Section 2

Description of the Project

This section introduces the Proponent's objectives for the development and operation of the Narrabri Coal Project and the staged approach to the project. This section focuses on Stage 1 of the project with a brief overview of the envisaged Stage 2 activities presented at the conclusion of the section.

The coal resource within the Project Site is described and the proposed Stage 1 mining operations and sequence are detailed together with processing and product transport activities. This section also describes the proposed hours of operation, infrastructure and services, safety management, waste management and progressive and final rehabilitation associated with the project.

The Stage 1 project is described in sufficient detail to provide the reader with an overall understanding of the nature and extent of the activities proposed, how the various activities would be undertaken and to enable an assessment of the potential impacts on the surrounding environment. The boundaries of the various components described throughout this section are indicative. Where dimensional information is provided, it needs to be recognised as indicative only.

Details of the safeguards and management measures that the Proponent proposes to implement to minimise or negate the potential impacts on surface water, groundwater, soil, noise, air quality, Aboriginal heritage, flora and fauna and other components of the local environment are provided in Section 4 of this document.

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2.1 INTRODUCTION

2.1.1 Objectives

The Proponent's objectives for the development and operation of the proposed Stage 1 of the Narrabri Coal Project are to:

(i) develop and safely operate a productive mine producing low ash, thermal coal;

(ii) commence production at the earliest possible date to maintain the Proponent's coal production levels in the Gunnedah Basin;

(iii) continue to supply international and domestic markets for the coal produced;

(iv) develop and operate the mine in a manner that complies with all statutory requirements;

(v) undertake all activities in an environmentally responsible manner, employing a level of control and integrating safeguards that would ensure compliance with appropriate criteria/goals and/or reasonable community expectations at all times;

(vi) provide a boost to the local economies of Narrabri and Boggabri and their surrounding districts through employment and service supply opportunities related to the operation of the coal mine;

(vii) design and establish a Pit Top Area that would minimise surface disturbance and would serve the mine for the foreseeable future;

(viii) achieve the above objectives in a cost-effective manner and thereby ensure the ongoing viability of the proposed mining operation; and

(ix) obtain sufficient technical information to determine the feasibility and design of a Stage 2 longwall mining operation.

2.1.2 Outline of the Project

The proposed Stage 1 of the Narrabri Coal Project would involve the following activities.

- Site Establishment
  - Establishment of a Pit Top Area incorporating surface infrastructure related to offices, workshops, amenities, crushing / sizing, stockpiling and train loading.
  - Establishment of the pit bottom ("Pit Bottom Area").
  - Construction of a box cut, transport drift and a conveyor drift to provide access to the Pit Bottom Area.
  - Construction of an upgraded intersection between the Kamilaroi Highway and Kurrajong Creek Road, and upgraded rail crossing and site access road from the Kamilaroi Highway to the Pit Top Area.
  - Construction of a rail loop from the North Western Branch Railway.
  - Construction of connected evaporation / storage ponds within the rail loop.
  - Establishment of a vertical ventilation shaft.

- Operations
  - Mining of coal from the Hoskissons Coal Seam using underground continuous miner methods in Mining Areas A, B and C (refer to Section 2.5.1) at a maximum rate of 2.5Mtpa.
  - Transportation of the mined coal to the ROM stockpile via a conveyor system (refer to Section 2.6.1).
  - Crushing and sizing of the ROM coal through the crushing / sizing plant and stockpiling on the product stockpile (refer to Section 2.6.3).
  - Loading of product coal into train wagons via the rail load-out bin for transportation to Port Newcastle (refer to Section 2.7).

In addition to these principal activities, the proposed mine would be operated with comprehensive systems to manage groundwater, surface water, noise, air quality, and visibility. These systems are detailed in Section 4, Part B.

A conceptual overview of the envisaged Stage 2 operations within the proposed mine is provided in Section 2.16.

2.1.3 Project Site Layout

Figure 2.1 presents the Project Site layout and identifies the following components.

- The Pit Top Area.
- The box cut for the transport and conveyor drift portals.
- Surface buildings.
- A Ventilation Shaft Area for the construction of a ventilation shaft for the underground workings.
- The underground mine workings including:
  - Mining Area A: main drives;
  - Mining Area B: continuous miner secondary extraction; and
  - Mining Area C: panel roadways and possibly continuous miner secondary extraction (depending on feasibility of longwall mining).

For the purposes of describing the proposed activities, the Pit Top Area encompasses all surface infrastructure except for the Ventilation Shaft Area. This includes the Site Access Road, the rail loop, the crushing and stockpiling areas, box cut and drift portals, and all surface buildings and service infrastructure.

2.1.4 Approvals Required

The project will be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*. As such, the Minister for Planning is the approval authority.

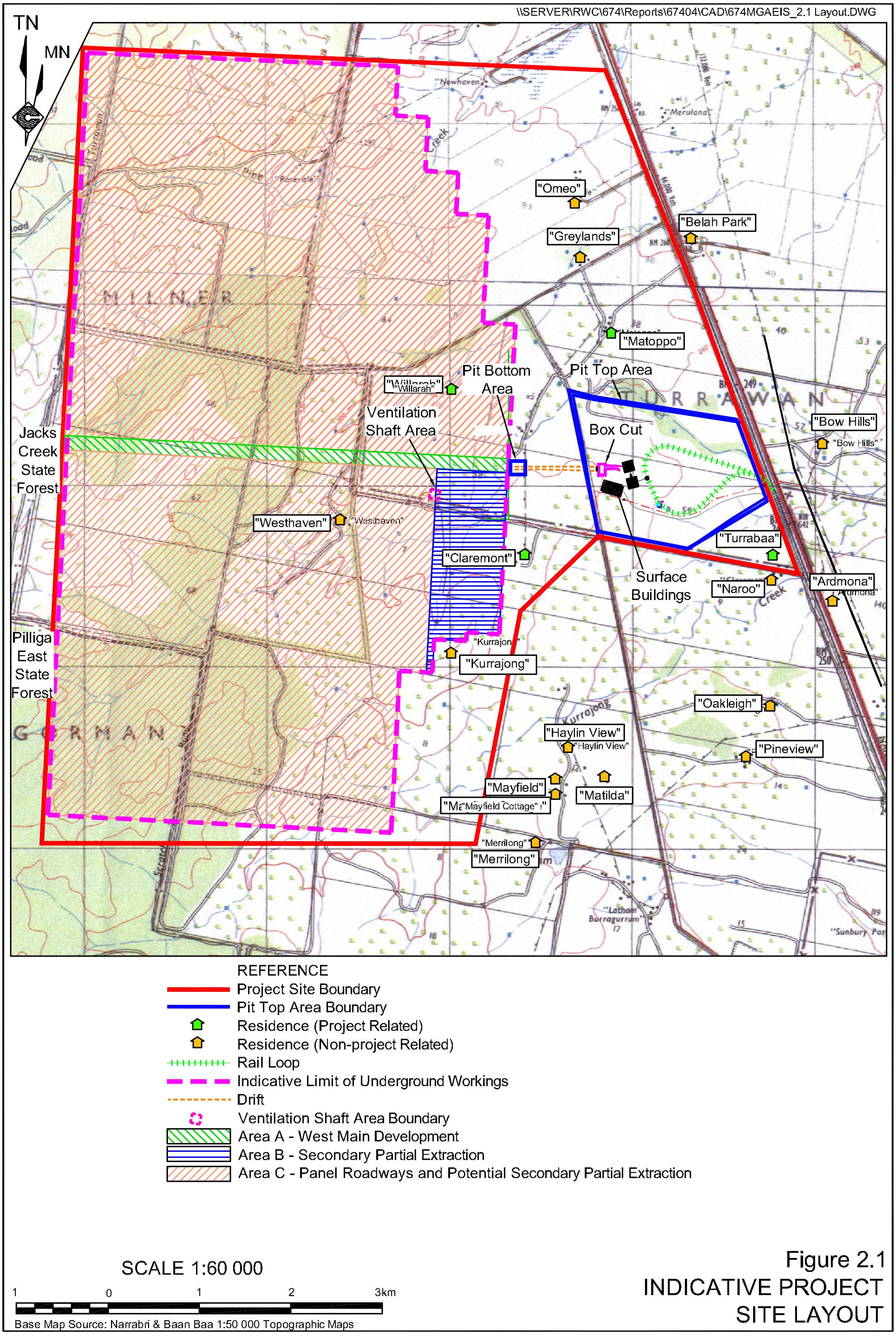

Figure 2.1
INDICATIVE PROJECT SITE LAYOUT

Under Part 3A, the application for project approval must be made prior to the receipt of Director-General's Requirements for the project. The application was made in November 2005 (application number 05_0102).

The following licences and leases, additional to those encompassed by the planning approval process, would be required to allow commencement of the project.

Environment Protection Licence – Department of Environment and Conservation. An Environment Protection Licence is required under Section 47 of the *Protection of the Environment Operations Act 1997* to develop and operate Stage 1 of the Narrabri Coal Project.

Mining Lease – Department of Primary Industries (Mineral Resources)
As the coal is owned by the Crown, the Proponent requires a mining lease to be issued by DPI (MR), under Section 51 of the *Mining Act 1992* to provide for the recovery of coal from the Hoskissons Coal Seam. The Proponent applied for a mining lease in October 2006, the granting of which requires the receipt of project approval. The boundaries of the mining lease application are coincident with the Project Site boundary except for a 0.6ha area where a Country Energy sub-station is planned to be located.

Section 138 Road Permit
Under the *Roads Act 1993,* a permit would be required for the proposed intersection works with the Kamilaroi Highway.

Water Licence – Department of Natural Resources
A licence may be required under Section 10 of the *Water Act 1912* to enable the Proponent to construct dams for the collection of surface water for dust suppression purposes.

Water Licence – Department of Natural Resources
A licence is required under Section 116 of the *Water Act 1912* to permit the extraction of groundwater during mining activities. Based on the proposed mine development sequence (see **Figure 2.4**), the Project Site geology and permeability characteristics of the geological strata, through which the mine would be developed, a model to predict groundwater in-flows was constructed by GHD Pty Ltd. Based on "best estimate" conditions, the model predicts an in-flow of 30ML in the first year of operation increasing steadily over the next 24 years before stabilising at about 690ML per year. This water would require extraction for management on the surface.

It is noted that once the *Water Management Act 2000* is fully enacted, the licensing of the water intercepted by the mine workings would be as outlined in the draft Aquifer Interference Policy. DNR has indicated the specific details of this policy and licencing requirements would be provided at a later date.

Further approvals and notifications would be required in accordance with the *Coal Mines Health and Safety Act 2002*, relating to the commencement of operations. Additionally, as the orientation of the proposed Stage 1 continuous miner roadways through Area C may impact on potential future longwall mining operations, DPI (MR) is required to approve the proposed design of the continuous miner roadways prior to any mining in these areas.

The Proponent would ensure all buildings constructed on the Project Site are approved and/or certified by Narrabri Shire Council.

2.1.5 Project Timetable

Table 2.1 provides an indicative project timetable currently being followed by the Proponent, from submission of a Conceptual Project Development Plan in early September 2005, through to the sale and despatch of the first coal products in 2008.

Table 2.1
Indicative Timetable for Project Progression

Activity	Indicative Timing
Submission and approval of Conceptual Project Development Plan to DPI (MR)	Early September 2005
Planning Focus Meeting	29 September 2005
Completion of resource definition drilling in the northern section	End September 2005
Resource definition drilling in southern section	October 2005 to June 2006
Undertake high resolution aeromagnetic survey	September / October 2005
Ongoing assessment of exploration data and resource refinement	To end June 2006
Prepare 'bankable' feasibility study for Stage 1	End December 2005
Receive *Environmental Assessment* Requirements.	January 2006
Submit *Environmental Assessment* for adequacy assessment	Early July 2006
Submit application for Mining Lease	October 2006
Submit *Environmental Assessment* for public exhibition	March 2007
Submit application for Environment Protection Licence	April 2007
Application / *Environmental Assessment* exhibition period	April / May 2007
Compilation of submissions and preparation of response	May 2007
Review of submissions and lodgement of revised Statement of Commitments and Preferred Project Report (if necessary)	June 2007
Compilation of Director-General's Environmental Assessment Report	July 2007
Issue Project Approval	August 2007
Mining Lease and Environment Protection Licence issued	August 2007
Narrabri Coal Project Stage 1 site establishment commences	September 2007
Narrabri Coal Project Stage 1 production commences	September 2008

2.2 GEOLOGICAL AND RESOURCE ASSESSMENT

2.2.1 Regional Geology

2.2.1.1 Geological Setting

An overview of the regional geological setting is provided for both the following resource assessment and to introduce the various rock units above and below the coal seam to be mined and which are referred to in the hydrogeological assessment of the project.

The Narrabri Coal Project Site is located within the Permo-Triassic Gunnedah Basin, which forms the central part of the north-south elongate Sydney-Gunnedah-Bowen Basin system. It is located near the northern and western boundary of the Gunnedah Basin and the eastern margin of the Surat Basin, a sub-basin of the larger Great Artesian Basin. Hence, the rocks and sediments beneath and surrounding the Project Site can be grouped into:

- undifferentiated Quaternary sediments;
- Jurassic Surat Basin sequence; and
- the Gunnedah Basin sequence.

The Boggabri Ridge, comprising Early Permian volcanic rocks, forms the basement of the Gunnedah Basin and divides the basin into two parts, the Maules Creek sub-basin to the east, and the Mullaley Sub-basin to the west. The Project Site is located in the Mullaley Sub-basin which contains Permian and Triassic sedimentary and volcanic rocks. The rocks strike approximately north-south and dip to the west at an angle of less than 10^{o}. In the area adjacent to the Boggabri Ridge, there is a local angular unconformity between the Late Permian Black Jack Group and the overlying Triassic Digby Formation. In the western part of the Project Site, the Gunnedah Basin sequence is unconformably overlain by the Jurassic age Surat Basin sequence, containing Jurassic to Cretaceous fluvial, lacustrine and marine sediments also dipping to the west.

2.2.1.2 Stratigraphy

The regional stratigraphy relating to the Project Site is summarised as follows.

Quaternary Sediments

- Undifferentiated Quaternary alluvial gravel, sand silt and clay overly the Jurassic and Triassic Sediments. Present in the east and northeast of the Project Site, it is associated with the Namoi River.

Surat Basin Sequence (Jurassic)

- The Pilliga Sandstone outcrops along the western margin of EL 6243, and is up to 60m thick and consists of medium bedded and cross-bedded, well sorted fine to coarse grained quartzose sandstone. This formation constitutes one of the intake beds and aquifers for the Great Artesian Basin groundwater system.

- The Purlawaugh Formation outcrops over the western half of the Project Site. It consists of thinly bedded, generally fine grained, silty lithic sandstone interbedded with siltstone and mudstone. The sandstone has low porosity and permeability.
- The Garrawilla Volcanics consist of alkali basalt flows (vesicular to non-vesicular) and interbedded pyroclastics. The volcanics sub-crop under alluvium along north-south alignment in the centre of the Project Site.

Gunnedah Basin Sequence (Permian to Triassic)

- The Deriah Formation is sporadic across the Project Site with intersections up to 15m thick present in the north. It consists of fine to medium grained lithic sandstone rich in volcanic fragments.
- The Napperby Formation is up to 140m thick with a coarsening upwards sequence of siltstone / sandstone laminate and fine to medium grained quartz-lithic sandstone. It subcrops under alluvium towards the eastern part of the Project Site.
- A Basalt Sill intrudes the lower Napperby Formation within the Project Site. It is of variable thickness, but typically 15m to 20m thick, and is likely to be associated with Garrawilla Volcanics.
- The Digby Formation is interpreted as thickly bedded, polymictic, lithic, pebble conglomerate with volcanic clasts. Typically 15m to 20m thick, the lower boundary with Black Jack Group is an angular unconformity.
- The Digby Conglomerate cuts the Hoskissons Coal measure at approximately 160m in the east of the Project Site, whereas in the west, there is up to 20m of Black Jack Group developed above the Hoskissons Coal Seam.
- The Black Jack Group consists mainly of lithic sandstone, siltstone, claystone and the thickness varies (70m in the west and less than 40m in the eastern part of the Project Site) due to the unconformity with the overlying Digby Formation. The Hoskissons and Melville Coal Seams are both part of this group and are present to varying degrees within the Project Site.
- The formations beneath the Black Jack Group which make up the remainder of the Gunnedah Basin Sequence are:
  - Millie Group – includes the Watermark and Porcupine Formations;
  - Bellata Group – includes the Leard and Maules Creek Formations; and
  - Boggabri Volcanics and Werrie Basalt.

2.2.2 Exploration

Exploration Licence (EL) 6243 (**Figure 2.2**) was granted to Narrabri Coal Pty Ltd in May 2004 and covers an area of 113km^2. The area incorporating EL 6243 was initially explored by Pacific Power in the 1980s using widely spaced drilling.

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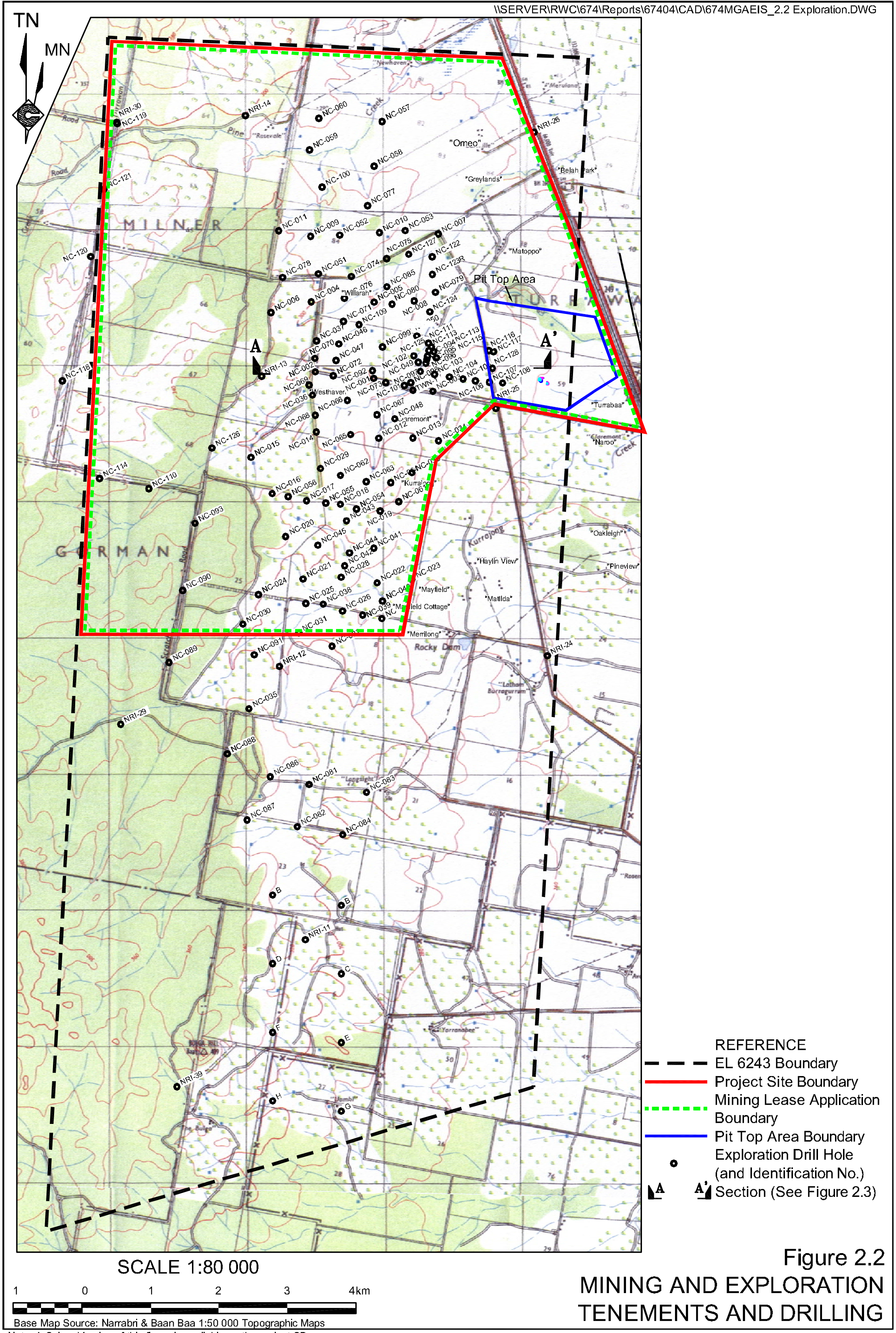

Base Map Source: Narrabri & Baan Baa 1:50 000 Topographic Maps

Figure 2.2

MINING AND EXPLORATION TENEMENTS AND DRILLING

Note: A Colour Version of this figure is available on the project CD

Interpretation of regional aeromagnetic data identified a significant regional geological structure dividing the EL area into a northern section and southern section of roughly equal areas. Initial exploration efforts concentrated on defining the nature of this structure and confirming sufficient coal reserves in the northern section of the EL to justify Stage 1 mine development.

The Proponent will continue its exploration activities in the southern half of EL 6243 over the next few years. Any coal mining proposal within that area would depend upon the quantity and quality of coal identified, technical and economic factors and environmental constraints. In any event, any proposal would be the subject of a separate application for planning approval.

The exploration commenced in July 2004 and has, to date, entailed:

- drilling of in excess of 130 drill holes, more than half of which have been cored, and the majority of which have been geophysically logged (**Figure 2.2**);
- ply-by-ply quality analysis of a number of the cores recovered from the coal seam;
- Uniaxial Compressive Strength (UCS) determination for roof and floor strata;
- slake durability testing of floor strata;
- specialist analysis of regional aeromagnetic data and data from a high resolution (low height) aeromagnetic survey of the EL area which was conducted in September 2005;
- specialist assessment of gas make and nature;
- specialist "televiewer" reports on three deep holes for evidence of stress-related breakout;
- geotechnical review of data with emphasis on assessment of likely mining conditions; and
- specialist investigations of the coal for spontaneous combustion.

The results from this exploration activity have confirmed seam characteristics of the Hoskissons Coal Seam in the area. The seam lies at depths of between 140m to 350m across the Project Site. The seam subcrops in the east and, as it dips to the west, it thickens to approximately 9m. (**Figure 2.3**). Drilling results indicate that the lower 4m of the coal seam is of excellent low ash thermal quality.

The exploration program also identified two massive overlying strata units, namely:

- a 12m to 20m thick conglomerate in close proximity to the coal seam; and
- a 0m to 30m thick volcanic sill located 40m to 60m above the coal seam in part of the Project Site.

In addition, a 20m to 40m thick layer of basaltic lava flows (the Garrawilla Volcanics) lies close to the surface in the east and attains depths of greater than 100m to the west.

