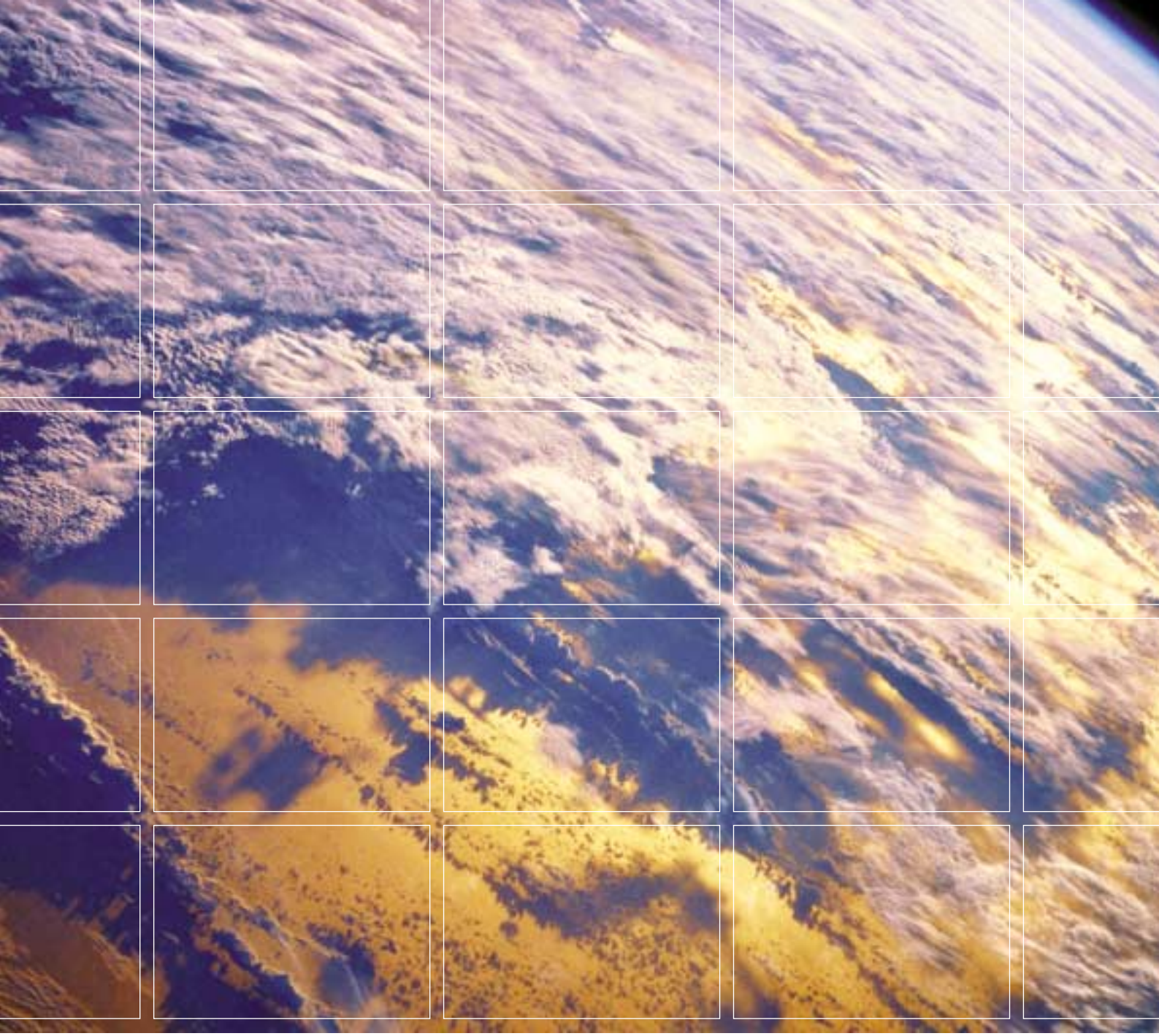

Carrington Pit Extended

Statement of Environmental Effects - Volume 1

Coal & Allied Operations Pty Ltd

October 2005

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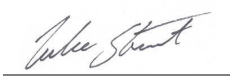
Signed:	
Date:	*26 October, 2005*
Approved by:	*Ian McCardle*
Position:	Project Director
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Date:	*26 October, 2005*

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FINAL REPORT

Coal & Allied Operations Pty Ltd

Carrington Pit Extended
Statement of Environmental Effects

October 2005

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ACRONYMS

Abbreviation	Description
AHD	Australian Height Datum
ARI	Average Recurrence Interval
CNA	Coal & Allied
DA	Development Approval
dB(A)	Decibel
DEC	Department of Environment and Conservation
DMR	Department of Mineral Resources
DoP	Department of Planning
DPI-MR	Department of Primary Industries - Mineral Resources
EC	Electrical Conductivity
EIS	Environmental Impact Statement
EMS	Environmental Management System
ENM	Environmental Noise Model
EP&A Act	Environmental Planning and Assessment Act
EPBC Act	Environment Protection and Biodiversity Conservation Act
EPIs	Environmental Planning Instruments
EPL	Environmental Protection Licence
ERM	Environmental Resources Management
GSSE	Global Soil Systems Environmental
ha	Hectares
HAS	Holmes Air Sciences
HCMA	Hunter Catchment Management Authority
HCMT	Hunter Catchment Management Trust
HVCPP	Hunter Valley Coal Preparation Plant
HVLP	Hunter Valley Loading Point
HVO	Hunter Valley Operations
INP	Industrial Noise Policy
ISC3-ST	Short-term Industrial Complex Model

Abbreviation	Description
LEP	Local Environmental Plan
L_{eq}	Continuous Sound Pressure Level
LGA	Local Government Area
MCP	Mine Closure Plan
MER	Mackie Environmental Research
MIC	Maximum Instantaneous Charge
MOP	Mine Operations Plan
Mtpa	Million Tonnes per Annum
NA	Non Applicable
NFR	Non Filterable Residue
NLP	Newdell Loading Point
NPW Act	National Parks and Wildlife Act
PM	Particulate Matter
PoEO Act	Protection of the Environment Operations Act
REP	Regional Environmental Plan
RCT	Ravensworth Coal Terminal
ROM	Run of Mine
RTCA	Rio Tinto Coal Australia
SEE	Statement of Environmental Effects
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
TDS	Total Dissolved Solids
TSC Act	Threatened Species Conservation Act
TSP	Total Suspended Solids
WPCPP	West Pit Coal Preparation Plant

1 INTRODUCTION

1.1 BACKGROUND

Carrington Pit is located in Coal & Allied Pty Limited's (CNA) Hunter Valley Operations (HVO) north of the Hunter River. Planning approval for the Carrington Pit was obtained in August 2000, for a truck and shovel operation with an approved annual production of 6 million tonnes per annum (Mtpa) of Run of Mine (ROM) coal to be transported by private haul roads to the West Pit or Hunter Valley Coal Preparation Plants (CPP). In 2004, the Carrington Mine consent was integrated into the West Pit Extension and Minor Modifications consent (West Pit consent, DA450-10-2003). This consolidated eighteen approvals and integrated operations across HVO north of the Hunter River such that coal from any pit in HVO north of the Hunter River could be processed at either the West Pit (WPCPP) or Hunter Valley Coal Preparation Plants (HVCPP). It also allowed for transport of coal via overland conveyor to the Bayswater Power Station for domestic consumption or to various loading facilities for transport to the Port of Newcastle. This consent also allowed for an increase in the rate of mining within the Carrington Pit to 10 Mtpa of ROM coal with mining to be complete by 2008.

The Carrington Pit is now well developed with significant areas of rehabilitation already established. An opportunity has been identified to extend the Carrington Pit to the south and the east to utilise up to 18.6 Mt of coal resources which would otherwise be uneconomical to mine in the future and therefore be sterilised.

The proposed extension would be mined using generally the same mining equipment and personnel as is currently approved and the life of the Carrington Pit would be extended by four to potentially seven years depending on market conditions and mining conditions under the eastern extension area.

1.2 PROJECT OVERVIEW

The proposed Carrington Extension includes an extension of approximately 140 hectares (ha) of land wholly owned by CNA. Coal reserves to be accessed include seams from surface to unlimited depth below the Bayswater seam. Within the application area the mining footprint will be extended approximately 60 ha to the south and 80 ha to the east.

The 60 ha to the south is mainly Class IV land presently used for agricultural purposes and currently undisturbed by mining. The remaining area of 80 ha to the east is a rehabilitated overburden emplacement.

In addition to extending the area to be mined, a temporary services corridor will be placed around the southern edge of the Pit. This services corridor will be used for light vehicle access roads, pipelines and other services. Other features of the project include the construction of up to three levees, a potential barrier wall and the modification of the final void to function as an evaporative sink.

1.3 PURPOSE OF THE STATEMENT OF ENVIRONMENTAL EFFECTS (SEE)

This SEE has been prepared to support an application under Section 96(2) of *Environmental Planning and Assessment Act 1979* (*EP&A Act*) to modify the West Pit consent (DA-450-10-2003) to extend the Carrington Pit and change the development consent boundary as shown in *Figure 1.1*.

In addition, this SEE assesses the environmental planning issues relevant to a proper consideration of the application for approval in accordance with Section 79(C) of the *EP&A Act.*

1.4 THE SITE AND SURROUNDS

The Carrington Pit forms part of HVO which is located midway between Singleton and Muswellbrook in the Hunter Valley of NSW. It is located to the north of the Hunter River and east of the Alluvial Lands and North Pit. *Figure 1.1* shows HVO north of the Hunter River in its local setting.

Carrington Pit is surrounded by mining, power generation and grazing activities, including:

- Bayswater Power Station and West Pit to the north;
- The Alluvial Lands, North Pit and Ravensworth Narama to the east;
- Grazing land and the village of Jerrys Plains to the west; and
- HVO south of the Hunter River, Warkworth Mine, Wambo Mine and United Colliery to the south.

The Carrington Pit is located in the Singleton Local Government Area (LGA).

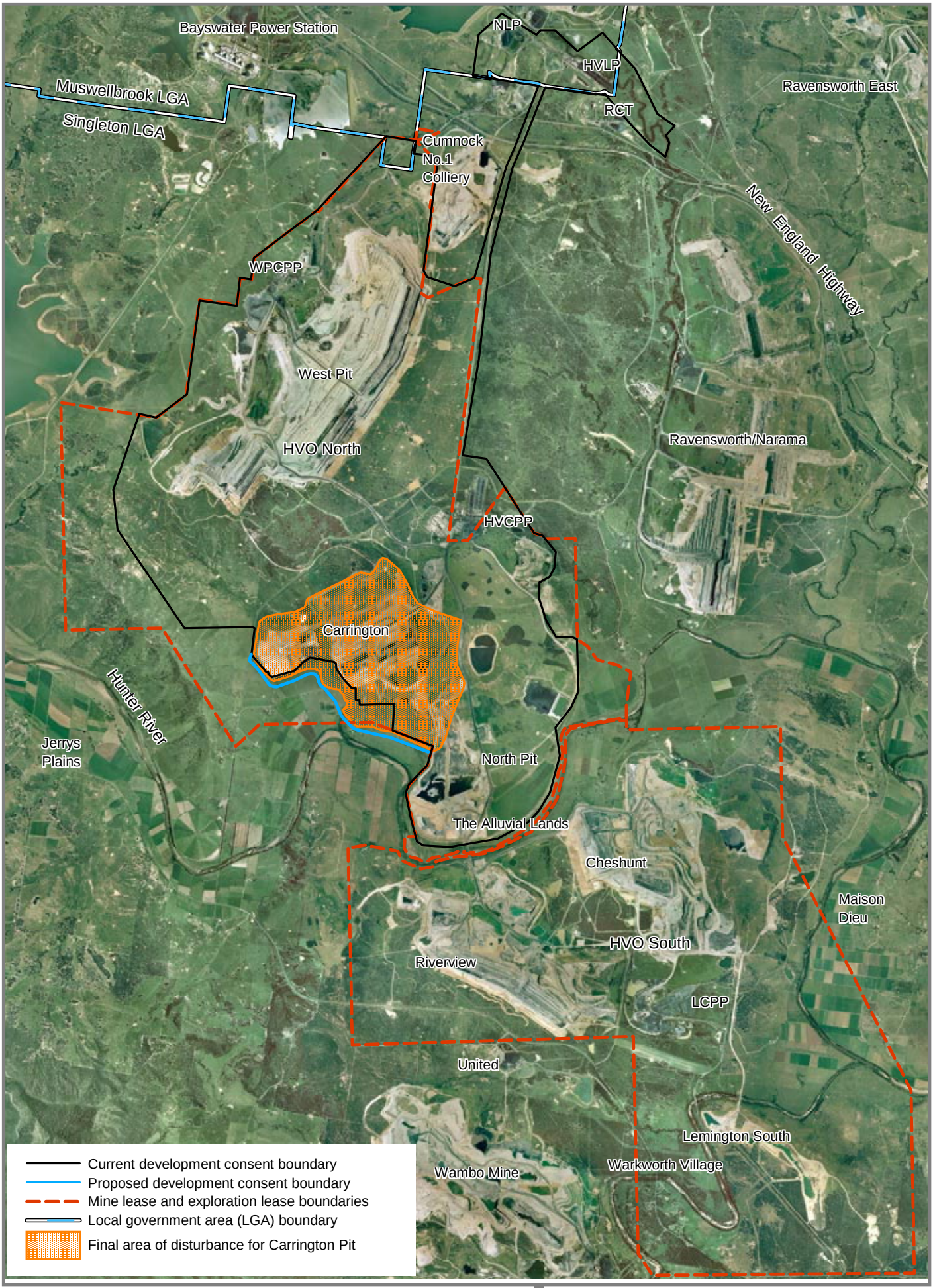

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Figure 1.1 **HVO North of the Hunter River**

1.5 SEE STRUCTURE

This SEE is structured as follows:

- *Chapter 1* provides an introduction to the proposed extension to mining, an overview of the development of the Carrington Pit and the existing operations at HVO, the local setting of the site and surrounding area, the purpose of the SEE and the structure of this report;
- *Chapter 2* provides a description of existing operations in the Carrington Pit and within HVO north of the Hunter River. It then describes the proposed modification;
- An outline of the legislative planning framework is included in *Chapter 3*;
- A description of the issues and approval requirements raised during the government and community consultation process is provided in *Chapter 4*;
- *Chapter 5* describes the interactions between the proposed extension and the socioeconomic and biophysical environment;
- *Chapter 6* provides a set of commitments to meet environmental management and monitoring objectives for the project; and
- *Chapter 7* provides the conclusion and justification for the proposed Carrington Extension.

A document named *"Supporting Annexes for the Carrington Extended SEE"* contains Annexes referred to in this report.

2 PROJECT DESCRIPTION

2.1 INTRODUCTION

The purpose of the proposed Carrington Extension is to maximise the recovery of 18.6 Mt ROM coal resources located within the Carrington area. The extension of Carrington Pit has been designed taking into consideration the need to minimise the impact on the environment. Throughout the development of the project and the assessment process, the project has been altered to protect an Aboriginal heritage site, CM-CD1, reduce impacts to River Red Gums located near a billabong to the south of the proposed extension area and avoid the Energy Australia substation and its associated footprint.

2.2 PROJECT ACTIVITIES

This SEE seeks consent for the following activities as depicted in *Figure 2.1*:

- modification and extension of the existing development consent boundary (refer to *Figure 1.1*);
- mining of approximately 19 Mt of coal from surface to unlimited depth below the Bayswater seam in accordance with mine plans, that will be facilitated by a mining lease application over the area depicted in *Figure 2.2*;
- extending the main Carrington Pit further to the south and to the east through an existing overburden emplacement;
- construction of up to three levees and a potential groundwater barrier wall;
- diversion of an existing drainage line to a final location located to the west rather than the east as originally proposed;
- a service corridor around the southern extension area to allow provision of water pipelines, light vehicle access roads, mining equipment substations and other services;
- relocation of the remaining void to the north and modification of the void to perform as an evaporative sink; and
- rehabilitation of the pit and the disturbed areas to a final landform.

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Figure 2.1 **Proposed Carrington Extension and Features**

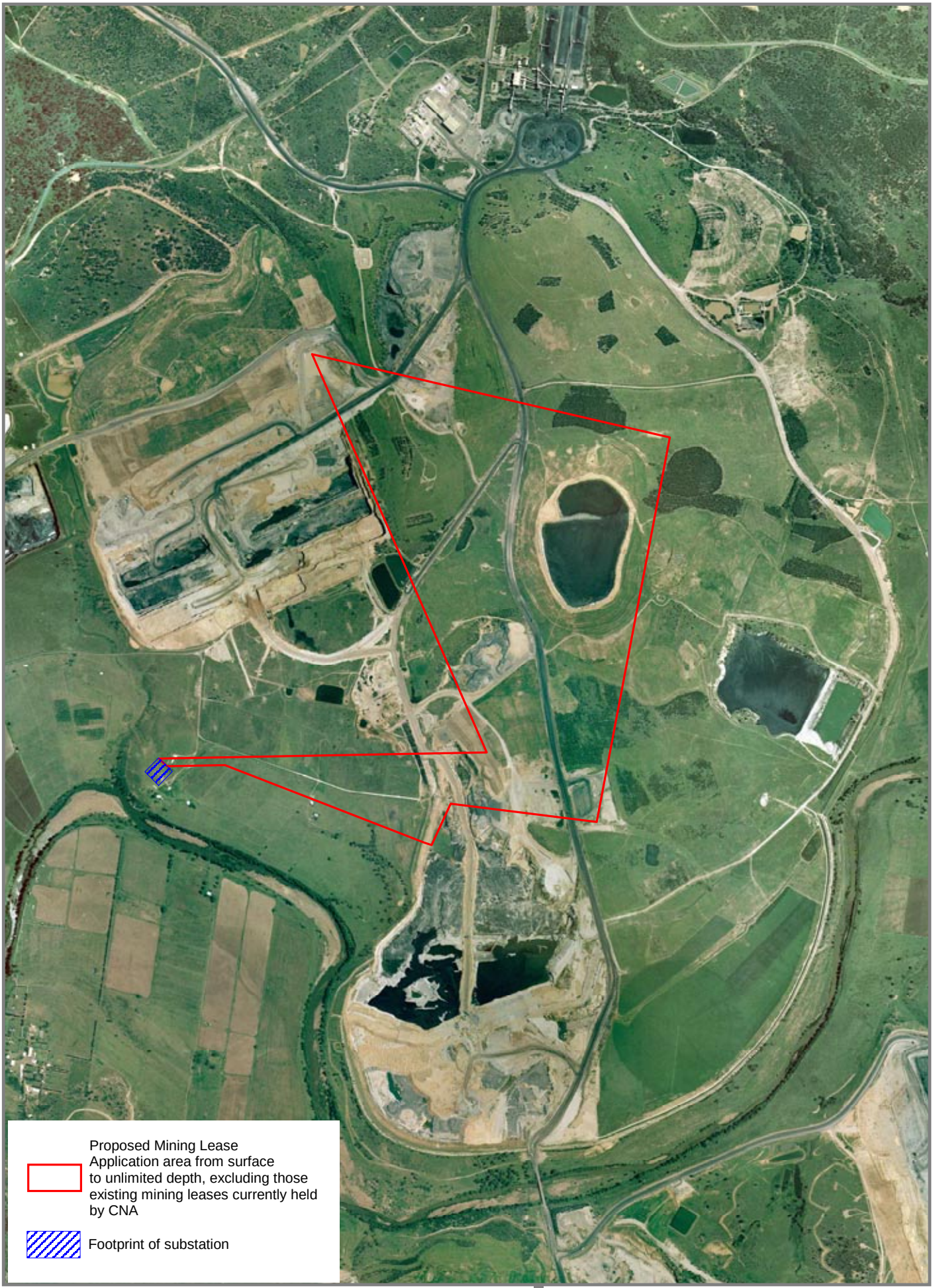

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Figure 2.2 **Mining Lease Application Area**

2.2.1 *Mining Activities Within The Extension Areas*

The proposed Carrington Pit extension comprises a surface area of approximately 140 ha. This area forms part of a mining lease application from surface to unlimited depth to secure tenure over those areas that are not currently within an existing mining lease as depicted in *Figure 2.2*.

