

Section 2

Description of the Proposed Modification

2.1 INTRODUCTION

2.1.1 Objectives

The Applicant's objectives for the modified Werris Creek Coal Mine are to:

- (i) develop and operate a safe mine producing low ash, thermal coal;
- (ii) develop and operate the mine in a manner that complies with all statutory requirements;
- (iii) maximise resource recovery, and efficiency of mining operations, through modification of the open cut area and recovery of the remaining coal resources within the underground workings of the former Werris Creek Colliery;
- (iv) undertake all activities in an environmentally responsible manner, employing a level of control and safeguards that would ensure compliance with appropriate criteria/goals or reasonable community expectations at all times;
- (v) maintain and expand international and domestic markets for the coal produced;
- (vi) maintain the stimulus to the local economies of Werris Creek and Quirindi and their surrounding districts through employment opportunities and the supply of services required for the operation of the coal mine;
- (vii) create a final landform amenable to a combination of agricultural and native vegetation conservation activities;
- (viii) establish and manage a biodiversity offset area to compensate for the disturbance to native vegetation resultant from the proposed mining and associated activities; and
- (ix) achieve the above objectives in a cost-effective manner and thereby ensure the ongoing viability of the Werris Creek Coal Mine.



2.1.2 Overview of the Proposed Modification

The proposed modification, if approved, would involve the following activities, the locations of which are shown on **Figure 2.1**.

- Modification to the open cut area. The northern extent of the open cut area would be widened such that the eastern perimeter corresponds with the eastern extent of the sub-cropping G Seam.
- Dewatering the underground workings of the former Werris Creek Colliery to enable open cut mining through part of these workings.
- Construction of up to four dams within an underground water storage area to store the water pumped from the underground workings.
- Extension of the out-of-pit overburden emplacement to the north along the modified eastern perimeter of the open cut area.
- Modification to the overall shape of the overburden emplacement, with the height increased to approximately 445m AHD to accommodate the increased volume of overburden and revised mine plan associated with the modified open cut design.
- Construction of an additional train loading bin and conveyor at the rail load-out facility to facilitate the separation of product coal for specific markets and therefore increase the efficiency of train loading.

While the rehabilitation objectives and methods would remain consistent within those currently implemented at the Werris Creek Coal Mine, the proposed sequence of rehabilitation, and designated land use on the final landform has been modified slightly from that approved by DA 172-7-2004. In addition, the proposed modification to the open cut area and overburden emplacement would increase the area of an endangered ecological community to be cleared. In order to offset this clearing, a modified biodiversity offset strategy has been proposed.

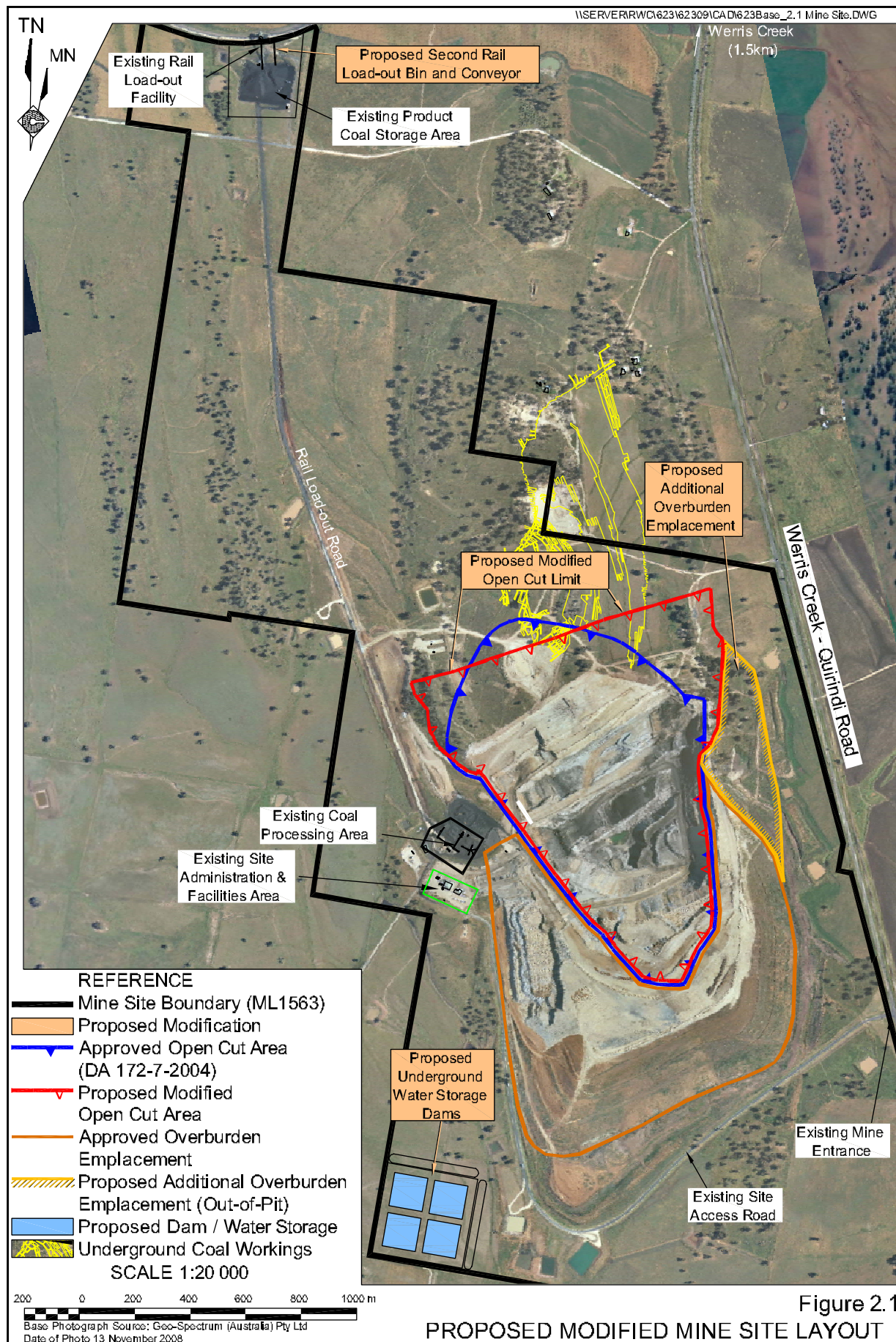
2.1.3 Approvals Required

In addition to the proposed modification to DA 172-7-2004, an aquifer interference licence under the *Water Management Act 2000* (WM Act) will be required to enable the full dewatering of the underground workings. Acknowledging the embargo on new licences currently in place, the Applicant proposes to obtain the additional licence allocation through application for an exemption from the Minister (see Section 1.8.1) as the economic cost of failure to secure the water would be high, with the impact on the environment assessed as being minimal.

As there will be no significant change to the activities undertaken at the Werris Creek Coal Mine, nor the land on which this is undertaken, no variation to the current Environment Protection Licence (EPL) 11290, issued by the Department of Environment and Climate Change under the *Environmental Planning and Assessment Act 1979* is considered necessary.

Up to four additional dams on the mine site would be constructed to store water from the underground workings. These dams would not capture any runoff from the mine site and hence will not require licensing under Section 10 of the *Water Act 1912*.





2.2 RESOURCE ASSESSMENT

2.2.1 Exploration

There is an extended history of exploration on and around the site of the Werris Creek Coal Mine. Records show that four boreholes were sunk in 1924 to locate the eastern mine entries for the Werris Creek Colliery (Harper, 1925). There remains evidence of a further two boreholes at the site of portals on the western side of the syncline, but logs of these holes have not been located. The so-called 'Cable Bore' was sunk into the workings at approximately the deepest point of the basin (Pratt, 1996), although recent research suggests that this hole may not provide a reliable stratigraphic record of the coal geology.

Exploration Licence (EL) 5993 was granted to Creek Resources Pty Ltd, a company directly associated with the Applicant, on 18 September 2002 covering an area of 531ha (see **Figure 2.2**). The target of exploration was an isolated outlier of coal-bearing strata preserved within a syncline approximately 2.5km long and 1km wide (referred to hereafter as the Werris Creek coal resource). Between February and June 2003, a number of drilling programs were undertaken, with a total of 29 non-cored and five cored drill holes completed. Following the intersection of multiple coal seams in one of the initial holes, exploration focused on the southern end of the Werris Creek coal resource. The drilled holes were geophysically logged and the location, depth, cored intervals and logging details recorded. The result of the exploration activities was the identification of five primary coal seams (C to G Seams) and two rider coal seams (A and B Seams). The results of this exploration formed the basis of the original proposal for the Werris Creek Coal Mine set out in the 2004 EIS. A further 36 non-cored boreholes were drilled throughout the second half of 2004 to better define the limit of oxidation (lox) line of the lowermost seam (G Seam) and hence the outer perimeter of the Werris Creek Coal Mine as outlined in the 2004 EIS.

Since 2004, a number of exploration campaigns have been undertaken to further the assessment of the northern Werris Creek coal resource and increase confidence in the geological model for the northern Werris Creek coal resource. Four cored holes and 10 open holes were drilled between June and August 2007. Between February and May 2008, nine fully cored holes were drilled for a total of 947m. A considerable amount of PLI and UCS testing of the cored samples has been undertaken for the last drill program to assist with geotechnical and mining issues.

Figure 2.2 identifies the location and type of the exploration completed by the Applicant on EL 5993 and ML 1563 since 2003.

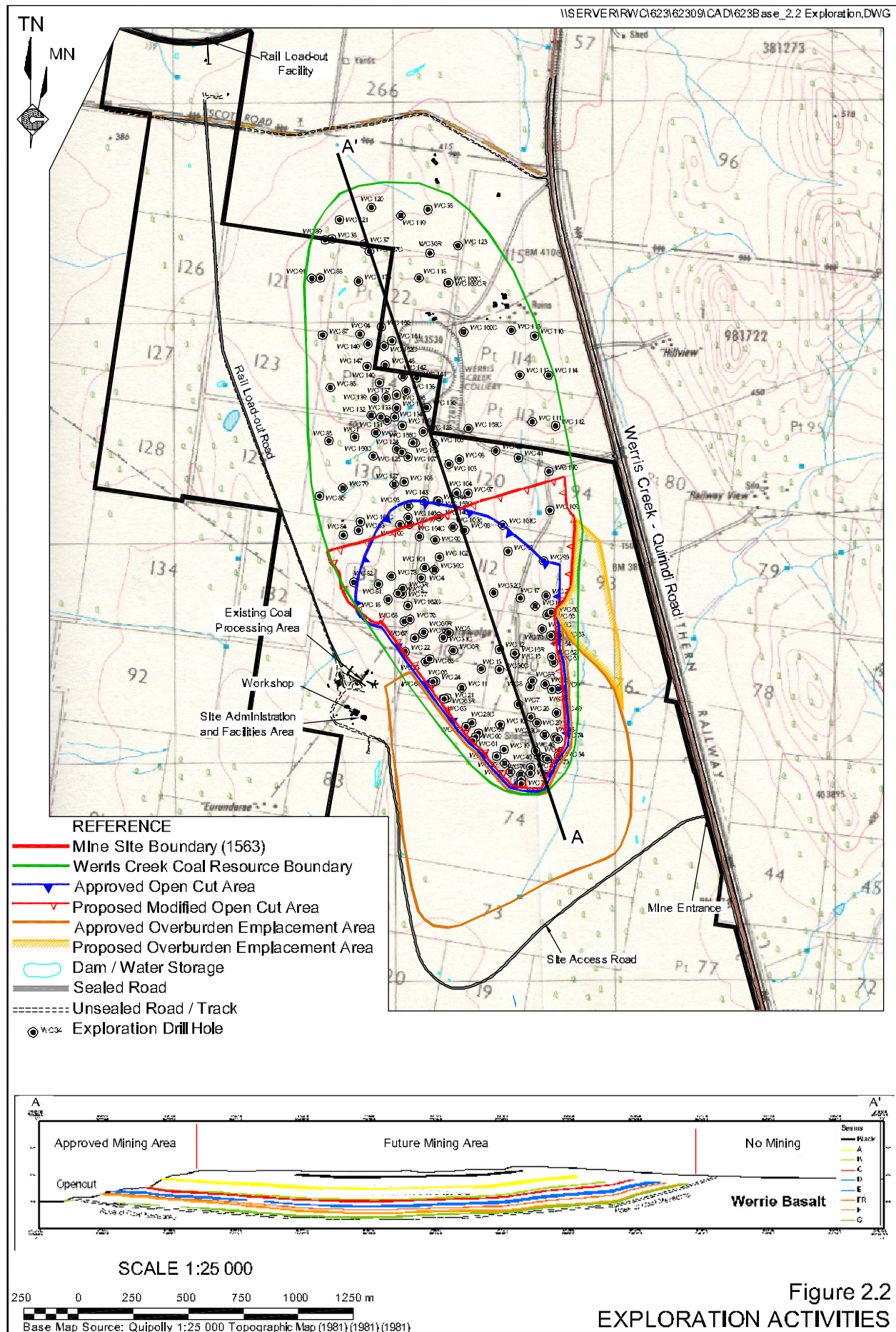
Exploration for the definitive delineation of the deepest coal seam (G Seam) of the Werris Creek coal resource (and therefore limit of the resource recoverable by open cut methods) is ongoing. This involves the drilling of exploration holes with a blast hole rig two benches (approximately 200m) in front of the advancing highwall.

2.2.2 Resources / Reserves

2.2.2.1 Modified Mine Area

The exploration undertaken within and adjacent to the proposed modified open cut area has defined approximately 1.5 million tonnes of coal from the A Seam to G Seam. The coal to be removed is from the former underground workings occurring within the E Seam.





