required. The workshop would be retained for an ongoing land use, e.g. farm machinery shed or hay shed. The existing structures and associated buildings within the administration area would be retained. Part or all of the 11kV power line installed for the amended Project would be removed after power is no longer required, with the extent of removal of the line based on an assessment at that time as to whether there would be any benefit in its retention, e.g. for an ongoing alternate use for the workshop.

Domain 5 – Private Haul Road and Mine Area Access Road

The private haul road between Waukivory Creek and the Stratford Mining Complex would most likely be retained following the cessation of coal transportation given it would be a road suitable for future access to the properties adjacent to the road, particularly in the event of subdivision, if that is envisaged or permissible at that time. An access road would need to be constructed linking the private haul road and Fairbairns Road. The bridge across Waukivory Creek would be retained as a long-term access to Lot 911 DP 748573. The section of the road between Waukivory Creek and the sized coal bin would be removed in part or in full unless it is required for any subsequent land use.

The Mine Area access road would be retained to provide access to the retained buildings within the administration area and the Applicant's adjacent landholdings.

2.16.5 Final Landform

An important factor in designing the final landform was the adoption of the visual control strategy recommended by Richard Lamb & Associates, a strategy that focussed on constructing a final landform that closely resembles the pre-mining landform in terms of its drainage patterns and microtopography.

Figure 2.18 displays the indicative landform within the Mine Area at the end of coal extraction and **Figure 2.19** displays the indicative final landform within the Mine Area at mine closure, i.e. after the completion of all rehabilitation activities. It is noted that there would be no void remaining in the final landform as the final void remaining at the end of coal extraction within the Main Pit would be backfilled to a level 1m to 5m above the projected maximum recovered groundwater level. The Applicant would routinely monitor settlement within the backfilled sections of the open cut pits during mining operations to quantify the degree of settlement occurring and ensure that sufficient backfill material is emplaced to achieve the long-term positive landform.

Figures 2.20A and **2.20B** respectively present contour plans showing the comparison between the existing landform and the proposed final landform whilst **Figures 2.21A** and **2.21B** present a similar visual landform comparison. The specific details of the final landform would be determined on the basis of operational experience to reflect, for example, actual as opposed to scheduled overburden production volumes and actual as opposed to the assessed bulking effect, but would be consistent with the concepts presented in **Figure 2.19**.

The completed landforms within each of the rehabilitation domains would be as follows.

Domain 1 – Open Cut Pits and Permanent Overburden Emplacement

The indicative final landform within this domain would be comparable in form and drainage patterns to the existing landform, albeit up to approximately 45m higher within parts of the footprint of the permanent overburden emplacement.

Figures 2.20B and **2.21B** show that the final landform would retain the internal topographic ridges and watercourses directing runoff towards adjacent creeks.

Elevations across Domain 1 would vary from 115m AHD near Waukivory Creek to approximately 200m AHD on the eastern uphill side of the domain. Slopes on the final landform would typically vary from <2° to 14°.The changes in elevation arising from the creation of the final landform displayed on **Figure 2.19** would result in marginally shallower slopes on the eastern side of the domain and marginally steeper slopes on the western side of domain adjacent to the backfilled Main Pit than currently exist.

The final landform displayed on **Figure 2.19** reflects the proposed landform at the end of the life of the amended Project. It is likely some settlement would occur, particularly above the Main Pit, that would result in the long-term landform being marginally lower than that shown on **Figure 2.19**. However, the final landform as displayed in **Figure 2.19** has been designed to remain self-draining even after long-term settlement.

A number of the water management structures remaining at the completion of rehabilitation activities would be retained within the final landform (see **Figure 2.19**) although selected dams may be backfilled or reduced in capacity once their role to control sediment-laden water is redundant.

Most of the dams along the northern and southern clean water diversion channels on the eastern side of the Mine Area would be reduced in capacity but maintained to provide short-term detention for runoff and the re-establishment of the natural through drainage. The stabilised entries of the clean water diversion channels to Waukivory and Oaky Creeks constructed for the amended Project would remain. **Figures 2.19**, **2.20B** and **2.21B** display the indicative drainage configuration on the final landform and the proposed dams to be retained.

Domain 2 – Interim Overburden Emplacement

An estimated 13 million lcm of materials within the interim overburden emplacement positioned on the eastern side of the retained section of McKinleys Lane would be recovered on completion of coal extraction and used to partly backfill the Main Pit.

The landform created following the removal of this material would be comparable to the existing landform i.e. with comparable elevations, slopes and watercourses. As with Domain 1, a series of farm dams would be constructed to initially control sediment on the rehabilitated landform and, subsequently, for use by grazing stock.