Activities within the area will include:

- mining of coal reserves from surface to depth within approximately 60 ha of land to the south; and
- mining of coal reserves in the Broonie and Bayswater seams within approximately 80 ha to the east.

The proposed extension will have a minimum life of approximately four years with mining planned for completion by 2011. However, approval will be sought to mine up until 2014 to provide sufficient operational flexibility to take into account changing market conditions which may result in a slower rate of mining.

Mining will occur in accordance with mine plans detailed in the current Mining Operations Plan (MOP).

Mining in the extension area will be achieved using generally the same mining methods, haul routes, coal preparation and transport facilities as well as substantially the same equipment fleet as approved in the West Pit consent. Interactions with other operations within HVO will therefore be generally the same as was described in the *West Pit Extension and Minor Modifications EIS* (ERM, 2003).

2.2.2 *Surface Water Management And Other Activities*

Surface water management in the pit will use the same techniques as described in the *West Pit Extension and Minor Modifications EIS* (ERM, 2003), with the addition that water pipelines may be installed in the services corridor located around the western and southern boundaries of the proposed extension as depicted in *Figure 2.1*. These pipelines will be used to transport water around the site.

A number of levees were previously recommended as part of the Carrington EIS (ERM, 1999). These levees were required to protect the mine workings from flood waters to a 100 year Annual Recurrence Interval (ARI) flood event.

The following levees have been constructed to date:

- Levee 1 – a large levee constructed on the eastern side of the drainage line between the Carrington and West Wing Pits. (Levee also known as Cook's Levee)

- Levee 2 – a small levee constructed on the western side of the drainage line referred to above

- Levee 3 – a large levee constructed to the south of the West Wing Pit at the current development consent limit

- Levee 4 - a large levee constructed to the south of the Carrington Pit at the current development consent limit

A further three levees have been proposed for the extension to the current mine workings:

- Levee 5 – a large levee to be located along the southern boundary of the proposed extension area of the Carrington Pit. (This levee is referred to as the South Levee in the Hydrological Report (Lyall & Assoc, 2005))

- Levee 5A – a small levee constructed to the north west of the Levee 5. (This levee is referred to as the Gully Levee in the Hydrological Report (Lyall & Assoc, 2005))

- Levee 6 – a large levee that was initially proposed when mining was planned to extend closer to the archaeological site CM-CD1. (This levee is referred to as the Archaeology Levee in the Hydrological Report (Lyall & Assoc, 2005)). There are two potential locations for this levee. At this time it is considered unlikely that Levee 6 will be required

The construction of the levees will be staged to ensure that the pit is protected. The location of the proposed levees is shown on *Figure 2.1*.

The small drainage line, which was originally planned and approved to be relocated to the east of its original location, is now required to be relocated to the west as shown on *Figure 2.1* to take advantage of the topography of the area. Similar methods to those already approved will be used for the diversion of the drainage line.

HVO's Mine Closure Plan (MCP) which will be provided to the regulatory authorities at least five years before closure of the mine will provide details of drainage, the final landform and the removal of the levees. This MCP is currently being reviewed internally.

2.2.3 Rehabilitation

Rehabilitation will be progressive and is proposed to occur in stages. *Table 2.1* is indicative of the areas to be rehabilitated each year and the cumulative rehabilitation over the proposed life of the pit.

Rehabilitation rates will generally follow the rate of mining, that is, if mining progresses to 2014, the rate of rehabilitation will be slightly slower than indicated in *Table 2.1*. Areas disturbed during the construction of the levees and service corridor will also be rehabilitated following the completion of mining activities. Actual rate of rehabilitation will be dependent on the rate of mining and seasonal conditions.

Table 2.1 Proposed Rehabilitation Schedule

	Yearly Period			Cumulative
Year*	Rehabilitation* (ha)	Pit (ha)	Dump (ha)	Rehabilitation (ha)
2005	49	63	227	49
2006	115	58	72	164
2007	48	55	77	213
2008	31	38	101	244
2012	46	39	91	291
2013	56	27	73	347
2014	24	15	79	372

* The year and rehabilitation areas are indicative only and depend on mining rates and seasonal conditions favouring rehabilitation.

As the proposed extension will disturb some areas of Class II land the rehabilitation plan will, at a minimum, include rehabilitating the same sized area of Class II land that will be disturbed. Rehabilitation of Class II lands will be in accordance with the methods proven on the HVO Alluvial Lands. The rehabilitation plan will also optimise the linkage between areas of rehabilitated and undisturbed Class II land.

2.2.4 Evaporative Sink And Barrier Wall

The original void planned for the Carrington Pit is planned to be relocated further north away from the Hunter River and will be modified to function as an evaporative sink to manage groundwater post mining. The evaporative sink will be located partially within the eastern extension area. It is proposed to cover an area of approximately 72 ha in total. The conceptual location of the evaporative sink is shown on *Figure 2.3*.

Two designs for the evaporative sink have been proposed in Section 5.3 and *Annex D*. The final dimensions and design will be determined from further groundwater modelling and will be detailed in the MOP but will be designed to incorporate safety and final landform requirements. The final location and detailed design of the evaporative sink will be provided to DoP for approval.

In addition to the evaporative sink, it is proposed to install an impermeable barrier along the southern boundary of the southern extension area to prevent groundwater migration from the Hunter River into the evaporative sink and protect groundwater quality in the alluvium. This barrier was proposed in the original West Pit EIS (ERM 2003) dependant on groundwater monitoring results. CNA now recommend that this barrier be installed as mining retreats from the extension area. The impermeable barrier will effectively separate

freshwater from the Hunter River from the saline water in the areas disturbed by mining; it will also reduce the volume of water directed to the evaporative sink and prevent water losses from the Hunter River.

If the need for the barrier wall is confirmed by the Department of Natural Resources (DNR), timing for construction of the impermeable barrier will be determined by ongoing monitoring and in consultation with the Department of Planning (DoP) (formerly Department of Infrastructure, Planning and Natural Resources). However, options for timing of construction include:

- installation of the impermeable barrier at the completion of mining in the southern extension area; and
- installation of the impermeable barrier prior to mining commencing in the extension area.

The general location of the impermeable barrier is shown on *Figure 2.1. Section 5.3* and *Annex D* provide further details on the barrier wall. The detailed design of the impermeable barrier will be provided to DoP for approval prior to construction.

2.2.5 Final Landform

The final landform for the Carrington Pit will include rehabilitated overburden emplacements and the evaporative sink. The proposed extension areas will be rehabilitated to a combination of woodland, grazing land and potential cropping land in accordance with the HVO MCP which will be developed with consideration of the Department of Primary Industries (DPI) formerly the Department of Mineral Resources *Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of NSW* (DMR, 1999).

2.2.6 Rejects Management

Coarse and fine rejects deposition at HVO is a critical component of the operation. A rejects management strategy will be developed as part of the overall mine planning process. In the event that rejects disposal was identified as restricted it may be necessary to investigate the Carrington void as a potential disposal location. Detailed investigations will be undertaken and government approval will be sought if this is required.

2.3 RESOURCE ASSESSMENT

The coal resources in the Carrington Extension form part of the Singleton Super Group. Four seams of the Singleton Super Group will be accessed in the Carrington Extension – the Piercefield, Vaux, Broonie and Bayswater seams.

The Bayswater seam has an expected composition of 12.8% ash and a total sulphur content of approximately 0.48%. These characteristics make the Bayswater seam suitable as an unwashed steaming coal for the domestic market or as a washed coal for export.

The Broonie seam is expected to have an average ash content of about 9%, while the total sulphur is relatively higher than the Bayswater seam ranging from 0.6 to 0.73%. These seams are to be marketed as a steaming coal with some potential as a semi-soft coking coal. The volume of coal which could be extracted from the proposed extension is shown in *Table 2.2.*

Table 2.2 Resource Table

Area	In Situ (Mt)	ROM (Mt)	Export saleable(Mt)
Southern Extension Area	11.5	8.3	6.1
Eastern Extension Area	36.7	10.3	7.4
Total	**48.2**	**18.6**	**13.5**

2.4 PROJECT ALTERNATIVES

A number of options were considered including the 'do nothing' option, Alternatives included:

- a larger southern extension area;
- combinations of extension areas;
- numbers and locations of levees; and
- different final landforms.

2.4.1 Options Considered

Extension Areas

The first option for the extension areas included mining in both the eastern extension and southern extension areas with the southern extension area extending further to the south. In this design, the southern extension area encroached onto Class II lands and required an Energy Australia substation to be relocated. The second option included mining in both the eastern and southern extension areas and shortening the southern extension area. The third option considered mining in the eastern extension area only. The preferred option best utilises available coal resources while reducing impacts on Class II agricultural lands.

Levees

Two options were considered for Levee 5A. The first option considered a shorter levee that used existing topography as flood protection. The second option extended Levee 5A on the western limits of the main pit to produce a safer and more practical pit wall. This second option was considered to be the preferred option.

The requirement for Levee 6 was also considered. If this levee is required there are two potential locations. Both locations have been planned avoid CM-CD1 and minimise encroachment on Class II lands. *Figure 2.1* shows the proposed location of all levees including both options for the location of Levee 6 if it is required.

Final Landform

A number of options were examined for the final landform. These included:

- final void location;
- the development of a separate evaporative sink and an engineered tailings facility in the final void; or
- the development of the final void as an evaporative sink only.

Initial groundwater studies indicated that an evaporative sink is an important component for improved long term groundwater management and as such, forms part of the preferred option.

2.4.2 The 'Do Nothing' Option

The 'do nothing' option would see mining in Carrington Pit completed by 2008 in accordance with the current West Pit consent. Should this occur, it is unlikely that CNA would go back to mine the area in the future as it would be fully rehabilitated and isolated from active mining areas. As such, the coal resource will be uneconomical to mine.

2.4.3 The Preferred Option

The preferred option was chosen to reduce environmental and operational constraints. This option includes:

- establishing the southern boundary of the extension area to minimise impacts to Class II lands and protect the billabong area containing River Red Gums;
- establishing the new development consent boundary so that it avoids the land on which the Energy Australia substation is located:
- the extension of Levee 5A to provide a safer and more practical pit wall; and
- developing the final void to function as an evaporative sink.

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Figure 2.3 **Indicative Rehabilitation Scheme and Evaporative Sink**

3 PLANNING AND STATUTORY FRAMEWORK

3.1 INTRODUCTION

This chapter identifies the consent conditions that are subject to modification, discusses the provisions of Section 96(2) under the *EP&A Act* and provides justification for its application. In addition, an assessment of the proposed modifications against relevant statutory planning provisions is undertaken.

3.2 PROVISIONS FOR THE USE OF SECTION 96(2)

Section 96(2) of the *EP&A Act* provides for a consent authority to consider an application to modify a consent as follows:

> *(2)* ***Other modifications***
> *A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent if:*
>
> *(a) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all), and ….*

The following section outlines the justification for the use of Section 96(2).

3.2.1 *Justification For The Use Of Section 96(2)*

Advice on the use of Section 96(2) of the *EP&A Act* to modify the West Pit consent (DA 451-10-2003) to include the proposed extension was sought from the DoP by letter on 12 November, 2004 (*Annex A)*. The DoP confirmed in its letter dated 23 February, 2005 *(Annex A)* that the proposed modifications should be dealt with under this part of the Act provided that the following key issues were addressed within an SEE:

- surface and groundwater;
- noise, blasting and vibration;
- air quality;
- heritage, both Aboriginal and European;
- flora and Fauna; and
- visual amenity.

These issues are addressed in *Chapter 5*.

Section 96(2) (a) states that for the consent authority to consider a modification to the consent under Section 96(2) of the *EP&A Act,* it must be satisfied that the modified development would be substantially the same as the approved development.

This SEE demonstrates that the proposed modifications to the Carrington Pit will be undertaken in broadly the same manner as the existing operations and will not increase the approved extraction rates or significantly alter the external impacts of HVO north of the Hunter River. A detailed assessment of any potential impacts in relation to the proposed modifications, as well as recommended mitigation measures addressing any identified impacts, is described in Chapters 5 and 6.

Mining in the Carrington Pit extension will be achieved using substantially the same mining methods, haul routes, coal preparation and transport facilities, number of employees as well as the same equipment fleet as approved in the original West Pit consent (DA 451-10-2003). The proposed modifications will not result in an increase in extraction volume over the approved rate of 10 Mtpa. Similarly, there will be no increase in the life of HVO north of the Hunter River, as the proposed modifications will increase the life of the Carrington Pit to 2014 which is within the timescale set by the West Pit consent.

The modifications include a change to the footprint of the Carrington Pit, the construction of up to three levees to protect mining works from flood events, the diversion of an existing drainage line from east to west and the establishment of a service corridor for light vehicle access roads, pipelines and other services. These proposed modifications are minor in the context of the operations across HVO north of the Hunter River. In view of the consistency of the existing and proposed operations, their accordance with existing operational limits and their relatively small scale, the development as modified is substantially the same as the approved development.

3.2.2 Conditions Requiring Modification

To facilitate the proposed alterations, the following conditions need to be modified in the West Pit consent (DA 450-10-2003).

Administrative Conditions:

2. *The applicant shall carry out the development generally in accordance with the:*

   (a) DA 450-10-3002

   (b) EIS titled Hunter Valley Operations-West Pit Extension and Minor Modifications, Volumes 1-4, dates October 2003, and prepared by Environmental Resources Management Australia, Pty Ltd.

This condition should be modified with a reference to this Statement of Environmental Effects (SEE).

Specific Environmental Conditions:

41. *The applicant shall not mine within 60 metres of the area CM-CD1 and the Older Stratum being measured from the margin of the predicted maximum extent of that deposit as identified in Drawing 002- Revision A, dated 4 August 2000, unless otherwise agreed by a Cultural Heritage Indigenous Management Agreement (Condition 40).*

This condition should be modified to the following:

> *The applicant shall not mine within 15 metres of the area CM-CD1 and the Older Stratum being measured from the margin of the predicted maximum extent of that deposit as identified in Drawing 002-Revision A, dated 4 August 2000 unless otherwise agreed with the Minister for Planning.*

3.3 PLANNING AND REGULATORY FRAMEWORK

This section assesses the proposed modifications against the relevant environmental planning instruments. It describes the provisions of the *EP&A Act, 1979* and *EP&A Regulations, 2000* under which the project is defined as State Significant and designated development and the implications this has for the assessment process.

3.3.1 New South Wales Legislation

The assessment of the approved development and the proposed modifications is in accordance with the framework established by the *EP&A Act*, *EP&A Regulations* and the *Threatened Species Act (TSC Act).*

State Significant Development

State significant development is development that is, among other things, declared by a State Environmental Planning Policy (SEPP) or a Regional Environmental Plan (REP) to be State significant development. The approved development is classified as State significant development due to the provisions within *SEPP 34 Major Employment-Generating Industrial Development (SEPP 34)* as it employs over 100 persons on a full-time basis. The application of SEPP 34 will be discussed further in this chapter.

Under the provisions of the *EP&A Act* and SEPP 34, the Minister for Planning is the consent authority for State significant development. As such the proposed modifications will be submitted to DoP for assessment prior to the Minister making a decision.

Designated Development

Schedule 3 of the *EP&A Regulations* sets out development that is defined as designated development. This includes, among other things:

> *Coal mines that mine process or handle coal, being:……*
>
> *b) open cut mines:*
>
> *i) that produce or process more than 500 tonnes of coal or carbonaceous materials per day, or*
>
> *ii) that disturb or will disturb a total surface area of more that 4 hectares of land (associated with a mining lease or mineral claim or subject to a notice under Section 8 of the Mining Act , 1992) by clearing or excavating, by constructing dams, ponds, drains, roads, railways or conveyors or by storing or depositing overburden, coal or carbonaceous materials or tailings, or*

The approved development will continue, through the extension of the Carrington Pit, to process more than 500 tonnes of coal per day and will over the life of the proposed operations, disturb more than 4 ha of land. Accordingly, the development is classified as designated development.

Pursuant to the *EP&A Act,* an environmental impact study (EIS) must accompany a DA in respect of designated development. As an EIS was prepared by ERM (2003) to accompany the development application for the West Pit project, this SEE will supplement the HVO *West Pit Extension and Minor Modifications EIS,* with regard to the proposed modifications.

Integrated Development

Integrated development is defined under Section 91 of the *EP&A Act*. It includes projects that require development consent and one or more specified approvals under the following acts:

- *Fisheries Management Act 1994;*
- *Heritage Act 1977;*
- *Mine Subsidence Compensation Act 1961,*
- *National Parks and Wildlife Act 1974,*
- *Protection of the Environment Operations Act 1997;*
- *Rivers and Foreshores Improvement Act 1948;*

- *Roads Act 1993;*
- *Water Act 1912;*
- *Rural Fires Act 1997; and*
- *Water Management Act 2000.*

Where one of these approvals is required, the DA must be submitted to the relevant approval authority and the consent authority (in this case the Minister for Planning) cannot determine the application until that approval authority has provided General Terms of Approval. The relevant acts that require integrated approval as a result of the proposed modification are outlined below.

National Parks And Wildlife Act 1974

Under Section 90 of the National Parks and Wildlife Act 1974, consent is required to knowingly destroy, deface or knowingly cause or permit destruction or defacement of or damage to, an object or Aboriginal place.

Chapter 5 indicates that the proposed modifications will have some impact on Aboriginal places on or adjacent to the site. Approval will be required from Department of Environment and Conservation (DEC) for this activity.

Protection Of The Environment Operations Act 1997

Although the proposed modifications will not change the nature of the mine site, the extraction methodology or the process of the mining works, nor will there be an increase in the volume of coal removed per year, the existing Environmental Protection License (EPL) for HVO will require modification to accommodate the Carrington Extension and approval from the DEC.

Water Act 1912

Part 2 of the *Water Act* relates to water rights and works. In respect of current water management systems, the existing mine infrastructure will be used for all operations within the proposed extended area. However mine water Dam 9N will be relocated to the south-east of its current position (refer to *Section 5.2* in *Chapter 5*). Current infrastructure relating to management of surface water runoff, erosion and sedimentation controls is either licensed or does not require licensing. A permit would be required from the Department of Natural Resources (DNR) to undertake re-alignment of the drainage channel between the West Wing and main Carrington Pit operations. Should water management plans change in the future, then applications should be made where appropriate.