2.2.2.2 Overall Resource Area

The total thickness of the coal-bearing sequence, comprising the seven coal seams (Seams A to G) of the synclinal basin, is approximately 130m although the uppermost coal seams within the sequence (A Seam and B Seam) contain only limited quantities of coal separated by thick interburden layers (typically 30m to 40m).

Significantly greater quantities of coal are present within the C Seam to G Seam. With the exception of the interburden layer between the F Seam and G Seam, which ranges in thickness from 20m to 40m, these seams are generally separated by reduced thicknesses of interburden (typically 2m to 6m). **Figure 2.3** presents the mapped perimeter of the synclinally folded coal seams, and a profile of these as they dip to the north, over the area proposed to be mined as part of the proposed modification.

Four JORC compliant resource statements and two reserve statements have been completed for the Werris Creek coal resource since the granting of EL 5993 in 2002. The most recent resource statement was that compiled by Colin Coxhead in June 2008 (Coxhead, 2008) in which the majority of the Werris Creek coal resource (see **Figure 2.2**) is identified as a 'Measured' or 'Indicated' resources. Less than 8% of the coal of the Werris Creek coal resource remains 'Inferred'. Coxhead (2008) records the coal resources at the Werris Creek as 38 million tonnes (see **Table 2.1**).

Table 2.1
Werris Creek Coal Resource Summary

Category	ML 1563	EL 5993
Measured	22.8 Mt	7.2 Mt
Indicated	4.0 Mt	1.4 Mt
Inferred	1.7 Mt	0.9 Mt
TOTAL	28.5 Mt	9.5 Mt
Source: Coxhead (2008)		

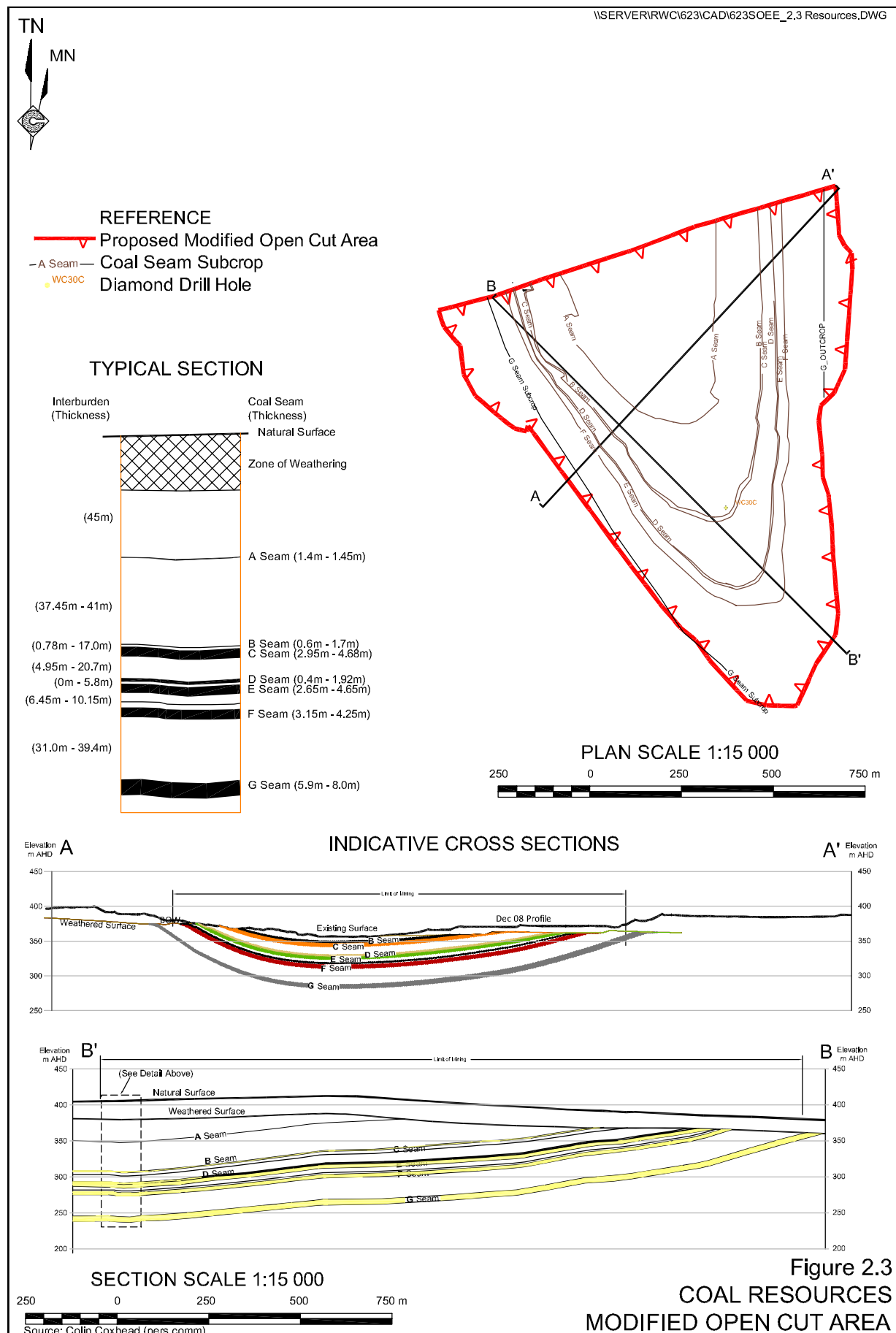
The most recent reserve statement was compiled by ASEAMCO in June 2008 (ASEAMCO, 2008). ASEAMCO (2008) identifies a proved and probable reserve of 19.91 million tonnes within ML 1563 and EL 5993, however, this reserve excludes the coal contained within or below the underground workings of the former Werris Creek Colliery. A summary of the coal reserves of ML 1563 and EL 5993 is presented in **Table 2.2**.

Table 2.2
Werris Creek Coal Reserve Summary

Proved Reserves	17.61Mt
Probable Reserves	2.30Mt
Proved + Probable	19.91Mt

The mine reserve has increased by approximately 13.5Mt (taking into account mining drawdown).





2.2.3 Coal Quality

The coal typically has an air-dried moisture of between 3.2% to 6.6%, low total sulphur content with ash content within the various seams ranging from 7% to 20%. **Table 2.3** presents the typical coal quality of each of the identified seams.

Based on the coal quality analysis of **Table 2.3**, the Werris Creek coal resource can be regarded as an export quality, low to medium ash thermal and PCI product. Overall the coal at Werris Creek can be classified as bituminous, with a maximum vitrinite reflectance value of 0.60.

Table 2.3
Werris Creek Coal Quality

Coal Seam	Proximate Analysis (% air dried basis)		Specific Energy (kcal/kg) @	Total Sulphur (% adb**) @	Grindability (HGI#)
	Ash	Volatile Matter			
A *	20.0	#	#	#	#
B *	16.0	31	6 552	0.3	44
C	11.9	30	6 640	0.3	47
D	16.5	24	6 251	0.3	48
E	7.4	30	7 066	0.3	50
F	11.9	28	6 700	0.3	49
G	7.8	31	6 995	0.3	47
Total	10.1	30	6 834	0.3	48
* Rider Seam ** adb = Air dried basis HGI# = Hardgrove Grindability @ Weighted average value # A seam sample not analysed for coal quality as it does not form a significant part of the reserve					
Source: Modified after RWC (2004) - Table 2.2					

The coal has low volatile matter (<32%), low crucible swell number (1), low total sulfur (<0.35%), low phosphorous (<0.005%) and low chlorine (<0.2%), qualities which make the coal suitable for the PCI market. The iron and calcium contents can vary between seams, as well as spatially within seams, with the presence of iron and calcium lowering the ash deformation temperature of the coal. Ash content varies between the seams with the E and G Seams generally having lower ash, the C and F Seams with moderate ash contents, and the Black, A, B and D Seams with high ash. A typical product specification for Werris Creek coal is provided in **Table 2.4**.

Table 2.4
Typical Product Specification, Werris Creek

Property	Basis	PCI Product	Thermal Product
Total moisture	(ar)	12 %	12 %
IM	air dried basis	4.5 %	4.5%
Ash Content	air dried basis	8 %	13-15 %
Volatile Matter	air dried basis	31 %	30 %
Total Sulphur	air dried basis	0.35 %	0.35 %
Specific Energy	(Kcal/Kg, air dried basis)	6 900	6 500
Ash Fusion Temperature (°C)	Initial Deform Hemisphere Flow		1 320 1 350 >1 500
Grindability (HGI)		52	50
Source: Werris Creek Coal Pty Limited			



2.2.4 Spontaneous Combustion Potential

As part of the original Werris Creek Coal Mine development, composite samples from the B Seam to G Seam were prepared and analysed for percentage oxygen on a dry ash free basis. Self Heating Temperatures (SHT) were then calculated using the US Bureau of Mines formula.

$$\text{SHT (Min)} = 139.7 - (6.6 \times \% \text{ oxygen, dry ash free basis})$$

Table 2.5 presents the calculated SHT values for each seam along with the USBM Guideline Values for assessing spontaneous combustion potential.

Table 2.5
Spontaneous Combustion Potential

Coal Seam	% Oxygen (Dry ash free basis)	SHT (Min)	Spontaneous Combustion Potential
B	11.94	61	High
C	11.28	65	High
D	9.45	77	Medium
E	10.39	71	Medium
F	9.79 - 10.17	73 - 75	Medium
G	10.80	68	High
			USBM Guidelines
			<70 High
			70 < SHT < 100 Medium
			> 100 Low

Source: RWC (2004) – **Table 2.3**

The SHT (Min) calculations place the coal from the Werris Creek Coal Mine in the medium to high spontaneous combustion potential range. The USBM formula does, however, tend to provide conservative estimates for spontaneous combustion potential. The experience at the Werris Creek Coal Mine to date is that standard practices such as watering coal stockpiles and residence time minimisation should be more than adequate to manage the potential for spontaneous combustion (see Section 1.6.9).

2.3 MINE PLANNING CONSIDERATIONS

2.3.1 Economic

As has been the case at the Werris Creek Coal Mine to date, the extent of open cut mining is ultimately determined by economic aspects such as coal price and mining costs at the time, with both coal price and mining costs determining the limit of the economic stripping ratio, ie. the volume of overburden and interburden above and between the various coal seams which must be removed to access each tonne of coal. This, in turn, is determined by coal seam thickness and the depth of cover. At the currently approved northern limit of mining, the open cut would be approximately 145m below ground level with the average overburden/interburden to coal stripping ratio (incorporating the proposed modification to the open cut area) comparatively low (5.4bcm of overburden/interburden per tonne of coal). This ratio is in the lower range when compared to other open cut coal mines in New South Wales.

Other economic factors considered in the development of the Werris Creek Coal Mine included the following.



- (i) Coal Ash Content. The coal seams are generally low in ash (see Section 2.2.3) and when crushed and sized, the coal is suitable as a thermal coal without a requirement for further beneficiation. By avoiding the need to wash the coal, and the associated expense of constructing and operating a coal washery, the production process is significantly simplified, improving the economic basis for the mining operations.
- (ii) Rail Access. The Werris Creek Coal Mine is located adjacent to an active rail siding on the Main Northern Railway Line which directly links the mine to the Port of Newcastle. This minimises the cost of transporting the coal to export markets given the Applicant is not required to construct a new rail siding nor haul coal significant distances by road prior to placement on the rail network.

2.3.2 Geological

The Werris Creek coal resource occurs within a synclinal basin structure, with the syncline axis dipping generally to the north-northwest (at approximately 5°). The upward fold of the eastern and western extremities of the coal seams approaches 30° but flattens to zero towards the middle of the synclinal structure. The extremities of each coal seam and northward dipping nature of this synclinal structure is presented on **Figure 2.3**.

The currently approved limit of mining (see **Figure 1.3**) will not maximise the recovery of coal from the Werris Creek Coal Mine, as by narrowing towards the northern boundary, the near surface coal of the G Seam, and then the remaining seams higher in the sequence would not be recovered. The modified limit of mining for this application follows the alignment of the G Seam (where it sub-crops), ensuring constant access to the high quality G Seam at a low stripping ratio. By following the alignment of G Seam sub-crop, the increasing depth of the open cut mine would continue to be offset by the near-surface intersection of this high yielding seam, thereby maintaining an acceptable maximum stripping ratio of approximately 6:1 (bcm overburden/interburden : tonne of coal).

The coal deposit continues beyond the proposed northern limit of mining (see **Figure 2.3**). By modifying the open cut mining area, access to this additional coal resource would be simplified by removing any requirement to realign or widen the mining face or relocate overburden placed within the in-pit overburden emplacement.

2.3.3 Environmental

Although the limits of the proposed modified mining area have been set with predominantly economic and geological considerations in mind, the following environmental considerations have influenced the overall mine planning process.

Figure 2.4 provides a representation of each of the matters discussed in relation to the design of the mine and associated activities.

- Ecological Considerations

The proposed modification to the open cut area of the Werris Creek Coal Mine, as well as the northerly extension of the out-of-pit overburden emplacement, would increase the area of the endangered White Box Yellow Box Blakely's Red Gum Woodland community disturbed by the mine. An assessment of the local and regional significance of this community is described in Section 4.6 and to mitigate



for the removal of a further 8.8ha of this community (bringing the total area of this community disturbed by the mine to 50.8ha), 115ha of the final landform would be designated for the re-establishment of this community. In addition, the Applicant has committed to including 32ha of the “Railway View” property, incorporating approximately 20ha of the same vegetation community, into a revised Biodiversity Offset Strategy (see Section 2.11.7).

