Centennial Coal

MYUNA COLLIERY
EXTENSION OF MINING

ENVIRONMENTAL ASSESSMENT

February 2011

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Myuna Colliery Extension of Mining Environmental Assessment

Prepared for

Centennial Myuna Pty Limited

Prepared by

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Prepared by	Kelly Pearsall
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Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
1	29-Oct-2010	Environmental Assessment	Catherine Brady Associate Director	
2 Revised Final	25-Feb-2011	Environmental Assessment	Catherine Brady Associate Director	

Certification

Submission of Environmental Assessment (EA)

prepared under the Environmental Planning and Assessment Act 1979 section 75F

EA prepared by		
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in respect of	Myuna Colliery Extension of Mining Project	
Project application		
Applicant name	Centennial Myuna Pty Ltd	
Applicant address	Level 18, BT Tower, 1 Market Street Sydney NSW 2000	
land to be developed	Refer to attached schedule of land (**Appendix P**). Map(s) attached	
Environmental Assessment	an Environmental Assessment (EA) is attached	
Certification	I certify that I have prepared the contents of this Environmental Assessment and to the best of my knowledge it is true in all material particulars and does not, by its presentation or omission of information, materially mislead.	
	 Signature	 Signature
	Name: Kelly Pearsall	Name: Catherine Brady
	Date: 25 February 2011	Date: 25 February 2011

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GLOSSARY OF TERMS

Term	Definition
Bord and pillar mining	Method of underground coal mining where the coal seam is divided into regular block like array (pillars) by driving headings and cut-throughs. In some cases, the pillars are removed in a concurrent or later operation.
Caving	A collapse of the mine workings.
Continuous Miner	The electric powered cutting machine used to remove coal from the face and load it into the shuttle car, and to form mine roadways and extract coal pillars.
Development Consent Mining Area	Shown on **Figure 1.2**, and includes the Surface Facilities Area.
Ecologically Sustainable Development (ESD)	Using, conserving and enhancing resources so that ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased.
Ecosystem	An interacting system of animals, plants, other organisms and non-living parts of the environment.
Emission	The discharge of a substance into the environment.
Greenhouse Gases	Gases with the potential to cause climate change (eg. Methane, carbon dioxide and other as listed in the National Greenhouse and Energy Reporting Act 2007). Expressed in terms of carbon dioxide equivalent.
Groundwater	All waters occurring below the land surface derived from aquifers.
Hydrogeology	The area of geology that deals with the distribution and movement of groundwater in soils and rocks of the earth's crust.
Fassifern seam	Deepest coal horizon of the Permian Age Newcastle Coal Measures, with an average depth of 140 metres.
Great Northern seam	Lies above the Fassifern seam in the Newcastle Coal Measures and has an average depth of 120 metres.
Permian Age	The youngest geological period of the Palaeozoic era, covering a span between approximately 290-250 million years.
Project Application Area	Encompasses ML 1370, a portion of CCL 762 and the Surface Facilities Area**.** It comprises an area external to the existing Development Consent Mining Area (with the exception of the inclusion of the Surface Facilities Area).
Project	Extension of underground coal mining and associated activities at Myuna Colliery within the Project Application Area for up to 21 years.
Rehabilitation	The restoration of a landscape and especially the vegetation following its disturbance.
Run of Mine (ROM)	Raw coal production; unprocessed.
Sensitive Receptor	A sensitive receptor is defined by DECCW as location where a person (may or does) work or reside, including residential, hospitals, hotels, shopping centres, play grounds, recreational centres or similar.
Subsidence	The vertical lowering, sinking or collapse of the ground surface.
Surface Facilities Area	Comprises surface land containing mining and non-mining infrastructure (part of which is subject to MPL 334).
Tilt	The change in slope of the surface landform, calculated as the difference in subsidence between two points on the land surface, divided by the distance between those two points.
Wallarah seam	Uppermost coal horizon of the Permian Age Newcastle Coal Measures, with an average depth of 80 metres.

ACRONYMS

Acronym	Definition
AADT	Average Annual Daily Traffic
ABS	Australian Bureau of Statistics
ACHMP	Aboriginal Cultural Heritage Management Plan
ADTOAC	Awabakal Descendants Traditional Owners Aboriginal Corporation
AEMR	Annual Environmental Management Report
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
ANZECC	Australian and New Zealand Environment Conservation Council
ATOAC	Awabakal Traditional Owners Aboriginal Corporation
BCA	Benefit Cost Analysis
BOM	Bureau of Meteorology
CCL	Consolidated Coal Lease
Centennial	Centennial Coal Company Limited
CH_4	Methane
CL	Coal Lease
CO	Carbon Monoxide
CO_2	Carbon Dioxide
$CO_{2\text{-}e}$	Carbon Dioxide Equivalent
CMPL	Centennial Myuna Pty Limited
CHP	Coal Handling Plant
CCL	Consolidated Coal Lease
CL	Coal Lease
CMA	Catchment Management Authority
DCC	Department of Climate Change
DEC	Department of Environment and Conservation (now DECCW)
DECCW	Department of Environment, Climate Change and Water
DoP	Department of Planning
EA	Environmental Assessment
EARs	Environmental Assessment Requirements
ECRTN	Environmental Criteria for Road Traffic Noise
EEC	Endangered Ecological Community
EETM	Emission Estimation Technique Manuals
EIS	Environmental Impact Statement Myuna and Cooranbong Collieries (Newcom Collieries, 1977)
EL	Exploration Licence
EMP	Environmental Management Plan
EMS	Environmental Management System
EMSF	Environmental Management System Framework
ENCM	Environmental Noise Control Manual
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*

Acronym	Definition
EPI	Environmental Planning Instrument
EPL	Environment Protection Licence
ESAP	Energy Saving Action Plan
ESD	Ecologically Sustainable Development
GDEs	Groundwater Dependent Ecosystems
GHG	Greenhouse Gas
Ha	Hectares
HMCMA	Hunter Central Rivers Catchment Management Authority
HWLSCZ	High Water Level Subsidence Control Zone
HVAS	High Volume Air Samplers
I&I	Industry and Investment NSW
IGAE	Intergovernmental Agreement on the Environment
ILUA	Indigenous Land Use Agreement
INP	Industrial Noise Policy
IPM	Issues Prioritisation Matrix
Infrastructure SEPP	*State Environmental Planning Policy (Infrastructure) 2007*
LDP	Licensed Discharge Point
LEP	Local Environment Plan
LGA	Local Government Area
LHCCREMS	Lower Hunter Central Coast Regional Biodiversity Conservation Strategy
LMCC	Lake Macquarie City Council
ML	Mining Lease
ML/day	Megalitres per day
MPL	Mining Purposes Lease
MOP	Mining Operations Plan
MSC Act	*Mine Subsidence Compensation Act 1961*
Mt	Million tonnes
Mtpa	Million tonnes per annum
NES	National Environmental Significance
NGA	National Greenhouse Account
NGER Act	*National Greenhouse and Energy Reporting Act 2007*
NoW	NSW Office of Water
NO_2	Nitrogen Dioxide
N_2O	Nitrous Oxide
NPI	National Pollution Inventory
NPV	Net Present Value
NP&W Act	*National Parks and Wildlife Act 1974*
NPWS	National Parks and Wildlife Service
NSW	New South Wales
PAC	Planning Assessment Commission
PEA	Preliminary Environmental Assessment
PFM	Planning Focus Meeting
PM_{10}	Particulate matter less than 10 microns
POEO Act	*Protection of the Environment Operations Act 1997*

Acronym	Definition
REMP	Rehabilitation and Environmental Management Plan
ROM	Run of Mine
RTA	NSW Roads and Traffic Authority
SEP	Stakeholder Engagement Plan
SEPP	State Environmental Planning Policy
SEWPac	Department of Sustainability, Environment, Water, Population and Communities
SIDRA	Intersection Traffic Modelling Software
SF_6	Sulphur Hexafluoride
SMP	Subsidence Management Plan
SMZ	Seagrass Management Zone
SoC	Statement of Commitments
SPLs	Sounds Power Levels
RBL	Rated Background Level
t	Tonne
TAPM	The Air Pollution Model
TARPs	Targeted Action Response Plans
TEC	Threatened Ecological Community
tpa	Tonnes per annum
TSC Act	*Threatened Species Conservation Act 1995*
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
UNSW	University of New South Wales
VAM	Ventilation Air Methane

Executive Summary

Introduction

Myuna Colliery is an existing underground coal mine owned and operated by CMPL, a wholly owned subsidiary of Centennial Coal Company Limited (Centennial). Myuna Colliery's Surface Facilities Area is on the western side of Lake Macquarie, at Wangi Wangi, approximately 25 kilometres south-west of Newcastle, New South Wales (NSW). Development of Myuna Colliery commenced in 1979 and since this time extraction of coal and associated mining activities has occurred in three coal seams (Wallarah, Great Northern and Fassifern) using bord and pillar methods. Myuna Colliery has an approved average Run of Mine (ROM) coal production of 1.3 million tonnes of coal per annum (Mtpa), which is transferred to the Surface Facilities Area at Wangi Wangi for processing and transport to Eraring Power Station by Eraring Energy's Enclosed Overland Conveyor.

Myuna Colliery currently operates under an existing Development Consent (SH 110/148) within the Development Consent Mining Area, in accordance with the conditions of relevant mining leases and, in areas beyond the existing Development Consent Mining Area, under the transitional provisions of the *Mining Act 1992* (Mining Act).

As the transitional provisions of section 74(1) of the Mining Act will cease on 16 December 2010, and as existing mining operations are not scheduled for completion until 2031, CMPL requires Project Approval under Part 3A of the EP&A Act to continue mining beyond this date in those areas outside the existing Development Consent Mining Area and within the existing mining leases.

The Project Application Area for the proposed Project is located on the western side of Lake Macquarie, approximately 25 kilometres south-west of Newcastle. The Project Application Area encompasses ML 1370, MPL 334, a portion of CCL 762 and the Myuna Colliery Surface Facilities Area. The Project Application Area is external to the existing Development Consent Mining Area, with the exception of the inclusion of the Surface Facilities Area.

The proposed Project will extend mining and coal handling at Myuna Colliery within the Project Application Area and proposes to:

- mine using bord and pillar methods in the Wallarah, Great Northern and Fassifern seams in CCL762 and ML1370, for a further 21 years;
- produce, handle and distribute to Eraring Power Station, up to 2Mtpa using existing infrastructure;
- continue the use of ancillary infrastructure and services for a further 21 years;
- upgrade the water management system; and
- rehabilitate the surface facilities within 5 years of completion of mining.

The proposed Project is a major development under *State Environmental Planning Policy (Major Development) 2005* (SEPP 2005), and is therefore subject to the provisions of Part 3A of the EP&A Act.

AECOM Australia Pty Ltd (AECOM) has been engaged by Centennial Myuna Pty Limited (CMPL) to prepare this Environmental Assessment (EA) under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the extension of currently approved underground mining operations at Myuna Colliery. This EA has been prepared to assess potential impacts associated with the Project in accordance with the provisions of Part 3A of the EP&A Act, together with the Director-General's Environmental Assessment Requirements (EARs) issued by the Director-General of the Department of Planning on 16 July 2010.

Strategic Context and Need for the Project

Project Approval is required to ensure Myuna Colliery maximises the extraction of coal under its existing mining lease, without which, mining would be restricted to within the Development Consent Mining Area. Without Project Approval, cessation of mining at Myuna Colliery would result in mine closure within approximately five years, the loss of some 175 jobs and the sterilisation of approximately 37 million tonnes (Mt) of coal resource.

This EA provides a detailed justification and associated benefits of the proposed Project, and considers potential environmental, social and economic impacts locally, regionally and on a State-wide basis. The Project need and alternatives are further detailed in **Section 3.0** of the EA.

Project Description

Project Approval is sought for the extension of current operations at Myuna Colliery for a further 21 years including operation of the Surface Facilities Area, as well as mining using bord and pillar methods in the Wallarah, Great Northern and Fassifern coal seams within the Project Application Area. Production and handling of up to 2 Mtpa of ROM coal is sought for the proposed Project, which is within the operational capacities of the existing approved Coal Handling Plant (CHP) at the Surface Facilities Area.

Interaction with Existing Licenses and Approvals

The proposed Project, including operations proposed within the Project Application Area and Surface Facilities Area, will operate in accordance with the requirements of existing approvals, authorities and licences, with the exception of the 1977 Development Consent.

Myuna Colliery's existing Environmental Management System will be revised and updated for the proposed Project as required to ensure ongoing effectiveness.

For areas where secondary extraction is proposed to be undertaken, CMPL will seek approval for secondary extraction from NSW Department of Infrastructure and Investment. CMPL will seek approval from the Dams Safety Committee prior to any mining within the Eraring Ash Dam Notification Area in accordance with current lease conditions.

CMPL will continue to undertake mining in the Development Consent Mining Area in accordance with the 1977 Development Consent. Handling and distribution of that coal will be undertaken in accordance with the 1977 Development Consent except as may be modified by approval of the Project .

Continuation of Underground Mining Area

Project Approval is sought for the continued operation of underground mining activities within the Project Application Area. The Project Application Area encompasses the coal measures and three seams currently mined at Myuna Colliery and as such includes areas of existing workings and areas requiring new workings to be developed. Access to new areas will be developed from the existing workings. The proposed method of extraction for these areas is by conventional underground bord and pillar mining methods, similar to methods employed for previous underground mining at the Colliery.

Mine Design

The mining layout to be implemented within the three seams in any given portion of the Project Application Area will be determined during detailed mine planning, taking into consideration the constraints established to ensure mine safety. A geotechnically engineered mine design will be developed within two identified subsidence zones:

- **Zone A** – Long term stable mining systems generating up to 20 millimetres surface subsidence (i.e. no noticeable surface impacts) on sensitive surface features including land and seagrass beds; and
- **Zone B** – Mining systems generating up to a maximum of 650 millimetres surface subsidence (under Lake Macquarie).

The proposed subsidence zones are shown on **Figure 6.3** of the EA. A 26.5 degree angle of draw will apply to the boundary between Zone A and Zone B (refer to **Figure 6.2** of the EA).

The mining system will include:

- Multiple seam mining – first workings or non-caving partial pillar extraction systems where multiple seams are to be mined; and
- Single seam mining – first workings, partial pillar extraction or wide panel full extraction.

The mine design will address the various mine constraints which are specified in mining leases, including the High Water Level Subsidence Control Zone (HWLSCZ); the Notification Area of Eraring Ash Dam; 40 metres of solid rock head; and the coal pillar factor of safety.

Continued Operation of the Surface Facilities Area

CMPL is seeking Project Approval for the continued operation of the Surface Facilities Area. All existing infrastructure located at the Surface Facilities Area and existing mining areas (including existing underground workings for ventilation) will continue to be utilised for the Project including (but not limited to) mine access,

emergency management, underground services and infrastructure and the use of the Eraring Energy-owned Enclosed Overland Conveyor to transport coal to Eraring Power Station. As such, no changes are proposed to the current mine access, infrastructure or mine facilities.

Minor changes to the licensed discharge point configuration and temporary coal stockpile area (involving minor clean water diversion works) will be required to improve water management at the Surface Facilities Area. These are discussed further in **Section 4.4.6**.

Mine Closure and Rehabilitation

The final land use for the Surface Facilities Area will be determined in accordance with a Rehabilitation and Environmental Management Plan to be commenced within 5 years of the closure of Myuna Colliery. The Rehabilitation and Environmental Management Plan will be developed in consultation with relevant stakeholders.

Consultation

Community Consultation

Myuna Colliery has been in operation for over 25 years and has a long history of engagement with the community in which it operates. Over the last 25 years Myuna Colliery has been actively involved in the community through participation in and sponsorship of a number of community initiatives.

Prior to the commencement of the Environmental Assessment process, Myuna Colliery developed a Stakeholder Engagement Plan. The Myuna Colliery Stakeholder Engagement Plan is designed to ensure clear, effective, open and two-way communication is provided to all identified stakeholders throughout the Project.

Myuna Colliery has kept the local community informed of the proposed Project through the distribution of project information in the local Lakes Mail newspaper and the development and distribution of dedicated project information flyers (**Appendix D**). The project information flyers were provided to local businesses, local residences, local Councillors and Members of parliament and made publicly available on the Centennial Coal website.

The distribution of information regarding the proposed Project advertised the Myuna Colliery Community Information Line as a mechanism for the local community to contact the Myuna Colliery with any questions or concerns regarding the proposed Project.

Statutory and Agency Consultation

This EA has been prepared in accordance with Part 3A of the EP&A Act and its Regulation. Part 3A of the EP&A Act ensures that the potential environmental effects of a proposal are properly assessed and considered in the decision making process.

In preparing this EA, the Director-General's EARs have been addressed as required by section 75F of the EP&A Act. The key matters raised by the Director-General for consideration in the EA are outlined in **Section 1.7.2** of the EA.

CMPL has undertaken consultation with key local and State Government agencies during the preparation of this EA as specified in the EARs. The purpose of this consultation was to provide an overview of the Project and to clarify methods of assessment for the EA. In this regard, face to face meetings, where possible, have been held with relevant statutory agencies identified in the EARs, to assist with the preparation of the EA.

Consultation has been undertaken with a number of relevant statutory authorities including DoP, DECCW, I&I (including Department of Primary Industries-Mineral Resources, Forests NSW and NSW Office of Water), NSW Roads and Traffic Authority (RTA), Mine Subsidence Board, Hunter Central Rivers Catchment Management Authority, Lake Macquarie City and Wyong Councils.

Table 7 in the EA describes the consultation undertaken as part of the EA for statutory and agency stakeholders.

Issues Identification and Prioritisation

The potential environmental and social issues associated with the proposed Project have been identified through the preliminary environmental risk assessment undertaken for the Preliminary Environmental Assessment (PEA), consultation with Government agencies and the community, and considertation of the Director-General's EARs issued for the EA. The environmental risk assessment undertaken for the PEA was based on existing knowledge,

and identified a number of issues for which additional information and assessment was required to better determine their level of risk.

Issues associated with the proposed extension of operations at Myuna Colliery were determined to include:

- Subsidence;
- Noise;
- Air quality (dust, greenhouse gas);
- Water management (surface water and groundwater);
- Aquatic ecology;
- Greenhouse gas;
- Terrestrial ecology;
- Heritage (Aboriginal and European);
- Social and Economic;
- Traffic; and
- Other minor issues (including rehabilitation and mine closure, visual, land use, hazards and soils).

The prioritisation of issues has been undertaken using an environmental risk analysis, based on the number and proximity of potential sensitive receivers surrounding the Surface Facilities Area, the existing physical environment, and management practices currently employed at the Colliery.

An issues prioritisation matrix was used to identify priorities. The table below identifies the prioritisation of environmental issues, and therefore the focus of assessment for the proposed Project:

Issues Prioritisation

Low	Moderate
Surface Water Traffic Terrestrial Ecology Heritage (Aboriginal and European) Greenhouse Gas Economic Other minor issues (Rehabilitation and Mine Closure; Land Use; Soils; Waste; Visual; Hazards)	Air Quality Groundwater Acoustics Aquatic Ecology Social

Subsidence

A subsidence assessment was prepared by Seedsman Geotechnics for the proposed Project (refer **Appendix C**), which addresses subsidence features and predictions, while the EA assesses impacts on surface features, infrastructure, heritage areas, watercourses, groundwater, and flora and fauna.

There is a very strong precedent for stable bord and pillar mining layouts at the depths proposed at Myuna Colliery, which will result in no measurable or discernable surface impacts (i.e. vertical subsidence of less than 20 millimetres). Seedman Geotechnics (2010) concluded there is a high level of confidence in bord and pillar layouts being capable of meeting the subsidence constraints within Mining Zone A.

A subsidence constraint of up to 650 millimetres has been identified for Subsidence Zone B. To achieve this subsidence constraint, it is predicted that wide pillar extraction could only safely be undertaken in the Fassifern Seam within Zone B (Seedsman Geotechnics, 2010). Seedsman Geotechnics (2010) concluded that the future mining within Mining Zone B of Myuna Colliery can be designed to meet the vertical subsidence constraints of 650 millimetres through consideration of geological features, depth of cover, stability of the seam roof and floor, pillar stability and method of mining in Myuna Colliery's Myuna Mine Design Management process. It is noted that 650 millimetres is an upper subsidence limit for Mining Zone B, and that planning considerations for mine design which consider safety requirements as a priority may result in lower levels of subsidence in this zone.

An Extraction Plan, or equivalent document, which takes into account the existing information presented in this EA, will be developed for mining within Mining Zone B, in consultation with I&I, prior to secondary workings (partial and full extraction) being undertaken in Zone B.

Air Quality

The Air Quality Impact Assessment predicted that ground level concentrations and deposition rates for modelled parameters, TSP, PM_{10} (annual average), deposited dust, nitrogen dioxide (NO_2) and carbon monoxide (CO) and odour, met will meet all regulatory assessment criteria at nearest sensitive receivers. Total 24-hour maximum PM_{10} (background plus predicted increment), however, will be in exceedance of the project–specific criterion, though this exceedance is attributed to the background PM_{10} used in the assessment being already above this criterion. Cumulative maximum 24-hour average PM_{10} attributable to the Project is predicted to be below the Project criterion at all receivers, excluding periods of regional pollution events.

Continued operations at Myuna Colliery are not expected to generate significant impacts to air quality as has been demonstrated by the existing operations. The continued operations of the Colliery are not expected to adversely impact the existing cumulative ambient air quality of the local area or surrounding region.

Groundwater

Within the current area of operations at Myuna Colliery, groundwater seeps into the underground workings and forms mine water make, which is stored in underground storage areas. The proposed Project will result in an additional 11.6 ML/day of water flowing into the proposed workings from the three coal seams, due to the increased extent of mining. This will result in an overall increase in water discharged through both licensed discharge points LDP001 and LDP002 from 5.1 ML/day to 8.6 ML/day over the life of the proposed Project, although these increased discharge volumes will remain within the current combined volumetric limits for these discharge points specified in EPL 366 of 13 ML/day.

Negligible changes in groundwater levels in the shallow alluvial aquifers are predicted during the operation of the proposed Project. Due to the limited connection between the shallow alluvial aquifers and the deeper coal seam aquifers that will be affected by the proposed Project, it is considered that this variation in groundwater levels in the shallow alluvial aquifers is attributable to changes in rainfall recharge and evaporation.

Therefore, impacts on alluvial aquifers, existing alluvial groundwater users and Groundwater Dependent Ecosystems (GDEs) resulting from the proposed Project will be minimal, and therefore significant impacts to the groundwater environment are not expected.

Surface Water

Myuna Colliery's Surface Facilities Area is located near to Wangi Creek which is a heavily modified waterway as a result of the Wangi Power Station outflow canal. Myuna Colliery's existing water management system discharges water to Wangi Creek through two discharge points licensed under Myuna Colliery's Environment Protection Licence (EPL) 366.

The proposed Project will result in an increase in the current underground water make and extraction, which will consequently result in an increase in combined discharges through LDP001 and LDP002 from an average of 5.1 ML/day to an average of 8.6 ML/day over the life of the proposed Project.

The impact on the hydrology, geomorphology and water quality of surface waterways and receiving waters as a result of the proposed Project is expected to be negligible, though monitoring and management programs will be established to monitor potential impacts.

The proposed Project includes a number of features that will enhance the existing water management system and result in efficiencies in water management at Myuna Colliery. Efficiencies include the reduction of clean water catchments contributing to the dirty water management system, which will result in an overall improvement of the performance of these structures and reduce the volume of event based discharges, and amendments to the existing configuration of licensed discharge points to improve monitoring of water quality and volume.

Provided the identified mitigation measures are implemented, the proposed Project is not expected to result in a significant impact to surface water.

Noise and Vibration

Results of the noise impact assessment indicate that operational noise levels at the Surface Facilities Area are predicted to meet the Project-specific noise criteria at all modelled residential receivers under calm and prevailing weather conditions with a number of recommended noise mitigation and management strategies in place (refer to **Section 10.3.4**).

Limited underground shot firing may be required for the proposed Project. Vibration from underground shot firing is predicted to be negligible at the nearest residential locations. All shots will be planned and designed to achieve the required outcomes with minimum impacts on the surrounding residential receivers.

Given the existing environment, history of operations, and mitigation measures, the proposed Project is not expected to result in significant acoustic impacts.

Ecology

The aquatic ecology assessment identified 18 threatened species 'known' to occur within the study area, 11 of which have the potential to be affected by the proposed Project. The assessments of significance undertaken for these 11 species each concluded that the proposed Project will not have a significant effect on the habitat utilised by these species, such that it will not cause an observable alteration to their behaviour or habitat requirements.

Seagrass habitat is extensive throughout shallow nearshore sections of the Project Application Area, however, given that predicted subsidence levels where seagrass beds occur (Zone A) will be negligible (less than 20 millimetres), the proposed Project will not have an substantial impact on seagrass habitat. Direct or indirect impacts to fish and threatened species that utilise seagrass habitat are therefore not expected.

In order to mitigate impacts to aquatic ecology, a Seagrass Management Zone (SMZ) will be implemented (refer to **Figure 10.4.2**), and a Seagrass Management Plan will be prepared to define the requirements for seagrass surveys and monitoring within the SMZ, which will be undertaken should secondary workings (partial or full pillar extraction) take place beneath the SMZ.

The terrestrial ecology assessment identified 40 threatened flora species/populations/ecological communities, 57 vulnerable or endangered fauna species and 35 migratory species listed under the TSC Act and/or EPBC Act with a moderate or high chance of occurring within the Project Application Area.

The proposed Project is expected to give rise to negligible land surface subsidence (less than 20 millimetres) and is not expected to significantly impact on terrestrial ecology, including an State or Nationally listed threatened species, populations, communities or migratory species within or adjacent to the Project Application Area. Similarly, no impact to the conservation values of Lake Macquarie State Conservation Area at Point Wolstoncroft is expected as a result of the proposed Project.

Social and Economic

Social and economic profiles were assessed for the proposed Project and it was concluded that continued operations at Myuna Colliery will provide numerous social and economic benefits for the local area and the greater region through continued employment, revenue and community support.

The proposed Project will contribute approximately $222M into the State economy through additional wages, royalties and business turnover on an annual basis, while flow-on spending as a result of the proposed Project is likely to economically benefit a number of different sectors of the regional economy.

Potential negative social impacts relating to noise, air, and traffic issues as a result of the continuing operation of the Surface Facilities Area will be mitigated and managed in accordance with Myuna Colliery's existing Environmental Management System and additional measures outlined in this EA.

Traffic and Transportation

The proposed Project will employ in the order of 210 personnel per day, which represents an increase of 35 employees above current levels, and will give rise to an additional 70 movements on the traffic network per day. This increase above current levels is considered minimal and unlikely to compromise the function of the surrounding network.

The intersections of Wangi Point Road / Summerhill Drive and Donnelly Road / Wangi Road all have sufficient sight distances for vehicles accessing and exiting the Surface Facilities Area. The additional 70 vehicle movements generated by the Project at these intersections is considered to be negligible, and employees will achieve safe through-movement when accessing and exiting the Surface Facilities Area.

Heritage

The Cultural Heritage Assessment recorded six new sites, two previously recorded sites and two areas which were considered to be culturally sensitive to the Aboriginal community representatives within the Project Application Area. The assessment concluded that although there are some existing sites of cultural significance, surface subsidence will be restricted to less than 20 millimetres on land and foreshore areas within the Project Application Area and potential impacts are not expected to be significant.

The European heritage assessment found no listed items of European heritage recorded within the Project Application Area, and concluded that it is unlikely that there will be an impact on unidentified European heritage items within or listed items adjacent to the Project Application Area.

Greenhouse Gas

The Greenhouse Gas (GHG) Assessment calculated direct and indirect GHG emissions relating to the proposed extension of mining operations at Myuna Colliery to be a total of 5,420,073 t CO_2-e per annum, which represents approximately 38% increase in GHG emissions over existing site emissions.

CMPL has committed to mitigation and offset of Scope 1 and Scope 2 emissions through the ongoing implementation of the site's Energy Saving Action Plan, by undertaking research into reducing emissions generated by ventilation air methane, and by committing to offset 10% of its Scope 1 emissions per annum where opportunities to avoid or mitigate emissions are not available, or until a National Emissions Trading Scheme is imposed on the Colliery.

Mine Closure and Rehabilitation

All surface infrastructure associated with Myuna Colliery's operations is located at the Surface Facilities Area, which encompasses a footprint of approximately 89 hectares.

The final land use for the Surface Facilities Area will be determined in accordance with a Rehabilitation and Environmental Management Plan (REMP) to be commenced within 5 years of the closure of Myuna Colliery. The REMP will define the objectives and criteria for mine closure and investigate options for future uses of the Surface Facilities Area. The REMP will be implemented and the Surface Facilities Area rehabilitated within 5 years of completion of mining.

Geology and Soils

The extended operations of Myuna Colliery's Surface Facilities Area and underground mining is not likely to result in additional geological or soil impacts given continuation of the current Land Management Plan, Targeted Action Response Plans (TARPs) and successful mitigation techniques. Soil and geology will be considered as part of rehabilitation practices leading to the REMP.

Statement of Commitments

In accordance with the EARs, a Statement of Commitments (SoC) for the Project is included in **Section 11.0** of the EA. The SoC sets out CMPL's environmental commitments and provides details on the environmental management and monitoring of the proposed Project during its extension of operations.

The Proponent is committed to ensuring the preparation, augmentation and implementation of the environmental management and monitoring plans, ongoing monitoring and environmental mitigation measures detailed in the SoCs for the proposed Project Approval.

Residual Consequences

Based on the identified environmental effects of the proposed Project and the ability to confidently manage those effects to minimise harm to the environment, the proposed Project will overall present minimal residual

consequences, provided that the recommended mitigation, management and monitoring measures are implemented. On balance, the benefits of the proposed Project, and with proposed management, mitigation and offset measures in place, are considered to outweigh the predicted residual consequences.

Cumulative Impacts

Cumulative impacts of the extended operations at Myuna Colliery, particularly with respect to water, noise and air quality have been considered in each of the technical studies undertaken in respect of the proposed Project. The cumulative impacts of the continued operation of Myuna Colliery were also considered taking into account other existing and recent developments and operations, as well as major projects planned in the local area. The technical assessments concluded that the extended operations of the Colliery will have minimal cumulative environmental impacts.

Project Justification

The Director-General's EARs require justification for the proposed Project to be provided, having regard to environmental, social and economic considerations together with the principles of Ecologically Sustainable Development (ESD). The environmental impact assessment of the proposed Project undertaken in this EA has addressed the relevant biophysical, economic and social considerations. The proposed extension of operations at Myuna Colliery has been considered in the context of the principles of ESD and it is considered to be consistent with these principles. The proposed Project is not expected to result in significant environmental impacts provided the current environmental management is maintained and recommended additional safeguards and mitigation measures are implemented.

Conclusion

Project Approval is sought for the extension of an existing underground coal mine and use of an existing approved Surface Facilities Area within an existing mining lease area. The Project satisfies the definition of a Major Development under SEPP 2005 and has therefore been assessed in accordance with Part 3A of the EP&A Act.

This EA has assessed the potential environmental impacts and management of the proposed Project and concludes that the future operations at the Myuna Colliery will not result in significant impacts to the environment, provided current environmental management is maintained at the site and recommended additional mitigation measures detailed in **Section 10.0** and in the Statement of Commitments are implemented.

The proposed Project will result in benefits to the local community and economy associated with the continued employment of 210 employees. Additional wages, royalties and flow-on effects with a net benefit of $222M will be injected into regional and State economies as a result of the proposed Project over its 21 year life. The proposed Project has been considered in respect of biophysical, economic and social grounds and is considered to be consistent with the principles of ESD.

1.0 Introduction

This section provides a brief introduction to Myuna Colliery, the proposed Project, the approval process for the proposed Project, and the purpose and content of this report.

1.1 Overview

Myuna Colliery is an underground coal mine owned and operated by Centennial Myuna Pty Limited (CMPL), a wholly owned subsidiary of Centennial Coal Company Limited (Centennial). Myuna Colliery is located 25 kilometres south-west of Newcastle, New South Wales (NSW) in the Lake Macquarie and Wyong Local Government Areas (LGA) (refer to **Figure 1.1**).

CMPL currently undertakes underground mining at Myuna Colliery by means of an existing Development Consent, the conditions of relevant mining leases and in areas beyond the existing Development Consent Mining Area under the transitional provisions of the Mining Act *1992* (Mining Act). As the transitional provisions of the Mining Act will soon cease, CMPL requires approval under the *Environmental Planning and Assessment Act 1979* (EP&A Act) to continue mining in those areas outside the existing Development Consent Mining Area and within the existing mining leases beyond 16 December 2010.

The proposed Project will extend mining and coal handling at Myuna Colliery within the Project Application Area, using bord and pillar methods in the Wallarah, Great Northern and Fassifern seams with the continued use of ancillary infrastructure, for a further 21 years. The Project Application Area comprises an area external to the Development Consent Mining Area, with the exception of the inclusion of the Surface Facilities Area.

The Preliminary Environmental Assessment (PEA) for the proposed Project was submitted to the Department of Planning (DoP) on 1 June 2010 to provide the Minister for Planning with a relevant level of detail on the proposed Project and identify likely key environmental issues to enable the Director-General's Environment Assessment Requirements (EARs) to be issued on 16 July 2010. AECOM Australia Pty Ltd (AECOM) has been engaged by CMPL to prepare this Environmental Assessment (EA) and seek the approval of the Minister for Planning through the Planning Assessment Commission (PAC) under section 75J of the EP&A Act for the extension of underground coal mining and associated activities at Myuna Colliery within the Project Application Area for a period of 21 years.

CMPL will continue to undertake mining in the Development Consent Mining Area in accordance with the 1977 Development Consent. Handling and distribution of that coal will be undertaken in accordance with the 1977 Development Consent except as may be modified by approval of the Project (refer to **Section 5.0**).

1.2 Background

Lake Macquarie City Council (LMCC) granted consent to the development of the Myuna and Cooranbong Collieries in 1977, as described in the Environmental Impact Statement titled *Environmental Impact Statement for Myuna and Cooranbong Collieries* (the EIS) (Newcom Colliery Pty Ltd, 1977) and subject to certain conditions (the existing Development Consent). The existing Development Consent was granted pursuant to the provisions of the now repealed *Local Government Act 1919*, and deemed to be a development consent under Part 4 of the EP&A Act by virtue of the operation of clause 7 in Schedule 3 of the *Miscellaneous Acts (Planning) Repeal and Amendment Act 1979*.

The Development Consent remains in force and authorises the extraction of coal within an area designated in the EIS as the "Myuna Colliery proposed working area" (the existing Development Consent Mining Area). Development of Myuna Colliery commenced in 1979.

Newcom Colliery began underground mining at Myuna Colliery in three coal seams (Wallarah, Great Northern and Fassifern) using bord and pillar methods in 1982, and transferred ownership to the State owned entity Elcom Collieries Pty Ltd in 1991. In 1992, ownership of Myuna Colliery was transferred from Elcom Collieries Pty Ltd to ENC (Management) Pty Ltd, which in 1993 was renamed Powercoal Pty Ltd. At this time Powercoal held the NSW Government coal mining assets and was owned by Pacific Power (a NSW Government state owned corporation).

In 2002, Centennial Coal Company Ltd acquired all Powercoal assets including a portfolio of five development projects and seven mines, including the Myuna Colliery. CMPL has operated Myuna Colliery since this time.

CMPL currently undertakes underground mining at Myuna Colliery:

- Within the Development Consent Mining Area; and
- Within Consolidated Coal Lease 762 (CCL 762) and Mining Lease 1370 (ML 1370) but external to the Development Consent Mining Area, pursuant to the combined operation of section 74(1) of the Mining Act and clause 8K of the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation).

The Development Consent Mining Area, and the areas comprised in CCL 762, ML 1370 and Mining Purposes Lease 334 (MPL 334) are shown on **Figures 1.2** and **1.3**.

1.3 Proposed Project

The Project Application Area is shown on **Figure 1.2** and encompasses ML 1370, MPL 334, a portion of CCL 762 and the Surface Facilities Area. The Project Application Area is external to the existing Development Consent Mining Area, with the exception of the inclusion of the Surface Facilities Area.

The Project will extend mining and coal handling at Myuna Colliery within the Project Application Area and proposes to:

- mine using bord and pillar methods in the Wallarah, Great Northern and Fassifern seams in CCL762 and ML1370, for a further 21 years;
- produce, handle and distribute to Eraring Power Station, up to 2 million tonnes per annum (Mtpa) using existing infrastructure;
- continue the use of ancillary infrastructure and services for a further 21 years;
- upgrade the water management system; and
- rehabilitate the surface facilities within 5 years of completion of mining.

CMPL will continue to undertake mining in the Development Consent Mining Area in accordance with the 1977 Development Consent. Handling and distribution of that coal will be undertaken in accordance with the 1977 Development Consent except as may be modified by approval of the Project (refer to **Section 5.0**).

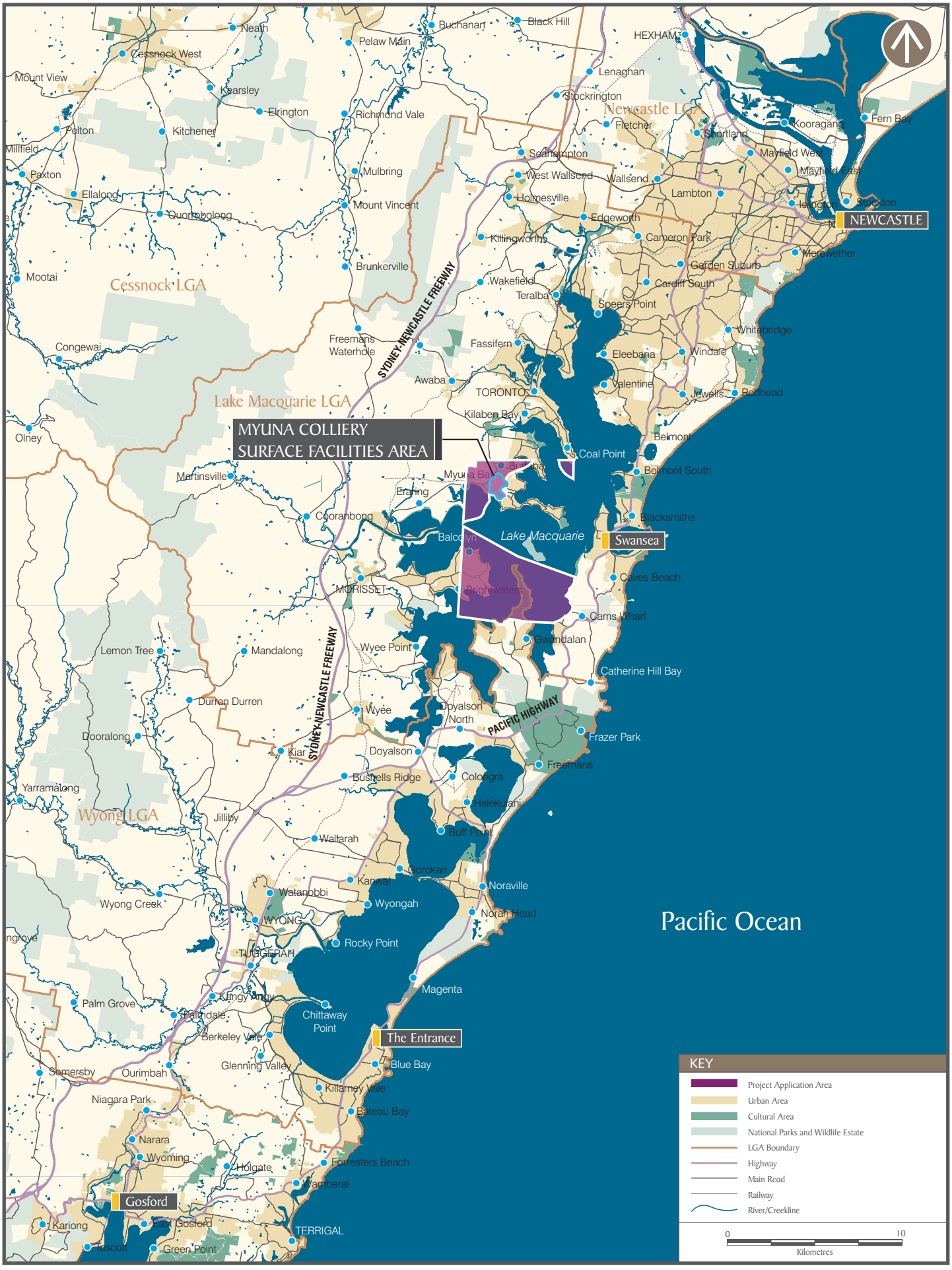
An overview of the existing operation is provided in **Section 4.0** and further details on the proposed Project are provided in **Section 5.0** with key features of the proposed Project outlined in **Section 5.0.**

1.4 The Proponent

The proponent, CMPL, is a wholly owned subsidiary of Centennial and supplies thermal coal to domestic markets. Centennial supplies approximately 47% of the State's coal fired electricity generation and is the largest independent coal company in Australia with regards to coal production, operating 10 coal mines in NSW.

1.5 Project Location and Site Context

The Project Application Area is located on the western side of Lake Macquarie, approximately 25 kilometres south-west of Newcastle (refer to **Figure 1.1**). Myuna Colliery's Surface Facilities Area is located in the township of Wangi Wangi in the Lake Macquarie LGA. The Project Application Area is primarily located under Lake Macquarie, however also extends under the Morisset Peninsula and Point Wolstoncroft in the south, and to a lesser extent under Coal Point, Rathmines and Fishing Point in the north. The Project Application Area is largely within the Lake Macquarie LGA, with the exception of Point Wolstoncroft which is part of the Wyong LGA (refer to **Figure 1.3**).