In addition, a licence is required under Part 2 of the *Water Act* for any levee which occupies a floodplain, or is used to contain or exclude flood waters from a river. Therefore levees constructed as part of this project will require a licence.

Part 5 of the *Water Act* relates to artesian wells. The area where the impermeable barrier may be located is outside the defined limits of the Water Sharing Plan for the Hunter River (pers. comm. Fergus Hancock DNR, 26/8/05). Mr Hancock indicated that, as the barrier is located on the same cadastral map as the pit, the licence required under Part 5 of the *Water Act* for the pit operations would be able to be extended to licence the barrier. In addition, pit seepage is generally less than originally predicted in the 2003 EIS (ERM 2003) and is unlikely to increase measurably for the proposed extended mining area. Licensing relating to groundwater seepage to the mine pit has been required under Part 5 of the *Water Act* and may need to be amended.

3.3.2 Planning Instruments

The approved development is subject to a number of local, regional and State environmental planning instruments (EPIs). Those EPIs relevant to the proposed modifications are summarised below.

Singleton Local Environment Plan (LEP)

Under the Singleton LEP, HVO and its surrounds are zoned Rural 1(a). Within this zone, mining is permissible with development consent. One of the objectives of the Rural 1(a) zone is:

"*To allow mining where environmental impacts do not exceed acceptable limits and the land is satisfactorily rehabilitated after mining.*"

The purpose of this SEE is to demonstrate that the proposed modifications will not result in environmental impacts that will exceed the acceptable limits as approved in the West Pit consent and that rehabilitation will be undertaken progressively. CNA's Environmental Management System (EMS) has been developed to manage environmental impacts across HVO. In addition, the HVO MCP will be provided to the regulatory authorities at least five years before closure of the operation to provide details of drainage, the final landform and the removal of the levees.

Hunter Regional Environment Plan (REP)

General

The *Hunter REP* sets a policy framework for development in the Hunter Region between 1989 and 2009. The plan guides the preparation of local EPIs and the processing of DAs in accordance with regional objectives.

The parts of the *Hunter REP* with direct relevance to coal mining include:

- Division 1 of Part 4 – Land Use and Settlement;
- Division 1 of Part 5 – Transport;
- Division 1 of Part 6 – Natural Resources; and
- Division 1 of Part 7 – Environmental Protection.

The requirements of each of these parts are provided in the *West Pit Extension and Minor Modifications EIS* (ERM, 2003). The sections below describe how the proposed extension relates to these requirements.

Division 1 of Part 4 – Land Use and Settlement

The objective of the *Hunter REP* in relation to rural land is to protect prime crop and pasture land (Class I, II or III, or special purpose land) from alienation, fragmentation, degradation and sterilisation. The proposed extension will encroach into isolated patches of Class II lands. The extent of these patches within the extension area and the expected impact on this land is addressed in *Chapter 5*.

Division 1 of Part 5 – Transport

Division 1 of Part 5 of the Hunter REP seeks to maximise accessibility and facilitate the movement of people and goods throughout the region in a manner which recognises social, economic, environmental and safety considerations. The REP encourages the transport of goods, especially coal and other bulk materials, by rail and other non-road modes where practicable.

The approved development includes the transfer of coal to HVO's rail loading points at Hunter Valley Loading Point (HVLP) and Newdell Loading Point (NLP) and Ravensworth Coal Terminal (RCT) and the continuation of the transport of coal by rail from HVO to the Port of Newcastle. The proposed modifications will not change any transport details that have been approved.

Division 1 of Part 6 – Natural Resources

Division 1 of Part 6 of the *Hunter REP* relates to planning strategies for mineral resources and extractive materials. Clause 41 of the REP lists a range of matters that a consent authority must consider when considering applications for mining. Each of these matters has been considered within the *West Pit Extension and Minor Modifications EIS* (ERM, 2003) and followed by a comment on the development's compliance with each matter. The proposed modifications do not have any impacts in relation to *Division 1 of Part 6-Natural Resources* as the development as amended would maintain compliance with each of these matters.

Division 1 of Part 7 – Environmental Protection

Division 1 of Part 7 of the *Hunter REP* relates to pollution control, including the control of air, noise and water pollution. Clause 47 of the REP lists a range of matters that a consent authority must consider when considering applications for designated development (such as coal mines) or the expansion of designated development. Compliance with each of these matters has been described within the W*est Pit Extension and Minor Modifications EIS* (ERM, 2003). Any potential impacts in relation to *Division 1 of Part 7- Environmental Protection* will be addressed within the relevant chapters of this SEE.

State Environmental Planning Policies (SEPP)

SEPP 34 – Major Employment-Generating Industrial Development

SEPP 34 aims, among other things, to promote and coordinate the orderly and economic use and development of land and the economic welfare of the State and to facilitate certain types of major employment-generating industrial development of State significance.

SEPP 34 applies to a number of major industrial developments, including development for the purposes of mining, which would (after the construction stage) employ 100 persons or more on a full-time basis or have a capital investment value of $20 million or more. Such development is declared to be State significant development and the consent authority for the purposes of the development becomes the Minister for Planning.

The approved development for HVO north of the Hunter River will continue to employ more than 100 persons on a full-time basis. Accordingly, the proposal can be classified as State significant development and under both *SEPP 34* and the provisions of the *EP&A Act* the Minister for Planning becomes the consent authority. As previously discussed, the proposed modifications will require the review and the consent of the Minister under S96(2).

SEPP 34 also requires the Minister to give notice to a council of any DA to carry out development to which *SEPP 34* applies which is proposed to be carried out in the council's area. *SEPP 34* also requires the Minister to take into consideration any submissions made by that council in determining the DA.

SEPP 44 – Koala Habitat Protection

SEPP 44 aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline. Surveys undertaken on the site of the proposed extension indicate that while the site contains scattered individuals of one feed tree species, Forest Red Gum (*E. tereticornis*), this tree species constitutes less than 15% of the total number of trees on the site. As such, the site does not contain potential koala habitat.

3.4 CONCLUSION

Under the provisions of the *Singleton LEP*, development for the purpose of a mine requires development consent. Due to the number of employees at HVO north of the Hunter River, the development is classified as State Significant under *SEPP 34*, which makes the Minister for Planning the consent authority.

Under the provisions of the *EP&A Act*, the approved development is also defined as both designated and integrated development. This classification requires that an EIS be prepared to address potential environmental, social and economic impacts of the proposal while its classification as integrated development required the Minister to refer the proposal to stipulated government agencies for their comments prior to determination of any DA.

The proposed modifications do not change any of the above classifications and requirements of the development. The proposed modifications are substantially the same as the approved development and therefore may be consented under Section 96(2) of the Act. The proposed extension of the Carrington Pit and the construction of additional site management features such as a services corridor, evaporative sink and flood levees, does not substantially alter the development for which consent was originally granted. Furthermore, the approved development, amended by the proposed modifications is consistent with the relevant provisions contained within the EPIs that apply to the development, including the *Singleton LEP* and the *Hunter REP*.

4 CONSULTATION

4.1 CONSULTATION PROCESS

A consultation strategy was developed as part of the SEE process to assist in the identification of key issues for consideration by CNA and the SEE project team. Consultation with government bodies and community stakeholders was incorporated into the strategy to both inform the stakeholders of the project and to allow any issues of concern to be raised at an early stage of the planning process and allow them to be incorporated into the SEE.

The key stakeholders identified as part of the Stakeholder Consultation Strategy and the communication methods used to consult with each group are summarised in *Table 4.1* below:

Table 4.1 Outline of Communication Methods used for each Stakeholder

Stakeholder	Communication Method
Near Neighbours	• Personal Visits • Newsletters
Village residents	• Newsletters
Council	• Briefings for staff • Presentations to Councillors • Newsletters to Council
State Members	• Offer of briefing • Newsletters to electoral office
Aboriginal Groups	• Meetings • Site walks
Environmental NGOs	• Newsletters
CNA Employees	• Briefings for staff
Neighbouring Mines	• Offer of briefing • Copies of newsletter
Regulatory Agencies	• Briefings on specific issues • Newsletters to DoP, DEC, DPI, Hunter Catchment Management Authority (HCMA) Department of Mineral Resources (DMR)
Community Consultative Committee	• Briefing on project • Newsletters

4.2 GOVERNMENT CONSULTATION

Both State and Local government were consulted to identify key issues. Consultation with government agencies was undertaken both formally and informally through meetings and letters and included DoP, the DEC and the DPI. The information received has been used to direct technical studies and refine the SEE. A summary of the requirements outlined during the consultation process is provided in *Table 4.2* below together with references to the relevant chapters that address these issues.

In addition a presentation on the groundwater results was made to DoP and DNR representatives on 17 August 2005. Col Mackie of Mackie Environmental Research (MER) presented the findings of the modelling results and discussed the management and monitoring options available.

Table 4.2 Summary of Government Agency Issues

Agency	Summary of Issues	Section of the SEE
DoP	Description of the proposal	Chapter 2
	Justification for the proposal	Chapter 7
	Permissibility	Chapter 3
	Surface water	Section 5.2 and Annex C & D
	Groundwater	Section 5.3 and Annex D
	Noise, blasting and vibration	Section 5.4 and Annex E
	Air quality	Section 5.5 and Annex F
	European heritage	Section 5.6 and Annex G
	Aboriginal heritage	Section 5.7 and Annex G
	Flora and fauna	Section 5.8 and Annex H
	Visual amenity	Section 5.9
	Cumulative impacts	Chapter 5
	Environmental Monitoring and Management	Chapter 6
	Consultation	Chapter 4

4.3 LOCAL ABORIGINAL STAKEHOLDERS

Initial consultation for the assessment was undertaken by GSS Environmental and involved a consultation meeting to which Aboriginal groups known to have expressed an interest in heritage assessment were invited (refer to *Table 4.3*). The meeting was held on the 15th of October 2004 (refer to *Annex G* for further detail). An opportunity for a representative from each group to participate in the fieldwork was provided.

Table 4.3 Aboriginal Groups Invited to Consultation Meeting

Aboriginal Group
Wanaruah Local Aboriginal Land Council
Ungooroo Aboriginal Corporation
Wonnarua Nation Aboriginal Corporation
Upper Hunter Wonnarua Council
Combined Council of Hunter Valley Aboriginal Corporation
Lower Wonnarua Tribal Consultancy Pty Ltd
Wonnarua Aboriginal Custodians Corporation
Wattaka Wonnarua CC Service
Yarrawalk Enterprises
Valley Culture
Upper Hunter Aboriginal Corporation
Hunter Valley Cultural Consultants

A second notice was sent to the interested groups on the 19th October 2004 outlining the detail for the proposed survey. Due to the nature of the project and the number of interested groups it was decided that the five separate groups would be selected to participate in each day of the field work. This ensured that all groups who expressed an interest in the project had an opportunity to participate.

A survey involving two Archaeologists and representatives of six Aboriginal groups was undertaken on the 26th and 27th October 2004.

The survey involved systematically walking over the area in order to inspect all areas of exposure or areas with some archaeological visibility.

The six Aboriginal groups represented on survey are presented in *Table 4.4*.

Table 4.4 Aboriginal Groups Represented in Survey

Aboriginal Group	Representative
Yarawalk Enterprises	Scott Franks
Ungooroo Aboriginal Corporation	Rhonda Ward
Wanaruah Local Aboriginal Land Council	Barry French and Tony Matthews
Wattaka Wonnarua CC Service	Des Hickey
Upper Hunter Valley Consultants	Cliff Matthews
Valley Culture	Beverley Van Vliet

Barbara Foot of the Wonnarua Aboriginal Custodians Corporation visited the site on the 27th October 2004. She was taken to the various sites that were found on the previous day.

Further consultation was undertaken by ERM. ERM prepared an assessment report (refer to *Annex G*) detailing results of the survey and proposed management recommendations. This report was circulated in September 2005 to the Aboriginal groups listed in *Table 4.3*.

GSS Environmental has prepared a letter report that summarises the responses from the above groups. This report has been included in *Annex G*. No issues were raised by any of these groups.

4.4 RESULTS OF COMMUNITY CONSULTATION

Face to face meetings were held with near neighbours and interested members of the public. Of the eleven people contacted for a meeting, seven agreed to a meeting and four requested a newsletter only. Newsletters were left with all neighbours after the meeting. A copy of the newsletter has been included in *Annex B*. The issues raised in the meetings are summarised in *Table 4.5* below.

Table 4.5 Summary of Face to Face Meeting Discussions

Category	Discussion Points
Noise	• General approval of directional noise monitoring; • Blasting a concern if it affects structures; • Community pleased that new reverse beepers are on trial to replace beeping reversing indicators.
Dust	• Concerns regarding monitoring and the high level of dust travelling up the valley; • Request for Particulate Matter (PM) 2.5 monitoring as concerns raised about health effects of dust.
Visual	• Concerns expressed that lights shine onto Jerrys Plains road next to Riverview mine.
Groundwater	• Concerned about hydraulic link and possible water loss from river and groundwater including impacts to River Red Gums in the billabong area; • Request that neighbours in direct contact with River be kept informed about groundwater impacts.
Surface Water	• Concerned about mudstone and siltstone washing into River after levee removal; • Surface water drainage to follow existing creek/drainage line.
Community involvement	• Request provision of jobs to keep community alive; • Request that CNA get behind TAFE apprenticeships for locals to access jobs in the mines; • Concern about impact on school closures as CNA is not leasing out houses in the local area resulting in a reduced number of children attending local schools; • CNA school support programmes are appreciated by the community.

After the completion of the face to face meetings, newsletters were distributed to residents in Jerrys Plains, Maison Dieu, Warkworth and along Lemington Road on the 15 April, 2005. In addition, newsletters were sent to NGOs, Singleton Shire Council staff and Councillors, Muswellbrook Shire Council, State Government regulatory agencies, State members and the HVO Community Consultative Committee members.

5 IMPACT ASSESSMENT

5.1 INTRODUCTION

This chapter addresses the likely impacts associated with the proposed extension, in order of the significance of the potential impacts. Where appropriate, management and mitigation measures are recommended.

5.2 SURFACE WATER MANAGEMENT

5.2.1 Surface Water

Impacts to surface water from the proposed mine extensions (excluding impacts to flooding) were assessed by Mackie Environmental Research (MER). The full assessment is presented as *Annex D.* Surface water related studies have included an assessment of changes to the runoff regime and a review of mine water management systems.

The extension of mining will temporarily remove catchment runoff from an area of about 60 ha in the east channel. This runoff currently enters a local un-named drainage channel and either recharges the alluvium or flows into the Hunter River via a billabong. The runoff would be restored by 2014 following reshaping of spoils and the final void area. However the final void may also attract runoff from an area as large as 290 ha resulting in long term loss (of runoff) to the river. For median conditions and typical catchment parameters this would equate to about 109ML/annum or 0.4% of the ten percentile regulated (low) flow in the river.

Review of the mine water management system indicates a small deficit during dry and drought periods due to the relatively low rates of seepage to the mine pit. This deficit is currently met through staging storage within the wider CNA water sharing system linking operations between West Pit, North Pit and Riverview and Carrington Pits. A surplus is expected to prevail during wet years. This surplus can also be managed through the available storage. There would be no significant change in pit water seepage or runoff entering Carrington Pit for the proposed extended mining scenario. Dam 9N (refer to *Figures 22* and *23* in *Annex D*) which currently receives all pumped water from the mine pit, will be relocated to the south-east of its current position. The dam will continue to receive pit water. Sedimentation Dam 12N would be destroyed (as originally planned) without impact on the mine water system. Sedimentation Dam 13N will be enlarged following closure and a number of additional temporary sedimentation dams constructed to manage runoff from the final landform. Further surface water assessment details, excluding flooding, are provided in *Annex D*.

5.2.2 *Flooding*

With the Carrington Pit located north of the Hunter River there is a concern that extreme rainfall events may impact on the mining activities with potential floodwaters entering the pit. Up to three levees have been proposed to protect the open cut and divert floodwaters. The proposed levees included Levees 5, 5A and 6. Levee 6 is now not required due to short time that mining will occur to the north of the levee.

The impact of the proposed levees on the Hunter River and its floodplain was assessed by Lyall and Associates Consulting Water Engineers. The full assessment is provided in *Annex C.*

The assessment was undertaken using a truncated version of the HEC-RAS model and assessed the impact of the proposed levees on the flood regime of the Hunter River for the 100 year and 185 year ARI flood events. This was based on a minimum design standard for the levees to a 100 years ARI event with a freeboard of 1 m which is equivalent to a 185 year ARI event.

From the model it was found that the levees would protect the mine area from floods in excess of the 20 year ARI event, as lesser events would be contained in the confines of the channel and the lower floodplain. As the proposed levees are outside the main passage of flow, their main impact would be a local redirection of flows from the northern floodplain towards the channel. This would be accompanied by small increases in velocity, which would not have a significant effect on the morphology of the river channel. The modelled increases in flood level would reach a maximum of 60 mm upstream of Levee 5, but at most locations, the modelled change in flood level is smaller and probably within the accuracy of the hydraulic model.

The modelled flow velocities on the northern floodplain near the levees range between 0.3 and 1 m/s and are likely to be high compared to actual velocities along the faces of the levees during major flooding.

For major flood events, the levees would result in a small displacement of floodplain storage. However, the effects would be localised and are too small to be measured by hydraulic modelling.

5.2.3 *Management And Monitoring Measures*

Management of surface water will continue to be undertaken in accordance CNA EMS Procedure 7 – Water Management and the HVO North Site Water Management Plan. Operational impacts in respect of surface waters relate to two areas:

- diversion of runoff from surrounding undisturbed catchments to minimise contributions to the mine water system;

- capture and treatment of all runoff from disturbed areas to minimise impacts on natural drainage.

The topography is such that no diversion drains are required beyond those already approved. However it will be necessary to relocate mine water Dam 9N and sedimentation Dam 12N.

Design, construction and monitoring of the dams should ensure that:

- all new banks, channels and similar works are constructed to convey runoff from areas above the dams and ensure they do not cause damage to, or interfere with the stability or water quality of existing water courses;

- new banks, channels and similar works will be maintained in a stable form to minimize scouring and erosion. Impacts of such works should be measured by monitoring of water quality parameters pH, Electrical Conductivity (EC) and non filterable residue (NFR) at Dam 12N at monthly intervals during periods of sustained runoff, and comparing such measurements to measured water quality in the water course below the dam; and

- future dam design will provide for a minimum capacity based upon a 1 in 20 years ARI storm event and inlet/spillway structure designed to convey a 1 in 10 years ARI storm event and/or to meet design criteria prescribed in Managing Urban Storm water – Soils and Construction (NSW Dept. of Housing, 1988) for Type C or D basins and/or other design criteria considered appropriate to local conditions and micro climate influences.

Monitoring will continue to be undertaken in accordance with CNA EMS Procedure 1.10 – Monitoring and Measurement. Mine pit water monitoring will provide for:

- fortnightly measurement of the volume of water pumped from the mine pit(s). Such measurement may be conducted using either flow meters, weirs, flumes, pump operational hours (combined with appropriate pump curves) or other suitable methods that result in an estimation error of less than 10%;

- monthly monitoring of mine pit(s) water quality by measurement of pH and EC in the receiving dam(s).

In addition to the above and as part of overall water management procedures, the monitoring programme should be subject to review annually by CNA environmental services group and/or their appointed consultants.