The modified open cut area has, however, been designed to avoid a second Endangered Ecological Community (EEC), the Brigalow Community, despite this restricting access to the higher yielding G Seam in the vicinity of this community.

- Noise

The overburden emplacement has been designed to form an acoustic (and visual) barrier between the mine and the Werris Creek - Quirindi Road and landholdings to the east and south of the Mine Site. Noise modelling has been completed to ensure the modified operations comply with the existing noise criteria of DA 172-7-2004.

- Visual Amenity

As for noise, the overburden emplacement (once rehabilitated) would effectively remove the mining and processing activities from view from the majority of locations and residences surrounding the Mine Site.

Further detailed descriptions of the existing physical, biological and social environment, and the potential impact(s) of the proposed development, are provided in Sections 3 and 4 of this document.

2.3.4 The Former Werris Creek Colliery

As illustrated on **Figure 2.4**, the modification of the open cut area proposes to mine through sections of the underground workings of the former Werris Creek Colliery. Drilling into and through these workings has previously identified that groundwater has largely filled the underground void spaces. In order to prevent any in-rush of water into the open cut as open cut mining progresses towards these workings, the Applicant would maintain a safe working distance to the workings, both horizontally and vertically in accordance with DPI-MR guidelines, whilst these are completely dewatered. **Figure 2.4** identifies the extent of the DPI-MR required safe working zone restrictions.

Only once complete dewatering of the workings is confirmed would the open cut progress into the workings.



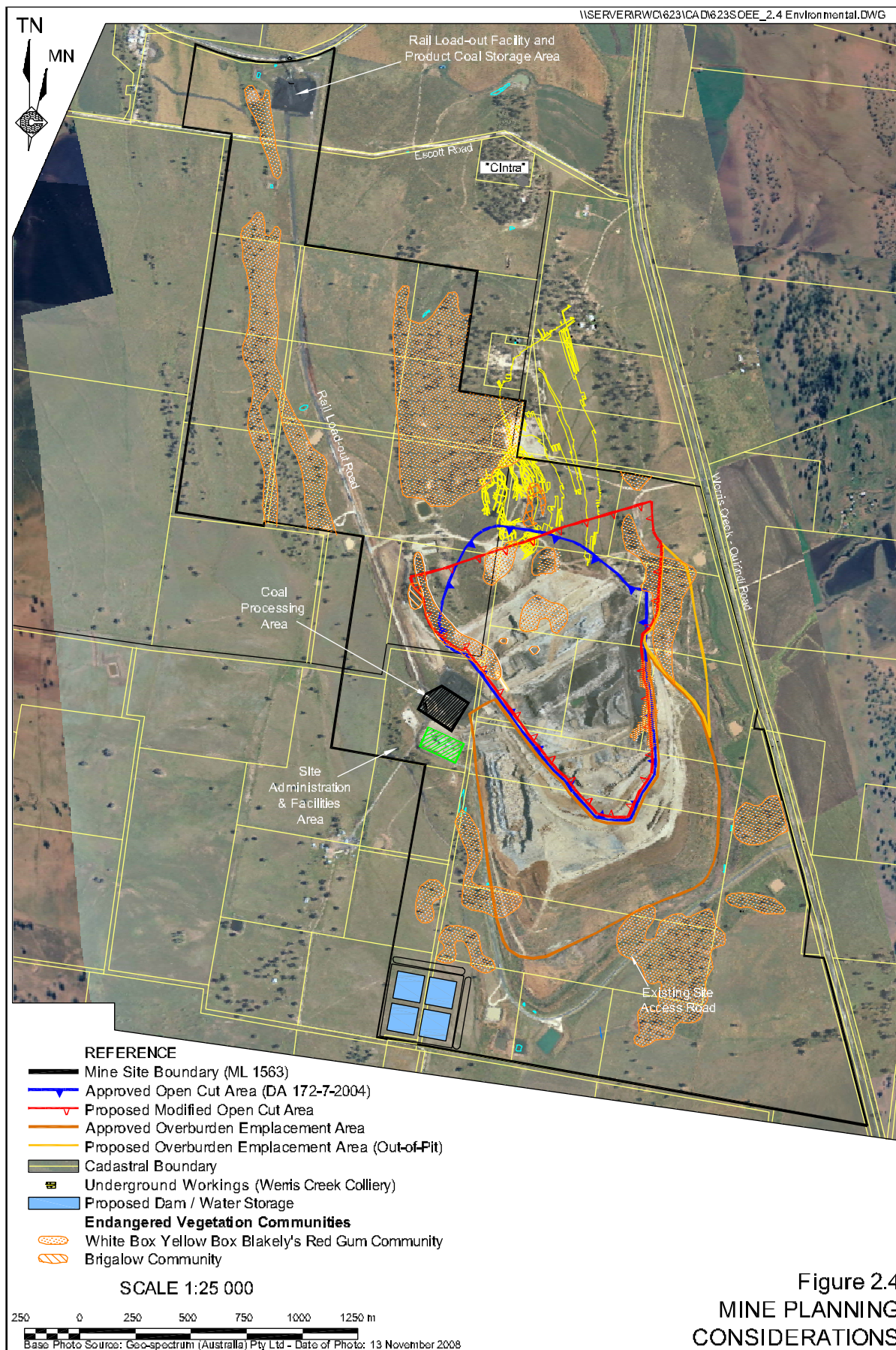


Figure 2.4
MINE PLANNING
CONSIDERATIONS



2.4 UNDERGROUND WORKINGS DEWATERING AND DAM CONSTRUCTION

2.4.1 Introduction

As identified in Section 2.3.4, the underground workings of the former Werris Creek Colliery would be dewatered prior to the advancement of the open cut beyond the 50m setback from these workings (in accordance with “*In-rush Hazard Management Guidelines*”, DPI-MR (2007)). The following sub-sections describe:

- the volume and quality of water stored within the underground workings (Section 2.4.2);
- the proposed dewatering operations (Section 2.4.3); and

the proposed location, indicative design and management of the surface dams that would be constructed to store the groundwater pumped from the underground workings.

2.4.2 Groundwater Volume and Quality

Through a review of the available survey information for the underground workings of the former Werris Creek Colliery, two separate and disconnected areas of workings have been identified. The main concentration of workings, where groundwater was measured to be 58.5m below surface (354.5m AHD), are estimated to contain 331 600m³ (331.6ML). The eastern workings, where groundwater was measured to be approximately 45m below surface (~352m AHD), are estimated to contain 16 600m³ (16.6ML).

Approximately 30ML of water from within these workings has been extracted over the life of the Werris Creek Coal mine to date and used for dust suppression purposes, leaving approximately 318ML to be removed prior to progression of the modified open cut to within 50m (horizontally) of these workings.

Sampling of two monitoring bores constructed into the main concentration of underground workings was undertaken in January 2009, approximately 4 weeks following the installation of these bores to allow sufficient time for the bores to equilibrate. **Table 2.6** provides a summary of the water quality analyses completed for the water samples.

Based on the results presented in **Table 2.6**, the quality of the water contained within the underground workings is brackish and of almost neutral pH. While matrix interference restricted the analysis of some metals, concentrations of copper, lead, manganese and zinc may exceed the 99% protection criteria of ANZECC (2000) for receiving waters.

2.4.3 Surface Dams and Water Management

As noted in Section 2.4.2, the quality of the water to be extracted from the underground workings is likely to be brackish (EC of >2 500µS/cm) with the concentration of some metals potentially exceeding the ANZECC (2000) 99% protection criteria. Noting this slightly inferior water quality, and similar to the current approach to managing the water that accumulates in the open cut void (see Section 1.5.2.4) the Applicant proposes to store the extracted water in a number of surface water dams to be constructed progressively as a series of cells within an underground water storage area, which would have a combined capacity of at least 370ML (see **Figure 2.4**).



Table 2.6
Water Quality of Werris Creek Colliery Void Water

Parameter	Practical Quantitation Limit	Borehole 1	Borehole 2
pH	0.1	6.5	6.9
Electrical Conductivity ($\mu\text{S}/\text{cm}$)	1	2850	2980
Total Dissolved Solids (mg/L)	0.005	1810	1670
Ion Balance			
Total Alkalinity (mg/L)	0.005	0.463	0.443
Sulphate (mg/L)	0.002	0.458	0.072
Chloride (mg/L)	0.001	0.45	0.637
Calcium (mg/L)	0.0001	0.385	0.244
Magnesium (mg/L)	0.0001	0.0553	0.0285
Sodium (mg/L)	0.0001	0.136	0.295
Potassium (mg/L)	0.0001	0.0183	0.0079
Metals			
Arsenic (mg/L)	1	1	1
Barium (mg/L)	5	82	388
Beryllium (mg/L)	1	<1	<1
Cadmium (mg/L)	0.1	<0.1	<0.1
Chromium (mg/L)	1	1	1
Lead (mg/L)	1	5	8
Manganese (mg/L)	1	2280	141
Mercury (mg/L)	0.1	<0.1	<0.1
Nickel (mg/L)	1	5	5
Vanadium (mg/L)	5	<5	<5
Zinc (mg/L)	5	19	20

Source: Modified after RCA (2009) – Table 2

Whilst the exact design of the underground water storage area would be determined based on the actual volume of water dewatered from the underground workings, **Figure 2.5** provides an illustration of the indicative layout and dimensions of the underground water storage area as a series of four cells. The overall underground water storage area covers approximately 11.4ha. The cells within the underground water storage area would be constructed sequentially in the following order.

- A diversion bank would be constructed up-slope of the underground water storage area, diverting water flowing from the northwest to the west of the two dams and into natural drainage.
- Construction of the first two cells would commence immediately on receipt of approval for the proposed modification.
- The water pumped from the underground workings would be transferred to the first cell (UWC1) following the construction and certification of this dam, estimated to be approximately 3 months from the commencement of construction.
- Once the pumping of groundwater to UWC1 commences, construction of the next cell(s) in the sequence would commence, with certification to be obtained prior to the discharge of any water into this cell.
- As UWC1 reaches capacity, a freeboard of 1.0m would be retained, discharge would move to UWC2.
- Groundwater levels in the underground workings would be monitored at least monthly to revise the calculation / estimation of the volume of water remaining in the underground void spaces. Cells would continue to be constructed and certified based on the estimated volume of water left to be dewatered from the underground workings.



Each cell would be constructed by cut and fill methods to create a storage depth of at least 6m. The cut material (essentially topsoil and subsoil) would be used to create both the inner and outer walls of approximately 1:2 (V:H). Topsoil removed from the area of dam construction would be placed on the outer slope of the cells to a depth of approximately 1m of the underground water storage area (Inset on **Figure 2.5**) and seeded with a seasonal cover crop. This topsoil would eventually be respread over the rehabilitated landform at the completion of mining.

Excess topsoil would be stockpiled to the east of the underground water storage area. This material would be used to cover the backfilled dams at the completion of mining to recreate the pre-disturbance topography.

The internal wall of each cell would be constructed with the clayey subsoil and compacted to achieve a permeability not exceeding 1×10^{-9} m/s. Samples have been submitted for laboratory testing to confirm permeabilities of this magnitude could be achieved through compaction of the subsoil.

2.4.4 Dewatering Operations

During the construction of the underground water storage dam(s), high volume down-hole pumps would be installed on the bores constructed into the underground workings (“dewatering bores”). The water level within the dewatering bores would be regularly monitored and each pump would be installed with a low water cut-out to avoid running dry and damaging the equipment. In addition, a flow meter would be installed on each pump to enable the pumping rate and cumulative volume of water pumped to be recorded.

From the surface of the dewatering bores, the water would flow (via gravity) through HDPE pipes to the underground water storage dams. Allowance would be made at the top of the dewatering bore for water to be drawn off at this point for immediate dust suppression use. Alternatively, water would be pumped from the underground water dams into a water truck for dust suppression.