These three strata units could potentially influence the layout and design of the Stage 2 longwall mining panels and the magnitude of surface subsidence. The potential impact of these strata units on subsidence is discussed further in Section 2.5.5.

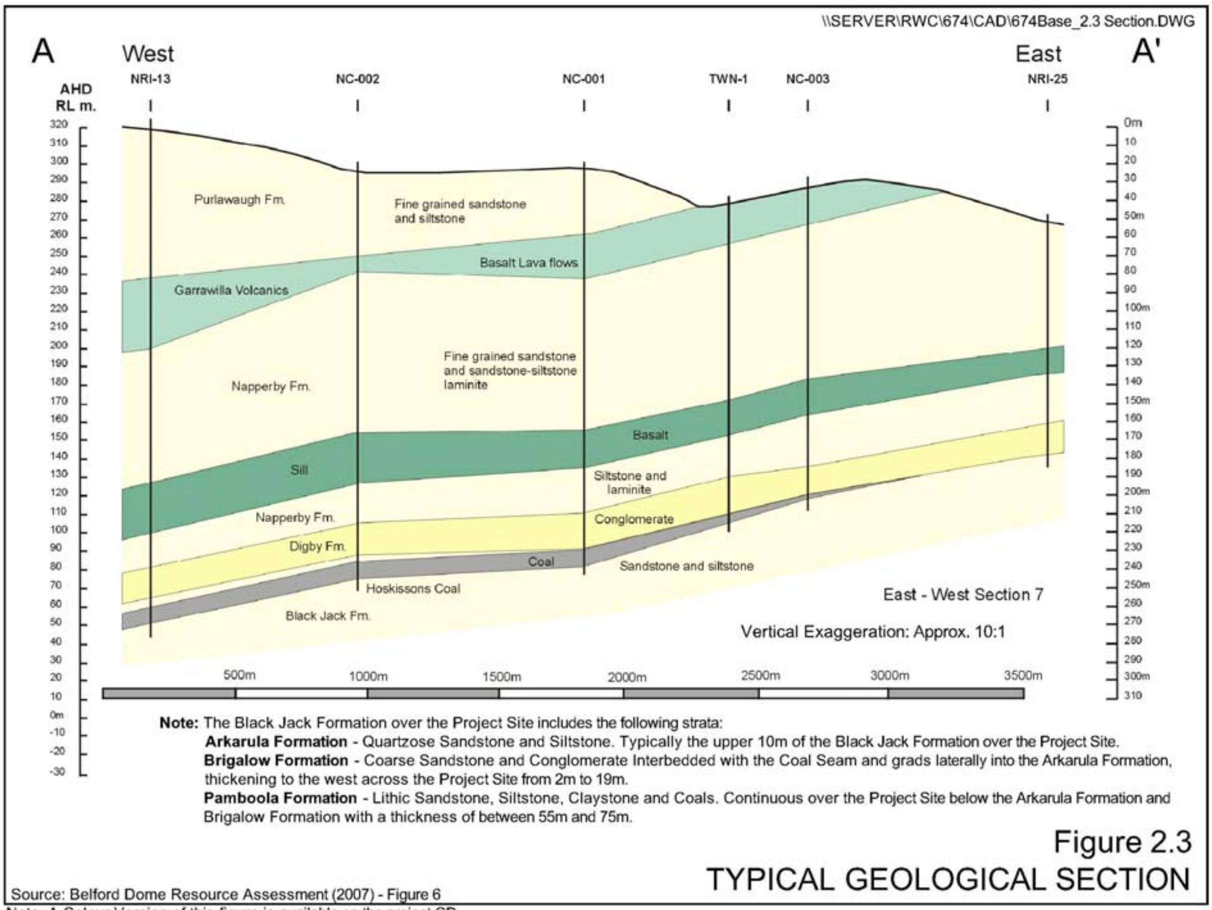

Figure 2.3
TYPICAL GEOLOGICAL SECTION

Note: A Colour Version of this figure is available on the project CD

2.2.3 Coal Resources and Reserves

The coal resources within the proposed coal mine occur within the Hoskissons Coal Seam within the Late Permian Black Jack Formation. Another coal seam within this formation is the Melvilles Coal Seam, which lies approximately 50m below the Hoskissons Coal Seam, however, the thickness and poor quality of the Melvilles Coal Seam excludes it from any current mining potential. The Hoskissons Coal Seam is up to 10m thick and is present across EL 6243 at depths ranging from approximately 140m in the east to approximately 300m in the west. An east-west cross section displaying the typical stratigraphic trends and sequence across EL 6243 is displayed in **Figure 2.3**.

The lower part of the Hoskissons Coal Seam contains low ash coal suitable for thermal applications and therefore is suitable for recovery by underground mining methods. The lower approximately 4.2m of the seam (referred to as the **H**oskissons **C**oal Seam Ply (HC2)) has been identified as the preferred working section for mining. A working section height of approximately 4.2m is the optimum limit for safe, productive continuous miner operations and is towards the upper end of single-pass long wall technology. **Table 2.2** provides summarised quantity and quality information about the proposed working section, HC2.

Table 2.2
In-situ and Recoverable Coal Quantities and Quality

Seam Ply	Thickness (m)	Volume (Mm^3)	M Tonnes (in-situ)	M Tonnes (recoverable)	RD (ad*)	IM (%)	Ash (%)	VM (%)
HC2	4.06	154.7	216.4	160	1.43	4.2	10.5	27.8
RD – Relative Density		IM – Inherent Moisture			VM – Volatile Matter		* ad – air dried basis	
Source: Modified from Belford Dome Resource Assessment (2007) – Table 6, Section 8								

The data presented in **Table 2.2** records that approximately 216 million tonnes of coal occurs within the lower HC2 ply which constitutes the proposed mining section.

The assessment of the recoverable coal resources in the Project Site conducted by SRK Consulting (SRK) established that approximately 74% of the coal or approximately 160 million tonnes could be recovered by continuous miner methods from the Project Site.

2.2.4 Spontaneous Combustion Potential

Based on the coal quality data, Beamish (2006) concluded that the Hoskissons Coal Seam in the Narrabri area has a high to very high propensity for spontaneous combustion.

Management of the spontaneous combustion risk would incorporate the following elements.

- A spontaneous combustion management plan approved by DPI (MR) incorporating an underground mine design to obviate risk of spontaneous combustion.
- Underground gas monitoring.
- Minimisation of the length of time coal is held in stockpiles.
- Monitoring of coal stockpiles for signs of spontaneous heating.
- A comprehensive reporting system.
- An action plan to promptly address any evidence of spontaneous heating.

2.3 MINE PLANNING

2.3.1 Introduction

Once the characteristics of the coal resource within the northern section of EL 6243 were better understood, the Proponent commenced planning a mining operation to responsibly and safely recover a substantial part of the defined coal resource. At the outset, it was recognised the coal resource may be suitable for extraction by longwall mining methods, however, given the absence of any experience with longwall mining in this area, the Proponent favoured a staged approach by first commencing with a continuous miner operation to confirm mining conditions. Mine planning needed to consider economic, geological, geotechnical and environmental issues, all of which contribute to a successful mine design. Details of these considerations are set out in the following sub-sections followed by an overview of the staged approach to mining the defined coal reserve.

2.3.2 Economic Considerations

In assessing the economic issues relevant to the design of the Narrabri Coal Project, the Proponent has drawn on experience gained by an associated company, Namoi Mining Pty Ltd, which mined the Hoskissons Coal Seam with continuous miners at Gunnedah Colliery from 1996 to early 2000. This experience has provided a high level of confidence with respect to productivity levels that can be expected from a continuous miner operation at the Project Site in similar seam conditions.

Although the Project Site is almost 400km from Port Newcastle and the cost of rail freight would be significantly higher than that for producers in the Hunter Valley, a number of economic considerations offset this disadvantage.

The low ash, low sulphur quality of in-situ coal in the proposed 4.2m thick working section would enable an unwashed, raw coal thermal product to be produced and sold into the export market. The high quality ensures that there would be a ready market for the coal.

An important consideration in defining the location of the Pit Top Area was the positioning of the rail loop with respect to the North Western Branch Railway Line and road crossing of the railway line from the Kamilaroi Highway. The location of the rail loop and road crossing was ultimately made on a combination of practical, environmental, safety and economic grounds. The selected location for the rail loop would minimise the removal of native vegetation and impacts of flooding whilst the use of the existing railway level crossing (upgraded) would provide a long term safe crossing point for use by all local motorists.

2.3.3 Geological Considerations

The exploration results identified that the coal resource included large areas which appear to be free of major structural disturbance and accordingly these areas would support a high production continuous miner operation. Potential appears to exist for much of the coal reserve to be recovered by longwall mining methods.

The geological data compiled enabled the eastern-most and shallowest area where the Hoskissons Coal Seam is present to be defined. This area then contributed to defining the locations of the box cut and portals for the transport drift and conveyor drift, ie. based on a 1:6.5 (V:H) gradient and the need to locate the base of the drifts (the Pit Bottom Area) centrally within the resource area.

2.3.4 Geotechnical Considerations

A range of geotechnical studies have been undertaken to assist in the design of the project. These studies have provided important information used in the planning of the proposed underground mine and include the following.

- Geophysical logging of drill holes by GroundSearch Australia.
- Detailed regional aeromagnetic survey by SRK Consultants.
- Geological modelling by JB Mining Services to assess structural, stratigraphic and coal seam data.

- Geotechnical testing of the rocks / strata which overly the coal seam by Australia Soil Laboratories.
- Stress direction testing by Sigra Pty Ltd.
- Coal seam gas analysis by Earth Data Geological Consultants.
- Groundwater testing and modelling by GHD Pty Ltd, RCA Australia Pty Ltd and Coffey Geotechnics.*
- Assessment of the spontaneous combustion potential of the Hoskissons Coal Seam (Beamish, 2007).

*The relevant data / information from this study can be referred to in Part 2 of the *Specialist Consultant Studies Compendium*. All other information is held on company files.

In addition to the geotechnical studies listed above, a geotechnical risk interpretation of structural factors that may influence mining conditions was carried out by Mining Geotechnical Services Pty Ltd using the assembled geological and geophysical data. The analysis investigated subsidence and subsurface fracturing for Stage 1 extraction and concluded that subsidence would not exceed 20mm as a result of Stage 1 mining.

Stage 2 subsidence was also assessed conceptually as a number of significant factors, including mining method and panel geometry, have yet to be determined. Worst case conditions were assumed with Section 2.16 of this document providing an overview of likely operations and Section 4, Part C presenting a preliminary assessment of environmental impacts (based on worst case subsidence levels).

Stage 1 mine design parameters were formulated to ensure that surface subsidence as a result of mining remains less than 20mm. Subsidence parameters are provided as expected values based on empirical analysis (refer to Part 8 of the *Specialist Consultant Studies Compendium*). Further information regarding the subsidence values determined and the associated impacts is presented in Section 4B.8.

2.3.5 Environmental Considerations

As the proposed mine would be an underground operation designed not to generate more than 20mm surface subsidence during Stage 1 continuous miner operation, the environmental considerations primarily relate to the location of surface infrastructure, ie. the Pit Top Area and Ventilation Shaft Area.

- <u>Vegetated Land / Agricultural Land</u>

  The Pit Top Area was located within cleared paddocks to minimise clearing of native vegetation and utilise already disturbed land. The Pit Top Area was located close to the Kamilaroi Highway and nearby rail corridor in order to minimise fragmentation of agricultural land.

- Ecological Considerations

  The Pit Top Area was located within existing disturbed land, to avoid or minimise interaction with surface water drainage lines and any associated riparian habitat corridors and to minimise clearing and fragmentation of existing wildlife habitat corridors.

- Aboriginal Heritage

  An archaeological survey of the Pit Top Area and Ventilation Shaft Area identified seven Aboriginal archaeological sites consisting of two isolated finds, two artefact scatters, two scarred trees and one resource site. The location of surface structures within these areas has been designed to avoid disturbance to the identified sites. Additionally, and to ensure the avoidance of accidental disturbance to these or other sites on the Project Site, the development and operation of the project would require appropriate fencing of the sites in close proximity to project activities, the prevention of disturbance to the watercourses that traverse the Project Site and the monitoring of sub-surface soil excavations by representatives of the Narrabri Local Aboriginal Land Council. The Proponent would also abide by the provisions of the *National Parks and Wildlife Act 1974* in relation to the identification of additional Aboriginal archaeological sites following the approval and commencement of the project.

- Water Resources

  The groundwater that would be encountered by the underground workings is saline with an average total dissolved solids concentration of >10 000mg/L. Based on groundwater modelling undertaken by GHD (see Part 2 of the *Specialist Consultant Studies Compendium*), it has been estimated that approximately 30ML of groundwater would be intercepted during the first year of mining, increasing steadily as the total volume of void space increases underground to around 818ML per year (after approximately 25 years) before decreasing again and fluctuating about 690ML per year. This volume of water would be greater than that required for operational purposes and due to its saline nature would require storage and segregation from natural surface water drainage on the Project Site. Surface water storage structures have therefore been designed to provide for the storage and evaporation of the dewatered groundwater. Section 2.5.3 provides the design and location of these structures, based on recommendations provided by WRM (2007) – see Part 1 of the *Specialist Consultant Studies Compendium*. Contingency planning has also been completed in the event that actual mine in-flows would eventually lead to the capacity of the evaporation / storage ponds to contain a 1 in 100 year ARI rain event without overflowing being exceeded. Section 2.4.10.4 provides additional detail on the proposed contingency planning.

  Potential impacts on the water quality, flow rates and flooding patterns of local tributaries of Kurrajong Creek have also been considered in the project design. The Project Site layout presented in this section, has been arrived at based on an assessment of these factors by WRM (2007) with greater detail on the mitigation measures and operational safeguards to be adopted by the Proponent presented in Section 4B.1.4.

- Noise

  An assessment of the likely noise generation of the project was conducted to ensure that the noise levels experienced by residents on the surrounding properties remains within the noise criteria nominated by the DEC. In order to ensure compliance with the noise criteria, some construction activities would be restricted during adverse weather conditions or temperature inversions. Section 4B.9 presents these restrictions, based on the recommendations of Spectrum Acoustics (2007) – see Part 7 of the *Specialist Consultant Studies Compendium*.

2.3.6 Staged Approach

The Proponent has decided to develop the Narrabri Coal Project in two stages. **Figure 2.4** displays the sequence of development during Stage 1 whilst the details of envisaged Stage 2 operations are presented in Section 2.16. **Figure 2.4** presents an indicative illustration of the sequential development of the mine. Areas A, B and C are identified and it can be seen that beyond the first 2 to 3 years (following extraction from Area B) the mine could continue to a longwall operation.

As described previously, Stage 1 would be an operation based solely upon the use of underground continuous miners for the development of a network of underground roadways through the centre and along the eastern margin of the resource. From the Pit Bottom Area, mining would commence along the "West Main" and comprise up to eight individual roadways (5.5m wide and 4m high) that are linked at regular intervals along the mains. The coal pillars between the individual roadways would be sufficiently wide (typically about 27m) so that the subsidence at the surface above the mined area would not exceed 20mm. The West Main would be developed first to form underground connections between the Pit Bottom Area and the vertical ventilation shaft.

Other Stage 1 activities planned include the following.

(i) Secondary partial extraction in Area B. The pillars retained in Area B would be designed to ensure the resultant subsidence at the surface is <20mm. The configuration of mining within Area B would also be designed to maximise underground storage of saline water intercepted at lower elevations in the mine.

(ii) The development of further panel roadways by continuous miners in Area C. The spacing and orientation of these roadways would reflect the outcome of the geotechnical and related assessments of the issues relating to caveability. In the event that longwall mining is demonstrated to be technically feasible, the roadways would provide the access necessary for the subsequent installation of one or more longwall units.

If the geotechnical assessment of the potential for longwall mining establishes that it would be inappropriate for longwall mining to proceed in Area C, all future roadways would be mined in a manner similar to those in Area B, ie. providing for controlled secondary partial extraction without subsidence at the surface exceeding 20mm. In this case, the recovery of coal would

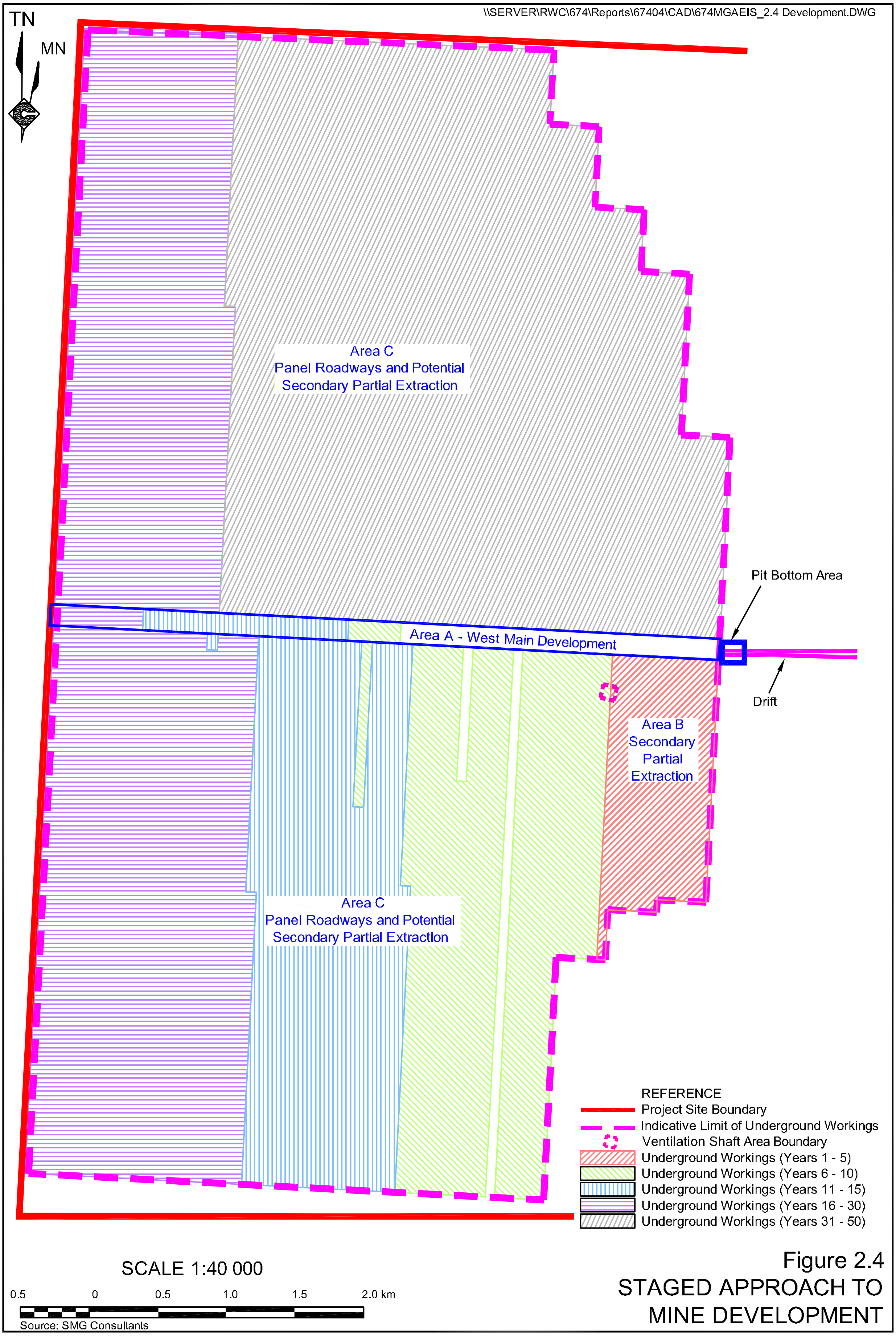

Figure 2.4
STAGED APPROACH TO MINE DEVELOPMENT

continue throughout Area C for the remaining life of the mine. **Figure 2.4** presents the progression of Stage 1 mining in increasing time increments to provide the reader with an understanding of planned mine progression using continuous miner methods. The actual progression of the mine may vary from that presented in **Figure 2.4**, however, it should be noted the DPI (MR) would be required to approve official mine plans as part of a Mining Operations Plan (MOP) for the Narrabri Coal Project.

2.4 SITE ESTABLISHMENT

2.4.1 Introduction

Site establishment would involve the following tasks.

- Vegetation clearing and topsoil and subsoil stripping (refer to Sections 2.4.2 and 2.4.3).
- Upgrading / construction of a site access road from the Kamilaroi Highway to the Pit Top Area including an upgrade of the existing railway level crossing and the intersection with the Kamilaroi Highway (refer to Section 2.4.4).
- Construction of surface infrastructure within the Pit Top Area including offices, car park, water storages, workshop, bulk supplies and fuel storage and bathhouse (refer to Section 2.4.5).
- Erection of the crushing / sizing plant and construction of the ROM and product stockpile areas (refer to Section 2.4.6).
- Development of a box cut, transport drift and conveyor drift to the associated Pit Bottom Area for commencement of underground coal mining (refer to Section 2.4.8).
- Construction of a ventilation shaft for ventilation of the underground mine workings (refer to Section 2.4.7). Until this shaft is completed, the drifts and Pit Bottom Area would be ventilated by a fan located within the box cut.
- Earthworks for and construction of a rail loop from the North Western Branch Railway to the Pit Top Area (refer to Section 2.4.9).
- Construction of a range of water management structures including the initial two evaporation / storage ponds (refer to Section 2.4.10).

Table 2.3 lists the indicative areas of disturbance associated with all components of the Pit Top Area, Ventilation Shaft Area and Evaporation / Storage Ponds. In total, up to 49ha of land would be disturbed by all surface and related facilities.

Figures 2.5 and **2.6** display the layouts of the areas to be disturbed during the site establishment phase.

Table 2.3
Indicative Areas of Disturbance During Site Establishment

Component	Area (ha)
Box Cut and Drift Portals	1.0
Perimeter Amenity Bund	6.8
ROM Coal Stockpile Area	1.2
Crushing / Sizing Plant	0.2
Product Stockpile Area	1.2
Surface Buildings	2.3
On-site Tracks	0.6
Site Access Road	2.7
Rail Loop	4.7
Evaporation / Storage Ponds	26.5
Ventilation Shaft Area	0.5
TOTAL	**48.7**

2.4.2 Vegetation Clearing

The Pit Top Area has been located on cleared agricultural land that contains a very limited number of scattered individual trees. While it is intended that all of these trees would be avoided during the establishment of the Pit Top Area, there may be unforeseen design issues identified during site establishment that may require the removal of one or more individual trees. A small number of individual trees would also need to be removed to provide for an adequate road width for the ventilation shaft access road, the rail loop from the North Western Branch Railway Line and to provide adequate sight distance and intended roadworks at the intersection with the Kamilaroi Highway.