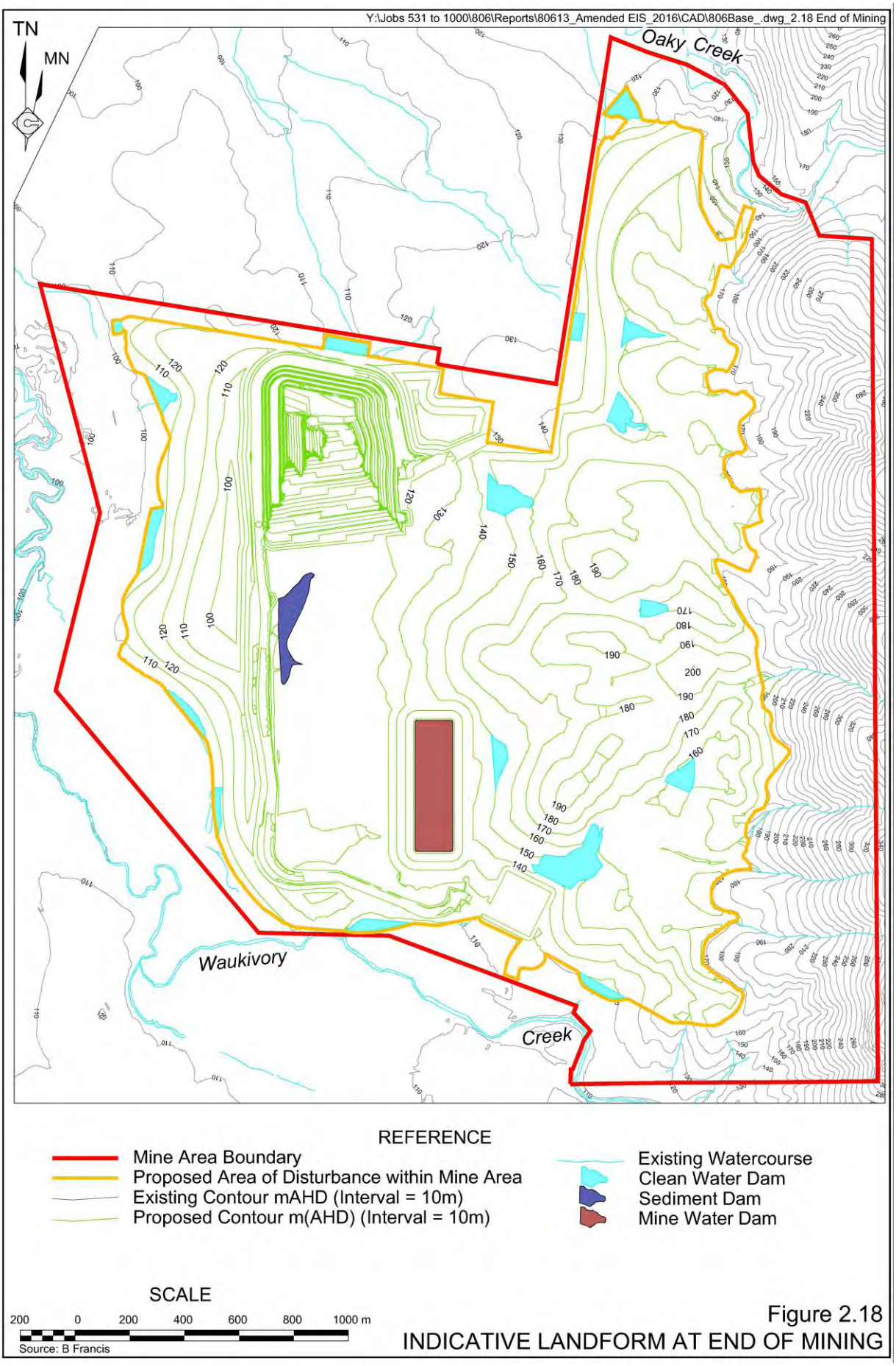


Figure 2.18
INDICATIVE LANDFORM AT END OF MINING

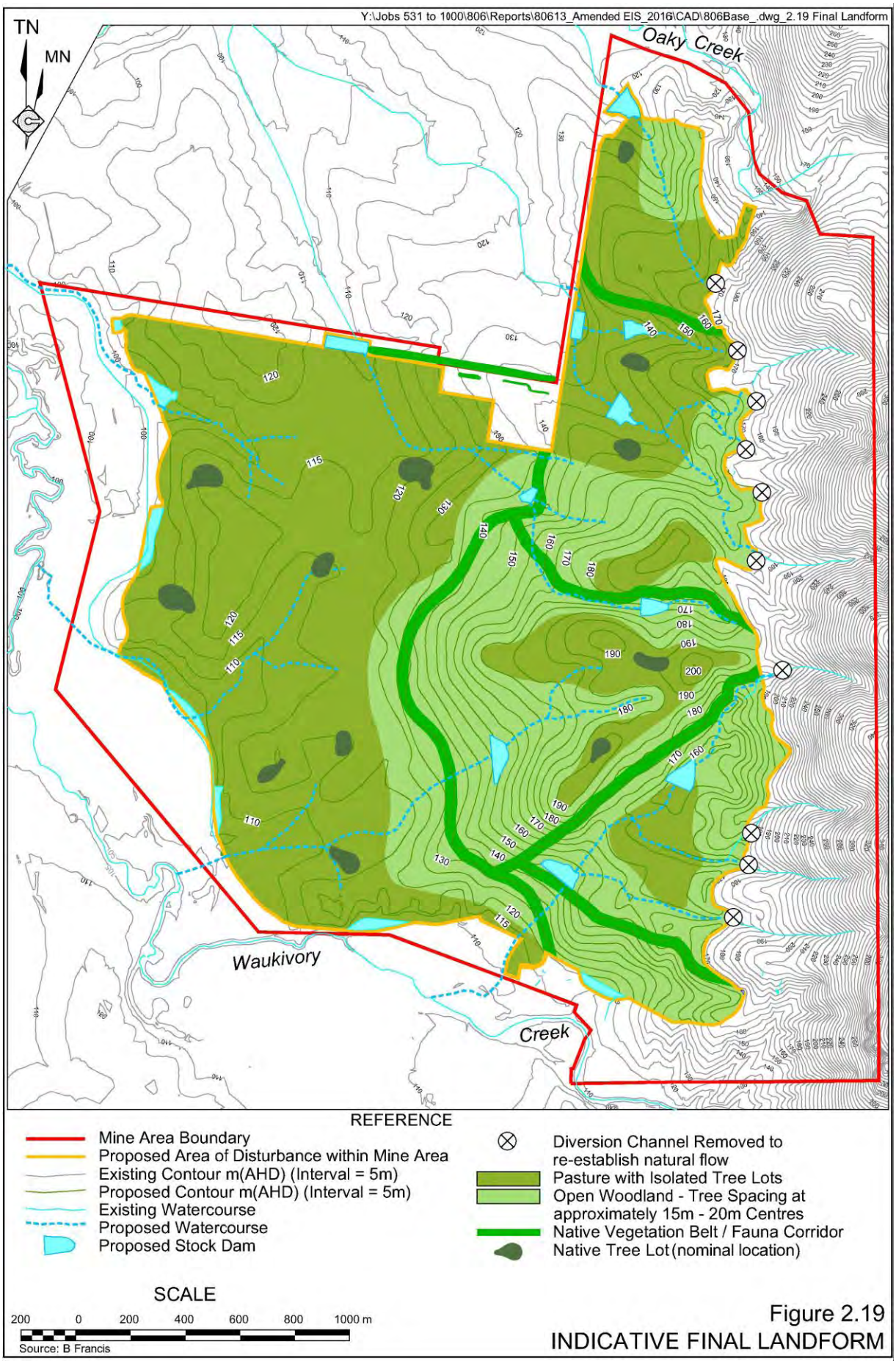


Figure 2.19
INDICATIVE FINAL LANDFORM

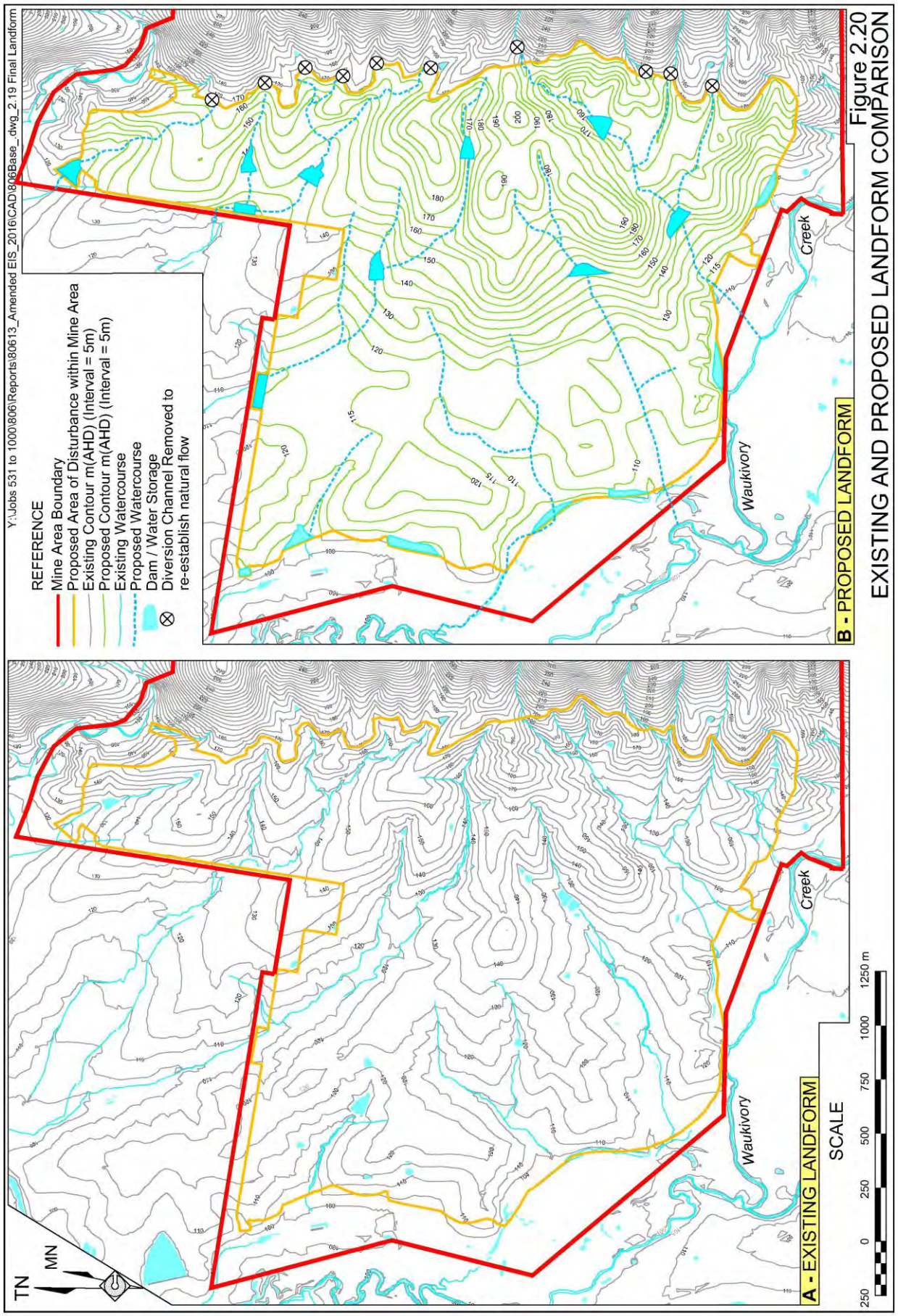
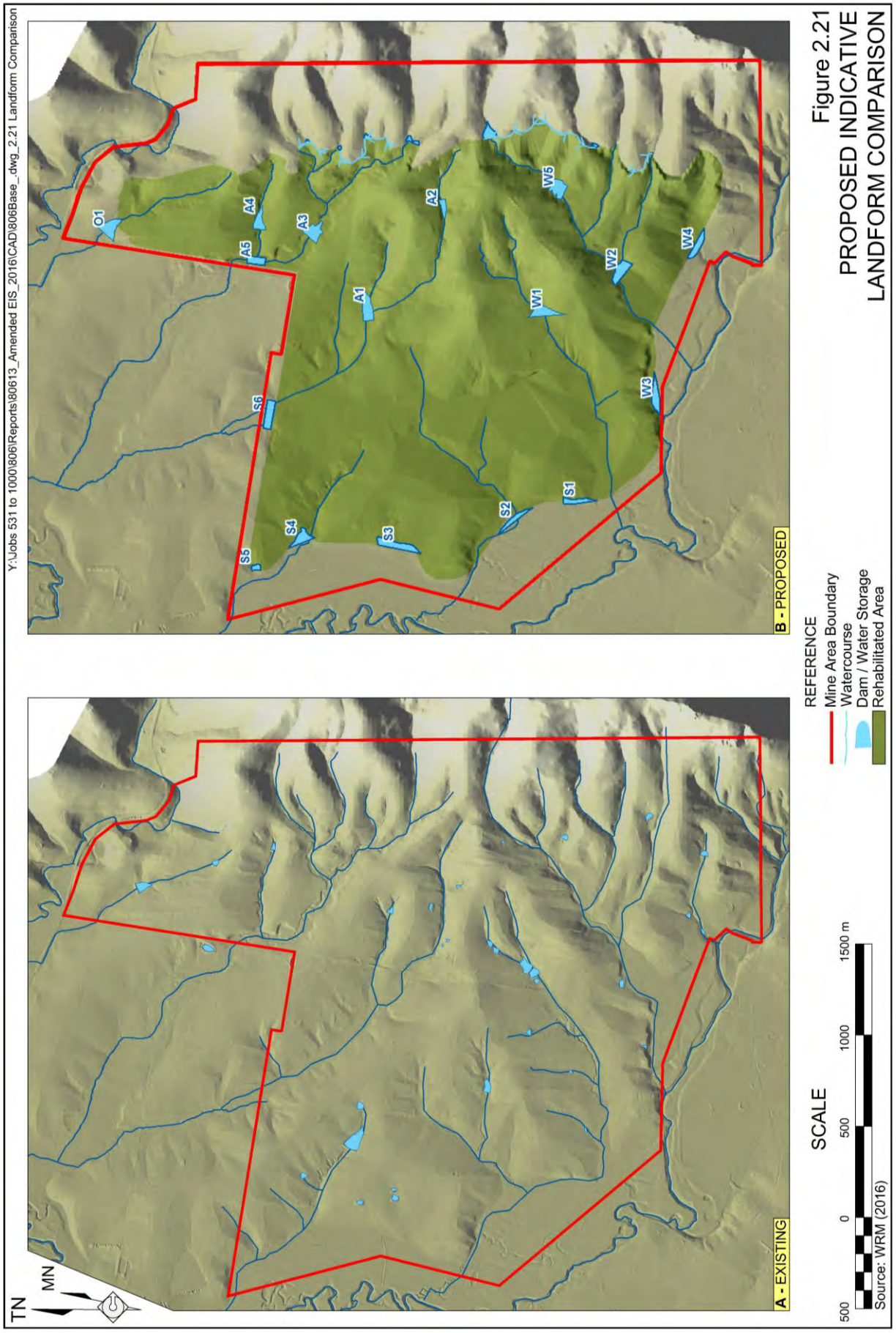