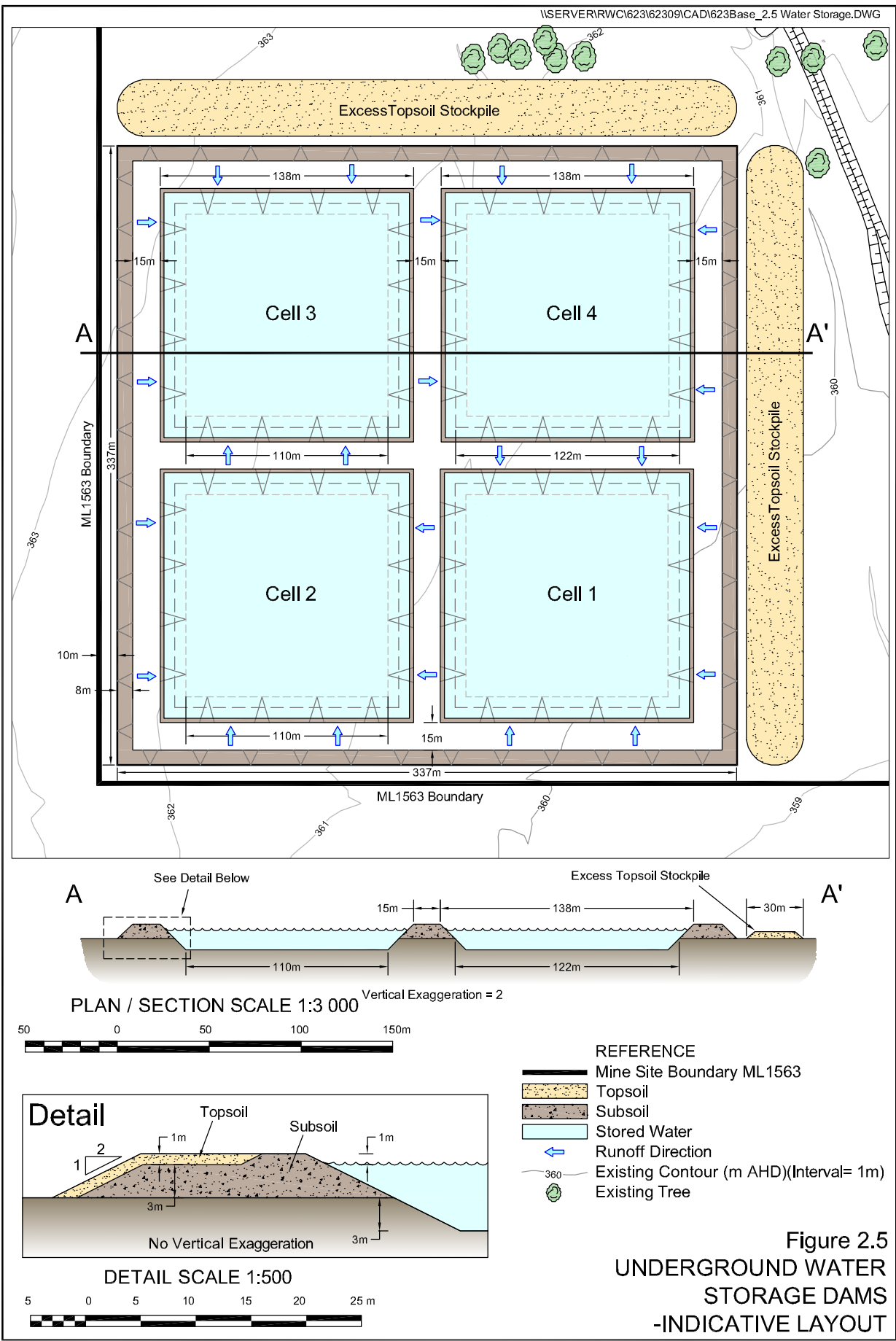
2.5 MINING OPERATIONS

2.5.1 Introduction

The open cut mine would continue to be developed using conventional haulback methods described in Section 1.5.2. In summary:

1. appropriate drainage would be constructed upstream (and where necessary downstream) of the mining area to be disturbed to divert water around or capture water within the mining area;
2. vegetation would be cleared and either used for agricultural purposes or stockpiled for future use in rehabilitation;
3. soil would be stripped and stockpiled for future use in rehabilitation of the disturbed areas within the Mine Site;
4. overburden above and interburden between the coal seams would be drilled, blasted and transported to either the in-pit or out-of-pit overburden emplacement; and
5. a series of near horizontal benches would be formed from where the exposed coal would be blasted and removed for crushing, screening and despatch from the Mine Site.





The following sub-sections describe the proposed modification to the open cut area and overburden emplacement, the proposed sequence of mining and then concentrate on those aspects of the operation which would differ from those currently undertaken.

2.5.2 Mining Area Layout

Figure 2.5 identifies the proposed modifications to the mining area (incorporating the open cut and overburden emplacement) layout. As noted previously, the modified open cut area has been determined by the lateral extents of coal within the deposit, ie. the advancing northern highwall has been widened to enable recovery of the G Seam in its entirety.

By modifying the open cut area, the volume of overburden and interburden that would have to be removed would increase. This increased volume of overburden / interburden would be partially accounted for by the enlargement of the overall open cut void (thereby increasing the available storage area within completed sections of the open cut). However, the increased volume of material exceeds the storage capabilities of the open cut void and a consequence it is proposed to increase the total footprint (area) and height of the out-of-pit emplacement.

The eastern section of the overburden emplacement beyond the perimeter of the open cut area would be extended by approximately 9.5ha to the northeast, including both an in-pit component (reflecting the widening of the open cut to the east) and an out-of-pit component (where the emplacement continues to follow the eastern perimeter of the open cut). There would also be a small increase in area (1.7ha) on the western side of the open cut and adjacent to the coal processing area.

Notably, the mining area layout of **Figure 2.6** (and progressive mine plans for the proposed modification) have been prepared with the knowledge that a further extension of the mine to the north is likely to be proposed (prior to the completion of mining associated with this modification). In order to accommodate this future northerly extension, and the increased stripping ratio associated with mining the coal seams at their lowest point (which coincides with some of the more elevated areas of local topography), the proposed height of the overburden emplacement, which is currently limited to approximately 410m AHD (no more than 40m above the pre-mining surface topography), has been increased to 445m AHD. At 445m AHD, the overburden would still remain at an elevation equivalent to the small hill top to the north of the open cut area.

It is noted that by increasing the elevation of the overburden emplacement by up to 35m, the area on the flat upper plateau of the emplacement in the final landform would be reduced from that provided for in the original EIS (RWC, 2004) for the Werris Creek Coal Mine and subsequent MOPs (2005 and 2008). This area of the final landform was allocated to the reinstatement of higher class agricultural land, to offset the initial disturbance of an equivalent area of land on the “Narrawolga” property of the pre-mining environment. Section 2.11 considers the revised final landform design and land uses.



2.5.3 Mining Sequence

The open cut area would continue to be developed in a northerly direction, with individual mining blocks developed in an east-west direction along a series of 100m wide mining strips (S01 to S13¹). **Figure 2.6** identifies the proposed sequence of development of these mining strips within each strip. The sequence reflects the continuation of mining operations in accordance with the existing open cut layout for Strip 8 when it is anticipated approval for the proposed modification would allow for Strips S08 and S09 to be widened to the extent of the G Seam. The mining sequence presented in **Figure 2.6** reflects an annual production level of 1.5Mtpa. Should the production level exceed 1.5Mtpa (up to 2.0Mtpa), there may be some minor variation to the sequence, eg. the western section of S11 may proceed the eastern sections of S08 and S09.

As illustrated, the open cut would continue to be developed in a northerly direction, with the direction of operations along each east-west aligned strip illustrated on **Figure 2.6**. It is noted that within this general sequence of open cut development, the actual mining operations may be slightly varied to optimize strip ratio across the operation.

Based on the proposed mining sequence of **Figure 2.6**, a production rate of 1.5Mtpa and the calculated volume of overburden and interburden to be removed and managed, **Figure 2.7** presents the progressive development of the mine area at 1 year (April 2010) and 3 years (April 2012) following approval of the proposed modified mine area.

2.5.4 Land Preparation

2.5.4.1 Introduction

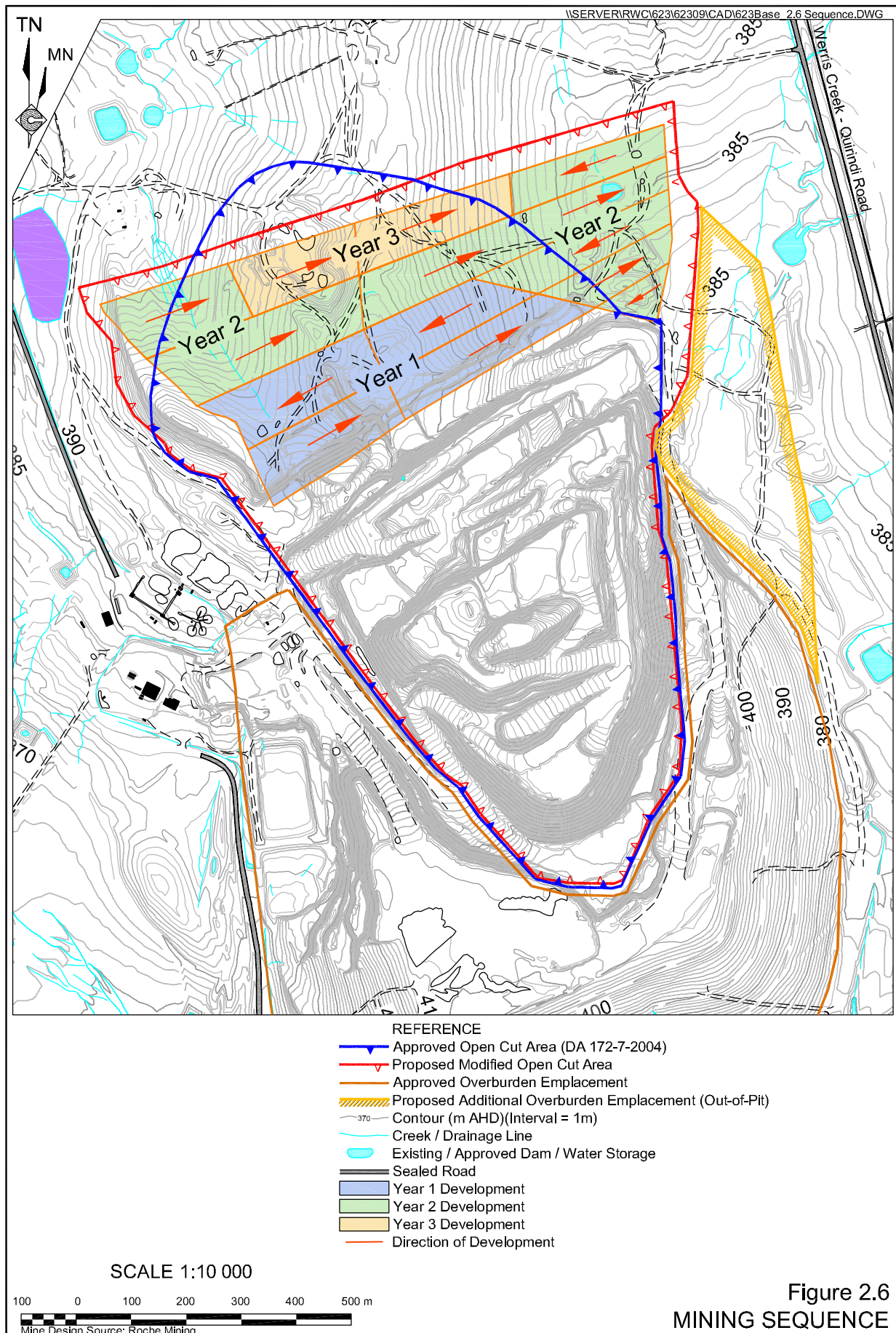
Land preparation refers to the preparatory works required prior to the commencement of major earthworks and coal recovery, ie. drainage installation, vegetation clearing and soil stripping. The methods of land preparation would not vary from those currently implemented at the Werris Creek Coal Mine and described in Section 1.5.2.2 (1 to 3). The following sections provide a summary of the land preparation works that would be undertaken as part of the proposed modification, ie. in addition to those already approved by DA 172-7-204.

2.5.4.2 Vegetation Clearing

As described in Section 1.5.2.2 (2), the clearing of vegetation on the Mine Site would be undertaken on an annual basis, with the extent of clearing undertaken in each campaign sufficient for the subsequent year of mine development. When practicable, the clearing campaigns, particularly the removal of trees, would be scheduled for the autumn period. This would minimise potential impacts on fauna frequenting the areas of disturbance.

¹ Strips S01 to S07 remain unchanged from the approved mine operations. Strips S08 to S13 represent modified strips reflecting the widening northern highwall of the open cut.





The areas of additional land to be cleared as part of the proposed modification is a mixture of cleared land (12.4ha) and remnant native vegetation (8.8ha). Notably, the remnant native vegetation is predominantly of the White Box Yellow Box Blakely's Red Gum Woodland Community, identified as an Endangered Ecological Community (EEC) under both the NSW *Threatened Species Conservation Act 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Due to the presence of the White Box Yellow Box Blakely's Red Gum Woodland Community, containing listed Koala feed species, an inspection would be carried out to identify if Koalas are present prior to each clearing campaign. If identified, clearing would be suspended until the Koala(s) move away or are removed by a suitably qualified person

2.5.4.3 Drainage Installation

As the open cut area is developed to the north, a network of diversion and catch banks, storage dams, sediment basins would be installed to either divert and/or collect “clean” water or collect “dirty” water for settlement prior to re-use or discharge. The installation / construction of the required drainage features would be undertaken in accordance with the existing Site Water Management Plan for the mine (and the specifications listed in the recently released guideline *Managing Urban Stormwater: Soils and Construction, Volume 2E Mines and Quarries (DECC, 2008)* with the following minor modifications (as identified on **Figure 1.5**).