5.3 GROUNDWATER MANAGEMENT

5.3.1 Existing Environment

Two saline aquifer systems are located within the Carrington Pit area. These include moderate to high hydraulic conductivity aquifer materials contained within an ancient alluvial palaeochannel, and relatively low conductivity aquifers contained within the underlying coal measures. Both the deep and shallow saline groundwater systems have had little or no rainfall recharge in recent years. Water levels within the alluvial aquifer have steadily declined in both the west and east alluvial channels as a result of dewatering associated with mining activities and the prevailing drought conditions over the last three or four years. Groundwater characteristics are described in *Section 2* of *Annex D*.

5.3.2 Assessment Process

Potential impacts to the groundwater resource relate to two key areas:

- dewatering impacts within the alluvial aquifer, with potential associated impacts to environmental flows in the adjacent Hunter River, and depressurisation of the coal measures; and

- changes to groundwater hydrochemistry resulting from depressurisation of the saline coal seam aquifers.

The impacts from Carrington Pit development on the groundwater systems within the palaeochannel and the underlying hard rock regime, have been previously assessed using computer-based aquifer modelling techniques (MER 1999, 2000b, 2003, 2004). Two models have previously been employed:

- a single layer model addressing the palaeochannel alluvium and the management of seepage and river leakage during mining. This model has also been used to predict the recovery of water levels post mining;

- a regional three layer model addressing the hard rock coal measures aquifers, cumulative impacts and the magnitude of leakage induced by depressurisation within the coal measures.

These previous models have been expanded within the current study and translated into the Modflow-Surfact code, a derivative of Modflow offering more robust handling of de-saturation and improved solution accuracy/efficiency based upon adaptive time stepping. Details relating to model design, calibration and simulation procedures are provided in *Appendix C* of *Annex D*.

5.3.3 *Results*

The computer simulation of aquifer responses assessed a number of variations that are detailed in *Table 5.1*. Further detail is provided in *Annex D*.

Table 5.1 Computer Simulation Results

Simulation	Objective	Results
Modelling results of mining operations to the approved extents without a barrier.	To confirm predictions made in the Carrington EIS and subsequent studies (MER 1999, 2000b, 2003, 2004).	• Indication of southward groundwater flow from the eastern channel to the Hunter River until January 2007; • From January 2007, a reversal of flows will result in water flowing north from the Hunter River; • Pit seepage is relatively constant between 2004 and end of mining; • Water from the Hunter River is predicted to flow into adjacent areas at a sustained rate of about 0.08 ML/day by 2010.
Modelling results of mining operations to the proposed extents without a barrier.	Determine impact of mining extension areas on the groundwater water system and compare results with predictions made for the currently approved mining operation scenario.	• Indication of southward groundwater flow from the eastern channel to the Hunter River until January 2007; • From January 2007, a reversal of flows will result in water flowing north from the Hunter River; • Pit seepage is relatively constant between 2004 and end of mining; • Water from the Hunter River is predicted to flow into adjacent areas at a sustained rate of about 0.13 ML/day by 2010.
Modelling results with a groundwater barrier.	Determine the influence of a groundwater barrier on the groundwater system when mining has been extended.	• In 2010 -2011 modelling indicates a relatively flat water table southward of the barrier; • Modelling of recovery of water levels beyond the final void (adopting an average annual recharge rate), results in an elevated water table with partial restoration of flow back to the River; • The rate of induced seepage is negligible.

Groundwater Barrier

CNA understands the sensitivity of groundwater issues associated with mining closer to the Hunter River.

Although modelling results indicate seepage from the Hunter River to be small, it is recognised that the installation of a barrier wall will address concerns related to the potential exchange of groundwaters between mining operations and the Hunter River.

The concern from the authorities is initially the potential for loss of groundwater from the alluvial lands into the Carrington Pit during mining and then on completion of mining the egress of saline groundwater from mined out areas into the Hunter River alluvials.

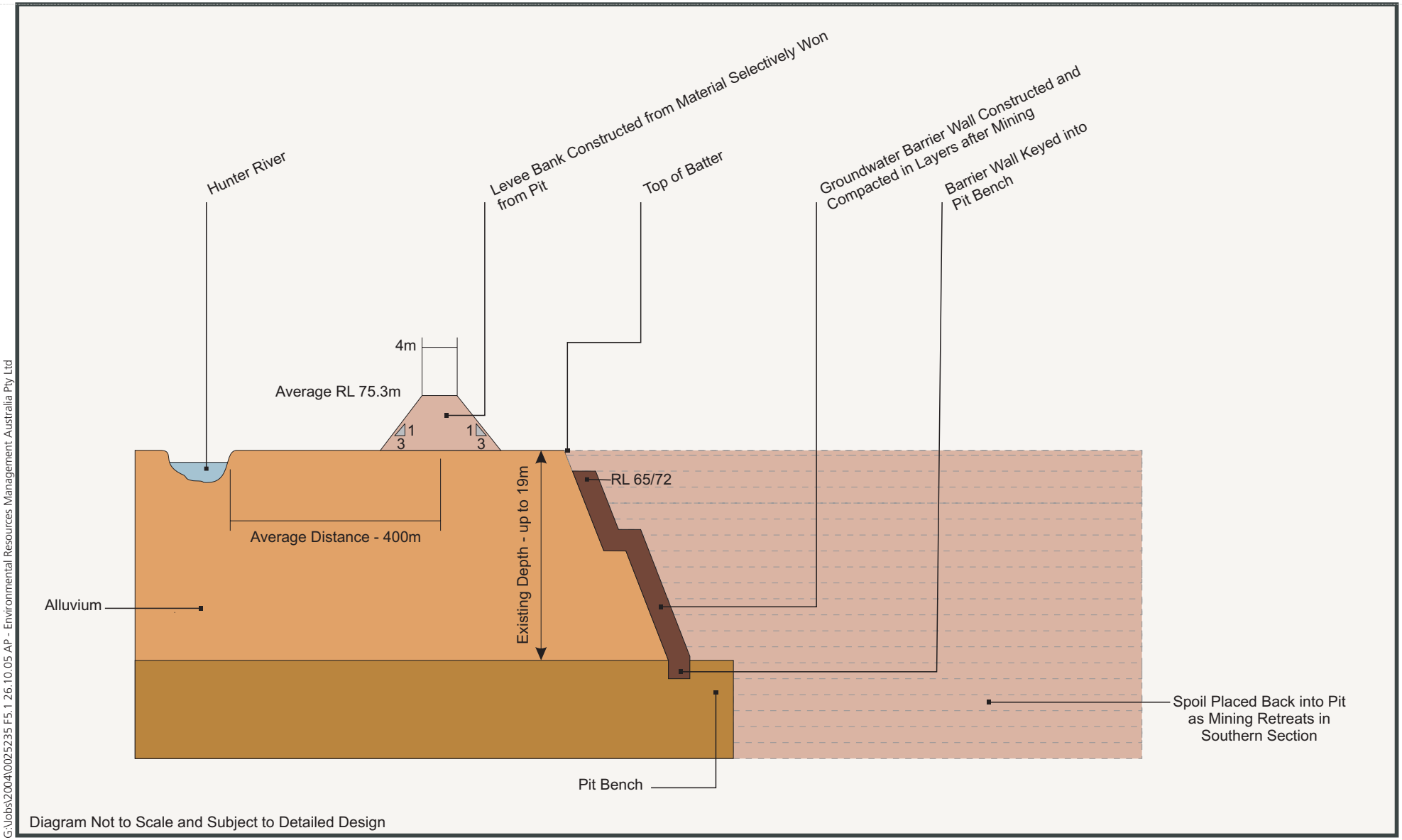
Two conceptual designs for a barrier have been proposed and are depicted in *Figures 5.1* to *5.2*.

The barrier may be installed a short distance beyond the southward limits of mining in both the eastern and western channels (refer *Annex D*). Such a barrier would be constructed to provide hydraulic isolation of the mining operations and to effectively inhibit any measurable exchange of groundwater between the mine pit and the alluvial lands to the south. The maximum permeability of the barrier would be 1×10^{-4} m/day.

Timing for the barrier would be dependant on monitoring results and regulatory requirements. A trigger for the requirement of the barrier would be a reversal of hydraulic to the river from currently southward to northward.

The preferred methodology is to construct Option 1 as mining retreats from the southern extension area. *Figures 5.1* to *5.2* depict conceptual schematics of the groundwater barrier options that may be constructed. Options for this barrier are also discussed in *Section 3.1.3* of *Annex D*.

If is confirmed that the barrier is required, final design and location will be based on the most up-to-date research at the time and submitted to the relevant regulatory authorities for approval prior to construction.



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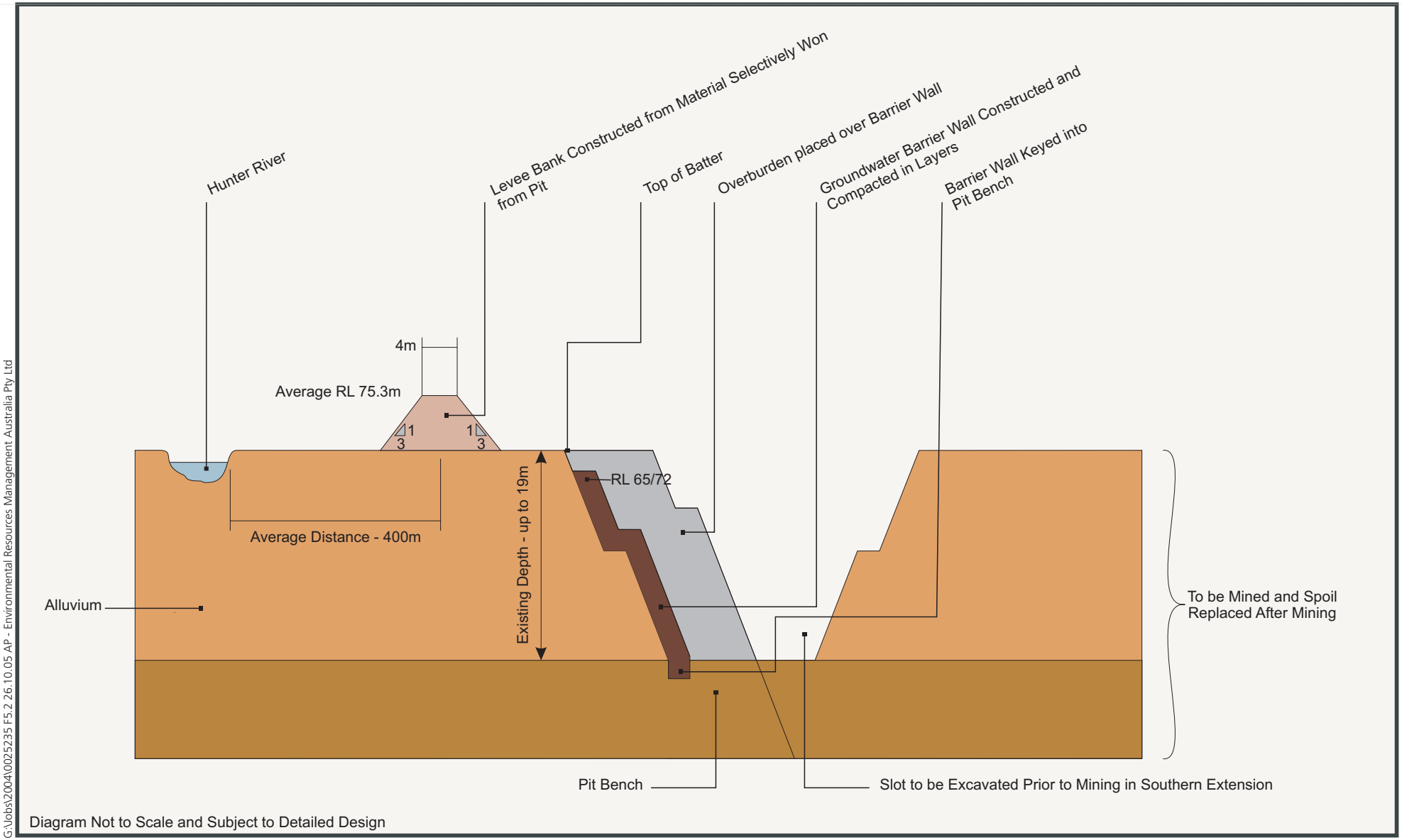
ERM

Figure 5.1 **Carrington Barrier Wall Schematic with Proposed Levee 5 - Option 1.**



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ERM

Figure 5.2 **Carrington Barrier Wall Schematic with Proposed Levee 5 - Option 2.**

Final Void

Mining operations at Carrington are expected to be completed by about 2011 at the earliest. After this time pit reshaping will be undertaken and water levels in the final void will begin to recover. The recovery process will involve a resaturation of waste rock spoils. Water for this resaturation will derive from rainfall infiltrating through rehabilitated areas, direct rainfall to any open void area, and a small component of seepage from the coal measures. The latter will be governed largely by the prevailing coal measures pressures which will in turn be governed by future regional mining operations.

Two scenarios have been identified for pit closure design. These are:

- an open water void above emplaced materials that would generate an evaporative sink over an elevation range of 40 to 45mAHD, and
- a filled, reshaped pit without an open water void but with a depression designed to facilitate evapotranspiration at an elevation above 45mAHD.

Computer model simulations indicate groundwater levels within the mine pit (emplaced spoils) will be slow to recover with more than 100 years predicted for equilibration of the final void water level. The equilibrated level for an open water void is below the prevailing river level and is influenced by a combination of processes including direct rainfall to the open void, rainfall infiltration-percolation through spoils within the pit void, regional groundwater seepage from the underlying coal measures, and evaporative losses from the open water surface.

Final design would be based on the most up-to-date research at the time of closure since each design offers a different outcome with respect to long term void water quality. Negligible seepage is predicted to occur from the palaeochannel alluvium through the barrier walls into the pit void.

The final location and design will be submitted to the relevant regulatory authorities for approval prior to construction.

5.3.4 Impact Assessment

Key findings of the groundwater assessment are summarised in *Table 5.2* and detailed in *Section 7* of *Annex D*.

Table 5.2 Potential Impacts to Groundwater Resulting from Pit Extensions

Potential Impact	Description
Loss of groundwater pressure of levels	• Local and regional aquifer pressures and groundwater levels within both the palaeochannel alluvium and the coal measures will continue to decline. The hydraulic grade within the alluvium is currently towards the river but will reverse within a few years leading to the potential for increasing leakage from the Hunter River; • The billabong area located in the south-eastern part of the east channel (see *Figure 2.1*) is unlikely to be affected by further declines in the water table since water levels in this area are already close to river levels as a result of mine and drought induced water table losses; and • Within the deeper coal measures, the area affected by loss of pressure will expand to a distance of about 1 to 2 kilometres from the mine lease. More distant areas will be affected by a 0.2 to 0.5 m decline in water level (aquifer pressure) with an exponential increase in loss of pressure towards the pit. Areas immediately adjacent to the pit will lose more than 60 metres head of water by the time mining ceases.
Potential loss of groundwater yield at existing bore locations	• Bores in the locality of the mine have generally been abandoned. Any remaining bores are unlikely to be affected.
Potential change in groundwater quality	• Dewatering-depressurisation of the alluvium and the coal measures is predicted to have minimal adverse impact on groundwater quality; and • Some leakage may occur from the Hunter River downwards into the alluvium or into the coal measures as water levels-pressures are reduced. The volume of leakage is predicted to be greater for the extended mining scenario compared to the current mining lease area since operations will be closer to the river. However this leakage would be mitigated by construction of barrier walls in the east and west alluvial channels. Any leakage from the river to the alluvium would result in improved groundwater quality within the alluvium.
Void water level recovery	• Numerical modelling of recovery of water levels for an open void system supports an equilibrated recovery level between 45 and 55mAHD, depending upon the final pit closure design. This level results from a small component of groundwater seepage to the void, rainfall infiltration through spoils, direct rainfall and runoff to an open void area and evaporation from that same area. The predicted equilibrated level would maintain a shallow hydraulic grade from installed barrier walls and northern areas of the palaeochannel, to the open void; and • The river reach low flow water level varies from +60m in the west, to about 58m in the east where an unnamed drainage (draining the billabong area) enters the river. While predicted void water levels are lower than the prevailing river level, leakage from the river towards the void would not occur at a significant rate due to the proposed installation of cut off walls. Leachate generated from the emplaced spoils, would be contained within the void.

Adapted from MER (2005)

5.3.5 Management And Monitoring Measures

Water Management procedures as outlined in CNA EMS Procedure 7 – Water Management and the HVO North Site Water Management Plan, will continue to be implemented. In addition, the current schedule of groundwater quality monitoring, as outlined in CNA EMS Procedure 1.10 - Monitoring and Measurement, will be maintained. This schedule includes:

- bi-monthly monitoring of basic water quality parameters (pH and EC) in nominated existing piezometers;
- six-monthly measurement of total dissolved solids (TDS) and major ion speciation of water samples from nominated existing piezometers;
- graphical plotting of data and identification of trend lines and statistics including mean and standard deviation calculated quarterly; and
- comparison of trends with rainfall and any other identifiable processes that may influence such trends.

Additional monitoring procedures will include:

- bi-monthly monitoring of water levels in all existing piezometers installed in the alluvium and in the underlying coal measures; and
- semi-continuous (data logger) monitoring at selected piezometers in order to measure impacts of rainfall recharge and percolation.

Ongoing impact analyses will include:

- modification to monitoring programmes will occur as required to ensure appropriate data is collected;
- installation of additional monitoring bores if required;
- formal review of depressurisation and comparison of responses with aquifer model predictions annually;
- expert review will be undertaken by a suitably qualified hydrogeologist if measured pit seepage and depressurisation exceeds predicted seepage and depressurisation; and
- annual reporting (including all water level and water quality data) to DoP in an agreed format.

If the barrier wall is installed, monitoring of the performance of the barrier will be detailed in the HVO North Site Water Management Plan.

5.3.6 Conclusion

Modelling results confirm previous modelling predictions. Additional modelling, undertaken to determine the potential impact from mining the proposed extension area, indicates that resultant impacts to the groundwater system will be minimal.

Existing and additional proposed monitoring procedures will provide a process for identification of potential impacts to the groundwater system underlying the Carrington Pit. If indicated as necessary by modelling results, conceptual barrier wall options will be detailed further and constructed as necessary.

5.4 NOISE AND VIBRATION

5.4.1 Noise Modelling Assessment Process

The noise and vibration assessment has been undertaken by ERM to assess impacts due to the Carrington Extension as a part of HVO north of the Hunter River. The modelling approach is consistent with the assessment described in the *West Pit and Minor Modifications EIS* (ERM, 2003). The full assessment is provided in *Annex E.* This section provides a summary of the assessment and includes an overview of the consent conditions, the modelling undertaken and the likely noise and vibration impacts at the nearest receptors (refer *Figure 5.3* and *Table 5.3*) locations around HVO north of the Hunter River.

Consent Conditions

As approval for the Carrington Extension is being sought as a modification to the West Pit consent (DA 450-10-2003), noise and vibration have been assessed against the noise and vibration limits specified in the West Pit consent. These limits include noise limits, land acquisition limits, airblast overpressure limits and ground vibration impact assessment criteria. These limits are set out in *Annex E* and the results tables provided below.