Figure 2.20
EXISTING AND PROPOSED LANDFORM COMPARISON


Y:\Jobs 531 to 1000\806\Reports\80613_Amended EIS_2016\CAD\806Base_.dwg_2.21 Landform Comparison
A - EXISTING
B - PROPOSED
O1
A1
A2
A3
A4
A5
W1
W2
W3
W4
W5
S1
S2
S3
S4
S5
S6
TN
MN
REFERENCE
Mine Area Boundary
Watercourse
Dam / Water Storage
Rehabilitated Area
SCALE
500
0
500
1000
1500 m
Source: WRM (2016)
Figure 2.21
PROPOSED INDICATIVE
LANDFORM COMPARISON

Domain 3 – Western and Northern Amenity Barrier

Following the removal of the materials in Domain 2, all materials within the western and northern amenity barrier would be recovered to backfill the Main Pit to create the final landform in that area. The landform created following the removal of this material would be comparable to the existing landform with gentle slopes towards the Avon River and Waukivory Creek. The dams adjacent to the footprint of the former amenity barrier would be retained to control any sediment-laden runoff during the final rehabilitation phase and to provide a source of stock water following the return of the land to a grazing land use.

Domain 4 – Mine Area Infrastructure

There would be limited modifications to the landform within the administration area throughout the life of the amended Project.

Domain 5 – Private Haul Road and Mine Area Access Road

The final landform along the length of the private haul road would only be modified in those areas where the road would not be retained. Minor works would be undertaken to blend the rehabilitated areas into the surrounding landform and in association with the constructed linkage to Fairbairns Road.

The Mine Area access road would be retained to provide long-term access to the retained buildings within the former administration area and the Applicant's adjacent landholdings. Accordingly, the final landform in the area of the Mine Area access road would be slightly modified from the existing landform, albeit comparable with and married into the landform in the area of the former interim overburden emplacement area.

2.16.6 Rehabilitation Procedures

2.16.6.1 Introduction

A range of rehabilitation procedures would be adopted throughout the life of the amended Project to achieve the objectives set out in Section 2.16.2. These procedures relate to the following.

- Stabilisation and revegetation of interim landforms, e.g. amenity barriers and the interim overburden emplacement. The same procedures would also be used for the roadside batters along the private haul road and Mine Area access road.
- Profiling of the final landform to achieve the pre-determined final landform contours.
- Subsoil and topsoil placement on final landforms to be returned to grazing or nature conservation.
- Establishment of native vegetation for habitat and corridor purposes.
- Decommissioning and removal of all infrastructure not required for ongoing land uses.

2.16.6.2 Stabilisation of Interim Landforms and Roadside Batters

Stabilisation is proposed for those components within the Mine Area that would not form part of the final vegetated landform, i.e. the external faces of western and northern amenity barrier and the interim amenity barriers within the permanent overburden emplacement. In these areas, emphasis would be placed upon the rehabilitation of these structures so as to provide stable vegetated external slopes to limit potential visual impacts. The stabilisation would also serve to control sediment-laden runoff and dust generation from the outer surfaces of those structures.

The rehabilitation procedures for each component would differ marginally, the details of which are outlined as follows.

Western and Northern Amenity Barrier

The outer western slope of the barrier would be progressively shaped, typically to approximately 10° to 14º. The outer northern slope would be constructed with slopes ranging from approximately 10° to 18°. Shaping of the outer slopes of the barriers would typically be completed in lifts of between 5m and 10m and sections approximately 400m to 500m in length generally progressing from south to north (western slopes) and west to east (northern slopes). Each section shaped and prepared for revegetation would cover approximately 2ha.

Once shaping of the overburden material is completed in each section, at least 0.25m of subsoil and at least 0.15m of topsoil would be spread on the outer surface. Subject to its availability, the Applicant would endeavour to place greater thicknesses of subsoil and topsoil on the western and northern slopes to:

- maximise the opportunities for plant growth; and
- provide an effective topsoil and subsoil stockpile for the materials to be incorporated on the final landform above the Main Pit.

Once all subsoil and topsoil is in place, the surface would be harrowed and/or ripped parallel to the contour immediately prior to seeding with a pasture mix and fertilizer. Hay or a grass mulch would be applied to the surface to give a natural colouration, and assist in erosion control and soil moisture retention. Seeds and/or seedlings of selected shrubs and small trees would also be spread and/or planted across selected areas on the outer slopes of the barrier to create a variable appearance consistent with that observed in the local area. The pasture sown would likely be drawn from the species listed in **Table 2.13**.

Table 2.13
Pasture Species for Short-term Stabilisation

Species	Rate (kg/ha)	Fertiliser
Solander Setaria	2	Starter 15 or Grower 11 (or equivalent) - 400kg/ha
Paspalum	2	
Fescue	8	
K.V. Rye	9	
S.S. Haifa Clover	2	
S.S. Osa Red Clover	2	
Note: Legumes would be inoculated with their appropriate rhizobia immediately prior to sowing.		
Source: Wrightson Seeds Australia Pty Ltd.		