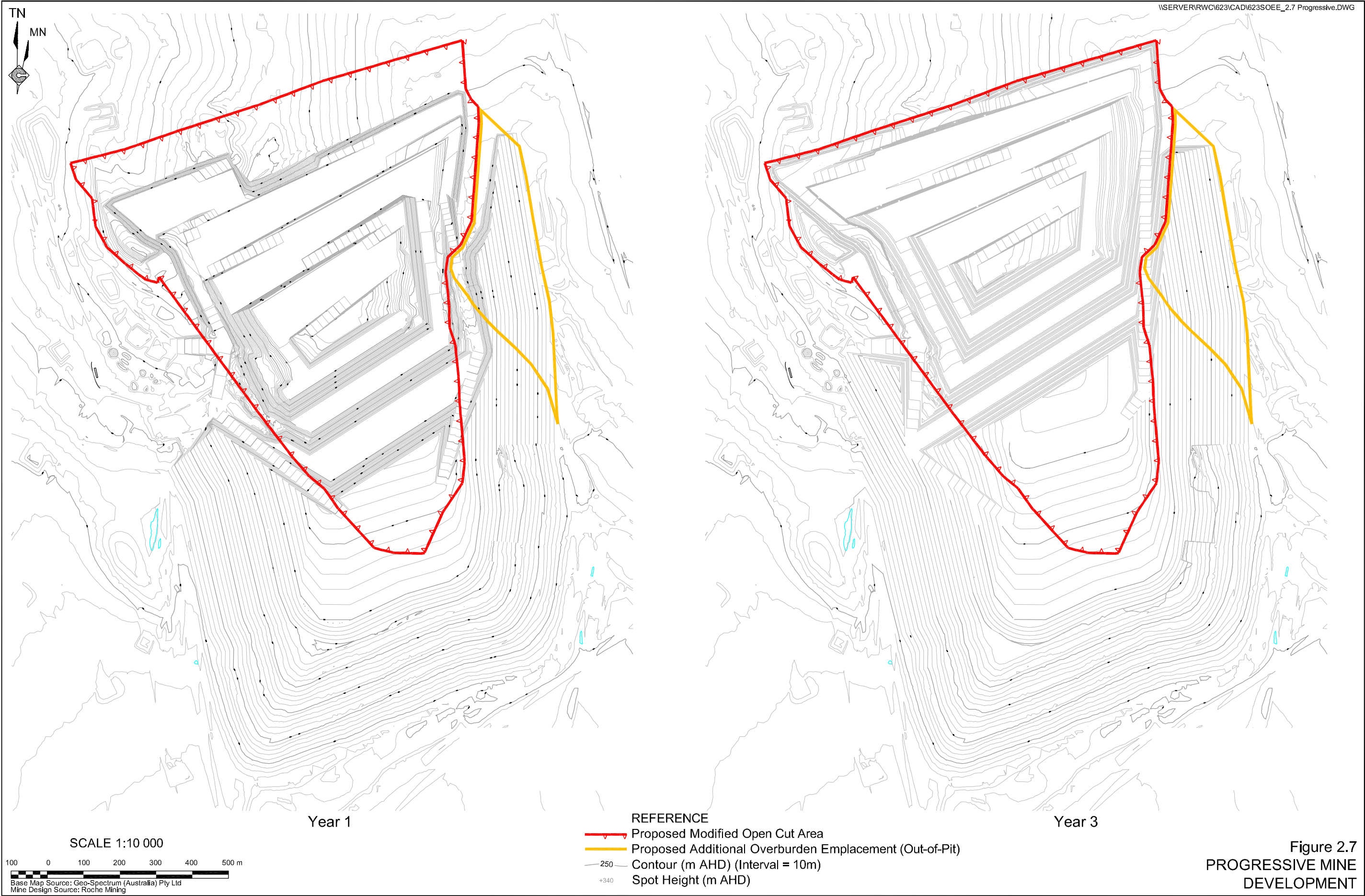
- SD1, an existing farm dam would be drained and removed prior to vegetation clearing and soil stripping in this area.
- DB1a, a diversion bank would be extended and realigned around the northeastern perimeter of the open cut area to divert clean runoff initially into SD2 (see **Figure 4.3**).
- CB1a, a catch bank would be constructed beyond the downstream toe of the overburden emplacement. CB1a would channel runoff from the overburden emplacement into an existing catch bank (CB1) that runs around the toe of the overburden emplacement (see **Figure 4.3**).

As is currently undertaken at the mine, the following drainage control would be implemented for any other areas of surface disturbance associated with the progressive development of the modified open cut operations.

- A temporary diversion bank would be constructed beyond the upslope boundary of the area to be cleared. The diversion bank would divert clean water from upslope areas into natural drainage lines or to designated storage dams within the Mine Site.
- A catch drain or bank would be constructed and/or sediment fencing erected beyond the downslope boundary of the area to be cleared. Runoff collected by the catch drains or banks would be directed to sediment basins and/or storage dams from which it would preferentially be drawn for dust suppression purposes.

Section 4.1.4 provides further detail on the design of the new or modified water management structures.





The Applicant would continue to routinely liaise with Soil Services and other specialist consultants with respect to the water management system performance and the achievement of its objectives, with modifications or additional structures installed as necessary, subject to relevant approval processes. All water management structures would continue to be inspected and ongoing maintenance, such as channel slope stabilisation, sediment removal and erosion protection carried out, as required.

2.5.4.4 Soil Stripping and Stockpiling

Once the vegetation has been cleared, the topsoil and subsoil resource would be stripped and either stockpiled or respread over completed sections of the final landform. The Applicant would continue to strip, stockpile and respread soil using the same methods and employing the same following general principles as are currently implemented at the mine.

1. Areas of disturbance requiring soil stripping would be clearly defined following vegetation clearing (using marker pegs/posts if necessary).
2. Topsoil and then subsoil would be stripped to the depth recommended for the particular soil type (see **Table 2.7**).

Table 2.7
Soil Stripping Suitability and Procedures

Layer (Thickness)	Material	Stripping Suitability	Soil Stripping Procedures
SMU 1			
1 (14-23cm)	Light to medium clay, medium clay to heavy clay or sandy clay.	Generally suitable for use as topsoil. Contains valuable seed, organic matter, nutrient reserves and other favourable attributes.	Strip to a depth of 15cm.
2 (24-66cm)	Light to medium clay, medium clay, medium to heavy clay.	Generally suitable for use as subsoil.	Strip all of layer 2 to maximum depth of 80cm from current surface but cease stripping at shallower depths if mottled material or weathering rock/bedrock encountered.
Remainder of Profile	Overburden.	Suitable for use in forming the base material for rehabilitation.	No specific procedures.
SMU 2			
1 (15-43cm)	Light clay, light to medium clay, medium clay or heavy clay.	Generally suitable for use as topsoil. Contains valuable seed, organic matter, nutrient reserves and other favourable attributes.	Strip to a depth of 20cm.
1,2,3,4&5 (20-110cm)	Light to medium clay, medium clay, medium to heavy clay, heavy clay, sandy clay.	Generally suitable for use as subsoil.	Strip to a depth of up to 110cm from the current soil surface but ceasing stripping at shallower depths if mottled material or weathering rock/bedrock is encountered.
Remainder of Profile	Overburden.	Suitable for use in forming the base material for rehabilitation, though the location of this SMU is generally such that only the upper layers would need to be stripped.	No specific procedures.

Source: Modified after Geoff Cunningham Natural Resource Consultants Pty Ltd (2004a) – Section 7



3. As far as practicable, no soil would be stripped or otherwise handled in wet conditions (to avoid breakdown in soil structure).
4. The stripped soil would preferentially be transported to a completed section of the final landform for respreading as part of rehabilitation activities. If areas of the final landform are not available, the topsoil and subsoil would be stockpiled at locations surrounding the overburden emplacement at heights no greater than 2m and 3m respectively, with slopes no greater than 1:2 (V:H) and a slightly roughened surface to minimise erosion.
5. The stockpile would then be identified by soil type and located in positions to avoid surface water flows.
6. All stockpiles would be seeded with a non-persistent cover crop to reduce erosion potential, as soon as possible after completion of stockpiling. Where seasonal conditions preclude adequate development of a cover crop, stockpiles will be treated with a straw/vegetative mulch to improve stability.
7. Sediment fencing would be erected immediately down-slope of the stockpiles until a stable vegetation cover is established.
8. Vehicle access on the soil stockpiles would be prohibited.
9. In the event that unacceptable weed generation is observed on soil stockpiles, a weed eradication program would be implemented.
10. The inventory of soil resources on the mine site would be expanded and regularly reconciled with rehabilitation requirements.

Open Cut Area and Overburden Emplacement

The additional disturbance on the Mine Site associated with the proposed modification to the open cut area and overburden emplacement would require disturbance to two soil types, identified as Soil Mapping Units (SMU) 1 and 2 by GCNRC (2009).

A basic description of each SMU, together with comments on stripping suitability and stripping procedures, is summarised in **Table 2.7**.

Due to the generally good structure of both the topsoils and subsoils, bulldozers and/or open-bowl scrapers would be used for stripping. In order to minimise handling, scrapers would dump their loads neatly to form a uniform stockpile that requires little further forming prior to establishment of a vegetation cover.

Underground Water Storage Area

Prior to construction of these dams, the topsoil layer only would be stripped and then replaced on the bank of each cell.

2.5.5 Overburden and Interburden Management

2.5.5.1 Introduction

The method of overburden removal and management will not change from that currently implemented at the mine and described in Section 1.5.2.2(4).



2.5.5.2 Material Characteristics

A previous investigation of the physical and chemical characteristics of the overburden and interburden of the Werris Creek coal resource completed by URS (2004) concluded that there is a low potential for both acid formation and soluble salt generation from the overburden and interburden material. As such, there are no specific handling and emplacement requirements for these materials. **Figure 2.8** presents the location of the drill holes from which the overburden / interburden samples were taken.

2.5.5.3 Overburden and Interburden Blasting

As is currently the case, the majority of the overburden and interburden would need to be blasted to achieve a level of fragmentation suitable for its subsequent excavation, loading and transportation or dozing. It remains the objective of the Applicant to minimise the number of blasts by maximising blast size without compromising compliance with the environmental criteria identified in **Table 1.6** of Section 1.6.5.1. It is projected that an average of one or two blasts would continue to be initiated per week.

Blast design, drilling, loading and firing would be undertaken by a suitably qualified and experienced blasting engineer holding a shot-firer's certificate issued by the DPI-MR.

Table 2.8 identifies typical blast design parameters to be adopted within the proposed modified open cut mine to achieve compliance with relevant guidelines for airblast overpressure and ground vibration at all surrounding residences and the Werris Creek - Quirindi Road.

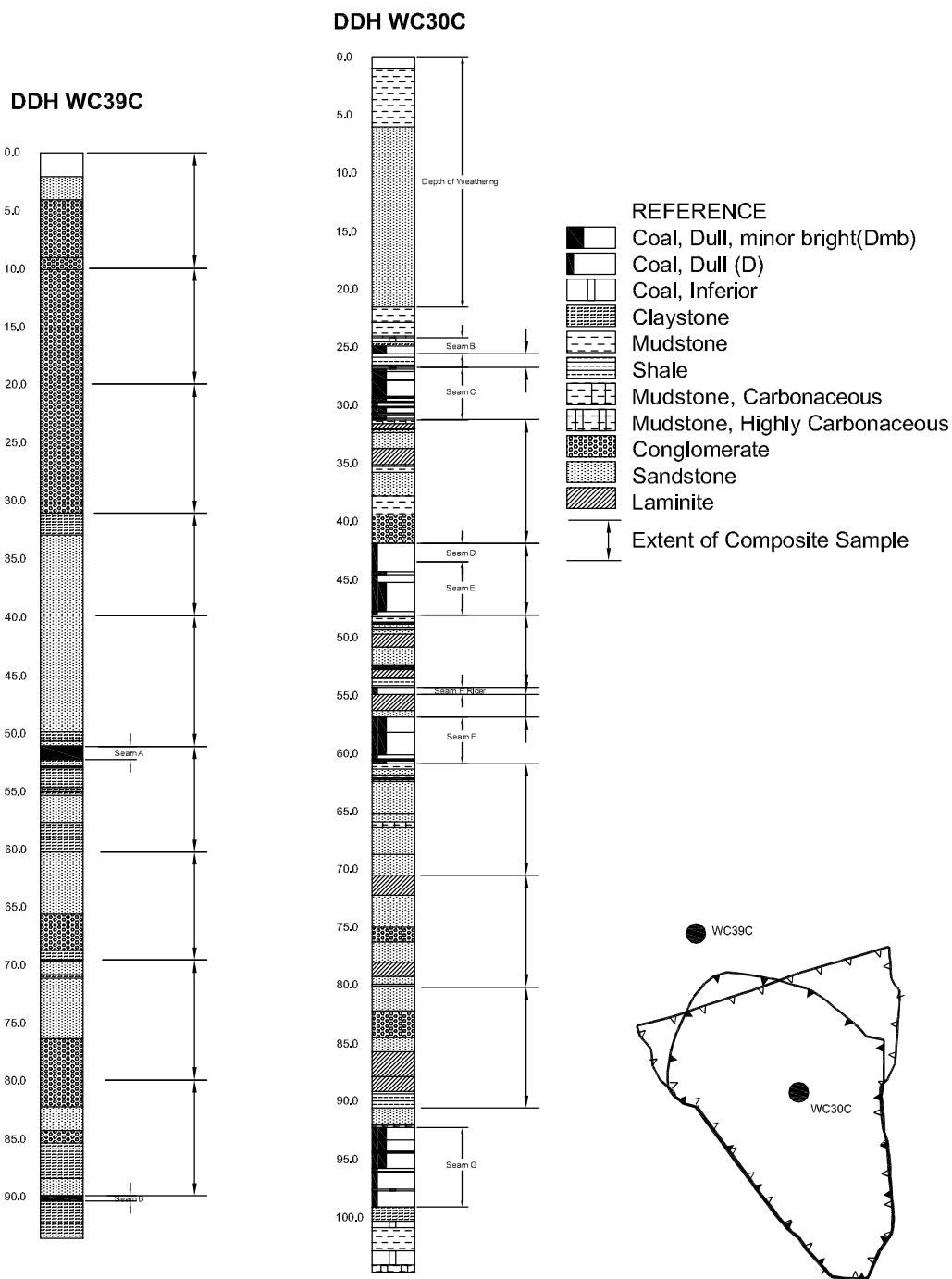
Table 2.8
Typical Blast Design Parameters

Parameter	Details
Bench Height	2m – 20m
Blast Hole Diameter	200mm – 229mm
Blast Hole Inclination	10 degrees off vertical
Blast Hole Spacing	6.5m – 9.5m
Burden	4.5m – 7m
Stemming	1.5m – 6.3m
Bulk Explosive Type	ANFO
Maximum Charge per hole	60kg – 1600kg
Maximum Instantaneous Charge	800kg – 1600kg
Initiation System	None!
Source: Werris Creek Coal Pty Limited	

The nominated blast design parameters have been determined using conservative predictive formulae and reflect the experience gained since April 2005. Refinements to the blasting design would continue to be made for the life of the mine in response to changing conditions.