The area indicated on **Figure 2.1** for the ventilation shaft is within a largely vegetated area, selected primarily as it affords a visual buffer for the infrastructure. It is anticipated that the ventilation shaft can be constructed within the already cleared areas within the ring of vegetation. A small number of individual trees may require clearing to provide for manoeuvring of construction equipment, however, any clearing requirements would be minimised as much as is practicable.

Any required felling of individual trees would be undertaken in a single campaign as part of site establishment. The trees would be visually inspected for roosting or nesting fauna prior to clearing, with any fauna identified appropriately relocated. Trees would be broken into small sections and either used for landscaping purposes or positioned within the vegetation around the Ventilation Shaft Area to provide fauna habitat.

All groundcover vegetation would be stripped with the topsoil to ensure maximum retention of nutrients and to facilitate the rapid vegetation of the soil stockpiles to minimise the opportunity for erosion.

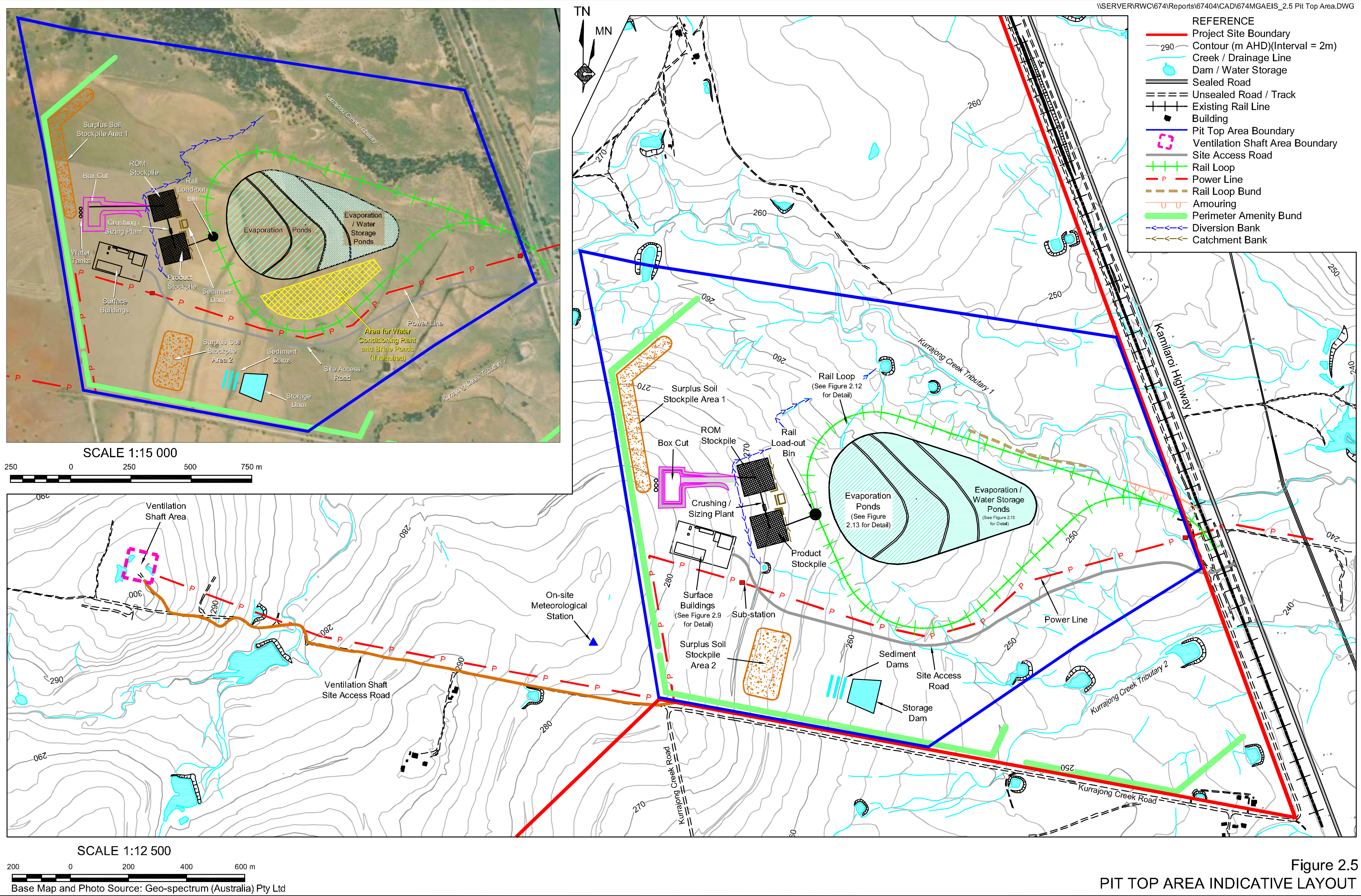

Figure 2.5
PIT TOP AREA INDICATIVE LAYOUT

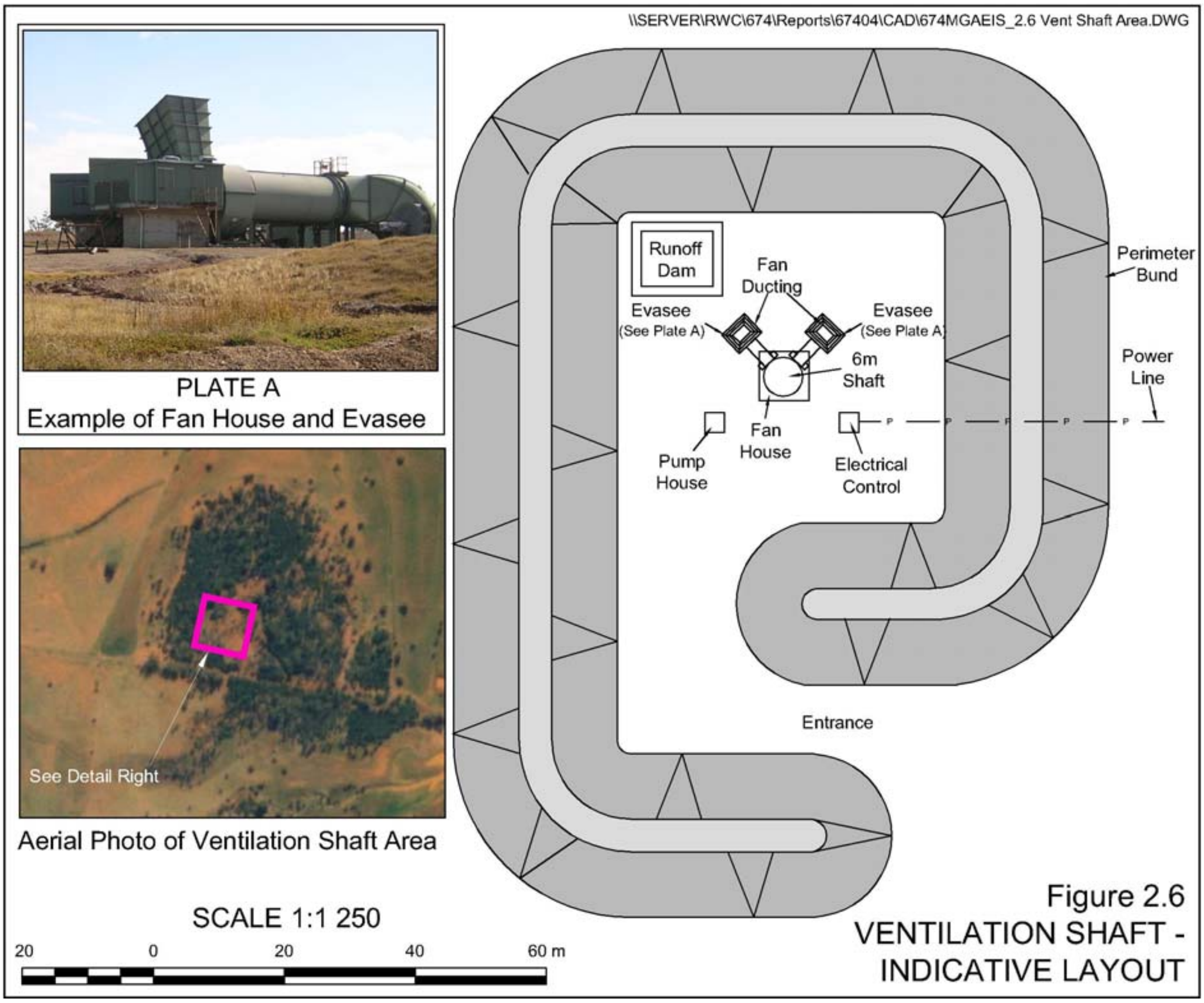

Figure 2.6
VENTILATION SHAFT - INDICATIVE LAYOUT

2.4.3 Soil Removal

2.4.3.1 Introduction

The soil materials within the proposed areas of disturbance were described and assessed by Geoff Cunningham Natural Resource Consultants (GCNRC, 2007) – see Part 5 of the *Specialist Consultant Studies Compendium*. The assessment identified:

- the suitability of the soils present for stripping and long-term stockpiling; and
- the requirement for specific stripping and stockpiling methods and/or erosion control measures.

The assessment was based on field and laboratory examinations of key physical and chemical attributes.

Soil stripping would only be required within the proposed areas of surface disturbance listed in **Table 2.4**. Emphasis would be placed upon using as much soil as is necessary during the site establishment phase to provide for the long term stabilisation of disturbed areas, particularly the perimeter amenity bund. All surplus soil would be stockpiled for the long term rehabilitation of the Pit Top Area.

2.4.3.2 Soil Categories and Stripping

Three soil mapping units (SMUs) were identified within the areas of proposed surface disturbance. **Figure 2.7** presents the location of the soil mapping units and **Table 2.4** provides a summary of the soil stripping suitabilities and proposed procedures for each.

Table 2.4
Soil Stripping Suitability and Procedures

Layer (Thickness)	Material	Stripping Suitability	Proposed Soil Stripping Procedures
SMU 1			
1 (15cm)	Topsoil	Marginally suitable for stripping in all proposed disturbance areas	1. Clearly mark the limits of the area to be stripped. 2. Strip topsoil to recommended depth. 3. Stockpile in the nominated stockpile area. 4. Stabilise stockpiles as quickly as practicable with pasture cover.
2 (25cm)	Subsoil	Marginally suitable for stripping	1. Strip subsoil to the recommended depth in the areas of disturbance. 2. Stockpile in the nominated stockpile area. 3. Stabilise stockpiles as quickly as practicable with topsoil veneer and pasture cover.
3 (not defined)	Potentially Saline Soil	Not suitable	Avoid stripping, where possible.
SMU 2			
1 (15cm)	Topsoil	Suitable for topsoiling	1. Clearly mark the limits of the area to be stripped. 2. Strip topsoil to recommended depth. 3. Stockpile in the nominated stockpile area. 4. Stabilise stockpiles as quickly as practicable with pasture cover.
2 (25cm)	Subsoil	Suitable for subsoiling	1. Strip subsoils only in areas of greater disturbance, ie. do not strip in areas for buildings, hardstand areas and surface facilities. 2. Strip subsoil to the recommended depth in the nominated areas. 3. Stockpile in the nominated stockpile area. 4. Stabilise stockpiles as quickly as practicable with pasture cover.
3 (not defined)	Remainder of Profile	Suitable for rehabilitation prior to subsoil and topsoil placement if required	1. Strip material in areas of disturbance to depths >65cm, as required. 2. Stockpile in nominated stockpile location. 3. Stabilise stockpiles as quickly as practicable with pasture cover.
SMU 3			
1 (15cm)	Topsoil	Marginally suitable for stripping in all disturbance areas	1. Clearly mark the limits of the area to be stripped. 2. Strip topsoil to recommended depth. 3. Stockpile in the nominated stockpile area. 4. Stabilise stockpiles as quickly as practicable with pasture cover.
2 (not defined)	Remainder of profile	Not suitable	Avoid stripping, where possible.
Source: Modified after Geoff Cunningham Natural Resource Consultants Pty Ltd (2007) – Section 7.2			

The majority of the Pit Top Area lies in SMU 2, with a section of the northern part of the rail loop in SMU 1. The Ventilation Shaft Area lies within SMU 3, and as such, only topsoil would be stripped in this area, ie. in areas where the natural topsoil remains.

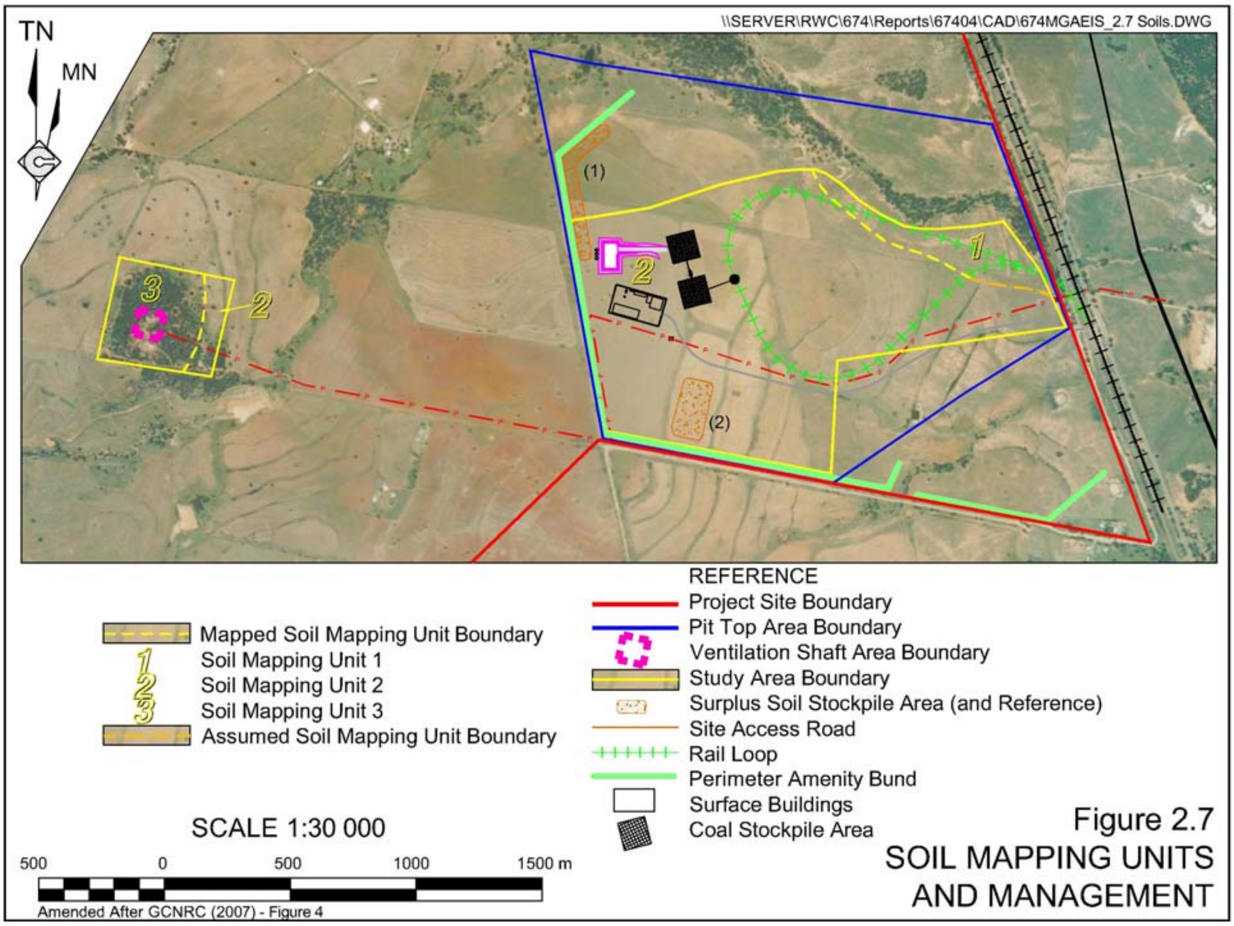

Figure 2.7
SOIL MAPPING UNITS AND MANAGEMENT

2.4.3.3 Soil Stockpiling Methods

All soils within areas to be disturbed during the site establishment phase would need to be stockpiled, either short term or long term. Short term soil stockpiling procedures would be used for those areas where the soil is to be re-used within 3 months to stabilise disturbed areas whereas long term soil stockpiling procedures would be used for soils that need to be stored for the life of the mine.

All soil would be stripped in accordance with the depths proposed in **Table 2.4** using mainly open-bowl scrapers. Both topsoils and subsoils would be stockpiled separately to enable their easy recognition and retrieval once rehabilitation is underway. The locations of all long-term soil stockpiles would be surveyed and documented on the Pit Top Area "as constructed" plans.

All topsoil stockpiles would not exceed 2m in height and subsoil stockpiles would not exceed 3m in height. The individual stockpiles would be shaped and trimmed using bulldozers, with the dimensions of each stockpile reflecting the method of construction, the area available and avoidance of natural or created drainage lines. All long term subsoil stockpiles would be covered with a thin veneer of topsoil. The surfaces of all long term stockpiles would be left with a 'rough' surface to assist in runoff control, seed retention and germination. Due to the intended longevity of stockpiling, all long term stockpiles would be seeded using a pasture cover crop to reduce erosion potential and assist in the maintenance of the biological viability of the soil resource. This stabilisation would be undertaken as soon as practicable after the construction of the stockpile to minimise erosion.

Following stockpile construction, the operation of machinery on the topsoil and subsoil stockpiles would be avoided in order to prevent compaction and maintain soil aggregation.

2.4.3.4 Soil Stockpiling Locations

Table 2.5 lists the indicative quantities of topsoil and subsoil within each of the components to be disturbed and the proposed method of use/stockpiling. Essentially, all topsoil and subsoil to be reused during the site establishment phase would be stockpiled in close proximity to the area where it is to be reused. All topsoil and subsoil not re-used would be separately stockpiled. **Figure 2.7** displays the indicative locations of the two surplus soil stockpile areas (1 and 2) that would be used for the long term storage of topsoil and subsoil.

Table 2.5
Indicative Quantities of Topsoil and Subsoil to be Stripped

Component	Area	Volume (m^3)		Method of Use/Stockpiling*
	(ha)	Topsoil	Subsoil	
Box Cut and Drift Portals	1.0	1 500	2 500	C
Perimeter Amenity Bund	6.8	10 200	17 000	B
ROM Coal Stockpile Area	1.2	1 800	3 000	C
Crushing / Sizing Plant	0.2	300	500	C
Product Stockpile Area	1.2	1 800	3 000	C
Surface Buildup	2.3	3 450	5 750	C
On-site Tracks	0.6	900	1 500	C
Site Access Road	2.7	4 050	6 750	D
Rail Loop	4.7	7 050	11 750	D
Evaporation / Storage Ponds	26.5	39 750	66 250	A
Total	**48.7**	**70 800**	**118 000**	

***Method of Use/Stockpiling**
A - Soil stockpiled around the perimeter of the Evaporation / Storage Ponds.
B - Soil replaced following construction and supplemented with soil from the Site Access Road and Rail Loop.
C - Soil stockpiled in Surplus Soil Stockpile Area 1 for ultimate rehabilitation.
D - Some soil used on Perimeter Amenity Bund and surplus soil placed in Surplus Soil Stockpile Areas 1 and/or 2.

Soil Stockpile Area 1 would provide storage for approximately 14 000m^3 of topsoil and 25 000m^3 of subsoil whilst Soil Stockpile Area 2 would provide storage for approximately 8 000m^3 of topsoil and 12 000m^3 of subsoil.

2.4.4 Site Access Road, Railway Crossing and Intersections

This section presents the design features for the Site Access Road, North Western Branch Railway Crossing and the three road intersections that would be used by project-related traffic. Further detail and justification for these designs is provided in Section 4B.8.4 as part of an assessment of the impacts associated with project traffic.

Site Access Road

The proposed alignment of the Site Access Road is depicted on **Figure 2.5** and includes use of the existing intersection with the Kamilaroi Highway and the level crossing over the North Western Branch Railway. The Site Access Road would commence at an intersection with the Kamilaroi Highway just beyond the railway level crossing and continue in a westerly direction to the light vehicle car park within the Pit Top Area.

The Site Access Road would be constructed as a two lane, sealed road with an 8m pavement width and 1m wide unsealed shoulders. Topsoil and subsoil would be stripped from the road disturbance footprint and the area filled with gravel (see Detail A on **Figure 2.8**) drawn from the Ventilation Shaft Area and supplemented with material supplied from an approved gravel quarry on the "Bow Hills" property[1]. In order to allow for the continued flow of surface water towards Kurrajong Creek Tributary 2, roadside drains would be constructed along the length of the road directing water to a series of culverts at natural drainage points within the existing landform. These natural drainage points are identified on **Figures 2.5** and **2.8**.

North Western Branch Railway Crossing

The existing level crossing over the North Western Branch Railway would be upgraded to provide flashing lights and warning bells. The road pavement for 5m both sides of and between the railway lines would be concreted to strengthen the crossing (see Detail B on **Figure 2.8**).

Kurrajong Creek Road – Site Access Road Intersection

A "T" intersection would be constructed between the existing Kurrajong Creek Road (terminating road) and the proposed Site Access Road (through road) (see **Figure 2.8**). Access beyond the "T" intersection to the "Turrabaa" property (owned by the Proponent) would be closed and the track rehabilitated.

Kurrajong Creek Road would be sealed for a distance of approximately 200m from the intersection with a "Stop" sign erected for northbound vehicles on Kurrajong Creek Road.

Site Access Road – Kamilaroi Highway Intersection

The intersection between the Site Access Road and the Kamilaroi Highway would be upgraded to RTA standards (see **Figure 2.8**). The distance between the holding line of the railway crossing and the edge line of the new pavement formation would be 38m, thereby meeting the RTA requirement of 26m. In order to ensure that no vehicle remains stationary within the Kamilaroi Highway through lane during periods of railway crossing closure (to allow through rail traffic), channelised right and left turn lanes have been incorporated into the design of the intersection. Based on a worst-case scenario during a 6 minute closure of the Kurrajong Creek Road railway crossing, Constructive Solutions[2] have designed a 98m channelised right turn lane with a 100m deceleration lane taper, ie. 198m lane[3], and a 65m channelised left turn lane with a 100m deceleration lane taper.

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[1] The Bow Hills Gravel Quarry was approved on Narrabri Shire's gravel pit register on 15 May 1990 and referred to as SR 23. Following the gazetting of SEPP 37 in 1993, a development application for the quarry was submitted (No. 101/1995) and approved on 25 October 1995.

[2] Constructive Solutions are road design/engineering consultants to the Proponent. Constructive Solutions has previously provided approved intersection designs for intersections associated with the Tarrawonga (East Boggabri) Coal Mine.

[3] As the majority of project related traffic is anticipated to arrive from Narrabri, ie. from the north, the 38m section of road between the Kamilaroi Highway and holding line of the railway crossing has been incorporated into the right turn lane, thereby reducing the length on the Kamilaroi Highway right turn lane to 160m.