The fertiliser that would be used is also listed in **Table 2.13**. Both seed and fertiliser would be applied with conventional farming equipment. The hay or grass mulch would be applied using a hydroseeder or hay mulcher.

The Applicant would also plant a range of trees and shrubs on the outer face of the barrier. **Figure 2.22** displays the irregular pattern of vegetation recommended by Richard Lamb and Associates designed to achieve a natural appearance on the outer face of the barrier.

The key shrubs and small trees to be planted on the western slope of the western and northern amenity barrier would include all/or a selection of the following species.

- Blackthorn (*Bursaria spinosa*)
- Green Wattle (*Acacia irrorata*)
- Mock Olive (*Notelaea longifolia*)
- Falcate Wattle (*Acacia falcata*)
- Coffee Bush (*Breynia oblongifolia*)
- Narrow-leaved Geebung (*Persoonia linearis*)
- Common Hop Bush (*Dodonaea triquetra*)
- Sticky Hop Bush (*Dodonaea viscosa subsp. angustifolia*)
- Blue Flax Lily (*Dianella caerulea*)
- Spreading Flax Lily (*Dianella revoluta*)
- Spotted Gum (*Corymbia maculata*)
- Grey Gum (*Eucalyptus punctata*)
- Grey Box (*Eucalyptus moluccana*)
- Red Ironbark (*Eucalyptus fibrosa*)
- Tallowwood (*Eucalyptus microcorys*)
- White Mahogany (*Eucalyptus acmenoides*)

All trees and shrubs planted across the Mine Area using tubestock would be planted with a water-saving product to encourage the rapid growth as has been achieved to date with the Applicant's various road-side planting programs (see **Plates 2.3** to **2.6**).

The Applicant would consider the installation of an irrigation system on the outer face of the barrier for use during extended dry periods. Water used for irrigation of the barrier would be drawn from existing on-site dams, sediment dams or potentially the water treatment plant output.

Interim Amenity Barriers

The sections of the permanent overburden emplacement that would be constructed as interim amenity barriers to limit visibility (and noise) of the operational activities within the emplacements would be shaped with an outer slope of approximately 14° to 18° and covered with at least 0.3m of subsoil. Greater thicknesses of subsoil may be used to effectively act as a temporary subsoil stockpile on the slopes of the interim amenity barrierswithin the emplacement.

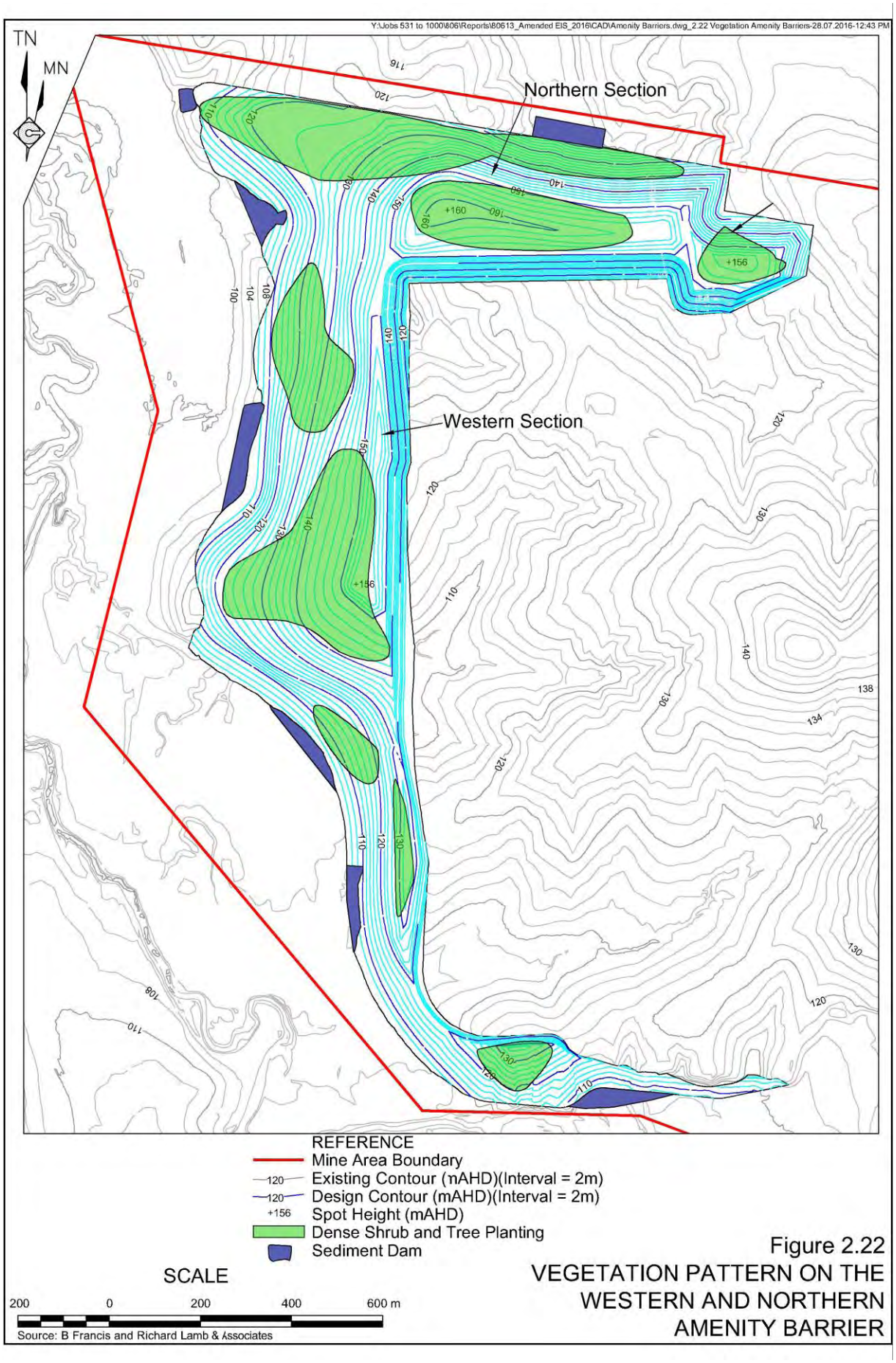


Figure 2.22
VEGETATION PATTERN ON THE WESTERN AND NORTHERN AMENITY BARRIER

Plate 2.3: Tree screen plantings adjacent to The Bucketts Way (12 months growth) (Ref: E806P_001)

Plate 2.4: Tree screen plantings adjacent to The Bucketts Way (4 years growth) (Ref: E806T_001)

Plate 2.5: Tree screen plantings adjacent to Fairbairns Road (12 months growth) (Ref: E806P_002)

Plate 2.6: Tree screen plantings adjacent to Fairbairns Road (4 years growth) (Ref: E806T_014)

The placed subsoil would be scarified and seeded with pasture seed mix (from **Table 2.13**) and both fertiliser and lime applied. All seeded slopes would be covered with a hay mulch. This practice would enable the subsoil from the emplacement footprint to be preferentially retained and subsequently reclaimed for use in the final landform treatment.

Interim Overburden Emplacement

The interim overburden emplacement would be progressively constructed to the elevations reflected by the contours displayed on **Figure 2.18**. As an area of the emplacement is shaped, it would be rehabilitated in a similar manner to the interim amenity barriers whereby only subsoil would be placed on the final surface. After ripping and/or scarifying, the pasture seed mix (with fertiliser and lime) would be applied using conventional farm equipment, along with hay mulch. As discussed above, this practice would maximise the availability of topsoil for final rehabilitation activities.

Roadside Batters

The roadside batters constructed from fill along the private haul road and Mine Area access road would be shaped and covered with up to 0.3m of subsoil and at least 0.15m of topsoil. Immediately following soil placement, the slopes would be seeded with a pasture mix and fertilised (see **Table 2.13**). If appropriate, hay mulch would be applied to the slopes.

2.16.6.3 Final Landform Profiling

The permanent overburden emplacement and the in-pit emplacement would be profiled using GPS or similar technology fitted on the on-site earthmoving equipment to achieve the required final landform. This practice would be undertaken regularly, i.e. once approximately 2ha of the emplacement is constructed to the appropriate final elevation. If required, additional overburden would be brought into the active profiling area to achieve the proposed landform.