\\SERVER1\RWC\623\CAD\623SOEE_2.8 Overburden.DWG



- REFERENCE**
- Approved Open Cut Area (DA 172-7-2004)
 - Proposed Modified Open Cut Area
 - Borehole Sampled for Overburden /Interburden Characterisation

Figure 2.8
OVERBURDEN / INTERBURDEN
CHARACTERISATION

Drill Log Source: Colin Coxhead, (pers comm)



As is currently implemented by the Applicant, a precautionary exclusion zone of 500m would be maintained for each blast. However, it is noted that experience since April 2005 suggests that it is highly unlikely for flyrock to be propelled more than 100m from the blast site. The proposed modification to the mine area would result in the open cut encroaching within 500m of the Werris Creek – Quirindi Road. In accordance with the DPI-MR recommended safe exclusion distance, the Applicant would manage the temporary closure of this road for each blast in this area ie unless the DPI-MR authorise blasting without closure of the Werris Creek – Quirindi Road. In the event it is necessary to close the road, it would be managed in accordance with Traffic and Rail Management Plan prepared for the modified operations and would incorporate the following features to minimise the potential disruption to local traffic.

- Blasts would occur outside the operating hours of school bus services.
- Avoidance, where possible, of timetabled rail movements.
- Adequate warning would be provided to road users in the form of road signs identifying standard blast times.
- Follow-up inspections of the road would be undertaken in the unlikely event it is necessary to remove any debris prior to re-opening of the road.

2.5.5.4 Overburden and Interburden Removal

As is the current practice, the overburden and interburden materials would be blasted and removed by conventional haulback methods, ie. the overburden and interburden would be transported by haul truck to the overburden emplacement. Where practicable, throw blasting and/or carry dozing would continue to augment haulback placement of overburden and interburden materials in the mined-out areas of the open cut mine (see Section 1.5.2.2.(4)).

Through comparison of the approved and modified mining area layouts, the proposed modification would require an additional 5.9 million bank cubic metres (bcm) of overburden and interburden material to be removed and placed within the overburden emplacement (see **Table 2.9**). **Figure 2.7** presents an indicative progression of mining and emplacement of overburden and interburden material at Year 1 and 3 of the proposed modification (modifying Years 5 and 7 of the currently approved mine).

The final overburden emplacement within the modified mine area would rise to a maximum elevation of 445m AHD and be constructed to enable the outer slopes to be profiled with a comparatively gentle slope of 10° (see **Figure 2.7**). This slope of 10° is comparable to the existing north-south oriented ridge within the Mine Site that the overburden emplacement has been designed to emulate. A series of contour banks, similar to those on the existing landform, would be created at approximately 10m vertical intervals on the outer slopes of the emplacement. The internal slope of the overburden emplacement would be left at angle of repose given the likely continuation of the mine to the north.

Section 2.11 considers the activities required to create the final landform should the proposed modification represent the final mining activities at the Werris Creek Coal Mine.



2.5.6 Coal Recovery

The recovery of the coal would be continue to be undertaken as described in Section 1.5.2.2(5). That is, a series of horizontal benches would be developed through the exposed coal seams by the removal of overburden, providing near horizontal working areas for the mining equipment. As a result of the dipping synclinal nature of the coal seams, a number of intersections of the coal would be made as mining progresses along each strip. As enough coal is exposed, it would be ripped or blasted (depending on the thickness – see Section 1.5.2.2(2)), excavated and transported to the Run-of-Mine (ROM) stockpile via a ramp and bridge network.

Through comparison of the approved and modified mining area layouts, the proposed modification would increase the total production from the Werris Creek Coal Mine by an estimated 560 000t (see **Table 2.9**).

Table 2.9
A Comparison of Mining Rates

Year of Modified Operation (Cumulative Year of Operation)	Approved Operations		Modified Operations	
	Coal Mined (t)	Overburden / Interburden Removed (bcm)	Coal Mined (t)	Overburden / Interburden Removed (bcm)
1 (5)	1 600 000	7 020 000	1 500 000	10 042 000
2 (6)	1 600 000	7 130 000	1 500 000	7 216 000
3 (7)	740 000	2 627 000	1 500 000	5 470 000
Total	3 940 000	16 777 000	4 500 000	22 728 000

Source: Werris Creek Coal Pty Limited

2.5.7 ROM Coal Stockpiling

The majority of ROM coal would be transported directly to the coal processing area ROM pad with coal immediately adjacent to the roof and floor of each seam (which would inevitably be diluted by the adjoining rock materials during mining) stockpiled separately for use in blending to produce coal products with a higher ash tolerance. This would allow a clean coal product to continue to be mined and stockpiled from each seam as well as a diluted product.

As is currently undertaken, a series of temporary ROM coal stockpiles may be used from time to time within the open cut mine area to:

- minimise noise propagation during night time operations; and
- limit the variability in haul truck cycle times and therefore maximise the efficiency of the excavator loading the haul trucks.

2.5.8 Mining Rate

Annual coal production would be primarily determined by the capacity of the various items of mining equipment operating within the mine. Notably, the approved limit of open cut mining is likely to reduce the capacity of the mining fleet due to the reducing strip length which limits the number of coal seams able to be exposed along each strip and therefore area of active coal recovery.



By widening the mining strips and the northern section of the open cut, the capacity of the mining fleet would be improved and it is envisaged that a market of up to 2.0Mtpa may be obtainable. While production of up to 2.0Mtpa would be possible, it is anticipated that production and sales would average approximately 1.5Mtpa.

The proposed mining sequence of **Figure 2.6** and the progressive mine development plan of **Figure 2.7** have been prepared to attain annual production and sales of 1.5Mtpa. **Table 2.9** provides a comparison of the annual mining rate and volume of overburden and interburden material to be removed between the approved and modified operations (Years 5 to 7 of the approved mining operations).

2.5.9 Mining Equipment

The type and number of mining equipment would remain equivalent to that presented in **Table 1.3** (Section 1.5.2.3).

2.6 COAL PROCESSING

The location and layout of the coal processing area would not require any modification to accommodate the modified open cut and overburden emplacement designs (see **Figure 1.5** and Section 1.5.3).

2.7 TRANSPORTATION

2.7.1 Coal Transportation by Rail

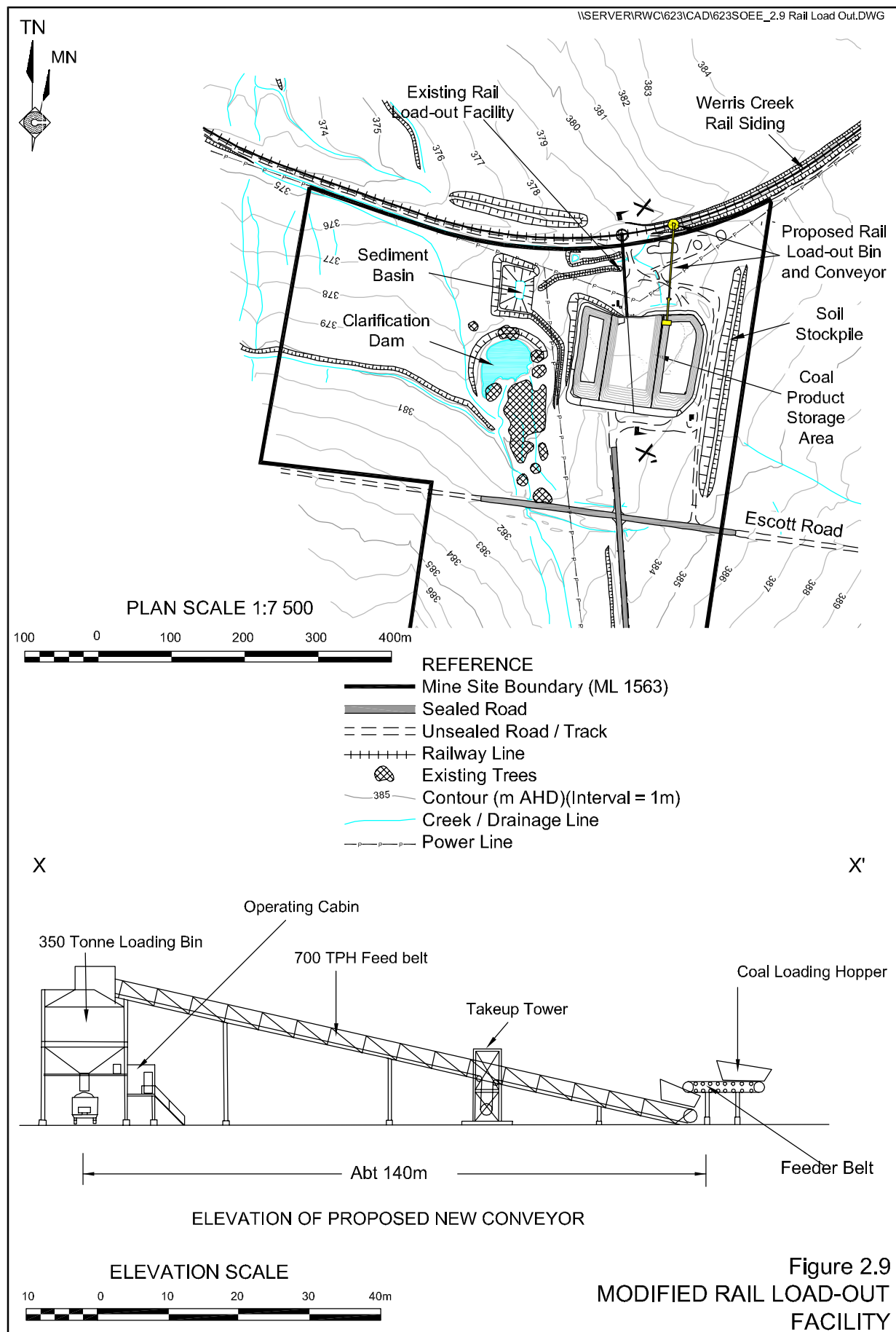
2.7.1.1 Transport to Coal Product Storage Area

There would be no change to the current method or scale of haulage operations between the Coal Processing Area and Coal Product Storage Area at the Rail Load-out Facility (see Section 1.5.4.2). The speed limit on the Rail Load-out Road would continue to be limited to 80km/hr with a further speed restriction of 20km/hr enforced at the “Give Way” signed intersection with Escott Road.

2.7.1.2 Transport from the Rail Load-out Facility

Coal would continue to be loaded into train wagons via the rail load-out facility on the Werris Creek Siding of the Main Northern Railway Line. In order to increase the efficiency of coal loading, it is proposed to construct a second loading bin and conveyor adjacent to the existing bin and conveyor on the Werris Creek Siding. The second bin would be of approximately 350t capacity and equivalent height to the existing bin. The existing overhead power line to the existing feed hopper would be placed underground in a location approved by Country Energy. The second bin and conveyor would be used for loading a specific coal product to specially designed trains for one of the mine’s customers. The second loading bin would ensure the different coal products are not mixed prior to loading to the trains. The coal would be loaded into each train loading bin via a coal loading hopper and conveyor. **Figure 2.9** presents the proposed modification to the rail load-out facility.





Train loading would take between 1.5 and 2 hours with approximately ten trains per week loaded and despatched from the rail load-out facility as described in Section 1.5.4.3. The scheduling of rail movements would continue to be determined by Pacific National as part of the Hunter Valley Coal Chain Logistics System.

2.7.2 Coal Transportation by Road

There would be no change to the scale of method road transport from the Werris Creek Coal Mine from that described in Section 1.5.4.3.

2.8 WASTE MANAGEMENT

2.8.1 Production Waste

The proposed modification would generate two types of production waste:

- overburden and interburden from the development of the open cut area; and
- water from the underground workings of the former Werris Creek Colliery

The management of these waste streams has been described previously in Sections 2.5.5 and 2.4 respectively.

2.8.2 Non-production Waste

Non-production wastes generated by the operation of the Werris Creek Coal Mine would continue to be managed as described in Section 1.5.5.

2.9 HOURS OF OPERATION AND MINE LIFE

The hours of operation at the mine would not change from those approved by DA 172-7-2004.

- 7:00am to midnight, midnight to 4:00am, Monday to Friday.
- Midnight to 4:00am, 7:00am to 2:00pm, Saturday.
- On-site coal processing may be undertaken for the additional hours of 2:00pm to 10:00pm Saturday.
- The rail load-out facility and maintenance activities are undertaken at any time Monday to Sunday.

Based on an average production rate of 1.5Mtpa, the proposed modification would have little influence on the life of the mine. That is, the estimated remaining life of the mine is three years, bringing the total operational life of the mine to seven years as estimated in the original EIS for the Werris Creek Coal mine (RWC, 2004). Any future changes to mine life would be presented in subsequent Environmental Assessments and the relevant AEMRs.



2.10 EMPLOYMENT

Employment levels at the Werris Creek Coal Mine would remain consistent with current levels (see Section 1.5.7). The Applicant would continue to encourage the employment of existing members of the communities within Werris Creek and Quirindi.