Noise Modelling

The Environmental Noise Model (ENM) noise prediction software was used for modelling. The noise model (See *Annex E, Chapter 3*) estimated L_{eq} noise levels, based on measurements conducted at West Pit described in the *HVO West Pit and Minor Modifications EIS* (ERM, 2003) assuming all plant and equipment operate simultaneously and at full power. In practice, such an operating scenario would be unlikely to occur.

Table 5.3 Location of Receptors

Receptor		ISG Coordinates		Direction from Mine
No.	**Property Owner**	**X**	**y**	**Compass**
1	Hayes	292153	1402554	SW
2	Skinner	292801	1401825	SW
3	Gee	293074	1401571	SW
4	Muller	293884	1400207	S
5	Bowman	305645	1399385	SE
6	Moxey	305748	1400194	SE
7[1]	Stapleton	303750	1403450	SE
8[1]	Holz	301500	1404300	SE
10[2]	Moses	294700	1402575	SW
11[4]	Wambo owned	294850	1399525	S
13[3]	Jerrys Plains Centre	291092	1403349	W
14[3]	Jerrys Plain North	290294	1403963	W
39	Kanaar	302041	1395132	S

1. These private properties are currently inside a zone of affectation or subject to a private land holders agreement with mines other than HVO.
2. These private properties are currently inside an HVO zone of affectation or subject to a private land holders agreement.
3. Additional Jerrys Plains assessment locations were added to ensure calculations are representative of the area.
4. Receptor 11 is owned by Wambo Mine.

Additional Notes:

Receptors 9 and 12 are owned by CNA. These receptors have therefore been omitted from the assessment.

Receptor identification numbers are in accordance with the West Pit 2003 EIS.

As the Carrington Pit was assessed as part of HVO north of the Hunter River for the West Pit consent, all operations within HVO north of the Hunter River were included in the modelling scenarios for the proposed Carrington Extension.

Three operating scenarios were modelled to cover the life of the proposed Carrington Extension and included operating years 2006, 2011 and 2014. Appropriate operating years for other pits within HVO north of the Hunter River such as West Pit and the Alluvial Lands dumps were also modelled. A summary of the scenarios modelled including these other pits is provided in *Table 5.4* below.

Table 5.4 Operations Modelled in Each Scenario

Modelled Year	Mine Plans		
	West Pit	**Carrington**	**Alluvial Lands dumps**
2006	Year 3	**2006**	Year 3
2011	Year 8	**2011**	Year 8
2014	Year 14[1]	**2011**	Not operating

1. In the West Pit EIS 2014 was labelled Year 14 for model purposes and hence is referred to as Year 14 in the current study.

Other activities included in the modelling are provided in *Annex E* as are the mine plans and equipment locations used in the noise modelling. They present worst-case operating scenarios. This allows a conservative assessment to be made of potential impacts the proposal may have on the area surrounding the mine.

5.4.2 Noise Modelling Results

Predicted Noise Levels - Calm Weather Conditions

Table 5.5 summarises noise modelling results for calm weather conditions at 12 receptors around HVO north of the Hunter River. The location of these receptors are shown on *5.3*. The results demonstrate that mine operations will satisfy consent noise limits during calm weather conditions at all private properties not already within a zone of affectation.

Table 5.5 $L_{eq,\ 15minute}$ Noise Under Calm Meteorology, dB (A)

Receptor	Day, Evening and Night Time			Consent Limits`
No.	**2006**	**2011**	**2014**	**Day/Evening/Night**
1	18	17	17	38-40
2	22	22	21	39
3	23	22	22	39
4	26	25	25	36-40
5	19	19	19	35
6	18	18	17	35
7[1]	32	33	33	40
8[1]	38	41	40	NA (Acquisition)
10[2]	37	35	35	NA (Acquisition)
11[4]	24	22	22	39
13[3]	16	15	16	40
14[3]	17	17	18	40
39	21	19	18	35

1. These private properties are currently inside a zone of affectation or subject to a private land holders agreement with mines other than HVO.
2. These private properties are currently inside an HVO zone of affectation or subject to a private land holders agreement.
3. Additional Jerrys Plains assessment locations were added to ensure calculations are representative of the area.
4. Receptor 11 is owned by Wambo Mine.

Additional Notes:

Receptors 9 and 12 are owned by CNA. These receptors have therefore been omitted from the assessment.

Receptor identification numbers are in accordance with the West Pit 2003 EIS.

X:\Minor Projects\0025235 Carrington\Figures July 2005\F 5-3.wor 25 07 2005 Environmental Resources Management Australia Pty Ltd

Figure 5.3 **Receptor Locations**

Predicted Noise Levels - Prevailing Weather Conditions

Noise levels were predicted for prevailing weather conditions as set out in the Industrial Noise Policy (INP) which recommends procedures to assess noise under a range of meteorological conditions. Specific adverse meteorological conditions, referred to as INP weather conditions, were assessed (in lieu of monitored data) and the consent limits were applied under these conditions. *Table 5.6* summarises the results for predicted noise levels under prevailing weather conditions for 2006, 2011 and 2014. As noise levels at night under INP weather conditions were exceeding the consent limit at some receptors, an additional modelling run was undertaken for 2006 with fewer pieces of equipment in the pit (one shovel, one drill and one dozer were removed from the model). The results for this modelling run are shown in the *Table 5.6* as 2006 Mitigated.

With the mitigation measures in place, the results demonstrate that mine operations will satisfy consent noise limits during INP weather conditions at all private properties not already within a zone of affectation for all years assessed.

Table 5.6 Noise for INP Weather – Night

Receptor	Predicted $L_{eq,15\ minute}$ Noise Level, dB(A)				L_{eq} Consent Limit, dB(A)	L_{eq} Noise Consent Acquisition, dB(A)
No.	2006	2006 Mitigated	2011	2014	Day/Evening/Night	
1	40	39	36	35	38-40	>41
2	41	40	37	36	39	>41
3	41	40	37	37	39	>41
4	41	40	38	38	36-40	>41
5	29	29	29	29	35	>41
6	29	29	29	29	35	>41
7[1]	41	40	40	40	40	>42
8[1]	48	48	49	49	NA (Acquisition)	NA (Acquisition)
10[2]	49	48	44	44	NA (Acquisition)	NA (Acquisition)
11[4]	40	39	39	38	39	>41
13[3]	38	37	35	34	40	>41
14[3]	37	36	34	33	40	>41
39	32	31	30	30	35	>41

1. These private properties are currently inside a zone of affectation or subject to a private land holders agreement with mines other than HVO.
2. These private properties are currently inside an HVO zone of affectation or subject to a private land holders agreement.
3. Additional Jerrys Plains assessment locations were added to ensure calculations are representative of the area.
4. Receptor 11 is owned by Wambo.

Additional Notes:

Receptors 9 and 12 are owned by CNA. These receptors have therefore been omitted from the assessment.

Receptor identification numbers are in accordance with the West Pit 2003 EIS

Sleep Disturbance

The sleep of residents can be disturbed by transient noise such as shovel gates banging, bulldozer track plates, truck engine at fast revving and vehicle reversing alarms.

Maximum noise levels were calculated under INP wind conditions for each receptor location and each operating scenario. Calculations were undertaken for a single event, rather than the simultaneous operation of a number of plant items because the values given are instantaneous maxima and such events are not expected simultaneously. The 2011 (Year 8) predictions conservatively assume that Carrington and the Alluvial Lands dumps are operational. The criteria used to assess sleep disturbance are based on the DEC's background plus 15 dB for the $L_{1,\ 1min}$ noise level (which in this case is conservatively approximated by the maximum noise level (L_{max})).

Table 5.7 demonstrates that calculated noise levels under prevailing weather conditions are within the DEC's conservative sleep disturbance criterion at all private residences not currently within a zone of affectation.

Table 5.7 Sleep Disturbance Impact – INP Weather

Receptor	External L_{max} Noise Level From On-Site Plant, dB(A)			$L_{1,1min}$ Night Consent Limit, dB(A)
No.	**2006**	**2011**	**2014**	
1	37	35	35	46
2	36	36	36	46
3	36	37	37	46
4	37	38	38	46
5	28	28	28	46
6	28	28	28	46
7[1]	40	40	40	46
8[1]	46	52	52	NA (Acquisition)
10[2]	45	44	44	NA (Acquisition)
11[4]	39	39	39	46
13[3]	31	32	34	46
14[3]	31	34	34	46
39	37	34	34	46

1. These private properties are currently inside a zone of affectation or subject to a private land holders agreement with mines other than HVO.
2. These private properties are currently inside an HVO zone of affectation or subject to a private land holders agreement.
3. Additional Jerrys Plains assessment locations were added to ensure calculations are representative of the area.
4. Receptor 11 is owned by Wambo.

Additional Notes:

Receptors 9 and 12 are owned by CNA. These receptors have therefore been omitted from the assessment.

Receptor identification numbers are in accordance with the West Pit 2003 EIS

5.4.3 *Cumulative Noise Assessment*

Adjoining industrial activity also influences the noise climate at residences potentially exposed to the proposed extension. However, for most residences this is limited, as the proposed extension constitutes the main contributor of industrial noise. Other industrial operations of significance are Riverview and Cheshunt Pits, Wambo, Ravensworth-Narama and Ashton Coal Mines.

Predicted noise levels from surrounding mines were sourced from a number of technical studies listed in *Annex E* which provided predicted L_{10} or L_{eq} noise levels for calm and adverse weather. The cumulative noise from these operations was added to the results for worst case INP weather from the proposal.

Table 5.8 summarises the cumulative noise effects of surrounding mines and related infrastructure. The percentage values in the parenthesis indicate the contribution of the proposed Carrington Extension (in noise terms) at that receptor.

Table 5.8 Cumulative Night-time L_{eq} Noise Levels at Surrounding Receptors

Receptor	Proposal Year		
No.	2006	2011	2014
	Cumulative Noise Level (Proposal contribution), dB(A)		
1	40 (79%)	37 (79%)	37 (63%)
2	41 (79%)	39 (63%)	39 (50%)
3	42 (63%)	40 (50%)	39 (63%)
4	43 (50%)	41 (50%)	41 (50%)
5	41 (6%)	40 (8%)	38 (13%)
6	41 (6%)	40 (8%)	37 (16%)
7[1]	43 (50%)	42 (63%)	40 (100%)
8[1]	49 (79%)	50 (79%)	49 (100%)
10[2]	48 (100%)	45 (79%)	45 (79%)
11[3]	45 (25%)	42 (50%)	41 (50%)

1. These private properties are currently inside a zone of affectation or subject to a private land holders agreement with mines other than HVO.
2. These private properties are currently inside an HVO zone of affectation or subject to a private land holders agreement.
3. Receptor 11 is owned by Wambo.

Additional Notes:

Receptors 9 and 12 are owned by CNA. These receptors have therefore been omitted from the assessment.

Receptor identification numbers are in accordance with the West Pit 2003 EIS

Additional Jerrys Plains Assessment locations were added for Year 20 as noise contours extended further west than other years.

The results are for prevailing weather conditions as described earlier and are therefore conservative. It should be noted that based on the information provided in corresponding EIS's, Wambo and Ravensworth/Narama mines will cease operations in 2016 (year 14) and 2007 (year 4) respectively. However, the Ravensworth Narama mine was presumed to operate until 2012 (year 8) for assessment purposes. The predicted noise from these operations was therefore cumulatively assessed accordingly. From beyond Year 14, noise is attributed to the proposal, Ashton and HVO south of the Hunter River.

Applying a night time cumulative noise criterion equivalent to the DEC's night time amenity goal of 40 dB(A) $L_{eq,9hour}$, applicable for a rural residence according to the INP, shows that all private residences not currently within a zone of affectation will be within or marginally (not more than 3 dB) above the DEC's amenity goal. As discussed earlier, the predictions above are based on a worst case $L_{eq,\ 15minute}$ noise level from each operation. Adopting a conservative 3 dB correction that is expected between the predicted worst case $L_{eq,\ 15minute}$ and $L_{eq,\ 9hour}$ noise level, implies that noise levels at these private residences are predicted to be below the DEC's amenity goal. This correction is due to the inherent downtime of plant over the 9 hour night-time period as compared with a worst case 15-minute noise emission level.

It should be noted that this 3 dB intrusiveness to amenity correction has not been applied to any results.

The private residence predicted to experience cumulative noise above the DEC criterion is Receptor 8. This property is currently inside a zone of affectation or subject to a private land holders agreement. The proposal's contribution to these exceedances is displayed in percentage terms in *Table 5.8*.

5.4.4 Blasting Noise And Vibration

The proposed 2006 and 2011 Carrington operations blast details were provided by CNA. These were used to calculate potential noise overpressure and ground vibration in accordance with Blastronics published data for all modelling scenarios including 2014 which is based on the Carrington Pit mine plan for 2011. The results indicate that noise overpressure and ground vibration consent limits will be achieved at all private residential locations for the life of the extension. The results are summarised in *Tables 5.1* and *5.2* of *Annex E*.

5.4.5 Noise And Vibration Management

The Carrington Pit forms part of the consolidated HVO north of the Hunter River. This consolidation has provided the opportunity for improved operational management and therefore improved environmental control over a large source of industrial noise. It has been a significant and positive step toward noise management, which now provides increased operational flexibility. In addition, a detailed noise management procedure (including monitoring) exists for HVO (CNA EMS Procedure 9 – Noise) and will be amended to include the proposed extension to reduce impacts further. Features of the noise monitoring programme include attended as well as unattended monitoring in specified locations and operating conditions.

To manage vibration impacts, blast design will incorporate control on the MIC (maximum instantaneous charge) to ensure that acceptable vibration limits are maintained. This will also be addressed through monitoring.

5.4.6 Conclusion

The noise modelling has shown that under INP assessable weather conditions most private residential properties not currently located within a zone of affectation experience noise levels below the consent limits. The exceptions are Receptors 1 to 4 for the 2006 activities where noise is predicted to be marginally (2 dB) above limits. Mitigation measures to reduce noise impacts to ensure the consent limits are met will include a reduction in mining equipment. However, noise acquisition limits are predicted to be satisfied.

The proposal's noise impacts at all these locations are predicted to remain similar to existing levels for the life of the proposal.

As discussed in the *West Pit Extension and Minor Modifications EIS* (ERM, 2003), the Year 1 model results demonstrate good or conservative correlation with monitoring data for 2002. It should be noted that whilst this does provide some degree of certainty, the model results are for specific worst case assessable INP weather conditions and the monitoring conditions are likely to have varied from these conditions.

As such the proposed extension is substantially the same as the approved development.

5.5 AIR QUALITY

The air quality assessment for the proposed Carrington Extension was undertaken by Holmes Air Sciences (HAS). The full report has been included in *Annex F.*

The air quality assessment has been undertaken to assess air quality impacts due to the Carrington Extension as a part of HVO north of the Hunter River as a whole. The modelling approach is consistent with the air quality assessment described in the *West Pit Extension and Minor Modifications EIS* (ERM, 2003). Modelling has been undertaken for three operational periods: 2006, 2011 and 2014 using the same scenarios described in *Table 5.4*.

5.5.1 Air Quality Assessment Criteria

Air quality criteria are stipulated by the DEC in a document titled *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW*. The relevant criteria for mining assessment are provided in *Table 5.9*.

Table 5.9 Assessment Criteria for Air Quality Pollutants

Pollutant	Averaging Period	Maximum Increase (g/m^2/month)	Maximum total (g/m^2/month)
Deposited Dust	**Annual**	**2**	**4**
		Concentration $\mu g/m^3$	
PM_{10}	24 hour	50	
	Annual	30	
Total Suspended Solids (TSP)	Annual	90	

5.5.2 Air Quality Assessment Process

The short-term industrial source complex model (ISC3-ST – Version 03025) has been used for this study. It uses the Gaussian dispersion equation to simulate the dispersion of a plume from either point area or volume sources. This model takes into account dry and wet deposition, dust retention in an open pit, and includes mechanisms for determining the effect of terrain on plume dispersion. It uses a meteorological file that provides wind speed, wind direction and other dispersion parameters on an hourly basis.

Emissions of particulate matter from the extension area have been estimated by analysing the proposed mine plan and using emission factors developed both locally and in the United States. The mine plan information used includes information on the locations of the areas where coal is to be extracted and the locations of haul routes, the sizes of trucks, the types of equipment used to load coal and overburden, the number of holes drilled for blasting, the sizes of blasts, the number of hours that dozers would spend on coaling and overburden operations, the likely moisture content of coal and overburden and the silt content of coal and overburden.

In assessing impacts, the approach has been to show the predicted effects of the Carrington Extension with operations within HVO north of the Hunter River then to consider these effects with other sources. The air quality impacts for 2006, 2011 and 2014 with the identifying receptor numbers are provided in *Table 5.10, Table 5.11* and *Table 5.12*. Receptor identification numbers, locations and owners are shown in *Figure 5.3*.

Table 5.10 Summary of Affected Receptors for 2006

Receptor		Carrington Extension with HVO north of the Hunter River				Cumulative Assessment			
No.	**Property Owner**	PM_{10} 24 Hour µg/m³	PM_{10} Annual µg/m³	TSP Annual µg/m³	Deposition Annual g/m²/ month	PM_{10} 24 Hour µg/m³	PM_{10} Annual µg/m³	TSP Annual µg/m³	Deposition Annual g/m²/ month
Goal		**50**	**30**	**90**	**2**	**150[a]**	**30**	**90**	**4**
1	Hayes	12.3	2.0	2.2	0.02	17.4	13.5	19.5	0.67
2	Skinner	15.2	2.1	2.2	0.02	29.1	14.6	20.7	0.70
3	Gee	19.3	2.2	2.3	0.02	35.2	15.0	21.2	0.71
4	Muller	15.0	1.7	1.8	0.02	27.7	16.7	23.1	0.77
5	Bowman	17.4	7.7	9.3	0.44	43.5	24.0	32.6	1.47
6	Moxey	20.0	8.0	9.6	0.42	37.9	22.6	30.8	1.27
7[1]	Stapleton	35.3	11.0	13.2	0.63	49.5	23.8	31.8	1.28
8[1]	Holz	39.5	12.5	15.7	0.90	57.0	28.6	37.7	1.58
10[2]	Moses	28.1	5.0	5.3	0.04	32.8	23.3	29.8	0.82
11[4]	Wambo owned	18.0	2.2	2.3	0.02	37.3	19.9	26.8	0.87
13[3]	Jerrys Plains Centre	16.6	7.8	9.3	0.43	36.9	24.0	32.5	1.43
14[3]	Jerrys Plain North	17.9	7.7	9.3	0.44	44.2	24.2	32.8	1.50
39	Kanaar	9.1	1.8	2.1	0.06	41.4	22.9	31.6	1.35

1. These private properties are currently inside a zone of affectation or subject to a private land holders agreement with mines other than HVO.
2. These private properties are currently inside an HVO zone of affectation or subject to a private land holders agreement.
3. Additional Jerrys Plains assessment locations were added to ensure calculations are representative of the area.
4. Receptor 11 is owned by Wambo Mine.

Additional Notes:

Receptors 9 and 12 are owned by CNA. These receptors have therefore been omitted from the assessment.

Receptor identification numbers are in accordance with the West Pit 2003 EIS.

USEPA 24 hour ambient air quality standard (99th percentile over 3 years).