Emphasis would be placed upon the placement of weathered rock or overburden without any large rocks near the final surface to ensure large rocks are not exposed during the profiling activities.

2.16.6.4 Soil Placement

Once the final landform is constructed and profiled, subsoil and then topsoil would be placed on the final surface prior to its revegetation, with the depth of subsoil and topsoil application based on the available volumes and total area of disturbance within the Mine Area to be rehabilitated. **Table 2.14** presents a summary of the calculated volumes of topsoil and subsoil to be stripped over the life of the amended Project. Based on the available volumes, the thickness of subsoil and/or topsoil application to the final landform would be approximately 75cm and 15cm respectfully providing a total soil profile depth of 90cm. Given that 33 of the 40 soil pits within the Mine Area recorded that the main root zone is in the top 80cm of the soil profile, the respread soil profile would be adequate for revegetation. The placement of weathered overburden on the final surface (immediately below the subsoil) would also provide an additional root zone for deeper rooted vegetation.

Table 2.14
Quantities of Topsoil / Subsoil – Mine Area

	Soil Mapping Unit	Area (ha)	Average Stripping Depth (cm)	Volume (bcm)	Spread Volume (m^3)[1]
Topsoil	1	196	10	196 400	225 860
	2	55	15	82 950	95 393
	3	238	15	357 300	410 895
	Total	**490**	-	**636 650**	**732 148**
Subsoil	1	145	60	871 800	1 002 570
	2[3]	31	0	0	0
	3	142	85	1 208 700	1 390 005
	Total	**319[2]**	-	**2 080 500**	**2 392 575**

Notes:
1. Spread volume = 1.15 x in situ volume due to bulking
2. Not all areas of disturbance would require the stripping of subsoil.
3. Subsoil material from SMU 2 would not be stripped for rehabilitation due to elevated salinity levels. Based on soil profile data, the subsoil thickness in SMU2 is approximately 210cm which equates to approximately 650 000bcm of saline subsoil to be placed in the active open cut pit or within the out-of-pit emplacement.

2.16.6.5 Vegetation Establishment

Pasture Establishment

The establishment of pasture on the nominated sections of the Mine Area would be undertaken progressively following the profiling of the final landform as indicated on **Figure 2.19** and the respreading of the subsoil and topsoil. A pasture mix comprising species identified in **Table 2.13** and other species as recommended at the time would be applied with a fertiliser using conventional farm equipment. The Applicant estimates full pasture development would be achieved within three years of initial seedings.

Native Vegetation

Native vegetation would be established within three areas on the final landform (**Figure 2.19**), i.e. within:

i) the areas nominated as open woodland;

ii) fenced tree lots scattered across the pasture areas on the final landform, typically on the lower slopes within the Mine Area; and

iii) fenced fauna corridors.

Table 2.15 lists a range of native tree and shrub species occurring within the Site, a selection of which would be used in each of these areas. The native vegetation would be grown by direct seeding and/or using tubestock. Seed used in direct seeding programs or for seedling propagation would preferably be collected within the Mine Area or nearby. A sterile cover crop would be sown within the corridor areas to be re-established with native vegetation to stabilise the surface while the native seedlings/seed mix propagates and flourishes, but generally without the application of fertiliser.

Table 2.15
Native Species for Revegetation of the Final Landform

Tree Species		Shrub Species	
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
Northern Grey Ironbark	*Eucalyptus siderophloia*	Blackthorn	*Bursaria spinosa*
Red Ironbark	*Eucalyptus fibrosa*	Prickly Moses	*Acacia ulicifolia*
Grey Gum	*Eucalyptus punctata*	Green wattle	*Acacia irrorata*
White Mahogany	*Eucalyptus acmenoides*	Prickly shaggy pea	*Podolobium ilicifolium*
Grey Box	*Eucalyptus moluccana*	Mock olive	*Notelaea longifolia*
Cabbage Gum	*Eucalyptus amplifolia*	Narrow-leaved orange bark	*Maytenus silvestris*
White stringybark	*Eucalyptus globoidea*	Prickly beard heath	*Leucopogon juniperinus*
Broad-leaved Apple	*Angophora subvelutina*	Falcate Wattle	*Acacia falcata*
Spotted Gum	*Corymbia maculata*	Hairy Clerodendrum	*Clerodendrum tomentosum*
Blackwood	*Acacia melanoxylon*	Coffee Bush	*Breynia oblongifolia*
Turpentine	*Syncarpia glomulifera*	Narrow-leaved geebung	*Persoonia linearis*
Forest Oak	*Allocasuarina torulosa*	Common hop bush	*Dodonaea triquetra*
Tallowwood	*Eucalyptus microcorys*	Sticky hop bush	*Dodonaea viscosa* subsp. *angustifolia*
		Blue flax lily	*Dianella caerulea*
		Spreading flax lily	*Dianella revoluta*

Source: Biosis – Pers Comm.

The tree lots and open woodland vegetation would ultimately provide shade for grazing stock, i.e. similar to the existing landscape within the Mine Area, and are expected to achieve growth rates similar to those achieved in the various road-side plantings undertaken by the Applicant (**Plates 2.3** to **2.6**). The principal shade trees would be as follows.

- Northern Grey Ironbark (Eucalyptus siderophloia).
- Grey Gum (Eucalyptus punctata).
- White Mahogany (Eucalyptus acmenoides).
- White Stringybark (Eucalyptus globoidea).
- Broad-leaved Apple (Angophora subvelutina).

The corridors would be permanently fenced and tree lots temporarily fenced to limit/prevent grazing by native animals and stock. In the longer term, i.e. once the trees are greater than approximately 3m in height, the tree lots could be grazed. The areas of open woodland with tree lots would be grazed for short duration programs during their growth to promote growth of the grasses until the trees are sufficiently advanced for sustained longer term grazing.

2.16.6.6 Site Decommissioning

Decommissioning of infrastructure within the Site would occur following the completion of extraction operations and throughout rehabilitation of the Main Pit and interim overburden emplacement, or as the relevant infrastructure is no longer required for these activities. It is anticipated that some components of the administration area, including but not limited to the workshop may be retained for an ongoing land use. All services not required for the final land

use would be removed in accordance with the supplier requirements and buildings transported off the Site or demolished and recycled for scrap steel, if available, or disposed of at an appropriately licenced landfill.

Where feasible, fencing and other restrictions to public access of the Site would be retained or re-instated during site decommissioning to ensure public safety is not jeopardised during the final rehabilitation activities.

Internal access roads that are to be retained in the final landform would be reduced in size and/or width to suit the final land use. All other access roads would be removed and rehabilitated in accordance with the proposed final landform (see Section 2.16.5 and **Figure 2.19**).

Once all relevant infrastructure within the administration area has been removed, a contamination assessment would be undertaken of targeted areas. The recommendations of this assessment would be implemented to ensure that any identified contamination is remediated before the remaining rehabilitation activities within these areas are completed.

2.16.7 Rehabilitation Monitoring and Maintenance

Rehabilitation monitoring and, if necessary, related research, would be conducted in accordance with the relevant section of the MOP relating to monitoring. Monitoring would focus on the presence and magnitude of erosion, vegetation cover, weed propagation, strike rate and plant growth (for native vegetation). The performance indicators to be monitored and the frequency of monitoring would be specified in the MOP and the Visibility Management Plan.

The Applicant's commitment to effective rehabilitation would involve an ongoing maintenance program arising from the results of the monitoring program. This would include, for example, re-seeding and re-topsoiling and/or the application of soil ameliorants or mulch if monitoring identifies deficiencies in rehabilitated areas. Drainage controls would also be maintained. Species-specific weed eradication methods and programs would be undertaken, as required.

2.16.8 Interim and Final Land Uses

The Applicant intends to maximise the use of the land within its ownership, i.e. both within and external to the Site, for agricultural purposes throughout the life of the amended Project and after the Mine Area is rehabilitated. This would be achieved through the following practices.

1. All land owned by the Applicant and its related companies beyond the boundary of the Mine Area would continue to be used for agricultural activities. The Applicant has negotiated a range of agreements with the former landowners and others to allow cattle grazing, fodder production and, in the case of the adjacent Speldon Partnership dairy, an extension of dairying operations, etc. to continue throughout the life of the amended Project.
2. All manageable parcels of land within the Mine Area beyond the proposed areas of disturbance during the first 2 years of operations would continue to be used for grazing or other purposes. Beyond the end of the first 2 years, the land used for grazing would be progressively reduced until about the end of Year 7 or 8 at which time it would increase again as revegetated pasture land becomes available

for grazing. The extent of the land within the Site available for agricultural purposes throughout the life of the amended Project is discussed in Section 4.10.1 in the Agricultural Impact Statement (Volume 5, Part 13 of the *Specialist Consultant Studies Compendium*).