2.11 REHABILITATION

2.11.1 Introduction

The Applicant would continue to implement a progressive approach to the rehabilitation of disturbed areas at the mine to ensure that, where practicable, areas where mining or overburden placement are completed are quickly shaped and vegetated to provide a stable landform. The progressive formation of the post-mining landform and the establishment of a vegetative cover would also minimise the visibility of mine-related activities from surrounding properties and from the Werris Creek – Quirindi Road.

The proposed modification would require the final landform created to be altered (to account for the modified open cut area and additional volume of overburden and interburden generated), however, the proposed rehabilitation procedures would remain consistent with those currently implemented at the mine and which were developed in 2004 with the assistance of Geoff Cunningham Natural Resources Consultants Pty Ltd and Countrywide Ecological Service.

The following sub-sections:

- reaffirm the rehabilitation objectives of the Applicant at the Werris Creek Coal Mine and commitment to re-establish equivalent areas of native vegetation and higher capability land;
- describe the design of the final landform; and
- describe the procedures to be applied to each component of the mine, water management structures and other areas of disturbance associated with the mining and coal processing operations are also outlined.

2.11.2 Objectives

The Applicant's rehabilitation objectives remain unchanged from those of the approved operations. In the short term, the immediate rehabilitation objectives are:

- to stabilize all earthworks, drainage lines and disturbed areas not required for mine-related activities;
- to reduce the visibility of mine-related activities from adjacent properties and the local road network; and
- to establish ground cover and tree lots as soon as practicable to reduce potential for erosion and to visually screen the operation from adjacent properties.



In the longer term, the Applicant's objectives are as follows.

- Provide a low maintenance, geotechnically stable and safe landform which is commensurate with the agricultural land uses on and around the Mine Site and/or nature conservation.
- Blend the created landforms with the surrounding environment such that the vegetated post-mining landform appears a natural extension of the surrounding topography.
- Revegetate with native tree, shrub and grass species and/or pasture species comparable with either the existing vegetation communities or those which occurred in the area prior to mining and agriculture-related disturbance. Particular emphasis would be placed on the extension of the White Box Yellow Box Blakely's Red Gum Woodland community which occurs to the north of the modified open cut area and overburden emplacement footprint. This extension of the woodland community would partially compensate for those areas disturbed by the mine development, link currently isolated remnant pockets of this community, and provide a greater area and more diverse native fauna habitat, and wildlife corridors.
- Re-instate as much Class III Land Capability / Class 2 Agricultural Suitability land as possible compared with that disturbed during the mine life.

2.11.3 Final Landform

Figure 2.10 presents the proposed final landform of the modified mine area ie. in April 2012. It is noted that this landform has been designed based on the cessation of mining at the Werris Creek Coal Mine as presented in Year 3 on **Figure 2.7**, which has been prepared with a view to a further northerly extension of the open cut (beyond the Year 3 mine plan). That is, the mining operations at the end of Year 3 have been designed to accommodate a northerly extension of the mine, as opposed the completion of mining. As a result, the final landform represents the optimisation of the landform, in order to meet the objectives for the final landform identified in Section 2.11.2, following the cessation of mining at Year 3.

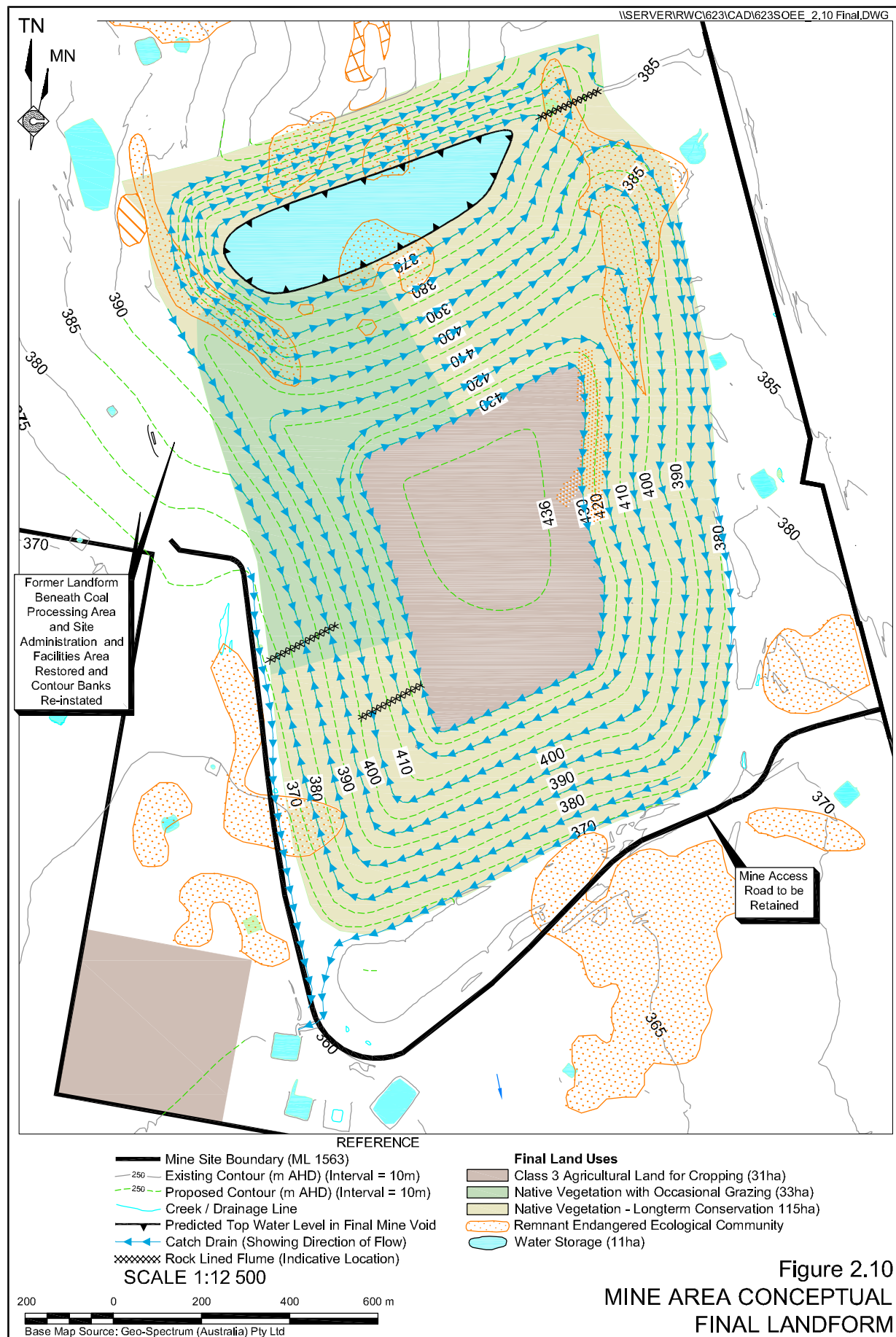
Should the future northerly extension not proceed, the progressive development of the mine, and subsequent final landform, would need to change to optimise the development of the final landform as mine closure approaches. The general design of the final landform would, however, remain consistent with that presented as **Figure 2.10**, with any changes or modification presented in the Mine Closure Plan for the mine.

The main features of the final landform would be as follows.

- (i) An elevated hill top would be formed by the overburden emplacement within and to the south of the open cut area. The hill top, which would form a rough horse-shoe shape around the final void, would extend from the retained section of a small north-south oriented ridgeline through which the open cut would be partially developed. The final height of the hill top would be approximately 435m AHD, reduced from that of the original overburden emplacement as the top 5m to 10m of overburden pushed into the final void to reduce the final slope angle to no greater than 18° (1V:3H). The upper surface of the hill top would be left as a flat plateau which will approximate the level of the highest point in the immediate locality (~425m AHD).

The outer slopes on the reshaped emplacement will be no greater than 10° which will also approximate the natural landform.





- (ii) A water storage would be developed in the area of the final void as the groundwater table gradually rises to pre-mining levels. Slopes within the final void would approximate 18° (1V:3H) within some steeper slopes of up to 26° (1V:2H) along the northern and eastern margins. These final slopes would be formed through a combination of backfilling and highwall (restoration) blasting.

As is the current practice, contour banks would be constructed on both the elevated (hill top) and depressed (retained void water storage) sections of the final landform. Bank dimensions would be established in accordance with the existing practice of ensuring suitable bank height based on slope and catchment area with bank design undertaken by a suitably qualified and experienced consultant or contractor. All bank design works would be included in an updated MOP for the mine and construction works documented in each AEMR.

With the exception of the void water and underground water dams, the final landform of the site would incorporate the retention of existing sediment basins and storage dams for future use as required for future agricultural activity.

The void water and underground water dams (VWD1 & 2, UWD1, 2 and 3) would be drained, with the banks pushed in and covered with topsoil to create a swale like formation.

Similar to the existing plan for revegetation and final land use, the upper plateau of the hill top would be covered with soil stripped from the higher class lands to create an area of higher capability agricultural land. The remainder of the final landform would be revegetated with native pasture species, grasses, shrubs and trees commonly found within the White Box Yellow Box Blakely's Red Gum Woodland community. The re-established grassland / woodland would provide linkages with existing remnant vegetation both within the mining lease and in the surrounding landscape.

2.11.4 Decommissioning Activities

Mine site decommissioning would be undertaken as described previously in the 2004 EIS for the Werris Creek Coal Mine., however, as foreshadowed in Section 1.4.3, the planned end of mine life is likely to change noticeably from that currently approved. Ultimately, upon cessation of mining and processing activities, the following structures and facilities would be decommissioned and removed prior to final rehabilitation of the Mine Site.

- The rail load-out facility.
- The coal processing plant.
- Various fuel storage, workshops, offices and ablutions structures.
- Roads not to be maintained in the final landform.

Rail Load-out Facility

Prior to the cessation of mining and rail loading activities, the Applicant would attempt to identify a buyer for the facility in its entirety or in part. Should the Applicant successfully negotiate the sale, the decommissioning and removal of the rail load-out facility would be undertaken in a similar fashion to its import to the Mine Site, ie. it would be separated into large but transportable parts for delivery by road (or rail) to its intended destination.



Should the sale of the rail load-out facility not be negotiated, the structure would be separated into smaller sections with parts on-sold as scrap metal and any useable elements transported to a storage facility off site.

Coal Processing Plant

As for the rail load-out facility, the re-use at another site or sale of the crushing and screening plant would be the preference of the Applicant. On cessation of processing activities, the plant would be separated into various sections, thoroughly cleaned with high-power water sprays and transported by road to its intended destination.

Should the immediate sale of the plant not be negotiated, the same process as described above would be followed with the exception that the separated plant would be transported to a storage facility off site.

Miscellaneous Buildings and Structures

The majority of buildings and structures erected/constructed on the Mine Site are demountable and therefore would simply be dismantled, washed down with high powered water sprays and transported off site.

Any hydrocarbon storage facility would be pumped out. A thorough inspection of the soil directly below and surrounding the fuel storage facility and refuelling area would be conducted to ensure any contaminated soil would be identified. Small volumes of contaminated soil would be treated on site by ripping, spreading and allowed to naturally remediate. Should larger volumes of soil be found to be contaminated, these would be dug up and removed to a facility licensed or a designated area on site to dispose of these soils. The fuel storage facility would be on-sold or re-used at another site.

Roads

The Applicant intends to retain the mine access road and rail load-out road in the final landform. However, should it be deemed appropriate for these to be rehabilitated, the following steps would be followed.

- (i) Either or both roads would be closed with a lockable gate used to prevent access from the Werris Creek-Quirindi Road and/or Escott Road.
- (ii) The bitumen seal would be ripped and removed by truck and disposed within the final mine void.
- (iii) All compacted sub-base and base-course material would be ripped, excavated and disposed of in the final mine void.
- (iv) The roads would be rehabilitated through further ripping, the resspreading of topsoil and reseeded with pasture species or native tree and shrub species depending on the land use designated for that section of the road.



2.11.5 Final Land Use

The Applicant currently envisages three principal uses of the rehabilitated landform following successful vegetation establishment (see **Figure 2.10**).

- (i) Conservation areas for the native flora and fauna including the White Box Yellow Box Blakely's Red Gum Woodland community (115ha).
- (ii) Native vegetation with occasional grazing (33ha).
- (iii) Primarily cropping (31ha).

The post-mining land use has been assigned considering the pre-mining land use(s), the pre-mining capability class of the land and the final landform created. For example, within the disturbance footprint of the mine, 71ha of Class III land has been identified, with the remaining land being of lower class and either used for some form of agriculture or retained as remnant vegetation. Due to the creation of the 18° to 26° slopes of the final hill top and water storage, the Class III land cannot be re-established in the same location from which it originally occurred. However, through the preferential placement of stripped topsoil and subsoil from this area on the upper plateau of the final hill top, approximately 31ha of Class III land would be re-established and designated as cropping land.

The moderate slopes of the majority of the final landform would not be amenable to consistent grazing due to the likely creation of eroding surfaces. As such, the majority of the remaining areas of the final landform have been designated for the conservation of native vegetation, including the White Box Yellow Box Blakely's Red Gum Woodland community. Recognising the value of the retained water storage to grazing and other agricultural activities, a limited area surrounding the likely final water level of the water storage has been allocated to native vegetation with occasional grazing. The allocation of final land use presented on **Figure 2.10** reflects the fact that while the majority of the land in the pre-mining land was being used for some form of agriculture, much of this land was of lower land capability and should more appropriately been used for native vegetation conservation with possible occasional grazing.