Table 5.11 Summary of Affected Receptors for 2011

Receptor No.	Carrington Extension with HVO north of the Hunter River				Cumulative Assessment			
	PM_{10} 1-day µg/m³	PM_{10} 1-year µg/m³	TSP 1-year µg/m³	Deposition 1-year g/m²/ month	PM_{10} 1-day µg/m³	PM_{10} 1-year µg/m³	TSP 1-year µg/m³	Deposition 1-year g/m²/ month
Goal	**50**	**30**	**90**	**2**	**150[(a)]**	**30**	**90**	**4**
1	4.6	1.0	1.1	0.01	19.1	18.4	9.5	0.69
2	8.0	1.2	1.3	0.01	27.8	19.8	11.0	0.72
3	9.4	1.2	1.3	0.01	29.0	20.2	11.4	0.73
4	5.2	1.1	1.2	0.01	29.1	22.8	14.4	0.82
5	14.6	4.3	5.3	0.26	33.4	25.4	18.4	1.30
6	16.9	5.0	6.1	0.30	29.3	24.3	17.0	1.15
7[1]	29.5	9.3	11.5	0.61	41.3	25.5	18.2	1.21
8[1]	35.0	12.2	15.9	0.99	55.6	**33.1**	27.5	1.66
10[2]	12.9	2.8	2.9	0.03	35.2	27.6	19.2	0.83
11[4]	7.4	1.3	1.3	0.01	40.4	26.5	18.8	0.95
13[3]	15.3	4.5	5.4	0.27	30.9	25.4	18.2	1.26
14[3]	14.2	4.2	5.2	0.26	34.2	25.5	18.6	1.31
39	7.6	1.1	1.3	0.03	49.3	**30.1**	24.4	1.50

1. These private properties are currently inside a zone of affectation or subject to a private land holders agreement with mines other than HVO.
2. These private properties are currently inside an HVO zone of affectation or subject to a private land holders agreement.
3. Additional Jerrys Plains assessment locations were added to ensure calculations are representative of the area.
4. Receptor 11 is owned by Wambo Mine.

Additional Notes:

Receptors 9 and 12 are owned by CNA. These receptors have therefore been omitted from the assessment

Receptor identification numbers are in accordance with the West Pit 2003 EIS.

USEPA 24 hour ambient air quality standard (99th percentile over 3 years).

Table 5.12 Summary of Affected Receptors for 2014

Receptor No.	Proposal in isolation				Proposal with other sources			
	PM_{10} 24 Hour µg/m³	PM_{10} Annual µg/m³	TSP Annual µg/m³	Deposition Annual g/m²/month	PM_{10} 24 Hour µg/m³	PM_{10} Annual µg/m³	TSP Annual µg/m³	Deposition Annual g/m²/month
Goal	**50**	**30**	**90**	**2**	**150[(a)]**	**30**	**90**	**4**
1	7.8	1.2	1.3	0.01	27.3	15.1	21.3	0.71
2	9.1	1.3	1.4	0.01	27.3	16.9	23.2	0.74
3	11.2	1.4	1.5	0.01	30.9	17.0	23.3	0.75
4	7.7	1.3	1.4	0.01	31.1	19.4	26.2	0.83
5	15.0	4.4	5.3	0.25	41.5	23.4	31.8	1.40
6	18.2	5.4	6.5	0.31	32.9	22.7	30.9	1.28
7[1]	32.6	11.2	13.7	0.72	46.8	25.9	34.5	1.44
8[1]	38.6	15.1	19.5	1.21	60.2	**35.6**	46.6	2.06
10[2]	20.3	3.0	3.2	0.03	43.0	27.5	34.3	0.88
11[4]	7.3	1.5	1.5	0.01	40.6	23.5	30.9	0.97
13[3]	15.9	4.6	5.6	0.26	38.7	23.4	31.7	1.37
14[3]	14.8	4.3	5.2	0.25	42.1	23.5	31.9	1.42
39	8.6	1.2	1.3	0.03	50.8	25.9	35.4	1.53

1. These private properties are currently inside a zone of affectation or subject to a private land holders agreement with mines other than HVO.
2. These private properties are currently inside an HVO zone of affectation or subject to a private land holders agreement.
3. Additional Jerrys Plains assessment locations were added to ensure calculations are representative of the area.
4. Receptor 11 is owned by Wambo Mine.

Additional Notes:

Receptors 9 and 12 are owned by CNA. These receptors have therefore been omitted from the assessment.

Receptor identification numbers are in accordance with the West Pit 2003 EIS.

USEPA 24 hour ambient air quality standard (99th percentile over 3 years)

5.5.3 Dust Modelling Results

Dust Assessment For HVO North Of The Hunter River

Modelling results outlined in *Table 5.10, Table 5.11* and *Table 5.12* demonstrate that dust emissions from the proposed extension alone will not exceed the criteria provided by the DEC (as shown in *Table 5.9*) at any of the surrounding receptors.

Cumulative Dust Assessment

An assessment of dust emissions from the proposed extension area together with the expected emissions from surrounding mines demonstrate that Receptor 39 will experience a minor exceedance (0.1 µg/m$^{3)}$ of the PM_{10} annual level in 2011, while Receptor 8 will experience an exceedance of this parameter in both 2011 and 2014. Only 1.1 µg/m^3 of the PM_{10} annual level in 2011 at Receptor 39 will result from mining in the Carrington extension area, therefore this was not considered further.

Receptor 8 is within an existing zone of affectation and has an agreement with CNA. It should also be noted that emissions from HVO north of the Hunter River make little contribution to the exceedances experienced at the surrounding residences.

5.5.4 Air Quality Management

The modelled results have been developed based on the assumption that the project applies control measures to minimise dust emissions. A number of dust control measures have been developed, and are already used during existing mining operations to ensure that dust emissions are kept to a minimum. Dust sources and the control techniques to reduce dust emissions (as outlined in CNA EMS Procedure 8 – Air Quality Management) are provided in *Table 5.13*.

Table 5.13 Air Quality Mitigation Measures

Source	Control Techniques
Areas disturbed by mining	Disturb only the minimum area necessary for mining. Reshape topsoil and rehabilitate completed overburden emplacement areas as soon as practicable after the completion of overburden tipping.
Blasting	Adequate stemming will be used at all times.
Coal handling areas	Maintain coal handling areas in a moist condition using water carts to minimise wind blown and traffic generated dust.
Drilling	Dust aprons will be lowered during drilling.
	Drills will be equipped with dust extraction cyclones, or water injection systems that will be used while drilling.
Haul road dust	All roads and trafficked areas will be watered using water carts to minimise the generation of dust.
	All haul roads will have edges clearly defined with marker posts or equivalent to control their locations, especially when crossing large overburden emplacement areas.
	Obsolete roads will be ripped and revegetated.
Minor roads	Development of minor roads will be limited and the locations of these will be clearly defined. Minor roads used regularly for access will be watered. Obsolete roads will be ripped and revegetated.
Topsoil stripping	Access tracks used for topsoil stripping equipment will be kept damp during use. Topsoil stripping to be avoided in extreme dry periods.

5.5.5 *Greenhouse Gas Emissions*

An assessment of Greenhouse Gas Emissions as a result of the proposed Carrington Extension has been undertaken and is included in *Annex F.*

Data was provided by CNA for HVO operations in 2004. This data showed that HVO used 57,015 kilolitres of diesel and 127,036 MWh of electrical energy to produce 17,200,000 tonne of ROM coal. The method used to estimate carbon dioxide emissions is provided in *Annex F.*

Table 5.14 summarises the estimated carbon dioxide emissions from the operation of HVO north of the Hunter River as well as the carbon dioxide emissions from the combustion of coal produced by the mine.

Table 5.14 Summary of Estimate Carbon Dioxide Emissions from Combustion of Coal from HVO North of the Hunter River

	Total ROM coal mined	Product coal	CO_2-e released when coal burnt	CO_2-e released during mining
Year	**t/y**	**t/y**	**t CO_2-e/y**	**t CO_2-e/y**
2006	18,796,223	13,157,356	34,866,995	1,099,785
2011	12,957,891	9,070,524	24,036,888	758,179
2014	15,997,171	11,198,020	29,674,752	936,010

5.5.6 *Conclusion*

It is concluded that Receptor 8 will be impacted by dust levels exceeding the NSW DEC assessment criteria when mining operations are considered cumulatively. This receptor is already within an existing zone of affectation or has already made agreements with CNA or with other mining companies. It is therefore considered that there will be no significant increase in air quality impacts due to the proposed Carrington extension. As such the proposed extension is substantially the same as the approved development.

5.6 *HISTORICAL ARCHAEOLOGY*

5.6.1 *Assessment Process*

Historical archaeology in the southern extension area was assessed by ERM. No assessment of the eastern extension area was undertaken as this area is a recently rehabilitated overburden dump. The report has been included as *Annex G* and was undertaken by reviewing relevant heritage registers, historical and parish maps and consultation with the Singleton Historical Society. A survey of the study area was also conducted. A previous heritage assessment undertaken by ERM Mitchell McCotter in 1999 assessed part of the present study area, no items of European heritage were found in that survey.

5.6.2 *Database Searches*

The heritage registers searched were:

- Australian Heritage Database;
- State Heritage Register and Inventory;
- Energy Australia Section 170 Register;
- Roads and Traffic Authority Section 170 Register;
- Singleton Local Environmental Plan;
- Hunter Regional Environmental Plan; and
- National Trust of Australia.

No heritage items or issues were raised in relation to the study area as a result of these searches.

5.6.3 *Historical And Parish Maps*

Historical maps and old parish maps provide little evidence suggesting heritage items may occur in the study area. The study area falls within lands that have, until recently, been divided into large farming lots. Parish maps indicate that the existing road that runs through the study area, referred to as Old Lemington Road, was built sometime between 1920 and 1935. This suggests that houses in the study area are no older than this time. An aerial photograph taken in 1958 confirms that many of the structures that are now in the study area were in place at the time.

5.6.4 *Historical Consultation*

Consultation with Ian Webb of the Singleton Historical Society and Museum indicated that the only known heritage item in or near the impact area is the Great North Road. Historical maps, including a map of the Great Northern Road provided to ERM by Mr Webb (dated 1883) indicates the Great North Road, or its proposed route known as the Mitchell Line, runs east of the study area.

5.6.5 Site Survey

A number of buildings and other structures were recorded within the study area; these include two farmhouses, a dairy parlour and a number of sheds and other structures associated with farming. None of these buildings have significant heritage value. The oldest of the structures appear to be the two farmhouses and dairy parlour, which probably date to about the mid 1900's. It is very unlikely that any occupation deposit (potential archaeological deposit) is associated with any of these buildings. No other area or structures that might contain historical archaeological deposit, such as wells or dumps, were found during the survey.

5.6.6 Conclusion

The results of the site survey, database searches, historical and parish maps, and historical consultations indicate that there will be no significant impacts to historical archaeology in the area as a result of the proposed Carrington Extension. As such the proposed extension is substantially the same as the approved development.

5.7 ABORIGINAL ARCHAEOLOGY

5.7.1 Assessment Process

An assessment of the impacts of the proposed extension on the Aboriginal heritage of the study area was conducted by ERM. No assessment of the eastern extension area was undertaken as it is a recently rehabilitated overburden dump. The full assessment is provided in *Annex G* and involved the following tasks:

- a review of background information;
- a survey to identify and record archaeological sites and areas of archaeological potential;
- an archaeological assessment of these sites and areas;
- consultation with the Aboriginal community to understand the Aboriginal significance of the study area, archaeological sites or areas of archaeological potential identified during the survey; and
- an assessment of the impacts of extending the mining area and the provision of management recommendations.

The Aboriginal consultation undertaken as part of this assessment is addressed in *Chapter 4* of this SEE.

5.7.2 *Survey Methods*

Four methods were used to undertake the archaeological survey of the study area: exposures, site definition, artefact identification (stone artefact and scarred tree) and site recording. A full description of the methods used is provided in *Annex G*.

5.7.3 *Results*

Ten previously unrecorded sites were found during the survey: seven artefact scatters (C1, C2, C6, C7, C8, C9 and C10) two isolated finds (C4 and C5) and one scarred tree (C3). Three sites, previously recorded by ERM Mitchell McCotter, were also found: CM1, CM2 and CM-CD1. Two previously recorded sites (CM45 and CM46) were not relocated. Details of the findings at each of the sites, as well as a site location map of the study area, can be found in *Annex G*.

A total of 78 artefacts were recorded during the survey. The type of artefacts found and the raw materials used for their production is summarised in *Table 5.15*.

Table 5.15 Artefacts Recorded During the Survey – Summary Data

	Raw Material			
Artefact type	Mudstone	Silcrete	Igneous	**Total**
Flakes[1]	39	22	1	62
Cores	7	4	0	11
Retouched flakes	5		0	5
Total[2]	51	26	1	78

1. Flakes includes complete flakes and broken flakes
2. A complete list of artefacts is provided in *Annex G*

5.7.4 *Significance Assessment*

Cultural significance is a concept that rests on the perception of the community (Pearson and Sullivan 1994:21). The Burra Charter (Australia ICOMOS Burra Charter 1999) defines cultural significance as aesthetic, historic, scientific or social value for past, present or future generations. These aspects of significance may overlap and assessment can be a complex process. The cultural significance of most Aboriginal objects and sites is largely determined by their social value, assessed by the Aboriginal community, and their scientific value, assessed by archaeologists.

The identification of levels of significance for Aboriginal sites and relics is somewhat subjective and no precise guidelines for scaling are provided under the relevant legislation or under the Burra Charter. However, the terms low, moderate and high significance provide a basis for management recommendations.

- sites that are assessed to be of high significance should be conserved. These sites warrant protection against development;

- sites that are assessed to be of moderate significance should be conserved if possible. In the event that these may be affected by development some management strategies should be implemented to mitigate against the impact; and

- sites that are assessed to be of low significance should be conserved if possible, but should not represent an obstacle to development.

Social (Aboriginal) Significance

At the time of the fieldwork, no specific issues were raised by the Aboriginal people concerning any area of Aboriginal significance. No particular area of high cultural value was identified in or near the study area. The Aboriginal significance of the study area is therefore to a large part predicated by the presence of stone artefacts and the expected presence of other material not found during the survey. The Aboriginal people consider areas close to creek lines to have high potential to contain sub-surface artefacts, but also consider all areas to have some potential and therefore are of cultural value.

A number of the Aboriginal people expressed interest in the scarred tree (site C3) found in the north east of the study area. The tree's cultural significance was confirmed by Barbara Foot (a senior representative of the local Aboriginal community). Scarred trees are generally considered to have considerable cultural value, perhaps because of their links to the recent past, or are more easily interpreted than stone artefacts, which may require skills in artefact identification and analysis before interpretations are forthcoming.

Another important consideration in the assessment of Aboriginal significance is an understanding of the cultural landscape. The study area should be considered a part of, or intrinsically linked to, a cultural landscape. This has significance separate from any particular site or artefact that has been or may be recorded. The low ridge that runs through the study area is a prominent feature in the landscape and may have been important as a cultural landmark, as a vantage point to view the surrounding landscape and the animals (resources) and people within it, and perhaps other cultural reasons outside of any prehistoric economic system that might be proposed by an archaeologist.

Scientific (Archaeological) Significance

The scientific significance of an Aboriginal site, object or place essentially refers to its potential to address research questions and provide additional information that will add to an understanding of past Aboriginal occupation (Australia ICOMOS Incorporated 2000:12). There are a number of criteria that need to be considered to determine the scientific significance of an Aboriginal site, place or object. These include rarity and representativeness, integrity and connectedness and how each of these contributes to research potential. An assessment of these aspects is provided in *Annex G.*

The archaeological significance of each of the fifteen sites identified in the study area is summarised in *Table 5.16* below.

Table 5.16 Archaeological Significance of Sites in the Study Area

Landform	Site	Significance	Comment
Creek lines	CM1	Low to moderate	The site has research potential due to its association with sites CM2 and CM-CD1 and its potential to contain subsurface cultural material associated with the minor creek line.
	C4, C5	Low	While these sites have some potential to contain subsurface cultural material, similar sites are common in the local area and region.
	CM-CD1	High	This site has the potential to address archaeological questions concerning Aboriginal occupation during the early Holocene and late Pleistocene.
Low Ridge	C1, C2, C6, C7, C8, C9 and C10	Low to moderate	These sites have the potential to address questions concerning Aboriginal settlement systems and particularly the importance of the low ridge as a focus of occupation and/or a source of raw material in the local area.
	Remaining part of CM2	Moderate	While much of this site has been destroyed by mining it retains potential to address questions concerning Aboriginal settlement systems and mobility and particularly the importance of the Tertiary terraces of the Hunter as a raw material source for Aboriginal stone tools. Its association with site CM-CD1 also confers some archaeological value. Most of what remains of this site lies outside the study area. The portion of the site within the study area (in isolation) has limited potential to address any of the above research questions.
Alluvial Flats	CM45, CM46	Low	Similar sites are likely to occur in the local area and region. In isolation these sites have limited potential to address research questions.
	C3	Low	While similar sites are not common in the local area or region scarred trees have limited potential to address research questions.

5.7.5 *Impact Assessment*

The Carrington Extension will impact the known and potential archaeological resource. Eleven sites will be directly impacted by the extension: C1, C2, C3, C4, C8, C9, C10, part of CM2, CM45 and CM46. Recommendations for the management of these sites are provided in *Table 5.17* and *Table 5.18* below. In addition, ongoing implementation of CNA EMS Procedure 2.1 – Cultural Heritage, will be undertaken during proposed works.

If further mining development is required, the destruction of any of the sites to be retained at this time will be requested from the relevant government authorities and in consultation with the Aboriginal groups.

Table 5.17 Recommendations for Sites Identified during Survey

Site	Archaeologist Recommendations	Further works required	Section 90
C1, C2, C8, C9 and C10	Sites be destroyed after further archaeological investigation	Further archaeological salvage work will be undertaken on the low ridge involving further recording of archaeological material on the ridge through excavation and collection of artefacts to clarify the nature and extent of archaeological material across the ridge. This work may or may not involve salvage at the specific sites.	Required
C3	Scarred tree be removed and relocated to a location where it will be protected from further development	The methods used to remove the tree, the precise area or place where the tree should be relocated and the way it should be housed should all be determined in consultation with the Aboriginal community. The work should be carried out under a section 90 application obtained from the DEC.	Required
C4	Site be destroyed	No further archaeological investigation is required.	Required

Table 5.18 Recommendations for Previously Identified Sites Located in the Study Area

Site	Archaeologist Recommendation	Further works required	Section 90
CM-CD1	Protect site against impact of development	Protection of buffer zone around this fence ideally to include CM1 and part of CM2 and consultation with local Aboriginal groups to develop management strategies. The size of the buffer zone will be dependent on the depth of the mine pit and will be sufficient to protect the site from structural failure of the underlying sediments, erosion that may occur during the life of the mine (ie prior to rehabilitation) and inadvertent damage that could be caused by mine personnel and machinery.	Not required
CM1	Site be protected against the impact of development	Erection of a permanent fence around the site and consultation with local Aboriginal groups to develop management strategies	Not required
CM2	That the part of CM2 within the buffer zone of CM-CD1 be protected against the impact of development and destruction of the part of CM2 within the study area.	Erection of a permanent fence around the site and consultation with local Aboriginal groups to develop management strategies. No further archaeological investigation required for the section of CM2 within the study area.	Required for part of CM2 within the study area
CM45 and CM46	Sites to be destroyed	No further work required.	Required

5.7.6 Conclusion

The extension of the Carrington Pit will have some impact on the Aboriginal and social value of the study area. In addition to the potential impact to sites and stone artefacts, the extension of the pit and the construction of levees will also impact the cultural landscape. It should also be noted that the West Pit consent included consent to destroy some of the sites previously identified (*Table 5.18*). The landscape has therefore, to some extent, already been compromised by over 100 years of farming and, more recently, by open cut coal mines in the vicinity, however the area is quite large and contains cultural value.