3. The disturbed land rehabilitated with pasture within the Mine Area would be allowed to regenerate for a period of at least 3 years before cattle would be re-introduced onto that land. The re-introduction of cattle would invariably be limited in the first instance to high intensity, short duration programs which would avoid selective grazing which may affect the botanical composition of the sward, prevent the formation of rank, stemmy growth and assist in the maintenance of a diverse and extensive ground cover.

The native vegetation areas to be established would serve both as habitat and corridors for native fauna while the scattered individual or groups of trees across the final landform would provide habitat for native fauna, shade for stock and enhance the aesthetics of the area through the expansion of the open woodland formation currently present in the southeastern section of the Mine Area.

2.16.9 Biodiversity Offset Strategy

2.16.9.1 Introduction

The DGRs issued on 24 April 2012 require that the Applicant provide:

> *"a comprehensive offset strategy to ensure the development maintains or improves the terrestrial and aquatic biodiversity values of the region in the medium to long term."*

Biosis (2016) determined there would be some residual impacts on native vegetation as a result of the amended Project and, consequently in accordance with the DGRs, adopted the BioBanking Assessment Methodology (BBAM) and BioBanking Credit Calculator 2014 (Version 4.0) to calculate the credits required and the credits available within a proposed Biodiversity Offset Area located to the east of the proposed area of disturbance within the Mine Area (see Section 2.16.9.3). The assessment undertaken following the initial fieldwork between 2011 and 2013 used the BioBanking Assessment Methodology (BBAM) current at that time (DECC, 2009c). The assessment for the amended Project has been updated in accordance with the revised BBAM (OEH, 2014a) and the most recent version of the BioBanking Credit Calculator.

The *NSW Biodiversity Offsets Policy for Major Projects* (OEH, 2014b) and associated *Framework for Biodiversity Assessment* (FBA) (OEH, 2014c) were issued after the DGRs for the amended Project had been issued. As a result, the assessment of biodiversity impacts was not required to address these guidelines. However, during consultation in January 2016, OEH indicated it was supportive of the use of either the FBA or the BioBanking Assessment Methodology (BBAM) to assess impacts. The Applicant subsequently elected to use the BBAM to assess impacts and quantify offsets, as this method was used in the 2013 assessment and use of the FBA would have required OEH to re-issue SEARs for the amended Project. The use of the BBAM has resulted in an assessment that is consistent with the objectives and principles of the *NSW Biodiversity Offsets Policy for Major Projects* (OEH, 2014b).

The following subsections provide a summary of:

- residual impacts on native vegetation as a result of the amended Project and the credits required to offset the impact;
- the proposed Biodiversity Offset Area and credits available within that area;
- credit calculation results; and
- proposed strategies.

The biodiversity offset for the amended Project is drawn from Biosis (2016) as their assessment addresses the forest/woodland and limited rainforest vegetation as well as the River Oak Riparian Woodland vegetation adjacent to the Avon River and Waukivory Creek. No further consideration of biodiversity offsets are required for aquatic ecological communities.

Following receipt of development consent, the Applicant would prepare a detailed Biodiversity Management Plan in consultation with OEH, DPE, Hunter Local Land Services and other relevant government agencies that would provide further details on the implementation of the strategy. It is proposed that the Plan would be prepared within 12 months of receipt of development consent.

2.16.9.2 Residual Impacts on Native Vegetation

As is discussed in Section 4.12.3, three native vegetation communities have been identified within the area to be disturbed. The BBAM was applied to these communities to objectively quantify the ecosystem credits required due to the amended Project.

Table 2.16 provides a summary of the communities and the existing vegetation ecosystem credits calculated used the BBAM.

Table 2.16
Summary Table – Existing Vegetation Ecosystem Credits

Vegetation Community (2016 Assessment)	Equivalent Biometric Vegetation Type and Map Unit Number	Impacted Area (ha)	Ecosystem Credits Required	Minimum Offset Area Required (ha)
Ironbark / Grey Gum / Spotted Gum / White Mahogany Open Forest / Woodland	Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest (HU804)	36.6	1 358	121
River Oak / Cabbage Gum / Broad-leaved Apple Riparian Forest	River Oak – White Cedar Grassy Riparian Forest of the Dungog Area and Liverpool Ranges (HU928)	0.7	26	1.8
Giant Stinging Tree / Fig Rainforest Gullies	Shatterwood – Giant Stinging Tree – Yellow Tulipwood dry rainforest of the NSW North Coast Bioregion and northern Sydney Basin Bioregion (HU613)	4.2	297	27.4
Total		**41.5**	**1 681**	**150.2**
Source: Biosis (2016) – Modified after Table 30.				

Species credits are not being sought for particular threatened species occurring within the proposed Biodiversity Offset Area. Both the Grey-crowned babbler and the Squirrel glider were recorded near the proposed disturbance area during the fauna surveys and anecdotal sightings of the Brush-tailed phascogale were reported by a local resident (see Section 4.12.3.5 for a more detailed description of the results of fauna field surveys). The Grey-crowned babbler is an ecosystem credit species, and is accounted for within the ecosystem credit calculations. The Squirrel glider and Brush-tailed Phascogale have not been entered into the credit calculator since the habitat within the Biodiversity Offset Area for these species is of higher quality than that being impacted by the amended Project. Retention and management of these areas would have significant benefits for these species.

2.16.9.3 Proposed Biodiversity Offset Area

During the development of the amended Project and following the initial flora field survey to ascertain the nature of the vegetation communities likely to be disturbed by the amended Project, an area within and extending beyond the eastern side of the Mine Area was identified as a possible Biodiversity Offset Area. The Study Area was subsequently expanded to include this area and, in March 2011, more intensive investigations commenced to define the suitability of the area for use as an offset. The field investigations of this area were undertaken in accordance with the BBAM current at that time (DECC, 2009c) and the biodiversity offsetting assessment for the amended Project updated in accordance with the revised BBAM (OEH, 2014a) and the most recent version of the BioBanking Credit Calculator to determine the available offset credits within the proposed Biodiversity Offset Area.

Figure 2.23 shows the location of the proposed Biodiversity Offset Area. The entire area is located on land owned by the Applicant with the eastern boundary of the area coinciding with the eastern boundary of the Applicant's land and the western boundary generally coinciding with the eastern boundary of the proposed 132kV power line diversion corridor. This boundary has been positioned such that the power line corridor is confined primarily to areas of grassland with occasional paddock trees and small areas of rainforest within gullies that would require limited, if any, clearing for the overhead power line. Waukivory Road and Waukivory Creek mark the northern and southern boundaries respectively of the Biodiversity Offset Area.

The proposed Biodiversity Offset Area is underlain by a suite of carboniferous volcanics and sedimentary along the eastern margin of the Gloucester Valley within the Mograni Range. As such, no coal resources are located beneath the Biodiversity Offset Area. The absence of coal beneath the Biodiversity Offset Area was a factor in the Minister for Minerals and Energy allowing the Applicant to apply for a mining lease for mining purposes only within the eastern side of the Mine Area (see **Figure 1.3**). It is noted that the mining lease application over this area relates only to construction of the eastern sections of the interim and permanent overburden emplacements and the bulk of the southern and northern diversion channels. The mining lease would not permit GRL to mine the offset area as this activity would not be approved under the development consent. The topography of the Biodiversity Offset Area is comparatively steep, with the bulk of the area assigned a soil and land capability class of 7, i.e. a land class with extremely severe limitations. It is noted that one of the land uses recommended for this class of land is biodiversity habitat.

The proposed Biodiversity Offset Area covers a total of 267ha, of which approximately 142ha would consist of managed native vegetation. Approximately 41.1ha of this vegetation currently consists of low condition Dry sclerophyll forest which the Applicant would actively revegetate.