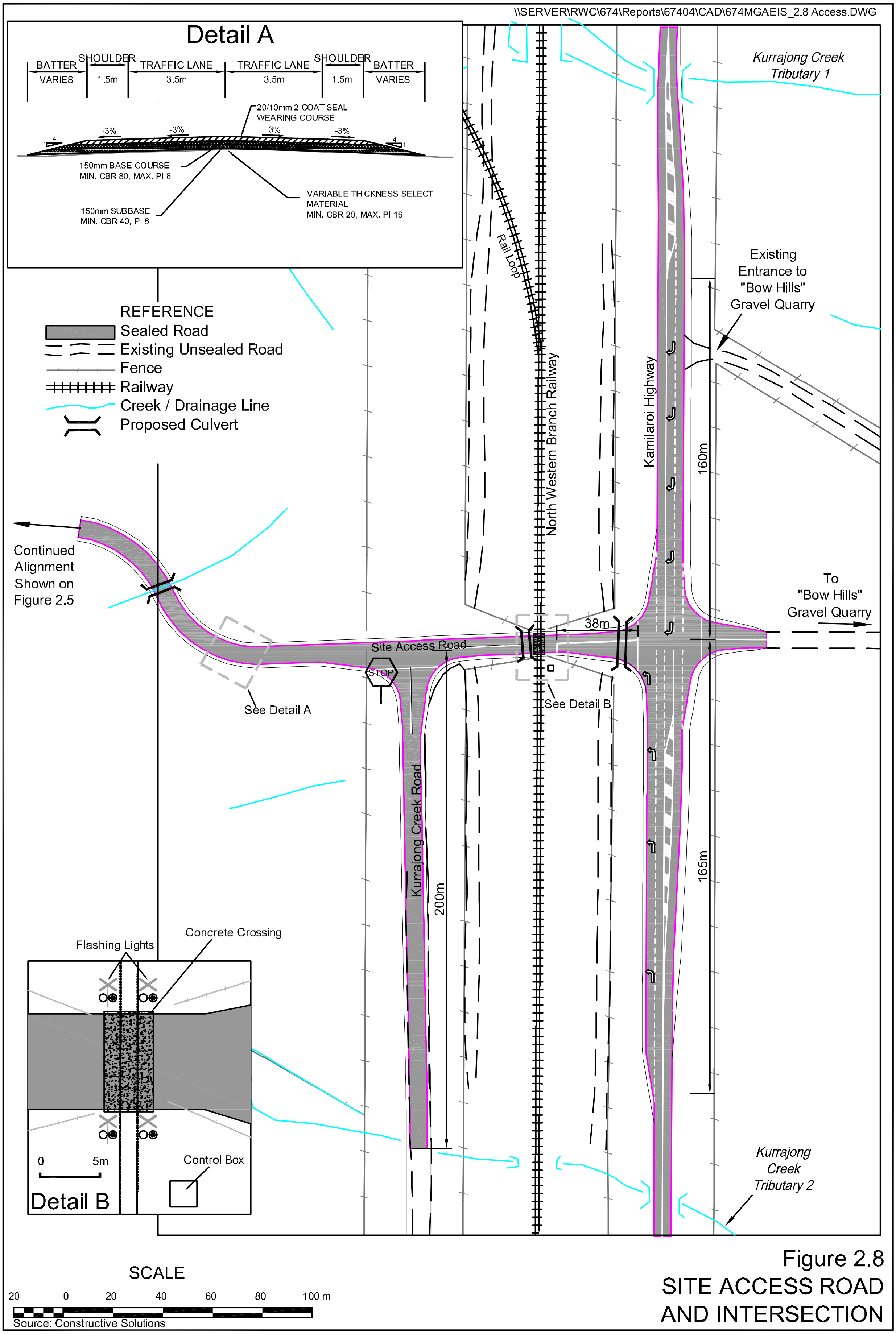


Figure 2.8
SITE ACCESS ROAD AND INTERSECTION

Section 4B.8.3 presents in greater detail, the considerations made in the design of the intersection and railway crossing.

Kamilaroi Highway – Gravel Quarry Access Road

An approved intersection between the Kamilaroi Highway and "Bow Hills" gravel quarry is located approximately 100m north of the railway crossing.

In order to avoid complications with the channelised right turn lane that would be constructed on the Kamilaroi Highway, it is proposed this intersection would be relocated to directly opposite the railway crossing (see **Figure 2.8**). This would allow any vehicle awaiting entry to the crossing to remain off the Kamilaroi Highway until such time as the crossing is re-opened and the intersection cleared. The relocation of the intersection would be subject to a modification of the approval of the "Bow Hills" gravel quarry (SR 23) by Narrabri Shire Council.

Alternatively, drivers would exit the "Bow Hills" property via the approved intersection, enter onto the Kamilaroi Highway and use the channelised right turn lane of the Site Access Road – Kamilaroi Highway intersection.

2.4.5 Pit Top Area Surface Infrastructure

The Pit Top Area would be constructed largely within cleared paddocks. Where possible, any large individual trees would be retained. Where areas need to be levelled or built up as a base for specific items of infrastructure, either the material excavated from drift construction or cut and fill methods would be used.

The surface infrastructure and their likely dimensions and construction material is presented in **Table 2.6** and **Figure 2.9**. Services planned for the Pit Top Area are detailed in Section 2.9.

Table 2.6
Pit Top Area Surface Infrastructure

Infrastructure Item	Indicative Area (m^2)	Building Height (m)	Construction Material	Use/Other
Car park	2 000	-	Sealed pavement	Would be defined by bollards
Office, bathhouse and assembly area	1 080	5	Transportable buildings	Would be constructed to meet relevant building codes.
Mechanical and electrical workshop and store	600	8	Transportable buildings	Mechanical workshop would be surrounded by a drain to the oil/water separator.
Vehicle wash bay	60	-	-	Surrounded by a drain to the oil/water separator to recycle water.
50 000L fuel storage	90	3	Self contained tank (double lined)	Draining to oil/water separator.
Switch room	70	5	Sheet metal	Power distribution.
Compressor shed	36	5	Sheet metal	Compressor storage.
Hardstand	3 150	-	Gravel	To store equipment
Bulk supplies/ stone dust	350	5	Sheet Metal	Covered storage
Water tanks (x3)	80 (total)	5	Steel / Concrete	10m diameter (volume = 3 x 100 000L)

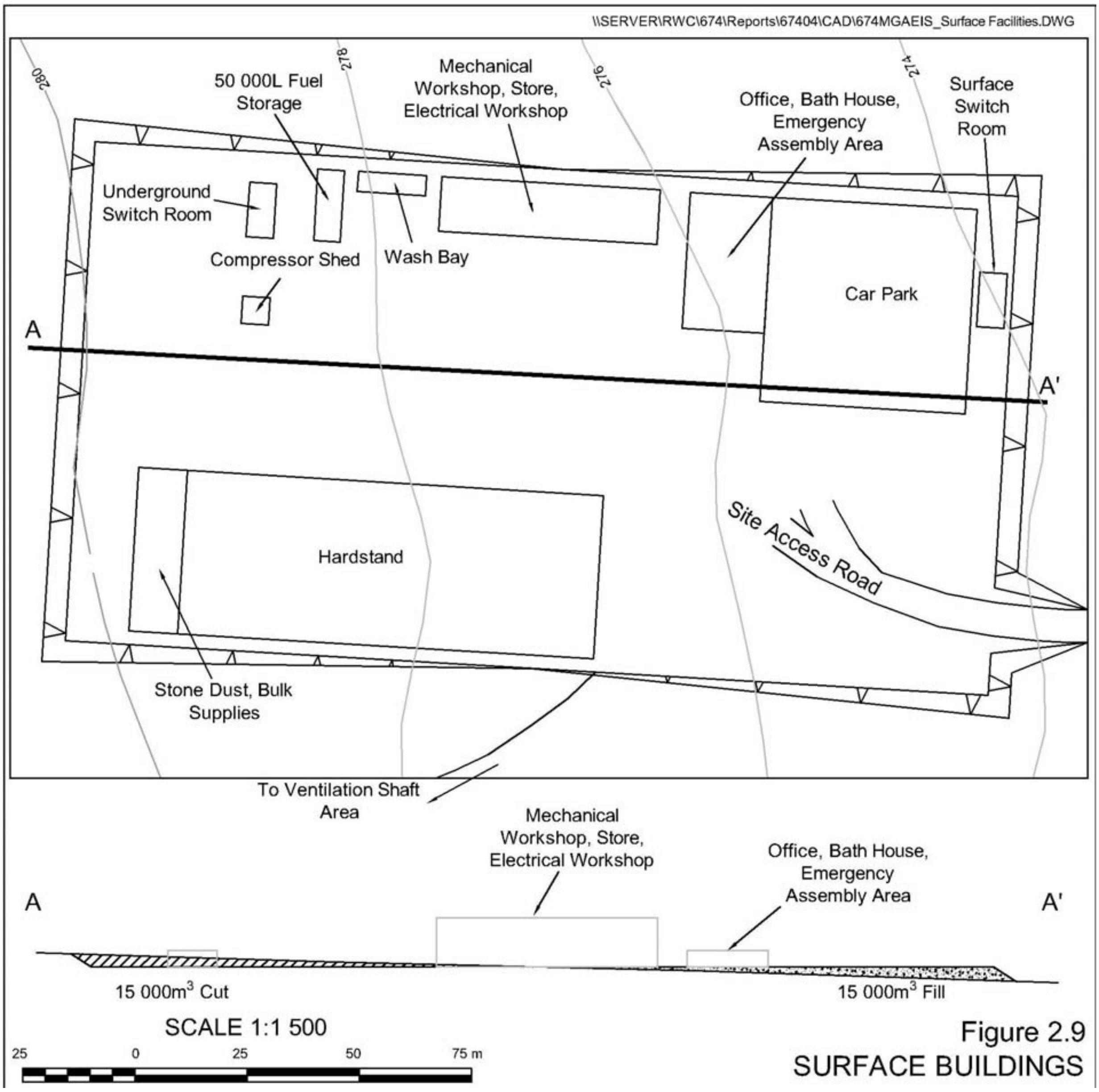


Figure 2.9
SURFACE BUILDINGS

The Pit Top Area would be lit with soft lighting to minimise impact on surrounding residents while allowing for evening maintenance and deliveries and night train loading activities.

The Site Access Road to the main office would be sealed, as would the Pit Top Area car park. The roads between different components of the Pit Top Area would be unsealed given the equipment using those roads would often be tracked rather than rubber-tyred.

Landscaped areas would be created around the office, bathhouse and assembly area using native vegetation.

2.4.6 Crushing / Sizing and Stockpiling Infrastructure

The crushing / sizing and stockpiling infrastructure would consist of a ROM coal stockpile area, a crushing / sizing plant and a product stockpile area, all connected by a series of conveyors and stackers (**Figure 2.10**). The infrastructure would be established on flat pads constructed principally through cut and fill methods and using mined rock sourced from the box cut, transport drift and conveyor drift excavation. The combined ROM and product stockpile area would be isolated from upslope runoff and provided with a sediment trap and water storage dam to collect and retain all runoff from within the stockpile area.

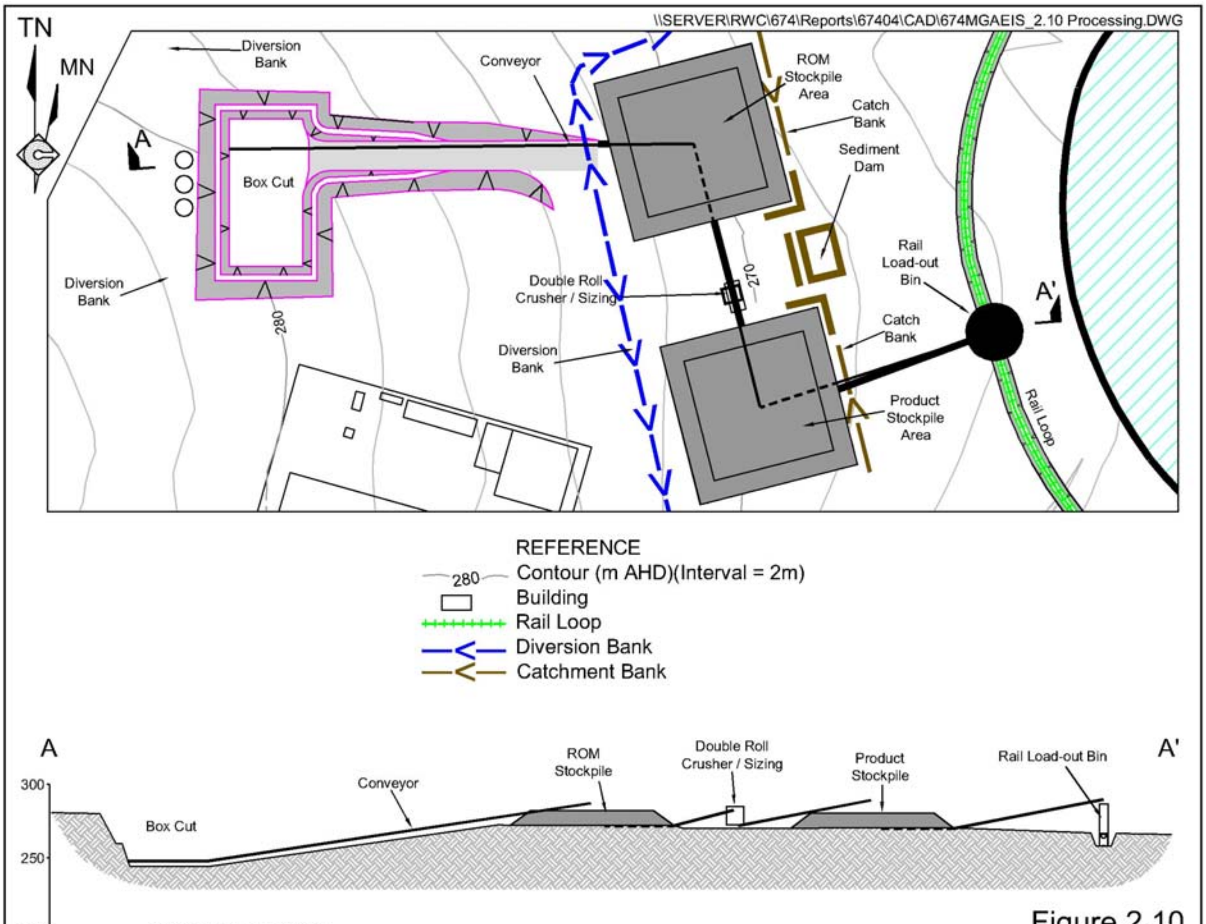


Figure 2.10
COAL STORAGE AND PROCESSING AREA
INDICATIVE LAYOUT

The indicative dimensions and details of the individual infrastructure items are as follows.

- ROM Coal Stockpile Area
  - Indicative pad dimensions: 110m x 110m.
  - Maximum stockpile height: 10m.

- Crushing / Sizing Plant
  - Anticipated type: double roll crusher.
  - Capacity: 2 000tph.
  - Noise mitigation: enclosed.
  - Dust mitigation: enclosed and strategic water sprays – coal is pre-wet (refer to Section 2.6.1).

- Product Stockpile Area
  - Indicative pad dimensions: 110m x 110m.
  - Maximum stockpile height: 10m.

2.4.7 Ventilation Shaft

The ventilation shaft would be constructed in an area already disturbed by previous quarry activities and surrounded by comparatively tall vegetation, which would provide a visual screen up to a height of approximately 8m. Access to the Ventilation Shaft Area would be via an existing unsealed farm track which would be upgraded and maintained for the life of the project.

Construction of the ventilation shaft would involve its excavation from the surface to the base of the mine (approximately 220m deep) by either conventional drill and blast or blind boring. The shaft would be approximately 6m in diameter and supported with roof bolts and mesh as required. If significant groundwater is intersected during construction, those sections of the shaft would be sealed using shotcrete, in-strata grouting or hydrophobic sealant. Irrespective of the method of construction, the equipment used would be fitted with appropriate silencers and the material removed would be used to progressively form the perimeter amenity bund.

The Proponent has committed to ventilating the shaft during construction with any gas diluted to below statutory requirements by fresh air provided through the ventilation system. The measured gas contents of the coal seam are provided in Section 2.5.6.

Approximately 6 200m^3 of rock would be removed during the excavation of the shaft, all of which would be brought to the surface. A perimeter amenity bund would be constructed around the ventilation evasee principally within the area previously disturbed by quarrying activities (see **Figure 2.6**). The perimeter amenity bund would be constructed within an opening only on its southeastern side, ie. the direction from which the ventilation shaft access road approaches the Ventilation Shaft Area. **Figure 2.6** displays the layout of the Ventilation Shaft Area and **Plate A** presents a photograph of a typical ventilation fan house and evasee.

The surface infrastructure would consist of a fan house and evasee approximately 6m high, constructed of prefabricated metal. There would be two main mine fans, specifically centrifugal (rather than axial) to reduce noise. The outlet would be a standard vertical arrangement, directing an upwards discharge. The ventilation fan would be electrically powered, connected to mains power provided by an extension of the power line from the Pit Top Area along the ventilation shaft access road. As such, no vegetation would require clearing to install power supply to the Ventilation Shaft Area.

The ventilation shaft would be constructed concurrently with the mining of the West Mains (see **Figures 2.1** and **2.4**). During the construction of the ventilation shaft, mine ventilation would be provided from a surface fan located within the box cut for the two mine drifts (see Section 2.4.8). The box cut itself would provide noise attenuation for the operation of this fan. It is anticipated that only one ventilation shaft would be required to service the entire mine. In the unlikely event an additional ventilation shaft is required, the appropriate approvals process would be followed to enable further shafts to be constructed.

2.4.8 Box Cut, Transport Drift and Conveyor Drift

There would be two drifts into the underground mine, namely the transport drift providing vehicle / personnel access and the conveyor drift providing for the transportation of coal from the Pit Bottom Area to the ROM coal stockpile area.

The portals for both drifts would be located within a 100m x 50m box cut excavated to a maximum depth of 40m below the natural surface.

The weathered material within the box cut to a depth of approximately 25m below surface would be removed through free digging, ie. using an excavator and haul truck. Below approximately 25m, the material to be removed would be harder and several small blasts (up to four) may be required to fracture the material prior to removal by excavator and haul truck. The expected area at the base of the box cut requiring blasting would not exceed 5 000m^2 providing a total of 50 000bcm to 75 000bcm of material (assuming a maximum box cut depth of between 35m and 40m). The blast size required would represent a very small blast by open cut mining standards (approximately 5% of a typical blast at the Tarrawonga Coal Mine). Given the blasts at Tarrawonga Coal Mine are designed to comply with DEC criteria for ground vibration and overpressure at residences a similar distance from the blast, and each blast would be at least 25m below surface level, the relevant criteria would be easily met. The excavated material would be stored adjacent to the box cut and used in the construction of the perimeter amenity bund.

Diversion banks would be constructed around the perimeter of the box cut to reduce run-off into the box cut (see **Figure 2.10**). Rainfall and other water accumulating within the box cut would be directed to a sump with a capacity to ensure the ingress of water to the drifts is minimised.

A roadheader (such as a Mitsui Mike 200MA) would be used for the excavation of the drifts, with excavated material hauled to the surface by truck. This material would be used to surface the ROM and product stockpile pads with the remainder used in the Pit Top Area perimeter amenity bund (Section 2.4.12). The portal entries would be supported by concrete.

Beyond the portal entry, roof bolts and mesh would be used to support the drift. Although expected to be minimal, if any water in-flow occurs into the drifts during construction, it would be sealed using shotcrete, in-strata grouting or hydrophobic sealant. The drifts would be approximately 6m wide, 3.5m high and have a slope of approximately 1:6.5 (V:H) (**Figure 2.11**).

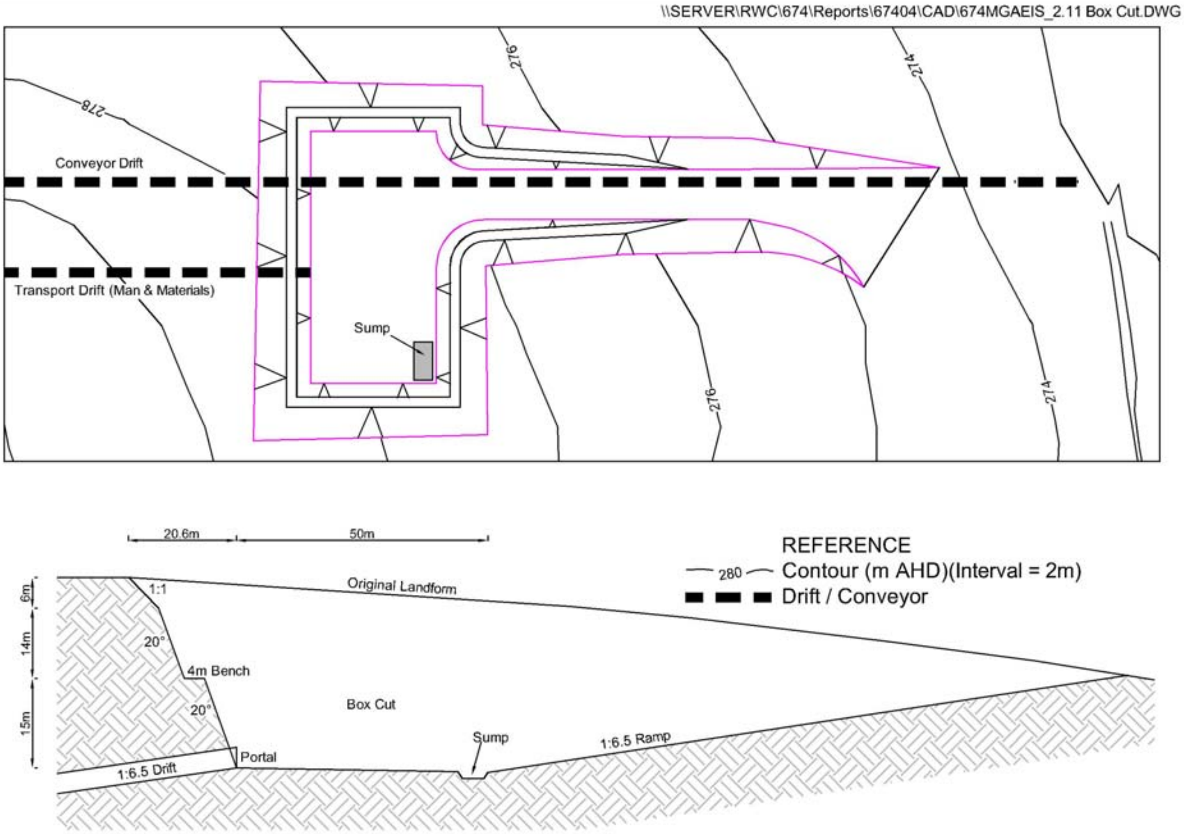


Figure 2.11
SCHEMATIC BOX CUT EXCAVATION

It is likely that blasting may be required during excavation of those sections of the drift that traverse the volcanic sill (see **Figure 2.3**). However, the sill would only be encountered at a depth of approximately 150m below ground level (vertically), and as such, blasting would have no impact at the surface.