There is some potential for the mine extension to impact archaeological material that was not detected during the survey. The destruction of this area adds to the cumulative impact on archaeological, and more generally, cultural resources within the Central Lowlands. The proposed extension of the Carrington Pit has incorporated some flexibility to protect CM-CD1, a site that is considered to have a high significance.

5.8 ECOLOGY

5.8.1 Assessment Process

An assessment of the ecology of the area was undertaken by ERM and included a desk top review and field survey. The full assessment is provided in *Annex H.* This section describes the study area and the existing vegetation and summarises the techniques used to assess the ecology within the study area, the likely impacts of the proposal and any mitigation measures required to address these impacts.

Study Area

The study area covered the southern extension area and areas to the south extending to the Hunter River. As such the study area was divided into two areas: those which will be disturbed, including the southern extension area and the services corridor, and areas which will not be disturbed directly by mining and are directly adjacent to the disturbed areas including the billabong area, the southern cleared area and the riparian zone.

The study area has been highly modified through clearing and farming activities and is predominantly pasture. Remnant native trees remain in two areas and drainage lines within the study area are dominated by exotic groundcover species and are highly eroded. Riparian vegetation along the Hunter River in the south of the study area is dominated by exotic ground, shrub and canopy species.

Assessment Methodology

Prior to a field investigation, background literature reviews and database searches were undertaken to obtain records of threatened flora and fauna species and vegetation communities previously recorded within the locality (within a 10 km radius of the study area) and listed under the NSW *Threatened Species Conservation Act 1995* (*TSC Act*) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*). Sources of information are provided in *Annex H*.

A field investigation of the flora and fauna of the study area was undertaken by three ecologists between 18 and 20 October 2004. Survey methods included:

- meandering surveys to record vegetation;
- recording opportunistic sightings of fauna;
- bird surveys;

- collecting scat and hair samples for identification by Barbara Triggs of Dead Finish;
- frog call playback for the Green and Golden Bell Frog (*Litoria aurea*);
- the use of Anabat detectors at the billabong and along the Hunter River and analysis of tapes by Glenn Hoye of Fly By Night Bat Surveys;
- habitat assessment including the presence of nesting/shelter sites, cover and abundance of ground, shrub and canopy layers, presence of free water or water bodies and rock and basking sites for reptiles; and
- survey of hollow-bearing trees within the woodland surrounding the billabong.

5.8.2 Results

Flora

The flora in the extension area was dominated by exotic pasture species with a small stand of remnant native trees (approximately 20 in total) present within the proposed services corridor adjacent to the Carrington Pit. Tree species in this area included Grey Box (*Eucalyptus moluccana*) and Narrow-leaved Ironbarks (*Eucalyptus crebra).* The area was extremely dry and dominated by exotic species.

Flora immediately outside of the extension area was dominated by exotic pasture species. Drainage lines within this area connected to the billabong to the east and the Hunter River to the south and were highly eroded and impacted by rubbish dumping. Vegetation along the riparian zone of the Hunter River was dominated by exotic canopy and understorey species including Willow (*Salix* sp.), Caster Oil Plant (*Ricinus communis*), Tree Tobacco (*Nicotiana glauca*), Pepper Tree (*Schinus areira*) and White Mulberry (*Morus alba*). A full list of species recorded during the survey is provided in *Annex H.*

A stand of mature River Red Gum (*Eucalyptus camaldulensis*) trees was identified adjacent to the billabong and along the associated drainage line to the north of the billabong. This area has been mapped by the Hunter Catchment Management Trust (HCMT) (2005) as River Red Gum Woodland, having evidence of dieback or waterlogging and has been listed in the Hunter Catchment as an endangered population in Part 2 (f) Schedule 1 of the *TSC Act*. Potential impacts to the River Red Gums from extension of the Carrington Pit have been assessed under Section 5a of the *EP&A Act* (Eight-part Test), provided as *Appendix B of Annex H.* Dominant ground cover species in the vicinity of the billabong were a mixture of both exotics and natives.

No threatened flora has been previously recorded within the locality and none was recorded in the study area during the field investigation. Given the modified nature of the study area, it is unlikely that any would occur. In addition, no floral assemblages diagnostic of any endangered ecological community were identified during the field investigation of the study area.

Fauna

The majority of the extension area provides limited resources for native fauna. Species observed within the extension area during the field investigation included an Australian Kestrel (*Falco cenchroides*) and Eastern Grey Kangaroos (*Macropus giganteus*). The stand of scattered trees within the proposed services corridor, some of which were hollow-bearing, provides potential habitat for bird and bat species. However, the lack of native shrubs or ground cover in this area makes it unsuitable habitat for native ground-dwelling fauna, and the scattered and isolated nature of the trees makes it unlikely that arboreal mammals would be present. The list of fauna species recorded within the study area during the investigation is provided in *Annex H.*

Fauna species were found to be concentrated around the billabong area, with a number of hollow-dependent bird and bat species, as well as the Brushtail Possum (*Trichosurus* sp.), being recorded in this area.

Three species of bat, including the Eastern Freetail Bat (*Mormopterus norfolkensis*), which is listed as Vulnerable on Schedule 2 of the *TSC Act* and is known to use hollow-bearing trees, were identified from Anabat tape analysis. The other bat species recorded in the study area were the Eastern Horseshoe Bat (*Rhinolophus megaphyllus*) and the Little Forest Bat (*Vespadeuls vulturnus*).

The riparian zone provides resources for birds including seasonal migrants such as the Channel-billed Cuckoo (*Scythrops novaehollandiae*) and the insectivorous Dollarbird (*Eurystomus orientalis*). A tortoise shell (empty) was recorded along the bank of the river. The list of fauna species identified throughout the survey is provided in *Annex H*.

Threatened fauna species have previously been recorded within the locality and are listed in *Annex H*. However, given the disturbed nature of the proposed extension area, and based on the habitat preferences and requirements of these species, it is considered unlikely they would utilise the extension areas for foraging or shelter.

5.8.3 Impact Assessment

Direct Impacts

Direct impacts of the proposal on flora and fauna of the study area include native vegetation clearance and habitat loss. The proposed Carrington extension will involve the clearing of exotic pasture with the exception of a small stand of native trees in the proposed services corridor. Approximately 20 trees may require removal from this area. During the investigation it was estimated that approximately six trees in this area contained small hollows. The possible identification of the Eastern Freetail Bat within the billabong area increases the chance that this species utilises the trees within the proposed services corridor, and may be impacted by the proposed extension. An assessment of the impacts of removal of this potential habitat on the Eastern Freetail Bat is provided in an Eight-part Test, *Appendix B* of *Annex H.* Fragmentation and connectivity of vegetation within the extension area and locality is not expected to change as a result of the proposal.

Indirect Impacts

The proposed Carrington Extension is not expected to further impact on the source of groundwater for the River Red Gums in the billabong area, as dewatering from the existing Carrington Pit has already reduced groundwater levels to near the lowest possible level in this area as described in *Annex D*. In addition, the introduction of a barrier wall along the southern boundary of the southern extension area will assist in recharging the groundwater in this area.

Other potential indirect impacts to habitats surrounding the proposed extension area include:

- potential sedimentation effects in areas downstream of constructed levee banks, in particular the billabong area and associated drainage line;
- potential for inadvertent damage to the River Red Gums from mine personnel and machinery;
- changes to surface flows within the study area due to construction of levee banks leading to a reduction of inundation at the billabong which may impact the River Red Gums;
- reduction in availability of fauna habitat such as hollow-bearing trees as a result of adverse impacts on the stand of River Red Gums;
- potential spread of weed species from movement of soil into the billabong area; and
- changes to water quality in the billabong and drainage lines downstream of extension areas.

These potential impacts can be reduced through the implementation of mitigation measures provided in *Section 5.8.6* below. An assessment of the potential impacts of the proposal on the River Red Gums at the study area is provided in an Eight-part Test (*Appendix C* of *Annex H)*.

5.8.4 Assessment Under Section 5a Of The EP&A Act

An Eight-part Test was conducted for one threatened species, the Eastern Freetail Bat, which was tentatively identified within the billabong area and one endangered population, '*E. camaldulensis* in the Hunter Catchment'. The results of these assessments concluded that impacts from the proposal were unlikely to be significant and a Species Impact Statement (SIS) is not required.

Given that the extension area is highly modified and is unlikely to provide potential habitat for any of the other threatened species previously recorded within the locality (*Annex H*), no significant impacts from the proposed extension are anticipated and Eight-part Tests are not required for these species.

5.8.5 Assessment Under The EPBC Act

The Australian Kestrel is listed as a migratory species under the *EPBC Act* and was recorded during the field investigation. Although listed as migratory, the species does not migrate and is not migratory as defined in the Bonn Convention, on which the *EPBC Act* is based. In addition, it is unlikely that the removal of exotic pasture and the small stand of trees in the proposed services corridor will have a significant impact on this species. Furthermore, pasture areas will remain to the south and west of the proposed extension area and woodland will be conserved in the southeast of the study area. It is therefore not considered necessary to prepare a referral to the Department of Environment and Heritage for this species.

5.8.6 Ecological Management Measures

Given that the proposed mine extension is located adjacent to drainage lines and a remnant stand of River Red Gums that have been listed as an endangered population and, further, provide habitat for a threatened bat species, a number of measures have been recommended to mitigate potential impacts of the proposal:

- ongoing implementation of CNA EMS Procedure 10.2 – Flora and Fauna;
- grazing cattle will be removed from the billabong area to enable recruitment of the River Red Gums and to reduce stresses on this area;
- no River Red Gums will be removed from the billabong area;

- buffer areas (areas in which no construction, vehicle or personnel movements or mining activities are undertaken) will be defined around the stand of River Red Gums surrounding the billabong to prevent compaction of soil and edge effects. It is recommended the buffer be at least 20 m in width;

- fencing will be constructed on the development side of the buffer around the River Red Gums to prevent access by mining personnel and vehicles;

- construction of levees will take into consideration the indirect impacts on surface water flows, particularly close to the billabong area;

- appropriate erosion and sediment controls will be implemented across the study area prior to commencement of any construction activities to prevent potential impacts on the Hunter River, the billabong and drainage lines within the study area;

- pre-clearance surveys in accordance with CNA procedures will be undertaken for all trees to be removed from the services corridor; and

- any soil removed for the proposed mine construction or associated activities will not be dumped on, or directly adjacent to, conserved areas, buffer areas or any watercourses or waterbodies where there is potential for weed seeds to be spread during rainfall events.

- development and implementation of a monitoring program to assess groundwater conditions and the health of the stand of River Red Gums in the billabong area; and

- if monitoring identifies groundwater changes which impact on the trees as a result of mining activities, surface water management will be developed to redirect surface water to the billabong to simulate a flooding event as in an ephemeral drain.

5.8.7 Conclusion

It is considered that with the specific mitigation and management measures to be implemented at the study area, significant impacts to the endangered population of River Red Gums will be avoided. Protecting this area of vegetation will also protect habitat for native fauna, including the threatened Eastern Freetail Bat. The extension of the Carrington Pit into other areas is not considered to be of significance to the other native flora and fauna species that may utilise the study area. As such the proposed extension is substantially the same as the approved development.

5.9 VISUAL AMENITY

5.9.1 Assessment Process

The visual amenity assessment was undertaken by ERM and has been based on an analysis of the following factors:

- visual absorption capacity – a factor of site visibility and the degree of contrast between the proposal and the local and regional visual landscape;
- visual sensitivity – a measure of the level of concern attached by a user group to a change in the landscape character. Visual sensitivity is based on the number of people affected, land use and distance of the viewer from the proposal; and
- the nature and extent of rehabilitation and landscape mitigation measures.

Study Methodology

The tasks involved in undertaking the assessment are summarised below:

- a review of the local landscape setting;
- identification and description of significant viewer locations;
- an assessment of the visibility of the proposal from each significant viewer location;
- determination of the absorption capacity of the proposal, based on visibility from each significant viewer location in the context of the local and regional setting;
- assessment of the visual sensitivity from each significant viewer location;
- determination of the likely visual impacts of the proposal, based upon an analysis of the visual absorption capacity and visual sensitivity of each significant viewer location; and
- formulation of mitigation measures.

5.9.2 *Existing Environment*

Regional Context

Defining landscape features located within the region surrounding Carrington Pit include:

- steep sloping ridges along the escarpment boundaries;
- undulating hills; and
- alluvial flats on the floodplain of the Hunter River.

Large areas of the surrounding landscape have been cleared for agricultural purposes, primarily for dairy and cattle farming. In addition, active mining areas and supporting industrial infrastructure are common landscape features.

Local Setting

Carrington Pit is located on relatively flat land located to the north of the Hunter River. The footprint of the pit will be extended toward the Hunter River and east toward the existing mining areas.

The mine is bordered by:

- West Pit to the north and vegetated ridges to the north east;
- cleared agricultural land to the east and the Alluvial Lands dumps to the south east;
- agricultural land and the Hunter River and Riverview and Cheshunt Pits to the south; and
- partially vegetated ridges and slopes to the west.

5.9.3 *Viewer Locations*

The visibility of the proposed Carrington Extension is dependant upon the surrounding topography and the elevation of viewer locations. There are limited viewing opportunities of the proposed extension area due to the undulating nature of the surrounding landscape. Potential viewers of the proposed extension include an adjacent landowner and road users. One viewer location was assessed as well as the likely views afforded to users of a short section of Lemington Road and Jerrys Plain Road. Viewer location 1 corresponds to Receptor 10 on *Figure 5.3* which also shows the location of Lemington Road and Jerrys Plains Road.

A summary of the visual amenity impacts of the proposed extension is provided below.

5.9.4 Impact Assessment

The visual impact assessment is based on the visual absorption capacity and visual sensitivity of viewer location 1 and users of Lemington and Jerrys Plains Road. Visual absorption capacity and visual sensitivity are defined below and *Table 5.19* provides the assessment of these criteria.

Visual Absorption Capacity

The visual absorption capacity of the development can be expressed as the level of visual contrast (i.e. form, shape, pattern, line, texture and colour) of the proposed development to the visual setting within which it is placed.

A high visual absorption capacity will occur if there is minimal contrast and a high level of integration between the proposal and the existing landscape setting. Conversely, a low visual absorption capacity will occur when the proposal has a high visual contrast to the surrounding landscape and there is little or no visual screening, resulting in a more extensive visual impact.

Visual Sensitivity

Visual sensitivity is a measure of the level of concern attached by surrounding land users to a change in the existing landscape. It is based largely upon visibility and distance from critical viewing areas, but is also influenced by land use, the current degree of exposure to the style of development proposed and the length of viewing time.

Lighting Impacts

Large spot lights will be directed into active mine areas during night works. Illumination from these lights may be viewed during some stages of works. Due to the undulating topography and the distances separating viewer location 1 and the mine extension area and the temporary nature of the illumination, the visual impacts from the lights are predicted to be minor. As described in *Chapter 2*, rehabilitation of the Carrington Pit will be progressive. Mining will cease in the areas closest to viewer location 1 between 2009 and 2010, followed by rehabilitation returning the visual landscape to an agricultural and vegetative setting in accordance with the MCP.

Table 5.19 Summary of Visual Absorption Capacity and Sensitivity

Location	Setting	Visual Absorption Capacity	Visual Sensitivity
Viewer Location 1 (Property 10 on *Figure 5.3*).	Located on ridge line south west of Carrington Pit. Distant views to Carrington Pit and North Pit. Immediate views of agricultural land, scattered trees transmission lines, riparian vegetation along Hunter River to the east and south.	High to moderate – as proposed extension will be in keeping with existing mining landscape. Impacts are expected to be short lived as rehabilitation will be progressive.	Low as the proposed extension will be in keeping with the existing mining landscape which is dominated by mines to the north east, east and south east. The immediate views of agricultural properties will not be impacted by the proposal.
Road Users on southern section of Lemington Road and Jerrys Plains road near Moses Crossing.	Views of existing Carrington Pit and cleared agricultural land with scattered trees.	High to moderate – as proposed extension will be in keeping with existing mining landscape and traffic volumes are low.	Low as the proposed extension will be in keeping with the existing landscape and users of Lemington Road are generally local residents and mine workers. Lemington road is not considered to be a "tourist drive."

5.9.5 Conclusion

Of the surrounding privately owned properties, viewer location 1 has been identified as having views of the proposed extension. Other viewers include users of the southern section of Lemington Road.

Mines are a common landscape feature in the area surrounding the proposed extension. Other dominant features include large expanses of agricultural land. The visual sensitivity of the landscape is therefore considered to be low and absorption capacity high to moderate with any impacts being short term due to ongoing rehabilitation within the pit.

The potential visual impacts associated with the proposed extension area will be short in duration, with mining expected to be completed by 2014 followed by rehabilitation. Existing vegetation, mining extension area orientation and the surrounding undulating landscape, reduces the potential number of visual receptors. In addition, the landscape is considered to have low visual sensitivity and high to moderate visual absorption capacity and all works will continue to be undertaken in accordance with CNA EMS Procedure 10.1 – Visual Management, therefore the proposal will not significantly impact the regional or local visual environment and the proposal is substantially the same as the approved development.

5.10 SOILS AND LAND CAPABILITY

5.10.1 Assessment Process

Soils and land capability for the southern extension area were assessed by Global Soil Systems Environmental (GSSE). The eastern extension area is a rehabilitated overburden dump and has not been further assessed. The full report, including the extent of the study area assessed by GSSE has been included in *Annex I*.

Soil Type

The soil types within the southern extension area were classified in accordance with the Northcote (1992) system. Three soil units were found:

- Red Brown Earths;
- Brown Clay; and
- Black Earth.

The Red Brown Earth occurs on the western ridge and upper to midslope areas. It covers approximately 28% of the total study area and is characterised by a dark brown hardsetting sandy loam surface horizon eventually grading to a reddish brown massive medium clay subsoil.

The Brown Clay occurs within the central drainage depression and footslope area. The soil unit encompasses approximately 29% of the study area. A yellowish brown medium clay surface horizon grades to a brown sticky silty clay and eventually to a yellowish brown plastic heavy clay.

The Black Earth is located on the alluvial flats adjoining the Hunter River and encompasses some 43% of the study area. The soil is characterised by a self mulching, dark brown silty clay loam surface horizon grading to a strong structured brown black silty clay loam and eventually to a deep brown sticky silty clay.

An assessment of the suitability of these soils for top dressing is provided in *Annex I.*

Land Capability

The land capability classes within the southern extension area are Classes II, IV, VIII and M. These land capability classes are described below.

- *Class II – Land Suitable for Regular Cultivation*

Land of moderate soil erosion hazard, where simple soil conservation practices are necessary, including contour cultivation, crop rotation and good soil management. Usually gently sloping land suitable for a wide variety of agricultural uses.