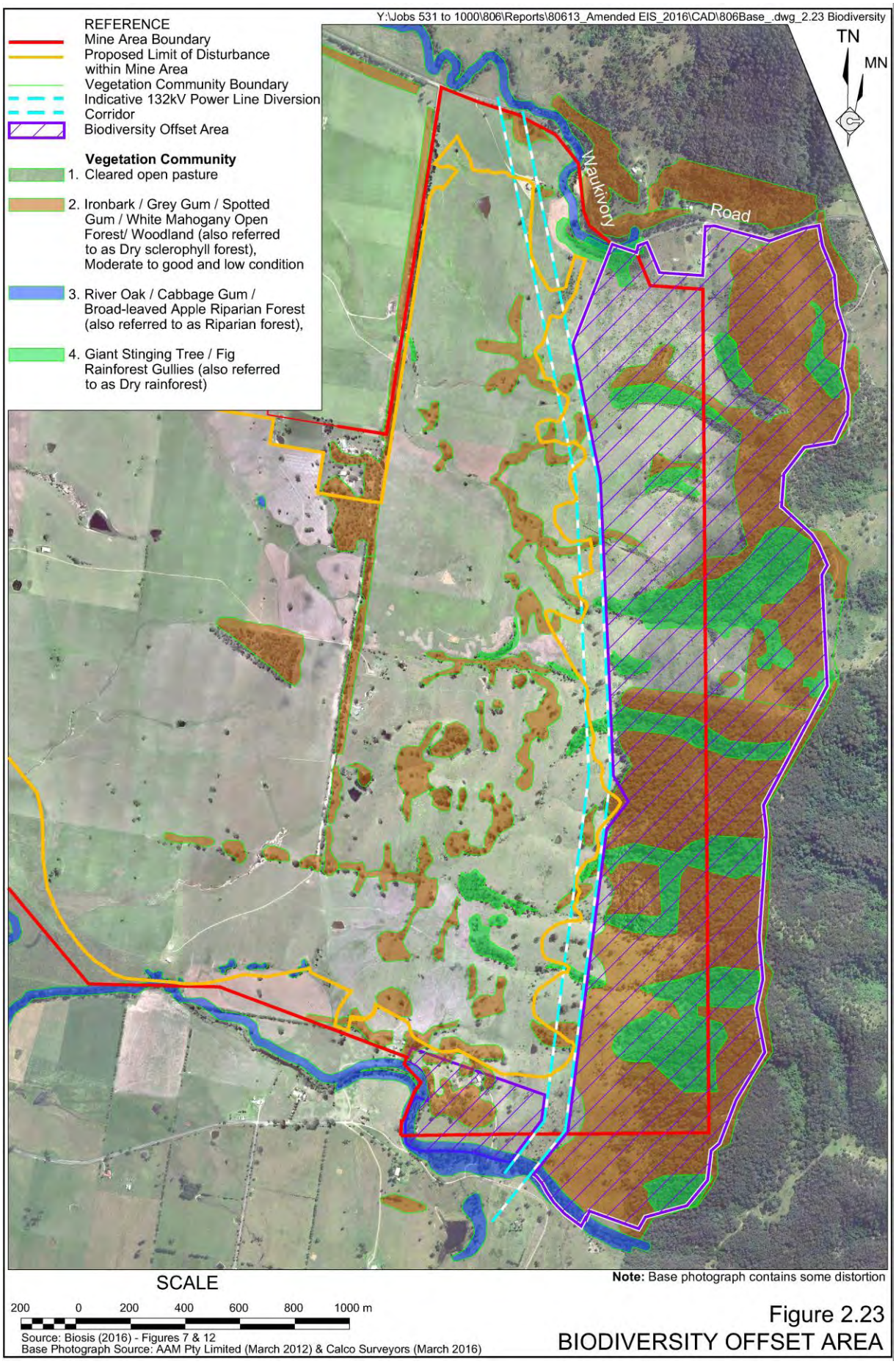


Figure 2.23
BIODIVERSITY OFFSET AREA

Once the investigations were undertaken (and a management strategy developed as described in Section 2.16.9.4), the BBAM was applied to the communities within the proposed Biodiversity Offset Area to objectively quantify the ecosystem credits acquired. **Table 2.17** provides a summary of the communities and the Biodiversity Offset Area ecosystem credits calculated using the BBAM.

Table 2.17
Summary Table – Biodiversity Offset Area Ecosystem Credits

Vegetation Community (2016 Assessment)	Equivalent Biometric Vegetation Type and Map Unit Number	Maximum Available Area (ha)	Ecosystem Credits Generated
Ironbark / Grey Gum / Spotted Gum / White Mahogany Open Forest / Woodland	Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest (HU804)	135.0*	1 526
River Oak / Cabbage Gum / Broad-leaved Apple Riparian Forest	River Oak – White Cedar Grassy Riparian Forest of the Dungog Area and Liverpool Ranges (HU928)	2.9	40
Giant Stinging Tree / Fig Rainforest Gullies	Shatterwood – Giant Stinging Tree – Yellow Tulipwood dry rainforest of the NSW North Coast Bioregion and northern Sydney Basin Bioregion (HU613)	50.5	548
Total		**188.5**	**2 114**
* Includes 41.1ha of Community 2 in Low Condition that would be revegetated and to which additional management actions would be applied			
Source: Biosis (2016) – Modified after Table 30.			

2.16.9.4 Proposed Strategy

For the defined Biodiversity Offset Area, a Biodiversity Management Plan would be prepared and address, as a minimum, the standard and additional management actions specified by the BBAM (OEH, 2014a) for each vegetation community. The standard management actions would be as follows.

- Management of grazing for conservation.
- Weed control.
- Management of fire for conservation.
- Management of human disturbance.
- Retention of regrowth and remnant native vegetation.
- Replanting or supplementary planting where natural regeneration would not be sufficient.
- Retention of dead timber, particularly hollow logs.
- Erosion control.
- Retention of rocks.

Additional management actions specific to particular vegetation types as specified in the BioBanking Credit Report (see Biosis (2016) Appendix 6) are as follows.

- Fox control (all vegetation types).
- Exclusion of miscellaneous feral species (all vegetation types).

- Feral and/or native herbivore control/exclusion (e.g. rabbits, goats, deer etc.) (all vegetation types).
- Exclude commercial apiaries (Spotted Gum - Broadleaf Mahogany / Red Ironbark shrubby open forest community only).
- Slashing (Spotted Gum - Broadleaf Mahogany / Red Ironbark shrubby open forest community only).

Additional management actions to obtain extra credits in the more degraded parts of the Biodiversity Offset Area would also be incorporated into the Plan depending on the management zone, as follows.

- Strategic replanting of a diverse range of species to boost species richness.

  Replanting would be guided by the most recent scientific literature and recent practical experience with bush regeneration and vegetation community restoration. Replanting would utilise a selection of suitable species that are:

  – known to occur naturally in the relevant vegetation community;
  – of local provenance, that is, propagated or sourced from material that occurs locally, preferably from within the Site itself;
  – inclusive of a range of species from all strata represented within the relevant vegetation community (tree layer, shrub layer and ground layer);
  – likely to be sufficiently robust to become self-sustaining without excessive levels of ongoing care or intervention; and
  – unlikely to become invasive or weedy themselves.
- Site preparation and planting of local provenance species in all of the overstorey, mid-storey, shrub and ground layers.

  Site preparation would be applied as the first step of rehabilitation with the aim of maximising the prospects of success of plantings and/or seedings. The following actions would be considered for implementation.

  – Weed removal and control using appropriate physical, mechanical or chemical methods.
  – Appropriate surface treatment of the soil depending on the situation – ripping, ploughing or spiking.
  – Control of erosion or potential erosion by use of jute matting, mulch or other recognised devices and stabilising techniques.
  – Application of water and/or fertiliser where and when considered appropriate.
  – Consideration of the use of fire (ecological burns) to encourage regeneration of native species, particularly obligate seeders.
- Preparation of an integrated weed management strategy.

- Introduction of hollow logs from the adjoining disturbance areas.

  Larger logs with hollows would be relocated to maximise the ecological benefit from a potentially valuable resource available from the impact area. A protocol detailing the steps to be undertaken during the relocation process would be developed as part of the Biodiversity Management Plan, based on the following considerations.

  – Selection of suitable logs from the development area would be undertaken by an experienced fauna ecologist. Suitable logs would be identified in the proposed disturbance area and clearly marked for relocation prior to clearing.

  – Location and strategic placement of logs in the Biodiversity Offset Area would be considered carefully by a fauna ecologist based on the known or likely presence and habitat requirements of fauna nearby that would be expected to utilise the logs as shelter.