2.4.9 Rail Loop and Load-out Bin

It is proposed to construct a rail loop from the North Western Branch Railway, located immediately east of the Project Site, onto the Pit Top Area to provide for direct product loading of trains through an overhead load-out bin. The indicative layout of both the rail loop and load-out bin is illustrated in **Figure 2.12**. Plate B on **Figure 2.12** displays a typical rail load-out bin, albeit shorter than that proposed.

Rail Loop

The rail loop would be constructed to the NSW standard gauge according to the following parameters.

- Length: approximately 3.36km.
- 100m horizontal straight section of track adjacent to and beneath the rail load-out bin with a grade to meet loading requirement of the carrier.
- Construction materials to meet standards required by Country Rail Infrastructure Corporation (CRIC) and Australian Rail & Track Corporation (ARTC).

The proposed 3.36km length is sufficient to accommodate two 84 wagon trains, if required.

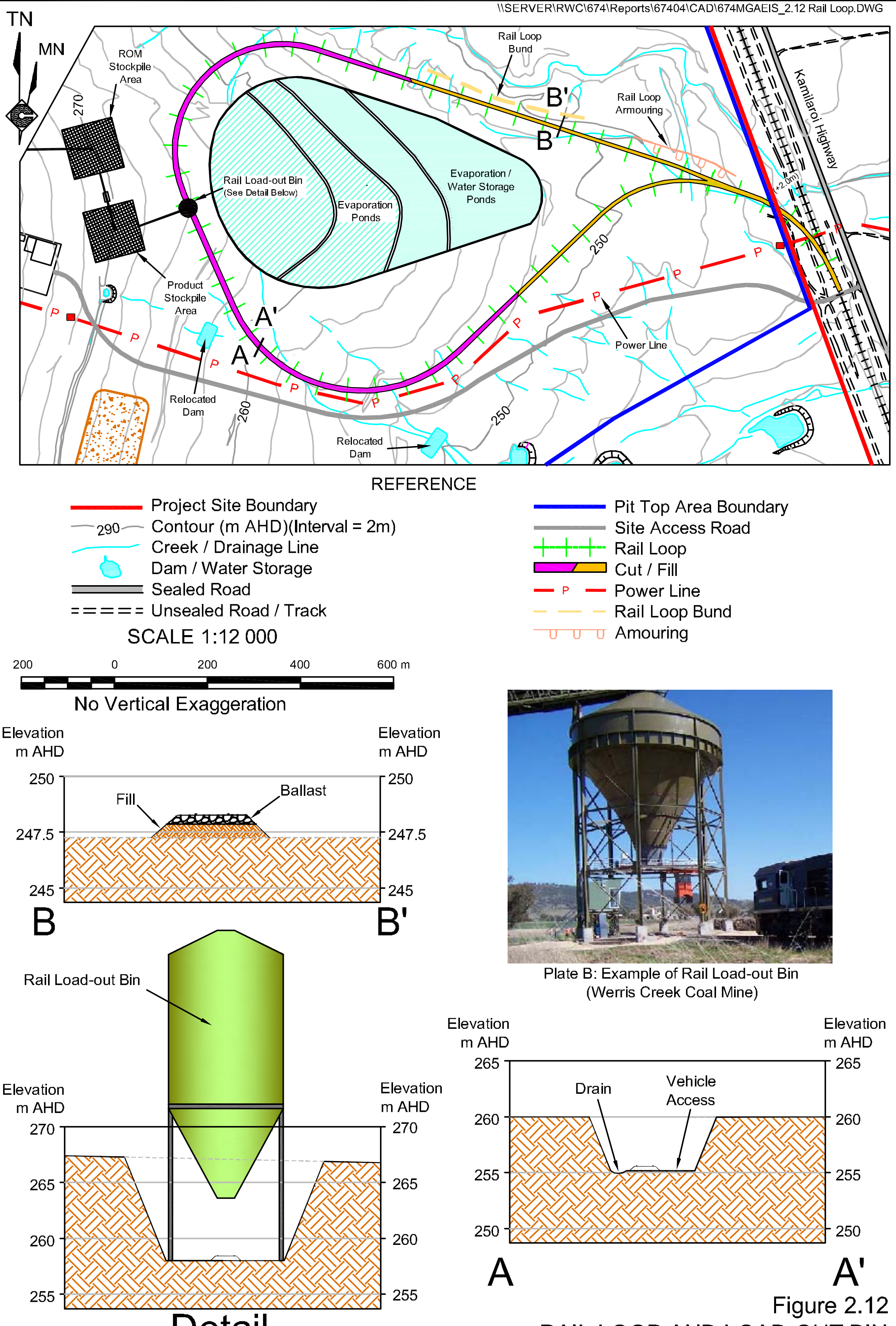


Plate B: Example of Rail Load-out Bin (Werris Creek Coal Mine)

Figure 2.12
RAIL LOOP AND LOAD-OUT BIN

Load-Out Bin

The load-out bin would be constructed to the following indicative design parameters.

- Capacity: 1 500t.
- Height: 32m approx (5m to 6m stilt supports beneath a 24m to 26m high bin).
- Bin constructed with: pre-fabricated metal, painted olive green or similar.

A weighbridge system would be incorporated into the rail loop beneath the load-out bin.

A reclaim system beneath the product stockpile area would feed a conveyor to fill the load-out bin at a rate of approximately 3 000tph.

Due to the natural slope of the Pit Top Area to the east and the maximum grade limit on the rail loop (1:120 (V:H)), the rail loop would be constructed in a cutting for most of its length with a short section of the rail loop in the east constructed on fill cross sections around the rail loop are displayed on **Figure 2.12**). The materials removed from the cut areas would be used in the fill areas, with all excess material used to construct the perimeter amenity bund (Section 2.4.11).

The maximum surface disturbance footprint of the rail loop would be a strip of at least 13m wide (top of the cut) to incorporate the railway line, an adjacent access track (primarily located inside the rail loop) and a drain for the cut areas. **Figure 2.12** displays the location of a diversion bund and an area of rock armouring to be positioned adjacent to the northern side of the rail loop to protect the railway line from floodwaters within Kurrajong Creek Tributary 1.

Where the northern section of the rail loop nears the riparian vegetation adjacent to Kurrajong Creek Tributary 1, works would be undertaken to avoid, as much as is practicable, disturbance to the riparian vegetation. Silt-stop fences and/or straw bales would be installed along the edge of the riparian vegetation during construction of the northern part of the rail loop to minimise any sediment potentially entering the tributary.

Where the southern section of the rail loop is aligned through two existing dams, these dams would be relocated upstream and downstream prior to construction with a waterway established between them to divert water flows away from the rail loop.

2.4.10 Water Management Structures

2.4.10.1 Introduction

The water management structures to be established within the Pit Top Area are shown on **Figure 2.5**. The management of water on the Project Site, and more specifically the Pit Top Area, has been designed to serve four primary functions, namely:

- erosion and sediment control;
- management of flood waters;
- capture and storage of water for operational and environmental purposes; and
- storage and containment of saline water pumped from the underground workings.

2.4.10.2 Water Management Structures (General)

While Section 4B.1.4 provides the detailed design and position of the water management structures proposed to achieve the four primary functions described in Section 2.4.10.1, **Figure 2.5** presents the location of the principal water management structures of the Pit Top Area, all of which are discussed below.

- Where practicable, the existing contour banks within the Pit Top Area would be retained. Either pipes or shallow crossings would be installed to achieve continuity of ongoing flows.
- Surface water flowing over disturbed areas of the Project Site would be captured (by "catch banks") and diverted at non-erosive velocities to a series of elongated sediment dams and in turn into the storage dam in the southeastern corner of the Pit Top Area. The settled water in the storage dam would be used for dust suppression.
- Surface water flowing over undisturbed areas of the Pit Top Area would, where required, be diverted (by "diversion banks") away from the disturbed or active areas and either directed to natural drainage downstream of the Project Site or to one of the several storage dams located between the Pit Top Area and Ventilation Shaft Area.
- The Pit Top Area has been designed to capture and store all water falling on, or flowing through disturbed areas. As such, the size of the sediment and storage dam(s) would be sufficient for all but extreme, ie. >72 hour, 1 in 100 ARI events. Section 4B.1.4 presents further detail on the design parameters of the various structures.
- The perimeter amenity bund would either be constructed with pipes strategically placed where upslope runoff would flow towards the bund or a gap would be left in the bund to avoid impeding substantial flows, eg within Kurrajong Creek Tributary 2.
- Dams and drainage features impacted by the construction of the rail loop would be relocated upstream and downstream as described in Section 2.4.9.

2.4.10.3 Water Management Structures (Evaporation / Storage Ponds)

Groundwater modelling has predicted that the volume of mine in-flow is likely to exceed operational requirements and, due to its saline nature, needs to be stored on the surface and prevented from entering natural drainage lines. In order to accomplish this, the groundwater pumped to the surface from the underground workings would be discharged into a series of evaporation / storage ponds. Constructing the ponds sequentially would provide several operational and environmental advantages.

(i) In the event mine in-flows are less than predicted, the area of disturbance associated with the overall footprint for the evaporation / storage ponds could be reduced by not constructing and/or commissioning the final ponds. Similarly, in the event mine in-flows are greater than anticipated, additional ponds could be constructed without compromising the effectiveness of the active pond(s).

(ii) The Proponent would be able to operate several ponds concurrently, ie. one for active acceptance of groundwater, and others strictly for evaporation of water. In this way, there is potential for individual ponds to be re-used and therefore further reduce the total area required for the evaporation / storage ponds.

(iii) Water from the evaporation / storage ponds would be used for dust suppression purposes both underground and within the bunded self-contained areas of the Pit Top Area including the ROM coal stockpile area, crushing / sizing plant and product stockpile area. Run-off from these areas would be diverted to a sump for evaporation or pumping back to the evaporation / storage ponds.

(iv) The evaporation / storage ponds and areas where this water would be used for dust suppression would be completely segregated from other surface water flows on the Pit Top Area. With the exception of direct rainfall on these areas, all other water would be diverted away.

Figure 2.13 displays the layout and typical sections through the evaporation / storage ponds. Essentially, each pond would cover between 4ha and 6ha and contain water to a depth of approximately 3.5m deep, with 0.5m freeboard. A sequential process of topsoil removal would be adopted with subsoil recovered from the floor of each cell used to construct the perimeter walls with the topsoil used to stabilise the outer slopes of the dam walls created. Surplus topsoil would be stored in dedicated stockpiles near the perimeter of the evaporation / storage ponds or in Soil Stockpile Areas A and/or B.

As the water to be held within the evaporation / storage ponds would be saline in nature, the ponds would be constructed to be effectively impermeable. Based on the South Australian publication "EPA Guidelines – Wastewater and Evaporation Lagoon Construction (EPA 509/04)", a permeability of $1x10^{9}$m/sec would be the maximum allowable level of material used to construct the floor and walls of the evaporation / storage ponds. To achieve this level of permeability, the Proponent would preferentially compact a layer of clay, of at least 300mm thick, obtained from in-situ material, ie. from soil/subsoil excavated from the site of the evaporation / storage ponds. Preliminary testing of soil from three representative soil samples indicates that some of the heavier clay material on site would meet the permeability benchmark (when compacted) whereas the clay and gritty clay from the other two were either marginal or too permeable (GCNRC, 2007). This suggests that selective use of the in-situ material for pond lining would achieve the desired level at impermeability although additional testing would be undertaken at the time of construction on prospective lining clay (GCNRC, 2007). In-situ testing of the compacted clay on the floor and walls of the ponds would also be undertaken. Further detail on the results of the soil sampling and analysis is presented in Section 4B.5.2.3.

In the event insufficient in-situ material of suitable impermeability is not available, additional clay would be imported or an impermeable plastic liner used.

It is proposed that Evaporation Ponds A and B would be constructed during the site establishment phase. With a combined capacity of 365ML, these two ponds are likely to be able to manage water pumped from underground for at least 15 to 20 years (based on the predicted mine in-flows predicted by GHD (2007)). Actual mine in-flows would be compared to those predicted by GHD (2007) in an attempt to:

(a) validate the in-flow predictions and therefore confirm the necessity for contingency water management (which may include the construction of a Water Conditioning Plat – see Section 2.4.10.4), and at what approximate year of the mine life these contingency measures would be required; or

(b) determine whether the GHD (2007) predictions overestimate in-flows (in which case there would be no necessity to consider contingency water management) or underestimate in-flows (in which case the contingency water management may need to be undertaken sooner than Year 15 to 20).

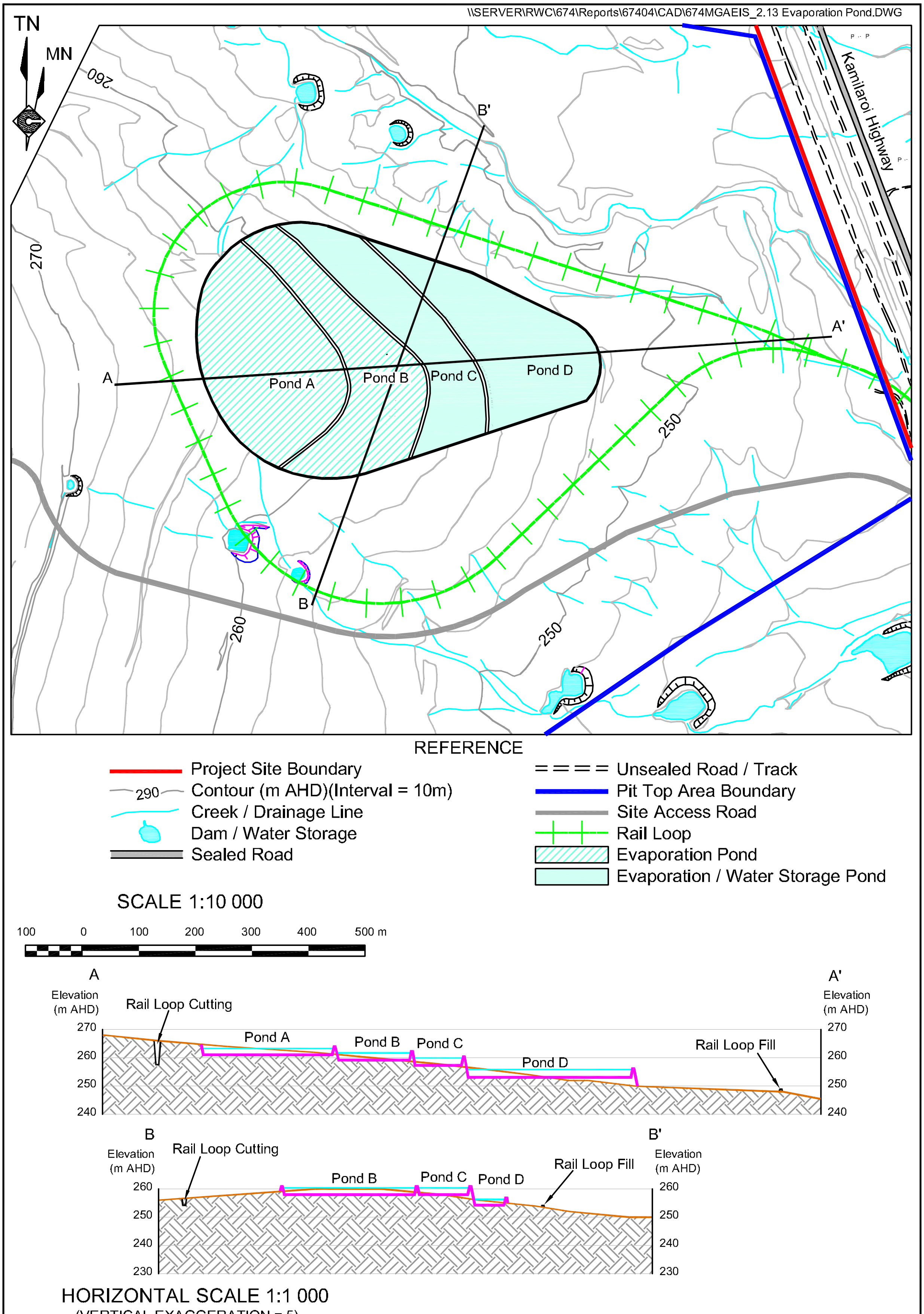


Figure 2.13
EVAPORATION / STORAGE PONDS

The method of assessing actual mine in-flows and the various contingency water management strategies that have and would be considered are discussed in greater detail in Section 2.5.4.

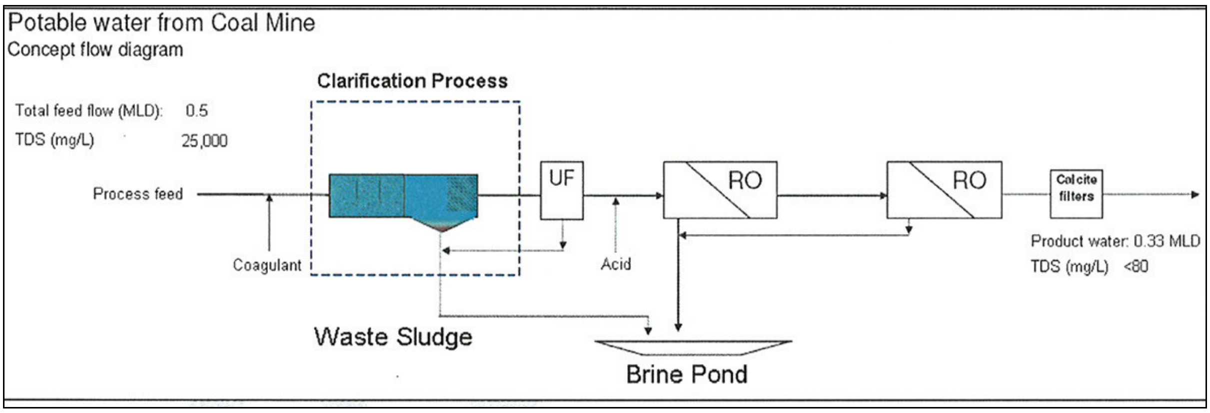
2.4.10.4 Water Management Structures (Water Conditioning Plant and Infrastructure)

The groundwater modelling predictions of GHD (2007) indicate that mine in-flows, based on average hydraulic conductivity values, peak at approximately 818ML/year in Year 24 before decreasing to around 690ML/year for the remaining mine life. GHD (2007) also undertook a sensitivity analysis of mine in-flows and predicted that if the hydraulic conductivity of the Hoskissons Coal Seam and coal seam floor (Arkarula Formation) is an order of magnitude greater than the calculated average, then the predicted mine in-flows would be increased by 30% and 7% respectively. Based on these predictions of mine in-flows, the capacity of the evaporation / storage ponds to contain this water, and rainfall which falls during a 1 in 100 year ARI rain event, would be exceeded at some time after Year 15 to 20. Notwithstanding the results of the sensitivity analysis, the Proponent's experience in mining the Hoskissons Coal Seam by continuous miner methods at the Gunnedah Colliery suggests the predicted in-flows of GHD (2007) over-estimate the dewatering requirements, Parsons Brinckerhoff Australia Pty Limited (PB) were approached to assess the suitability and technical requirements of a water conditioning plant, which would reduce the salinity of the water to an acceptable standard for irrigation and possible drinking water. A copy of a technical memorandum provided by PB is included as **Appendix 4**.

Contingency water management is discussed in greater detail in Section 2.5.4, however, should a water conditioning plant be deemed necessary to manage the dewatered mine in-flows, it would be constructed based on the following conceptual design, well in advance of predicted evaporation / storage pond overflow. The design features and conceptual design provided by PB is summarised as follows.

General Design Features

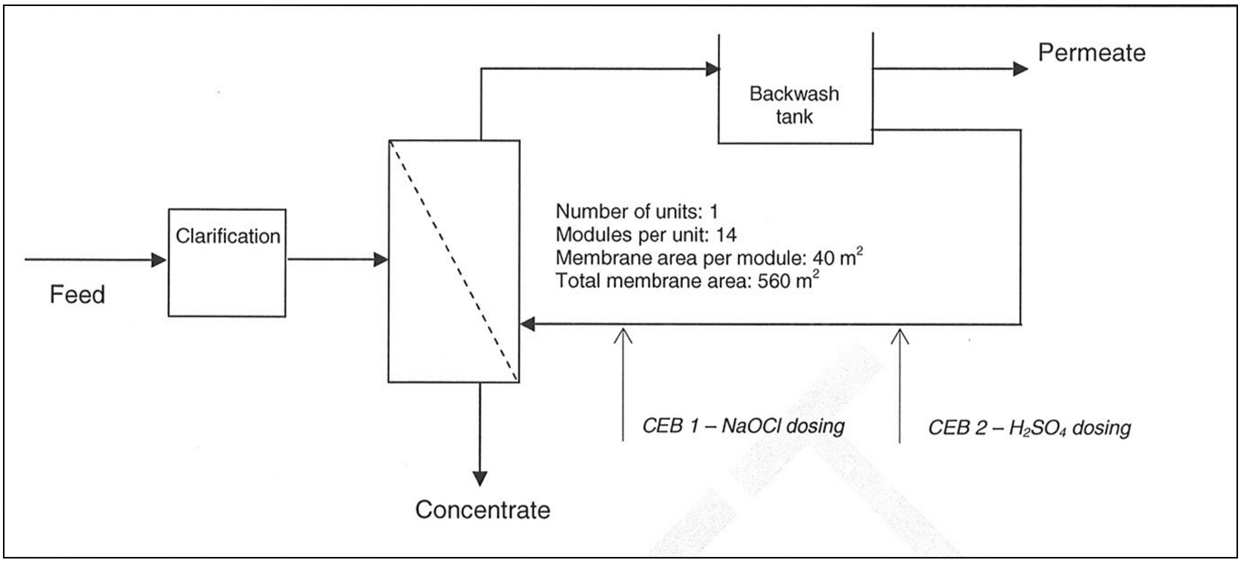
The water conditioning plant would be based on combined micro filtration / ultra filtration (MF/UF) and reverse osmosis (RO) technologies and would be installed as a self contained unit which is capable of processing up to 0.5ML/day. The number of units could then be increased if groundwater in-flows increase over time. A schematic representation of the conditioning plant system is as follows.



The approximate footprint of the water conditioning plant would be 10m x 12m, or 120m^2. Additional surface area of up to 10ha would be provided for the construction of ponds to contain the concentrated brine produced by the RO process.