2.11.6 Rehabilitation Procedures

2.11.6.1 Introduction

The rehabilitation procedures to be implemented for the proposed modification would not vary significantly from those currently implemented and documented in the MOP and AEMR's for the mine. The following sub-sections provide a summary of the specific methods adopted by the Applicant to meet the objectives described in Section 2.11.2, and achieve the conceptual final landform described in Section 2.11.3 and the principal land uses described in Section 2.11.5 (see **Figure 2.10**).



2.11.6.2 Overburden Emplacement and Open Cut Mine Area

Rehabilitation of the overburden emplacement and worked-out sections of the open cut mine would involve four basic steps.

Step 1: Overburden Placement and Shaping

Placement and shaping of the overburden to create final slopes with gradients generally up to 10° would continue to be undertaken in a manner which, wherever practicable, ensures that any friable or weathered materials are placed below the subsoil and topsoil layers as a cover over the more competent overburden and interburden materials, thereby avoiding the exposure of large rocks on the final surface.

Step 2: Subsoil and Topsoil Replacement

Subsoil and topsoil would continue to be placed on the shaped landform in the reverse order to stripping, ie. subsoil then topsoil, with the materials being preferentially sourced from areas being stripped in advance of mining or, if no such materials are available, from previously established stockpiles.

The subsoil layer would be spread on an even but roughened surface which has been ripped along the line of the contour to break any compacted and/or smooth surfaces. Ripping would also assist the keying of the subsoil materials, maximise ingress of water and minimise erosion.

The thickness of subsoil and topsoil replaced has been determined based on the:

- (i) areas designated for the various final land uses, ie. thicker soil layers would be replaced in areas designated for cropping;
- (ii) volumes of the various soils (SMU 1 to 3) on the Mine Site; and
- (iii) the recommendations of GCNRC (2004a) and GCNRC (2009a).

Table 2.10 presents the proposed thicknesses for replacement of soils, the land capability class to be attained, the particular SMU soil to be used and the volume of soil required for respreading.

Table 2.10
Final Landform Subsoil and Topsoil Replacement

Final Land Use	Land Capability	SMU	Area (ha)	Subsoil * Thickness (m)	Topsoil * Thickness (m)	Subsoil Volume (m ³)	Topsoil Volume (m ³)
Cropping	3	2	31	1.1	0.2	341 000	62 000
Nature Conservation	5	1, 2 and 3	115	0.6	0.15	690 000	172 500
Nature Conservation – Occasional Grazing	4/5	1 and 2	33	0.8	0.15	264 000	49 500

Source: Cunningham (2004a) – Section 7.2



An inventory of soils is maintained at the mine to ensure that adequate soil resources remain available for the selective use of the soil resources as outlined in **Table 2.10**.

Cleared trees, branches of <300mm diameter and other vegetative debris would then be spread over those areas designated for native woodland re-establishment.

Step 3: Drainage Installation

Contour banks would continue to be progressively installed on the rehabilitated landform. The banks would be constructed with channel back slopes of 10° and channel foreslopes of 40°. The heights (effective depths) and cross-sectional areas of the individual banks would be determined on the basis of the individual sub-catchment areas but would generally be less than 0.7m and 3.0m² respectively.

Step 4: Agricultural Land Pasture Sowing – Revegetation with Grasses and Pasture Species

The topsoiled surfaces would be sown with a mixture of pasture species appropriate to the season. The seed mixture would include fast growing non-persistent cover species and perennial grasses and legumes. A list of suitable warm season grasses, cool season legumes and cool season grasses is provided in **Table 2.11**.

In order to maximise seed germination and establishment, where practicable, sowing would employ scratch or direct seeding techniques, with specialised techniques such as straw mulching, bitumen mulching and hydromulching used where rapid soil stabilisation and erosion protection are required.

Table 2.11
Pasture Species Seed Mix

Pasture Species	Rate (kg/ha)	Fertiliser
Warm Season Grasses		
Bambatsi Panic	1 – 2	250kg/ha
Green Panic ^{*2}	2 – 4	Di-ammonium Phosphate (DAP)
Rhodes Grass ^{*2}	1 – 2	
Purple Pigeon Grass	1 – 2	
Annual Legumes		
Subterranean Claer	4 - 5	
Cool Season Legumes ^{*1}		
Barrel (Sephi) medic	2 – 4	
Snail (sava) medic ^{*2}	3 – 5	
Woolly Pod Vetch	4 – 6	
Serradella (Elgara)	1 – 2	
Lucerne	0.5	
Cool Season Grasses		
Phalaris (Sirolan or Holdfast)	1 -2	
Wallaby Grass	0.3 - 1	
^{*1} Inoculated with appropriate rhizobia		
^{*2} Specific Soil Conservation Application		
Source: DIPNR (formerly Department of Land and Water Conservation) pers comm.		



Step 5: Endangered Native Woodlands – Revegetation with Native Species

The Applicant has already undertaken significant plantings of White Box, Yellow Box and Blakely's Red Gum on the existing eastern emplacement in accordance with the proposed land use of this area of the final landform. As undertaken for the plantings completed to date (see Section 1.5.8), all seedlings would continue to be propagated from locally sourced seed. All areas of the final landform designated for nature conservation (see **Figure 2.10**) would be excluded from stock to provide optimum conditions for vegetation establishment. The outer slopes of the hill top of the final landform have been specifically targeted for nature conservation for the following reasons.

- This area provides opportunity to promote linkages with remnant vegetation retained to the north, south and east of the mine.
- Establishment of a corridor of vegetation in this area will promote fauna habitation and enhance the biodiversity values of the final landform. It will also provide valuable linkages with a biodiversity offset area established by the Applicant south of the active mining area (see Section 1.5.8).
- It will provide a natural screen to ongoing operations at the mine, as well as enhance the natural appearance of the site post mining by screening the rehabilitated plateau that will be utilized for future farming practices.

2.11.6.3 Water Management Structures

Rehabilitation procedures applied to individual water management structures would be assessed on a case by case basis to determine the most appropriate strategy. Generally, the outer banks of all water management structures would be topsoiled immediately on construction and seeded with appropriate cover and perennial pasture species as defined in **Table 2.11**. Specialised treatments such as sodding, bitumen/jute meshing or rock-lining may be utilised on those structures carrying the largest volumes of water or where an adequate cover of pasture species cannot be attained.

Where practicable, native tree and shrub species would be planted around the water storages to be retained in the final landform. This would enhance the filtration ability of these structures and surrounding areas, minimise the potential for erosion, as well as encouraging their use by native mammal, reptile, amphibian and bird species.

A final void will be a feature of the final landform that will have a long term water storage capacity. RCA Australia (2009) indicate that approximately 24 years following the cessation of mining, the water level recovery would approximate 75% of the pre-mining groundwater level (365m AHD). The Applicant would undertake regular water quality monitoring for a period of at least 5 years post mining to verify water quality parameters remain consistent and within stock drinking water parameters.



2.11.6.4 Other Areas of Disturbance

The Applicant would progressively rehabilitate disturbed areas once they are no longer required for project-related activities and, once rehabilitated, those areas would be well defined to prevent inadvertent passage of vehicles over them.

2.11.6.5 Rehabilitation Maintenance

The Applicant would maintain an ongoing rehabilitation monitoring program in accordance with existing procedures. This includes general assessment of vegetation establishment and re-seeding, as and when required. All drainage controls on the mine site are inspected on a regular basis and maintenance works undertaken, as and when required. Grazing is excluded across the areas subject to rehabilitation to provide optimum conditions for vegetation establishment and fauna habitation.

The overburden emplacement areas are regularly inspected to identify areas of localised subsidence or excessive erosion and ameliorative measures implemented, as required. This includes actions such as importation of additional overburden, subsoil and topsoil to remediate and stabilize the affected area. The final landform has been designed to effectively minimize the potential for this to occur and notably over the life of the rehabilitated areas to date, there has been no incidence of localised subsidence in the emplacement area that has required rectification.

The overall success of mine rehabilitation will be measured by qualified flora and fauna experts who will be able to make comparisons of rehabilitated areas with control plots established around the site. This work has been commenced in accordance with the Werris Creek Coal Mine Flora and Fauna Management Plan, approved by the Department of Planning in April 2005. This process will be further defined in the Mine Closure Plan for the site which will be established prior to mine cessation.

2.11.6.6 Noxious Weed Management

The Applicant monitors noxious weeds on a regular basis with an external weed spraying contractor engaged to undertake weed management campaigns across the site. Any specific targeted noxious weed campaign would continue to be undertaken utilizing best practice methodologies and in consultation with the Department of Primary Industries and Rural Lands Protection Board.

2.11.7 Offset Strategies

The proposed modification to the approved mine area and overburden emplacement would require the clearing of an additional 8.8ha of the endangered White Box Yellow Box Blakely's Red Gum Woodland community, bringing the total area of clearing to approximately 50.0ha. As proposed as part of the original Werris Creek Coal Mine development, the proposed rehabilitation would partially offset this disturbance by increasing the area of native vegetation (including this community) locally as well as linking the currently isolated pockets of this community to the north and south of the open cut area.

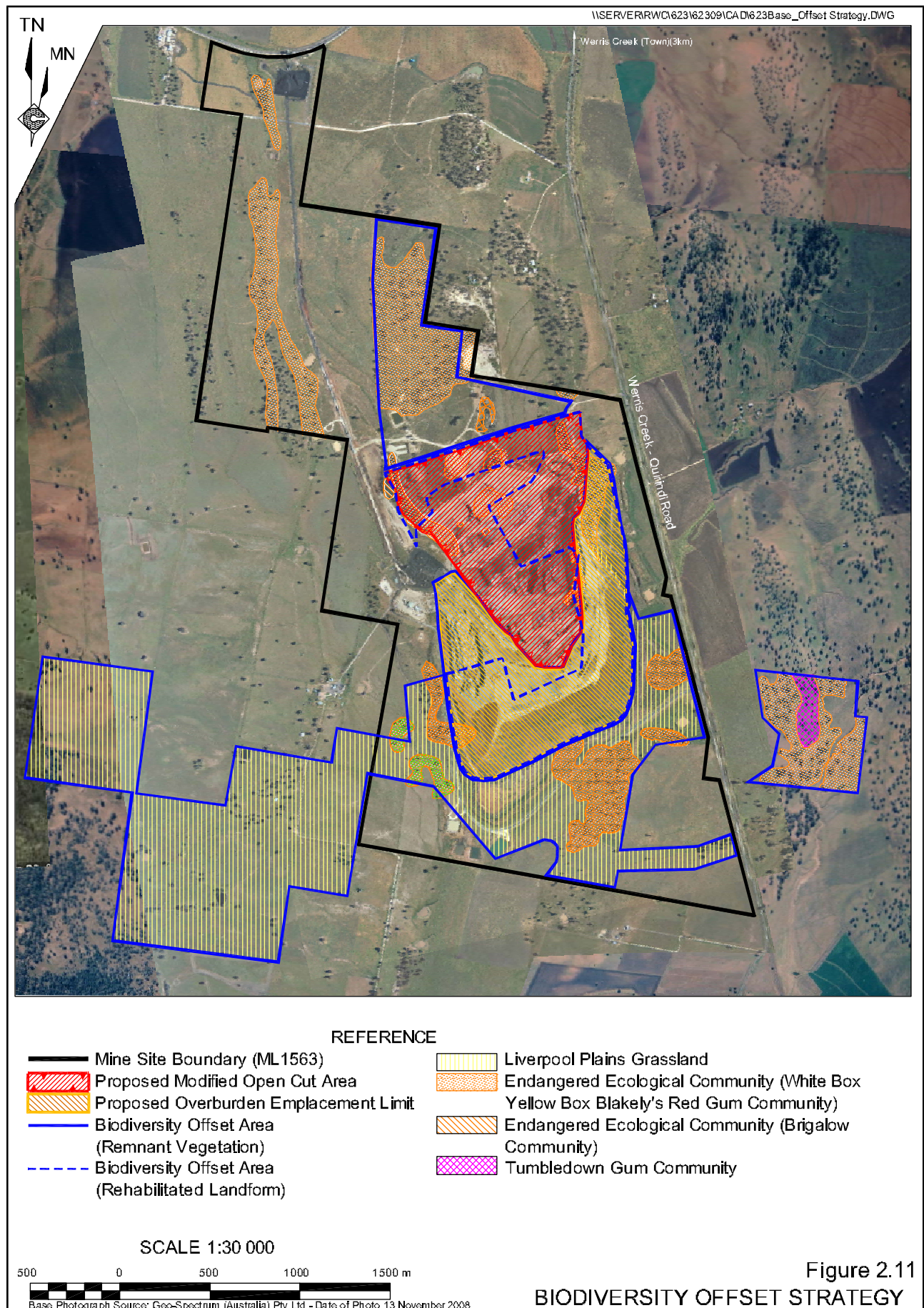


In addition to rehabilitation of the final landform (115ha rehabilitated to re-establish the White Box Yellow Box Blakely's Red Gum Woodland community), the Applicant proposes the following additional measures, which are identified on **Figure 2.11**, to be incorporated into an overall biodiversity offset strategy.

- 124ha of Liverpool Plains Grassland (vegetation on Cracking Clay Soils of Liverpool Plains), including 22ha of remnant White Box Yellow Box Blakely's Red Gum Woodland to the south of the mine.
- 20ha of remnant White Box Yellow Box Blakely's Red Gum Woodland on the "Railway View" property to the southeast of the mine.
- 4.5ha of Tumbledown Gum Woodland community on the "Railway View" property to the southeast of the mine.

The biodiversity offset would be secured in the long term by notation on title, and the offset areas managed in accordance with a management plan to be developed in consultation with the DECC and DoP.





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