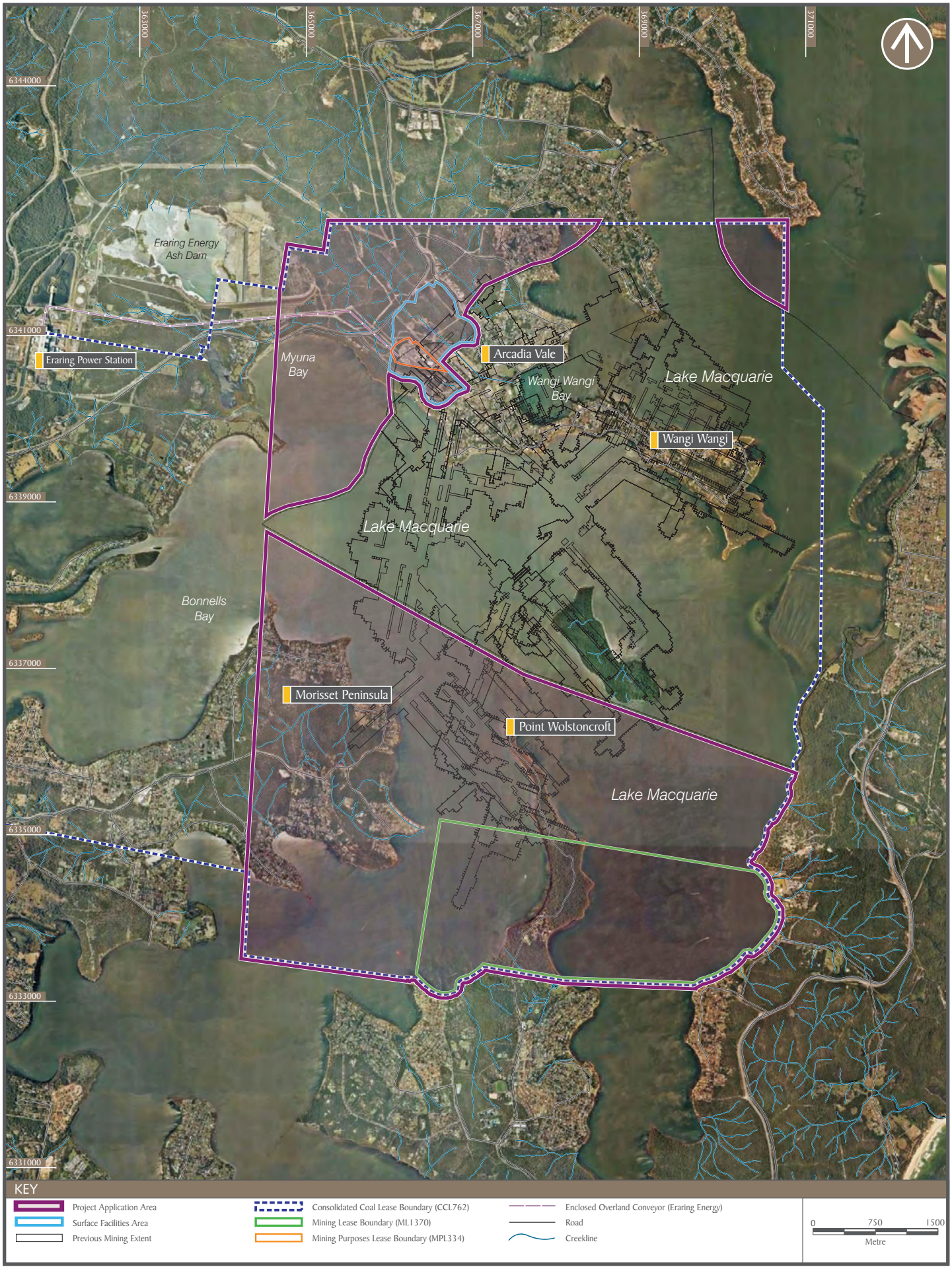
AECOM

REGIONAL CONTEXT

Centennial Myuna Pty Ltd

Environmental Assessment

Figure 1.1



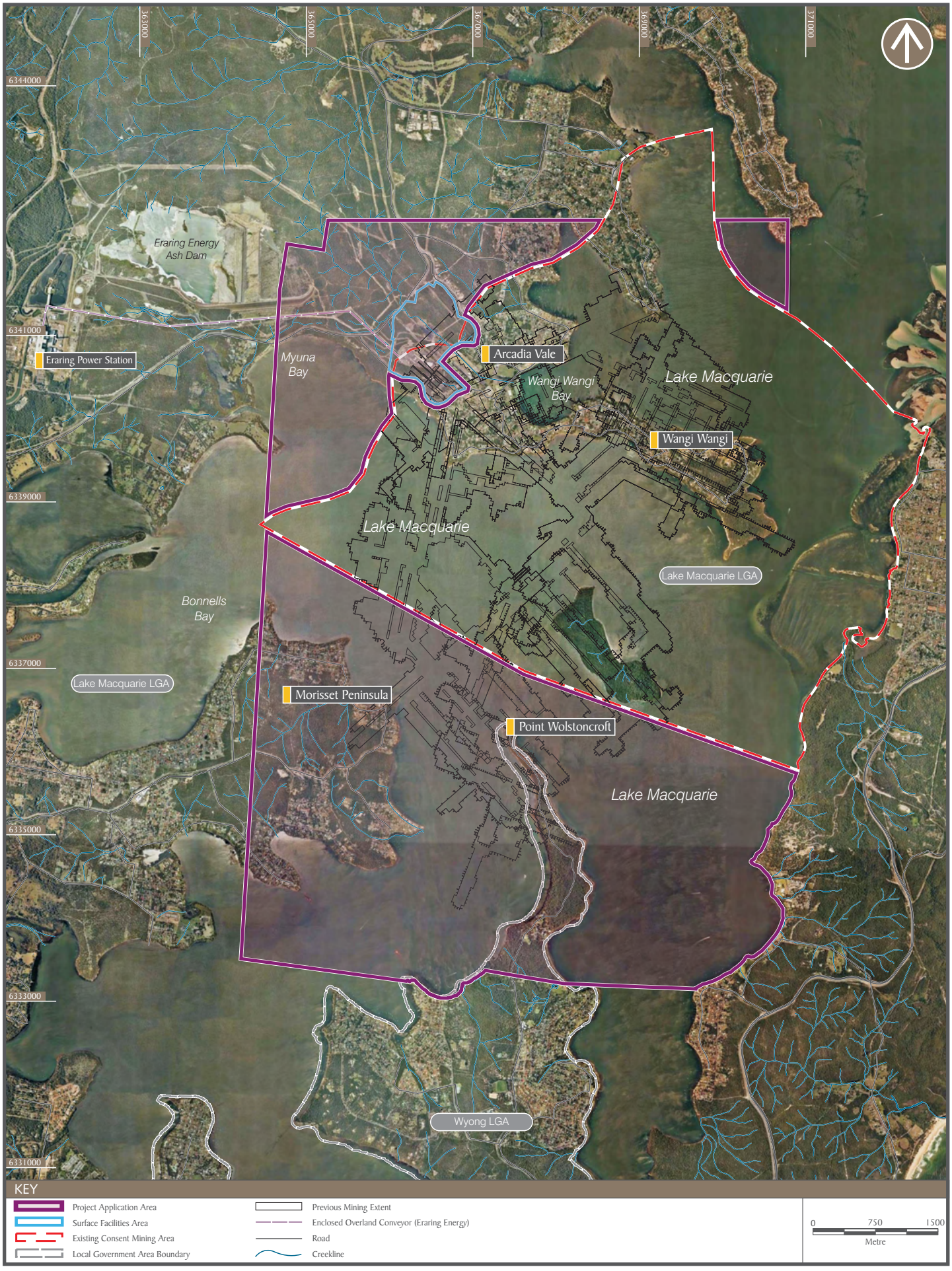
AECOM

PROJECT APPLICATION AREA AND MINING LEASES

Centennial Myuna Pty Ltd

Environmental Assessment

Figure 1.2



AECOM

PROJECT APPLICATION AREA

Centennial Myuna Pty Ltd

Environmental Assessment

Figure 1.3

1.6 Project Need

Project Approval is required to ensure Myuna Colliery is operational within the Project Application Area post 16 December 2010. The proposed Project will prolong the life of the Colliery, will enable ongoing direct employment for 210 employees, will provide ongoing significant local, regional and State economic benefits in the form of additional wages, royalties and flow-on effects, and will continue to supply Eraring Power Station with a valuable coal resource. The need for the proposed Project is discussed in more detail in **Section 3.1**.

1.7 Environmental Assessment Process and Purpose

The proposed Project is a 'major development' under s75U of the EP&A Act and State Environmental Planning Policy (SEPP) (Major Development) and is therefore subject to the provisions of Part 3A of the EP&A Act with the Minister delegating approval to the PAC.

Following the introduction of Part 3A of the EP&A Act in 2005, SEPP (Major Development) and SEPP (Mining Petroleum Production and Extractive Industries) 2007 (SEPP (Mining)), section 74 of the Mining Act *1992* (Mining Act) was repealed with transitional arrangements (clause 8K in the EP&A Regulation 2000) in place until 16 December 2010.

Myuna Colliery has undertaken mining outside the existing Development Consent Mining Area under section 74 of the Mining Act, which is due to cease on 16 December 2010. CMPL therefore seeks approval under section 75J of the EP&A Act for the Project to extend beyond this date.

Mining within the existing Development Consent Mining Area can continue indefinitely beyond 16 December 2010 under the Colliery's existing consent. If Project Approval is granted, it will, together with the existing Development Consent, authorise the existing and proposed mining operations at Myuna Colliery.

1.7.1 Preliminary Environmental Assessment

A PEA outlining the proposed Project and background environmental data was submitted to the Director-General on 1 June 2010. This allowed the Director-General to issue appropriate and project specific EARs and the key environmental issues of significance and level of environmental assessment required for the application to be established.

The PEA for the proposed Project identified key issues for assessment in the EA, including:

- Subsidence;
- Air quality;
- Noise;
- Groundwater;
- Surface water (discharge);
- Aquatic ecology (seagrass); and
- Aboriginal heritage.

1.7.2 Environmental Assessment Requirements

This EA has been prepared in accordance with Part 3A of the EP&A Act and its Regulation. Part 3A of the EP&A Act ensures that the potential environmental effects of a proposal are properly assessed and considered in the decision making process.

Under section 75F of the EP&A Act, the EA must be prepared in accordance with the requirements issued by the Director-General of DoP. The Director-General's EARs were issued on 16 July 2010, a copy of which is attached as **Appendix A** to this EA.

The key matters raised by the Director-General for consideration in the EA are outlined in **Table 1**, together with the relevant section of the EA which addresses that matter. A full copy of the EARs for the Project is provided in **Appendix A**.

Table 1 Director-General's Environmental Assessment Requirements

Requirement	Description	Reference in EA
General Requirements	The Environmental Assessment of the project must include: - an executive summary; - a detailed description of the project, including: • need for the project; • alternatives considered, including justification for the proposed mine plan; and • various stages of the project. - a risk assessment of the potential environmental impacts of the project, identifying the key issues for further assessment; - a detailed assessment of the key issues specified below, and any other significant issues identified in the risk assessment (see above), which includes: • a description of the existing environment, using sufficient baseline data; • an assessment of the potential impacts of the project, including any cumulative impacts, taking into consideration any relevant guidelines, policies, plans and statutory provisions (see below); and • a description of the measures that would be implemented to avoid, minimise and if necessary, offset the potential impacts of the project, including detailed contingency plans for managing any significant risks to the environment; - a statement of commitments, outlining all the proposed environmental management and monitoring measures; - a conclusion justifying the project on economic, social and environmental grounds, taking into consideration whether the project is consistent with the objects of the *Environmental Planning* and *Assessment Act* 1979; and - a signed statement from the author of the Environmental Assessment, certifying that the information contained within the EA is neither false nor misleading.	**Executive Summary** **Section 3.1** **Section 3.2** **Section 5.0** **Section 9.0** **Section 10** **Section 10** **Section 10** **Section 11** **Section 13** **Front of EA**

Requirement	Description	Reference in EA
Key Issues	- **Subsidence** - including: • accurate predictions of potential subsidence effects (both systematic and non-systematic, paying particular attention to the long term stability of final pillars) including potential cumulative effects of multi seam mining and a sensitivity analysis; • identification of sensitive receptors potentially affected by subsidence (such as environmental features, and infrastructure) and an assessment of the significance and sensitivity of those receptors; • assessment of the potential impacts of subsidence effects on the natural and built environment, with particular reference to sensitive receptors; • assessment of potential subsidence impacts on Lake Macquarie and its foreshore areas, seagrass beds, riparian zones, wetlands and saltmarshes; • identification of how mine design has been or will be used or adapted to manage and mitigate subsidence impacts; • identification of how predicted and unpredicted subsidence impacts would be rehabilitated, including methodologies and response times; and • identification of further research required to address any uncertainties or information gaps.	**Section 6.0** and **Appendix C** **Sections 2.2** and **6.8** **Section 6.8** and **10.5** **Sections 6.7** and **10.4** **Sections 5.4** and **6.6** **Section 6.8** **Section 6.8**
	- Soil and Water - including: • a detailed site water balance, including a description of site water demands, water supply and disposal methods; • detailed modelling and assessment of potential impacts on: ▪ the quality and quantity of existing surface water and groundwater resources; ▪ affected licensed water users and basic landholder rights; and ▪ the riparian, ecological, geomorphological and hydrological values of watercourses; • a detailed description of the proposed water management system (including all infrastructure and storages) and water monitoring program; • a detailed description of measures to minimise all water discharges, including an investigation of potential water re-use options; and • a detailed description of measures to mitigate surface water groundwater impacts.	**Section 10.12.4** **Section 10.2** and **Appendix G** **Section 10.2** and **Appendix G** **Sections 4.4.6, 5.5** and **10.2** **Section 10.2** **Section 10.2**
	- **Biodiversity** - including: • a detailed assessment of the potential impacts on any terrestrial or aquatic threatened species or populations, their habitats, endangered ecological communities, groundwater dependent ecosystems and benthic communities in Lake Macquarie; • a detailed description of the measures that would be implemented to avoid or mitigate impacts on biodiversity.	**Sections 10.4** and **10.7** **Appendix I** and **Appendix L**

Requirement	Description	Reference in EA
	- **Noise and Vibration** - including a quantitative assessment of potential operational noise impacts.	**Section 10.3** and **Appendix H**
	- **Air Quality** - including a quantitative assessment of potential air quality impacts.	**Section 10.1** and **Appendix F**
	- **Traffic and Transport** - including an assessment of potential impacts to the performance and safety of the local road network.	**Section 10.6** and **Appendix K**
	- **Land Management** - including an assessment of the compatibility of the project with surrounding land uses.	**Sections 2.4** and **10.12.2**
	- **Rehabilitation and Mine Closure** - a detailed description of the proposed rehabilitation and mine closure strategies for the project, having regard to the key principles in *Strategic Framework for Mine Closure,* including: • rehabilitation objectives, methodology, monitoring programs, • performance standards and proposed completion criteria; • decommissioning and removal of surface infrastructure; and • nominated final land uses, having regard to any relevant strategic land use planning or resource management plans or policies.	**Sections 5.6** and **10.12.1**
	- **Heritage** - both Aboriginal and non-Aboriginal.	**Sections 10.8** and **10.9** and **Appendix M**
	- **Greenhouse Gases** - including: • a quantitative assessment of the potential scope 1, 2 and 3 greenhouse gas emissions of the project; • a qualitative assessment of the potential impacts of these emissions on the environment; and • an assessment of all reasonable and feasible measures that could be implemented on site to minimise greenhouse gas emissions and ensure the project is energy efficient.	**Section 10.10** and **Appendix N**
	- **Hazards** - including bushfires.	**Section 10.12.6**
	- **Waste** - including: • accurate estimates of the quantity and nature of the potential waste streams of the project; and • a detailed description of the measures that would be implemented to minimise, handle and dispose of waste on site.	**Section 10.12.5**
	- **Social and Economic** - including a detailed assessment of the costs and benefits of the project as a whole, and whether it would result in a net benefit for the NSW community.	**Section 10.5** and **Appendix J** **Section 10.11** and **Appendix O**
References	The environmental assessment of the key issues listed above must take into account relevant guidelines, policies, and plans. While not exhaustive, the following attachment contains a list of some of the guidelines, policies, and plans that may be relevant to the environmental assessment of this project.	**Noted**
Consultation	During the preparation of the Environmental Assessment, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners. In particular you must consult with: - Department of Environment, Climate Change and Water,	**Section 8.0**

Requirement	Description	Reference in EA
	including the NSW Office of Water; - Industry and Investment NSW; - Mine Subsidence Board; - Department of Transport and Infrastructure; - Dams Safety Committee; - Hunter-Central Rivers Catchment Management Authority; - Lake Macquarie City Council; and - Wyong Shire Council. The consultation process and the issues raised must be described in the Environmental Assessment.	

Written comments were received from relevant statutory agencies identified in the EARs to assist with the preparation of the EA (and are provided in **Appendix A**). **Table 2** below summarises the key issues identified by the statutory agencies together with the relevant section of the EA which addresses the matter.

Table 2 Agency Environmental Assessment Requirements

Issues Raised	Reference in EA
Department of Industry and Investment (I&I) – Minerals and Energy Division	
- The proponent is required to hold appropriate mining title from I&I Mineral Resources.	**Section 4.1**
- The EA should provide sufficient detail on rehabilitation and final land use.	**Section 5.6 and 10.12.1**
- The EA should provide an assessment of subsidence impacts.	**Section 6.0**
Department of Industry and Investment (I&I) – Fisheries	
- The potential impacts of subsidence on the aquatic habitat in Lake Macquarie should be addressed.	**Sections 6.7.4 and 10.4**
NSW Office of Water	
The EA must include the following:	
- General environmental risk analysis.	**Section 9.0**
- An assessment of water supply and interception and extraction against the Water Sharing Plan for the Hunter Unregulated Rivers and Alluvial Water Sources.	**Section 7.2.6**
- Demonstrate the Project is consistent with the principles of the NSW State Rivers and Estuaries Policy, Wetlands Management Policy and relevant groundwater policies.	**Appendix G** and **L**
Department of Environment, Climate Change and Water (DECCW)	
The EA must include the following:	
- Description of the proposal and premises.	**Sections 4.0** and **5.0**
- A detailed Air Quality Impact Assessment.	**Section 10.1** and **Appendix F**
- An assessment of predicted Scope 1, 2 and 3 greenhouse gas emissions.	**Section 10.10** and **Appendix N**
- A comprehensive noise assessment.	**Section 10.3** and **Appendix H**
- An assessment of potential impacts on water quality and quantity.	**Section 10.2** and **Appendix G**
- A description of predicted impacts associated with subsidence.	**Section 6.0** and **Appendix C**
- Details of waste and its classification that would be generated by the proposal.	**Section 10.12.5**
- Details of monitoring programs required during operation of the proposal.	**Section 10.0** and **Section 11.0**

Issues Raised	Reference in EA
- An assessment of threatened species, populations and ecological communities and their habitat, including terrestrial and aquatic ecosystems. - An assessment of Aboriginal cultural heritage values.	**Sections 10.4** and **10.7** **Sections 10.8** and **Appendix M**
Roads and Traffic Authority (RTA)	
Preparation of a traffic and transport study in accordance with RTA's *Guide to Traffic Generating Developments*, including: - Assessment of traffic routes and intersections. - Current traffic counts. - Proposed traffic generation and trip distribution. - Cumulative traffic impacts and road network capacity.	**Section 10.6** and **Appendix K**
Dam Safety Committee	
A portion of the Project Application Area falls within the Notification Area for the Eraring Ash Dam. The Dam Safety Committee will regulate mining within the Notification Area under the *Dams Safety Act 1978* and the *Mining Act 1992*.	Noted Refer **Section 7.0**
Wyong Shire Council	
- An assessment of terrestrial and aquatic ecosystems. - A summary of consultation with relevant stakeholders. - A description of modifications to the Surface Facilities Area. - A description of how subsidence constraints will be achieved. - Consideration of cumulative impacts. - Consideration of greenhouse gas offsets. - Consideration of potential soil contamination impacts. - An assessment of Aboriginal cultural heritage values. - A detailed Air Quality Impact Assessment.	**Sections 10.4, 10.7** and **Appendix I** and **L** **Section 8.0** **Section 5.0** **Section 6.6** **Section 10.14** **Section 10.10.4** **Section 10.12.4** **Sections 10.8** and **Appendix M** **Section 10.1** and **Appendix F**
Mine Subsidence Board	
- Subsidence should be kept to 20 millimetre maximum in Zone A. - New construction / extensions to existing structures will require approval of the MSB.	**Section 6.6** Noted
Eraring Energy	
- A portion of the Project Application Area falls within the Notification Area for the Eraring Ash Dam. Consideration of dam safety is required. - Subsidence impacts on the Enclosed Overland Conveyor should be considered. - Subsidence impacts on seagrass beds in the Lake should be considered.	**Section 7.2** **Section 6.5.3** **Section 10.4** and **Appendix I**

1.7.3 Stakeholder Consultation

During the preparation of this EA, key stakeholders were consulted, including local community groups and key local, State and Federal Government agencies. Throughout the preparation of the EA, these stakeholders have been kept informed of the progress of the Project. Further details regarding stakeholder consultation are provided in **Section 8.0**.

1.7.4 Purpose of this Report

The purpose of this report is to describe the proposed Project and address the EARs as required under section 75E of the EP&A Act. The EA assesses the environmental, social and economic effects of the proposed Project and identifies the measures necessary to manage any adverse environmental impacts, to allow the PAC to make an informed decision with regard to the approval of the Project.

1.8 Structure of this Environmental Assessment

This EA is generally structured as follows:

- **Section 1.0** provides an introduction to the Project, including information about the applicant, the Project context, the need for the Project and the approvals regime.
- **Section 2.0** provides the site context and location of current operations, as well as a brief description of the land uses and ownership surrounding Myuna Colliery.
- **Section 3.0** provides information on the need for the Project and outlines the alternatives that were considered by CMPL during the development of the Project Application.
- **Section 4.0** describes the existing operations at Myuna Colliery.
- **Section 5.0** describes the proposed extension of mining operations at Myuna Colliery and the scope of the Project Application.
- **Section 6.0** outlines the proposed mining methods, reviews the predicted subsidence from the extension of mining activities at Myuna Colliery and outlines the potential effects on the surrounding environment.
- **Section 7.0** describes the approval pathway and legislative context for the proposed Project.
- **Section 8.0** describes the consultation process undertaken in accordance with the EARs.
- **Section 9.0** provides an identification of the key environmental issues identified in the risk assessment, PEA and EARs, and their prioritisation.
- **Section 10.0** provides an assessment of the potential impacts of the proposed Project on key environmental issues and outlines mitigation measures to be implemented at Myuna Colliery. Key environmental issues include air quality, groundwater, aquatic ecology, acoustic impacts, social impacts, greenhouse gas, terrestrial ecology, Aboriginal and European heritage, surface water, economic, traffic and transport, and cumulative impacts. The residual environmental consequences of the proposed Project is also discussed.
- **Section 11.0** Statement of Commitments – details the Statement of Commitments (SoC) proposed for the Project.
- **Section 12.0** Project Justification – details the reasoning for the Project with respect to the principles of Ecological Sustainable Development (ESD).
- **Section 13.0** provides a summary of findings and a conclusion to the EA.

2.0 Site and Context

2.1 Site Description and Land Ownership

The Project Application Area is predominately positioned beneath Lake Macquarie, which is NSW Government Crown land and is used primarily for recreational purposes. The Project Application Area also extends under the suburbs of Arcadia Vale, Wangi Wangi, Myuna Bay, the Morisset Peninsula, Point Wolstoncroft, and to a lesser extent, under the suburbs of Coal Point, Fishing Point and Rathmines. Other land ownership includes Crown land and freehold land, including land owned by Centennial Fassifern Pty Ltd and Eraring Energy. Land ownership within the project Application Area is shown on **Figure 2.1**.

Myuna Colliery's Surface Facilities Area is situated on land owned by Centennial Fassifern Pty Ltd, a sister company of CMPL. Myuna Colliery's Surface Facilities Area is located on Wangi Point Road, west of the residential area of Arcadia Vale and north-west of Wangi Wangi. Infrastructure at the Surface Facilities Area is located approximately 0.5 kilometres from the nearest receiver at Wangi Wangi. The Surface Facilities Area provides access to the underground workings, and is the site of mine infrastructure including the Coal Handling Plant (CHP), workshop, administration building, water management infrastructure, emergency coal stockpile, portal, buildings, rotary breaker, storage areas, roads, substation and non-mined owned infrastructure. The mine infrastructure at the Surface Facilities Area is surrounded by vegetated ridgelines, and is adjacent to the site of the former Wangi Power Station.

The Enclosed Overland Conveyor, which is owned and operated by Eraring Energy as described in **Section 4.4.2**, is located to the north-west of the Surface Facilities Area. The Enclosed Overland Conveyor is situated on land owned by Eraring Energy, the State of NSW (Crown land) and Centennial Fassifern Pty Ltd.

Parkland areas to the south-west of the Surface Facilities Area along the foreshore of Myuna Bay form part of the Lake Macquarie State Conservation Area which is reserved under the *National Parks and Wildlife Act 1974* and is managed by the NSW National Parks and Wildlife Service (NPWS), and discussed further in **Section 2.2.1**.

2.2 Surface Features of the Project Application Area

The surface features of the Project Application Area comprise both natural and man-made features, generally as described in the following sections.

2.2.1 Natural Features

The Project Application Area includes a range of natural surface features, including Lake Macquarie and other watercourses, and sections of foreshore area which form part of the Lake Macquarie State Conservation Area. These natural surface features are shown on **Figure 2.2** and described in the following sections.

Watercourses

Lake Macquarie, a large coastal lake in New South Wales, has an open water area of 115.1 square kilometres, a perimeter of 196.15 kilometres (OzCoasts, 2010), and supports a range of aquatic ecosystems and recreational uses. Lake Macquarie is a wave-dominated estuary, meaning the estuary has a high sediment trapping efficiency, naturally low turbidity and salt wedge/partially mixed circulation where there is likely to be sedimentation (OzCoasts, 2010). The lake bed is generally flat, averaging 7 metres in depth though deepens to approximately 11 metres in places. The total catchment area is 786 square kilometres (OzCoasts, 2010) and falls under the jurisdiction of the Hunter-Central Rivers Catchment Management Authority (CMA). The estuary is 24 kilometres long, from north to south and 3.2 kilometres at its widest point from east to west (Cardno Ecology Lab, 2010).

Two watercourses are located in the northern portion of the Project Application Area, Sawmill Creek and Wangi Creek, which drain into Lake Macquarie. Wangi Creek directly traverses the Surface Facilities Area. Postmistress Creek and its tributaries and several other unnamed creeks traverse the Morisset Peninsula within the southern portion of the Project Application Area.

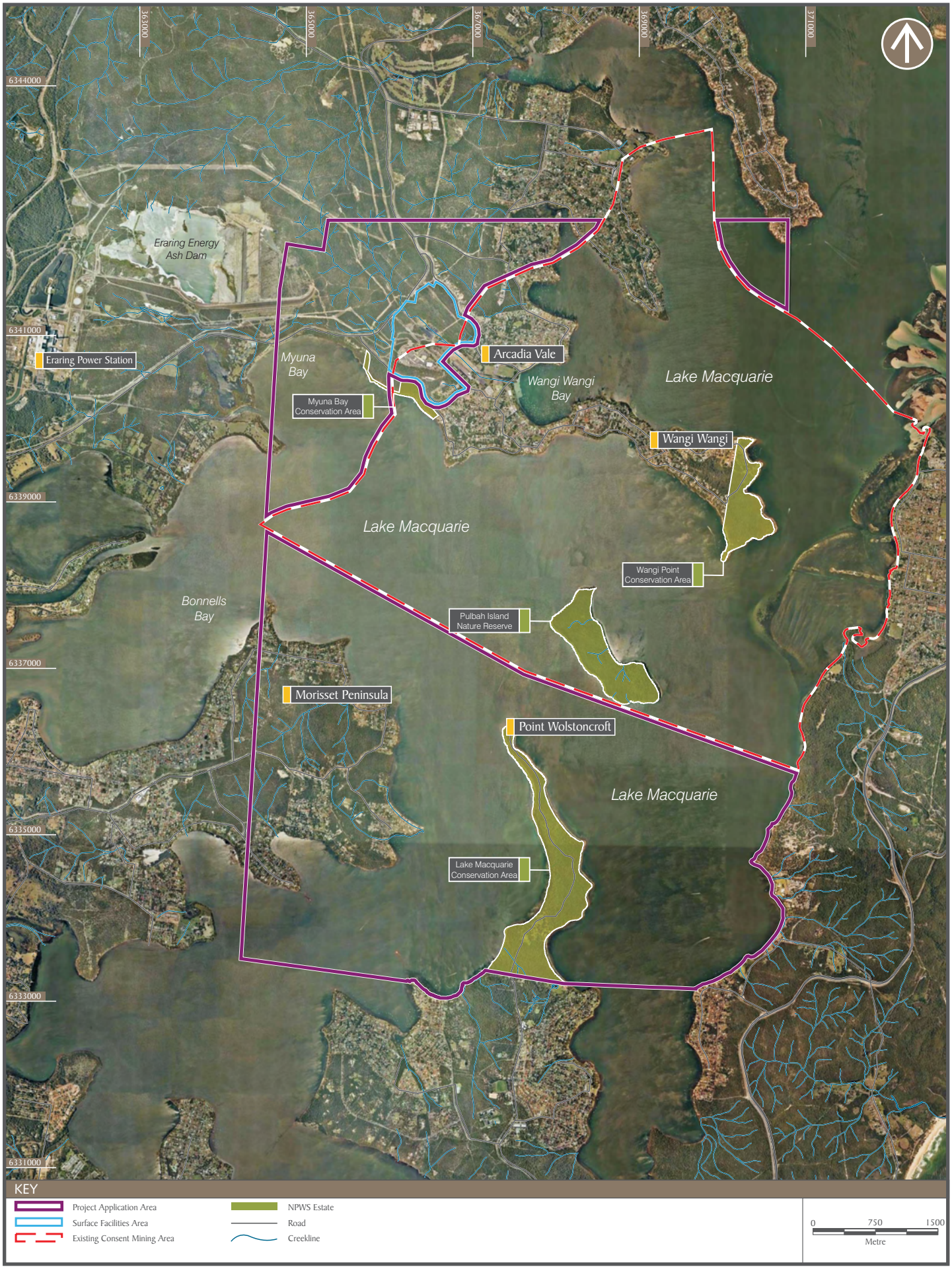
AECOM

LAND OWNERSHIP

Centennial Myuna Pty Ltd

Environmental Assessment

Figure 2.1



AECOM

NATURAL SURFACE FEATURES

Centennial Myuna Pty Ltd

Environmental Assessment

Figure 2.2

Lake Macquarie State Conservation Area

Point Wolstoncroft and portions of the foreshore of Myuna Bay within the Project Application Area form part of the Lake Macquarie State Conservation Area, which is managed by the NPWS.

The Lake Macquarie State Conservation Area includes some 16 kilometres of foreshore vegetated areas and open spaces in six different sections around Lake Macquarie which provide important habitat for native flora and fauna species (NPWS, 2005).

Point Wolstoncroft comprises a narrow peninsula of 107.8 hectares with 6 kilometres of foreshore on the south-eastern shore of Lake Macquarie. The NSW Department of Sport and Recreation manages a portion of the Point which contains a sport and recreation centre.

Eleven hectares and 1.1 kilometres of foreshore at Myuna Bay are conserved within the Lake Macquarie State Conservation Area, of which a portion is contained within the Project Application Area.

2.2.2 Man-Made Surface Features

The Project Application Area comprises portions of vegetated and built up areas, including the residential suburbs of Arcadia Vale, Morisset Peninsula, Coal Point, Fishing Point and Rathmines.

The built up areas of the Project Application Area incorporate man-made surface features and infrastructure such as roads, bridges, sewer and water pumping stations, pipelines, fibre optic cables and electrical transmission lines. The Pacific Highway is the closest major transport route, located on the eastern side of Lake Macquarie, one kilometre east of the Project Application Area. Main roads within the Project Application Area include Fishery Point Road in the south-west and Wangi Road and Summerhill Drive in the north.

Other major man-made surface features within the Project Application Area, shown on **Figure 2.3**, include (but are not limited to):

- Eraring Energy owned Enclosed Overland Conveyor;
- A portion of the Eraring Energy Ash Dam and its Notification Area. The Notification Area, which has been gazetted under section 369 of the Mining Act, is prescribed by the NSW Dam Safety Committee, and is an area in which certain activities (including underground mining and lease applications) are required to be referred to the Dams Safety Committee. The Notification Area surrounds the Eraring Ash Dam, a prescribed dam under the Mining Act and schedule 1 of the *Dams Safety Act 1978*; and
- Point Wolstoncroft Sport and Recreation Centre.

2.3 Geology and Soils

Myuna Colliery is located in the northern portion of the Sydney Basin. The coal deposits within its mining tenements belong to the late Permian Age Newcastle Coal Measures. Myuna Colliery currently mines within the Wallarah, Great Northern, and Fassifern seams of the Newcastle Coal Measures.

To date, geological exploration at Myuna Colliery has primarily targeted the Wallarah, Great Northern and Fassifern seams. An indicative cross-section of the stratigraphy of the Wallarah, Great Northern and Fassifern seams which will be mined as part of the proposed Project is shown in **Figure 2.4.**

The Wallarah seam occurs at the top of the Newcastle Coal Measures and is the uppermost coal horizon in the region. The Wallarah seam extends across the majority of ML 1370. Isopachs of the seam indicate a pattern of coal thickness between 2 to 3 metres and the ash of the typical working section being approximately 12% to 16%, however the roof and floor of the geological seam are likely to present a variety of working conditions. The grade of the seam is generally less than 1 in 30, outcropping to the east. The remaining mineable reserves in the Wallarah seam are at an average depth of 80 metres and are primarily located in the south of the Project Application Area with a smaller resource under Wangi Peninsula.

The Great Northern seam lies below the Wallarah seam and ranges from less than 2 metres to more than 4 metres in thickness but generally varies between 2.5 to 3 metres. The seam typically has a strong roof although there are some limited areas where rock is replaced by shale, mudstone, or tuffaceous siltstones. The seam is underlain by a variable thickness of tuffaceous siltstones and claystones.

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MAN-MADE SURFACE FEATURES

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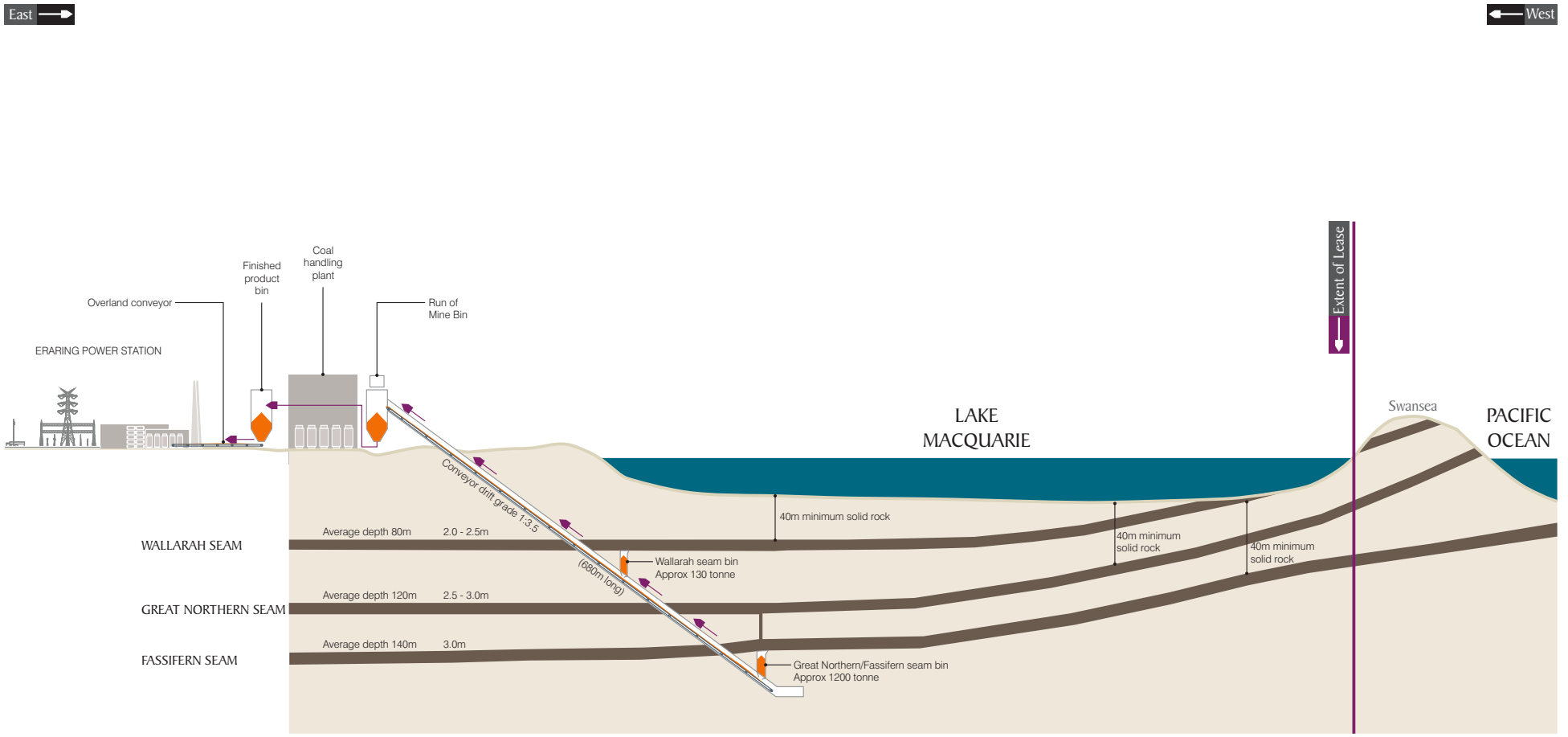
Environmental Assessment

Figure 2.3



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COAL SEAM STRATIGRAPHY

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Figure 2.4

The continuity of the Great Northern seam is limited by a north south zone of deterioration and splitting, which underlies a similar zone in the Wallarah seam. The Great Northern seam has an average depth of 120 metres, rising to the east and outcropping on the Swansea Peninsula.

The Fassifern seam is the most extensive coal reserve within the Myuna Colliery mining tenements and, by virtue of its thickness and banded nature, offers a variety of working sections. The Fassifern seam has an average depth of 140 metres and rises in the east to outcrop under the Pacific Ocean.

There are four named conglomerate stratigraphic units in the sequence above the Fassifern Seam in the Project Application Area:

- Karingal Conglomerate between the Fassifern and the Great Northern Seams;
- Teralba Conglomerate between the Great Northern and Wallarah Seams;
- Karignan Conglomerate between the Wallarah and Vales Point Seams; and
- Munmorah Conglomerate in the overlying Narrabeen Group.

The most massive units are in the Teralba Conglomerate, however there is a wide variation in thickness. Where the Karingal unit is thicker, the Teralba unit tends to be thinner. The Munmorah Conglomerate is present at relatively shallow depths and parts of it may be weathered, and other parts may subcrop under Lake Macquarie (Seedsman Geotechnics Pty Ltd, 2010). The geological units of the Project Application Area are shown in **Figure 6.1**.

The soil landscapes within the Project Application Area are characterised by the Awaba, Doyalson and Wyong Soil landscapes. Awaba and Doyalson are erosional landscapes while Wyong comprises poorly drained deltaic floodplains and alluvial flats. Soils in the Wangi area are classified under the *Lake Macquarie to Gosford 1:100,000 Map Sheet* as part of the Awaba erosional landscapes. Soils in this area are typically shallow and gravelly, and are generally of moderate to low erodibility that vary in type from gravelly loam to well structured plastic clays. In contrast, the Wyong soil landscape, on Quaternary sediments, is situated on poorly drained floodplains with low slope. Low lying slightly elevated terraces are sometimes present. This soil type is commonly associated with drainage lines on the lake edge (Murphy 1993).

Bore logs of the area were completed during exploration at Myuna Colliery. These concentrated mainly on underlying geology, but revealed that the parent material for surface sediments is a conglomerate.

2.4 Surrounding Land Uses

Land uses surrounding the Project Application Area shown on **Figures 2.1** and **2.2** include:

- **Residential** – residential land uses include the suburbs of Morisset and Eraring to the west, Wangi, Swansea and Belmont to the east, Toronto and surrounds to the north, and Gwandalan and Mannering Park to the south. Residential land uses fringe much of the perimeter of Lake Macquarie. A bushland buffer (owned by Centennial Fassifern Pty Ltd) of at least 500 metres separates the Surface Facilities Area from the residential areas of Wangi Wangi and Arcadia Vale to the east and south of the infrastructure of the Surface Facilities Area, respectively. The Surface Facilities Area is surrounded by vegetated ridgelines and is immediately adjacent to the disused Wangi Power Station. A rezoning application for the Wangi Power Station, at 80 Donnelly Road Arcadia Vale, was approved on 14 July 2010. The site has been rezoned as Zone B4 Mixed Use Zone, which permits a range of development including residential and mixed use development. This rezoning is required to consider and mitigate against any potential impacts associated with the operation of the Colliery.
- **Nature Reserves and State Conservation Areas** –Morisset, Pulbah Island, Wangi Point (refer **Figure 2.2**), Awaba Bay, and Chain Valley Bay Conservation Areas, and Moon Island Nature reserve (located at the entrance to Lake Macquarie east of Swansea Heads) form part of the Lake Macquarie State Conservation Area.
- **Forestry, Coal Mining and Electricity Generation** – natural resources surrounding the Project Application Area include timber production within Awaba State Forest, bordered by Heaton and Watagan State Forests to the north, coal extraction at a number of collieries underneath and surrounding Lake Macquarie including Chain Valley, Mandalong Mine, Awaba, Mannering, Cooranbong and Newstan Collieries. With the proximity of coal resources, power generation is also a significant industry in the Lake Macquarie Area, with Eraring

Power Station located immediately to the west of the Project Application Area, and Vales Point and Munmorah Power Stations located to the south.

- **Recreation** – Lake Macquarie itself is a significant recreation resource within the area, with activities including recreational fishing, boating, water-skiing and bathing. There are approximately 2149 berths for vessels and four ramps within the estuary. Camping and caravan reserves along the shoreline provide holiday and semi-permanent accommodation for visitors (Cardno Ecology Lab, 2010).

2.5 History of Operations

Myuna Colliery was developed in order to provide a source of economically extractable coal for Eraring Power Station (Newcom Collieries Pty Ltd, 1977), located approximately 5 kilometres to the west of the Surface Facilities Area (refer to **Figure 1.2**). Construction of Eraring Power Station commenced in 1977, and it was consequently expected that coal consumption at the Power Station would reach 3 Mtpa by 1984. It was proposed that part of the coal supply would be met by two new underground coal mines; Myuna and Cooranbong.

Consent for the development of the Myuna and Cooranbong collieries was granted consent (SH 110/148) on 15 December 1977, and development was subject to certain conditions stipulated in the Development Consent (refer to **Appendix B**). Commencement of the development of Myuna Colliery began in August 1979.

Coal production commenced at Myuna Colliery in 1982 at an average rate of 1.3 Mtpa of Run of Mine (ROM) coal and up to 6,000 tonnes per day. Extraction of coal and associated mining activities at Myuna Colliery has been undertaken in three coal seams (Wallarah, Great Northern and Fassifern) using bord and pillar miner methods. The primary method of coal extraction throughout the history of Myuna Colliery has been first workings bord and pillar mining. Pillar extraction has also been undertaken, involving the removal of narrow panels to recover coal with controlled surface subsidence.

The 1977 Development Consent remains in force and authorises the extraction of coal within the existing Development Consent Mining Area. Cooranbong operates as part of Mandalong Colliery, operated by Centennial Mandalong Pty Limited. Operations at Cooranbong Colliery do not form part of this Project Application.

3.0 Project Need and Alternatives

3.1 Need for the Project

Myuna Colliery has been operating within the Development Consent Mining Area since 1979 with coal extraction commencing in 1982. Coal extraction has been carried out under the existing Development Consent granted in 1977 and under existing mining leases and s74 of the Mining Act beyond this area. Mining within the lease areas of the Project Application Area outside the existing Development Consent Mining Area would continue but for the repeal of s74 of the Mining Act on 16 December 2010.

Project Approval is required to ensure Myuna Colliery maximises the extraction of coal under its existing mining lease. Without such an approval, mining would be restricted to within the Development Consent Mining Area. Cessation of mining at Myuna Colliery would result in early mine closure after approximately five years, the loss of some 175 jobs and the sterilisation of approximately 37 million tonnes (Mt) of the coal resource.

If approved, the proposed Project will continue to provide employment for the existing 175 employees as well as providing employment for an additional 35 direct employees (and approximately 241 indirect) for a further 21 years (Gillespie Economics, 2010). Additional wages, royalties and flow-on effects with a net benefit of $222M will be injected into regional and State economies as a result of the proposed Project over its 21 year life (Gillespie Economics, 2010).

Myuna Colliery is located 5 kilometres east of Eraring Power Station and will continue to supply coal by the Eraring Energy owned Enclosed Overland Conveyor.

3.2 Alternatives Considered

CMPL has undertaken various internal studies based on a risk assessment approach. Consideration was given to maximising coal recovery within the existing mining tenements and maintaining operational flexibility, while at the same time, minimising environmental and social impacts.

Several mining scenarios were considered relevant to Myuna Colliery's status as an existing, operational underground coal mine, which are discussed as follows. A mine plan or extraction plan has not been prepared for the proposed Project as part of this EA, rather the subsidence limits and mine planning process which will dictate the future mine plan have been identified.