Pre-Conditioning

The water to be processed would be pre-conditioned to eliminate or limit the concentration of suspended solids, colloidal matter, scale and other water constituents to which the RO membranes are sensitive. This process, referred to as micro filtration / ultra filtration (MF/UF), which is presented schematically below, would also aim to correct water pH.



The initial clarification process serves to remove large solid particles from the groundwater before it enters the MF unit. The MF unit would typically consist of 14 membrane modules in the one unit that reduce suspended solids, colloidal material and bacteria.

The operation of the MF/UF plant involves hydraulic cleaning (HC) and two lots of chemical enhanced backwashes (CEB's). Each hydraulic clean and CEB is performed at different intervals and generates different wastes. CEB 1 is performed with sodium hypochlorite whilst CEB 2 is performed with sulphuric acid. The water is hydraulic cleaned every 15 minutes, whereas CEB 1 and CEB 2 would be undertaken every 6.3 hours and 12.8 hours respectively.

Chemicals will leave the system as backwash waste, which is generally of low pH, and would be disposed of with the brine into the brine ponds.

Reverse Osmosis

The water conditioning plant would be a facilitated RO system, ie. involves the pumping of water into a pressure vessel where it passes through the RO membrane rejecting the dissolved solids (including salt). The design of the RO system is dependent on the physical and chemical parameters of the water, the required quality of the treated water and the quantity of water requiring treatment.

Post Conditioning

In the event the treated water was required to be of potable quality, the water may have to be dosed with a variety of chemicals to ensure Australian Drinking Water Guidelines are adhered to. However, it is not anticipated that the Proponent would require drinking water quality and so post-treatment is not discussed further.

Preliminary Concept Design for Narrabri Coal Project Water Conditioning Plant

Based on the water conditioning process and design features described in the previous text, PB (2007) have provided a concept design for a combined MF/UF and RO water conditioning plant. Assumptions used in the development of the concept design are detailed in PB (2007) with two water qualities considered.

(i) Total dissolved solids of 12 000mg/L: based on the conversion of measured electrical conductivity of representative water samples (GHD, 2007).

(ii) Total dissolved solids of 25 000mg/L: based on the calculated sum of measured salt concentrations of representative water samples (GHD, 2007).

It was determined that an RO system comprising two passes (with one stage per pass) would provide for 66% recovery of water with a TDS of <80mg/L. Based on the treatment of 0.5ML per day, the plant would produce 330kL of potable quality water and 170kL of concentrated brine. To accommodate the brine production, a pond of 5ha in area would be required, although PB (2007) recommend a second pond of the same area be constructed to account for reduced evaporation rates or high rainfall years.

2.4.11 Mined Rock Management and Perimeter Amenity Bund

Weathered and fresh rock would be produced from a number of sources during construction in the following indicative volumes.

- Box cut – 400 000bcm.
- Drift development - 35 000bcm.
- Ventilation shaft – 6 200bcm.
- Rail loop cuttings – 30 000bcm.

The rock mined from the ventilation shaft would be used to construct the perimeter amenity bund around the Ventilation Shaft Area, as detailed in Section 2.4.7.

A small volume of the competent mined rock sourced from the box cut and drift development would be used to surface the ROM and product stockpile pads to create an all weather working surface.

The remainder of the material would be used to construct the perimeter amenity bund around most of the Pit Top Area.

The perimeter amenity bund would have a base approximately 34m wide and a height of approximately 4m. The external batter of the bund would be constructed with a 1:3 (V:H) slope with the internal batter constructed with a 1:1 slope. The bund would be continuous except for those areas to provide access to the Ventilation Shaft Area and adjacent to Kurrajong Creek Tributary 2. In both cases, an overlap would be constructed to maintain its effectiveness as a visual barrier to on-site activities.

It is intended that the perimeter amenity bund would be retained as a permanent feature of the landscape and as such, the topsoil and subsoil stripped from the bund footprint would be replaced over the bund and ground cover shrubs and trees on the bund established for long term stability and visual screening (see Section 2.15.3).

2.4.12 Surface Construction Equipment

The equipment to be used on the surface during construction activities are listed in **Table 2.7**.

Low loaders would be used intermittently to deliver and retrieve large earthmoving equipment and construction materials. Details of the transportation of this equipment is presented in Section 2.10.2.

Table 2.7
Surface Facilities Construction Equipment

Equipment (or similar)	No.	Use
Crane (70t to 150t)	2	Erection of structures
Excavator (100t to 120t)	1	Drift box cut excavation
Bulldozer (eg. Cat D9)	1	Water management structure construction
Articulated haul trucks (50t)	2	Transport of excavated box cut material
Scraper (eg. Cat 637)	2	Topsoil and subsoil stripping and stockpiling
Grader (eg. Cat 14G to 16G)	1	General site preparation works, road maintenance
Sheepsfoot compactor (eg. Cat 825)	1	Site access road construction
Portable compressor	1	Drift construction
Water cart	1	Dust suppression of construction areas
Gravel trucks (20m^3 capacity)	5	Gravel cartage for site access and other roads
Generator (1 x 850KVA + 1 x 70KVA)	2	Initial power provision

A number of light vehicles would be used for personnel transport around the Pit Top Area and between the Pit Top Area and Ventilation Shaft Area during both site establishment and operation.

2.5 MINING OPERATION

2.5.1 Mining Method

The mining operation would involve underground mining of the Hoskissons Coal Seam using conventional continuous miner methods.

A continuous miner would extract coal in a “room and pillar” arrangement whereby pillars are retained as roof support. The continuous miner would mine the coal in a series of rectangular tunnels and load the coal directly onto a shuttle car from where it would be transferred to a breaker feeder. The breaker feeder would reduce the coal to less than 150mm in size, and then feed the broken coal onto a conveyor system to transfer it to the surface ROM stockpile via the conveyor drift.

The continuous miner method would be used in Areas A, B and C (depicted on **Figure 2.14**) in accordance with the sequence described in Section 2.5.2.

As mentioned in Section 2.2.2, it is intended to mine the lower 4.2m (approximately) of the seam.

The mining operations in each area would be designed according to relevant industry standards to ensure the support of overlying overburden.

Although the width and general design of the roadways is unlikely to change throughout the life of the mine, it is possible that the direction of driveage may alter should unforeseen geological or structural conditions be encountered. The layout and design of all underground roadways would be subject to approval by DPI (MR).

2.5.2 Mining Sequence

The Proponent intends to adopt the following indicative mining sequence for the Stage 1 operations (as outlined in **Figure 2.14**). The ventilation shaft would be excavated from the surface to intersect the seam and connect with the roadways south of the West Main. Two ventilation fans would then be installed above the shaft.

Following connection of the drifts to the coal seam, a continuous miner unit would be deployed to form the Pit Bottom Area and then commence driveage of the roadways within West Main (Area A) towards the site of the Ventilation Shaft.

A second and third continuous miner would be deployed developing panel gateways to the south in Area B. The position of these gateways would be approved by the DPI (MR). The continuous miner units would progressively develop north-south orientated panel roadways to form coal blocks which may later be extracted by longwall methods by retreat (as part of Stage 2 of the project under subsequent approval) or ongoing continuous miner driveage of roadways and secondary partial extraction leaving stable pillars, similar to those left in Area B. (This latter method would only be used if longwall mining does not proceed in Area C).

Partial extraction would require pillar sizes to be smaller than the primary extraction pillars but large enough to ensure that they are stable and competent. Approximately 74% of the coal within Area B would be recovered using this method of extraction.

2.5.3 Mining Rate

Once fully operational, the mining rate for the Stage 1 mining is forecast to be up to a maximum daily rate of 10 000 tonnes. The maximum annual mining rate would be 2.5Mt.

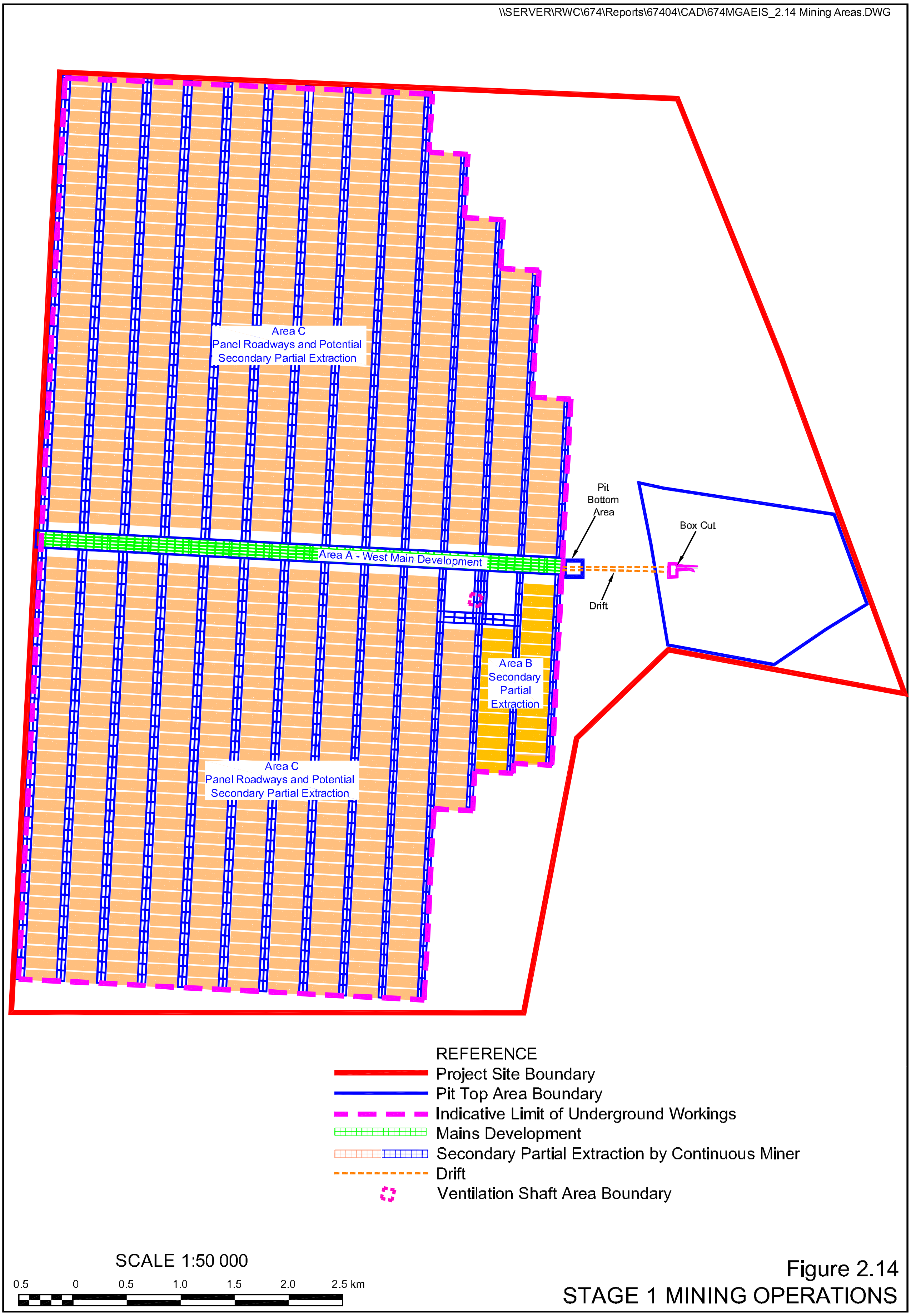


Figure 2.14
STAGE 1 MINING OPERATIONS

2.5.4 Dewatering and Irrigation

As a consequence of a reduced head pressure caused by the removal of coal from the sub-surface geology, groundwater would flow into the underground workings. The rate of this "mine in-flow" would ultimately be a function of the hydraulic conductivity of the seven layers of the geological sequence above and below the coal seam. A groundwater model was constructed by GHD to predict the rate of mine in-flow and **Table 2.8** presents the predicted mine in-flows for the mean conductivity over the life of the mine (ie. a transient model). Through sensitivity analyses of the model to variation of input parameters, GHD (2007) identified that alteration of the conductivity of the coal seam and Arkarula Formation had greatest influence on the predicted mine in-flow. The groundwater model was subsequently run with the permeability of each of these layers on order of magnitude greater than the mean value and **Table 2.8** presents the results of these model runs.

Table 2.8
Mine In-Flow Over Time

Year	Mean Conductivity (kh)[1]		Increased Conductivity (HCS kh = 0.02)		Increased Conductivity (Ark kh = 0.02)	
	m^3/day	ML/year[2]	m^3/day	ML/year[2]	m^3/day	ML/year[2]
1	61.0	22.3	124.2	45.3	124.2	45.3
2	294.0	107.3	408.1	149.0	408.1	149.0
3	245.9	89.8	348.6	127.2	348.6	127.2
4	294.2	107.4	407.1	148.6	407.1	148.6
5	517.1	188.7	730.8	266.7	730.8	266.7
10	618.1	225.6	816.0	297.8	829.8	302.9
15	820.0	299.3	1102.8	402.5	1006.9	367.5
20	1269.6	463.4	1656.9	604.8	1445.6	527.6
25	2149.2	784.5	2851.4	1040.8	2313.2	844.3
30	1971.4	719.6	2580.0	941.7	2159.6	788.3
35	1905.4	695.5	2456.0	896.4	2156.0	786.9
40	1903.0	694.6	2365.4	863.4	2142.5	782.0
45	1896.8	692.3	2293.5	837.1	2133.8	778.8
50	1862.2	679.7	2213.9	808.1	2112.2	771.0

Note 1: Hoskissons Coal Seam (HCS) kh = 0.002, Arkarula Formation (Ark) kh = 0.003
Note 2: Yearly volume is estimated based on daily in-flow rate on last day of relevant year, ie. ML/year = m^3/day x 365/1000
Source: Modified after GHD (2007) – **Figure 26**

As noted in Section 2.4.10.3, the dewatered mine in-flow would be used for dust suppression and coal wetting purposes with any excess discharged to evaporation / storage ponds constructed within the rail loop. Through monitoring the actual discharge rate, the Proponent would be able to estimate which of the transient groundwater model results (of **Table 2.8**) most accurately reflects the mine in-flows or if these in fact under- or over-estimate the dewatering requirements.

Recognising the saline nature of the groundwater, and depending on the actual mine in-flows, the Proponent would follow one of four water management strategies.

(i) Mine in-flows approximate those predicted by GHD (2007).

In all three modelled scenarios, mine in-flows would exceed mine requirements and would eventually exceed the 1 in 100 year ARI rain event storage capacity of the evaporation / storage ponds. In this instance, the Proponent would not construct Evaporation Ponds C and D in favour of the construction and operation of a water conditioning plant (as described in Section 2.4.3.11). The conditioned water would be of potable quality and would be irrigated over land owned by the Proponent and used on site. Should water conditioning and irrigation be required, the Proponent would prepare an Irrigation Management Plan for consideration and approval by DEC.

(ii) Mine in-flows are moderately less than those predicted by GHD (2007), ie. 10% to 25% reduced.

Dewatering in-flows reduced from the predictions of GHD (2007) by 10% to 25% may still eventually result in the capacity of Evaporation Ponds A to D to accommodate a 1 in 100 year ARI rain event being exceeded. The volume of water additional to the storage capacity of the evaporation / storage ponds would be relatively small and therefore rather than incorporating the power and cost intensive water conditioning plant into the project's water management, additional evaporation / storage ponds would be constructed either within the rail loop as an extension to Evaporation / Storage Ponds A, B, C and D or to the west of the southwest corner of the Pit Top Area, ie. between the Pit Top Area and Ventilation Shaft Area.

Supplementary ecological, Aboriginal heritage and soil assessments would be completed prior to the construction of the additional evaporation / storage ponds to ensure the environmental impacts would be minimal.

(iii) Mine in-flows are significantly less than those predicted by GHD (2007).

In this case, Evaporation Ponds A to D are likely to provide sufficient storage for dewatered mine in-flows and therefore no further water management would be required. WRM (2007) has determined that the existing evaporation / storage pond storage capacity could retain all mine in-flows as long as average dewatering requirements remained below 880m^3/day. Mine in-flows consistently above this value would trigger the requirement for one of the alternative water management strategies described in this section.

(iv) Mine in-flows exceed those predicted by GHD (2007).

The water management strategy in this case is likely to be the same as that for Scenario 1, however, the construction and operation of the water conditioning plant may be undertaken sooner, and the area required by the brine ponds enlarged. Depending on construction times required for the water conditioning plant, Evaporation Pond C may be required.

Figure 2.15 presents a conceptual illustration of the implication of each water management strategy on land use within and adjacent to the Pit Top Area.

2.5.5 Stage 1 Subsidence

An assessment of likely subsidence as a result of the proposed Stage 1 mining operations was conducted by Mining Geotechnical Services Pty Ltd (2007). The technical description relating to Stage 1 subsidence outlined below is drawn from the report by Mining Geotechnical Services Pty Ltd (2007) which is presented in full as Part 8 of the *Specialist Consultant Studies Compendium*.

Subsidence Above Continuous Miner Operations

There are three types of subsidence that could occur for Stage 1 operations in Areas A, B and C. However, it is stressed that the mining areas have been designed to avoid any such subsidence.

1. Chimney Subsidence: occurs when the underground roadways collapse and as overburden fills the resultant void, more overburden is caused to collapse. Chimney subsidence is generally limited to mines where the total overburden thickness is less than approximately 50m, or 10 times the extracted seam height, ie. 40m for this proposed mine. As the proposed underground mine is a minimum of approximately 150m deep, this type of subsidence would not reach the surface, even if it did occur.

2. Trough Subsidence: occurs if the pillars collapse or 'punch' into the floor. This type of subsidence is prevented by designing the pillars so that they are stable and the pillar stress does not exceed the bearing capacity.

3. Pillar Compression: mining increases the stress levels in the pillars and reduces their 'stiffness', thus causing the pillars to compress. This will result in subsidence of the surface, however, there is limited information on this type of subsidence as the surface expression is generally considered to be negligible. Even assuming 65% of the pillar compression is apparent at the surface, the maximum surface expression would be 12mm. This is a worst case scenario as the two massive strata units are expected to span the mining panels, hence further reducing the impact of any subsidence on the surface.

As all subsidence for Stage 1 operations is predicted to be well below 20mm (12mm maximum), no Subsidence Management Plan is required for Stage 1 mining activities.

2.5.6 Mine Gas

Exploration drilling results indicate that the Hoskissons Coal Seam contains between $2m^3$ to $7m^3$ of gas per tonne of coal, consisting of carbon dioxide (CO_2), methane (CH_4) and nitrogen (N_2). Such levels of gas are not high by industry standards and would be diluted by the ventilation being circulated, so that concentrations are kept within statutory limits. In some areas, if in-situ gas levels exceed prescribed limits, it may be necessary to pre-drain the gas to avoid any outburst potential.

Additional specialist investigations are continuing to ensure that gas quantities are consistently within safe limits across the potential mining areas. In addition, seam permeability is being measured. This would be an important parameter in the unlikely event that pre-drainage becomes necessary, particularly in the deeper or any structurally disturbed sections of the mine which may be encountered.

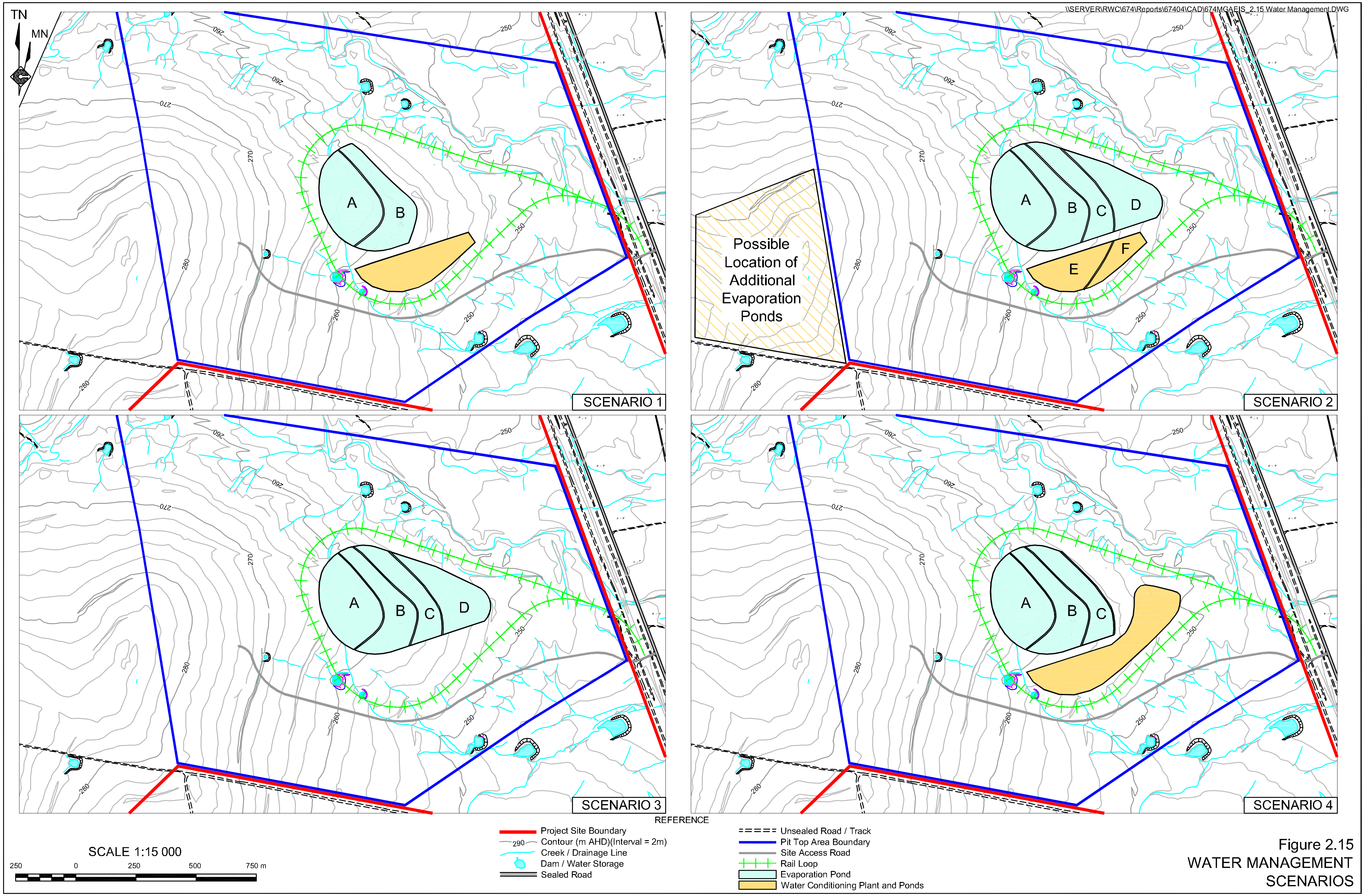


Figure 2.15
WATER MANAGEMENT SCENARIOS

2.6 CRUSHING AND STOCKPILING

2.6.1 Underground Crushing

Coal mined by the continuous miners would be broken through an underground breaker feeder to <150mm (nominal) prior to transfer onto the conveyor belt system to the ROM surface stockpile area, via the conveyor drift and portal. Strategically located water sprays would be operated on the continuous miners and the breaker feeder to minimise dust creation underground.