- *Class IV- Land Suitable for Grazing with Occasional Cultivation*

Class IV comprises the better classes of grazing land. Whilst this land could be used to cultivate an occasional crop, it is not suitable for cultivation on a regular basis owing to limitations of slope and erosion potential.

- *Class VIII – Land not suitable for Rural Production*

Class VIII is land unsuitable for agricultural or pastoral production because of severe physical limitations to the land. These may include cliffs, lakes, swamps and other land unusable for agricultural or grazing purposes.

- *Class M - Other*

Mining and quarrying areas, therefore, no soil conservation practices are in place.

5.10.2 Impact Assessment

The majority of the study area for the soil assessment was characterised by Class IV which takes up about 60% of the area. A large section of the alluvial land adjacent to the Hunter River is Class II land, covering approximately 37% of the study area. The other two land capability classes, VIII and M represent a swampy area in the south east and a small overburden stockpile in the north east corner, respectively. As a result, the majority of the land is not suitable for "prime agricultural land".

The proposed extension will impact on 3.8 ha of Class II lands, a small section of this area will be mined through and the balance will be covered by the South Levee. It is proposed that the Class II land will be rehabilitated in accordance with methods undertaken for the HVO alluvial lands. As part of the rehabilitation process the linkage between rehabilitated and undisturbed Class II land will be optimised.

5.11 TRAFFIC AND TRANSPORT

The proposed Carrington Extension will have no impact on traffic and transport as all coal will be transported on internal haul roads in accordance with the *West Pit Extension and Minor Modifications EIS* (ERM, 2003). In addition, there is unlikely to be any change in the number of employees and no change in the total tonnage of coal produced in any one year as a result of the proposed extension.

5.12 SOCIO-ECONOMIC ASSESSMENT

5.12.1 Assessment Process

The potential socio-economic impacts associated with the proposed Carrington extension have been assessed by addressing the issues raised by the community during the community consultation programme and predicting the social and economic impacts based on the assessments of impacts to amenity including air quality, noise and visual amenity. Economic impacts associated with employment and additional capital expenditure as a result of the proposed extension have not been considered as there will be no change in the number of employees, no additional equipment requirements and no increase in the life of the mine.

It should be noted however, that this proposal will result in HVO having access to an additional 18.6 Mt of ROM coal (approximately 13.5 Mt of product coal). This resource will further enhance the economic viability of HVO and provide royalties to the NSW Government.

Methodology

This socio-economic assessment has been based on desktop review of publicly available information and previous assessments produced for the *West Pit and Minor Modifications EIS* (ERM, 2003). It focuses on impacts to surrounding private residences.

A community consultation programme was undertaken throughout the preparation of this SEE. The community issues raised during the consultation have been taken into consideration in this section where appropriate and are outlined in *Table 4.5*.

Previous Socio-Economic Assessments

The socio-economic issues discussed in the *West Pit and Minor Modifications EIS* (ERM, 2003) related to local and regional economic development, and employment access and opportunities, both during construction and operation, as well as demographic changes, housing and accommodation, community structures and community facilities and services.

The EIS concluded that the modifications proposed to the operations within HVO north of the Hunter River would provide benefits to the area by ensuring on going employment across HVO, significant flow on effects into the regional, state and national economy and the provision of $54.75 million in royalties. In addition, CNA has demonstrated that it is socially responsible through involvement in the Community Consultative Committee, community and family open days, meetings with residents and school site tours.

5.12.2 Impact Assessment

Factors that have the potential to impact the surrounding property owners have been assessed in *Sections 5.2*, *5.3* and *5.8* and include groundwater, noise, dust and visual impacts. These factors are summarised in *Table 5.20*. Other socio-economic impacts which may impact on the wider community include employment and local economic impacts.

Table 5.20 Summary of Potential Socio-economic Impacts

Environmental Factor	Potential Issue	Mitigation Measures	Result
Noise	No change to predicted noise levels from West Pit EIS.	Continue management and monitoring as outlined in CNA EMS Procedure 9.1 – Noise and CNA EMS Procedure 9.2 – Blasting.	No additional impact on surrounding residences
Air Quality	Exceedance of PM_{10} annual for Receptors 8 and 39 for 2011 and Receptor 8 alone for 2014 when considered cumulatively.	Continue management and monitoring as outlined in CNA EMS Procedure 8 – Air Quality Management.	No additional impact on surrounding Receptor 8 as it is in the zone of affectation and HVO north of the Hunter River has negligible impact on cumulative results.
Visual	Potential views of mining for road users and Viewer Location 1.	Progressive rehabilitation.	Limited visual impact as area is already dominated by mining and cleared land currently used for agriculture.
Archaeology	Mining will destroy all Aboriginal objects and sites and the cultural landscape in which they occur in the proposed extension area.	CM-CD1, CM1 and part of CM 2 will be protected by a change in the mining plan.	Archaeological sites will be destroyed – however loss will be mitigated by protection of CM-CD1, CM1 and part of CM2.

Environmental Factor	Potential Issue	Mitigation Measures	Result
		If further destruction is required, approval will be sought from the relevant government authorities.	
Groundwater	Potential dewatering impacts within the alluvial aquifer, with potential associated impacts to environmental flows in the adjacent Hunter River, and depressurisation of the coal measures and potential and changes to groundwater hydrochemistry resulting from depressurisation of the saline coal seam aquifers.	Continued monitoring as outlined in CNA EMS Procedure 1.10 - Monitoring and Measurement.	Existing and additional proposed monitoring procedures will provide a process for identification of potential impacts to the groundwater system underlying the Carrington Pit. If indicated as necessary by modelling results, conceptual options presented for a barrier wall, will be detailed further and constructed as necessary.

Employment And Local Economic Impacts

The proposed extension will involve the extension of an existing mine, no additional employees or equipment are needed to meet the requirements of the proposed extension.

There is unlikely to be any impact on employee numbers or planned mine life. It is not anticipated that there will be any changes to the local economy as a direct result of the extension, other than those already recognised in previous assessments (ERM, 2003). However, the extension will result in the payment of royalties to the NSW Government.

5.12.3 Conclusion

The Carrington Extension will not significantly impact on the amenity of the surrounding area, as dust, noise and visual impacts are not expected to change significantly from that already approved. No significant off site economic impacts are expected as a result of the proposed extension as there are no anticipated changes required for equipment, employees or life of the HVO north of the Hunter River as whole.

As a result, it is not expected that there will be any significant changes to the socio-economic assessment and conclusions presented in the *HVO West Pit and Minor Modifications EIS* (ERM, 2003).

Accessing this resource will, however, further enhance the economic viability of HVO by allowing access to 18.6 Mt of ROM coal (or 13.5 Mt of product coal) over the life of the extension. The mining of this coal resource will result in substantial royalties being paid to the NSW Government.

6 ENVIRONMENTAL MANAGEMENT AND MONITORING

6.1 INTRODUCTION

CNA have developed an EMS that is certified in accordance with ISO14001. The EMS covers CNA corporate and Hunter Valley mine sites, including HVO. It is designed so that CNA can:

- efficiently manage its environmental issues;
- ensure compliance with regulatory requirements;
- continually improve its environmental performance; and
- satisfy the expectations of stakeholders and the local community.

The EMS uses environmental policy to feed into planning which in turn feeds into implementation and operation, then measurement and evaluation and finally review and improvement. These then feed back into the environmental policy and each relates back to the ISO 14001 standard. *Table 6.1* lists the procedures that have been developed as part of the CNA EMS. These procedures provide the minimum requirements for all CNA activities.

Table 6.1 CNA EMS Procedures

No.	Procedure Name
1	Environmental Management System
2	Environmental Social & Cultural Impact Management
3	Property Transaction
4	Closure Planning
5	Rehabilitation
6	Waste Management
7	Water Management
8	Air Quality Management
9	Noise
10	Land Management
11	Currently being developed
12	Acid Mine Drainage
13	Site Contamination Prevention and Control

Source: CNA 2005

The mitigation measures developed throughout this SEE will form part of the EMS. These mitigation measures are listed below in *Table 6.2* as a set of commitments to manage the identified impacts.

Table 6.2 Commitments

Impact	Commitment
Surface Water	• Ongoing implementation of CNA EMS Procedures 7 – Water Management, HVO North Site Water Management Plan and CNA Erosion and Sediment Control Plan; • Dam 9N (refer to Figures 22 and 23 in *Annex D*) will be relocated to the south-east of its current position and continue to receive pit water; • Sedimentation Dam 12N will be destroyed; • Sedimentation Dam 13N will be enlarged following closure; • A number of additional temporary sedimentation dams will be constructed to manage runoff from the final landform; • Runoff from surrounding undisturbed catchments will continue to be diverted to minimise contributions to the mine water system; • Continue to capture and treat all runoff from disturbed areas; • Ensure that new banks, channels and similar works are constructed to convey runoff from areas above the dams and ensure they do not cause damage to, or interfere with the stability or water quality of existing water courses; • Monitoring of water quality parameters pH, EC and NFR at Dam 12N at monthly intervals during periods of sustained runoff; • Compare measurements to measured water quality in the water course below the Dam 12N; • Future dams will be designed with criteria considered appropriate to local conditions and micro climate influences; • Monitoring procedures as outlined in CNA EMS Procedure 1.10 – Monitoring and Measurement, will be continued and will include fortnightly measurement of the volume of water pumped from the mine pit(s) and monthly monitoring of mine pit(s) water quality by measurement of pH and EC in the receiving dam(s).
Groundwater	• Ongoing implementation of CNA EMS Procedure 7 – Water Management and HVO North Site Water Management Plan. Groundwater quality monitoring, as outlined in CNA EMS Procedure 1.10 - Monitoring and Measurement, should be continued and include: • Bi-monthly monitoring of basic water quality parameters (pH and EC) in nominated existing piezometers; • Six-monthly measurement of TDS and major ion speciation of water samples from nominated existing piezometers; • Graphical plotting of data and identification of trend lines and statistics including mean and standard deviation calculated quarterly; and • Comparison of trends with rainfall and any other identifiable processes that may influence such trends. Additional monitoring procedures will include: • Bi-monthly monitoring of water levels in all existing piezometers installed in the alluvium and in the underlying coal measures; and • Semi-continuous (data logger) monitoring at selected piezometers in order to measure impacts of rainfall recharge and percolation. Ongoing impact analyses will include: • Modification to monitoring programmes will occur as required to ensure appropriate data is collected;

Impact	Commitment
	• Installation of additional monitoring bores if required; • Formal review of depressurisation and comparison of responses with aquifer model predictions annually; • Expert review will be undertaken by a suitably qualified hydrogeologist if measured pit seepage and depressurisation exceeds predicted seepage and depressurisation; and • Annual reporting (including all water level and water quality data) to DoP in an agreed format. If indicated as necessary by modelling results, conceptual options presented for a barrier wall, will be detailed further and constructed as necessary. The trigger for installation of the barrier wall would be a reversal of hydraulic to the river from currently southward to northward. If the barrier wall is installed, monitoring of the performance of the barrier will be detailed in the HVO North Site Water Management Plan.
Noise and Vibration	• Ongoing implementation of CNA EMS Procedure 9 – Noise; • Ongoing noise monitoring which currently includes directional noise monitoring; • Management of equipment to be used in the pit at night during winter months or adverse weather conditions; and • Blast design to incorporate control on the maximum instantaneous charge to ensure that acceptable vibration limits are maintained.
Air	• Ongoing implementation of CNA EMS Procedure 8 – Air Quality Management; • Disturb only the minimum area necessary for mining; • Reshape topsoil and rehabilitate completed overburden emplacement areas as soon as practicable after the completion of overburden tipping; • Adequate stemming will be used at all times; • Maintain coal handling areas in a moist condition using water carts to minimise wind blown and traffic generated dust; • Dust aprons will be lowered during drilling; • Drills will be equipped with dust extraction cyclones or water injection systems and will be used when drilling; • All roads and trafficked areas will be watered using water carts to minimise the generation of dust; • All haul roads will have edges clearly defined with marker posts or equivalent to control their locations, especially when controlling large overburden placement areas; • Development of minor roads will be limited and the locations of these will be clearly defined; • Obsolete roads will be ripped and revegetated; and • Access tracks used for topsoil stripping equipment will be kept damp during use. Topsoil stripping to be avoided in extreme dry periods.
Visual	• Ongoing implementation of CNA EMS Procedure 10.1 – Visual Management; and • Progressive rehabilitation be undertaken to reduce visual impacts associated with the extension.
Archaeology	• Ongoing implementation of CNA EMS Procedure 2.1 – Cultural Heritage Management;

Impact	Commitment
	• Further archaeological investigation at sites C1, C2, C8, C9 and C10 prior to removal; • Scarred tree (Site C3) be removed and relocated (in consultation with the Aboriginal community) to a location where it will be protected from further development; • Protect CM-CD1 by maintaining a buffer zone of at least 15m wide • Protection of CM1 and part of CM2.
Ecology	• Ongoing implementation of CNA EMS Procedure 10.2 – Flora and Fauna; • Grazing cattle will be removed from the billabong area to enable recruitment of the River Red Gums and to reduce stresses on this area; • No River Red Gums will be removed from the billabong area; • Buffer areas (areas in which no construction, vehicle or personnel movements or mining activities are undertaken) will be defined around the stand of River Red Gums surrounding the billabong to prevent compaction of soil and edge effects. It is recommended the buffer be at least 20 m in width; • Fencing will be constructed on the development side of the buffer around the River Red Gums to prevent access by construction personnel and vehicles; • Construction of levees will take into consideration the indirect impacts on surface water flows, particularly close to the billabong area; • Appropriate erosion and sediment controls will be implemented across the study area prior to commencement of any construction activities to prevent potential impacts on the Hunter River, the billabong and drainage lines within the study area; • Pre-clearance surveys in accordance with CNA EMS Procedure 10.2 – Flora and Fauna will be undertaken for all trees to be removed from the services corridor; • Any soil removed for the proposed mine construction or associated activities will not be dumped on, or directly adjacent to, conserved areas, buffer areas or any watercourses or waterbodies where there is potential for weed seeds to be spread during rainfall events; • Development and implementation of a monitoring programme to assess groundwater conditions and the health of the stand of River Red Gums in the billabong area; and • If monitoring identified groundwater changes which impact on the trees as a result of mining activities, surface water management will be developed to redirect surface water to the billabong to simulate a flooding event as in an ephemeral drain.
Soils	• Class II land to be rehabilitated in accordance with methods currently used for HVO alluvial lands; and • Rehabilitation plan to connect undisturbed and rehabilitated areas of Class II land where possible.

7 PROJECT JUSTIFICATION AND CONCLUSION

7.1 PROJECT JUSTIFICATION

The proposed Carrington Extension will provide access to an additional 13.5 Mt of product coal for export and affords the opportunity to access the Bayswater seam beneath a rehabilitated overburden dump. Without access to this coal, CNA's coal supply commitments would need to be met by accessing coal from West Pit, and would require the relocation of greater volumes of overburden than would be required in the Carrington Pit.

In developing the proposal, the potential environmental impacts have been assessed and a number of options were examined. As a result, the mine plan has been altered to reduce potential environmental impacts. These alterations included the relocation of a levee to reduce the area of Class II lands impacted by the proposal and modification to the mine plan to protect the Aboriginal site, CM-CD1. Potential noise impacts will be reduced by managing mining equipment during winter nights, particularly during 2006. Groundwater impacts will be managed and monitored to ensure minimal impact. An evaporative sink has been included in the mine plan to manage future groundwater inflows. Where impacts could not be reduced through alterations to the mine plan, mitigation measures have been developed. These measures have been included as *Table 6.2* Commitments and will form part of CNA's EMS.

Rehabilitation of the site will be undertaken in accordance with the MCP for HVO and the MOP for Carrington Pit which will detail the rehabilitation of the area. The rehabilitation strategy will improve the connection of land available for agricultural purposes compared to the existing land capacity distribution. This rehabilitation will be undertaken with consideration of the DPI's Synoptic Plan and will be consistent with the vegetation plans provided in the *HVO West Pit and Minor Modifications EIS* (ERM, 2003). The MCP will be provided to the regulatory authorities at least five years before closure of the operation and will provide details of drainage, the final landform and the removal of the levees.

The proposed Carrington Extension does not require any extension to the life of HVO north of the River; however, it will produce additional royalties for the NSW Government and will contribute to the ongoing economic viability of HVO. CNA will continue to contribute to the community through employment, school programmes and support for community organisations.

7.2 CONCLUSION

The likely impacts of the proposed Carrington Extension have been assessed using methods that adequately predict the expected impacts. These impacts have been described throughout this SEE and demonstrate that the proposed extension is substantially the same as the approved development. The likely impacts to existing groundwater and surface water resources, air quality, noise and vibration, visual character, land capability and Aboriginal and European heritage have been assessed and the proposed extension will not significantly increase the impacts to these characteristics compared to the approved development. Accessing the resource in the extension area will, however, further enhance the economic viability of HVO by increasing coal production by 18.6 Mt ROM coal over the life of the extension. This will result in substantive royalties being paid to the NSW Government.

The information provided in this SEE demonstrates that the Carrington Extension is a relatively small extension of HVO north of the Hunter River activities. As such HVO north of the Hunter River including the Carrington Extension is substantially the same development as the development approved in the West Pit consent. The proposed Carrington Extension will not significantly increase the environmental impact of HVO north of the Hunter River as a whole. As such, this SEE supports an application to modify the existing West Pit consent under S96 (2) of the *EP&A Act*.

REFERENCES

Australian ICOMOS (1999) *The Burra Charter: the ICOMOS charter for conservation of places of cultural significance.*

Australian ICOMOS Incorporated (2000) *The Burra Charter: the ICOMOS charter for conservation of places of cultural significance with associated Guidelines and Code on the Ethics of Coexistence.*

CNA (2005) *Corporate EMS Procedures.*

DMR (1999) *Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of NSW.*

ERM (1999) *Carrington Mine Environmental Impact Statement.*

ERM (2004) *Hunter Valley Operations West Pit Extension and Minor Modifications EIS.*

Holmes Air Sciences (2005) *Air quality assessment: Carrington Pit Extension.*

HCMT (2005) *Hunter Remnant Vegetation Project Final Draft Vegetation Mapping Hunter-Central Rivers Catchment Management Authority NSW.*

Lyall & Associates (2005) *Hydraulic Analysis Hunter River and Floodplain for Carrington Mine Extension.*

MER Environment Research (1999) *Carrington Mine Project. Groundwater and Surface Water Management Studies.*

MER Environment Research (2000b) *Rio – Tinto Coal – Carrington Coal Project: Mine Water Management Studies.*

MER Environment Research (2003) *Hunter Valley Operations – West Pit Extension and Minor Modifications: Surface and Groundwater Management Studies.*

MER Environment Research (2004) *Evaluation of Dewatering Slot No. 4 – Carrington Palaeo Channel Aquifer.*

MER Environment Research (2005) *Carrington Extended Water Management Studies.*

NSW DEC (2001) *Approved Methods and Guidance For the Modelling and Assessment of Air Pollutants in New South Wales.*

NSW Department of Housing (1988) *Managing Urban Storm water – Soils and Construction.*

Pearson M and Sullivan S (1995) *Looking After Heritage Places: the Basics of Heritage Planning for Managers, Landowners and Administrators.*

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