3.2.1 Option 1 – Maximum Production Scenarios

Various annual production limits of between 1.3 Mtpa and 2 Mtpa were considered when determining the production capacity to be sought. An increase in production above 2 Mtpa will require an upgrade to the existing CHP and equipment, rather than utilising the capabilities of the existing infrastructure which currently has the capacity to produce up to 2 Mtpa. A production limit of up to 2 Mtpa was considered appropriate to restrict potential environmental impacts and site infrastructure to that which currently exists at the Surface Facilities Area.

3.2.2 Option 2 – Alternative Coal Extraction Methods

Several options were considered in relation to conducting partial and full pillar extraction using continuous miners. Full pillar extraction was discounted below land due to the potential for significant subsidence and related environmental and social impacts.

For multiple seam mining under Lake Macquarie caving partial pillar extraction systems were discounted due to the potential for significant environmental impacts on the Lake bed.

Full pillar extraction resulting in surface subsidence zones of between 1,350 millimetres and 2,500 millimetres was also considered as part of the Project. Surface subsidence of greater than 20 millimetres (i.e. noticeable surface impact) and greater than 650 millimetres under the bed of Lake Macquarie were rejected by CMPL, based on the potentially significant impacts resulting from these subsidence levels.

3.2.3 Option 3 – Do Nothing

Without Project Approval, the extraction of coal within the Project Application Area cannot continue beyond 16 December 2010, sterilising approximately 37 Mt of coal resource and leading to the premature loss of 175 jobs and early mine closure.

Without Project Approval, mining could continue under the Colliery's existing 1977 Development Consent (SH 110/148) within the Development Consent Mining Area, however the remaining coal reserves within this area would be exhausted within approximately 5 years (refer to **Table 3**).

Table 3 Future Mining under the Existing 1977 Development Consent

Year of Future Production	Approximate Annual Coal Production (Mtpa)
Yr 1 2011	1.3
Yr 2 2012	1.3
Yr 3 2013	1.3
Yr 4 2014	0.8
Yr 5 2015	0.4

Source: Gillespie Economics, 2010

3.3 Consequences of Not Proceeding

As outlined above, without Project Approval or by adopting the 'Do Nothing' option the Colliery could close within 5 years and:

- 37 Mt of coal resource could be sterilised;
- the existing 175 jobs would be lost; and
- an additional 35 direct and 241 indirect jobs would not be created.

Should the proposed Project not proceed, there would be no added stimulus to the regional economy and the skills and expertise of the existing and potential workforce would not be utilised, which would result in the existing workforce having to seek alternate employment.

Specifically, not proceeding with the proposed Project would forego the following contributions to the regional economy:

- $159M in annual direct and indirect regional output or business turnover;
- $71M in annual direct and indirect regional value added;
- $53M in annual household income; and
- A total of 451 direct and indirect jobs regionally, including 175 existing jobs, 35 potential future jobs, and 241 indirect jobs (Gillespie Economics, 2010).

At the State level, not proceeding with the proposed Project would sacrifice the following contributions to the economy:

- $222M in annual direct and indirect output or business turnover;
- $104M in annual direct and indirect value added;
- $71M in annual direct and indirect household income; and
- 732 direct and indirect jobs (Gillespie Economics, 2010; see **Appendix N**).

The impacts on the NSW State economy are greater than for the regional economy, as the NSW economy captures mine and household expenditure both within the regional economy and the wider NSW State economy, and there is a greater level of intersectoral linkages in the larger NSW economy.

4.0 Existing Operations

4.1 Existing Licenses and Approvals

The existing Development Consent approves:

- Underground coal extraction in the Wallarah, Great Northern and Fassifern seams within the Development Consent Mining Area, by bord and pillar methods;
- Average ROM coal production of 1.3 million tonnes per annum (Mtpa);
- Two ventilation shafts;
- The employment of staff for the operation of each of the Myuna and Cooranbong Collieries to total up to 350 personnel;
- The transport of employees, materials and equipment to the underground workings by a drift comprising a rail track;
- The transport of coal from the underground workings to the CHP by a drift comprising a belt conveyor;
- The construction and operation of coal handling and support infrastructure within the Surface Facilities Area;
- The construction and use of a 33kV transmission line for power supply; and
- The transport of coal from Myuna Colliery by a three flight conveyor (the Enclosed Overland Conveyor) to Eraring Power Station.

CCL 762 confers the right to mine at various surface and depth restrictions, most relevantly:

- The strata between the depth of 20 metres below the surface and 5 metres below the floor of the Fassifern seam; and
- The strata between the depth of 30 metres below the bed of Lake Macquarie and 5 metres below the floor of the Fassifern seam.

ML 1370 confers the right to mine at various surface and depth restrictions, most relevantly:

- The strata between the depths of 15.24 metres below the bed of Lake Macquarie and 61.02 metres below Australian Height Datum (AHD);
- The strata between the depths of 15.24 metres below the bed of Lake Macquarie and 91.50 metres below AHD;
- The strata between the depths of 15.24 metres below the surface of the land and 91.50 metres below AHD;
- The strata between the depth of 15.24 metres below the surface of the land and 121.98 metres below AHD; and
- The Strata between the depths of 15.24 metres below the bed of Lake Macquarie and 121.98 metres below AHD.

The approvals, authorities and licences pursuant to which Myuna Colliery operates are outlined in **Table 4.**

Table 4 Myuna Colliery Approvals, Authorities and Licences

Title	Description	Date Granted	Expiry
Development Consent	Development of the Myuna and Cooranbong Collieries, as described in the EIS and subject to certain conditions	21/12/1977	No expiration date specified in the consent. Subject to renewal of mining leases
Environment Protection Licence (EPL) 366	Licence authorising discharges to water and Mining for Coal at a rate of 0.5 – 2 Mtpa	01/01/2000	N/A
CCL 762	A title including the area originally comprised in CL 195 for coal or mining purposes of approximately 10,820 hectares	CL 195 granted 8/8/1979, consolidated into CCL 762 in 1991	Renew 13/10/2022
MPL 334	Title to construct and operate prescribed mine related plant and infrastructure of approximately 33 hectares	20/10/1994	Renew 20/10/2015
ML 1370	Title that provides rights to mine the coal resource of approximately 635 hectares	26/9/1995	Renew 02/12/2016
Exploration Licence (EL) 4444	Licence granted to allow exploration to be undertaken to determine the occurrence and extent of the coal resource and to assess the potential for mining of approximately 5,164 hectares	23/10/1992	Renew 23/10/2012
Trade Waste Permit (D 171027)	Permits the discharge of 'prohibited substances' to sewer in accordance with various quality requirements	26/10/1995	N/A
Section 151 Licence (CCHR0910-04)	Installation and Monitoring of Surface Subsidence Stations at Point Wolstoncroft	10/9/2009	Licence currently being renewed
Water Access Licence	Licensing of three existing dewatering bores at the Surface Facilities Area	Licence currently being sought	N/A

4.2 Mining Operations

Underground coal mining has been conducted at Myuna Colliery since 1982. Myuna Colliery has development consent to produce an average of 1.3 Mtpa of ROM coal at an average rate of up to 6,000 tonnes per day in respect of mining within the Development Consent Mining Area.

Coal has been recovered from the three seams (Wallarah, Great Northern, and Fassifern) using bord and pillar systems and partial pillar extraction. The majority of mining has been conducted under Lake Macquarie leaving at least 40 metres of solid rock head. **Figure 1.2** shows the extent of previous workings within all seams.

Mining has been undertaken within both the existing 1977 Development Consent Mining Area, as well as some areas outside the Development Consent Mining Area within CCL 762 and ML 1370.

On rare occasions over its history, Myuna Colliery has been required to undertake underground shot firing operation when intrusions such as volcanic dykes impede the mine workings.

4.3 Subsidence Monitoring

Subsidence surveys at Myuna Colliery are undertaken in accordance with the requirements of the Survey and Drafting directions for Mine Surveyors (NSW-Coal, 2007) and previous versions of this direction. Various subsidence monitoring programs have been carried out at the Colliery to monitor subsidence within the High Water Level Subsidence Control Zone (HWLSCZ), including at Wangi Wangi, Wangi North, Wangi South, and Point Wolstoncroft. The maximum vertical subsidence measured in these areas to date has been less than 20 millimetres.

A monitoring program has been in place to collect data on surface movement induced by previous mining at Myuna Colliery within the HWLSCZ and under the land. The results indicate negligible surface subsidence impacts for first workings (i.e. less than 20 millimetres vertical subsidence) (Seedsman, 2010). Subsidence monitoring programs in these areas continue to show negligible subsidence of less than 20 millimetres (Seedsman, 2010).

4.4 Surface Facilities Area

The Surface Facilities Area illustrated in **Figure 4.1** comprises:

- Mine Infrastructure:
  - Men and materials portal;
  - Conveyor drift portal;
  - Drive houses;
  - Up-cast ventilation shaft and fan-house;
  - Downcast ventilation shaft;
  - Road ballast and concrete bore holes with associated infrastructure;
  - Power Factor Correction Banks;
  - Diesel and Oil Tanks;
  - Water storage tanks; and
  - Emergency Coal Stockpile Area.
- Coal Handling Plant:
  - Breaker and crusher groups, feeders and coal storage bins (ROM bin and Final Product Bin); and
  - Surface conveyor systems.
- Workshop and administration infrastructure:
  - Workshop, store and wash down facilities;
  - Material yard and equipment/oil and gas stores;
  - Materials reclaim area;
  - Administration offices and bath house;
  - Air compressors and associate infrastructure;
  - Service bay;
  - Hardstand areas, haul roads, car-parking areas and emergency heli-pad;
  - Explosives magazine; and
  - Fire station and associated fire fighting equipment.
- Pollution control infrastructure:
  - Wash down bay oil/water separator;
  - Primary settlement tank (sump);

- Emergency Coal Stockpile Sediment Dam and pump-house;
- Dust suppression system at the CHP and coal stockpile area;
- Sewerage treatment plant and associated infrastructure; and
- Hydrocarbon recycling depot.

- Water management Infrastructure, described in **Section 4.4.6**.

4.4.1 Coal Handling Preparation

ROM coal produced at Myuna Colliery is transferred from the underground workings to the CHP. Coal is initially delivered to the surface ROM bin by a number of underground conveyors. ROM coal is then fed through a primary screen before being transported to a rotary breaker for initial breaking. From the rotary breaker, the coal travels through three feeders and three screens, into three crushers. Once the coal has travelled through the crushers, coal with a final product size of generally less than 40 millimetres is loaded into the Final Product bin. From the Final Product bin, coal is loaded onto the Eraring Energy owned Enclosed Overland Conveyor and delivered to the Eraring Power Station.

In the event of break downs or servicing of the Enclosed Overland Conveyor, Myuna Colliery temporarily stores coal in a dedicated stockpile area in the north of the Surface Facilities Area (as shown on **Figure 4.1**). Coal is recovered from the stockpile by front end loader, loaded onto trucks and dumped into a CHP reclaim hopper for transportation to Eraring Power Station by the Enclosed Overland Conveyor as required.

4.4.2 Transport

Staff arrive at the Surface Facilities Area by private vehicles using the local road network. Personnel and materials are transported underground from the Surface Facilities Area to the pit bottom by a combination of rail mounted drift winders and mobile vehicles.

Coal produced by Myuna Colliery is supplied directly to Eraring Power Station by the Enclosed Overland Conveyor. Approval for Eraring Energy's Enclosed Overland Conveyor is provided by section 21 of the *Eraring Power Station Act 1981*.

4.4.3 Rejects Management

As Myuna Colliery does not wash ROM coal, there is no coal reject material produced on site. A negligible amount of waste rock from the CHP is stored on site.

4.4.4 Other Infrastructure

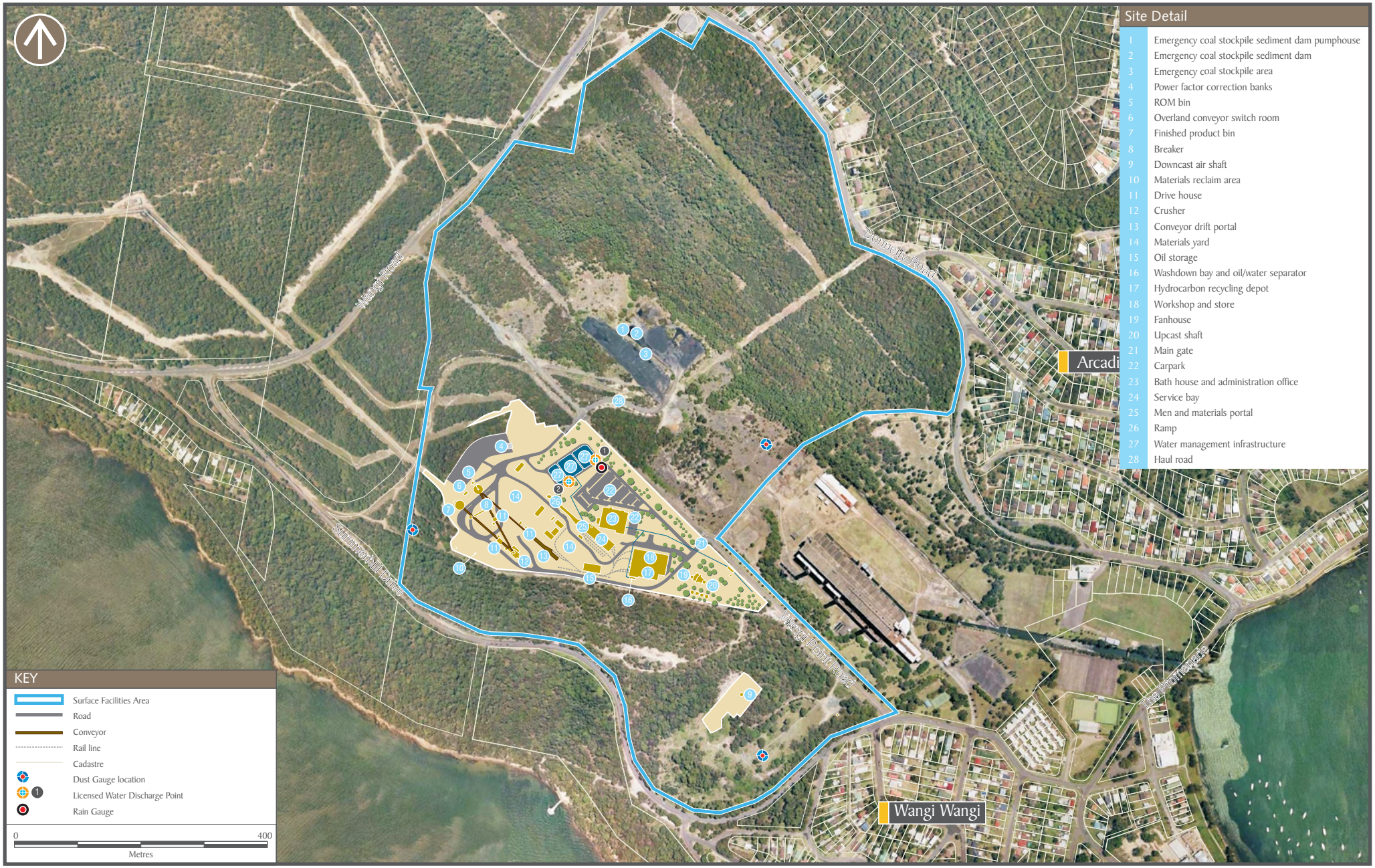
Non-mine infrastructure, located at the Surface Facilities Area includes:

- Enclosed Overland Conveyor (Eraring Energy owned);
- Potable water supplies (Hunter Water Corporation) from Toronto and Wangi Wangi reservoirs;
- Overhead transmission lines (Energy Australia) (including 11kV and 33kV power supplies);
- EnergyAustralia 33kV substation;
- Telecommunications (Telstra) network cabling; and
- Hunter Water sewage system (Hunter Water Corporation).

The location of the Enclosed Overland Conveyor and EnergyAustralia 33kV substation is shown in **Figure 4.2**.

4.4.5 Plant and Equipment

Myuna Colliery currently utilises continuous miners for coal extraction. A range of other ancillary equipment both in the underground workings and Surface Facilities Area are also used.



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SURFACE FACILITIES AREA - MINE INFRASTRUCTURE

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Environmental Assessment

Figure 4.1

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SURFACE FACILITIES AREA - NON MINE INFRASTRUCTURE

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Environmental Assessment

Figure 4.2

4.4.6 Water Management

Myuna Colliery's Surface Facilities Area is located in proximity to Wangi Creek which is a heavily modified waterway as a result of the Wangi Power Station outflow canal. Myuna Colliery's existing water management system discharges water to Wangi Creek through two discharge points licensed under the Colliery's EPL 366, namely Licensed Discharge Points (LDP) LDP001 and LDP002.

The primary water management infrastructure at the Surface Facilities Area is shown on **Figure 4.3** and includes:

- CHP Dam which receives water from both clean and dirty water catchment areas;
- Mine Water Settling Ponds 2 and 3;
- Drive-in primary settlement tank;
- Licensed Discharge Points – LDP001 (on the weir of Mine Water Settling Pond 3) and LDP002 (on the weir of the CHP Dam);
- First flush settlement tank;
- Sewerage treatment plant;
- All drains associated with water management on site; and
- Emergency Coal Stockpile Sediment Dam.

Water management at the Surface Facilities Area is primarily achieved through the separation of clean and dirty water:

- **Clean water management** - includes diversion of external catchment runoff through a series of clean water diversions which direct the flow of surface water from clean catchments away from dirty catchment areas, and the management of clean surfaces within the surface facilities area. Clean surfaces managed within the Surface Facilities Area include:
    - Roof runoff from the administration, bathhouse and workshop buildings, which is collected through downpipes and directed to the piped stormwater network, into the first flush settlement tank, eventually discharging into an open channel which drains to Wangi Creek.
    - Runoff from several clean hardstand areas including the car park and materials yard. To maintain these hardstand areas as clean catchments, regular sweeping is undertaken and these areas are also regularly inspected to ensure that they remain clean. This runoff is discharged through the first flush settlement tank eventually discharging into an open channel which drains to Wangi Creek.
    - External catchment runoff from areas surrounding the Surface Facilities Area. There are limited clean water diversions currently in place (refer **Section 10.2.2**). External catchment runoff flows into Wangi Creek.
- **Dirty water management** - includes the capture of water from disturbed surfaces and a series of dirty water diversions which direct flow of dirty water to the dirty water management system. Dirty water sources include:
    - Runoff from the CHP and storage yard is directed through a series of open drains, diversions, collection sumps and pipes to the primary settlement tank, which then discharges into the CHP Dam.
    - Runoff captured from the Emergency Coal Stockpile Area within the Emergency Coal Stockpile Sediment Dam. Water levels in the Emergency Coal Stockpile Sediment Dam are monitored, and water is transferred to Mine Water Settling Pond 2 as required through bi-directional pipeline and pumping mechanism. Water from Mine Water Settling Pond 2 flows to Mine Water Settling Pond 3 through a connecting weir, prior to discharge through LDP001 to Wangi Creek. In the event that the capacity of the Emergency Coal Stockpile Sediment Dam is exceeded, ponding extends into the broader Emergency Coal Stockpile Area. There is also a discharge point (that contributes to Wangi Creek) from this dam in the event of an extreme rainfall event (in excess of 80 millimetres in 24 hours), accompanied by a failure of the pumping mechanism.
    - Runoff from the washdown bay is directed to the oil/water separator and tank. Water from the oil/water separator is pumped to sewer in accordance with a Trade Waste Permit from Hunter Water Corporation.

- **Underground water management system** – The underground water management system comprises a range of large settlement areas and treatment processes with pumps operating in different coal seams. Water quality treatment through settling is carried out underground. Once the water has been settled underground, it is then pumped to the surface at a rate predetermined for appropriate blending. A small volume of underground water is siphoned from the initial surface pond into the CHP Dam. The majority and remaining underground water is pumped through Mine Water Settling Ponds 2 and 3 before discharging through LDP001 (shown on **Figure 4.3**).

Water management infrastructure includes a system of sedimentation dams, settling ponds, oil water separators and clean water diversions.

Other Water Management Infrastructure

Other water management infrastructure located at the Surface Facilities Area includes:

- Monitoring equipment for discharges;
- Dewatering bores; and
- Stormwater infrastructure including drains.
- Sewerage connections and drainage on site.

With the exception of the Trade Waste and sewage, all other water systems deliver water to Wangi Creek through the two LDPs. Wangi Creek discharges into Lake Macquarie at Wangi Bay.

4.5 Workforce and Hours of Operation

Myuna Colliery is a 24 hour a day, seven day a week operation. Up to 350 employees are approved to work at Myuna and Cooranbong Collieries under the existing Development Consent. Myuna Colliery currently employs 175 staff.

4.6 Environmental Management

Myuna Colliery has an established Environmental Management System (EMS) that has been developed in accordance with the *Centennial Coal Environmental Management System Framework* (EMSF) (July 2009). The EMS provides an environmental management framework for all activities and areas managed by CMPL. The EMS has been developed to be generally consistent with the elements of ISO 14001 which specifies the actual requirements for an EMS.

As part of this EMS, CMPL maintains a number Environmental Management Plans (EMPs) and procedures as outlined in **Table 5.**

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WATER MANAGEMENT INFRASTRUCTURE - SURFACE FACILITIES AREA

Centennial Myuna Pty Ltd

Environmental Assessment

Figure 4.3

Table 5 Myuna Colliery EMPs and Procedures

Reference	Title
MM-EMS-3-001	Water Management Plan
MM-EMS-3-002	Dust Management Plan
MM-EMS-3-003	Noise Management Plan
MM-EMS-3-004	Land Management Plan
MM-EMS-3-005	Bushfire Management Plan
MM-EMS-3-006	Hydrocarbon Management Plan
MM-EMS-3-007	Waste Minimisation and Management Plan
MM-EMS-3-008	Weed and Pest Management Plan
MM-EMS-3-009	Hazardous Substances Management Plan
MM-EMS-3-010	Stakeholder Engagement Management Plan
my10416rev3	Emergency Environmental Spill Plan
MY-EWP-028	Surface Disturbance Procedure
HSMS-HMP-D-03	Hazardous Management Plan: Inrush Management Document
Country Energy	Myuna Colliery Energy Savings Action Plan 2006

Additionally, ML 1370 and CCL 762 require the preparation of an Annual Environmental Management Report (AEMR) to report on the mining extraction progress and environmental performance of Myuna Colliery.

5.0 Proposed Project

5.1 Overview

The proposed Project will extend mining at Myuna Colliery for a further 21 years within the Project Application Area, which comprises an area external to the Development Consent Mining Area, with the exception of the inclusion of the Surface Facilities Area, and encompasses part of CCL 762 and ML 1370. The Project Application Area and Development Consent Mining Area are shown on **Figure 1.3**.

The proposed Project will extend mining and coal handling at Myuna Colliery within the Project Application Area and proposes to:

- mine using bord and pillar methods in the Wallarah, Great Northern and Fassifern seams in CCL762 and ML1370, for a further 21 years;
- produce, handle and distribute to Eraring Power Station, up to 2 Mtpa using existing infrastructure;
- continue the use of ancillary infrastructure and services for a further 21 years;
- upgrade the water management system; and
- rehabilitate the surface facilities within 5 years of completion of mining.

CMPL will continue to undertake mining in the Development Consent Mining Area in accordance with the 1977 Development Consent. Handling and distribution of that coal will be undertaken in accordance with the 1977 Development Consent except as may be modified by approval of the Project.

5.2 Mining Operations

Mining operations within the Project Application Area will continue to be carried out using bord and pillar methods in the Wallarah, Great Northern and Fassifern coal seams, generally consistent with the manner in which CMPL undertakes current mining operations at Myuna Colliery.

The proposed Project includes the use of the following mining methods:

- Bord and Pillar mining – a method of underground coal mining where bords/headings and cut-throughs are driven to form pillars.
- Partial Pillar Extraction – a system of mining whereby some of the coal pillars in a panel, or parts thereof, are systematically extracted.
- Full Pillar Extraction – a system of mining whereby coal pillars are systematically extracted.

The mining methods proposed will address the constraints identified for the mine design in **Section 6.0** and a geotechnically engineered mine design would be developed within two identified subsidence zones:

- **Zone A** – Long term stable mining systems generating up to 20 millimetres surface subsidence (i.e. no noticeable surface impacts) on sensitive surface features including land and seagrass beds; and
- **Zone B** – Mining systems generating up to a maximum of 650 millimetres surface subsidence (under Lake Macquarie).

5.2.1 Mining Area

The Project Application Area encompasses the coal measures and three seams currently mined at Myuna Colliery and as such includes areas of existing workings and areas requiring new workings to be developed. Access to new areas will be developed from the existing workings.

On rare occasions over its history, Myuna Colliery has been required to undertake underground shot firing operation when intrusions such as volcanic dykes impede the mine workings. Similarly, limited underground shot firing may therefore be required for the proposed Project.

5.2.2 Coal Production Limits

Production and handling of up to 2 Mtpa of ROM coal is sought from the combined Project Application Area and existing Development Consent Mining Area.

5.2.3 Subsidence Monitoring

Subsidence surveys and monitoring programs at Myuna Colliery will continue to be undertaken in accordance with government requirements to monitor subsidence within the High Water Level Subsidence Control Zone (HWLSCZ) and under the land.

5.3 Surface Facilities Area

Existing mining areas (including existing underground workings for ventilation) will continue to be utilised for the Project including (but not limited to) mine access, emergency management and underground services and infrastructure. As such, no changes are proposed to the current mine access, infrastructure or mine facilities.

Minor changes to the water management system are proposed including combining the Licensed Discharge Point configuration and construction of additional clean water diversion drains to improve water management at the Surface Facilities Area. These are discussed further in **Section 5.5.**

5.3.1 Coal Handling and Preparation

The proposed Project seeks approval to process up to 2 Mtpa of ROM coal through the CHP. The volume of coal proposed to be processed through the CHP is within the current capacity limits of the CHP.

5.3.2 Transport

The proposed Project seeks approval to transport up to 2 Mtpa of coal to the Eraring Power Station using the Enclosed Overland Conveyor.

No changes are proposed to transportation of personnel and materials to and on site.

5.3.3 Rejects Management

A negligible quantity of waste rock is generated from the coal processing process which will continue to be transported and stored on site.

5.3.4 Other Infrastructure

There will be no change to the existing non-mine infrastructure as a result of the proposed Project.

5.3.5 Plant and Equipment

The proposed Project will utilise the existing continuous miners for coal extraction, as well as the existing ancillary equipment both in the underground workings and the Surface Facilities Area.

5.4 Workforce and Hours of Operation

The proposed project will continue to operate 24 hours a day, seven days a week with a workforce of up to 210 full time employees.

5.5 Water Management

The proposed Project includes several minor upgrades to the existing water management system (described in **Section 4.4.6**), which will improve the operating efficiency of the current system. These upgrades are described below.

5.5.1 Licensed Discharge Points

To enable improved monitoring of the discharges through LDP001 and LDP002, it is proposed to combine these two licensed discharge points into a single LDP, known as LDP B. This discharge point will have a total volumetric discharge of 13 ML/day, which is the current approved volumetric limit of the two existing LDPs at the site.

A new licence discharge point is proposed at the Emergency Coal Stockpile Sediment Dam (LDP A) to enable discharge from this dam during rainfall events which exceed 140 millimetres in 24 hours.

5.5.2 CHP Dam

The CHP Dam, which forms part of the dirty water management system, currently receives clean water runoff from approximately 8.2 hectares of clean catchment area. Water captured in the CHP Dam is subsequently discharged through licensed discharge point LDP002 into Wangi Creek. As runoff from this 8.2 hectare

catchment area is considered to be clean, it is unnecessary for this water to be captured within the dirty water management system.

To improve the efficiency of the water management system (and the separation of clean and dirty water) a clean water diversion is proposed between this clean water catchment area and the CHP Dam, which will divert clean water away from the CHP Dam and into Wangi Creek. The construction of a clean water diversion between the clean water catchment and the CHP Dam (refer to **Section 10.2**) will reduce the area of catchment of the CHP Dam from a total of 11.5 hectares to approximately 7.8 hectares (GHD, 2010). This diversion will therefore reduce the volume of event-based discharges from LDP002.

5.5.3 Emergency Coal Stockpile Sediment Dam

Within the Emergency Coal Stockpile Area there is a small sediment dam in the western corner, known as the Emergency Coal Stockpile Sediment Dam. The Emergency Coal Stockpile Sediment Dam is bound by a bund approximately 1 metre high, with a depth of approximately 0.5 metres. Within the Emergency Coal Stockpile Sediment Dam, there is a pump which enables the transfer of water to Mine Water Settling Pond 2.

In the event that the capacity of the Emergency Coal Stockpile Sediment Dam is exceeded, ponding extends into the broader Emergency Coal Stockpile Area. There is also an emergency discharge point (that contributes to Wangi Creek) from this dam in the event of an extreme rainfall event (in excess of 80 mm in 24 hours), accompanied by a failure of the pumping mechanism.

The total catchment contributing to the broader emergency stockpile dam has an area of 5.6 hectares. As with the CHP Dam, both clean and dirty catchment areas drain to the Emergency Coal Stockpile Sediment Dam.

A series of diversions are proposed for this Dam, which will enable the diversion of clean water, and a reduction in the total catchment area draining to the Emergency Coal Stockpile Sediment Dam from 5.6 hectares to 3.2 hectares. This diversion will also increase the handling capacity of the dirty water system. The clean water diversions at the Emergency Coal Stockpile Sediment Dam will reduce the potential for discharges from this Dam to Wangi Creek.

While the additional diversion drains proposed will result in a reduction in the runoff contributing to the Emergency Coal Stockpile Sediment Dam, the detailed water balance indicated the potential for discharges to occur during rainfall events which exceed 80 millimetres in 24 hours. Therefore, a variation to EPL 366 will be sought to license this discharge point, to allow event based discharges.

5.6 Rehabilitation and Mine Closure

Myuna Colliery will develop and implement a Rehabilitation and Environmental Management Plan within 5 years of completion of mining.

5.7 Environmental Management

The EMS, described in **Section 4.6**, will be updated and augmented as required to incorporate additional EMPs and requirements for the proposed Project.

5.8 Licences and Approvals Required

Mining within the existing Development Consent Mining Area (with the exception of the Surface Facilities Area), will continue to operate in accordance with the existing 1977 Development Consent.

The proposed Project will require a variation to EPL 366 to allow:

- event based discharges from the Emergency Coal Stockpile Sediment Dam; and
- water quality and volumetric monitoring at LDP001 and LDP002 to be combined.

6.0 Mine Constraints

6.1 Background

An assessment of subsidence constraints and mine design criteria was undertaken for the proposed Project by Seedsman Geotechnics Pty Ltd (2010) and is included in **Appendix E.** This assessment describes the engineering geology of the Project Application Area, the previous subsidence outcomes at Myuna Colliery and mines in the surrounding area, and the way in which the mine can be designed to achieve the subsidence constraints defined for the proposed Project. A review of historical mining at Myuna Colliery and the rationale behind current mine constraints has also been undertaken (refer to the annexure to **Appendix E**), which is discussed in this section.

6.2 Geology

The regional geology of the Project Application Area is described in **Section 2.0**. The presence of conglomerates and coarse sandstone units in the overburden sequence is a feature of the Project Application Area.

The strength of the roof and floor of each of the seams affects the mine design and in turn the level of subsidence experienced at the ground surface.

There are four named conglomerate stratigraphic units in the sequence above the Fassifern Seam in the Project Application Area (refer to **Figure 6.1**), namely the:

- Karingal Conglomerate between the Fassifern and the Great Northern Seams;
- Teralba Conglomerate between the Great Northern and Wallarah Seams;
- Karignan Conglomerate between the Wallarah and Vales Point Seams; and
- Munmorah Conglomerate in the overlying Narrabeen Group.

The most massive units are in the Teralba Conglomerate, however there is a wide variation in thickness. Where the Karingal unit is thicker, the Teralba unit tends to be thinner. The Munmorah Conglomerate is present at relatively shallow depths and parts of it may be weathered, and other parts may subcrop under Lake Macquarie (Seedsman Geotechnics Pty Ltd, 2010). The geological units of the Project Application Area are shown in **Figure 6.1**.

6.2.1 Strength of Roof and Floor

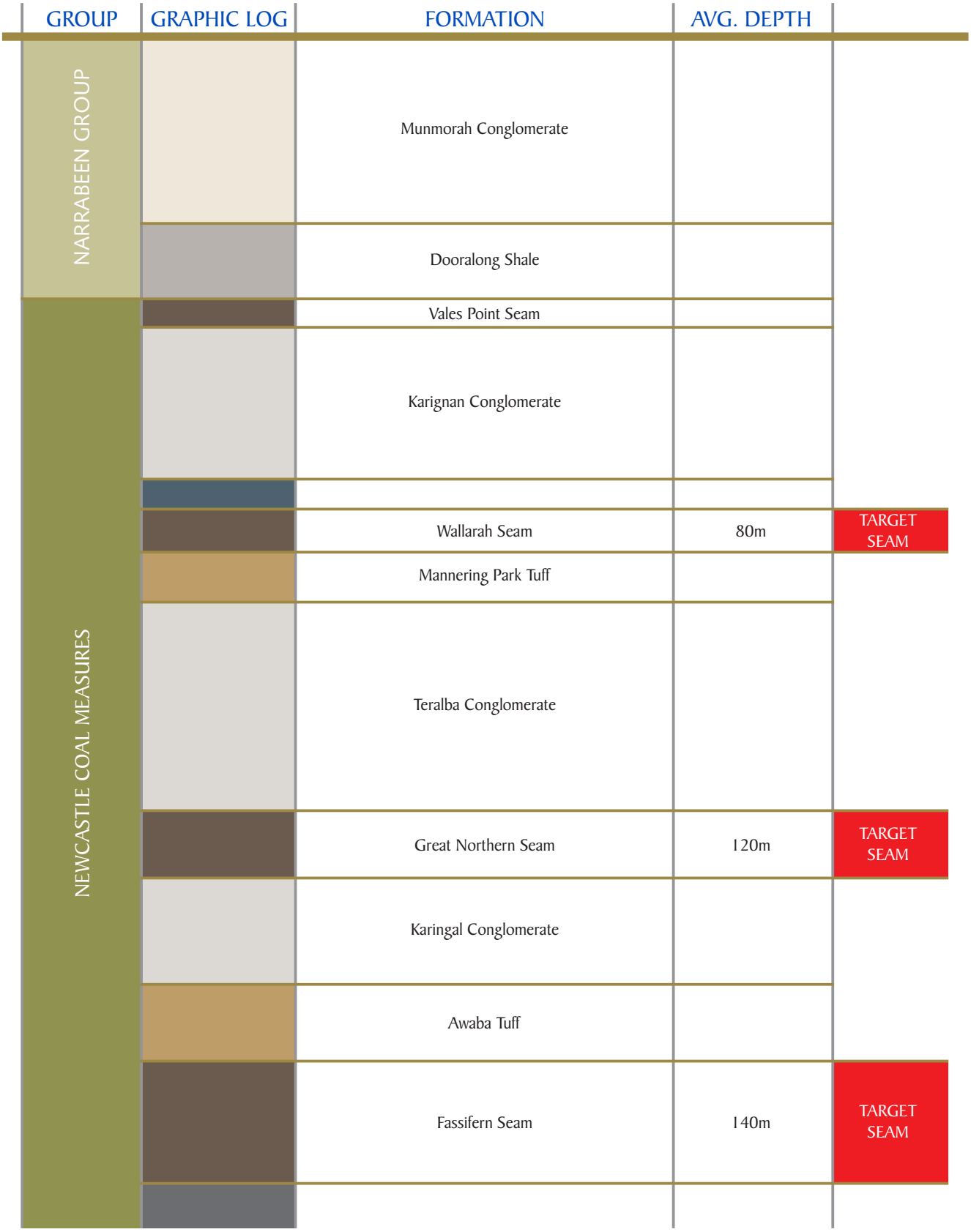
The strength of the roof and floor of each of the seams affects the mine design in terms of width of roadways, and pillar width, height and stability, which will affect the amount of deformation of the overlying strata, and in turn the level of subsidence experienced at the ground surface. The deformation of the roof/pillar/floor system depends on the vertical loads applied to the pillars and the stiffness of the various rock and coal units, which also depends on the depth of cover and layout of overlying workings.

6.2.2 Location of Known Geology

An extensive geological database has been established at Myuna Colliery based on exploration undertaken over the life of the mine incorporating seam intersections, coal quality, surface topography and roof and floor lithology. In house computer modelling software is used to model coal resources suitable for extraction.

6.2.3 Faulting

Numerous faults have been encountered in workings. The faults follow two trends, north-west/south-east and north north-east/south south-west. Indicative sections of the three coal seams discussed previously are provided in **Figure 6.1**.



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GENERAL STRATIGRAPHY OF THE PROJECT APPLICATION AREA

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Environmental Assessment

Figure 6.1

6.3 Hydrogeology

Varying quantities of groundwater inflow (water make) enter the mine in each of the three coal seams. Groundwater inflow varies depending on natural inputs to the system, aquifer properties and dimensions of the mine workings. Water make is managed through a system of underground pumps and holding dams prior to extraction of some water make to the surface water management system, prior to discharge through the LDPs to Wangi Creek. The volume of water discharged from underground is managed so as to meet volumetric limits at the LDPs.

A conceptual hydrogeological model was established as part of this EA to assess the adequacy of the current management of water make (refer **Section 10.2**).

6.4 Mine Safety

Pillar design and stability is an important aspect from a mine safety perspective. Pillars can be designed for the short, medium and long term. Factors including roof and floor strata, mining height, condition/shape of pillars and expected pillar stresses need to be defined to allow accurate pillar design to take place, to achieve the required level of stability appropriate to mine design requirements..

At Myuna Colliery, only pillars with long term stability are adopted for mine safety reasons, and all pillar design work and calculations at Myuna Colliery utilise the principles defined in the University of New South Wales (UNSW) pillar design procedure. Mine safety and pillar design principles are further discussed in **Section 6.5.1**.

6.5 Mine Design

6.5.1 Principles of Mine Design at Myuna Colliery

Mining has historically been undertaken in accordance with the conditions of the original mining lease CL195, now CCL762. The conditions of the original mining lease CL195 were predominantly based on the publication *Mining Under Tidal Waters* (Wardell, 1975), known as the Wardell Guidelines.

The aim of the Wardell Guidelines is to maximise coal recovery while protecting the safety of the mines from inundation, and creating minimal adverse effects on the land surface. The Guidelines recommended a ‘barrier’ around the foreshore areas of Lake Macquarie, now known as the HWLSCZ. **Figure 6.2** depicts the HWLSCZ. The mean HWLSCZ is additionally legislated under the *Coal Mines Health and Safety Act 2002*, and is discussed further in **Section 6.5.2**.

For mining under the tidal waters of Lake Macquarie, the original mining lease CL195 specified that no coal could be extracted with less than 40 metres of solid rockhead cover between the bed of the Lake and the coal seam. Although this requirement is no longer a lease condition at Myuna Colliery, it is still used as a guideline for mine design at the Colliery (CMPL, 2010). Further detail on the historical context of mine design at Myuna Colliery is described in a report prepared by CMPL (July 2010) provided as an annexure to **Appendix E**.

The Wardell Guidelines, whilst conceptually still relevant, have been superseded by subsequent work undertaken by the UNSW in relation to pillar stability. Myuna Colliery takes into consideration, modern geotechnical research and principles including the UNSW pillar stability work in a risk based process for establishing mine design criteria. Futher detail is described in Seedsman Geotechnics (2010) (refer **Appendix E**).

As described in **Section 6.4**, pillar stability is a primary consideration in mine design, which is affected by range of factors including roof and floor strata, mining height, condition/shape of pillars and expected pillar stresses.

Subsidence associated with bord and pillar mining can be related to the deformation of the roof/pillar/floor system which itself depends on the vertical loads applied to the pillars and the stiffness of the various rock and coal units. Engineering analysis assumes that the pillars have the same stiffness and are hence loaded similarly. Given the size/stability of the coal blocks, this is considered valid. It is also noted that the deformation of the roof and floor strata is also a function of pillar width.

A pillar stability factor criterion of 2.11 is conventionally applied to long term pillar stability (whereby a higher factor number denotes higher pillar stability). A factor of safety of 2.11 represents a probability of failure of 1 in 1,000,000 (Galvin *et al*., undated).

In assessing the current pillar layout at Myuna, Seedsman (2010) applied modern pillar design principles and equations with the resulting levels of pillar stability being high.

6.5.2 High Water Level Subsidence Control Zone

In accordance with lease conditions, Myuna Colliery must gain the consent of the Minister for Primary Industries if mining is to occur within a HWLSCZ. The HWLSCZ is defined as:

a) on the surface by the highwater level of the Lake Macquarie and a point 2.44 metres in elevation above that high water level;

b) in the seam by a line defined by an angle of draw of 35 degrees drawn landwards from the line drawn vertically beneath a point 2.44 metres in elevation above the highwater level of the Lake Macquarie;

c) in the seam by a line defined by an angle of draw of 35 degrees drawn lakewards from the line drawn vertically beneath the highwater level of Lake Macquarie;

The HWLSCZ is shown in **Figure 6.2**. Vertical subsidence measured within the HWLSCZ at Myuna Colliery throughout 28 years of mining has been less than 20 millimetres.

The HWLSCZ is investigated during the mine planning phase, which is described in the Myuna Colliery Mine Planning and Design Document (HSMS-SC-D-11) (CMPL, 2010).

6.5.3 Sensitivity of Surface Features

Mine design takes into consideration the overlying surface features and their sensitivity to the effects of subsidence. Sensitive features are both natural and man-made which are identified in **Section 2.0** of the EA, and are situated within proposed Mining Zone A. There are no known sensitive features within Zone B.

6.6 Myuna Colliery Project Application Area Mine Design

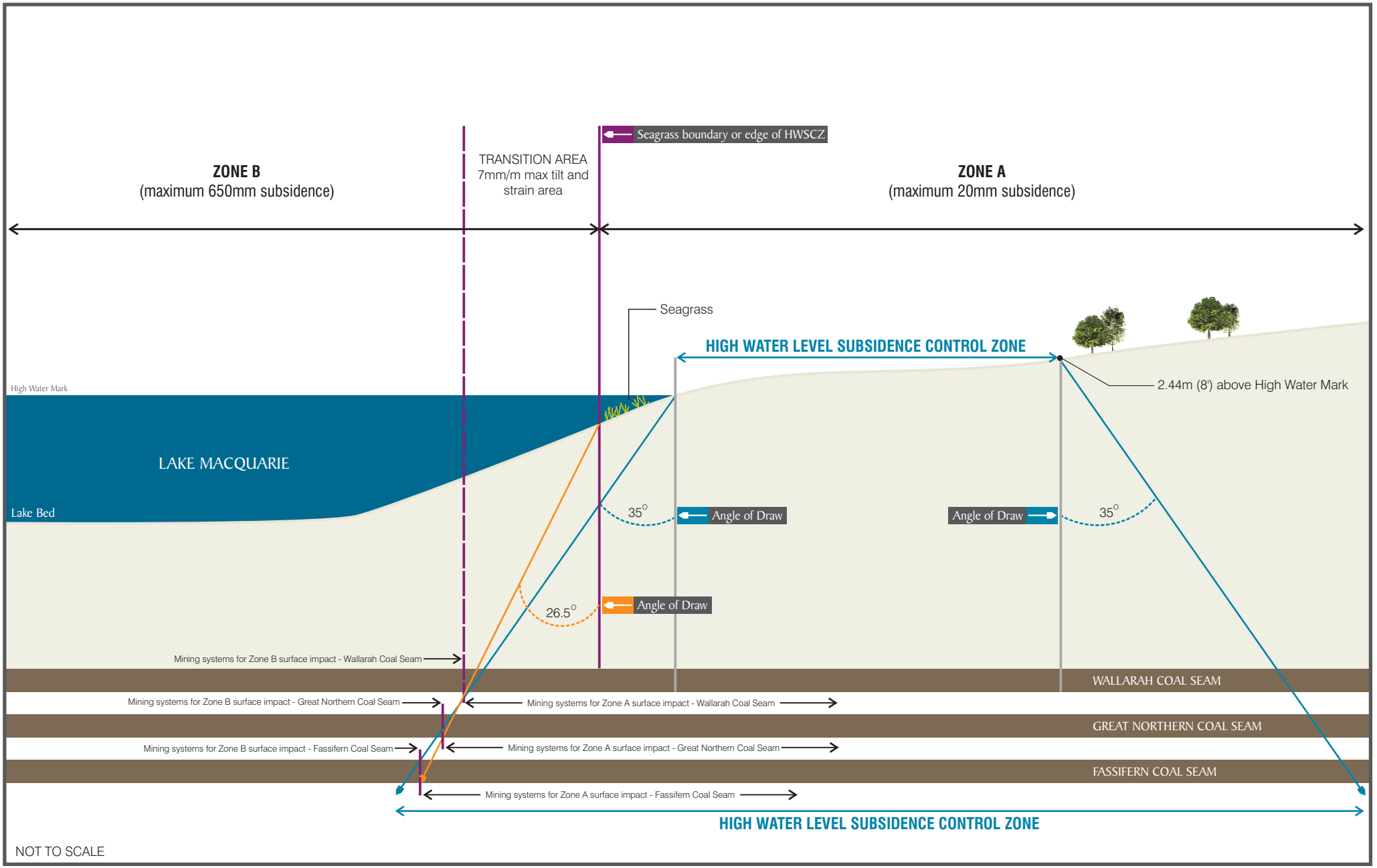
The typical mining panel layout adopted at Myuna Colliery is a multi heading layout constrained by available equipment design.