2.6.2 ROM Coal Stockpiling

The ROM coal stockpile area would cover an area of approximately 1.2ha and have a capacity of approximately 150 000t. Coal would be stockpiled up to 10m in height. A bulldozer would be used for stockpile management.

2.6.3 Surface Coal Crushing / Sizing

Coal from the ROM stockpile would be loaded into the crusher feed hopper through a reclaimer. The coal would then be sized and crushed / sized to <50mm by a double roll crusher with a capacity of approximately 2 000tph. After crushing, the coal would be stockpiled by a stacking conveyor onto the product stockpile area.

The crusher would be fitted with water sprays to suppress dust and would be fully enclosed to minimise noise emissions.

2.6.4 Product Coal Stockpiling

The product coal stockpile area would have a capacity of approximately 150 000t and be designed to accommodate a stockpile of up to 10m in height. A bulldozer would be used for stockpile management.

The product coal would be reclaimed and loaded into the rail load-out bin as required to meet train schedules. All surface conveyors would be partly enclosed to minimise dust creation in periods of windy weather. Water sprays would be provided to control dust on stockpile areas and maintain a coal moisture content of 6%.

Due to the low ash content of the coal mined and its recovery by continuous miners, washing of the coal is not required. Consequently, there would be minimal wastage, loss or dilution of the coal. The maximum mining rate of 2.5Mtpa would also be reflected in a similar crushing, stockpiling and product coal despatch rate.

2.7 TRAIN LOADING AND COAL TRANSPORTATION

The Proponent forecasts that with the use of the 1 500t capacity overhead load-out bin, a 42 wagon train with a capacity of 3100t would be loaded in approximately 1 hour. A wagon weighbridge would be located at the loading point.

Should railway upgrades, ie. construction of additional pass-bys allow for the use of longer trains on the North Western Branch Railway, the Proponent forecasts that 84 wagon trains, with a capacity of 5400t could be loaded over a 90 minute period. The Pit Top Area rail loop has been designed to accommodate these longer trains, which would reduce the number of rail movements generated by the project.

The operation and timing of trains along the North Western Branch Railway is governed by State Rail, and as such, the project requires 24 hour, 7 days a week train operation to ensure the flexibility to operate within the train paths allocated to the haulage contractor (Pacific National). While daytime loading would be preferable, it may not always be possible. In reality, it is likely that trains would arrive and depart at consistent time of the day once regular slot times are established.

At an anticipated maximum mining rate of 2.5Mtpa and an initial train capacity of 3 100t, an average of two to three trains would be loaded and despatched each day of the week. However, the rate of despatch would vary to meet shipping arrival schedules at Port Newcastle.

2.8 MINING EQUIPMENT

2.8.1 Operational Equipment

The indicative mining equipment to be used for Stage 1 mining operations is listed in **Tables 2.9** and **2.10**.

Table 2.9
Indicative Underground Operational Equipment

Indicative Equipment	No.	Use
Continuous miner	3	Underground primary and secondary mining
Shuttle cars	9	Transfer of coal from continuous miner to breaker feeder
Breaker Feeder	3	Breaking of coal
EIMCO (LHD)	6	Material transport
Man transport vehicle	6	Personnel transport
Roof bolting machine	3	Roof bolting
Panel conveyor belt	6	Transfer of coal from breaker feeder to transport drift conveyor

Table 2.10
Indicative Surface Operational Equipment

Indicative Equipment	No.	Use
Bulldozer (D9R)	1	Coal stockpile management
Electric ventilation fan (850kW)	2	Ventilation of underground workings
Product Transport Trains	2 to 3/day	Product coal transportation to Port of Newcastle
Conveyors	Various	Transport coal around stockpiling and processing areas
Double Roll Crusher	1	Coal Crushing

With respect to the underground equipment, the personnel transport vehicle would only come to the surface at shift change, while the EIMCO Load / Haul / Drive – LHD vehicles would be on the surface at various times intermittently during operations for loading and unloading. All other underground equipment would remain underground at all times unless major maintenance is required.

2.9 SERVICES

2.9.1 Potable, Ablutions and Fire Fighting Water Requirements

All potable water required for ablutions and related uses would be imported to site on a regular basis and stored in small water tanks located adjacent to the relevant surface infrastructure.

This water would also be used to supplement the water stored in three, 100 000L tanks above the box cut within the Pit Top Area for fire fighting should the need arise (see **Figure 2.10**).

2.9.2 Operational Water Requirements

Operational water would be required primarily for dust suppression both underground and in the coal handling areas and unsealed roads of the Pit Top Area.

Based upon its experience at Gunnedah Colliery and the Whitehaven Coal Mine, the Proponent estimates the annual water requirements for dust suppression and maintenance of moisture content in the coal to despatched would be as follows.

- Underground dust suppression (33L/t) - up to 66ML
- Surface dust suppression including stockpiles, conveyors, crushing / sizing plant and unsealed roads (17L/t) - up to 34ML
- Additional water application to coal stockpiles to increase moisture content by 6% (43L/t). - up to 20ML

Approximately 85% of the water used for surface dust suppression would be water originating from underground as any runoff from the areas where this water would be used would be collected and either allowed to evaporate or pumped to the evaporation / storage ponds.

Should a water conditioning plant be installed and operated, the conditioned water produced would be used for all surface and underground dust suppression requirements.

2.9.3 Electricity

During the initial site establishment activities, power would be provided by up to four generators. Permanent mains power would be installed for the operations within approximately 12 months of the commencement of site establishment. This would be achieved through the construction of a spur line from a 66kV powerline located to the east of the Kamilaroi Highway. The spur line would be located as depicted in **Figure 2.5** and would be directed to a substation where it would be converted to 11kV for use at the site offices, buildings and the crushing / sizing plant. An 11kV power line would also be constructed adjacent to the ventilation shaft access road to provide power to the ventilation fan (**Figure 2.6).**

Power would also be provided to the underground mine workings as required from the substation with all cables placed within the transport drift.

2.9.4 Communications

On-site communications would be by a combination of mobile phones and land phone/fax lines installed to service mine management and contract staff in the Pit Top Area. Two-way radio communication would be used between surface equipment operators. The primary means of communication in the underground mine would be by telephone.

2.9.5 Sewage

Sewage treatment would be undertaken by one or more self irrigating eco-cycle septic system(s) installed in the Pit Top Area (**Figure 2.9**). The waste water from this system would be irrigated onto landscaped areas around the Pit Top Area.

2.9.6 Fuel

Fuel storage and refuelling facilities for the mobile equipment would comprise one 50 000L WorkCover - approved self-bunded fuel tank and an adjacent refuelling bay, located adjacent to the surface buildings (**Figure 2.9**).

During the 12 month site establishment period, fuel use would be in the order of 300kL.

Annual diesel fuel usage for the project once fully operational would be approximately 370kL.

2.9.7 Explosives

If explosives are required to blast through the conglomerate and/or sill during the construction of the transport drift, conveyor drift or ventilation shaft, these explosives would be brought to the site as required by a blasting contractor who would also design and initiate the blast. If explosives are necessary, a Site Security Plan would be developed as required by WorkCover.

While it is unlikely that explosives would be required during Stage 1 mining, hence there would be no requirement for their storage on site, an explosives magazine would be constructed on site to provide storage for explosives in the event an emergency required their use.

2.10 TRAFFIC

2.10.1 Introduction

Coal transportation off site would be entirely by rail and is discussed in Section 2.7. Hence, this section deals with the ancillary road traffic levels.

During the site establishment phase, there would be a range of heavy vehicles delivering construction materials and machinery to the Pit Top Area, as well as contractor and employee light vehicle movements.

Most of the transport associated with the normal operation of Stage 1 would be related to employee transport, with an additional small amount of supply transport.

2.10.2 Site Establishment

During the 12 month site establishment period, the typical types and number of vehicles entering and exiting the Pit Top Area are forecast to comprise, at a maximum:

- low loaders (0 to 4 per day) to deliver large mobile equipment and infrastructure;
- heavy vehicles (0 to 6 per day) to deliver consumables, fuel and other stores as required;
- heavy vehicles (up to 32 per day for up to 2 weeks) to deliver gravel as required; and
- light vehicles (20 to 40 per day) for personnel transport.

The incidence of low loaders travelling to the Project Site is likely to be irregular and concentrated at times of delivery of major items of plant, equipment and materials. These vehicles would generally travel from either Narrabri or Gunnedah along the Kamilaroi Highway.

During the 4 to 6 week period during which the Site Access Road is under construction, additional truck movements would be required to supply gravel from the "Bow Hills" quarry. Based on the proposed average sub-base depth of 400mm required for the Site Access Road, approximately 10 000m^3 (equivalent to approximately 20 000t) of gravel would be required. Based on the use of trucks with an average capacity of 27t, an average of 25 truck loads per day is expected with a maximum of 50 per day.

A Traffic Management Plan would be prepared by the road works contractor to the satisfaction of the RTA to ensure appropriate procedures are in place for the management of both mine-related and public traffic during the intersection upgrade activities.

2.10.3 Mining Operations

The indicative vehicle movements during operations are provided in **Table 2.11**.

Table 2.11
Indicative Vehicle Movements During Mining Operations[1]

Activity	Vehicle Type	Estimated Average Daily Vehicle Movements	
		Average	Maximum
Equipment / supplies deliveries	Semi-trailer, rigid truck	8	20
Workforce[2]	Passenger vehicles	134[3]	200
Miscellaneous	Various light vehicles	10	20
TOTAL	Heavy	8	20
	Light	144	220

1 One round trip = 2 movements 2 Assumes 365 days per year operations 3 Assumes 1.5 employees/vehicle

2.11 HOURS OF OPERATION AND MINE LIFE

2.11.1 Hours of Operation

Hours of operation are forecast to be as presented in **Table 2.12**.

Table 2.12
Proposed Hours of Operation

Activity	Hours/Days
Site Establishment	
Vegetation clearing / soil removal	7:00am to 6:00pm / 7 days
Surface Infrastructure and Pit Top Area construction	7:00am to 10:00pm / 7 days
Pit Bottom Area development	24 hours / 7 days
Raw materials / supply delivery	7:00am to 10:00pm / 7 days
Mining Operations	
Underground mining	24 hours / 7 days
Crushing / sizing and stockpiling	24 hours / 7 days
Rail loading and transportation	24 hours / 7 days
Surface maintenance	24 hours / 7 days
Raw materials / supply delivery	7:00am to 10:00pm / 7 days

The establishment of the surface infrastructure, ie. primarily the Pit Top Area and Site Access Road, is anticipated to take approximately 12 months, with one to two crews operating up to 7 days per week. Excavation of the box cut and two drifts is expected to take up to 11 months.

Establishment and mining of the Pit Bottom Area is anticipated to take approximately three months and would be undertaken using one crew/shift on a 2x10 hour shift basis, 5 days per week. Shift times during this period would be:

- day shift 7.00am - 5.00pm; and
- afternoon shift 4.30pm - 2.30 am.

Hours of operation during normal mining operations would vary depending upon the activity type. **Table 2.12** presents the proposed hours of operation for each activity. It is proposed that mining and related operations would occur on a three shift basis with the following shift times being likely.

- day shift 7.00am - 5.00pm (Production); and
- afternoon shift 4.30pm - 2.30 am (Production); and
- night shift 10.00pm - 7.00am (Maintenance).

2.11.2 Mine Life

The 160Mt of coal recoverable from within Areas A, B and C would support a mine for a period of approximately 50 years based upon an annual production rate of 2.5Mt. This would be the likely life of the mine in the event that it remains a continuous miner operation for its entire life. Section 2.16 discusses the mine life in the event the method of mining changes to a longwall operation.

2.12 EMPLOYMENT

2.12.1 Site Establishment

Construction of the Site Access Road and intersection with the Kamilaroi Highway, Pit Top Area infrastructure, drift development and establishment of the stockpiling areas and crushing / sizing plant would be undertaken prior to the mining and crushing / sizing of any coal.

Construction contracts would generally be issued on a tender basis, with preference given to suitably experienced local/regional contractors, where justifiable.

An estimated workforce of up to 80 full-time equivalent persons would be employed during the site establishment period.

2.12.2 Operations

Table 2.13 identifies the projected mine workforce assuming a maximum coal production rate of 2.5Mtpa, the mining equipment fleet identified in **Tables 2.9** and **2.10**, and the projected three-shift underground mining and surface coal crushing / sizing operations. All plant and equipment operators would be multi-skilled. The mining workforce would be employed directly by the Proponent, with some specialist services contracted. The level of 94 persons is based upon two continuous miners operating. When a third continuous miner is introduced, total employment would rise to approximately 113 persons.

A number of technical, professional and mine support service personnel would also be expected to visit the mine site on an "as needs" basis including cleaners, rubbish removal contractors, specialist tradespersons and sales representatives, environmental, mine planning and geotechnical consultants, as well as the Proponent's senior management personnel.

The mine workforce would comprise a core workforce with experience in coal mining or related industries supplemented by suitable local persons. The Proponent would support employment of local district personnel, with arrangements for training and certification put in place to ensure suitable applicants can acquire the necessary skills.

The Proponent would implement a training and employment program which they would implement for Stage 1 of the Narrabri Coal Project. The local indigenous community would be encouraged to be involved in this program.

It is expected that some experienced mine workers would be sourced from the Hunter region as mines in that area close, but it is anticipated that the majority of employees would be local people trained on site.

2.13 WASTE MANAGEMENT

2.13.1 Nature of Wastes

The principal wastes that would be generated throughout the life of the Project can be categorised as non-production and production wastes.

Table 2.13
Indicative Direct Employment for the Narrabri Coal Project

Position	Employee / contractor number
Staff	14
Mine Manager	1
Engineers (mechanical/electrical)	2
Colliery Clerk	1
Reception and administration	4
Survey	1
Under-manager	2
Surface foreman	1
Storeman	2
Production Crews	34
Deputy	4
Underground operators	20
Bolting	8
Trades	2
Outbye Support	12
Deputy	2
Trades	4
Machine operators	6
Belt Crews	12
Deputy	2
Trades	6
Machine operators	4
Outbye Maintenance	8
Deputy	2
Trades	4
Machine operators	2
Coal Handling	4
Miscellaneous	10
Pump fitters	4
Surface Labour	6
TOTAL	**94**

Non-production wastes would include:

- general domestic-type wastes from the on-site buildings and routine maintenance consumables;
- oils and grease; and
- sewage.

Production wastes generated on the Project Site would comprise:

- mined rock from the development of the transport drift, conveyor drift and ventilation shaft; and
- potentially contaminated water from the maintenance workshop, washdown pad and fuel storage areas.

The management of mined rock has previously been described in Section 2.4.11. Potentially hydrocarbon-contaminated water would be collected in the oil/water separator and regularly removed from site by a licenced contractor.

2.13.2 Management of Non-production Wastes

2.13.2.1 Domestic-type Wastes and Routine Maintenance Consumables

All paper and general wastes originating from the surface facilities area, together with routine maintenance consumables from the daily servicing of equipment, such as grease cartridges, would be disposed of in 205L drums and 240L mobile garbage bins located adjacent to the various buildings. These bins would generally be collected daily and the contents placed in large waste storage receptacles or dumpsters positioned adjacent to the maintenance workshop to await removal by a licenced industrial waste collection contractor. Industrial waste collection would be undertaken fortnightly, or more frequently, if required.

Separate collection systems would be employed for recyclables such as paper and cardboard, drink containers (cans and PET bottles) and ferrous and non-ferrous metals, each of which would be despatched off site at appropriate intervals.

2.13.2.2 Oils and Grease

Routine maintenance of the more mobile mining and earthmoving equipment would generally be undertaken in the maintenance workshop within the Pit Top Area, while underground equipment would be subject to minor maintenance in-situ and brought to the surface for more substantial maintenance. Major equipment maintenance would be undertaken at facilities away from the mine.

Within the maintenance workshop, waste oils and grease would be collected and pumped to bulk storage tanks by oil evacuation pumps. All parts and packaging would be collected and transferred to the maintenance workshop for disposal or recycling.

Waste oils and grease would be stored appropriately at the maintenance workshop and collected by a licensed waste recycling contractor as required for recycling.

2.13.2.3 Sewage

The Proponent would install adequate toilet and ablution facilities within the mine facilities area for the site workforce and visitors. These facilities would incorporate one or more self irrigating eco-cycle septic sewage system(s) approved by Narrabri Shire Council. The treated septic system water would be irrigated on the landscaped areas. Additionally, these facilities would be regularly serviced as required by Council and the manufacturer.

2.14 SAFETY/SECURITY MANAGEMENT

2.14.1 Introduction

The Proponent recognises the need to implement procedures and controls to protect the safety of its own or contracted employees, visitors to the mine, the public in general, as well as local landowners and land users. Measures would also be required to ensure the security of the mine facilities and equipment from unauthorised access or use.

It is the Proponent's policy that each person employed on, or visiting the, Project Site is provided with a safe and healthy working environment and, to achieve this, the Proponent would implement a recruitment, induction and training program to achieve the following objectives.

- To ensure compliance with statutory regulations and maintain constant awareness of new and changing regulations.
- To eliminate or control safety and health hazards in the working environment in order to achieve the highest possible standards for occupational safety.
- To ensure the suitability of prospective employees through a structured recruitment procedure.
- To provide relevant occupational health and safety information and training to all personnel.
- To develop and constantly review safe working practices and job training.
- To conduct regular safety meetings and provide an open forum for input from all employees.
- To provide effective emergency arrangements for all employees, and general public protection.
- To maintain good morale and safety awareness through regular employee assessment and counselling (if required).
- To ensure all contractors adopt the Proponent's policy objectives and maintain safety standards at all times while working on its premises.
- To develop public awareness of the safety standards and objectives at the proposed Stage 1 of the Narrabri Coal Project.

Central to all aspects of site security and safety at the proposed Stage 1 of the Narrabri Coal Project would be:

- the adoption of a pro-active approach to employee and public safety;
- strict compliance at all times with the requirements of the:
  - *Coal Mine Health and Safety Act 2002*;
  - *Coal Mine Health and Safety Regulation 2006* ;
  - *Coal Mines (Underground) Regulation 1999*
  - *Dangerous Goods Act 1975*;
  - *Occupational Health and Safety Act 2000*;
  - all other relevant legislation and Australian Standards; and
  - WorkCover Authority.

- the prioritisation given to addressing any safety issues identified by an Inspector of Mine Safety Officer or authorized government official (as specified in the *Coal Mine Health and Safety Act 2002*); and
- an Occupational Health and Safety Policy to cover all component activities at the mine.

The Proponent is required under the *Coal Mine Health and Safety Act 2002*, to develop and implement a Health and Safety Management System and a Major Hazard Management Plan for the Narrabri Coal Project.

2.14.2 Safety/Security Measures

The Proponent would implement the following measures in association with the development of the mine.

(i) Erection and maintenance of fencing around the surface facilities, portals, ROM and product stockpile areas within the Pit Top Area. A security fence would also be erected around the various components related to the ventilation shaft. Internal agricultural fencing would also be established and/or maintained to enable the continuation of agricultural activities in those areas not designated for mining-related activities.

(ii) Signage would be placed along the Site Access Road as it enters the property advising visitors to sign in, office location and personal protective equipment requirements.

(iii) Position security/warning signs at strategic locations around or within the Project Site indicating the presence of mining operations. The signs would be positioned to alert employees/visitors entering the Pit Top Area and passing motorists.

(iv) Employee induction in safe working practices and regular follow-up safety meetings and reviews.

(v) Ensure all earthmoving and mining equipment complies with the *Mine Design Guideline* (MDG) 15 and is fitted with appropriate safety equipment, eg. rollover protection structures and seatbelts, an operating reversing alarm (or other approved warning device) and an approved location and method of operation for the fire suppression system, all of which would be maintained in a good condition and operated safely at all times.

(vi) Ensure all crushing and conveying equipment at all times complies with all relevant requirements and standards.

(vii) Strictly complying with all mining lease, planning approval and licence conditions.

(viii) Erection of advisory signage, such as “Trucks Entering 200m” and “Railway Crossing”, on the Kamilaroi Highway prior to the intersection with the Site Access Road.

2.15 REHABILITATION AND DECOMMISSIONING

2.15.1 Introduction

As the only proposed surface disturbance would be related to the Pit Top and Ventilation Shaft Areas, both of which are anticipated to be present for the life of the Stage 1, and potentially, Stage 2 operations, there would be no opportunity or need to undertake progressive rehabilitation, ie. other than that required during the site establishment phase. Consequently, the following sub-sections address the rehabilitation intended during the site establishment phase and a conceptual overview of the decommissioning and closure of the overall operation. Since mine closure is not anticipated to occur until the cessation of coal mining (either continuous miner or longwall mining operations), this section only provides a conceptual closure plan which would be further developed in consultation with the relevant government authorities closer to the time of closure. This approach would ensure that the closure plan addresses the most relevant requirements and methods, applicable at that time.

2.15.2 Objectives

The Proponent's rehabilitation objectives for all areas of mine-related surface disturbance within the Pit Top Area can be defined in the short term and long term.

In the short term, ie. for the site establishment phase, the objectives would be to stabilise all earthworks, drainage lines and disturbed areas no longer required for mine-related activities in order to minimise erosion and sedimentation, and to reduce the visibility of the activities from adjacent properties and the local road network.

In the longer term, ie. with respect to closure, the Proponent's objectives are to provide a low maintenance, stable and safe landform that blends with the surrounding topography and which maximises the return of agricultural land with an agricultural land suitability comparable to the existing levels.

2.15.3 Site Establishment Phase

The Proponent intends to progressively rehabilitate the areas disturbed during the site establishment phase principally to stabilise those areas and minimise the impacts of erosion. Erosion control would be achieved by the early establishment of ground cover over disturbed areas, such as the perimeter of the box cut, the perimeter amenity bund, road verges, rail loop embankments, water management structures and soil stockpiles. Surface stabilisation would be achieved through sowing a pasture seed mix relevant to the season in which planting occurs. **Table 2.14** lists the indicative components of both a winter and summary pasture seed mix together with typical fertiliser application rates. The actual seed mix would be based on seed availability at the time.