  – Placement and positioning of logs (or nest boxes) would be based on ecological knowledge of habitat requirements such as orientation, aspect, slope, available shelter, protection from the elements, etc.

One of the key components of the proposed strategy to manage biodiversity within the Biodiversity Offset Area would be the progressive rehabilitation of approximately 41.1ha of low condition Dry sclerophyll forest.

It is noted that the biodiversity offsetting assessment has not considered the extensive corridor plantings undertaken by the Applicant within its properties adjacent to the public road network. A total of in excess of 9 000 seedlings of locally occurring native species have been planted in the roadside corridors totalling more than 6km (see **Plates 2.3** to **2.6**). Though primarily to reduce visibility towards the proposed operational areas from public roads, these corridors would also contribute to local biodiversity improvements through the redevelopment of corridors within previously cleared land or the establishment of linkages between isolated patches of remnant native vegetation.

2.16.9.5 Credit Calculation Results

A summary of results from the BBAM for both the proposed disturbance area within the Site and the Biodiversity Offset Area is presented in **Table 2.18**. The ecosystem credits generated by the offset area alone would provide more than the required number of ecosystem credits (between approximately 12% and 84%) to offset the impacts on all native vegetation communities affected. The methodology has determined one vegetation community to be a 'red flag' within the proposed area of disturbance for the amended Project. The River Oak / Cabbage Gum / Broad-leaved Apple Riparian Forest is a red flag because the vegetation type is greater than 70 percent cleared within its entire known range. All steps have been taken to avoid or minimise impacts on the River Oak / Cabbage Gum / Broad-leaved Apple Riparian Forest by locating components for the Mine Area and private haul road such that they minimise vegetation disturbance to the greatest extent possible.

Table 2.18
Summary Table – Balance of Ecosystem Credits

Vegetation Community (2016 Assessment)	Equivalent Biometric Vegetation Type and Map Unit Number	Ecosystem Credits Required	Ecosystem Credits Generated by Offset Area
Ironbark / Grey Gum / Spotted Gum / White Mahogany Open Forest / Woodland	Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest (HU804)	1 358	1 526 (112.4%)
River Oak / Cabbage Gum / Broad-leaved Apple Riparian Forest	River Oak – White Cedar Grassy Riparian Forest of the Dungog Area and Liverpool Ranges (HU928)	26	40 (153.8%)
Giant Stinging Tree / Fig Rainforest Gullies	Shatterwood – Giant Stinging Tree – Yellow Tulipwood dry rainforest of the NSW North Coast Bioregion and northern Sydney Basin Bioregion (HU613)	297	548 (184.5%)
Total		**1 681**	**2 114**
Source: Biosis (2016) – Modified after Table 30.			

2.16.9.6 Long-term Security

The Applicant proposes to secure the Biodiversity Offset Area through a BioBanking Agreement or agreement equivalent to such an agreement prepared under the *National Parks and Wildlife Act 1974* or subsequent biodiversity conservation legislation. The agreement would be prepared following the receipt of development consent and in consultation with the OEH and DPE. The agreement would outline the proposed management regime for the Biodiversity Offset Area and the funding mechanisms to ensure the management is undertaken in perpetuity.

2.17 ALTERNATIVES CONSIDERED

It is recognised that the amended Project is an alternative to or a variation of the 2013 Project included in the 2013 EIS and Development Application. The Applicant has focussed upon introducing changes to the 2013 Project that improve environmental outcomes. Details of the key differences between the 2013 and amended Projects and environmental improvements, where appropriate, are set out in **Appendix 1** based upon the assessments compiled for each of the specialist studies.

During the design refinements associated with the amended Project, the Applicant examined a range of alternatives before deciding upon the proposed components as presented within this document. This subsection outlines the alternatives considered and the reasons for proceeding with the preferred options. For many components, the Applicant firstly assembled all relevant information so as to enable a design which avoided or minimised environmental impacts. For such components, e.g. the private haul road and the Mine Area entrance and access road, no alternatives were considered as they were simply designed to achieve minimal visual impact and achieve optimum grades and alignments.

Mine Area

The area in which the extraction of coal is proposed has been defined following an extensive evaluation of the geological, environmental and mine safety considerations. As a consequence, there were no feasible alternatives to its location. Although the development of two, more easterly open cut pits targeting the Weismantel and Clareval seams was initially proposed, the subsequent coal quality evaluation established that the recovery of coal from both seams was not economical, i.e. the Clareval Seam prior to the 2013 EIS and the Weismantel Seam subsequent to the 2013 EIS. Further, the areas of other seams identified intersecting or underlying alluvials and river systems were also precluded on environmental grounds.

Mining Methods

Given the steeply dipping nature and multiple coal seams within the Mine Area, open cut methods were determined to be the only feasible means of extracting the identified resource. Underground mining of multiple steeply dipping seams is not currently, nor is likely to be, technically or safely practicable in the foreseeable future.

Overburden Disposal

In terms of areas potentially available for out-of-pit overburden disposal, the Mine Area is constrained by:

- the presence of the Avon River and Waukivory Creek and their associated floodplains to the west;
- the steep nature of the landform to the east;
- the existence of multiple seams which subcrop across the Mine Area;
- the potential to sterilise coal resources;
- the visual sensitivities of the area and the desire to avoid excessive removal of remnant native vegetation; and
- a desire to minimise impacts on existing surrounding land uses and the local environment.

As a result, the conceptual configuration of the permanent overburden emplacement and the final landform was the result of numerous iterations which progressed from the conventional plateau type landform to that presented in **Figure 2.19**. In terms of the visual exposure of the amended Project from the west through to the north in particular, the visual constraints assessment undertaken for the amended Project identified the desirability of a strategy which would use the permanent overburden emplacement as a beneficial resource and one which would differ from the more traditional approach, i.e. one where the residual landform was generally flat and featureless, had little relationship with its former character and permanently conflicted with the line, form, colour and texture of the surrounds. As a consequence, the traditional approach to the permanent overburden emplacement design was discounted in favour of one which incorporated valleys, ridges and slopes similar in location and form to those naturally occurring in the same area prior to mining. The interim out-of-pit emplacement has been designed to minimise short term visual impacts whilst the permanent overburden emplacement has been designed to ensure the re-constructed long-term landform is indiscernible from those areas unaffected by the amended Project.

Coal Transportation to Stratford Mining Complex

The Applicant considered two options for the transportation of the sized coal from the Rocky Hill Mine Area to the Stratford Mining Complex, namely a private haul road or overland conveyor. After a review of both options, the Applicant determined to proceed with a private haul road for the following reasons.

1. The conveyor would need to traverse a distance of approximately 9.5km, approximately half of which would be within the existing operational areas of the Stratford Mining Complex. The presence of the conveyor would cause considerable difficulties across the operational areas of the Stratford Mining Complex.
2. The need for a comparatively straight alignment for a conveyor would limit the opportunities for the conveyor to avoid areas of native vegetation, operational and habitat enhancement areas within the Stratford Mining Complex and prime agricultural land such as the Denyer Dairy on the Yancoal property north of the Stratford Mining Complex. Each of these constraints has been virtually avoided through the selected alignment of the private haul road.
3. A conveyor would introduce a lineal feature that would be more visible on its likely alignment compared with the proposed private haul road.
4. The capital and operational costs of the conveyor would be excessive for the quantity of sized coal transported throughout the life of the amended Project. The requirement for at least two drive heads, the conveyor structure, a tripper drive, elevated gantry crossings over Waukivory and Dog Trap Creeks and commissioning alone would cost in excess of $40 million with maintenance costs of about $25 million (2016 dollars) over the 16 years of coal haulage. Furthermore, it is recognised that for distances less than 10km, use of conveyors (compared with off-road trucks) is not economical for less than at least 3 million tonnes per annum.
5. Any major damage to the conveyor would cause the mine to cease production.

Final Voids

The Applicant identified a range of approaches to manage the final void in the Main Pit following the cessation of coal extraction. Most of the alternatives focussed upon the retention of the void with various side slopes and depths of water. The Applicant ultimately decided to backfill the void to a level above the projected final groundwater level so as to establish a final landform which would reflect the landscape's intrinsic quality and enable it to be returned to its former grazing land use, as well as avoiding any adverse impacts arising from the long-term exposure of groundwater to the atmosphere, i.e. evaporation and concentration of salts and safety concerns.

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