As discussed in **Section 5.0**, the mine layout to be implemented within the three seams of the Project Application Area will be determined during the detailed mine planning process, and will include development of a geotechnically engineered mine design. All mine workings for the current operation are designed in accordance with the Myuna Colliery Mine Planning and Design Document (HSMS-SC-D-11) (CMPL, 2010) which forms part of the Myuna Health and Safety Management System (HSMS), which provides the framework from which Myuna Colliery manages hazards and risks which have the potential to cause impacts to the safety of personnel working in the mine, or the wider environment.

In relation to mine design, the HSMS includes planning systems to be developed to allow the mine to continue to be designed with consideration of the risk potential from known or inferred hazards. Mine design and development includes exploration, planning, assessment, monitoring and measurement, to allow major risks to be identified and addressed. This process integrates the provisions of the *Occupational Health and Safety Act 2000*, the *Coal Mine Health and Safety Act 2002*, and mining lease conditions as described above.

The development of a mine plan includes analysis of geological information including:

- Seam thickness;
- Seam structure;
- Overburden type and thickness;
- Rockhead thickness;
- Overlying / underlying coal seams and interburden to them;
- Coal quality;
- Direction of joints and coal cleat; and
- Known/expected geological structures.



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HIGH WATER LEVEL SUBSIDENCE CONTROL ZONE

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Environmental Assessment

Figure 6.2

Information will also be gathered on geotechnical aspects of the resource, including:

- Properties of roof, floor and seam (surface borehole data);
- Magnitude of stress and stress direction (historical evidence); and
- Gas makes.

To assess the designed method, extraction of sufficient information from the logs of boreholes already drilled in the area in undertaken, as well as review of experience from adjacent mined areas. Additional boreholes may be drilled as required. This information is gathered during the mine planning phase at Myuna in compliance with Myuna Colliery's Mine Planning and Design Document (HSMS-SC-D-11) (CMPL, 2010).

6.6.1 Mining Zones

A geotechnically engineered mine design would be developed within two identified subsidence zones:

- **Zone A** – Long term stable mining systems generating up to 20 millimetres surface subsidence (i.e. no noticeable surface impacts) on sensitive surface features including land and seagrass beds; and
- **Zone B** – Mining systems generating up to a maximum of 650 millimetres surface subsidence (under Lake Macquarie).

The proposed subsidence zones are shown on **Figure 6.3**. Mining Zone A and up to 20 millimetres of subsidence is proposed under sensitive areas including residential areas, State Conservation Areas, foreshore areas and seagrass beds. Zone B level of subsidence is proposed under the less sensitive areas of Lake Macquarie.

6.6.2 Mining Methods

Mining methods within Mining Zones A and B will include either multi-seam workings or single seam mining.

Where single seam mining is planned, the mining methods will include:

- First workings; and/or
- Partial pillar extraction; and/or
- Wide panel full extraction.

Where multi-seam mining is proposed, the mining methods will include:

- First workings; and/or
- Non-caving partial extraction. Non-caving is defined as a mining system which does not generate a connecting fracture between multi-seam workings.

Multi-seam workings are defined as where mine workings will vertically overlay each other in multiple coal seams.

Table 6 Mining Methods within Mining Zones A and B

Mining Zone	Single seam workings			Multi seam workings		
	First Workings	Non-Caving Partial Pillar Extraction	Wide Panel Full Extraction	First Workings	Non-Caving Partial Extraction	Wide Panel Full Extraction
A	✓	✓	X	✓	✓	X
B	✓	✓	✓	✓	✓	X

6.7 Subsidence Predictions

Subsidence engineering prediction methods have been considered to assess whether the subsidence constraints for Mining Zones A and B can be achieved within the Project Application Area. Prediction methods include:

- Precedent practice – what has happened at the site in the past;
- Empirical methods – interrogation of a database without a framework of physical laws. The Holla and Mine Subsidence Engineering Consultants methods are empirical methods and the interrogation is based on identifying worst-case outcomes; and

- Analytical methods – the application of the laws of physics through the practice of engineering analysis. The mathematics involved can be relatively simple (for example limit equilibrium analyses) or complex requiring the use of sophisticated computer analyses (sometimes referred to as numerical methods). Analytical methods are validated against the same database as used in empirical methods.

All three methods are discussed in relation to the proposed Project in Section 5.0, and will be applied during the development of future mine design layouts to meet the subsidence constraints at Myuna Colliery. The methods by which the subsidence constraints for Mining Zones A and B will be achieved are as per established mine design principles.

Experience in the Newcastle coal field to date indicates that long-term stable pillars can be designed and achieved at Myuna. Historically, problems have been experienced with the floor of the Great Northern Seam elsewhere in the coalfield (Awaba) but these have not been experienced at Myuna Colliery. Experience in the Fassifern Seam in a number of collieries (Myuna and Mannering Collieries) shows that there are no problematic materials in the immediate roof and floor of this seam. The mechanisms of floor failure are widely understood, analytical tools are available to check the floor conditions once core information is available, and management plans can be prepared to address this hazard.

6.7.1 Subsidence Zone A

The proposed Project includes mining in Mining Zone A to achieve a subsidence constraint of up to 20 millimetres of vertical subsidence at the surface.

There is a very strong precedent for stable mining layouts at the depths proposed at Myuna Colliery, which will result in no measurable or discernable surface impacts within Zone A (i.e. vertical subsidence of less than 20 millimetres). Seedman Geotechnics (2010) concluded that there is a high level of confidence in bord and pillar layouts being capable of meeting the subsidence constraints for within Zone A.

6.7.2 Subsidence Zone B

Myuna Colliery has specified mining systems for Zone B which would generate up to a maximum of 650 millimetres surface subsidence (under Lake Macquarie).

A range of engineering concepts have been investigated for Zone B, as detailed in Section 8 of **Appendix E**. As Zone B is located under Lake Macquarie, Seedsman Geotechnics (2010) (**Appendix E**) also reviews the level of inflows and subsidence above extraction panels from a range of studies into longwall operations underneath Lake Macquarie.

A number of models, including hydrogeological models based on extraction thickness and overburden depth (Forster, 1995), the presence of spanning units, sag of surcharged conglomerate beams, the heading of the goaf over the extraction panels, and the subsidence deformations associated with the pillars (Li *et al*., 2006, Seedsman 2004), have been considered to determine appropriate extraction panel widths to achieve the 650 millimetre subsidence constraint at Myuna Colliery (refer to section 8.0 of **Appendix E**). These models indicate that wide panel full extraction under Lake Macquarie can only be undertaken safely in the Fassifern Seam at Myuna Colliery (Seedsman Geotechnics, 2010).

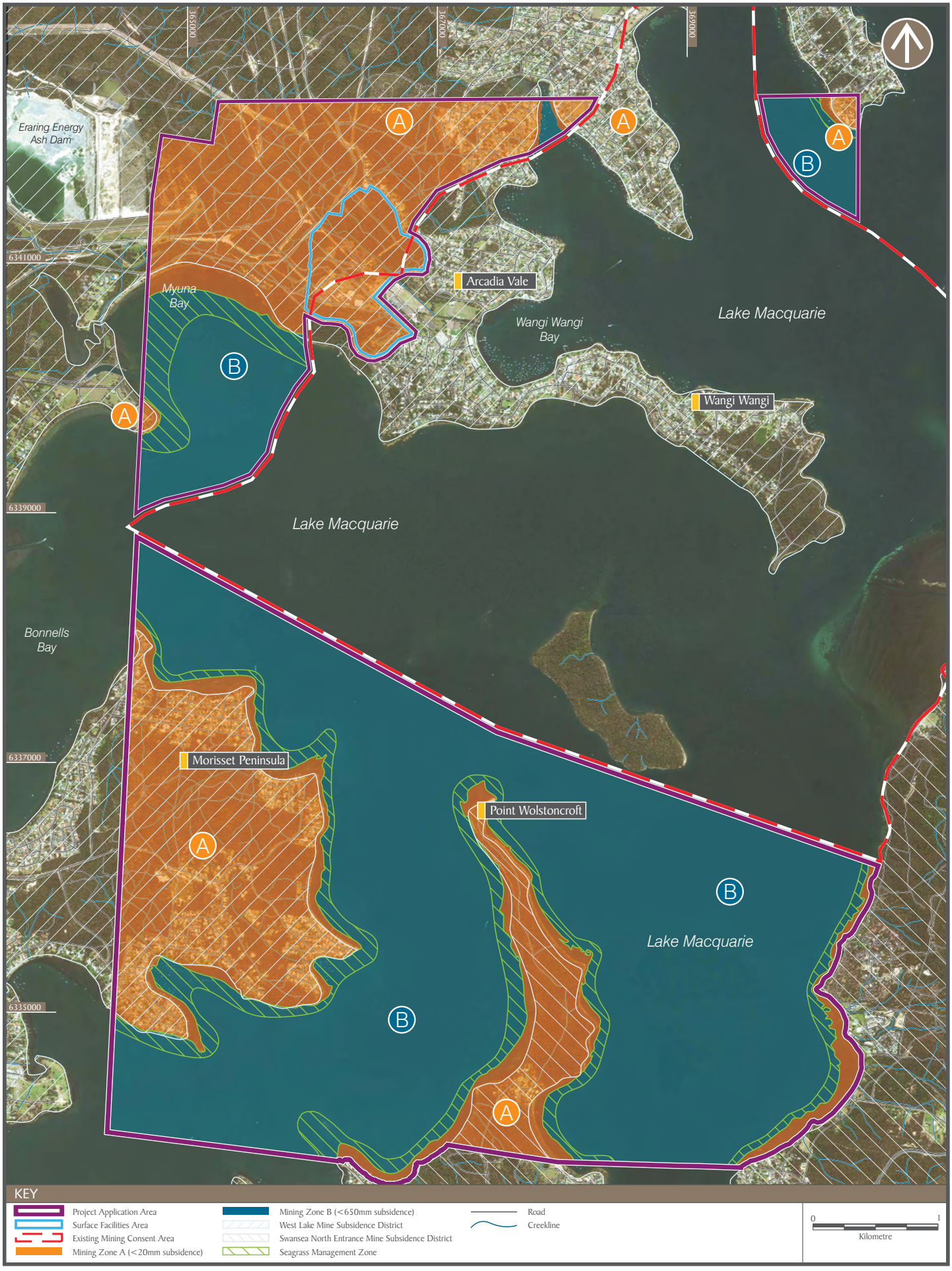
Based on experience at Myuna Colliery, and the neighbouring Mandalong Colliery, tilts and strains are able to be forecast. For Zone B, the maximum tilts are forecast to be in the range of 5-7 millimetres per metre and the maximum strains are forecast to be 5 millimetres per metre (tensile and compressive).

Seedsman Geotechnics (2010) concluded that the future mining within Zone B of Myuna Colliery can be designed to limit subsidence to less than 650 millimetres.

It is noted that 650 millimetres is an upper subsidence limit for Zone B, and that planning considerations for mine design which consider safety requirements as a priority, which may result in much lower levels of subsidence in this zone.

6.7.3 Transition Area

Mining systems in Zone B will be undertaken with an angle of draw of 26.5˚ from the boundary of Zone A, resulting in a transition area between the two zones, which will limit subsidence to a maximum of 20 millimetres and achieve maximum tilts and strains of 7 millimetres per metre at the boundary of Zone A (Seedsman Geotechnics, 2010). This angle of draw, which is illustrated on **Figure 6.2**, will provide Zone A and the existing seagrass beds with adequate protection from subsidence at the boundary between Zone B and Zone A.



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PROPOSED SUBSIDENCE ZONES

Centennial Myuna Pty Ltd

Environmental Assessment

Figure 6.3

6.7.4 Seagrass Management Zone

A Seagrass Management Zone (SMZ) will be established within Mining Zone B adjacent to the Mining Zone A boundary to minimise the potential for impacts to seagrass at the interface between the two zones (refer to **Figure 10.4.2**). The extent of the SMZ is based on depth contours and is based on the relationship between seagrass distribution and its relationship to depth, with seagrass typically not occurring in water greater than 5 metres within the Project Application Area. The extent of the SMZ will include the area from the lake-ward edge of the existing seagrass beds out to the 5 metre depth contour across the majority of the Project Application Area. Where seagrass beds occur at the edge of the 5 metre contour, the SMZ will extend out to approximately the 6 metre depth contour to allow a sufficient buffer.

6.8 Subsidence Impacts

Potential environmental consequences associated with vertical surface subsidence are assessed in **Section 10.0**.

The location of Zones A and B for the proposed Project have been designed to avoid significant impacts to sensitive surface features. Negligible subsidence impacts are expected within Zone A. Subsidence up to 650 millimetres in Zone B is achievable with the design parameters outlined **Section 6.5.2**

6.9 Conclusion

All mine workings for the current operation are designed in accordance with the Myuna Mine Design Management Document (HSMS-SC-D-11) (CMPL, 2010) forming part of the Myuna Colliery HSMS, which provides the framework from which Myuna Colliery manages hazards and risks which have the potential to cause impacts to the safety of personnel working in the mine, or the wider environment. This process integrates the provisions of the relevant health and safety legislation and mining lease conditions (CMPL, 2010).

The assessment undertaken by Seedsman Geotechnics Pty Ltd (2010) identified a process by which the mine can be designed to meet the specified subsidence constraints for Zone A and Zone B. These methods are soundly based on published engineering principles and experience at underground mines in the vicinity, as well as more than 28 years of mining at Myuna Colliery.

An Extraction Plan, or equivalent document, which takes into account the information presented in this EA for mining within Zone B will be developed prior to secondary extraction. The Extraction Plan will meet the relevant statutory requirements. The Extraction Plan, or equivalent document, will consider ways to rehabilitate potential predicted and unpredicted subsidence impacts, including methodologies and response times, and will identify the need for further research required to address any uncertainties or information gaps.

Potential environmental consequences resulting from vertical surface subsidence are assessed in **Section 10.0** of this EA.

7.0 Statutory Planning

The Project will be subject to the legislative requirements of the Commonwealth and State, as well as relevant local and regional planning strategies. This section describes the approval pathway for the Project, as well as outlining the various legislative requirements.

7.1 Commonwealth Legislation

7.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires the approval of the Federal Minister for Sustainability, Environment, Water, Population and Communities (SEWPaC), for actions that will have a significant impact on matters of National Environmental Significance (NES). Approval from the Commonwealth is in addition to any approvals under NSW legislation.

The EPBC Act lists seven matters of NES which must be addressed when assessing the impacts of a proposal, while the EPBC Act also provides for the identification, conservation, and protection of places of National Heritage significance. The flora and fauna investigations carried out for the Project have determined that there are threatened species and Endangered Ecological Communities (EEC) listed as NES under the EPBC Act, recorded within the Project Application Area. Although it is unlikely that the proposed Project will have significant impacts upon a matter of NES, a referral to SEWPaC to determine whether the proposed Project is a controlled action will be made in accordance with the requirements of the EPBC Act.

7.1.2 National Greenhouse Energy Reporting Act 2007

The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) provides a single National framework for the reporting and dissemination of information regarding greenhouse gas emissions, greenhouse gas projects and energy use, and production by corporations. The NGER Act mandates registration and reporting by corporations whose energy production or use, or greenhouse gas emissions meet specified thresholds. Centennial reports emissions from the corporation which includes emissions from Myuna Colliery.

7.1.3 Native Title Act 1993

The *Native Title Act 1993* recognises that Aboriginal people have rights and interests to land which derives from their traditional laws and customs. Native title rights can include rights to: live on the land, access the land for traditional purposes, protect important places and sites, collect food and medicinal resources from native plants, hunt and fish, teach traditional law and customs, and to have input into landuse practices and development planning. Native title can be negotiated in three ways; through a Native Title Claim (applications and determinations), through an Indigenous Land Use Agreement (ILUA), or future act agreements.

An ILUA is an agreement between a native title group and other parties who use or manage the land and waters. The ILUA process allows for negotiation between indigenous groups and other parties over the use and management of land and water resources, and the ability to establish a formal agreement. An ILUA is binding once it has been registered on the Native Title Tribunal's Register of Indigenous Land Use Agreements.

A portion of the land within the Project Application Area is subject to an ILUA (NIA2000/001) which was entered into on 28 May 1999 by Wonnarua Nation Aboriginal Corporation and Powercoal Pty Ltd (since acquired by Centennial). As such, Centennial Newstan is bound by the terms of the ILUA which are set out in the Master Deed, Clause 7 which requires compliance with an Aboriginal Heritage Protection Protocol, set out in Schedule 5. This Protocol requires that an Aboriginal Cultural Heritage survey needs to be undertaken where there is potential for mining operations to impact land within the Project Application Area which is subject to the ILUA, which has not previously been mined, or areas which have not previously been subject to heritage investigations. At least 30 days notice needs to be given to the Wonnarua People, if this land is to be disturbed by mining and a survey by a representative of the Wonnarua People may be required.

7.2 State Legislation

7.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act and the EP&A Regulation 2000 provide the framework for environmental planning in NSW and include provisions to ensure that proposals which have the potential to impact the environment are subject to detailed assessment and public participation.

As previously outlined, Myuna Colliery operates under a development consent issued by Council on 15 December 1977 (SH 110/148) under the *Local Government Act 1919*, which carries the same weight as a development consent under Part 4 of the EP&A Act.

Myuna Colliery holds the current ML 1370, CCL 762 and MPL 334, which extend over a greater area than that approved under the existing development consent. Current underground mining within the mining tenements (outside the area approved under its development consent) operates in accordance with section 74 of the *Mining Act 1992* (Mining Act) which, prior to its repeal, stated that nothing carried out under the EP&A Act or an environmental planning instrument, can prevent the holder of an operating mining lease from carrying on mining operations in the mining area.

Clause 8K of the EP&A Regulation states that despite its repeal, section 74 of the Mining Act continues to have effect in respect of an existing mining lease until the end of the relevant transition period (16 December 2010) or until an approval under the EP&A Act is given to carry out mining operations in the mining area.

Therefore, after 16 December 2010, underground mining at Myuna Colliery beyond the area covered by the current development consent can only continue with an approval under the EP&A Act.

The development assessment and approval system in NSW is set out in Parts 3A, 4 and 5 of the EP&A Act. The Minister for Planning determines applications for major infrastructure or other major projects of State or regional environmental planning significance under Part 3A of the EP&A Act. This section of the EP&A Act provides a single assessment process specifically designed for major projects and improved transparency and community consultation. Schedule 1 of SEPP (Major Development) identifies classes of development which are classified as projects to which Part 3A of the EP&A Act applies. Schedule 1 includes development for 'the purpose of mining'.

Sections 75 U and V of the EP&A Act list the legislation that must be applied consistently to projects, as well as outlining the approvals and authorisations required under other State planning policies that are either not required or cannot be refused for a project approved under Part 3A of the EP&A Act.

7.2.2 Mining Act 1992

The Mining Act makes provision for granting mining authorities, leases and licences which are required for the prospecting and mining of minerals and coal. The Mining Act also makes provision for the protection of the environment in relation to mining activities, including rehabilitation of areas subject to mining activities.

Myuna Colliery currently operates under ML 1370, CCL 762, and MPL 334 issued under the Mining Act. The conditions of ML 1370 and CCL 762 restrict mining under the 'High Water Level Subsidence Control Zone'; specifies the requirements for mining under 'marginal zones'; limits the type of operations within specified areas; and sets various depth restrictions across the lease areas. The leases specify resource recovery and mine working requirements; and include general conditions relating to rehabilitation and environmental management. The current leases also require the preparation of an annual exploration report as well as an AEMR.

ML 1370 and CCL 762 require the preparation of and mining to be carried out in accordance with a Mining Operations Plan (MOP). A MOP for the period between July 2006 and June 2013 was submitted to the then Department of Primary Industries (now DI&I) in February 2006. The lease agreements also require preparation of a Subsidence Management Plan (SMP) prior to the commencement of 'any underground mining operations which will potentially lead to subsidence of the land surface'.

Should Project Approval be granted, CMPL will be required to prepare an Extraction Plan or equivalent for those areas where greater than 20 millimetres of subsidence has been predicted in accordance with the relevant guidelines. The MOP is to be renewed in 2013 through the development of a Rehabilitation and Environmental Management Plan (REMP), which will be in place within 5 years of mine closure. An application for renewal of Myuna Colliery's mining leases will also be made should Project Approval be granted, consistent with s75V of the EP&A Act.

7.2.3 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is the principal NSW legislation relating to environmental regulation and, in particular, contains strict provisions regulating water, air, noise, and land pollution. A key feature of the POEO Act is the requirement for 'scheduled activities' which are listed in Schedule 1 of the POEO Act to be regulated by an EPL.

Schedule 1 includes 'mining for coal' and classifies coal mines with a capacity to produce more that 500 tonnes of coal per day or which have disturbed a total surface area of more than 4 hectares (ha) of land by clearing or excavating, or constructing dams, ponds, drains, roads, railways or conveyors, or storing or depositing overburden or coal (including rejects materials) as 'scheduled activities'.

EPL 366 regulates Myuna Colliery based on a maximum coal production of 2 Mtpa, which equates to the proposed future annual production of the proposed Project. The EPL also regulates the amount and quality of water discharges from the CHP dam (LDP002) and the outlet drain from Mine Water Settling Pond 3 (LDP001) at the Surface Facilities Area. A variation to EPL 366 will be sought to incorporate changes to the licensed discharge points following the grant of Project Approval. In accordance with section 75V of the EP&A Act, any required variation to the EPL will be consistent with the Project Approval.

7.2.4 Mine Subsidence Compensation Act 1961

The *Mine Subsidence Compensation Act 1961* (MSC Act) establishes a scheme for the payment of compensation for damage sustained to surface improvements by subsidence resulting from the mining of coal or shale. CMPL pays a levy under the MSC Act.

Section 15 of the MSC Act makes provision for the establishment of mine subsidence districts and requires that an approval is given by the Mine Subsidence Board for the alteration or erection of improvements or the subdivision of land within a proclaimed Mine Subsidence District. The Project Application Area lies within the West Lake and Swansea North Entrance Mine Subsidence Districts.

Under the MSC Act, the Mine Subsidence Board sets subdivision, building, and construction guidelines, which are designed to ensure that residences and other structures will tolerate the expected levels of subsidence in an area. Construction guidelines vary from area to area depending on the coal mining activity and the expected amount of subsidence.

7.2.5 Dams Safety Act 1978

A portion of the Project Application Area falls within the Notification Area for the Eraring Ash Dam (refer to **Figure 2.3**). The Dam Safety Committee regulates mining within the Notification Area under the *Dams Safety Act 1978* and the *Mining Act 1992*.

7.2.6 Water Management Act 2000

The *Water Management Act 2000* is relevant to the Project as the Project Application Area is within the North and South Lake Macquarie sections of the Water Sharing Plan for The Hunter Unregulated and Alluvial Water Sources.

Section 75U of the EP&A Act states that a water use approval under section 89, a water management work approval under section 90, or an activity approval under section 91 of the *Water Management Act 2000* are not required for an approved project.

7.2.7 Water Act 1912

CMPL has applied for licences under the *Water Act 1912* from the NSW Office of Water (NoW) for underground dewatering works which are carried out on site for the current mining operations. These licences are currently before NoW for approval and will be utilised for the proposed Project.

7.2.8 National Parks and Wildlife Act 1994

The *National Parks and Wildlife Act 1974* (NP&W Act) provides for the establishment, care, control, and management of national parks, historic sites, nature reserves, State conservation areas, Aboriginal areas, and State game reserves. The Project Application Area encompasses parts of Lake Macquarie State Conservation Area.

The *NP&W Act* also provides for the protection of Aboriginal objects and the protection of native flora and fauna. Under section 75U(1)(d) of the EP&A Act, and in relation to Aboriginal heritage, a permit under section 87 or consent under section 90 of the NP&W Act is not required for a project approved under Part 3A of the EP&A Act. Consultation has been carried out with DECCW and the local Aboriginal community and an assessment of the impact of the proposal on items protected under the NP&W Act, including Aboriginal heritage items, has been undertaken as part of this EA, as outlined in **Section 10.8**.

7.2.9 Heritage Act 1977

The purpose of the *Heritage Act 1977* (Heritage Act) is to protect and conserve non-indigenous cultural heritage, including scheduled heritage items, sites, and relics. The Heritage Act is administered by the NSW Heritage Office within DoP.

The *Heritage Act* makes provision for a place, building, work, relic, moveable object, precinct, or land to be listed on the State Heritage Register. As the proposed Project falls under Part 3A of the EP&A Act, should Project Approval be granted under Part 3A, it is exempt from requirements for approvals required under the Heritage Act. However, a European heritage assessment has been undertaken as part of this EA to assess the potential impact of the proposed Project on items or places of European heritage significance (refer to **Section 10.9**).

7.2.10 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides for the conservation of threatened species, populations, and ecological communities of animals and plants. This conservation is achieved, in part, by protecting critical habitat of threatened species, populations and ecological communities; and eliminating or managing certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities. The TSC Act also provides a framework to ensure that the impact of any action affecting threatened species is assessed.

The potential impact of the proposed Project on endangered species, populations, and ecological communities listed under the TSC Act has been assessed in this EA (refer to **Sections 10.4** and **10.7**).

7.3 State Planning Policies

7.3.1 State Environmental Planning Policy (Major Development) 2005

SEPP (Major Development) defines certain developments that are major projects requiring assessment under Part 3A of the EP&A Act and determination by the Minister for Planning. Schedule 1 of the SEPP identifies development for the purpose of mining as a project to which Part 3A applies.

The proposed Project is defined as development for the purpose of mining under Schedule 1 of SEPP (Major Development) and as such Part 3A of the EP&A Act applies to the Project.

The primary aim of the SEPP (Major Development) is *'to identify development of economic, social or environmental significance to the State or regions of the State so as to provide a consistent and comprehensive assessment and decision making process for that development'.*

Consent for Part 3A projects is required from the Minister for Planning, and an EA is required to be prepared in accordance with the EARs.

7.3.2 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

SEPP (Mining) recognises the importance of mining, petroleum production, and extractive industries within the State. Clause 7 of SEPP (Mining) identifies development which can be carried out only with development consent, and includes 'underground mining carried out on any land' and 'facilities for the processing or transportation of minerals' mined from that land or adjoining land.

Clause 5 of SEPP (Mining) addresses its relationship with other environmental planning instruments, and states that if SEPP (Mining) is inconsistent with any other environmental planning instrument, SEPP (Mining) prevails to the extent of the inconsistency, with the exception of SEPP (Major Development), SEPP 14 Coastal Wetlands and SEPP 26 Littoral Rainforests. Irrespective of the provisions of Lake Macquarie Local Environment Plan (LEP) 2004, Draft Lake Macquarie LEP 2011, or Wyong LEP 1991, Myuna Colliery and the proposed Project, including land accommodating existing surface infrastructure and operations, is permissible with consent.

Part 3 of SEPP (Mining) sets out the matters which must be considered prior to granting development consent for the purposes of mining. Clause 12 requires that the compatibility of the proposed mine with other land uses is considered prior to determination of the Project. Land use compatibility of the proposed Project is addressed in **Section 10.12.2** of this EA.

Clause 14 relates to natural resource management and environmental management, and the minimisation of impacts to water resources, ecology, and greenhouse gas (GHG) emissions. An assessment of the impacts on

these resources is provided in **Sections 10.2, 10.4, 10.7,** and **10.10**(respectively)**,** with mitigation measures summarised in **Section 10.10.4**.

Clause 15 relates to optimising the efficiency of resource recovery and the reuse or recycling of material. As previously outlined, if Project Approval is refused, approximately 37 Mtpa in coal resource will be sterilised. The proposed mining methods have been outlined in **Section 5.2**, while waste management for the proposed Project is discussed in **Section 10.12.5**.

Clause 17 relates to the proposed end use and landform of the land once rehabilitated, an issue which is addressed in **Sections 5.6** and **10.12.1** of this report.

7.3.3 State Environmental Planning Policy (Infrastructure) 2007

SEPP (Infrastructure) 2007 (Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across the State.

Clause 104 of the Infrastructure SEPP relates to traffic generating development and requires that certain proposals be referred to the NSW Roads and Traffic Authority (RTA) for comment. Development to which clause 104 applies is set out in Schedule 3 of the Infrastructure SEPP and includes development (for any purpose not otherwise specifically identified in the schedule) with the potential to generate traffic of more than 200 vehicles per day.

The existing Development Consent for Myuna and Cooranbong Collieries approves the operations to employ up to 350 staff. Myuna Colliery currently employs 175 staff, with the existing staff car park having the capacity for 200 cars. The proposed Project will require up to 210 staff (split over three shifts) and delivery vehicle movements to the surface facilities area per day. Although the access arrangements and traffic generation of the project will be similar to the existing development, the NSW RTA and LMCC have been consulted during the preparation of this EA (refer to **Section 8.2.2**).

7.3.4 State Environmental Planning Policy 44 – Koala Habitat Protection

The aim of SEPP 44 – Koala Habitat Protection is 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*.' Schedule 1 lists the LGAs to which SEPP 44 applies, and requires an investigation be carried out to determine if 'core' or 'potential' Koala habitat is present and is likely to be disturbed. Lake Macquarie and Wyong LGAs are listed in Schedule 1 of SEPP 44.

SEPP 44 applies to the extent that a consent authority is restricted from granting development consent from proposals on land identified as core koala habitat without the preparation of a Plan of Management. The potential for the proposed Project to impact on land identified as core koala habitat has been assessed as part of this EA, as outlined in **Section 10.7,** and concludes that the proposed Project will not have a significant impact on core koala habitat.

7.3.5 State Environmental Planning Policy 71 – Costal Protection

SEPP 71 – Coastal Protection applies as a portion of the Project Application Area lies within the coastal zone. SEPP 71 aims to protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast, and to protect and improve existing public access to and along coastal foreshores. The proposed Project is not inconsistent with these aims.

7.3.6 NSW Sea Level Rise Policy Statement

The *NSW Sea Level Rise Policy Statement* (DECCW, 2009) (The Statement) outlines the Government's objectives and commitments with regard to sea level rise adaptation. The Statement discusses the impacts of sea level rise as well as identifies objectives and benchmarks to support communities and local councils to adapt to sea level rise in a way that minimises the resulting social disruption, economic costs and environmental impacts. To assist in meeting the objectives of The Statement, the Government commits to supporting local councils and the community in adapting to sea level rise by:

- Promoting an adaptive risk-based approach to managing the impacts of sea level rise;
- Providing guidance to local councils to support their sea level rise adaptation planning;
- Encouraging appropriate development on land projected to be at risk from sea level rise;

- Continuing to provide emergency management support to coastal communities during times of floods and storms; and
- Continuing to provide up-to-date information to the public about sea level rise and its impacts.

Sea level rise along the NSW coast is predicted to rise 40cm relative to 1990 mean sea levels by 2050 and 90 cm by 2100. The environment of Lake Macquarie would be expected at undergo changes of varying magnitudes over this period including to chemical composition, abundance and distribution of aquatic species, and relative lake depth. In addition to these natural changes, cumulative impacts may be expected with other developments that impact on the lake including residential, commercial and industrial developments.

Subsidence impacts to the bed of Lake Macquarie within Zone B are expected as a result of the proposed Project, which would result in localised increases in depth of up to 650 mm in parts of the lake. An aquatic ecology assessment has been undertaken in this regard and determined that while there will be some impacts to aquatic ecology, opportunities to conserve seagrass habitat and minimise disturbance would be undertaken (refer **Appendix I**). The assessment has identified valuable habitats that are at the most risk (i.e. seagrass beds) and has provided mitigation and management measures to minimise significant impacts.

7.4 Regional Plans

7.4.1 Lake Macquarie City Council Lifestyle 2020 Strategy

The *Lake Macquarie City Council Lifestyle 2020 Strategy* identifies Myuna Colliery's Surface Facilities Area as an 'Urban Area' adjacent to a 'Neighbourhood'. In the Strategy, the vision for 'Urban Areas' is to preserve or enhance the character of the local area. Land use compatibility of the proposed Project is addressed in **Section 10.13** of this EA.

7.4.2 Lower Hunter Regional Strategy 2006

The *Lower Hunter Regional Strategy: 2006–2031* (DoP, 2006) provides the land use planning framework to guide sustainable growth in the region over the next 25 years, and is reviewed every five years.

While the Lower Hunter's centres provide a range of sites for commercial and retail uses, land is also required for more industrial employment uses. The additional employment land identified under the Regional Strategy recognises that although there is currently a supply of vacant employment land across the Region, localised supply-and-demand issues exist and an increase in the local supply of employment land for general industry needs is required in some areas. The Surface Facilities Area is identified as 'Employment Land' under the Regional Strategy.

7.5 Local Planning Policies

The Project Application Area is located within the Lake Macquarie and Wyong LGAs. The Lake Macquarie LEP 2004, Draft Lake Macquarie LEP 2011 and Wyong LEP 1991 apply to the Project Application Area and are discussed in the following sections.

7.5.1 Lake Macquarie Local Environmental Plan 2004

Lake Macquarie LEP 2004 is the principal Environmental Planning Instrument (EPI) applying to the Lake Macquarie LGA. The existing surface facilities at Myuna are situated on land zoned 4(1) Industrial (Core) and adjacent to land zoned 9 Natural Resources. The Project Application Area also encompasses land predominantly zoned 11 Lake and Waterways and 2(1) Residential, though also includes 1(2) Rural living, 6(1) Open Space, 7 Conservation (Primary and Secondary), 7(5) Environmental (Living), 8 National Park, 9 Natural Resources, and 10 Urban, Employment, and Recreation/Conservation.

Mining is permissibile with consent in the 4(1) Industrial (Core) zone and 9 Natural Resources zone, but is prohibited on land within the remaining zones.

Clause 19 of LEP 2004 relates to development for the purpose of a mine, and states that nothing in LEP 2004 prevents a person, with development consent, from carrying out development for the purpose of a mine on any land to which LEP 2004 applies, if the mine is underground.

The proposed Project is consistent with the objectives of the 4(1) zone as it will continue to be an employment-generating operation for the region; it is separated from neighbouring residences by a vegetation buffer and ridgeline; and water treatment processes will continue onsite as part of the proposed Project.

Clauses 30 and 31 of LEP 2004 relate to the control of pollution and erosion and sediment, and require that a soil and water management plan be prepared and that all reasonable and practicable control measures are implemented during development. Pollution and erosion and sediment control measures and plans currently implemented at Myuna Colliery, along with additional plans, will form part of environmental management measures to be implemented for the proposed Project.

Clause 50 relates to development affecting places or sites of known or potential Aboriginal heritage significance, and outlines the consultation that must be undertaken with local Aboriginal communities and the local Aboriginal Land Council prior to approval. Consultation with Aboriginal heritage stakeholders has been undertaken for this EA, as outlined in **Section 8.3.2**.

Similarly, clause 51 of LEP 2004 requires a heritage impact statement to be prepared for development that will be carried out on an archaeological site or potential archaeological site or a relic that has European heritage significance. A European heritage assessment has been undertaken as part of this EA, however no relic of European heritage significance has been identified within the Project Application Area or will be impacted by the proposed Project.

Clause 60 of LEP 2004 requires development on land adjoining Infrastructure, Conservation, Environmental (Coastline) or National Park zones to be consistent with the operation and objectives of that zone. The consistency of the proposed continuation of mining operations at the Myuna Colliery surface facilities area with surrounding land uses is discussed in **Section 10.12.2.**

7.5.2 Draft Lake Macquarie Local Environmental Plan 2011

Myuna Colliery's Surface Facilities Area is proposed to be zoned part SP(1) Special Activities – Mine and part E2 Environmental Conservation under the Draft LEP 2011.

Mining is permissible with consent in the SP(1) Special Activities – Mine zone, where one of the objectives of the zone is to promote the adaptive re-use of exhausted mine sites.

The vegetated ridgelines surrounding the infrastructure on the Surface Facilities Area is zoned E2 Environmental Conservation, the objectives of which are to protect, manage and restore areas of high ecological value and to conserve, enhance and manage corridors to facilitate species movement, dispersal and interchange of genetic material. The proposed Project will maintain the existing vegetation on the Surface Facilities Area in accordance with the objectives of the E2 zone.

7.5.3 Wyong Local Environmental Plan 1991

A small section in the south of the Project Application Area, at Point Wolstoncroft, is located within the Wyong LGA, and is zoned 6(a) Open Space and Recreation under the Wyong LEP 1991. In this zone, mining is permissible with consent.

Clause 35 of LEP 1991 relates to development in the vicinity of heritage items, and requires the consideration of the likely effect of the proposed development on the heritage significance of a heritage item, archaeological site, or potential archaeological site and on its setting, at the assessment stage. As discussed previously, European and indigenous heritage assessments have been undertaken as part of this EA, as discussed in **Sections 10.8** and **10.9**.

7.5.4 Wyong Development Control Plan 2005 – Chapter 13: Interim Conservation Areas for Wyong Shire

The aim of *Wyong Development Control Plan 2005 – Chapter 13: Interim Conservation Areas for Wyong Shire* (DCP 2005) is *to protect and conserve remaining natural areas and wildlife corridor opportunities until such time as detailed ecological studies have been fully completed, to allow land use decisions to be made within conservation investigation lands.*

Potential Conservation Investigation Areas are identified in Appendix B of DCP 2005. The only area relevant to the proposed Project within Appendix B is Point Wolstoncroft which is located within the southern portion of the Project Application Area.

An assessment of terrestrial ecology impacts within the Project Application Area, including Point Wolstoncroft has been undertaken as part of the EA (refer to **Section 10.7** and **Appendix L**) and has determined that potential impacts to terrestrial ecology are negligible (refer to **Section 10.7**). The assessment in Appendix L has addressed the environmental planning criteria listed in Part 2 of the DCP, including an assessment of threatened species,

communities, populations or critical habitat under the TSC Act 1995 and an assessment of the significance of those species or habitat that have the potential to be impacted.

7.5.5 Draft North Wyong Shire Structure Plan

The *Draft North Wyong Shire Structure Plan* (Department of Planning, 2010) (Draft Structure Plan) is a high-level strategic planning framework developed to assist in the implementation of the 2008 *Central Coast Regional Strategy* (Department of Planning, 2008) (Regional Strategy) and to guide future local planning. The Regional Strategy identifies that the North Wyong area will accommodate the majority of the region's new greenfield development to 2031. The Draft Structure Plan considers a staging and sequencing plan to inform planning and infrastructure investment, meet housing demands, infrastructure requirements, and current and potential future mining issues.

Point Wolstoncroft is the only portion of the Project Application Area located within the Wyong LGA, and falls within the northern boundary of the Draft Structure Plan area. Point Wolstoncroft is part of the Lake Macquarie State Conservation Area, as discussed in Section 2.2.1. The Draft Structure Plan aims to ensure that planning for biodiversity at local levels improves or maintains existing areas of high biodiversity value to address biodiversity loss.

The Draft Structure Plan recognises Point Wolstoncroft as part of a State Conservation Area, and there are no future residential or employment areas proposed in the immediate vicinity under the Draft Structure Plan.

While a portion of the Project Application Area is located within the Draft Structure Plan area, the proposed Project would not directly impact proposed future development areas or compromise the preservation of biodiversity values designated under this plan.

8.0 Stakeholder Engagement

8.1 Background

Myuna Colliery has been operating within the local community for more than 25 years and has a long history of engagement with the community in which it operates. During this time Myuna Colliery has been actively involved in the community through participation in and sponsorship of a number of community initiatives at Arcadia Vale Public School, Wangi Peter Pan Kindergarten, Lake Macquarie Combined Fishing Club, Wangi Netball Club, Rathmines Public School, Powerhouse Christian Church, Wangi Lawn Bowling Club, Wangi Lions Club and the Wangi Beautification Project, Wangi Dobell Festival of Arts and Crafts, the Wangi Men's Shed and West Lake Soccer Club.

Myuna Colliery has demonstrated an ongoing commitment to providing information regarding its operations to the local community. Myuna Colliery provides regular updates of its activities in the Lakes Mail newspaper and actively promotes the Myuna Colliery Community Information Line. The Myuna Colliery Community information Line is visible on the Centennial Coal website and published monthly in the Lakes Mail newspaper (distributed to areas including Wangi Wangi, Arcadia Vale, Coal Point, Toronto, Awaba, Fishing Point, Buttaba, Eraring and Morisset Peninsula) as a mechanism for the local community to contact the Colliery with any enquiries or concerns regarding its operations.

Prior to the commencement of the Environmental Assessment process, Myuna Colliery developed a Stakeholder Engagement Plan to enable clear, effective, open and two-way communication with all identified stakeholders throughout the Project. The specific objectives of the Myuna Colliery Stakeholder Engagement Plan are to:

- set a process for engagement with stakeholders with an interest in the proposed Project, with clear desired outcomes for the Company and stakeholders;
- openly communicate with stakeholders about the proposed Project; and
- provide a means of community access to the Project team through the Myuna Colliery Community information Line.

The Stakeholder Engagement Plan is discussed further in **Section 8.3**.

8.2 EA Consultation

8.2.1 Planning Focus Meeting

The DoP advised that a Planning Focus Meeting (PFM) would be required in order for the Proponent to formally seek the views of relevant statutory authorities in respect of potential impacts of the proposed Project, and identify those issues which would need to be addressed in the EA.

A PFM was held on 17 June 2010. The PFM provided an opportunity for statutory authorities to establish the requirements for the form and content of the EA.

8.2.2 Statutory and Agency Consultation

CMPL has undertaken consultation with key local and State Government agencies as specified in the EARs during the preparation of this EA. The purpose of this consultation has been to provide an overview of the Project and to seek input into matters they would like to see addressed in the EA.

In this regard, face to face meetings, where possible, were held with relevant statutory agencies identified in the EARs, to assist with the preparation of the EA. Face to face meetings were held with a number of relevant statutory authorities including DECCW, DoP, and I&I.

Table 7 describes the consultation log undertaken as part of the EA for statutory and agency stakeholders. All relevant statutory authorities and agencies were provided with copies of the PEA for the Project. Details of consultation with DECCW in relation to management of water at Myuna Colliery, including the development of a pollution reduction programme, have also been provided in **Table 7**.