Table 2.14
Winter and Summer Pasture Species Seed Mixes

Summer			**Winter**		
Pasture Species	**Rate (kg/ha)**	**Fertiliser**	**Pasture Species**	**Rate (kg/ha)**	**Fertiliser**
Grasses					
Bombatsi Panic	1 – 2	Di-ammonium Phosphate (DAP) 250kg/ha	Phalaris (Sirolan or Holdfast)	1 -2	Di-ammonium Phosphate (DAP) 250kg/ha
Green Panic *2	2 – 4		Wallaby Grass	0.3 - 1	
Rhodes Grass *2	1 – 2				
Purple Pigeon Grass	1 – 2				
Legumes *1					
Subterranean Clover	4 - 5		Subterranean Clover	4 - 5	
			Barrel (Sephi) medic	2 – 4	
			Snail (sava) medic *2	3 – 5	
			Woolly Pod Vetch	4 – 6	
			Serradella (Elgara)	1 – 2	
			Lucerne	0.5	

*1 Inoculated with appropriate rhizobia
*2 Specific Soil Conservation Application
Source: Soil Services pers comm. (2004)

Apart from the initial stabilisation works, the Proponent intends to plant a selection of locally sourced tree and shrub species:

(i) on the outer surface and top surface of the perimeter amenity bund;

(ii) within defined landscaped areas around the surface facilities; and

(iii) adjacent to the Site Access Road.

Table 2.15 lists the range of tree and shrub species to be planted together with predicted heights at maturity.

2.15.4 Decommissioning Activities

On cessation of mining and crushing / sizing activities, many of the structures and facilities would be decommissioned and removed from site prior to final rehabilitation of the Pit Top Area and Ventilation Shaft Area, including:

- the coal crushing / sizing plant;
- various fuel storages, workshops and offices;
- rail loop and load-out bin;
- infrastructure related to the transport drift and conveyor drift;
- surface infrastructure related to the ventilation shaft; and
- roads not to be maintained in the final landform.

Table 2.15
Tree and Shrub Species to be used for Landscaping

Common Name	Scientific Name	Height at Maturity
LOWER FLATS AND FLOODPLAIN WOODLAND		
Trees		
Bimble Box	*Eucalyptus populnea*	To 25 m
Western / Inland Grey Box	*E. microcarpa*	To 25 m
Pilliga Grey Box	*E. pilligaensis*	To 25 m
Blakely's Red Gum	*E. blakelyi*	To 25 m
Belah	*Casuarina cristata*	5 - 20 m
White Cypress Pine	*Callitris glaucophylla*	5 - 20 m
Kurrajong	*Brachychiton populneus*	5 - 20 m
Native Orange	*Capparis mitchellii*	5 - 20 m
Shrubs		
Yellow Berry Bush	*Maytenus cunninghamii*	1 - 5 m
Wilga	*Geijera parviflora*	1 - 5 m
Yarran	*Acacia homalophylla*	1 - 5 m
Deane's Wattle	*A. deanei*	1 - 5 m
A Wattle	*A. ixiophylla*	1 - 5 m
RIPARIAN FOREST		
Trees		
River She-oak	*Casuarina cunninghamiana*	To 25 m
Blakely's Red Gum	*E. blakelyi*	To 25 m
Shrubs		
Yellow Berry Bush	*Maytenus cunninghamii*	1 - 5 m
Wilga	*Geijera parviflora*	1 - 5 m
Deane's Wattle	*Acacia deanei*	1 - 5 m
Source: Modified from Ecotone (2007) – Table 8		

There may be potential, however, for a future land owner to retain some items of surface infrastructure such as storage sheds and workshop buildings. Retention of any items would be negotiated with the future land owner at the time.

Following the removal of surface infrastructure from the drift portals within the box cut, the entries would be sealed in accordance with appropriate DPI (MR) guidelines and the void backfilled. Similarly, the infrastructure associated with the ventilation shaft and fan would be removed and the shaft sealed in accordance with DPI (MR) guidelines.

Any potentially hydrocarbon-contaminated material would either be removed or bio-remediated onsite.

2.15.5 Final Landform

The final landform of the Project Site would be very similar to that which currently exists as the only locations in which there would be surface disturbance during Stage 1 activities that would affect the surface are the Pit Top Area and Ventilation Shaft Area. **Figure 2.16** displays the features of the final landform within the Pit Top Area.

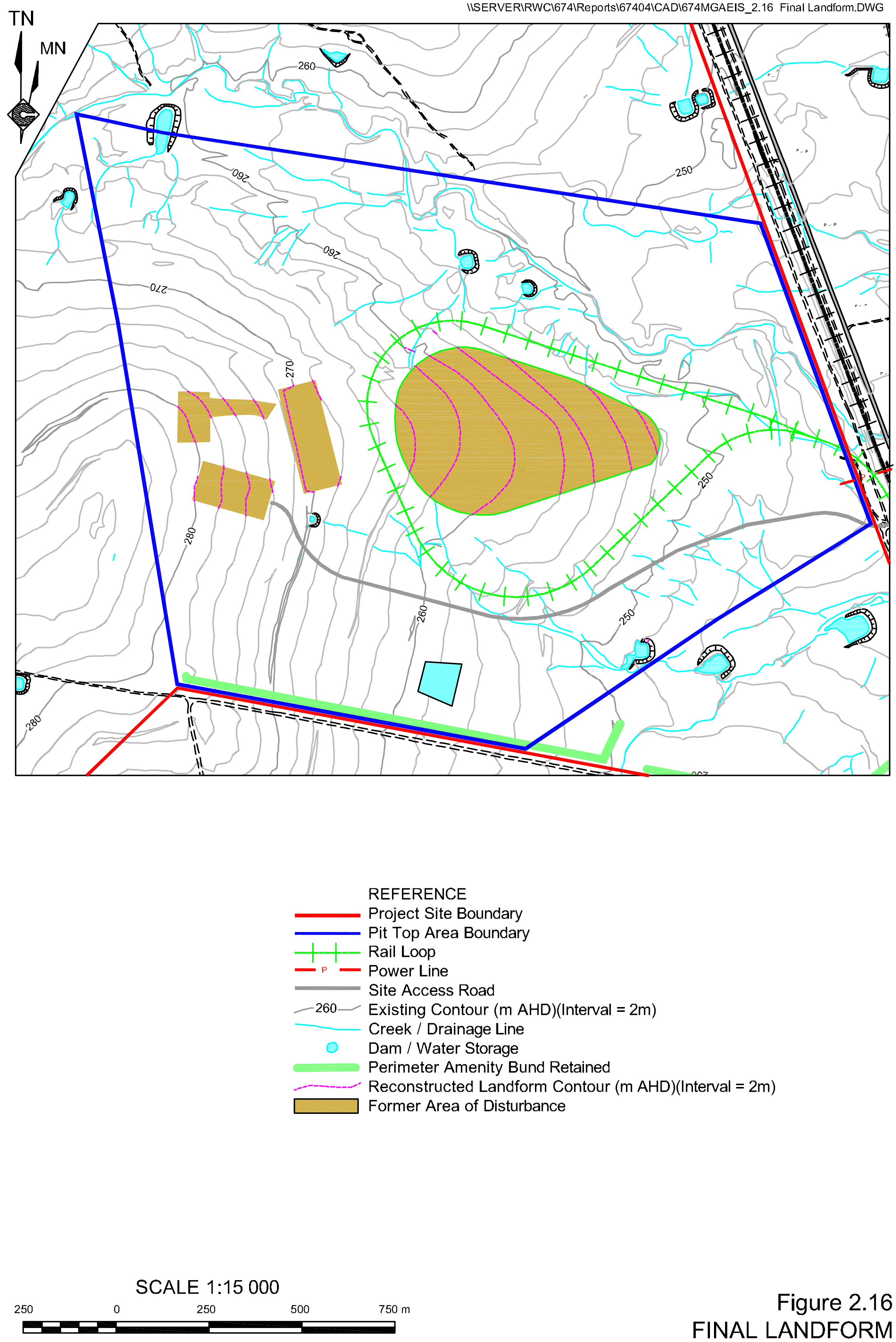


Figure 2.16
FINAL LANDFORM

Pit Top Area

The disturbance of the surface topography in the Pit Top Area would be restricted to the box cut, Site Access Road, surface facilities and the cut and fill required for the ROM and product stockpiles and rail loop.

As noted in Section 2.15.4, the portal entries would be sealed and the box cut backfilled to replicate the pre-mining landform. The material used to backfill the box cut would be sourced from the perimeter amenity bund.

There is potential for the rail loop to be considered valuable infrastructure for the future land owner and hence retained on closure. In the unlikely event the rail loop is not to be retained, the cutting would be filled with material excavated from the footprint of the nearby ROM and product stockpile area and the entire disturbance footprint would be reprofiled to recreate a similar topography to that which currently exists, ie. undulating and sloping to the east.

The cut and fill disturbance within both the ROM and product stockpile areas would be profiled to ensure it has safe and stable slopes on construction. These slopes would be shaped to create a more undulating landform, more consistent with the surrounds.

With the exception of the material required to backfill the box cut, the perimeter amenity bund would be retained on closure and would act as a wind break for future agricultural activities and fauna habitats.

Most surface water structures such as the storage dam and diversion banks would also be retained to allow for continued water management across the Pit Top Area following mine closure.

The retention or removal of the sealed Site Access Road would be dependent on the final land use of the site and the requirements of the future land owner. All internal minor roads and tracks would be removed and pre-mining topography re-instated.

Evaporation / Storage Ponds

Accumulated salt within the evaporation / storage ponds would be excavated and either placed within the box cut prior to it being backfilled or despatched for disposal off site. In either case, the Proponent would undertake sufficient studies to illustrate that the risk of contamination is minimal and develop contingency plans developed for all possible contamination events.

The salinity level of the compacted clay floor would be analysed and any saline contaminated subsoil would be excavated and treated in the same way as the accumulated salt. In the event an impermeable plastic liner is used (in place of the compacted clay), the subsoil beneath the liner would also be analysed for elevated salinity levels after it is removed.

The remaining sub-surface material would be sampled and analysed for salinity. Any evidence of saline contamination would trigger the implementation of a Salinity Contamination Contingency Plan (to be developed in consultation with DNR and DEC). Confirmation of no saline contamination would allow the area to be rehabilitated to its prescribed final landform ie. the evaporation / storage ponds would be backfilled and a landform comparable with the existing landform would be created.

Ventilation Shaft

The shaft would be filled in (or sealed) by a method approved by the DPI (MR) and the surrounding bund wall removed, with the material forming the bund around the ventilation compound being pushed back into the shaft or backfill. The final topography of the Ventilation Shaft Area would be similar to that which currently exists with a central raised area.

2.15.6 Rehabilitation

Following decommissioning of the surface infrastructure and creation of the final landform discussed above, the following rehabilitation activities would be undertaken.

- Subsoil and topsoil would be replaced over areas of disturbance in the same order and approximately same depths as it was removed (ie. 15cm for topsoil and 25cm for subsoil).
- An appropriate pasture seed mix would initially be planted to re-establish nitrogen levels and biological activity in the replaced topsoil.

Discussions would be held, if appropriate, with the landowner to establish what seeding and ultimately cropping regime would be appropriate during the period between the commencement of revegetation and the relinquishment of the mining lease, ie. when the Proponent has no further obligations to the ongoing rehabilitation of the disturbed areas.

2.15.7 Final Land Use

With the exception of a proportion of the perimeter amenity bund wall, covering approximately 3.0ha, and most likely the rail loop covering 4.7ha, all land disturbed during the life of the mine would be returned to a land capability / agricultural land suitability similar to the existing levels. This would be achieved principally through the re-instatement of a comparable soil profile across those areas disturbed throughout the life of the project. Given this commitment, the Proponent intends that the bulk of the areas disturbed would be returned to productive cropping and periodic grazing.

The likely retention of the rail loop may influence the succeeding land use depending upon land uses around the Pit Top Area at that time.

2.15.8 Rehabilitation Monitoring and Maintenance

The Proponent's commitment to effective rehabilitation would involve an ongoing monitoring and maintenance program throughout and beyond the operation of the project.

As the majority of disturbance would be in place for the life of the operation, there is limited progressive rehabilitation works that could be undertaken apart from stabilisation of the drift areas, perimeter amenity bund, soil stockpiles and establishment of landscaped areas around the

Pit Top Area. These areas, along with final rehabilitation areas, would be regularly inspected and assessed against the short and long term rehabilitation objectives outlined in Section 2.15.2. During regular inspections, aspects of rehabilitation to be monitored would involve:

- evidence of any erosion or sedimentation from areas with establishing vegetation cover;
- success of initial pasture / cover crop establishment;
- adequacy of drainage controls; and
- general stability of the rehabilitation site.

Where rehabilitation success appears limited, maintenance activities would be initiated. These may include re-seeding and where necessary, re-topsoiling and/or the application of specialised treatments such as composted mulch to areas with poor vegetation establishment. Tree guards would be placed around planted seedlings should grazing by native animals be excessive. If drainage controls are found to be inadequate for their intended purpose or compromised by grazing stock or wildlife, these would be replaced and/or temporary fences installed to exclude grazing of native vegetation by native or domestic fauna.

Should areas of excessive erosion and sedimentation be identified, remedial works such as importation of additional fill, subsoil or topsoil material or redesigning of water management structures to address erosion would be undertaken.

No time limit has been placed on post-mining rehabilitation monitoring and maintenance. Rather, maintenance would continue until such time as the objectives outlined in Section 2.15.2 are met.

2.15.9 Noxious Weed Management

The Proponent is keen to avoid any noxious weed infestations and would take the necessary precautions to prevent the excessive growth of weeds within the rehabilitated areas and the long term soil stockpile areas. When appropriate, campaign weed spraying would be undertaken prior to the stripping of topsoil and periodic visual inspections would be undertaken of disturbance areas. The appropriate noxious weed control or eradication methods and programs would be undertaken in consultation with DPI (Agriculture) and/or the local Noxious Weeds Inspector.

2.15.10 Surrounding Land Management

The land owned by the Proponent beyond the areas proposed to be disturbed would be leased to surrounding landowners for agricultural purposes.

The Proponent would implement the principles of responsible land ownership and ensure that feral animals and weeds are managed appropriately across its entire land holding. Cooperation with adjoining land owners would be a regular feature of the ongoing land management within the Project Site.

2.16 OVERVIEW OF STAGE 2 MINING AND RELATED ACTIVITIES

2.16.1 Introduction

The Proponent intends to evaluate the feasibility of converting the Narrabri Coal Project from a continuous miner operation with an annual production of 2.5Mtpa to a longwall mining operation with an annual production of approximately 6Mtpa. It would then be necessary for the Proponent to finalise the design of the entire Stage 2 operation and undertake a comprehensive environmental assessment prior to seeking project approval and licence / lease variations that would be needed to proceed with Stage 2.

As previously explained in Section 2.3.6, the Narrabri Coal Project would be the most northern coal mining venture in the Gunnedah Basin, and as such, it is fundamental that the consideration of a longwall mining operation is considered carefully to ensure that it is both technically and economically feasible and would have acceptable environmental impacts.

Each of the issues influencing whether a longwall mining operation should proceed would need to be carefully evaluated, however, in the meantime, this section provides a brief overview of the proposed Stage 2 mining operations, the predicted level of subsidence, the need for coal beneficiation and modifications to all other aspects of the project including rail and road traffic levels and employment levels.

A conceptual overview of environmental impacts associated with the surface subsidence and additional surface facilities related to the Stage 2 mining operations is presented in Section 4C of this document.

2.16.2 Stage 2 Mining Operations

Figure 2.17 depicts the layout of the mine in the event that it is converted to a longwall mine. Longwall mining operations would be confined to Area C. Mining would involve the sequential development of roadways approximately 300m apart oriented north-south from the West Main and developed for the full distance (approximately 4km) to the northern and southern boundaries of Area C. Once each set of roadways are fully developed, the longwall equipment would be installed and the coal recovered as the longwall unit retreats back towards the West Main between the two roadways. All coal would be conveyed back to the Pit Bottom Area for transfer to the surface via the conveyor drift.

It is envisaged that the 6Mtpa coal production would be achieved through the combination of a single longwall unit and two or three continuous miners developing roadways for the longwall unit. It is envisaged that each panel (4km long / 300m wide) would take approximately 12 months to mine. Other modifications to the mining operation may involve a third drift, upgraded conveyor systems and an additional ventilation fan installed on the Stage 1 ventilation shaft. Subject to the amount of mine gas encountered, it may be necessary, to install gas drainage boreholes to reduce mine gas concentrations in the underground mine.

The preliminary subsidence assessment by Mining Geotechnical Services Pty Ltd (2007) was based on 250m wide longwall panels with a 4m mining height at depths of 180m to 300m. The chain pillars are taken to be 32m wide with a gate road height of 3.2m. Under these conditions,

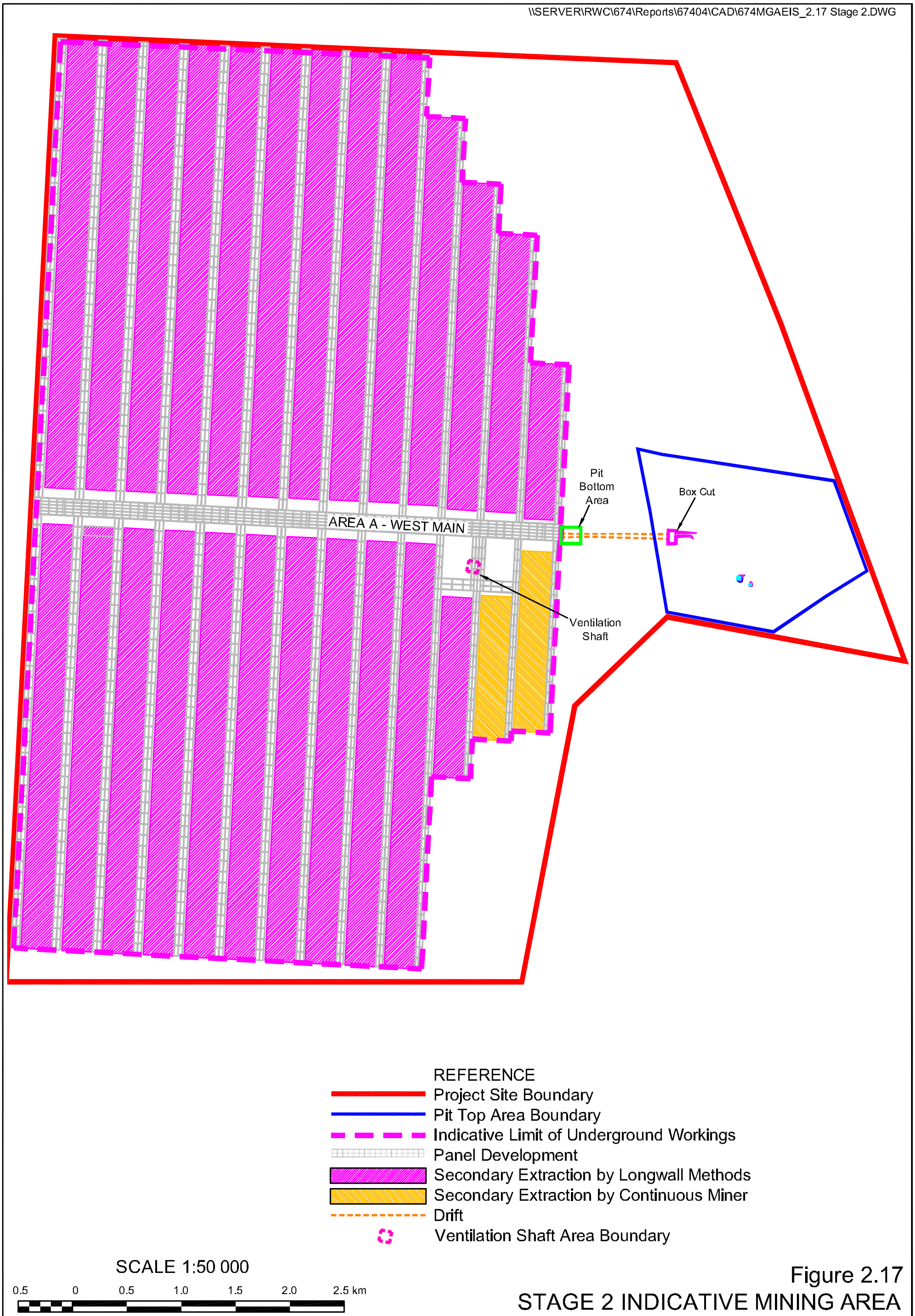


Figure 2.17
STAGE 2 INDICATIVE MINING AREA

a maximum predicted subsidence of 2.79m would occur where mining is 195m to 215m below the ground surface (ie. towards the east) with up to 2.24m occurring in the west where mining is 300m below the ground surface. Given this level of predicted subsidence, it is anticipated that subsidence would extend the following distances beyond the limit of mining (ie. the boundary of the potential longwall blocks).

- 75m beyond the western boundary.
- 10m beyond the eastern boundary.
- 125m beyond the northern and southern boundaries at the western end, reducing to 75m in the east.

It is noted that initially the Proponent intended to undertake a caveability trial in the central western side of the mine area principally to better understand the caveability of the rock units above the Hoskissons Coal Seam. The Proponent has been advised by Mining Geotechnical Services Pty Ltd that such a trial is no longer necessary, ie. based upon further evaluation of existing data and the opportunity to conduct tests underground during the early years of mine development.

2.16.3 Stage 2 Surface Operations

It is envisaged that the conversion of the mine from a continuous miner operation to a longwall mining operation would also involve a range of modifications to surface components. The main modifications envisaged are as follows.

(i) A coal handling and preparation plant (CHPP) would be required to wash the coal and separate the non-coal materials typically recovered during a longwall mining operation. Not all coal would need to be washed as only high ash coal (originating from the mine floor) would be detected by a coal scanner and directed to the CHPP for further beneficiation.

(ii) A new 66kV powerline (from Narrabri) and an upgraded power transformer may be required to meet the power requirements of the longwall unit and the CHPP.

(iii) Additional surface facilities, such as ablutions and parking area would be required for the additional 50 employees.

There would be no change to the ROM stockpiles or product stockpiling area. Only the throughput through these would increase by approximately 240%. Also, there would be no need to modify the rail loop or rail load-out bin.

2.16.4 Transportation

2.16.4.1 Rail Traffic Levels

The increase in coal production from 2.5Mtpa to 6.0Mtpa would result in two main changes to the despatch of coal products, namely:

(i) longer trains would be used, ie. up to 84 wagons per train with a train capacity of 6 200t; and

(ii) an average of three trains would be despatched daily.

2.16.4.2 Road Traffic Levels

As a result of the additional employees, 35 additional cars are forecast to travel to and from the Pit Top Area during Stage 2 operations.

2.16.5 Mine Life

The conversion of the mine from a continuous miner operation to a longwall mining operation would result in the mine life decreasing from a theoretical 50 years to approximately 30 years, given the increase in production from 2.5Mtpa to 6Mtpa and higher coal recovery rate.