Table 7 Statutory and Agency Consultation Log

Issue	Date	Details
Department of Planning (DoP)		
Introduction	30/03/10	Meeting with DoP to introduce and provide an overview of the proposed Project.
Lodgement of PEA	01/06/10	CMPL informed DoP of the intention to submit PEA. DoP confirmed that a PFM would be required.
PFM	17/06/10	PFM held.
Project Update	25/06/10	Update on status of Project provided to DoP.
Department of Environment, Climate Change and Water (DECCW)		
Water Management	23/10/09	DECCW letter providing EPL variation notices for Centennial's Lake Macquarie EPLs.
Water Management	13/11/09	Centennial Letter to DECCW providing comments on Draft EPL variations for all of Centennials Lake Macquarie EPLs.
Water Management	30/11/09	DECCW response to Centennial comments on Draft EPL variations and provision of revised draft EPLs.
Introduction	22/04/10	Meeting with DECCW to introduce the project.
Introduction	06/05/10	Meeting and presentation to DECCW to discuss the project application.
PFM	17/06/10	Representatives from DECCW were invited to the PFM but were unable to attend.
Meeting Request	13/08/10	Email requesting a meeting to discuss subsidence in relation to ecology. No response received.
Water Management	30/11/10	Meeting to discuss water quality monitoring and the inclusion of a Pollution Reduction programme on all of Centennials EPLs in Lake Macquarie.
Water Management	16/12/10	Draft Licence variations issued by DECCW to Centennial.
Water Management	10/01/11	Centennial comments to DECCW on Draft EPL variations
Water Management	22/02/11	Final EPL variation notices issued to Centennial.
Department of Sustainability, Environment, Water, Population and Communities (SEWPaC)		
Introduction	01/07/10	Meeting with the Commonwealth Department of Environment, Water, Heritage and the Arts (now Department of Sustainability, Environment, Water, Population and Communities) to discuss the proposed Project.
Industry and Investment NSW (I&I)		
Introduction	13/05/10	Introduced I&I to the proposed Mining Zones A and B and provided an overview of the proposed Project.
PFM	17/06/10	Representatives from I&I attended the PFM.
NSW Office of Water (NoW)		
Introduction	11/05/10	Meeting and presentation to NoW to discuss the proposed Project.

Issue	Date	Details
PFM	17/06/10	Representatives from NoW were invited to the PFM but were unable to attend.
Roads and Traffic Authority (RTA)		
Introduction	10/05/10	Phone discussion with RTA to introduce the Project and highlight that some information may be requested from RTA as part of the proposed Project
Comments on PEA	2/08/10	Letter sent requesting comments on the PEA. Letter in response dated 8/09/10 received from RTA.
Lake Macquarie City Council (LMCC)		
Introduction	06/05/10	Phone discussion with LMCC to introduce the Project and highlight that some information may be requested from LMCC as part of the proposed Project
PFM	17/06/10	Representatives from LMCC attended the PFM.
Wyong Shire Council (WSC)		
PFM	17/06/10	Representatives from WSC attended the PFM.
Hunter Central Rivers Catchment Management Authority (HMCMA)		
PEA	04/06/10	A copy of the PEA was provided to the HMCMA
Mine Subsidence Board (MSB)		
PFM	17/06/10	Representatives from the MSB attended the PFM.
Eraring Energy		
PFM	17/06/10	A representative on behalf of Eraring Energy attended the PFM.

8.3 Project Stakeholder Engagement Plan

A Stakeholder Engagement Plan was prepared for the proposed Project. The purpose of the Stakeholder Engagement Plan was to provide a consistent framework to identify and consult with stakeholders with an interest in the proposed Project.

The Stakeholder Engagement Plan included the following:

- Identification of broad stakeholder groups that may have an interest in the proposed Project;
- Identification of appropriate methods of engagement for identified stakeholders;
- Identification of mechanisms for communication with stakeholders; and
- Identification of the means of recording feedback from stakeholders; and
- Appropriate assessment of community enquiries and concerns regarding the Project.

A record of all stakeholder engagement for the proposed Project has been maintained. Details of consultation with the local community and Indigenous stakeholders are provided in **Sections 8.3.1** and **8.3.2**.

8.3.1 Consultation with the Local Community

Myuna Colliery has kept the local community informed of the proposed Project through the distribution of project information in the local Lakes Mail newspaper (July 2010) and the development and distribution of a dedicated project information flyer (**Appendix D**). The project information flyer was provided to local businesses, members of the community, local Councillors and Members of parliament and made publicly available on the Centennial Coal website. The submission of the application by CMPL for the proposed Project to the Department of Planning was publicised in the Lakes Mail and the Land newspapers (1 July 2010) in accordance with the requirements of

the *Environmental Planning and Assessment Regulations 2000.* The Preliminary Environmental Assessment was made publically available on Centennial Coal's website.

The distribution of information regarding the proposed Project advertised the Myuna Colliery Community Information Line as a mechanism for the local community to contact the Myuna Colliery with any questions or concerns regarding the proposed Project. During the preparation of this Environmental Assessment, four community individuals contacted the Myuna Colliery on the Myuna Colliery Community Information Line to raise concerns regarding the proposed Project. These concerns were generally related to the impacts of subsidence from the proposed Project on residential areas, impacts on the proposed Project on property values, payments to local councils to improve services in the area and a request for further information regarding the proposed Project. This information was recorded on the Myuna Colliery Stakeholder Consultation Log.

Throughout the development of this Environmental Assessment, Myuna Colliery has also continued to build on its relationship with the local businesses and organisations within the local area. Discussions with Eraring Energy, the developers of the Wangi Power Station site, the Point Wolstoncroft State Recreation Area and the Wangi Lions Club were held to provide information to these community organisations on the current and proposed operations at the Myuna Colliery. Project Information Flyers were provided to these community groups.

The Myuna Colliery Stakeholder Engagement Plan will be regularly reviewed and updated as required to ensure the mechanisms for providing information to identified stakeholders is kept current and relevant to the activities at Myuna Colliery. Myuna Colliery will continue to keep the local community informed of its operations through the local newspaper and the Centennial Coal Website. A project information letter was distributed to the local community prior to the lodgement of the Environmental Assessment to ensure the community were aware of the Environmental Assessment, provide information on how to access the document and make the community aware of the process to be followed if they wish to make a submission to the Department of Planning regarding the proposed Project (refer to **Appendix D**).

8.3.2 Aboriginal Community Consultation

As part of the Aboriginal heritage assessment undertaken for the proposed Project, consultation with Indigenous stakeholders was undertaken in accordance with the DECCW *Aboriginal cultural heritage consultation requirements for proponents 2010.*

Three Aboriginal stakeholders registered an interest in the proposed Project: Awabakal Descendants Traditional Owners Aboriginal Corporation; Awabakal Traditional Owners Aboriginal Corporation and Bahtabah Local Aboriginal Land Council. A detailed log of the Aboriginal consultation undertaken throughout the proposed Project is provided in Section 1.5 and Appendix 2 of the Cultural Heritage Assessment provided in **Appendix M** of this EA.

9.0 Identification of Key Environmental Issues

This section outlines the risk assessment process that has been undertaken for the proposed Project in order to prioritise the key environmental, social and economic issues and confirm the need for the level of assessment in this EA.

9.1 Background

CMPL utilises a Risk Assessment process to identify environmental, safety and business risks to Myuna Colliery. This process involves its employees (and contractors where appropriate) identifying issues, or recognising areas where further information is required to identify these issues, and recommending any necessary additional controls for all risks identified. This process is guided by the overarching Environmental Policy adopted by Centennial which clearly states that it values its role in sustainable development and aims to manage its business to achieve balanced environmental, economic and social aspects. The Policy states Centennial's commitment to minimising environmental impacts and to continual improvement in environmental management and performance. The compilation of this EA was undertaken through a risk based and consultative approach. The primary objective of the risk assessment process was to identify those issues where further information or investigation was required in order to address existing knowledge gaps or recommend improvements to existing mitigation and management measures to ensure the residual consequences for the Project are acceptably low. Where the risks were considered unacceptable, or there was a knowledge gap in the information available, specialist investigations were undertaken.

An onsite risk assessment in relation to the proposed Project was undertaken by representatives from Centennial and AECOM on 23 April 2010 (refer to **Appendix E**). Based on the outcomes of this risk assessment, the potential environmental and social consequences of the proposed Project requiring further assessment were identified in the PEA (June, 2010) and ranked utilising a preliminary environmental risk assessment and an Issues Prioritisation Matrix (IPM). The majority of issues were assessed in the PEA as being of either Low or Moderate risk. No issues associated with the proposed Project were assessed to be of High or Extreme risk.

9.2 Identification of Potential Impacts of the Proposed Project

The potential impacts the proposed Project and their associated environmental, social and economic consequences have been identified through the preliminary environmental risk assessment undertaken for the PEA, consultation with Government agencies and the community, and considertation of the EARs issued for the EA. The environmental risk assessment undertaken for the PEA was based on existing knowledge, and identified a number of issues for which additional information and assessment was required to better determine their level of risk.

The environmental impacts associated with the proposed Project, which have potential environmental, social and/or economic consequences, include:

- **Land subsidence** within Zones A and B of the Project Application Area as a result of underground mining. Potential subsidence induced consequences are assessed in **Sections 6.0** and **10.0** and relate to:
    - social aspects;
    - ecology;
    - heritage (European and Aboriginal); and
    - water.
- **Air emissions**, including dust and GHG, from continued operation of the Colliery, and maximum annual coal production of up to 2 Mtpa ROM coal, including potential impacts at the Surface Facilities Area associated with the handling of ROM coal. Potential consequences of air emissions from the proposed Project relate to:
    - atmospheric issues; and
    - social aspects.
- **Noise emissions** from continued operation and increased maximum production by infrastructure at the Surface Facilities Area, including potential impacts associated with the handling of ROM coal. Potential consequences of noise emissions from the proposed Project relate to:

- social aspects.

- **Increased water discharges** at the Surface Facilities Area due to an increase in water make into the proposed workings, and increase in underground water extraction from the proposed workings to the surface. Potential consequences of increased surface water discharges resulting from the proposed Project relate to:
  - ecology;
  - soils; and
  - water (quality).
- **Land disturbance** associated with the construction of clean water diversions for the CHP Dam and Emergency Coal Stockpile Sediment Dam. Potential consequences of land disturbance impacts from the proposed Project relate to:
  - water (quality and quantity);
  - ecology; and
  - heritage (European and Aboriginal).
- **Increased daily traffic movements** to and from the Surface Facilities Area associated with an increase of 35 employees above current levels (175). Potential consequences of traffic impacts from the proposed Project relate to:
  - traffic and transport; and
  - social aspects.

9.3 Prioritisation of Risks

9.3.1 Approach

The prioritisation of environmental, social and economic consequences of the proposed Project has been undertaken based on the number and proximity of potential sensitive receivers surrounding the Surface Facilities Area, the existing physical environment, and management practices currently employed at the Colliery.

To assist in the ranking of the environmental and social issues, and identify those that are key for the proposed Project, the allocation of risk was based upon the considerations shown in **Table 8** and the IPM outlined in **Table 9**. This method is consistent with Centennial's risk assessment process and assesses priority on the basis of the likelihood of environmental effects and the potential consequence of those effects.

Table 8 Centennial Risk Allocation Considerations

Likelihood of Risk		Consequences of Unmanaged Effects	
A	Certain	1	Catastrophic
B	Probable	2	Major
C	Possible	3	Moderate
D	Remote	4	Minor
E	Improbable	5	Insignificant

Table 9 Centennial Issues Prioritisation Matrix

Risk Ranking	Risk Category		Generic Management Actions
1 – 4	E	Extreme	Immediate intervention required from senior management to eliminate or reduce this risk
5 – 9	H	High	Imperative to eliminate or reduce risk to a lower level by the introduction of control measures. Management planning required at senior levels
10 - 15	S	Significant	Corrective action required, senior management attention needed to eliminate or reduce risk
16 – 19	M	Moderate	Corrective action to be determined, management responsibility must be specified
20 - 25	L	Low	Monitor and Manage by corrective action where practicable

9.3.2 Ranking

Each of the potential environmental social and economic consequences of the proposed Project were ranked in accordance with the IPM as either being of Low, Moderate, Significant, High or Extreme risk. The initial findings of the risk assessment were used to prioritise and focus the required environmental assessments for the proposed Project, to ensure that each of these issues were addressed to a relevant extent and that appropriate management and mitigation options developed.

The majority of issues were assessed as being Low with the remainder Moderate. No potential environmental social and economic consequences associated with the proposed Project were assessed to be Significant, High or Extreme.

This assessment aims to allow the prioritisation of issues for assessment and does not consider the application of mitigation measures to manage environmental effects. It is anticipated that any Moderate risks identified will be able to be reduced to a Low risk through the identification and implementation of the mitigation measures outlined in **Sections 10** and **11**. The potential residual consequence of each issue, following the implementation of these measures, is discussed in the following sections of this report. **Table 10** ranks the potential environmental issues in order of prioritisation.

Table 10 Prioritisation of Consequences

Low	Moderate
Surface Water Traffic Terrestrial Ecology Heritage (Aboriginal and European) Greenhouse Gas Economic Other minor issues (Rehabilitation and Mine Closure; Land Use; Soils; Waste; Visual; Hazards)	Air Quality Groundwater Acoustics Aquatic Ecology Social

9.3.3 Assessment of Environmental, Social and Economic Consequences

Potential environmental, social and economic consequences of subsidence, air and noise emissions, water discharges, land disturbance and traffic generation arising as a result of the proposed Project are addressed in section **10.0** of this EA. The scope of the assessment of the potential consequences of the proposed Project has been determined based on the preliminary environmental risk assessment undertaken for the PEA, consultation with Government agencies and the community, and considertation of the EARs issued by the Director-General.

As an overview, the environmental, social and economic consequences associated with potential impacts of the proposed Project for which assessments were undertaken include:

- Air quality
    - Potential air quality impacts due to dust generation from continued operations at the Surface Facilities Area and emissions from the underground mine.
- Groundwater
    - Potential for mining activities and subsidence to adversely affect aquifers.
- Noise
    - Impact on nearby sensitive receivers from noise due to continued operation of the Surface Facilities Area.
- Aquatic ecology
    - Impacts to seagrass beds due to subsidence impacts and changes in water depth.
    - Impacts to aquatic ecosystems due to water quality discharges.
- Social
    - Social and economic benefits for the local area and the greater region through continued employment, revenue and community support.
    - Demand upon community, natural or transport resources resulting from continued operations.
    - Impacts to residential land value as a result of mining.
- Surface water
    - Impacts on local water resources and users due to loss of, or alterations to, surface flows from mining activities.
    - Impacts on local watercourses due to increased discharge at the surface discharge point.
- Traffic
    - Effects on existing road traffic network resulting from an increase in employees.
- Terrestrial ecology
    - Indirect impacts to threatened species, EECs and habitat due to subsidence impacts.
    - Impacts to Groundwater Dependent Ecosystems due to subsidence impacts on aquifers.
- Heritage
    - Impacts on natural heritage due to subsidence impacts upon surface features (i.e. significant rock formations and escarpments).
    - Impacts on Aboriginal heritage due to subsidence impacts upon surface features.
    - Impacts on European heritage due to subsidence impacts upon surface features.
- Greenhouse gas
    - Elevated GHG emissions associated with continued operations of the mine and associated infrastructure, and use of ROM coal at Eraring Power Station.
- Economic
    - Impacts on the State economy through additional wages, royalties and business turnover, and flow-on spending within a number of different sectors of the regional economy.
    - Loss of jobs due to Project refusal or mine closure.
- Other minor issues
    - Incompatibility of final landform with surrounding land uses.
    - Impacts to soil from continued operations at the Surface Facilities Area.
    - Disposal of waste generated as part of continuation of existing operations at the surface facilities.

- Visual impacts associated with existing surface facilities (including lighting).
- Impacts of hazards including bushfire and the storage of flammable liquids at the Surface Facilities Area.

The level of assessment of these potential environmental, social and economic consequences associated with the impacts of the proposed Project has been based on the outcomes of the risk assessment and reflects the need for additional assessment and/or mitigation measures to address these consequences. The assessment of these potential environmental, social and economic consequences is provided in **Section 10.0** of this EA.

10.0 Assessment and Management of Key Environmental Consequences

This section assesses the key environmental, social and economic consequences of the proposed Project and identifies mitigation and management measures where appropriate. The order in which the various environmental, social and economic consequences are addressed in this section is based on their priority as ranked by the risk assessment in **Section 9.0**.

10.1 Air Quality

The Air Quality Impact Assessment prepared by Heggies Pty Ltd (Heggies) as part of this EA assessed the potential cumulative air quality impacts of the proposed Project, which largely reflects the ongoing operation of Myuna Colliery's Surface Facilities Area, in addition to existing local pollutant sources. The complete Air Quality Impact Assessment is provided in **Appendix F** of this EA.

10.1.1 Background

Myuna Colliery's Surface Facilities Area is surrounded by a mix of land uses and types, including mining, industrial, vegetated and residential land, and is proximate to Lake Macquarie.

Local air pollution sources within the vicinity of the Surface Facilities Area include the existing operation of Myuna Colliery's Surface Facilities Area, along with the operation of Awaba Colliery (5.4 km north), Newstan Colliery (9.6 km north) and Eraring Power Station (approximately 5 km west). Eraring Power Station's Ash Dam, located approximately 1.5 km to the north-west, is also a potential source of atmospheric pollution in the local area. These nearby sources have the potential to contribute to background air pollution levels and cumulative impacts on sensitive receivers surrounding the Surface Facilities Area.

Other factors directly affecting air quality in the area include:

- Seasonal wind patterns;
- Temperature inversions; and
- Local topography.

Myuna Colliery's Surface Facilities Area is likely to experience light to moderate winds (between 1.5 m/s and 5.5 m/s) primarily from the south-east. Calm wind conditions (wind speed less than 0.5 m/s) occur approximately 6% of the time. Ground-based temperature inversions are generally observed on some nights and mornings. Rainfall in the region is typically less during the winter months with higher rainfall generally experienced during the summer months.

The topography in both the immediate and regional vicinity of the Surface Facilities Area is classified as un-complex terrain as it is relatively flat and generally void of steep slopes.

10.1.2 Methodology

The Air Quality Impact Assessment has been prepared in accordance with the DECCW's *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (the Approved Methods) and assesses compliance with DECCW air quality criteria.

In order to determine the potential impacts of the proposed Project on air quality, the Air Quality Impact Assessment involved:

- Determination of the existing ambient air quality environment including meteorological modelling of predicted wind and stability using The Air Pollution Model (TAPM);
- Compilation of an emissions inventory;
- Determination of project-specific air quality assessment criteria;
- Modelling of predicted impacts using the Ausplume Gaussian Plume Dispersion Model software (Ausplume); and
- Recommendation of mitigation measures where appropriate.

The modelling parameters contained a number of assumptions which allowed for a conservative 'worst case' scenario to be assessed. Therefore, all particulate predictions were conservative, with actual levels during standard operations expected to be lower than those modelled.

Meteorology

TAPM was used to predict meteorological conditions (including wind speed and direction, temperature, pressure, water vapour, cloud, rain water and turbulence) at Myuna Colliery using data sets from Inglewood and Mandalong Mine.

The closest available weather station to Myuna Colliery's Surface Facilities Area is Inglewood (8.5 kilometres to the south-west) where data from this weather station was limited to August 2005 to June 2006 (11 months). However the Mandalong Mine weather station (15 kilometres to the south-west) was able to provide the full (12 months) data set for the same period. Both the Inglewood and Mandalong Mine weather stations have been used in the TAPM model to infer meteorological conditions for the calendar year July 2005 to June 2006 for the Surface Facilities Area.

The local area has a prevailing wind primarily from the south-east. A summary of TAPM July 2005- June 2006 annual wind speed and direction predicted at Myuna Colliery Surface Facilities Area is presented as a wind rose in **Appendix F**.

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. TAPM was used to predict the frequency of each stability class at the Surface Facilities Area during 2005/2006. The most dominant stability class was where high winds or cloudy days and nights are common, indicative of neutral conditions conducive to a moderate level of pollutant dispersion due to mechanical mixing.

10.1.3 Existing Ambient Air Quality

Baseline air quality data has been obtained from Myuna Colliery's existing monitoring network (which commenced in 2005) and DECCW's Wallsend monitoring station.

Deposited Dust

Dust deposition levels have been monitored at the Surface Facilities Area since 2005 at the four locations indicated in **Figure 10.1.1**. Deposited dust gauge location 3 (DG3) best provides a measure of ambient dust deposition monitoring due to its distance from Myuna Colliery's infrastructure and as local wind direction is predominantly from the south-east. Annual dust deposition levels recorded at the Surface Facilities Area between 2005 and 2009 are shown in **Table 11.**

Table 11 Annual Average Dust Deposition Levels – Myuna Colliery 2005-2009

Monitoring Location	Annual Average Dust Deposition Levels (g/m^2/month)				
	2005	2006	2007	2008	2009
DG1	0.9	1.0	0.8	0.9	1.2
DG2	0.7	1.0	1.0	0.9	1.1
DG3	0.8	1.2	0.9	1.8	1.1
DG4	1.2	1.2	1.5	1.3	1.9

PM_{10}

PM_{10} concentrations (24-hour average, 1-in-6 day cycle) are measured by High Volume Air Samplers (HVAS) at two locations in the vicinity of Newstan Colliery, approximately 10 km to the north of the Surface Facilities Area and the second at the DECCW monitoring station at Wallsend, approximately 20 km north-north-east of the Surface Facilities Area. The DECCW monitoring station at Wallsend was considered to be more appropriate to provide a background PM_{10} data set, as this monitoring station is not significantly impacted by the influence of mining operations.

The highest 24-hour average PM_{10} level recorded at DECCW's Wallsend monitoring station was 50.7 µg/m^3 on 24 December 2005, which is slightly above the DECCW goal of 50 µg/m^3. The annual average PM_{10} concentration for 2005/2006, recorded at the DECCW's Wallsend monitoring site, was 18.0 µg/m^3.

Total Suspended Particulates

Total Suspended Particulate (TSP) concentrations (24-hour average, 1-in-6 day cycle) are also measured by the two HVAS in the vicinity of Newstan Colliery, however insufficient data of background TSP concentrations was available for use in the assessment in accordance with the DECCW Approved Methods. Therefore a 2:1 TSP/PM_{10} ratio was applied to the annual PM_{10} data measured at Wallsend to enable the calculation of an annual background TSP concentration for the Project. Based on the annual average PM_{10} concentration at Wallsend in 2005/2006 (18.0 µg/m^3), the background TSP concentration was calculated to be 36 µg/m^3.

Emissions from Underground Mining

Emissions from the underground coal mining activities include emission of nitrogen dioxide (NO_2) and carbon monoxide (CO) from the mine ventilation system at the Surface Facilities Area. There was no data available to determine site specific emissions of NO_2 and CO, however assumptions were made to provide a conservative assessment of the emission of NO_2 and CO from the mine ventilation system (refer to **Appendix F**).

Odour

Over the operational history of Myuna Colliery, no odour complaints have been received by the mine. As the proposed Project will see the continuation of current operations at the mine, negligible odour emissions are expected as a result of the Project. As such, no further assessment of odour was undertaken in the Air Quality Impact Assessment.

Summary

Baseline data for the years 2008-2009 showed that dust deposition and TSP are consistently below DECCW criteria, as shown in **Table 12**.

Table 12 indicates that the highest 24-hour average PM_{10} recorded in DECCW's Wallsend monitoring station was 50.7 µg/m^3 recorded on 24 December 2005. This is slightly above the DECCW goal of 50 µg/m^3. However, in accordance with the Approved Methods, this value has been included in the assessment as it is appropriate to assess whether any additional exceedances of the impact assessment criteria will occur as a result of the proposed Project. To ensure a conservative approach was undertaken for the proposed Project, this maximum background 24hr level of PM_{10} was used as the basis for the current air quality modelling.

Table 12 Baseline Air Quality Monitoring Data (2008-2009)

	Dust Deposition (g/m^2/mth)	PM_{10} (µg/m^3)		TSP (µg/m^3)
	Annual Average	24 hr	Annual Average	Annual Average
Maximum	N/A	**50.7**	N/A	N/A
Average	1.8	18	18	36
DECCW Criteria	**4**	**50**	**30**	**90**

10.1.3.1 Sensitive Receptors

A number of residences are located immediately adjacent to the boundary of the Surface Facilities Area and were identified as sensitive receivers for the purposes of the AQIA. The nearest sensitive receiver is located approximately 0.5 kilometres south-east of the infrastructure at Myuna Colliery's Surface Facilities Area. Sensitive receivers are described in **Table 13** and shown on **Figure 10.1.1.**

AECOM

LOCATION OF SENSITIVE RECEIVERS AND DUST MONITORING STATIONS

Centennial Myuna Pty Ltd

Environmental Assessment

Figure 10.1.1

Table 13 Nearest Sensitive Receivers

Receptor ID	Location	Location (m, MGA56)		Distance (km) / Direction from Mine Infrastructure	Elevation (m, AHD)
		Easting	Northing		
R1	2 Turrama Street, Wangi Wangi	366858	6340370	0.5 SW	12
R2	2 Moani Street, Wangi Wangi	366652	6340175	0.5 SE	29
R3	3 Sunset Close, Wangi Wangi	365707	6340844	0.5 W	36
R4	119 Donnelly Road, Arcadia Vale	366662	6341662	0.9 N	50
R5	93 Donnelly Road, Arcadia Vale	366857	6341348	0.7 NNE	40
R6	83 Donnelly Road, Arcadia Vale	367049	6341185	0.7 NE	31
R7	63 Donnelly Road, Arcadia Vale	367091	6340965	0.6 NE	32
R8	53 Donnelly Road, Arcadia Vale	367072	6340821	0.5 E	19

10.1.4 Impact Assessment

10.1.4.1 Emissions Inventory

Emissions of particulate pollution (deposited dust, PM_{10} and TSP) from current mining activities at Myuna Colliery occur as a result of the following activities:

- Conveying coal to the emergency hopper during shutdown of the Eraring Energy-owned enclosed overland conveyor;
- Infrequent loading of coal trucks from the emergency hopper during shutdown of the enclosed overland conveyor;
- Infrequent truck unloading of coal to the emergency stockpile and into the CHP reclaim hopper during shutdown of the enclosed overland conveyor;
- Use of a front end loader at the emergency coal stockpile during shutdown of the enclosed overland conveyor; and
- Wind erosion of the emergency coal stockpile.

Emissions from underground coal mining at the vent fan have the potential to include NO_2 and CO and odour.

10.1.4.2 Assumptions

The assumptions made in creating the emissions inventory for the proposed Project and used in the AQIA are detailed in Section 7.1.1 of **Appendix F.**

Reduction factors were obtained from Table 3 of the National Pollutant Inventory (NPI) Emission Estimation Technique Manuals (EETM). An emission reduction factor of 100% was applied to the crushers, screens, transfer points and conveyors due to these activities being fully enclosed onsite.

Similarly, an emission reduction factor of 100% was applied to hardstand areas and roads within the Surface Facilities Area due to all haul roads and open areas being sealed and regularly maintained by a street sweeper. Emissions from these sources were therefore assumed to be negligible.

10.1.5 Assessment Criteria

The air quality goals at sensitive receivers adopted for the assessment of the proposed Project are those specified in the DECCW Approved Methods (2005), the *Ambient Air Quality National Environment Protection Measure* (NEPM) (National Environmental Protection Council, 1998), or recommended by the National Health and Medical Research Council (NHMRC) as shown in **Table 14.**

Table 14 Project Air Quality Assessment Criteria

Measurement	Unit	Body	Criteria at Receiver
Dust Deposition ($g/m^2/mth$)	Incremental Annual Average	DECCW	**2**
	Total Annual Average	DECCW	**4**
PM_{10} ($\mu g/m^3$)	24 hr	DECCW / NEPM	**50**
	Annual Average	DECCW	**30**
TSP ($\mu g/m^3$)	Annual Average	National Health and Medical Research Council (NHMRC)	**90**
NO_2 ($\mu g/m^3$)	1-hour average	DECCW	**246**
	Annual Average	DECCW	**62**
CO ($\mu g/m^3$)	1-hour average	DECCW	**30**
	Annual Average	DECCW	**10**

10.1.5.1 Modelling Results

Emissions from the particulate generating activities identified in **Section 10.1.4** were modelled and the air quality dispersion modelling predictions results show that potential impacts from deposited dust, PM_{10} (annual average) and TSP generated by the proposed Project will meet all DECCW criteria, with the exception of total 24-hour maximum PM_{10} (refer to **Table 15**).

According to predicted emission rates, NO_2 emissions will need to be diluted by a factor of 7 and CO emissions diluted by a factor of 18 in order to fall below the DECCW criterion. Highly conservative assumptions have been adopted for the dispersion modelling and the distance to the nearest receiver is approximately 500 metres from the mine infrastructure.

Table 15 Project Air Quality Predictions

Measurement	Unit	Criteria at Receiver	Site Incremental Contribution	Predicted Cumulative Level at Receiver
Dust Deposition ($g/m^2/mth$)	Incremental Annual Average	**2**	<0.1	<0.1
	Total Annual Average	**4**	<0.1	1.9
PM_{10} ($\mu g/m^3$)	24 hr	**50**	1.2 to 15.6	10.5 to **51.7 (R4)**
	Annual Average	**30**	<0.1	18.1
TSP ($\mu g/m^3$)	Annual Average	**90**	<0.1	36.1
NO_2 ($\mu g/m^3$)	1-hour average	**246**	<9.82 to 68.3	9.82 to 68.3
CO ($\mu g/m^3$)	1-hour average	**30**	<3.17 to 22.1	3.17 to 22.1

Specifically, the results in **Table 15** show that:

- Total annual average dust deposition levels at all receivers surrounding the Surface Facilities Area will remain below the DECCW criterion of 4 g/m^2/month (refer to **Figure 10.1.2**);

- TSP annual average (background plus predicted increment) are predicted to below the Project criteria of 90 µg/m^3 at all receivers (refer to **Figure 10.1.3**);
- Total 24-hour PM_{10} incremental contribution from Myuna Colliery is predicted to be between 1.2 and 15.6 µg/m^3.
- Total 24-hour maximum PM_{10} (background plus predicted increment associated with the proposed Project at the nearest sensitive receptors ranging from 1.2 µg/m3 to 15.6 µg/m^3) will be in exceedance of 50 µg/m^3 at all of the nearest sensitive receivers. However, this exceedance is attributed to the background PM_{10} used in the assessment (sourced from the DECCW Wallsend monitoring station) being already above this criterion (refer to **Table 12**).
- The total 24-hour average PM_{10} (background plus highest predicted increment) are predicted to be below the Project criterion of 50 µg/m3 (the worst case 24-hour average PM_{10} incremental increases associated with the project at the nearest sensitive receptors ranged from 1.2 µg/m3 to 15.6 µg/m_3), hence showing that no additional exceedances are predicted to occur as a result of the proposed operations at the Surface Facilities Area;
- Cumulative maximum 24-hour average PM_{10} attributable to the Project is predicted to be below the criterion of 50 µg/m^3 at all receivers, excluding periods of regional pollution events, showing that no additional exceedances are predicted to occur as a result of the proposed operations at the Surface Facilities Area (refer to **Figure 10.1.4**);
- Annual average PM_{10} levels are predicted to be below the criterion of 30 µg/m^3 at all receivers (refer to **Figure 10.1.5**); and
- 1-hour average concentrations of both NO_2 and CO will be below the DECCW criteria at each of the 8 nearest sensitive receivers.

The extension of operations at Myuna Colliery will not result in additional annual exceedences of of air quality criteria, including PM_{10}

It is therefore concluded that the proposed Project will not have a significant impact on the existing cumulative ambient air quality of the local area or surrounding region. The existing air quality monitoring program for Myuna Colliery is considered adequate for the monitoring of potential air quality impacts on nearby sensitive receptors.

10.1.6 Management and Mitigation Measures

Existing air quality management at the Surface Facilities Area is undertaken in accordance with the Myuna Colliery Dust Management Plan (December 2007) and includes mitigation measures such as:

- Sealed hardstand areas including roads;
- Sweeping of all hard stand and sealed roads by a vacuum sweeper truck on a fortnightly basis;
- Sweeping of hard stand areas with an onsite bobcat with broom attachment, employed as necessary;
- Enclosure of the coal crushers and coal transfer points;
- Dampening down of operational and hardstand areas by the use of a water cart as required. Sprinklers are used for dust suppression when coal is stockpiled; and
- Enclosure and weekly wash down of all site conveyors to prevent aeration.

A complaints hotline is also maintained for the Colliery. Any complaints received are recorded and responded to in accordance with the procedures set out in the existing dust management plan.

10.1.7 Conclusion

The proposed Project will contribute between 1.2 and 15.6 µg/m^3 to maximum 24-hour PM_{10} levels, which is not in itself significant, however when combined with background data, cumulative levels will be in exceedance of the project specific criterion at all of the nearest sensitive receivers. This is due to the conservative background PM_{10} level used in the modelling (50.7 µg/m^3) being already above this criterion (50 µg/m^3). Current air quality management and dust mitigation practices in place at Myuna Colliery represent best practice mitigation measures and will be continued for the proposed Project.

Cumulative levels and the annual average PM_{10} attributable to background levels plus emissions from the proposed Project, however, are predicted to be below the project criteria at all receivers, excluding periods of regional pollution events.

With the exception of the 24-hour maximum PM_{10} levels, the proposed Project will comply with project criterion at all nearby receptors. Given the existing management regime at Myuna Colliery and limited history of complaints, continued implementation of the Myuna Colliery Dust Management Plan is considered adequate to manage any residual consequences to air quality as a result of the proposed Project.

AECOM

PREDICTED ANNUAL AVERAGE DUST DEPOSITION CONTOUR

Centennial Myuna Pty Ltd

Environmental Assessment

Figure 10.1.2

AECOM

PREDICTED TSP ANNUAL AVERAGE CONCENTRATION CONTOUR

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Figure 10.1.3

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PREDICTED 24 HOUR AVERAGE PM_{10} CONCENTRATION CONTOUR

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Figure 10.1.4

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PREDICTED ANNUAL AVERAGE PM_{10} CONCENTRATION CONTOUR

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Figure 10.1.5

10.2 Water Management

A Water Assessment was undertaken by GHD to assess existing surface water and groundwater conditions at Myuna Colliery, and to determine the potential impact of the proposed operations on current and proposed water systems. The Water Assessment is provided in **Appendix G**.

10.2.1 Surface Water

Myuna Colliery's Surface Facilities Area is located in proximity to Wangi Creek which is a heavily modified waterway as a result of the Wangi Power Station outflow canal. As described in **Section 4**, Myuna Colliery's existing water management system discharges water to Wangi Creek through two discharge points licensed under Myuna Colliery's EPL 366. The current obligations under EPL 366 for LDP001 and LDP002 are listed in **Table 16**.

Table 16 EPL 366 obligations for LDP001 and LDP002

Licensed Discharge Point – EPL 366	Type of Discharge Point	Type of Monitoring Point	Volumetric Limit (ML/day)
LDP001	Discharge to waters	Volume monitoring Monthly monitoring of filterable iron and manganese, total suspended solids (TSS), and pH	12
LDP002	Discharge to waters	Volume monitoring Monthly monitoring of oil and grease, TSS, and pH	1

10.2.1.1 Existing Environment

Site Hydrology

Surface water runoff within the Myuna Colliery Surface Facilities Area is conveyed within a number of natural and constructed flow paths. Watercourses that originate in or pass through the Project Application Area all contribute to Lake Macquarie. The named watercourses are Wangi Creek and Sawmill Creek, and are shown in **Figure 10.2.1** along with their respective catchment areas.

The Surface Facilities Area is located within the Wangi Creek catchment and covers approximately 23% of the creek catchment. Myuna Colliery does not extract water from natural watercourses, however it does discharge both groundwater and rainfall runoff into Wangi Creek, through LDP001 and LDP002.

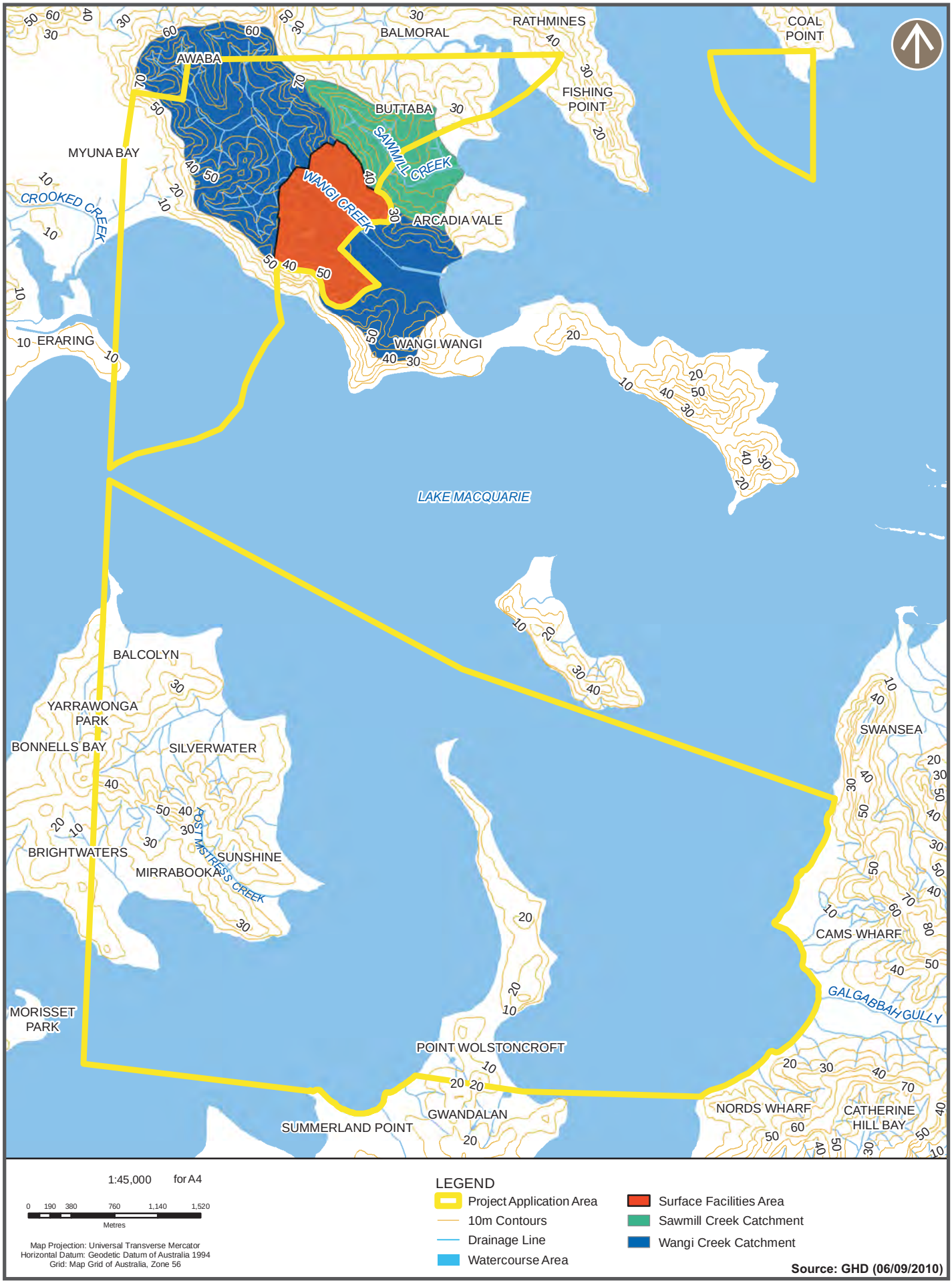
Surface Watercourses

The catchments of two named watercourses, Wangi Creek and Sawmill Creek, are located within and adjacent to the Surface Facilities Area, respectively. Of the two creeks, only Wangi Creek is directly influenced by discharge from the Surface Facilities Area, which is located in the lower reaches of the Wangi Creek catchment. Wangi Creek receives discharges from the two licensed discharge points, LDP001 and LDP002.

Myuna Colliery does not harvest clean catchment runoff or extract water from any watercourses within the Project Application Area.

Existing Surface Water Management System

Surface water consists of runoff (both clean and dirty) that contributes to surface water storages. At Myuna Colliery these include the CHP Dam, mine water settlement ponds and the Emergency Coal Stockpile Sediment Dam.



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WATERCOURSES WITHIN PROJECT APPLICATION AREA

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Figure 10.2.1

As described in **Section 4.4.6**, the surface water system is divided into clean and dirty water catchments, as follows:

- **Clean water management** - includes diversion of external catchment runoff through a series of clean water diversions which direct the flow of surface water from clean catchments away from dirty catchment areas, and the management of clean surfaces within the surface facilities area. Clean surfaces managed within the Surface Facilities Area include:
    - Roof runoff from the administration, bathhouse and workshop buildings, which is collected through downpipes and directed to the piped stormwater network, into the first flush settlement tank, eventually discharging into an open channel which drains to Wangi Creek.
    - Runoff from several clean hardstand areas including the car park and materials yard. To maintain these hardstand areas as clean catchments, regular sweeping is undertaken and these areas are also regularly inspected to ensure that they remain clean. This runoff is discharged through the first flush settlement tank eventually discharging into an open channel which drains to Wangi Creek.
    - External catchment runoff from areas surrounding the Surface Facilities Area. There are limited clean water diversions currently in place (refer **Figure 10.2.2**). External catchment runoff flows into Wangi Creek.
- **Dirty water management** - includes the capture of water from disturbed surfaces and a series of dirty water diversions which direct flow of dirty water to the dirty water management system. Dirty water sources include:
    - Runoff from the CHP and storage yard is directed through a series of open drains, diversions, collection sumps and pipes to the primary settlement tank, which then discharges into the CHP Dam.
    - Runoff captured from the Emergency Coal Stockpile Area within the Emergency Coal Stockpile Sediment Dam. Water levels in the Emergency Coal Stockpile Sediment Dam are monitored, and water is transferred to Mine Water Settling Pond 2 as required through bi-directional pipeline and pumping mechanism. Water from Mine Water Settling Pond 2 flows to Mine Water Settling Pond 3 through a connecting weir, prior to discharge through LDP001 to Wangi Creek. In the event that the capacity of the Emergency Coal Stockpile Sediment Dam is exceeded, ponding extends into the broader Emergency Coal Stockpile Area. There is also a discharge point (that contributes to Wangi Creek) from this dam in the event of an extreme rainfall event (in excess of 80 mm in 24 hours), accompanied by a failure of the pumping mechanism.
    - Runoff from the washdown bay is directed to the oil/water separator and tank. Water from the oil/water separator is pumped to the sewer in accordance with a Trade Water Permit from Hunter Water Corporation.

The dirty water catchments and dirty water diversions for the CHP Dam and Emergency Coal Stockpile Sediment Dam are shown on **Figure 10.2.3**.

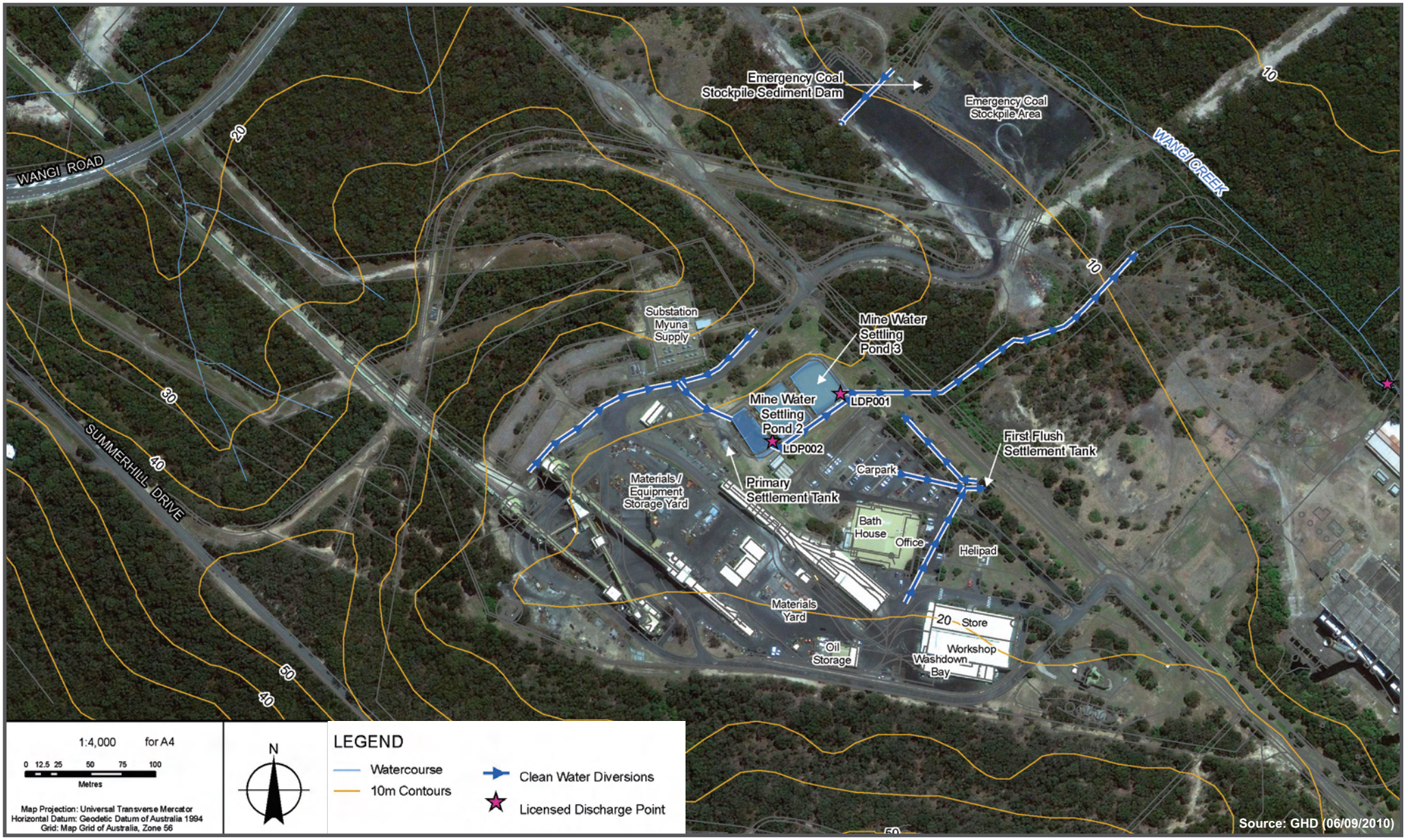
While the CHP Dam and Emergency Coal Stockpile Sediment Dam are primarily part of the dirty water management system, these storage areas currently receive contributions from clean water catchment areas, which is resulting in unnecessary volumes of flow through the water management system, and subsequent discharges through the LDPs. The catchments contributing to the CHP Dam and Emergency Coal Stockpile Sediment Dam are shown on **Figure 10.2.4**.

The surface water management infrastructure within the Surface Facilities Area and their respective capacities are listed in **Table 17**.

Table 17 Surface Facilities Area Water Management Structures

Water Management Structure	Capacity (ML)	Description
Primary Settlement Tank	0.04	The primary settlement tank collects runoff water from the CHP and storage yard, and then discharges into the CHP Dam.
Oil / Water Separator	0.01	Runoff from the washdown bay is collected in the oil/water separator. Water is discharged into the sewerage system through a trade waste agreement with Hunter Water (permit number D-171027).
CHP Dam	1.05	The CHP Dam captures runoff from both clean and dirty water catchments as indicated in **Figure 10.2.4**. Additionally, there is a transfer of underground water (a maximum of 1 ML/day through a siphon) from Mine Water Settling Pond 2. The CHP Dam then discharges (through LDP002) to Wangi Creek. The CHP Dam collects water from a dirty catchment area of 3.3 hectares, and receives contributions from a clean catchment area of approximately 8.2 hectares. Capacity of the CHP Dam is typically limited to receiving runoff in the order of 0.3 ML during a rainfall event. Runoff greater than 0.3 ML may be generated during a rainfall event of greater than 15 millimetres in 24 hours.
Emergency Coal Stockpile Sediment Dam	1.36 (includes additional spill volume)	This dam collects runoff from the Emergency Coal Stockpile Area, which is then transferred to the Mine Water Settling Pond 2 by a pump mechanism and bi-directional pipeline. The total catchment area (approximately 5.6 hectares) includes some clean water runoff from surrounding vegetated areas. The catchment area is shown on **Figure 10.2.4**. Water level within the Emergency Coal Stockpile Sediment Dam is managed by Myuna Colliery, and water is transferred to the Mine Water Settling Pond 2 when water levels increase, in particular during rainfall events which exceed 80 millimetres in 24 hours. A discharge point (that contributes to Wangi Creek) from this dam is utilised in the event of an extreme rainfall event (in excess of 80 millimetres in 24 hours) accompanied by a failure of the pumping mechanism.
Mine Water Settling Pond 2	1.80	Contains underground water make. Underground water is transferred to the CHP Dam by a siphon, and to Mine Water Settling Pond 3 through a connecting weir. Mine Water Settling Pond 2 also receives water from the Emergency Coal Stockpile Sediment Dam.
Mine Water Settling Pond 3	1.65	Contains underground water received from Mine Water Settling Pond 2, and does not receive any contributions from surface catchments. Water is discharged from Mine Water Settling Pond 3 through LDP001 to Wangi Creek.
First Flush Settlement Tank	0.16	Collects clean catchment runoff including roof runoff from the administration, bath house and workshop buildings. Discharges are directed into an open canal that drains into Wangi Creek.

The surface water system also includes potable water and waste water. Potable water is provided to both underground and surface facilities from the Hunter Water Corporation's Toronto and Wangi Wangi systems. The Wangi Wangi system provides water on demand to the underground workings, washdown bay, amenities and CHP. The Toronto system provides a secondary supply to the four existing 100,000 litre tanks on site, which are used for fire fighting and can be switched over to supply the Surface Facilities Area in an emergency.



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EXISTING CLEAN WATER DIVERSIONS

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Figure 10.2.2

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EXISTING DIRTY WATER CATCHMENTS AND DIRTY WATER DIVERSIONS

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Figure 10.2.3

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EXISTING CHP DAM AND EMERGENCY COAL STOCKPILE SEDIMENT DAM CATCHMENTS

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Figure 10.2.4

Waste water at Myuna Colliery includes grey water, sewage and some trade waste (residual water from the workshop oil-water separator system). Each of these waste water streams is directed to the sewerage system through a trade waste agreement with Hunter Water.

Water Quality

Five water quality monitoring point locations are associated with the Myuna Colliery Surface Facilities Area. These are referred to as:

- 'Upstream', located some 500 metres upstream of the confluence of the channel conveying discharge water from Myuna Colliery to Wangi Creek and considered to be the most representative of background water quality;
- 'Downstream', located approximately 180 metres downstream of the confluence;
- 'Lake Macquarie' (located approximately 1 kilometre from the upstream monitoring location); and
- LDP001 and LDP002.

These monitoring point locations are shown on **Figure 10.2.5**. These locations are typically sampled monthly and analysed for pH, electrical conductivity, TSS, oil and grease, turbidity, dissolved manganese and dissolved iron. Analytes were compared to the ANZECC/ARMCANZ (2000) trigger values. Consideration was also given to ambient water quality in the receiving environment, Lake Macquarie.

With the exception of TSS, all of the reportable analytes were within concentration limits identified within EPL 366. Exceedences of TSS occurred in 7% of discharges through LDP002. The most likely cause of exceedences is considered to be the presence of algae. This is being investigated separately by Myuna Colliery.

The assessment of water quality data for the upstream, downstream and LDP001 and LDP002 locations indicated that the quality of water leaving the Project Application Area was typically better than the water quality of the receiving waters in Lake Macquarie. The exception to this was elevated levels of manganese leaving the site, however this analyte was still within site specific limits set under the EPL.

In addition to a review of the quality of discharges from Myuna Colliery, a preliminary salt balance was developed for existing conditions. This salt balance utilised water quality data provided by Myuna Colliery and water flows determined from the water balance and hydrogeological model.

Under existing conditions, approximately 377 tonnes/day of salt enters the workings and 112 tonnes/day (approximately 30%) is discharged to Lake Macquarie through Wangi Creek. The remainder is stored within the underground workings.

10.2.1.2 Existing Water Balance

An operational water balance assessment of the current operation was undertaken and is included as Appendix B of **Appendix G**. The water balance considered a broad range of rainfall, evaporation and water transfer rate data. The results of the water balance for existing operations within the Project Application Area are provided in **Table 18**. **Table 18** provides the inputs and outputs for an average, dry and wet rainfall year. For the existing conditions five year simulation period, the years selected were 2005, 2006 and 2007, which represent average, dry and wet rainfall years, respectively. It should be noted that the results within **Table 18** are specific to those actual years.

Table 18 Existing Water Balance Conditions

	Average Rainfall Year (2005)	Dry Rainfall Year (2006)	Wet Rainfall Year (2007)
Inputs (total rainfall/runoff) (ML/year)	106.6	81.4	223.6
Rainfall/runoff to CHP Dam (ML/year)	54.1	40.7	111.6
Rainfall/runoff to Emergency Coal Stockpile Sediment Dam (ML/year)	6.3	8.6	24.6
Outputs (evaporation) (ML/year)	4.6	5.3	5.6
Underground water transfers to LDP001 (ML/year)	1296.0	2217.9	1786.4
Underground water transfers to LDP002	17.3	18.7	15.7

	Average Rainfall Year (2005)	Dry Rainfall Year (2006)	Wet Rainfall Year (2007)
Discharge through LDP001 (ML/year)	1594.5	2216.4	1784.9
Discharge through LDP002 (ML/year)	73.9	61.9	129.7

The results in **Table 18** indicate that, on average, rainfall accounted for approximately 73% of the discharges through LDP002. The lower discharge rates through LDP001 experienced during the wet rainfall year compared to the dry rainfall year demonstrates that the transfer of underground water to the mine settling ponds is not dependent on rainfall conditions, rather it is dependent on groundwater transfers, therefore discharge is dependent on the operational requirements at the time and does not actually have a direct correlation to rainfall.

The results indicate that the maximum discharge through LDP001 is below the current volumetric flow limit of 12 ML/day specified in the conditions of EPL 366 for both wet and dry years.

10.2.1.3 Impact Assessment

Surface Water Management System

The proposed Project will result in relatively minor changes to the existing clean water diversions at the Surface Facilities Area, and as such, significant impacts are not anticipated to the existing surface water behaviour.

As indicated in **Table 17**, the capacity of the existing CHP Dam is limited to receiving runoff from the surrounding catchment with a volume of up to 0.3 ML, which may be experienced during a rainfall event up to 15 millimetres in 24 hours. The proposed Project includes the construction of clean water diversions for catchments contributing to the CHP Dam, shown in **Figure 10.2.6**. This will reduce the clean water catchment contributing to the CHP Dam from approximately 8.2 hectares to approximately 4.5 hectares, which will have an overall effect of reducing strain on the capacity of the CHP Dam during rainfall events.

As with the CHP Dam, both clean and dirty catchment areas contribute to the Emergency Coal Stockpile Sediment Dam. The construction of the clean water diversions, shown indicatively in **Figure 10.2.6**, will result in a reduction in the total catchment area of the Emergency Coal Stockpile Sediment Dam from 5.6 hectares to 3.2 hectares, which will reduce pressure on the dirty water system. This will reduce the total catchment contributions to the Emergency Coal Stockpile Sediment Dam. A variation to EPL 366 will also be sought to allow event based discharges from the Emergency Coal Stockpile Sediment Dam during rainfall events, should the above upgrades to the system fail to eliminate this possibility entirely.

The location of the clean water diversions, shown indicatively in **Figure 10.2.6**, will be subject to further detailed design. These clean water diversions will direct the flow of clean water from the surrounding catchment towards existing defined drainage channels, which already receive clean water runoff from the existing clean water diversions. The location of both existing and proposed clean water diversion is shown in **Figure 10.2.6**. The proposed clean water diversions will be designed and constructed in accordance with the requirements of both *Managing Urban Stormwater: Soils and Construction (Vol 1*) and *Managing Urban Stormwater: Soils and Construction (Vol 2E)*.

Surface watercourses

Hydrologic Impacts

Myuna Colliery does not harvest any clean catchment runoff nor does it extract water from any of the watercourses within the Project Application Area. Additionally, the layout of the Surface Facilities Area and the configuration of the dirty water management system is such that runoff from the Surface Facilities Area contributes (through LDP002) to Wangi Creek. Therefore there is negligible removal of runoff from the natural catchment which contributes to the natural surface water system.

The most significant impact on waterways as a result of Myuna Colliery is discharge into Wangi Creek. These discharges are in excess of the flows that will occur as a result of runoff generated from the contributing catchment, however these flows have been occurring since commencement of operations at Myuna Colliery and as such, the existing environment within Wangi Creek has adapted to these flows.

As the proposed Project will not result in a significant change to the water management system at Myuna Colliery, the hydrologic impact on the watercourses is limited to the increase in discharge of underground water to Wangi Creek. Increase in discharge will be an incremental change, with an average daily increase of 3.2 ML (to a total

daily average of 8.6 ML) predicted to occur over the 21 year life of mine. As this increase in discharges will occur incrementally over an extended period, and is predicted to be within the current approved volumetric discharge limit of 12 ML/day, hydrologic impacts are not anticipated to have a significant impact on the watercourse. However, hydrological monitoring of Wangi Creek will be undertaken over the life of the mine in order to determine potential impacts, if any, to the flow of Wangi Creek.

Geomorphic Impacts

Potential impacts to the geomorphology of surface watercourses includes physical changes to the profile of watercourses associated with subsidence, as well as changes to the geomorphic profile of the watercourse through altered flow regimes.

Typically, subsidence has the potential to impact on the geomorphology of surface waterways due to changes to longitudinal gradients of the waterways and/or through the localised cracking of a stream bed. These effects will largely be realised in the event that mining results in a warping (uneven displacement) of the landscape surface.

Surface watercourses within the Project Application Area are situated in Subsidence Zone A, which may experience up to 20 millimetres of vertical subsidence as a result of the proposed Project. Vertical subsidence of up to 20 millimetres is expected to have a negligible impact on the geomorphology of surface waterways.

Wangi Creek is the only watercourse that is likely to experience alterations to flow regimes as a result of the proposed Project. As described above, increase in discharge will be an incremental change, with an average daily increase of 3.2 ML (to a total daily average of 8.6 ML) of expected to occur over the 21 year life of mine, and will occur incrementally. Although changes will be of an incremental nature, the increase in average discharges has the potential to alter the geomorphology of Wangi Creek through changes to the flow regime of this watercourse over the life of the proposed Project.

Monitoring of geomorphological features of Wangi Creek will be undertaken in order to determine impacts, if any, to the watercourse as a result of increased daily discharges over the life of the proposed Project.

Water Quality

The assessment of water quality data at ‘Upstream’, ‘Downstream’, LDP001 and LDP002 indicated that the quality of water leaving the Surface Facilities Area was generally better than the water quality in Lake Macquarie, with the exception of manganese. Although manganese concentrations were within the site specific limits defined for the operations at Myuna Colliery (which are lower than ANZECC /ARMCANZ (2000) guidelines), there were elevated concentrations of manganese discharged from the site compared to the receiving waters of Lake Macquarie.

As the proposed Project includes an extension of existing underground operations and no additional surface disturbances (other than the construction of clean water diversions within the Surface Facilities Area), the impact on water quality as a result of the Project will be negligible. The existing water quality monitoring program will be updated to include more detailed monitoring to establish background conditions in Wangi Creek.

The preliminary salt balance for the existing conditions was modified to represent the predicted variations in surface water management and mine water make for the proposed Project. Salt loads are predicted to increase by approximately 70% to 638 tonnes/day, and salt discharges are predicted to increase to 180 tonnes/day (approximately 66% increase above existing). The increase in salt load associated with the proposed Project is associated with the increase in the volume of discharges from the LDPs; the concentration of salt is not predicted to increase, therefore impacts to the water quality of receiving waters is not anticipated.

Water Balance

The results of the water balance for the proposed Project are provided in **Table 19**. The water balance for the proposed Project includes the construction of clean water diversions, and associated changes in catchment areas.

Table 19 Proposed Project Water Balance Conditions

	Average Rainfall Year (2005)	Dry Rainfall Year (2006)	Wet Rainfall Year (2007)
Inputs (total rainfall/runoff) (ML/year)	106.6	81.4	223.6
Rainfall/runoff to CHP Dam (ML/year)	40.3	30.4	79.4
Rainfall/runoff to Emergency Coal Stockpile Sediment Dam (ML/year)	3.6	4.9	14.1
Outputs (evaporation) (ML/year)	4.3	4.7	4.9
Underground water transfers to LDP001 (ML/year)	3010.6	3011.3	3018.7
Underground water transfers to LDP002	18.6	18.8	16.9
Discharge through LDP001 (ML/year)	3009.1	3009.9	3017.2
Discharge through LDP002 (ML/year)	61.3	51.5	98.7

A comparison to the existing conditions water balance in **Table 18** demonstrates that the construction of clean water diversions will reduce the volume of runoff contributing to the CHP and Emergency Coal Stockpile Sediment Dam by approximately 26% and 43%, respectively.

The proposed Project will result in an increase in discharges through LDP001 to an average of 8.6 ML/day, which is primarily attributable to the increase in average daily water make to the underground workings. However, it is likely that operational requirements will vary over time, similar to that experienced under existing conditions. As such, it is recommended that the current volumetric limit of 12 ML/day for LDP001 be retained.

Discharges through LDP002 will decrease as a result of the clean water diversions within the Surface Facilities Area, which will reduce the quantity of runoff produced by rainfall through this discharge by an average of 17%. This discharge point will continue to discharge approximately 1 ML/day of groundwater for the life of the proposed Project.

To enable improved monitoring of the discharges through LDP001 and LDP002, a variation to EPL 366 will be sought to combine these licensed discharge points into a single licensed discharge point, known as LDP B (refer to **Figure 10.2.5**), downstream of the confluence of LPD001 and LDP002, and upstream of the discharge point into Wangi Creek with a total volumetric limit of 13 ML/day.

The total catchment of the Emergency Coal Stockpile Sediment Dam will also be reduced, and as result, the capacity of this Dam for rainfall events will increase from 80 millimetres in to 24 hours, to 140 millimetres in 24 hours. This will reduce the likelihood of event based discharges from the Emergency Coal Stockpile Sediment Dam. This Dam will also be managed through the preparation of a Targeted Action Response Plan (TARP), which will include monitoring and management measures to minimise the likelihood of event-based discharges from the Emergency Coal Stockpile Sediment Dam. In addition, a variation to EPL 366 will be sought to license the discharge point at the Emergency Coal Stockpile Sediment Dam, known as LDP A (refer to **Figure 10.2.5**), to allow event based discharges from this source (rainfall events in excess of 140 millimetres in 24 hours), where discharges are not avoidable through the TARP.

Potential re-use of waste water was considered as part of the proposed Project. Water recirculation within mining operations is generally limited to dust suppression, mining process water and fire fighting. At Myuna Colliery there is no coal stockpile which is in regular use, and the majority of trafficked areas are concretes, therefore opportunities for dust suppression within the surface facilities area are limited resulting in the elimination of one of the options for recirculation. With respect to underground operations, the use of recirculated water requires the collection and storage of water to enable redistribution. At present, limitations within the site infrastructure do not allow this to occur. As such, re-use of waste water is not considered to be viable.

Note: Lake Macquarie monitoring point not shown on figure

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WATER MONITORING POINT LOCATIONS

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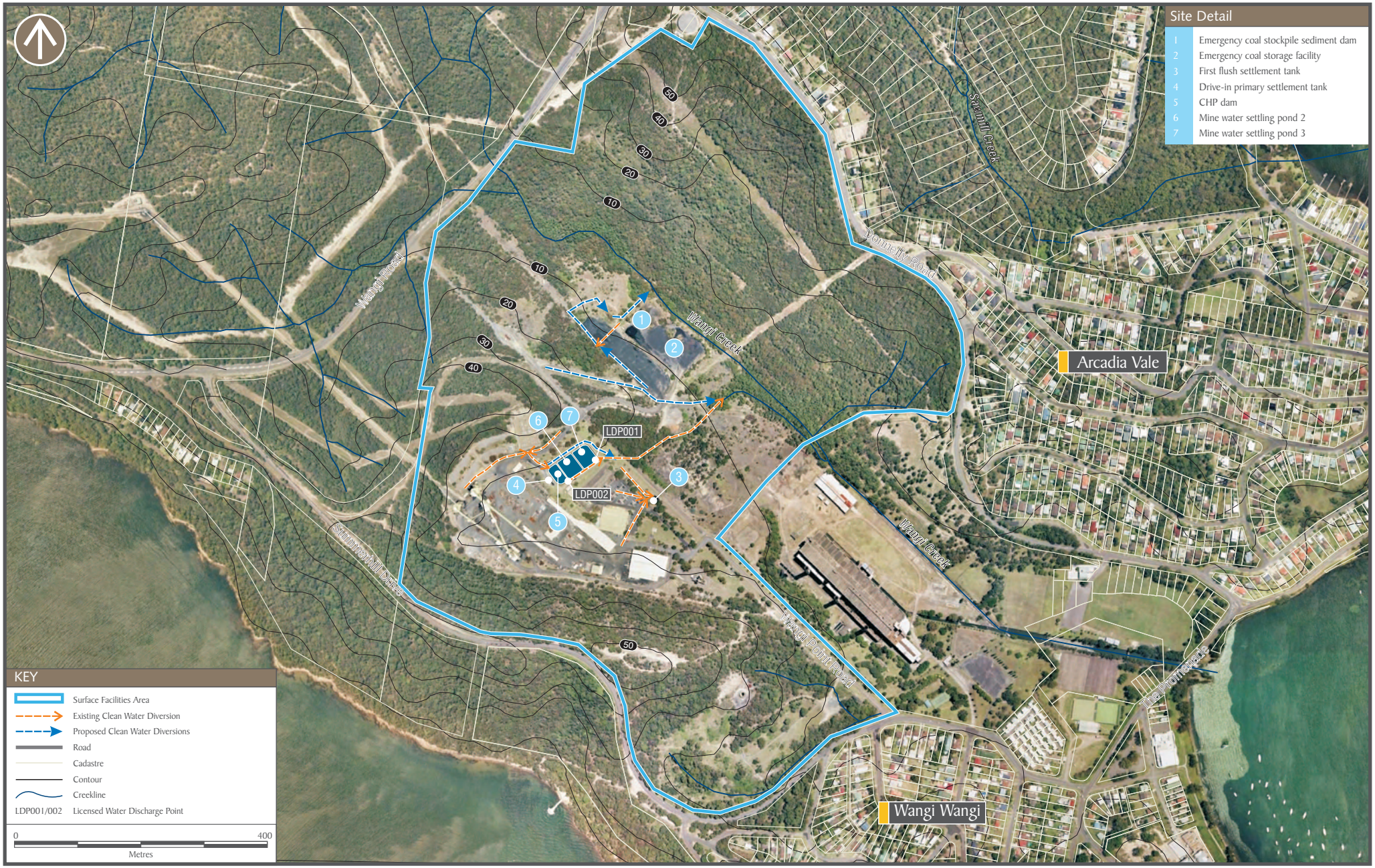
Figure 10.2.5



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PROPOSED CLEAN WATER DIVERSIONS FOR THE CHP DAM AND EMERGENCY COAL STOCKPILE SEDIMENT DAM

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Figure 10.2.6

10.2.1.4 Management and Mitigation Measures

The following management and mitigation measures are proposed to minimise potential impacts associated with the proposed Project:

- Regular sweeping of the hardstand areas within the clean water system will continue to be undertaken to maintain water quality of runoff from these areas. Hardstand areas will also continue to be regularly inspected to ensure that they remain clean.
- Sediment and erosion control measures will be implemented during construction of the clean water diversions at the CHP Dam and Emergency Coal Stockpile Sediment Dam. These measures will be in accordance with the requirements of both *Managing Urban Stormwater: Soils and Construction (Vol 1*) and *Managing Urban Stormwater: Soils and Construction (Vol 2E)*.
- The water level within the Emergency Coal Stockpile Sediment Dam will be managed through preparation of a TARP, which will include monitoring and management measures to minimise the likelihood of event-based discharges from the Emergency Coal Stockpile Sediment Dam.
- A variation to EPL 366 will be sought to license the discharge point at the Emergency Coal Stockpile Sediment Dam, known as LDP A, to allow event based discharges from this source (rainfall events in excess of 140 millimetres in 24 hours), where discharges are not avoidable through the TARP described above.
- A monitoring program will be developed be to identify and monitor geomorphologic features of Wangi Creek over the life of the proposed Project, to determine impacts to the watercourse as a result of increased daily discharges.
- A variation to EPL 366 will be sought to combine LDP001 and LDP002 into a single licensed discharge point, LDP B, downstream of the current confluence of LPD001 and LDP002, and upstream of the discharge into Wangi Creek. A volumetric limit of 13 ML/day will be sought, along with the existing water quality conditions in the EPL for the current discharge points.
- The existing water quality monitoring program at Myuna Colliery for the monitoring points 'Upstream', 'Downstream', and combined discharge point LDP B will be maintained for the life of the proposed Project. The parameters monitored will be increased, with sampling to be undertaken on a monthly basis for a period of two years, to establish natural background concentrations from water quality data collected for at least 24 samples. The samples will be analysed for the suite of parameters identified in Section 6.3 of the Water Assessment Report in **Appendix G**.
- To cater for the discharge of stormwater during rainfall events, a variation to EPL 366 will be sought to enable volumetric discharge from LDP B during rainfall events greater than 15 millimetres in 24 hours.

10.2.1.5 Conclusion

The proposed Project includes a number features that will enhance the existing water management system and result in efficiencies in water management at Myuna Colliery. Efficiencies include the reduction of clean water catchments contributing to the dirty water management system, which will result in an overall improvement of the performance of these structures and reduce the volume of event based discharges. Amendments to the existing configuration of licensed discharge points to improve monitoring of water quality and volume will also be made.

The hydrogeological model (refer **Section 10.2.2.2**) indicated that the proposed Project is predicted to increase the current underground water extraction, which will consequently result in an incremental increase in discharges through LDP001 and LDP002 from an average of 5.1 ML/day to an average of 8.6 ML/day over the life of the proposed Project.

The impact on the hydrology, geomorphology and water quality of surface waterways and receiving waters as a result of the proposed Project is expected to be negligible with the management and mitigation measures described above.

10.2.2 Groundwater

The Water Assessment undertaken by GHD for the proposed Project included the development of a preliminary hydrogeological model to document historical groundwater behaviour at Myuna Colliery, and predict impacts to groundwater behaviour as a result of the proposed Project. The Water Assessment is provided in **Appendix G**.

The preliminary hydrogeological model assessed the effect of current and historical mining at Myuna Colliery on groundwater (both alluvial groundwater and deeper coal seam groundwater), and estimated the likely inflow of groundwater (referred to as water make) into the mine workings (refer to **Figure 10.2.7**). Due to limitations in historical data, the numerical model is a preliminary representation of the underground water system.

The preliminary hydrogeological model was based on a conceptual understanding of the hydrogeological system at Myuna Colliery. A MODFLOW numerical model (a finite difference flow model from the United States Geological Survey and one of the industry standard codes for numerical groundwater modelling) was developed for the Project Application Area.

Data used to develop the model included hydrogeological data, inputs and outputs to the underground water system, and a range of assumptions where data was not available. These are described in Appendix A of **Appendix G**.

10.2.2.1 Existing Environment

Within the current area of operations at Myuna Colliery, groundwater seeps into the underground workings and forms the mine water make, which is stored in four underground storage areas:

- Dam 324 (Wallarah Dam);
- Dam 642 (Great Northern Dam);
- Dam 421 (Great Northern); and
- Dam 720 (Old Fassifern Dam).

Mine water make contained in these underground storages is allowed to settle in order to remove coal fines, prior to being pumped to Mine Water Settling Ponds 2 and 3 at the Surface Facilities Area, and is ultimately discharged to Wangi Creek through LDP001. Recent discharges of underground water has averaged approximately 5.1 ML/day, which is approximately 30% of current water make.

The hydrogeological model was calibrated through running several model scenarios; steady state, to simulate pre-mining conditions at Myuna Colliery, and transient, representing the period of mining from January 1981 to December 2010, as follows:

- **Steady State Model Simulation** – the model was initially run under pre-mining steady state conditions to establish initial heads for the transient model. The steady state model incorporated the geological flow boundaries and natural sources outlined in the conceptual model, however excluded human induced influences to the system.
- **Transient Model Simulation** – following the steady state simulation, the model was run for a 30 year period from 1 January 1981 to 31 December 2010, at annual time steps to simulate existing mining activities at Myuna. The average water make into the mine workings under existing conditions was calculated by the transient model to be 16.8 ML/day. This was divided as follows:
    - Wallarah Seam: 7.2 ML/day.
    - Great Northern Seam: 3.6 ML/day.
    - Fassifern Seam: 6.0 ML/day.

The underground water balance under existing conditions is shown in **Table 20**. The extraction of underground water from the existing workings, shown as 5.1 ML/day in **Table 20**, is approximately 30% of the total water make (16.8 ML/day). As a result, there is a net storage of underground water in the existing workings (approximately 12 ML/day). The water balance for the Great Northern and Fassifern seams have been combined (as shown in **Table 20**) due to limited data regarding underground water transfers between the two seams.

Table 20 Underground Water Balance – Existing Conditions

Seam	Average Inflow (ML/day)		Average Outflow (extraction) (ML/day)	Average Underground Storage (ML/day)
	Water Make	Potable Water		
Wallarah	7.2	0.09	1.85	5.47
Great Northern and Fassifern	9.6	0.19#	3.23	6.56
Total	**16.8**	**0.28**	**5.1**	**12.0**

Fassifern Seam only

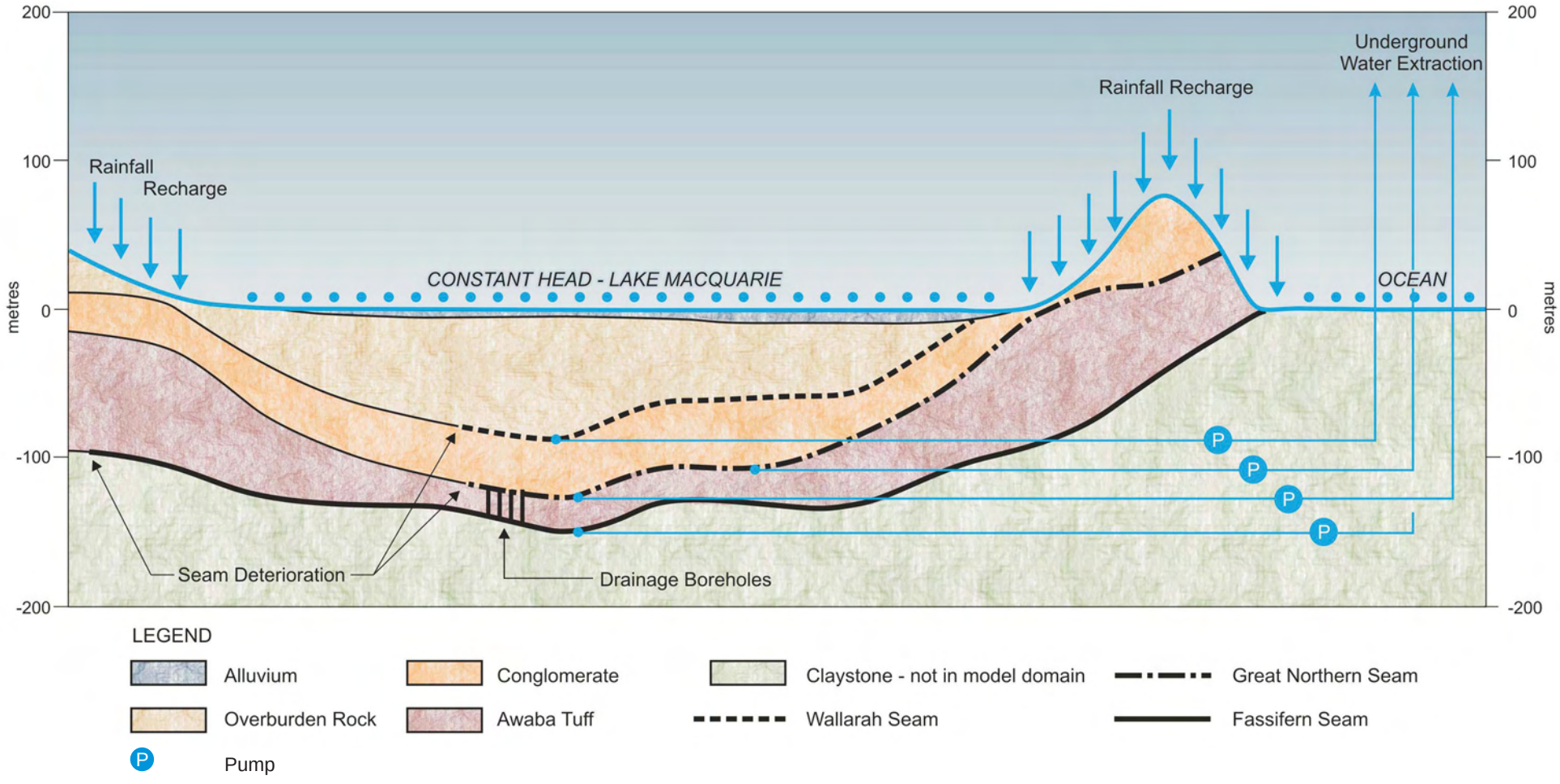
The existing average extraction of 5.1 ML/day is transferred to Mine Water Settling Pond 2, and ultimately discharged through LDP001 or LDP002, which have a combined volumetric limit of 13 ML/day.

10.2.2.2 Impact Assessment

A predictive simulation of the hydrogeological model was run over a 21 year period (commencing 1 January 2011) to predict future water make as a result of proposed Project. Since the hydrogeological model is based on limited data and a simplified conceptualisation of the hydrogeological system, it is necessary to make assumptions. The following model assumptions were made (in addition to model assumptions in Appendix B (Section 4.1) of **Appendix G**):

- There is no groundwater connection across areas of coal seam splitting, deterioration and faulting.
- Seam splitting, deterioration and/or faulting limit the groundwater flow domain within the seams to the west and south and limits groundwater connectivity with the other collieries to the west and south.
- There is no vertical seepage of groundwater from the Fassifern Seam into the underlying strata.
- Fracturing of overburden and interseam rocks (inducing secondary permeability) is minimal.
- An average value has been used for the thickness of each coal seam (Wallarah 2.5 metres, Great Northern 3 metres and Fassifern 3.5 metres).
- The head level of Lake Macquarie is constant since tidal variations will have little effect on inflows into the deep underground workings.
- The pre-mining piezometric surface within the coal seams was 0 metres AHD.
- Daily rainfall recharge does not vary across onshore areas.
- No other sources or sinks, other than those outlined in Appendix B (Section 4.1) of **Appendix G**, have been considered (such as creeks or streams).
- The majority of new workings will be in the Fassifern Seam (although additional workings may also be constructed in the other seams).
- At a production rate of 2 Mtpa, the proposed workings will cover an area of approximately 18 square kilometres.
- Average annual net rainfall of 0.05 m/yr.

The underground water balance for the proposed Project after 21 years is shown in **Table 21**. As the conceptual hydrogeological model is based on a range of assumptions, the individual predictions provided in **Table 21** should be considered reliable to +/-30% until more site data is gathered during the life of the proposed Project. Additional data will allow refinement of the data sources and hence confirm the model predictions. The existing water balance conditions from **Table 20** above are shown as 'Existing' in **Table 21.**



Source: GHD (30/05/2010)

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CROSS-SECTION OF HYDROGEOLOGICAL SYSTEM REPRESENTED IN THE MODEL

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Figure 10.2.7

Table 21 Underground Water Balance – Proposed Conditions

Seam	Average Inflow (ML/day)		Average Outflow (extraction) (ML/day)	Average Underground Storage (ML/day)
	Water Make	Potable Water		
Existing	16.8	-	5.1	11.7
Proposed Increase	11.6	0.28	3.2	8.7
Total	**28.4**	**0.28**	**8.3**	**20.4**

The average increase in water make into the proposed workings (after 21 years) is predicted to be 11.6 ML/day. This will increase total average water make (existing and proposed workings combined) to approximately 28.4 ML/day.

It is predicted that the required underground water extraction from the proposed workings will be approximately 3.2 ML/day when the workings are complete, bringing the total average underground water extraction to 8.3 ML/day. This is based on the following assumptions:

- Underground water extraction from the existing workings remains at an average of 5.1 ML/day (or approximately 30% of the water make into the existing workings).
- Extraction of underground water from the proposed workings will also be 30% of the water make into the proposed workings.

The predicted extraction of water make from the underground workings was therefore determined to increase from the existing 5.1 ML/day to an average of 8.3 ML/day, which will consequently result in an increase in discharges through LDP001 and LDP002 to an average of 8.6 ML/day (from the current 5.1 ML/day). This within the current licensed volumetric discharge limit of 12 ML/day for LDP001 and 1 ML/day for LDP002.

It is likely that operational requirements will vary over time, similar to that experienced under existing conditions. As such, it is recommended that the current volumetric limits of 12 ML/day for LDP001 and 1 ML/day for LDP002 are adequate for the proposed Project.

10.2.2.3 Beneficial Aquifers and Groundwater Dependent Ecosystems

Beneficial uses of aquifers include purposes such as drinking water, agricultural use (irrigation and stock watering), industrial use, recreation or aesthetics, and protection of ecosystems that have the potential to be affected by changes to groundwater levels in aquifers, known as groundwater dependent ecosystems (GDE). Six major types of GDEs have been identified in Australia (Sinclair Knight Merz, 2001):

- Terrestrial vegetation communities and dependent fauna that have seasonal or episodic dependence on groundwater;
- River base flow systems, including aquatic and riparian ecosystems that exist in or adjacent to streams that are fed by groundwater base flow;
- Aquifer and cave ecosystems that occupy caves or aquifers;
- Wetlands, including aquatic communities and fringing vegetation dependent on groundwater fed lakes and wetlands;
- Native terrestrial fauna that directly use groundwater (rather than rely on it for habitat); and
- Estuarine and near-shore marine ecosystems whose ecological function has some dependence on discharge of groundwater.

The hydrogeological model predicted negligible changes in groundwater levels in the alluvial aquifers during the operation of the proposed Project. No long term decreasing trend in alluvial groundwater levels was identified, suggesting that loss of alluvial groundwater due to the proposed Project is unlikely. Due to the limited hydraulic connection between the alluvium and the proposed Project, it is considered that any variation in alluvial groundwater levels is attributable to changes in rainfall recharge and evaporation. Furthermore, there is limited

connection between these shallow alluvial aquifers, and the deeper coal seam aquifers that will be affected by the proposed Project.

Although there is no current mapping of GDEs that covers the Project Application Area or surrounds, potential impacts to GDEs as a result of the proposed Project are considered negligible as the shallow alluvial aquifers which will typically support GDEs will not be affected by the proposed Project.

A search of the NSW groundwater borehole database was undertaken within 3 kilometres of the Project Application Area to identify potential beneficial uses of groundwater. The search identified 82 bores, of which 67 draw groundwater from alluvial aquifers, typically located at depths ranging from 1 metre to 10.1 metre below ground level, and are primarily used for domestic purposes. As the proposed Project will not affect the shallow alluvial aquifers, impacts to existing and future beneficial uses of the shallow aquifer are not predicted.

10.2.2.4 Management and Mitigation Measures

The proposed Project will result in an increase in mine water make extracted from the underground workings, which is ultimately discharged to Wangi Creek through the existing licensed discharge points. To manage the increase daily volume of discharge, a number of mitigation measures are proposed in **Section 10.2.1.4** to manage potential impacts to surface watercourses. This includes combining the two existing licensed discharge points, LDP001 and LDP002, to a single discharge point, to enable improved monitoring of discharge water quality.

While it is not anticipated that there will be a direct impact on beneficial groundwater users or GDEs as a result of the additional mine water make associated with the proposed Project, ongoing recording of underground water levels will be continued to monitor changes in the level of water stored in underground depressions and to verify that the rate of extraction is sufficient to ensure the current volumetric discharge limit is adequate.

10.2.2.5 Conclusion

The proposed Project is predicted to result in an additional 11.6 ML/day of water flowing into the proposed workings from the three coal seams, due to the increased extent of mining. This will result in an average increase in water discharged through licensed discharge points LDP001 and LDP002 from 5.1 ML/day to an average of 8.6 ML/day over the life of the proposed Project, although these increased discharge volumes will remain within the current combined volumetric limits for these discharge points specified in EPL 366 of 13 ML/day.

Impacts to alluvial aquifers, existing alluvial groundwater users and GDEs resulting from the proposed Project will to be minimal as water levels within these aquifers will be not be affected by the proposed Project, therefore significant impacts to the groundwater environment are not predicted.

10.3 Acoustic Impacts

10.3.1 Background

Heggies Pty Ltd (Heggies) was commissioned to undertake a Noise Impact Assessment (NIA) for the proposed Project which is included in **Appendix H**. The scope of the assessment was to identify the potential impacts of the proposed Project in relation to noise from the Surface Facilities Area and vibration from underground shot firing and to provide advice with regard to effective mitigation strategies, where necessary.

10.3.2 Methodology

10.3.2.1 Introduction

The NIA was prepared with reference to Australian Standard AS 1055:1997 *Description and Measurement of Environmental Noise Parts 1, 2 and 3* and in accordance with DECCW's *NSW Industrial Noise Policy* (INP). Where issues relating to noise are not addressed in the INP, such as sleep disturbance, reference has been made to the NSW Environmental Noise Control Manual (ENCM) and the Environmental Criteria for Road Traffic Noise (ECRTN).

Potentially sensitive receivers are located approximately 500 metres south-east of the infrastructure at the Surface Facilities Area in Wangi Wangi and approximately 600 metres east of the infrastructure at the Surface Facilities Area in Arcadia Vale, and are shown on **Figure 10.3.1**.

An ambient noise monitoring program (attended and unattended) was undertaken by Heggies at two locations in proximity to the Surface Facilities Area (as shown on **Figure 10.3.1**) which are representative of the nearest potentially affected private receivers. Background noise (L_{A90} - the A-weighted sound pressure level that is exceeded for 90 per cent of the time over which a given sound is measured) and average noise levels over a 15 minute period ($L_{Aeq(15minute)}$) noise levels were measured during the day, evening and night-time periods to determined appropriate background levels. These background levels are detailed in **Appendix H** and were used to determine project specific noise criteria for the proposed Project.

Noise measurements were conducted for all acoustically significant plant and equipment utilised during operations at the Surface Facilities Area. Sound Power Levels (SPLs) of plant and equipment were also determined and utilised for the purpose of this noise assessment (see Table 2 of **Appendix H** for further detail). Where on-site measurements could not be conducted, SPLs were obtained from a Heggies database of similar equipment.

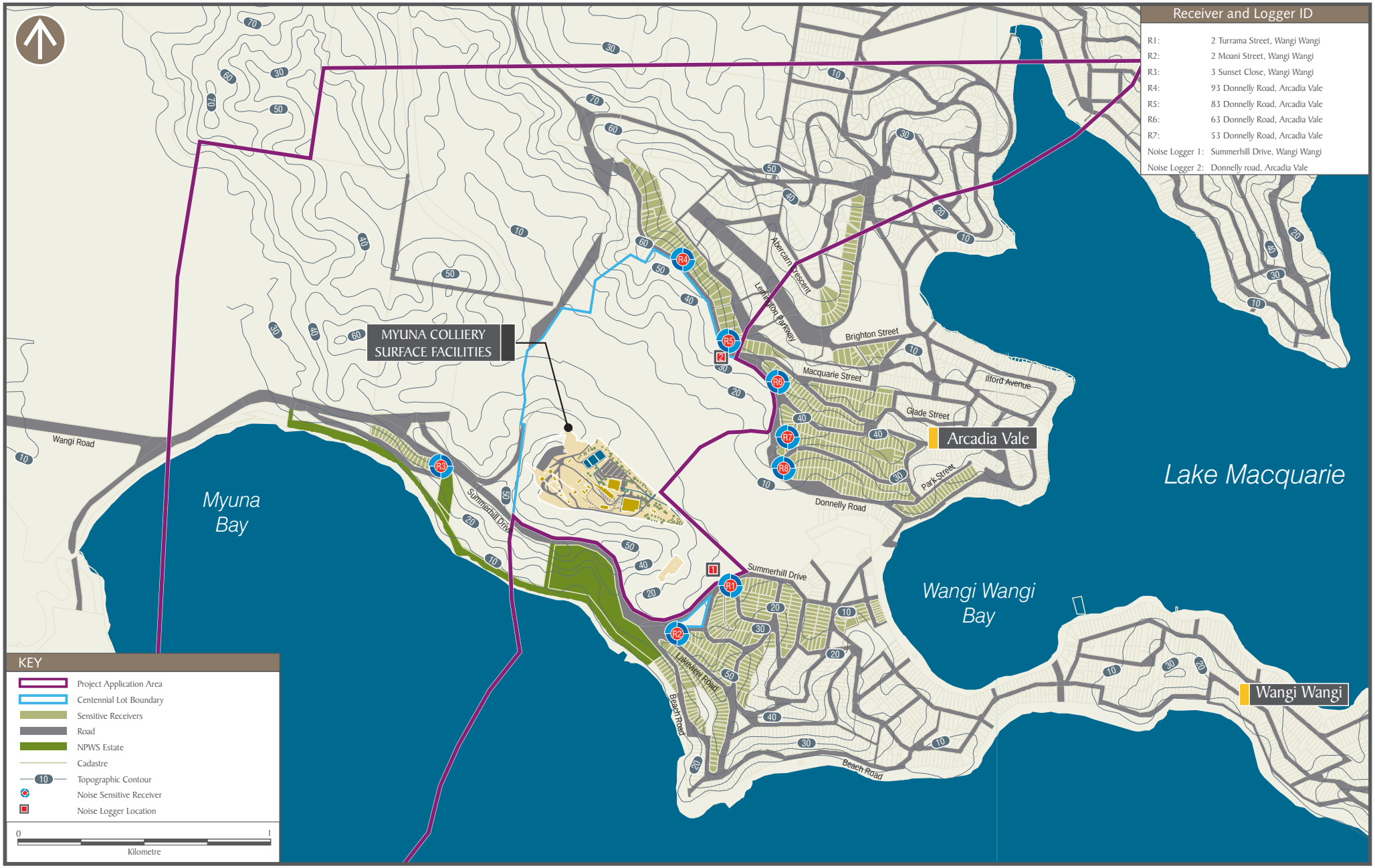
SoundPLAN was used to predict noise emissions from the proposed Project. Noise levels were predicted for the general operational scenario (i.e. 24 hour operation of the Surface Area Facilities with all equipment operating (i.e. representing a worse-case scenario for the purposes of modelling). Key operational assumptions were included in the NIA including:

- All acoustically significant plant and equipment operates simultaneously;
- All conveyors at the site are fully enclosed;
- The emergency coal stockpile is only anticipated to be in operation up to two days per quarter and as such has been considered qualitatively in the NIA; and
- The Overland Conveyor is owned, operated and maintained by Eraring Power Station and has not been included in the NIA, as it is assumed that noise from this equipment is included in the existing background noise environment.

10.3.2.2 Meteorological Data

Consistent with the air quality assessment in **Section 10.1**, TAPM has been used to generate a synthetic meteorological file for the proposed Project, assimilating data for two weather stations in proximity to the Surface Facilities Area: Inglewood and Mandalong Mine weather stations, located some 8.5 km and 11.5 km from the Surface Facilities Area, respectively. Seasonal wind records indicate that certain winds, typically from the southern sectors, are a feature of the area during the evening and night-time periods.

To determine a worst case scenario, temperature inversions during the night-time period were included as part of the NIA. Default temperature inversion values, as defined in the INP, have been assumed during the night-time period. **Table 22** shows the meteorological conditions under which the NIA was conducted.



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LOCATION OF SENSITIVE RECEPTORS AND NOISE MONITORING LOCATIONS

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Figure 10.3.1

Table 22 Meteorological Parameters

	Temperature	Humidity	Wind Speed	Wind Direction	Temperature Inversion
Calm (All periods)	20^{o}C	65%	<3m/s		
Prevailing Winds (Evening and night)	10^{o}C	90%	3m/s	Southern sectors	
Inversion (Night only)	10^{o}C	90%			F Class

Myuna Colliery's Surface Facilities Area is likely to experience light to moderate winds (between 1.5 m/s and 5.5 m/s) primarily from the southern sectors. Calm wind conditions (wind speed less than 0.5 m/s) occur approximately 6% of the time. Moderate (F Class stability) ground-based temperature inversions are generally observed on some nights and mornings.

10.3.2.3 Noise Assessment Criteria

Operational Noise

Background noise (LA90) and average continuous noise levels (LAeq(15minute)) were measured during the day, evening and night-time periods to determine appropriate background levels at R1, R2 and R4-R8. These background levels are detailed in **Table 23**, and were used to determine project specific noise criteria at R1, R2 and R4-R8. Background noise levels were not measured at R3 due to its distance to the monitoring locations, and as such the minimum possible RBL (30 dBA) under the INP was applied to this receiver.

The INP provides two forms of noise criteria with the aim of achieving environmental noise objectives; one to account for intrusive noise which involves setting a noise goal relative to the existing acoustic environment and the other to protect the amenity of particular land uses.

The intrusiveness criterion essentially means that the equivalent continuous noise level of the source over any 15 minute period (LAeq(15minute)) should not be more than 5 dBA above the measured background level (LA90). This is referred to as the rating background level (RBL), which is defined in the INP as the single figure background level representing each assessment period (day/evening/night) over the whole monitoring period.

The amenity assessment is based on noise criteria specific to land use and associated activities. The criteria relate only to industrial-type noise and do not include road, rail or community noise. The acoustic environment in the vicinity of the Surface Facilities Area typifies a 'suburban' receiver type in that "*an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry*" (INP). The amenity criteria as specified in the INP for suburban noise amenity areas is listed in **Table 23.** At both monitoring locations, the existing industrial LAeq noise levels are more than 6 dBA below the acceptable noise levels described for amenity criteria as stipulated in the INP therefore, the amenity criteria is equal to the acceptable noise level.

In accordance with the INP, the project specific noise levels reflect the most stringent noise level requirements from the noise levels derived from both the intrusive and amenity criteria. Applying the most stringent requirement of RBL plus 5 dBA as the project specific noise levels ensures that both intrusive noise is limited and amenity is protected.

Table 23 below shows the project specific noise criteria adopted for the proposed Project, which are based on the intrusiveness criteria. It also provides a summary of the measured background level relevant to sensitive receivers, the adopted RBL, and illustrates the relevant intrusiveness and amenity criteria.

Table 23 Project Specific Noise Criteria

Location	Period	Measured Background Noise Level (LA90)	Adopted RBL	Intrusiveness Criteria LAeq(15min)	Amenity Criteria (Suburban) LAeq(Period)	Project Specific Noise Criteria LAeq(15min)
R1 to R2 (Off Summerhill Drive, Wangi Wangi)	Day	35 dBA	35 dBA	40 dBA	55 dBA	**40 dBA**
	Evening	34 dBA	34 dBA	39 dBA	45 dBA	**39 dBA**
	Night	30 dBA	30 dBA	35 dBA	40 dBA	**35 dBA**
* R3 (Sunset Close,Wangi Wangi)	Day	ND	30 dBA	35 dBA	55 dBA	**35 dBA**
	Evening	ND	30 dBA	35 dBA	45 dBA	**35 dBA**
	Night	ND	30 dBA	35 dBA	40 dBA	**35 dBA**
R4 to R8 (Donnelly Road, Arcadia Vale)	Day	41 dBA	39 dBA	44 dBA	55 dBA	**44 dBA**
	Evening	40 dBA	37 dBA	42 dBA	45 dBA	**42 dBA**
	Night	36 dBA	34 dBA	39 dBA	40 dBA	**39 dBA**

ND = No data. * For the purposes of determining the relevant project specific noise criteria, as background noise levels were not measured at R3, the adopted RBL at this location has been based on the minimum RBL of 30 dBA in accordance with the INP.
LA90 - The A-weighted sound pressure level that is exceeded for 90 per cent of the time over which a given sound is measured. This is considered to represent the background noise (INP, DECCW, 2000).
LAeq(15min) - The equivalent continuous noise level—the level of noise equivalent to the energy average of noise levels occurring over a measurement period (INP, DECCW, 2000).

Sleep Disturbance

The sleep disturbance criteria adopted for the proposed Project is shown in **Table 24** and is consistent with the ENCM which requires the LA1(1minute) noise level of the source to not exceed the background noise level (LA90) by more than 15 dBA when measured outside the bedroom window of the receiver during the night-time hours (10.00 pm to 7.00 am). For the purposes of determining the relevant sleep disturbance noise goal, the adopted RBL has been calculated such that the background noise level excludes the existing contribution of Myuna Colliery, which provides a stringent noise goal for assessing sleep disturbance.

Table 24 Sleep Disturbance Noise Goals

Location	Measured Background Noise Level (LA90)	Adopted RBL LA90	Sleep Disturbance Noise Goal*
R1 to R2 (Off Summerhill Drive, Wangi Wangi)	30 dBA	30 dBA	45 dBA
R3 (Sunset Close, Wangi Wangi)	ND	30 dBA	45 dBA
R4 to R8 (Donnelly Road, Arcadia Vale)	36 dBA	34 dBA	49 dBA

ND = No data. * RBL plus 15 dBA

10.3.3 Impact Assessment

10.3.3.1 Operational Noise

Noise levels predicted at the nearest potentially affected residential locations are provided in **Table 25**. Noise contour maps for representative worst-case day, evening and night time scenarios are provided in **Figures 10.3.2**, **10.3.3** and **10.3.4**. The operational scenario includes all plant equipment located within the Surface Facilities Area operating during the day, evening and night time scenarios.

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SURFACE FACILITIES AREA NOISE CONTOURS - DAYTIME (CALM CONDITIONS)

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Figure 10.3.2

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SURFACE FACILITIES AREA NOISE CONTOURS - EVENING (WSW)

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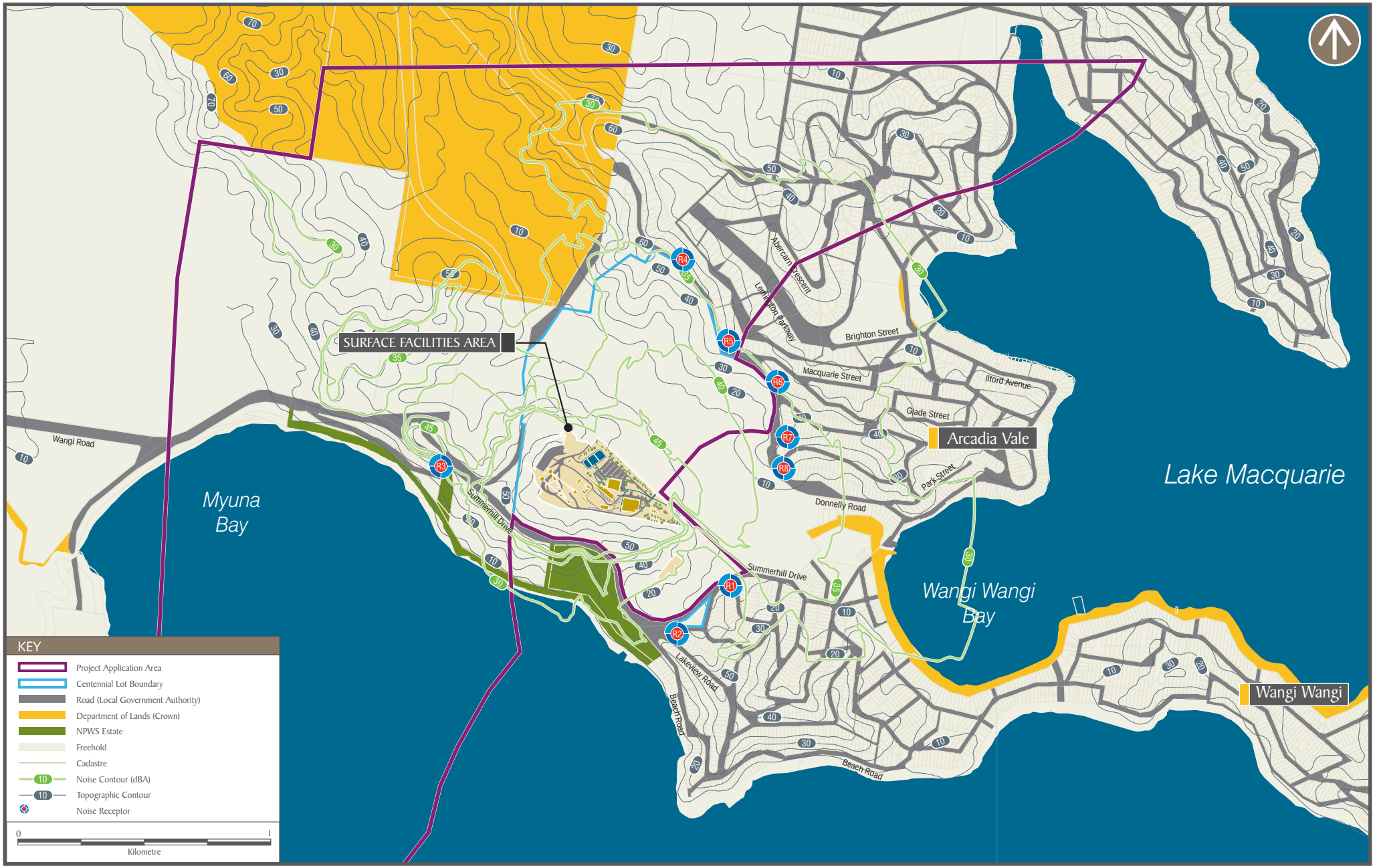
Figure 10.3.3



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SURFACE FACILITIES AREA NOISE CONTOURS - NIGHT TIME, TEMPERATURE INVERSION

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Figure 10.3.4

The model included the following noise management and mitigation measures during the night-time period:

- All enclosure doors on the rotary breaker, crusher and crusher conveyor drive house will remain closed during the night-time period, specifically:
    - Roller shutter doors on the north-east and south-west façades of the crusher enclosure; and
    - Wire frame doors on the north-east façade and north corner of the rotary breaker to be replaced with solid doors and kept closed at night-time.

Results presented in **Table 25** indicate that standard operational noise levels are predicted to meet the project specific noise criteria at all modelled residential receivers under calm and prevailing weather conditions with the recommended noise mitigation and management strategies in place. Since the operational scenario modelled is likely to represent an acoustically worst case scenario, actual operational noise levels are likely to be less than those predicted.

Table 25 Predicted Noise Levels – Standard Operational Scenario

Location	Period	Predicted Noise Level $LA_{eq(15minute)}$ (dBA)									Project Specific Noise Criteria ($LA_{eq,15min}$)
		Calm	Wind Direction							Temp Inversion	
			ESE	SE	SSE	S	SSW	SW	WSW		
R1	Day	<30	-	-	-	-	-	-	-	-	40 dBA
	Evening	<30	<30	-	-	-	-	-	<30	-	39 dBA
	Night	<30	<30	<30	<30	<30	<30	<30	<30	<30	35 dBA
R2	Day	<30	-	-	-	-	-	-	-	-	40 dBA
	Evening	<30	<30	-	-	-	-	-	<30	-	39 dBA
	Night	<30	<30	<30	<30	<30	<30	<30	<30	<30	35 dBA
R3	Day	<30	-	-	-	-	-	-	-	-	35 dBA
	Evening	<30	<30	-	-	-	-	-	<30	-	35 dBA
	Night	<30	<30	<30	<30	<30	<30	<30	<30	<30	35 dBA
R4	Day	35	-	-	-	-	-	-	-	-	44 dBA
	Evening	35	35	-	-	-	-	-	40	-	42 dBA
	Night	35	32	36	37	37	38	38	37	37	39 dBA
R5	Day	37	-	-	-	-	-	-	-	-	44 dBA
	Evening	37	34	-	-	-	-	-	42	-	42 dBA
	Night	37	31	35	38	39	39	39	39	39	39 dBA
R6	Day	37	-	-	-	-	-	-	-	-	44 dBA
	Evening	37	31	-	-	-	-	-	42	-	42 dBA
	Night	37	<30	32	36	38	38	38	39	38	39 dBA
R7	Day	37	-	-	-	-	-	-	-	-	44 dBA
	Evening	37	31	-	-	-	-	-	42	-	42 dBA
	Night	37	<30	30	34	38	39	39	39	39	39 dBA
R8	Day	37	-	-	-	-	-	-	-	-	44 dBA
	Evening	37	30	-	-	-	-	-	42	-	42 dBA
	Night	37	<30	30	32	36	39	39	39	39	39 dBA

10.3.3.2 Emergency Coal Stockpile

In the event of break downs or servicing and maintenance of the Enclosed Overland Conveyor, Myuna Colliery temporarily stores coal in a dedicated stockpile in the northern portion of the Surface Facilities Area. Coal is transferred from the emergency hopper to the stockpile by trucks along a sealed haul road. Coal is recovered from the stockpile by a front end loader, loaded onto trucks and dumped into a CHP reclaim hopper for transportation to Eraring Power Station by the Enclosed Overland Conveyor. Emergency stockpiling activities are only anticipated to occur for a maximum period of 3 days per year, with stockpiled coal returned back to the reclaim hopper over a 4 day period.

Notwithstanding this, noise calculations were conducted to the nearest affected residences with all standard surface plant in operation, and with trucks transporting coal between the CHP and Emergency Coal Stockpile Area. The noise calculations included the operation of a front end loader operating at the Emergency Coal Stockpile during the daytime only, as the front end loader does not operate on the stockpile during the evening or night-time periods.

Table 26 presents the predicted noise levels during emergency stockpiling activities including the following assumptions:

- All operational noise mitigation and management measures described in **Section 10.3.3.1**;
- Three (3) truck movements to the Emergency Coal Stockpile per 15 minute period; and
- No front end loader operation at the Emergency Coal Stockpile during the evening or night-time periods.

Table 26 Predicted Noise Levels – Standard Operational Scenario plus Emergency Coal Stockpiling

Location	Period	Predicted Noise Level $LA_{eq(15minute)}$ (dBA)									Project Specific Noise Criteria ($LA_{eq,15min}$)
		Calm	Wind Direction							Temp Inversion	
			ESE	SE	SSE	S	SSW	SW	WSW		
R1	Day	37	-	-	-	-	-	-	-	-	40 dBA
	Evening	<30	<30	-	-	-	-	-	<30	-	39 dBA
	Night	<30	<30	<30	<30	<30	<30	<30	<30	<30	35 dBA
R2	Day	<30	-	-	-	-	-	-	-	-	40 dBA
	Evening	<30	<30	-	-	-	-	-	<30	-	39 dBA
	Night	<30	<30	<30	<30	<30	<30	<30	<30	<30	35 dBA
R3	Day	<30	-	-	-	-	-	-	-	-	35 dBA
	Evening	<30	<30	-	-	-	-	-	<30	-	35 dBA
	Night	<30	<30	<30	<30	<30	<30	<30	<30	<30	35 dBA
R4	Day	42	-	-	-	-	-	-	-	-	44 dBA
	Evening	35	35	-	-	-	-	-	40	-	42 dBA
	Night	35	32	36	37	38	38	38	37	37	39 dBA
R5	Day	44	-	-	-	-	-	-	-	-	44 dBA
	Evening	37	34	-	-	-	-	-	42	-	42 dBA
	Night	37	31	35	38	39	39	39	39	39	39 dBA
R6	Day	42	-	-	-	-	-	-	-	-	44 dBA
	Evening	37	31	-	-	-	-	-	42	-	42 dBA
	Night	37	<30	32	36	38	39	38	39	38	39 dBA

Location	Period	Predicted Noise Level $LA_{eq(15minute)}$ (dBA)									Project
R7	Day	42	-	-	-	-	-	-	-	-	44 dBA
	Evening	37	31	-	-	-	-	-	42	-	42 dBA
	Night	37	<30	30	34	38	39	39	39	39	39 dBA
R8	Day	41	-	-	-	-	-	-	-	-	44 dBA
	Evening	37	30	-	-	-	-	-	42	-	42 dBA
	Night	37	<30	30	32	36	39	39	39	39	39 dBA

Results presented in **Table 26** indicate that noise emission levels during use of the Emergency Coal Stockpile are predicted to meet the project specific noise criteria at all modeled residential receivers under calm and prevailing weather conditions with the recommended noise mitigation and management strategies in place.

Furthermore, emergency stockpiling activities are likely to be worst case noise emissions at the surrounding residential receivers and would not represent typical operational activities at the site.

10.3.3.3 Cumulative Impacts

Potential cumulative noise impacts from existing and successive developments are embraced by the INP procedures, by ensuring that the appropriate noise emission criteria are established with a view to maintaining acceptable noise amenity levels for residences.

Potential cumulative noise impacts of the proposed Project could occur and impact on proposed developments, such as the redevelopment of the adjacent Wangi Power Station on Wangi Road, and other existing developments and operations in the area. The Wangi Power Station has been rezoned to permit a range of development including residential and mixed use development. The rezoning requires any future development to consider and mitigate against any potential impacts (including noise) associated with the operation of Myuna Colliery.

Existing industrial noise sources such as Eraring Power Station and the Enclosed Overland Conveyor are part of the existing noise environment, and as such, by preserving the existing amenity through meeting the relevant project specific noise criteria derived in **Table 25,** the cumulative noise impact of the project has been assessed as being insignificant.

10.3.3.4 Sleep Disturbance

The likelihood of sleep disturbance from typical night-time sources has been assessed. In assessing sleep disturbance from typical night-time activities, maximum noise levels (LAmax) of acoustically significantly plant and equipment to be used at the Surface Facilities Area were incorporated in to the noise model. LAmax noise level predictions were made at the nearest residential areas under adverse weather conditions at night. Noise events considered include coal falling into the ROM bin and those associated with a forklift drive off or pass-by. The use of the LAmax noise level provides a worst-case prediction.

The highest LAmax noise level at any residential area is predicted to occur as a result of forklift pass-by events in the materials yard under the influence of a temperature inversion. External noise levels up to LAmax 43 dBA may occur at residences on Donnelly Road under these circumstances. Predicted noise levels meet the recommended sleep disturbance noise goal of 49 dBA on Donnelly Road (R4 – R8) (refer to **Table 24** for sleep disturbance noise goals). Maximum noise levels on Summerhill Drive (R1 and R2) and Sunset Close (R3), Wangi Wangi are predicted to be below LAmax 30 dBA and as such meet the relevant sleep disturbance noise goal.

It was noted during the night-time attended noise survey on Donnelly Road, that maximum noise levels of up to 59 dBA were recorded from activities at Myuna Colliery due to the forklift moving and banging metal objects at the site. These noise levels exceed the recommended sleep disturbance noise goal of 49 dBA on Donnelly Road by 10 dBA.

Mitigation in relation to the use of the forklift is described in **Section 10.3.4.** With these measures in place, noise levels from the Surface Facilities Area will be below the recommended sleep disturbance noise goal of 49 dBA at residences along Donnelly Road.

In the interests of minimising sleep disturbance impacts, CMPL will brief and involve employees on the importance of minimising noise during the night-time period (refer **Section 10.3.4**).

10.3.3.5 Road Traffic Noise

The proposed Project will not alter the existing traffic and transport network. Therefore, there will not be any additional road traffic noise impacts associated with the proposed Project.

10.3.3.6 Underground Shot Firing Vibration

On rare occasions over its history, Myuna Colliery has been required to undertake underground shot firing operation when intrusions such as volcanic dykes impede the mine workings. Similarly, limited underground shot firing may therefore be required for the proposed Project. Vibration from underground shot firing is predicted to be negligible and below levels of human perception at the nearest residential locations. Notwithstanding this, all shots will be planned and designed to achieve the required outcomes with minimum impacts on the surrounding residential receivers.

The main potential vibration generating activities will include the operation of mobile equipment such as the loader and trucks should the Enclosed Overland Conveyor break down and coal needs to be stockpiled. Given the separation distance of approximately 500 metres between mine surface operations and the nearest potentially affected residences, vibration levels from these activities are predicted to be negligible at the nearest residential receivers.

10.3.4 Management and Mitigation Measures

The following noise mitigation and management strategies will be implemented for the proposed Project:

- All enclosure doors on the rotary breaker, crusher and crusher conveyor drive house will remain closed during the night-time period, specifically:
    - Roller shutter doors on the north-east and south-west façades of the crusher enclosure; and
    - Wire frame doors on the north-east façade and northern corner of the rotary breaker to be replaced with solid doors and kept closed at night-time.
- The forklift will not conduct activities, such as moving metal objects around the materials yard, during the night-time period.
- Employees will be briefed on the requirement to minimise noise during the night-time period.

Vibration from underground shot firing is predicted to be negligible and below levels of human perception at the nearest residential locations. Notwithstanding this, all shots will be planned and designed to achieve the required outcomes with minimum impacts on the surrounding residential receivers.

With these measures in place, the proposed Project is anticipated to meet the project specific noise criteria.

10.3.5 Conclusion

Operational noise levels are predicted to meet the project specific noise criteria at all assessed residential receivers under calm and prevailing weather conditions with the recommended noise mitigation and management strategies in place. Additionally, L_{Amax} noise levels are predicted to meet recommended sleep disturbance goals with the management strategies in place.

The proposed Project will not alter the existing road traffic network and hence no additional noise impacts are predicted from road traffic associated with the colliery.

Vibration from underground shot firing is predicted to be negligible.

With the relevant mitigation measures and management strategies are implemented, residual consequences associated with noise impacts will be minimal.

10.4 Aquatic Ecology

10.4.1 Background

An Aquatic Ecology Assessment was undertaken by Cardno Ecology Lab for the proposed Project, and is provided in **Appendix I**.

Lake Macquarie is a large coastal lake in NSW, with an open water area of 115.1 km^2. The lake bed is generally flat, averaging 7 metres in depth. Its overall condition is scored as 'very good' according to the *NSW State of the Catchments Draft Technical Report* (NSW DoP, 2008), and includes part of the Lake Macquarie State Conservation Area (Point Wolstoncroft).

Aquatic vegetation within Lake Macquarie includes:

- Seagrass comprising of four species: the most common, eel grass (*Zostera capricorni*), paddle weed (*Halophila ovalis*), Ruppia sp. and strapweed (*Posidonia australis*). The total area of seagrass in Lake Macquarie is approximately 15.3 km^2 (Creese *et al*., 2009);
- Mangroves: the most common species is the grey mangrove (*Avicennia marina*). The total area of mangrove in Lake Macquarie is approximately 1.1 km^2 (Creese *et al.,* 2009); and
- Saltmarsh which consists of the herbs *Sarcocornia quinqueflora* ssp. *Quinqueflora* sp.*, Einadia hastata*, *Salmolus repens* and *Suaeda australis* and the grasses *Zoysia macrantha* and *Sporobulus virginicus*. The total saltmarsh area in Lake Macquarie is in the order of 0.8 km^2 (Creese *et al.*, 2009).

Previous surveys of benthic assemblages within Lake Macquarie reported a relatively diverse assemblage of invertebrates, including several different families of polychaete worms, crustaceans and gastropod and bivalve molluscs. Approximately 232 species of fish have been recorded in Lake Macquarie (Lake Macquarie City Council, 2006a) from various different surveys, along with Dugongs, a number of species of turtles and estuarine and migratory birds.

Historically, mining within the existing Development Consent Mining Area has not resulted in observable subsidence on the lake bed (Cardno Ecology Lab, 2010). An assessment of subsidence impacts resulting from the proposed Project on aquatic ecology has been undertaken by Cardno Ecology Lab for this EA. The Aquatic Ecology Assessment is included in **Appendix I**, a summary of which is provided below.

10.4.2 Methodology

In order to determine the potential impacts of the proposed Project on aquatic ecology, the Aquatic Ecology Assessment incorporated a review of existing research, databases and survey results, along with Project-specific field investigations. Specifically, the assessment included:

- A desktop review of background research, including:
    - Review and compilation of existing information on the aquatic habitats, biota and fisheries of Lake Macquarie; and
    - Database searches of records from DI&I, the NSW NPWS *Atlas of NSW Wildlife*, 'Bionet' and the EPBC Protected Matters Search Tool for threatened and protected species, populations and communities likely to occur within the study area;
- Field surveys within the proposed Project Application Area and existing Development Consent Mining Area, including:
    - Mapping of the current seagrass distribution to determine the outer edges of the seagrass beds, species present and the relative bed density in terms of percentage cover; and
    - SCUBA dive seabed investigations of two locations above areas of previous mining activity in May 2010, to visually search for evidence of subsidence, evidence of and/or presence of benthic macroinvertebrates and macroalgae and the nature of the substratum;
- Assessment of impacts, including cumulative impacts, of the proposed Project on estuarine habitats, threatened and protected species, populations and ecological communities; and
- Identification of mitigation and/or monitoring for potential impacts where appropriate.

For the purposes of the assessment, the 'survey area' included the existing Development Consent Mining Area and the Project Application Area. The 'study area' refers to the Lake Macquarie estuary including the water area and foreshores.

10.4.3 Impact Assessment

10.4.3.1 Threatened and Protected Species and Communities

The review of existing records within public databases indicated that a total of 17 species of marine mammal, seven species of fish, 22 species of syngnathiforms (seahorses, seadragons, pipefish, pipehorses, ghost pipefishes and sea moths), five species of marine reptiles and 10 species of estuarine bird could potentially occur within the study area (refer **Appendix I)**. Of these species, 18 have been identified as known to occur within the study area (of which there have been recorded sightings) as shown in **Table 27**.

Table 27 Threatened Species know to occur within the Study Area

Common Name	Scientific Name	Listing under TSC Act/ FM Act	Listing under EPBC Act
Marine Mammals			
Dugong	*Dugong dugon*	E1	M
Southern right whale	*Eubalaena australis*.	V	E
Fish			
Grey nurse shark	*Carcharias taurus*	CE	CE
Estuary Cod	*Epinephelus coiodes*	P	-
Eastern blue devil fish	*Paraplesiops bleekeri*	P	-
Green sawfish	*Pristis zijstron*	PE	V
Australian grayling	*Prototroctes maraena*	P	V
Weedy seadragon	*Phyllopteryx taeniolatus*	P	L
Marine Reptiles			
Loggerhead turtle	*Caretta caretta*	E1	E
Green turtle	*Chelonia mydas*	V	V
Estuarine Birds			
Great knot	*Calidris tenuirostris*	V	L, M
Lesser sand plover	*Charadrius mongolus*	V	M
Black-necked stork	*Ephippiorhyncus asiaticus*	E1	-
Sooty oystercatcher	*Haematopus fuliginosus*	V	-
Pied oystercatcher	*Haematopus longirostris*	E1	-
Black bittern	*Ixobrychus flavicollis*	V	-
Painted snipe	*Rostratula benghalensis australis*	E1	V, M
Terek sandpiper	*Xenus cinereus*	V	L, M

P= Protected, V = Vulnerable, E = Endangered, E1 = Endangered (TSC Act), CE = Critically Endangered, PE = Presumed Extinct, M= Migratory protected under JAMBA and CAMBA agreements, L= Listed
Note: Study Area is the Lake Macquarie estuary including the water area and foreshores.

Coastal saltmarsh in the NSW North Coast, Sydney Basin and South-east Corner Bioregions is considered an EEC under an amendment to the TSC Act in 2004. Recent habitat maps of the study area indicate that although coastal saltmarsh in the NSW North Coast, Sydney Basin and South-east Corner Bioregions does occur within

the study area, it has not been mapped within the Project Application Area or in close proximity to these boundaries. It has therefore not been considered further in the assessment.

Saltmarsh and mangrove habitat are not known to occur within or in proximity of the Project Application Area (Cardno Ecology Lab, 2010).

10.4.3.2 Potential Impacts

The primary impact on estuarine aquatic ecology is considered to be the potential for subsidence of the bed of Lake Macquarie from subsurface mining, which could destabilise aquatic vegetation and affect estuarine invertebrates living in the lake bed sediments.

Saltmarsh and mangrove habitat are not known to occur within or in proximity of the Project Application Area and will not be affected by the Project (Cardno Ecology Lab, 2010). No impact to the conservation values of Lake Macquarie State Conservation Area at Point Wolstoncroft (in terms of aquatic ecology) is expected as a result of the Project (Cardno Ecology Lab, 2010).

Subsidence which may occur as a result of underground mining has the potential to impact on aquatic ecosystems in the following manner:

- Seagrass:
    - An increase in the mean depth of seagrass habitat (as a result of mining subsidence) may lead to a decrease in the distribution of seagrass;
    - Slumping of sediments (induced by subsidence) may cause destabilisation of plants and seagrass habitat in surrounding areas;
- Benthic Assemblages:
    - Alteration of benthic macroinvertebrate assemblages may occur due to changing vegetation and water depth due to subsidence;
- Threatened Species:
    - Subsidence impacts on seagrass habitat used by threatened species may alter the behaviour or habitat requirements of these species; and
- Fisheries resources:
    - Fisheries resources may experience indirect impacts as a result of loss of seagrass habitat and nursery habitat due to subsidence.

Seagrass

Field investigations carried out as part of the Aquatic Ecology Assessment and previous habitat mapping carried out within Lake Macquarie (Creese *et al*. 2009) shows seagrass beds fringing the majority of the foreshore within the survey area and Project Application Area (refer to **Figure 10.4.1**).

As discussed in **Section 6.0**, the proposed Project will limit subsidence levels to less than 20 millimetres under land, foreshore and seagrass areas (refer to Mining Zone A in **Figure 6.3**). Cardno Ecology Lab (2010) considered that, as the boundary of Mining Zone A represents the existing extent of seagrass beds within the Project Application Area, and as subsidence levels of less than 20 millimetres are proposed in Mining Zone A, impacts to seagrass beds are not expected to be perceptible as a result of the proposed Project.

Subsidence levels up to 650 millimetres proposed under the Lake (refer to Mining Zone B in **Figure 6.3**) have the potential to affect seagrass habitat at the boundary between Mining Zone B and the adjacent Mining Zone A. The consequence of this could be increased depth and subsequent loss of seagrass at the outer edges of Zone A, although the extent of this would depend on the topography of the seabed (Cardno Ecology Lab, 2010). In order to limit subsidence to a maximum of 20 millimetres at the boundary of Zone A, mining systems in Zone B will be undertaken with an angle of draw of 26.5˚ from the boundary of Zone A, resulting in a transition area between the two zones (refer to **Figure 6.2**). This angle of draw will also limit maximum tilts and strains at the boundary of Zone A to 7 millimetres per metre (Seedsman Geotechnics, 2010).

While the potential remains for an imperceptible reduction in seagrass area as a result of subsidence of less than 20 millimetres within Mining Zone A, observable impacts to seagrass habitat will be unlikely and any localised impacts of subsidence are likely to be negligible.

Increases in nutrient levels, sedimentation or pollutants arising due to a potential minor and imperceptible reduction in seagrass area, as a result of subsidence of less than 20 millimetres, will not be detected against background levels as that much of the existing land use within the wider catchment of Lake Macquarie is urbanised and industrial. Impacts to the water quality of Lake Macquarie as a result of the proposed Project have also been considered in **Section 10.2**, and are considered to be negligible.

Threatened Species

Of the 18 species listed in **Section 10.4.3.1** that are 'known' to occur within the study area, only 11 have the potential to be affected by the proposed Project. Assessments of significance were carried out for these 11 species, which included the dugong (*Dugon dugon*), loggerhead turtle (*Caretta caretta*), green turtle (*Chelonia mydas*) and the eight species of estuarine bird (refer to **Appendix I**).

The assessments of significance undertaken for these 11 species each concluded that the predicted levels of subsidence as a result of the proposed Project will not have a significant effect on the habitat utilised by these species, such that it will cause any observable alteration to their behaviour or habitat requirements (Cardno Ecology Lab, 2010).

Benthic Assemblages

Habitats present within the Project Application Area include low relief subtidal rocky reef, with mussel beds and macroalgae that occur off exposed headlands. These habitats generally occur within Zone A where subsidence will be less than 20 millimetres. It is unlikely that species assemblages associated with this habitat will be lost as a result of the increase in depth, however, it is possible that species composition of these assemblages could be altered, whereby species adapted for deeper water outcompete other species. It is unlikely that this potential change will result in any detectable impact within the Project Application Area.

The bed of Lake Macquarie is relatively flat and in the deeper areas consists of fine, dark, soft silt. The diversity and abundance of species found in these benthic sediments during previous surveys by the Ecology Lab is typical of that expected in a temperate NSW estuary and included polychaete worms, crustaceans and molluscs. Localised subsidence of up to 650 millimetres predicted for Mining Zone B will likely result in localised alterations in species composition due to depth changes. Given the large area of similar habitat within Lake Macquarie for these species, localised changes to benthic soft sediment assemblages as a result of subsidence and increase in water depth will not be significant.

Fisheries Resource

The extensive seagrass beds within Lake Macquarie provide important nursery habitat for many species of fish. Subsidence that results in a reduction in the area of seagrass beds within the Project Application Area could have an indirect impact on juvenile fish (and crustaceans) which utilise seagrass habitat by limiting the resource available. However, given that impacts to seagrass in Zone A will be negligible as a result of the proposed Project, no impacts to fisheries resources are expected. Subsidence up to 650 millimetres in Lake bed depth in Zone B is not considered to have a direct impact on fisheries resources within the Project Application Area as there will not be a significant impact to habitat utilised by fish species.

10.4.4 Management and Mitigation Measures

In order to minimise potential impacts to aquatic ecology at the boundary between Mining Zones A and B, the following mitigation measures will be implemented:

- The mine plan will be designed such that mining using Zone B mining systems will be undertaken with an angle of draw of 26.5° from the boundary of Zone A to transition between these two zones and limit subsidence to 20 millimetres at the boundary of Zone A (refer **Figure 6.2**);
- A SMZ will be established within Mining Zone B adjacent to the Zone A boundary to minimise the potential for impacts to seagrass at the interface between the two zones (refer to **Figure 10.4.2**). As seagrass distribution is strongly influenced by depth and was not observed to occur in water greater than 5 metres within the Project Application Area, the extent of the SMZ will include the area from the lake-ward edge of the existing seagrass beds out to the 5 metre depth contour across the majority of the Project Application Area. Where seagrass beds occur at the edge of the 5 metre contour, the SMZ extends out to approximately the 6 metre depth contour to allow a sufficient buffer. The SMZ will also delineate the area where future seagrass monitoring may be required should secondary mine workings take place in Mining Zone B; and

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SEAGRASS HABITATS

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Environmental Assessment

Figure 10.4.1

- A Seagrass Management Plan will be prepared and will include the requirements for seagrass surveys and monitoring within the SMZ, which will be undertaken should secondary workings (partial or full pillar extraction) take place beneath the SMZ. Monitoring requirements will be determined using a risk based approach, targeting the locations where the potential surface impacts of mining within Zone B are predicted to be greater than 20 millimetres within the SMZ. Seagrass monitoring surveys will verify the lake-ward edges of seagrass beds and include observations before, during and after mining activity, to detect any effects that might warrant more detailed quantitative field investigations.

Prior to undertaking secondary workings in Zone B, Myuna has committed to the development of an Extraction Plan. In relation to the benthic community of the Lake, this plan will include:

a) Refining the predicted subsidence based on a detailed mine layout and design;

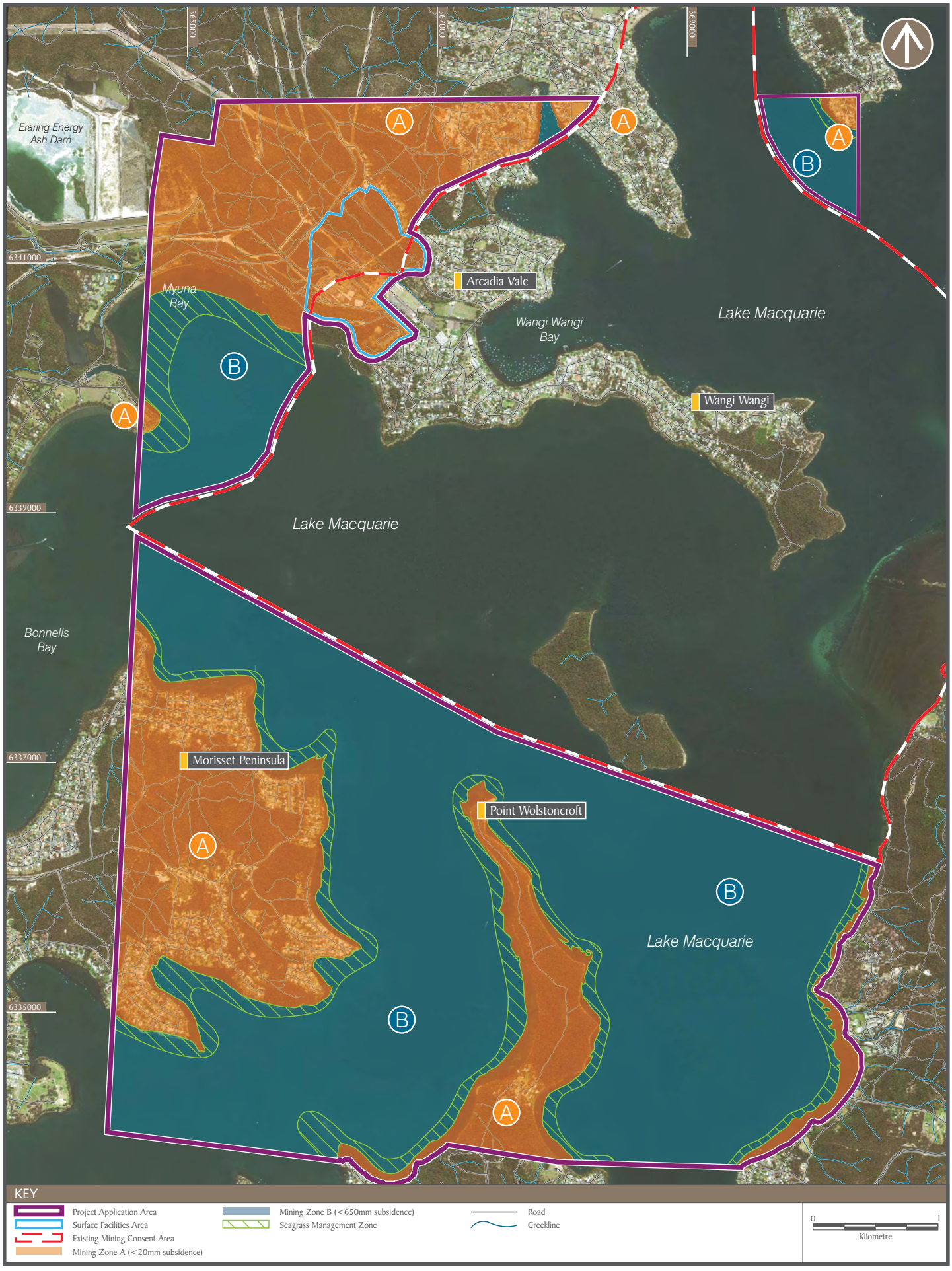
b) An assessment of the likely impacts of subsidence related to the detailed mine layout and design (based on prediction) on benthic communities within the proposed mining area;

c) An assessment of the consequences of these impacts on the availability of light to the benthic communities, including the proportion of the Lake bed likely to be affected; and

d) Management strategies to avoid reducing light availability to the Lake bed where the proportion of the Lake bed likely to be affected is, following consultation with DECCW, considered significant.

10.4.5 Conclusion

Seagrass habitat is extensive throughout shallow nearshore sections of the Project Application Area, however, given that predicted subsidence levels where seagrass beds occur (Zone A) will be negligible (less than 20 millimetres), the proposed Project will not have any substantial impact on seagrass habitat. Direct or indirect impacts to fish and threatened species that utilise seagrass habitat are not therefore expected. Impacts to seagrass, benthic assemblages, fisheries resources and threatened species as a result of the proposed Project are predicted to be negligible and minimal residual consequences are expected. Potential risks to seagrass at the boundary of Mining Zone A and B will be mitigated by the designation of a SMZ and preparation of the Seagrass Management Plan.



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SEAGRASS MANAGEMENT ZONE

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Environmental Assessment

Figure 10.4.2

10.5 Social Impacts

10.5.1 Background

The review of social impacts prepared by AECOM as part of the EA is provided in **Appendix J** and has focused on the Lake Macquarie and Wyong LGAs, within which the Project Application Area sits and where the majority of Myuna Colliery employees reside.

The majority of residents in the Lake Macquarie and Wyong LGAs are of working age, with the number of children being similar to the State average while the proportion of older people is higher. The proportion of families comprising couples without children in Lake Macquarie and Wyong LGAs is slightly higher than in NSW, as is the proportion of one parent families (AECOM, 2010a). While Wyong LGA is still growing, the rate of growth has slowed since 1986 (AECOM, 2010a). The population of the Lake Macquarie LGA increased markedly in the 1990s, though the rate of growth has slowed since 2001.

Lake Macquarie LGA attracts around 900,000 visitors per year, a third of which stay in one of over 100 accommodation options available including lakeside resorts, motels, bed and breakfasts and self-contained cottages (AECOM, 2010a). Wyong LGA also attracts many tourists each year as the Central Coast is one of the Nation's leading tourist areas.

Economic growth in the region has traditionally been fuelled by coal mining, however the area has also benefited from construction of the railway line (AECOM, 2010a), while upgrades and expansions of the Sydney-Newcastle Freeway have also improved linkages to Sydney. Economic growth within these LGAs now centres on the tourism and aged care industries and residential development. Over the past 25 years, Wyong LGA has changed from a holiday and retirement area to an urban fringe area of Sydney (AECOM, 2010a).

While mining itself is not a growth area within the Lake Macquarie and Wyong LGAs, the economic benefits of this industry to the area are considered to be significant (DoP, 2008). Average mining industry incomes are substantially higher than other sectors with the average weekly income for an underground coal miner in NSW approximately $2,000 (for 2005-06), significantly higher than the median weekly income of approximately $850 average (2006) for households in Wyong LGA and Lake Macquarie LGA. Approximately 40% of the state's installed coal-fired electricity generating capacity is located within the Lake Macquarie and Wyong LGAs (DoP, 2008), providing opportunities for growth in local and inter-regional businesses.

Myuna Colliery has been in operation for over 25 years. Over this period, Myuna Colliery has provided investments in many community projects in addition to providing a source of economic growth for the area through both direct employment and through the mining industry being a major economic support for the area.

10.5.2 Methodology

In order to determine a social profile of the area, a desktop assessment was undertaken reviewing information from Centennial, Australian Bureau of Statistics (ABS) Census, the local media, regional planning instruments as well as relevant background literature.

The potential impacts of the proposed Project on that profile were then assessed using a matrix system as described in Section 5.2 of **Appendix J**.

10.5.3 Impact Assessment

10.5.3.1 Area of Influence

The primary area of influence of the proposed Project comprises the physical footprint of the Project Application Area, including Lake Macquarie, and the suburbs immediately surrounding the Surface Facilities Area. There are residents, service providers and facilities in the Project Application Area, within the suburbs of Arcadia Vale, Wangi Wangi, Myuna Bay, the Morisset Peninsula, Point Wolstoncroft, and to a lesser extent, the suburbs of Coal Point Fishing Point and Rathmines.

The secondary area of influence of the proposed Project comprises where the existing 175 Myuna Colliery employees reside, which include areas of the Central Coast (30 employees), Lake Macquarie (95 employees) and West Newcastle / Lower Hunter Valley (50 employees).

10.5.3.2 Potential Impacts

Social impacts can be either positive or negative in nature. Based on the social profile and the review of secondary data sources, the potential environmental, economic, social, financial and cumulative impacts on the local community resulting from the proposed Project include:

- Environmental Impacts:
    - Land subsidence within Zone A of the Project Application Area as a result of underground mining, with potential subsidence induced impacts as a result of underground mining for the proposed Project relating to land use, ecology, heritage and water:
    - Ongoing operation of the Colliery and its Surface Facilities Area, including production up to 2 Mtpa ROM coal, with potential impacts associated with noise, dust, GHG and traffic.
- Economic Impacts:
    - Direct injection of wages into the local economy for a further 21 years;
    - Stimulus of the State economy through additional wages, royalties and business turnover on an annual basis, and economic benefits to a number of different sectors of the regional economy through flow-on spending as a result of the proposed Project (Gillespie Economics, 2010); and
    - Cessation of mining due to the removal of the economic stimulus provided by the proposed Project and the loss of 210 jobs.
- Social Impacts:
    - Ongoing investments in several community projects. These projects have included sponsorship of initiatives at Arcadia Vale Public School, Wangi Peter Pan Kindergarten, Lake Macquarie Combined Fishing Club, Wangi Netball Club, Rathmines Public School, Powerhouse Christian Church, Wangi Lawn Bowling Club, Wangi Lions Club and the Wangi Beautification Project, Wangi Dobell Festival of Arts and Crafts, the Wangi Men's Shed and West Lake Soccer Club.
- Financial Impacts:
    - Undermining of existing residential areas of the Project Application Area is likely to increase concern within the community relating to reduced property prices within residential areas.
- Cumulative Impacts:
    - Potential cumulative impacts of the proposed Project with existing developments and operations in the area and proposed development, such as marina expansions on Lake Macquarie, the continuation of existing coal mining projects at Awaba and Chain Valley Bay and the rezoning of the adjacent Wangi Power Station on Wangi Road will relate to air, noise, water, traffic, GHG, and land use.

The potential impacts of the project on the social profile of the surrounding area and region have been considered and are summarised in **Table 28**.

Table 28 Summary of Potential Social Impacts

Aspect	Potential Impact and Mitigation Measures	Type of Impact	Likelihood of Impact
Land Subsidence	Potential subsidence induced impacts as a result of underground mining for the proposed Project relate to land use, ecology, heritage and water. The Project Application Area is within a Mine Subsidence District for which CMPL pays levies under the Mine Subsidence Compensation Act. The proposed Project will restrict subsidence of land areas within these Subsidence Districts to less than 20 millimetres, and as such potential negative impacts on surface improvements (buildings, infrastructure, roads etc) will be minimal.	Negative	Unlikely
Extension of Operations	Potential impacts on the local community relate to air and noise emissions, GHG production, traffic and water quality. Given the existing environment, history of operations, negligible potential traffic, noise, air and water impacts related to the proposed Project, and mitigation measures proposed for GHG emissions, the proposed Project is not expected to result in significant environmental impacts on the local community.	Negative	Unlikely
Community Projects	Centennial has made recent and ongoing investments in several community projects of benefit to the local area, and which will continue throughout the proposed Project.	Positive	Likely
Local Economy	Socio-economic benefits associated with the proposed Project include wage distribution within the community, and royalties payable to State and Federal governments, which will positively impact the community by providing a source of economic growth for the area and will continue for a further 21 years should the Project proceed (refer to Gillespie Economics, 2010).	Positive	Likely
Employment	The proposed Project will result in the generation of employment for an additional 35 employees above current staff levels. The population demographics of the Lake Macquarie and Wyong LGAs indicate an increase in the younger working age group and a high level of unemployment. The 35 jobs created by the proposed Project could positively impact the area by providing employment opportunities for members of these communities.	Positive	Likely
Mine Closure	Mine closure in 2031 will negatively impact the local community due to the removal of the economic stimulus provided by the proposed Project and the loss of 210 jobs following the cessation of mining.	Negative	Probable
Financial Impacts	Undermining of existing residential areas of the Project Application Area is likely to give rise to a level of concern within the community, relating to reduced property prices within the residential areas. As the proposed Project will limit land surface subsidence to less than 20 millimetres within Mining Zone A, the proposed Project is unlikely to have a negative impact on property prices.	Negative	Unlikely
Cumulative Impact with Other Proposed Developments	Potential cumulative impacts of the proposed Project with existing developments and proposed projects in the area will relate to air, noise, water, traffic, GHG, and land use. Based on cumulative assessments undertaken for the EA, cumulative impacts of the proposed Project will be minor. Further, redevelopment of the site of the former Wangi Power Station is to have regard to and mitigate against any potential impacts from the Colliery.	Negative	Unlikely

Myuna Colliery is a long standing existing operation and the proposed Project will see the continuation of this operation. Few complaints have been received from the community over the life of the Colliery and no complaints regarding the existing operations were received during 2009 (CMPL AEMR, 2009). It is considered that potential negative impacts on the surrounding environment are unlikely as only minor alterations of existing surface infrastructure are proposed. Subsidence impacts will be managed to specified levels (as discussed in **Section 6.0**) with negligible land surface subsidence.

Myuna Colliery currently provides significant benefit to the local community from the direct injection of wages into the local economy as more than half of all employees come from within the Lake Macquarie and Central Coast area. Into the future, the proposed Project will continue to benefit the local area and provide benefits to the overall State economy through royalties payable to State and Federal governments.

Potential impacts to the local area and broader region have been assessed and discussed throughout this EA, including air quality and GHG emissions, noise and traffic. Each of these assessments includes a discussion of the mitigation and management measures to be implemented to ensure potential impacts are avoided or managed to appropriate levels.

10.5.4 Management and Mitigation Measures

The potential social impacts identified as part of this review are both positive and negative in nature. Myuna Colliery will continue to operate as a good neighbour in the community and utilise existing strategies and programs implemented in the local area.

CMPL currently contributes to the local community through various sponsorships and donations, including initiatives at a number of local schools, sporting clubs, community initiatives, and cultural associations. Future reviews will develop a list of priority areas for investment which is integrated with Myuna Colliery's current Risk Assessment process to ensure that the areas are still relevant and meet community need.

A key mechanism to ensure that potential community impacts are managed and measured effectively is via a well structured community engagement program. Myuna Colliery has an existing well-structured community engagement program in the form of a Stakeholder Engagement Plan that will continue to be utilised for the proposed Project. This Stakeholder Engagement Plan is regularly reviewed to ensure that the information and mechanisms for providing that information to key community and government stakeholders are appropriate.

10.5.5 Conclusion

The potential impacts of the proposed Project on the social environment are considered to be both negative and positive. The implementation of mitigation measures such as the implementation of existing community strategies will minimise residual consequences. Residual consequences will be limited to those environmental consequences contained throughout the EA. Residual consequences relating to mine closure have been discussed in **Section 10.13** of this EA.

10.6 Traffic

10.6.1 Background

AECOM prepared a Traffic Impact Assessment for the proposed Project which is included in **Appendix K**. Traffic was identified as a minor issue in the risk assessment presented in **Section 10.6**, and the level of assessment undertaken for the proposed Project reflects this minor risk.

The scope of the assessment was to review existing traffic conditions, assess likely changes in traffic, evaluate any potential impact on the road network as a result of the proposed Project and provide any necessary mitigation.

10.6.1.1 Local Road Network and Site Access

Myuna Colliery is bounded by Wangi Road, Summerhill Drive and Donnelly Road and is accessed from a private road (Wangi Point Road) which intersects with Summerhill Drive. The intersection of Summerhill Drive / Wangi Point Road is the main access point for the Myuna Colliery Surface Facilities Area. Summerhill Drive connects to Donnelly Road (at The Promenade) to the south east and to Wangi Road to the north-west. **Figure 10.6.1** shows the local road network surrounding the Surface Facilities Area.

Access to Myuna Colliery's Surface Facilities Area is from Wangi Point Road at the intersection with Summerhill Drive, and there is existing parking for up to 200 vehicles in the car park at the Surface Facilities Area.

10.6.1.2 Traffic Generation

All coal produced at Myuna Colliery is transported from the Surface Facilities Area directly by the Enclosed Overland Conveyor to Eraring Power Station. As such, traffic generation from current operations is associated with employees commuting to and from the site, as well as deliveries.

In accordance with the 1977 Development Consent, Myuna Colliery has approval to operate with up to 350 personnel at the Colliery. At present, however, there are currently 175 personnel employed at Myuna Colliery. As such, this assessment has focussed on the impact between existing and proposed operations, although it is noted that Myuna Colliery currently has approval to operate with a greater number of personnel than are currently employed.

Employees operate across three 8-hour shifts within a 24 hour period:

- 6.30 am – 2.30 pm;
- 2.30 pm – 10.30 pm; and
- 10.30 pm – 6.30 am.

To estimate traffic generated by employee vehicles, an occupancy rate of one employee per car was assumed to provide a worst-case assessment scenario. Employee postcode data provided by CMPL indicates that 54% of employees reside in the Lake Macquarie local Government area (LGA), 29% reside in West Newcastle and Hunter LGAs and 17% reside on the Central Coast. Further analysis of the geographic location of individual postcode areas and employee numbers within each postcode area indicates that 77% of employees come from areas to the north and are assumed to travel along Donnelly Road, 20% from areas to the south and west and are assumed to travel along Summerhill Drive, and 3% of employees from Wangi Wangi to the east of Myuna Colliery.

The highest number of employee vehicles (61 vehicles) access Myuna Colliery prior to the morning shift from Donnelly Road.

10.6.1.3 Intersection Performance

All vehicles accessing the site use the intersection of Summerhill Drive / Wangi Point Road, which is the access road for the Surface Facilities Area (refer **Figure 10.6.1**). Further from the site, the intersection of Donnelly Road / Wangi Road is predicted to accommodate over three quarters (77%) of employee vehicles travelling to and from the north. Observations indicate these two intersections have sufficient sight distances for vehicles accessing and egressing.

The intersection of Summerhill Drive / Wangi Road (refer **Figure 10.6.1**), however, is on the crest of a hill and has poor sight distance to the north. Accident data supplied by the RTA for a period between 1 July 2004 and 30 June 2009 shows that there have been five crashes during this time period. Of the five crashes, three were non-injury crashes and two were injury crashes. There were no fatal crashes at this intersection during this time period.

10.6.1.4 Future Growth

Traffic data obtained from LMCC and the RTA to determine existing traffic flows on the surrounding road network, provided in **Table 29**. Data from the nearest RTA permanent count station in the vicinity of proposed Project, located on Wangi Road at Wangi Creek Bridge, was analysed to determine average growth rates for traffic in the area. The analysis indicated that the growth rate in the area between 1995 and 2004 was 2.1% (refer to Section 2.3.1 of **Appendix K**). Using this growth rate, existing (2010) and future (2031) Average Annual Daily Traffic (AADT) data has been calculated at each LMCC and RTA count location and is shown in **Table 29.** The count locations are shown on **Figure 10.6.2**.

Table 29 Existing and Future Traffic Volumes

Count Location*	Road	Location	AADT		
			2005	2010	2031
1	Donnelly Road	Between Alexander Parade and Arcadia Street	3,167	3,521	5,498
2	Donnelly Road	Between Arcadia Street and House no 95	3,276	3,643	5,687
3	Donnelly Road	Between House no 95 and Wangi Road	3,410	3,792	5,920
4	Summerhill Drive	Between Wangi Road and Boundary Road	2,123	2,361	3,685
5	Summerhill Drive	Between Boundary Road and Dobell Drive	1,708	1,899	2,965
RTA count location	Wangi Road	Wangi Creek Bridge	8,728 (2004)	9,913	15,476

* Data for count locations 1 – 5 obtained from LMCC, RTA count location data obtained from the RTA.

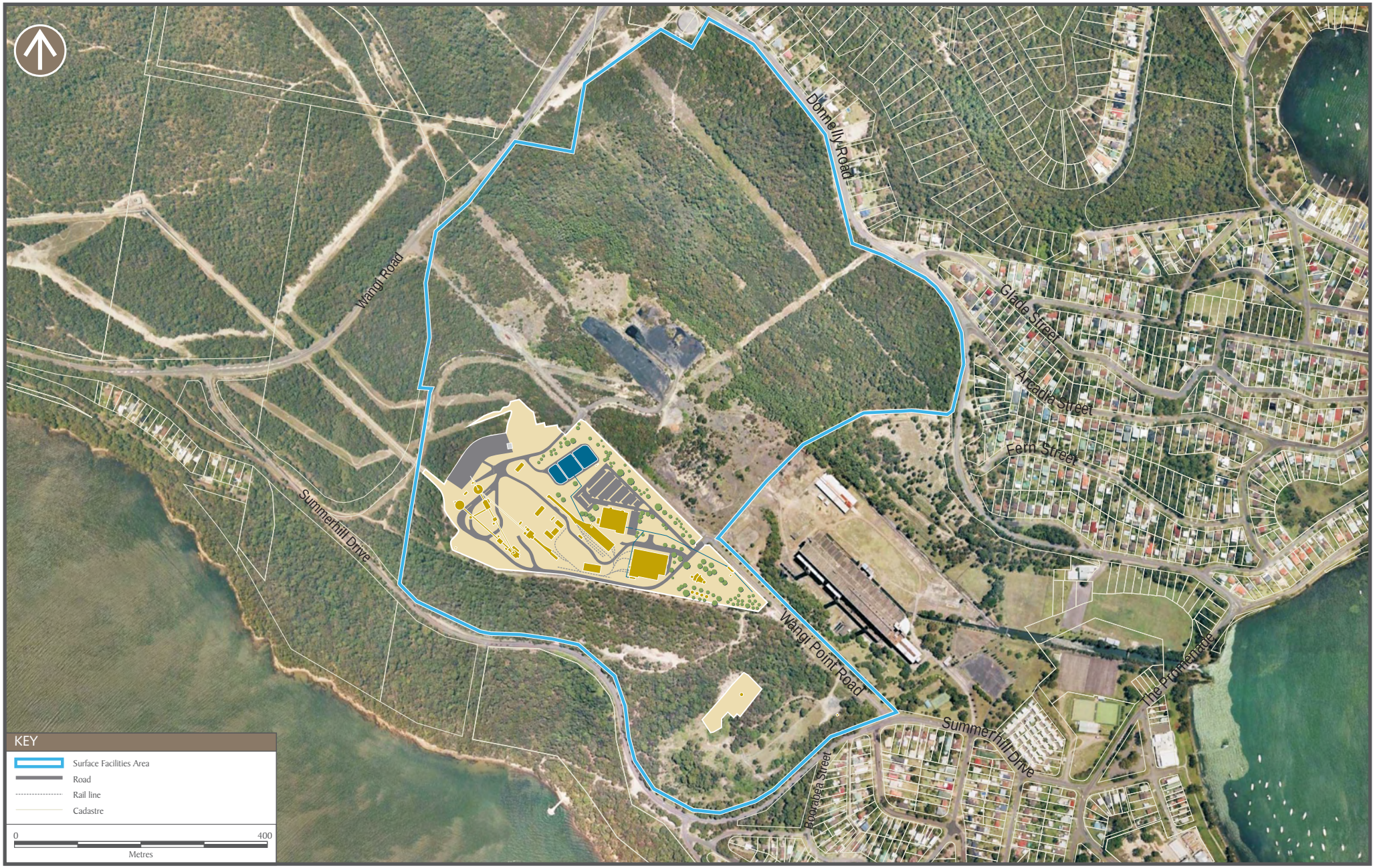
Future traffic volumes for 2031 are considered to be a worst case scenario as the growth rate (which has been applied to local roads in the vicinity of the site as well as Wangi Road), has been derived from counts on Wangi Road which connects townships and will be expected to have higher traffic flows, as opposed to local roads that provide access within townships.

10.6.2 Impact Assessment

10.6.2.1 Local Road Network and Site Access

The proposed Project will employ in the order of 210 personnel per day, which represents an increase of 35 employees above current levels. It is envisaged that 130 employees (62%) will work during the morning shift, 40 (19%) during the afternoon shift and 40 (19%) during the night shift. The proposed Project will not result in changes to the existing site access or car parking arrangements.

The 35 additional employees will give rise to an additional 70 movements on the traffic network per day**. Table 30** shows these additional 70 vehicle movements as a proportion of the existing AADT along the local roads in the vicinity of proposed Project.



AECOM

SURROUNDING ROAD NETWORK

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Figure 10.6.1

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TRAFFIC COUNT LOCATIONS FOR 2005 AADT DATA IN THE VICINITY OF THE SURFACE FACILTIES AREA

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Figure 10.6.2

Table 30 Additional Employee Vehicle Movements as a Proportion of Existing AADT

Count Location	Road	Location	AADT 2010	Additional Movements*	% Existing traffic*
1	Donnelly Road	Between Alexander Parade and Arcadia Street	3,521	54 (77%)	1.5%
2	Donnelly Road	Between Arcadia Street and House no 95	3,643		1.5%
3	Donnelly Road	Between House no 95 and Wangi Road	3,792		1.4%
4	Summerhill Drive	Between Wangi Road and Boundary Road	2,361	14 (20%)	0.6%
5	Summerhill Drive	Between Boundary Road and Dobell Drive	1,899	2 (3%)	0.7%

* The additional movements and percent of existing traffic has been calculated based on 77% of employees travelling along Donnelly Road, 20% travelling along Summerhill Drive from the south and west, and 3% of employees travelling along Summerhill Drive from Wangi Wangi to the east of Myuna Colliery.

The additional vehicle movements from Myuna Colliery are shown to be less than 1.5% of the existing 2010 traffic on the local roads, which the Traffic Impact Assessment considers to be negligible.

At present, a worst case scenario of 132 two-way employee vehicles per hour use Wangi Point Road at the shift change over time of 2.30pm (52 employee vehicles arriving for the new shift and 80 vehicles leaving from the previous shift). This will increase to 170 two-way movements as a result of the proposed Project.

The *RTA's Guide to Traffic Generating Developments* (RTA, 2002) indicates that a local street has a maximum peak hour environmental capacity of 300 vehicles per hour. The volume of traffic generated by the Project is well within the capacity of Wangi Point Road and is therefore anticipated to have a negligible impact on the road network.

10.6.2.2 Future Growth

The additional 70 traffic movements per day has been calculated as a proportion of the future AADT along the local roads in the vicinity of proposed Project, to represent potential impacts associated with future growth of traffic volumes. The proportion of future traffic movements is shown in **Table 31**.

Table 31 Additional Employee Vehicle Movements as a Proportion of Future AADT

Count Location	Road	Location	AADT 2031	Additional Movements*	% Future traffic*
1	Donnelly Road	Between Alexander Parade and Arcadia Street	5,498	54 (77%)	1.0%
2	Donnelly Road	Between Arcadia Street and House no 95	5,687		0.9%
3	Donnelly Road	Between House no 95 and Wangi Road	5,920		0.9%
4	Summerhill Drive	Between Wangi Road and Boundary Road	3,685	14 (20%)	0.4%
5	Summerhill Drive	Between Boundary Road and Dobell Drive	2,965	2 (3%)	0.5%

* The additional movements and percent of existing traffic has been calculated based on 77% of employees travelling along Donnelly Road, 20% travelling along Summerhill Drive from the south and west, and 3% of employees travelling along Summerhill Drive from Wangi Wangi to the east of Myuna Colliery.

In reality, the background traffic flows should increase over the 21 years of the life of the proposed Project and therefore the additional employee vehicles will be less than 1% of traffic flows in 2031. The Traffic Impact Assessment has identified this increase as negligible, and therefore Project generated traffic is predicted to have a negligible impact on the local road network in the vicinity of proposed Project in the future year of 2031.

10.6.2.3 Intersection Performance

The intersection geometries of Summerhill Drive / Wangi Point Road and Donnelly Road / Wangi Road all have sufficient sight distances for vehicles accessing and exiting the Surface Facilities Area, which will not be adversely affected by the proposed Project.

The intersection of Summerhill Drive / Wangi Road, however, is on the crest of a hill and so the sight distance to the north is reduced under existing conditions, due to the crest of the hill at this location. However as the volume of traffic on Summerhill Drive is low, and generated by the proposed Project is negligible (14 additional movements per day) compared to existing road traffic levels, the restricted sight distances at the location is not considered to pose a significant safety issue on through vehicle movements.

10.6.3 Management and Mitigation Measures

No additional mitigation measures are required as a result of the proposed Project.

10.6.4 Conclusion

The impact on the local road network from an additional 70 vehicle movements per day is considered minimal and unlikely to compromise the function of the surrounding network.

There is minimal residual impact to the existing access arrangement to the Surface Facilities Area and the surrounding road network as a result of the proposed Project.

10.7 Terrestrial Ecology

10.7.1 Background

A Terrestrial Flora and Fauna Impact Assessment was prepared for the proposed Project by RPS, and is provided in **Appendix L**.

The Project Application Area includes two areas of the Lake Macquarie State Conservation Area, listed under the *NP&W Act*, the Point Wolstoncroft Peninsula and Myuna Bay. Point Wolstoncroft Peninsula consists of 107.8 hectares of remnant native vegetation and 6 kilometres of foreshore, and Myuna Bay 11 hectares and 1.1 kilometres of foreshore conserved at Myuna Bay (NPWS, 2005) (refer to **Figure 2.2**). The remaining areas of the Lake Macquarie State Conservation Area are located proximate to the Project Application Area.

The mine infrastructure and CHP at Myuna Colliery's Surface Facilities Area is surrounded by vegetated ridgelines connected to remnant vegetation in the north-west of the Project Application Area, while riparian zones exist downstream of the Surface Facilities Area along Wangi Creek.

Terrestrial vegetation patterns within the Project Application Area include a total of 11 vegetation communities which have been identified through mapping prepared by the *Lower Hunter Central Coast Regional Environmental Management Strategy* (LHCCREMS) (House, 2003), and the *Natural Vegetation of the Wyong Local Government Area* (Bell, 2002) which provides additional accurate mapping for the Point Wolstoncroft penninsula. These 11 vegetation communities are effectively only eight communities, with the same vegetation types being mapped as different communities in the LHCCREMS and Bell mapping projects. Vegetation communities are primarily grassy, forested and woodland communities.

Although the proposed Project will involve limited land surface disturbance, a terrestrial ecology assessment was undertaken as part of this EA and is included in **Appendix L.** The purpose of the assessment was to identify terrestrial flora and fauna likely to occur within the Project Application Area, assess potential impacts of the proposed Project on terrestrial ecology, and recommend mitigation measures where appropriate.

10.7.2 Methodology

The proposed Project will involve limited land surface disturbance, will utilise the existing Surface Facilities Area, will involve minor clearing of native vegetation, and likely result in negligible levels of surface subsidence of land (less than 20 millimetres). Given the likely minimal extent of surface disturbance, a desktop assessment of the potential terrestrial ecological impacts of the proposed Project was carried out as it was determined that a field survey of the entire Project Application Area was not required.

This desktop assessment approach is supported by the letter from DECCW which accompanied the EARs issued for the proposed Project, which stated:

"DECCW is of the opinion that if the predicted subsidence levels can be shown not to adversely impact on terrestrial threatened species, populations, ecological communities and their habitat then no further assessment would be required."

The terrestrial ecology assessment comprised:

- A literature review and compilation of existing information such as regional vegetation mapping, Flora and Fauna Impact assessments and Environmental Assessments for nearby development, and Lake Macquarie City Council reports;
- Database searches of records from the NSW NPWS 'Atlas of NSW Wildlife', the EPBC Protected Matters Search Tool and the DECCW Threatened Species, Populations and Ecological Communities website; and
- Field survey of the area of the proposed minor surface water diversion works at the temporary coal stockpile area (19 June 2010) which recorded vegetation communities, a flora species list and key fauna habitats within the walkover area.

The 'study area' for the terrestrial ecology assessment was defined as a 10 kilometre radius around the boundary of the Project Application Area.

10.7.3 Impact Assessment

10.7.3.1 Threatened Species

A search of the DECCW Wildlife Atlas revealed the following threatened species listed under the TSC Act have been recorded within the study area:

- 24 threatened flora species (7 endangered and 17 vulnerable); and
- 56 threatened terrestrial fauna species (8 endangered and 48 vulnerable).

A complete list of threatened flora and fauna species identified during the literature review is included in **Appendix L**.

Of these species, only 3 vulnerable flora species and 12 threatened fauna species have been previously recorded within the Project Application Area, as shown on **Figures 10.7.1** and **10.7.2**. No threatened flora or fauna species, populations or communities were identified during the field survey of the area of the proposed minor surface water diversion works.

The EPBC Protected Matters Report identified one threatened ecological community (TEC), 53 threatened species (11 flora and 42 fauna species) and 66 migratory species listed under the EPBC Act with potential to occur within the Study Area (refer to **Appendix L**).

Appendix 2 of the terrestrial ecology assessment in **Appendix L** contains an assessment of the likelihood of each threatened species/population/community listed under the TSC Act and/or EPBC Act and identified in the background searches occurring within the Project Application Area. The assessment was based on a comparison of the habitat requirements of each threatened species/population/community and the habitat types present within the Project Application Area.

The likelihood of occurrence assessment identified 40 threatened flora species/populations/ecological communities, 57 vulnerable or endangered fauna species and 35 migratory species listed under the TSC Act and/or EPBC Act with a moderate or high chance of occurring within the Project Application Area (refer to **Table 32**).

Table 32 Summary of Migratory and Threatened Species/Populations/Communities with moderate or High Potential to occur within the Project Application Area

TECs/Populations, Threatened Species and Migratory Species				
Name		**Status under TSC Act**	**Status under EPBC Act**	**Likelihood of Occurrence**
TECs/ Populations	*Eucalyptus parramattensis subsp. Parramattensis*	E	-	Moderate
	Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South-east Corner Bioregions	E	-	Moderate
	Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bio-regions	E	-	Moderate
	Hunter Lowland Redgum Forest	E	-	Moderate
	Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	-	CE	Moderate
	Littoral Rainforest in the NSW North Coast, Sydney Basin and South-east Corner Bioregions	E	-	Moderate
	Lower Hunter Spotted Gum Ironbark Forest	E	-	Moderate
	Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions	V	-	Moderate
	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregion	E	-	Moderate
	Lowland Rainforest on Floodplain in the NSW North Coast Bioregion	E	-	Moderate

TECs/Populations, Threatened Species and Migratory Species					
	River-flat Eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South-east Corner bio-regions		E	-	High
	Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South-east Corner bio-regions		E	-	High
	Swamp Sclerophyll Forest on Coastal Floodplains		E	-	High
	Sydney Freshwater Wetland		E	-	Moderate
Threatened Species					
Scientific Name		**Common Name**	**Status under TSC Act**	**Status under EPBC Act**	**Likelihood of Occurrence**
Flora	*Acacia bynoeana*	Bynoe's Watlle	E	V	High
	Angophora inopina		V	V	High
	Caladenia tessellata	Thick-lipped Spider-orchid	E	V	Moderate
	Callistemon linearifolius	Netted Bottle Brush	V	-	Moderate
	Corybas dowlingii	Red Helmet Orchid	E	-	Moderate
	Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	Moderate
	Cynanchum elegans	White-flowered Wax Plant	E	E	Moderate
	Dendrobium malaleucaphilum	Spider Orchid	E	-	Moderate
	Diuris praecox	Newcastle Doubletail	V	V	Moderate
	Epacris purpurascens var. Purpurascens		V		Moderate
	Eucalyptus camfieldii	Camfield's Stringybark	V	V	Moderate
	Eucalyptus parramattensis subsp. Decadens	Earp's Gum	V	V	Moderate
	Genoplesium bauera		V	-	Moderate
	Genoplesium insignis	Variable Midge Orchid	E	-	Moderate
	Grevillea parviflora subsp. Parviflora	Small-flower Grevillea	V	V	Moderate
	Maundia triglochinoides		V	-	Moderate
	Melaleuca biconvex	Biconvex Paperbark	V	V	Moderate
	Microtis angusii	Angus's Onion Orchid	E	E	Moderate
	Pultenaea maritime	Coast Headland Pea	V	-	Moderate
	Rutidosis heterogama	Heath Wrinklewort	V	V	Moderate
	Syzygium paniculatum	Magenta Lilly Pilly	V	V	High
	Tetratheca glandulosa	Glandular Pink-bell	V	V	Moderate
	Tetratheca juncea	Black-eyed Susan	V	V	High
	Thesium austral	Austral Toadflax	-	V	Moderate
	Zannichellia palustris		E	-	Moderate
Fauna	*Anthochaera Phrygia*	Regent Honeyeater	E	-	Moderate
	Aratmus supercilious	White-browed Woodswallow	PDV	-	High
	Botaurus poiciloptilus	Australasian Bittern	V	-	Moderate
	Burhinus grallarius	Bush Stone-curlew	E	-	Moderate
	Calidris tenuirostris	Great Knot	V	M	Moderate
	Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	Moderate
	Calyptorhynchus lathami	Glossy Black Cockatoo	V	-	High
	Cercartetus nanus	Eastern Pygmy-possum	V	-	Moderate
	Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Moderate
	Climacteris picumnus	Brown Treecreeper	V	-	Moderate
	Crinia tinnula	Wallum Froglet	V	-	High

TECs/Populations, Threatened Species and Migratory Species					
	Irediparra gallinacean	Comb-crested Jacana	V	-	Moderate
	Dasyurus maculatus maculatus (SE mainland population)	Spotted-tailed Quoll	V	E	Moderate
	Ephippiorhynchus asiaticus	Black-necked Stork	E	-	Moderate
	Epthianura albifrons	White-fronted Chat	V	-	Moderate
	Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	High
	Glossopsitta pusilla	Little Lorikeet	V	-	High
	Haematopus fuliginosus	Sooty Oystercatcher	V	-	Moderate
	Haematopus longirostris	Pied Oystercatcher	E	-	Moderate
	Hieraaetus morphnoides	Little Eagle	V	-	Moderate
	Hoplocephalus bungaroides	Broad-headed Snake	E	V	Moderate
	Hoplocephalus stephensii	Stephen's Banded Snake	V	-	Moderate
	Ixobrychus flavicollis	Black Bittern	V	-	High
	Kerivoula papuensis	Golden-tipped Bat	V	-	Moderate
	Lathamus discolour	Swift Parrot	E	E	High
	Litoria aurea	Green and Golden Bell Frog	E	V	Moderate
	Litoria brevipalmata	Green-thighed Frog	V	-	Moderate
	Lophoictinia isura	Square-tailed Kite	V	-	Moderate
	Melithreptus gularis	Black-chinned Honeyeater	V	-	Moderate
	Miniopterus australis	Little Bentwing-bat	V	-	High
	Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	High
	Mormopterus norfolkensis	Eastern Freetail-bat	V	-	Moderate
	Myotis macropus	Large-footed Myotis	V	-	Moderate
	Ninox connivens	Barking Owl	V	-	High
	Ninox strenua	Powerful Owl	V	-	High
	Oxyura australis	Blue-billed Duck	V	-	Moderate
	Pandion haliaetus	Osprey	V	-	High
	Petaurus norfolcensis	Squirrel Glider	V	-	High
	Petroica boodang	Scarlet Robin	V	-	Moderate
	Petroica pheonicea	Flame Robin	V	-	Moderate
	Phascogale tapoatafa	Brush-tailed Phascogale	V	-	Moderate
	Phascolarctos cinereus	Koala	V	-	Moderate
	Pteropus poliocephalus	Grey-headed Flying-fox	V	V	High
	Ptilinopus magnificus	Wompoo Fruit-Dove	V	-	Moderate
	Ptilinopus regina	Rose-crowned Fruit-dove	V	-	Moderate
	Ptilinopus superbus	Superb Fruit-dove	V	-	Moderate
	Pyrrholaemus saggitatus	Speckled Warbler	V	-	Moderate
	Rostratula australis	Australian Painted Snipe	E	V, M	Moderate
	Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Moderate
	Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Moderate
	Stagonopleura guttata	Diamond Firetail	V	-	Moderate
	Sterna albifrons	Little Tern	E	-	Moderate
	Stictonetta naevosa	Freckled Duck	V	-	Moderate
	Tyto novaehollandiae	Masked Owl	V	-	High
	Tyto tenebricosa	Sooty Owl	V	-	Moderate
	Vespadelus troughtoni	Eastern Cave Bat	V	-	Moderate
	Xanthomyza Phrygia	Regent Honeyeater	E	E, M	Moderate
	Xenus cinereus	Terek Sandpiper	V	M	Moderate

TECs/Populations, Threatened Species and Migratory Species					
Migratory Species					
Fauna	***Breeding Likely to Occur Within Area***				
	Myiagra cyanoleuca	Satin Flycatcher	-	M	Moderate
	Ardea alba	Great Egret	-	M	Moderate
	Ardea ibis	Cattle Egret	-	M	Moderate
	Breeding May Occur Within Area				
	Monarcha melanopsis	Black-faced Monarch	-	M	Moderate
	Rhipidura rufifrons	Rufous Fantail	-	M	Moderate
	Species of Species Habitat Known to Occur				
	Actitis hypoleucos	Common Sandpiper	-	M	Moderate
	Arenaria interpres	Ruddy Turnstone	-	M	Moderate
	Calidris acuminate	Sharp-tailed Sandpiper	-	M	Moderate
	Calidris alba	Sanderling	-	M	Moderate
	Calidris canutus	Red Knot	-	M	Moderate
	Calidris ferruginea	Curlew Sandpiper	-	M	Moderate
	Calidris ruficollis	Red-necked Stint	-	M	Moderate
	Calidris tenuirostris	Great Knot	-	M	Moderate
	Charadrius bicinctus	Double-banded Plover	-	M	Moderate
	Charadrius leschenaultii	Greater Sand Plover	-	M	Moderate
	Charadrius mongolus	Lesser Sand Plover	-	M	Moderate
	Gallinago hardwickii	Latham's Snipe	-	M	Moderate
	Heteroscelus brevipes	Grey-tailed Tattler	-	M	Moderate
	Limicola falcinellus	Broad-billed Sandpiper	-	M	Moderate
	Limosa lapponica	Bar-tailed Godwit	-	M	Moderate
	Limosa limosa	Black-tailed Godwit	-	M	Moderate
	Numenius madagascariensis	Eastern Curlew	-	M	Moderate
	Numenius phaeopus	Whimbrel	-	M	Moderate
	Pluvialis fulva	Pacific Golden Plover	-	M	Moderate
	Pluvialis squatarola	Grey Plover	-	M	Moderate
	Tringa stagnatilis	Marsh Sandpiper	-	M	Moderate
	Xenus cinereus	Terek Sandpiper	-	M	Moderate
	Species or Species Habitat Likely to Occur				
	Anthochaera phrygia	Regent Honeyeater	-	M	Moderate
	Haliaeetus leucogaster	White-bellied Sea-eagle	-	M	Moderate
	Numenius minutes	Little Curlew	-	M	Moderate
	Species or Species Habitat May Occur				
	Apus pacificus	Fork-tailed Swift	-	M	Moderate
	Hirundapus caudacutus	White-throated Needletail	-	M	Moderate
	Merops ornatus	Rainbow Bee-eater	-	M	Moderate
	Rostratula benghalensis s. lat	Painted Snipe	-	M	Moderate
	Sterna albifrons	Little Tern	-	M	Moderate

Notes:

CE Critically Endangered
E Endangered Species
V Vulnerable Species
M Migratory Species
PD Preliminary Determination

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THREATENED FLORA RECORDED WITHIN THE PROJECT APPLICATION AREA

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Figure 10.7.1

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THREATENED FAUNA RECORDED WITHIN THE PROJECT APPLICATION AREA

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Figure 10.7.2

10.7.3.2 Vegetation Communities

Eleven identified vegetation communities occupy a total of 702 hectares within the Project Application Area. As outlined in **Section 10.7.1**, these 11 vegetation communities represent only eight communities, due to the separate mapping undertaken by the LHCCREMS and Bell mapping projects, namely Narrabeen Foreshore Redgum - Ironbark Forest is equivalent to Coastal Foothills Spotted Gum – Ironbark Forest (LHCCREMS); Narrabeen Coastal Sheltered Peppermint – Apple Forest is equivalent to Coastal Sheltered Apple – Peppermint Forest (LHCCREMS); and Narrabeen Wallarah Sheltered Grassy Forest is equivalent to Coastal Plains Smooth-barked Apple Woodland (LHCCREMS). The 8 vegetation communities mapped within the Project Application Area by LHCCREMS are shown on **Figure 10.7.3**, while the 3 vegetation communities mapped by Bell are shown on **10.7.4**.

Four of the LHCCREMS vegetation communities mapped within the Project Application Area correspond to three Endangered Ecological Communities (EECs) under the TSC Act (refer to **Table 33**).

Table 33 Vegetation Communities Mapped as EECs within the Project Application Area

LHCCREMS Map Unit	Vegetation Community Name	Listed EEC under TSC Act
37	Swamp Mahogany – Paperbark Forest	Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner Bioregions
38	Redgum Rough Barked Apple Forest	River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions
40	Swamp Oak Rushland Forest	Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South-east Corner Bioregions
42	Riparian Melaleuca Swamp Woodland	Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner Bioregions

None of the mapped vegetation communities within the Project Application Area correspond to any communities listed under the EPBC Act.

The proposed minor surface water diversion works occur in a highly disturbed area of grassland with scattered trees associated with the existing Mine Water Settling Ponds at the Surface Facilities Area. The proposed drainage works occur adjacent to Coastal Plains Scribbly Gum Woodland (LHCCREMS map unit 31) and a small area of Coastal Plains Smooth-barked Apple Woodland (LHCCREMS map unit 30).

Several SEPP 14 coastal wetlands occur within the study area but none within the Project Application Area. No wetlands protected by international treaty (the RAMSAR convention) were identified within the study area during the EPBC Act Protected Matters Database Search.

There is no current GDE mapping that covers the study area or surrounding lands, although four vegetation units mapped within the Project Application Area (Riparian Melaleuca Swamp Woodland; Swamp Oak Rushland Forest; Redgum Rough Barked Apple Forest; Swamp Mahogany – Paperbark Forest) are likely to be influenced by groundwater or be partially groundwater dependent.

10.7.3.3 Wildlife Corridors

The Lake Macquarie Native Vegetation and Corridor Map (LMCC, 2009) identifies the remnant vegetation of the Morisset Peninsula as a corridor of remnant native vegetation.

Regional and sub-regional corridors within the study area have been mapped for DECCW by Scotts (2003). A single regional corridor is mapped within the study area extending from Buttaba, along the Wangi Peninsula and across Lake Macquarie to the Swansea area. The mapped regional corridor is likely to have limited function within the landscape for all species other then highly mobile bird and bat species, as it includes 1.5 kilometres of open water and 2.7 kilometres of urban areas containing scattered tree cover. No sub-regional corridors have been mapped within the study area.

Although not mapped, the remnant native vegetation of Point Wolstoncroft is connected to large remnant native vegetation areas to the south by a corridor of native vegetation approximately 600 metres in width.

AECOM

LHCCREMS VEGETATION WITHIN THE PROJECT APPLICATION AREA

Centennial Myuna Pty Ltd

Environmental Assessment

Figure 10.7.3

AECOM

WYONG REGION VEGETATION WITHIN THE PROJECT APPLICATION AREA

Centennial Myuna Pty Ltd

Environmental Assessment

Figure 10.7.4

10.7.3.4 Potential Impacts

The proposed Project is expected to give rise to negligible surface impacts. Surface subsidence will be limited to a maximum of 20 millimetres in Zone A and no surface cracking or water inflows into the workings are expected to occur (Seedsman Geotechnics, 2010).

The proposed Project will necessitate minimal clearing for the surface water management works. As such, impacts on State or Nationally listed threatened species, populations, communities or migratory species within or adjacent to the Project Application Area are not expected.

Similarly, RPS found that as negligible surface impacts are expected, the proposed Project is unlikely to impact on any 'potential' or 'core' koala habitat areas that may occur within the Project Application Area and is unlikely to affect or fragment any existing native vegetation corridors (**Appendix L)**

The Project proposes less than 20 millimetres of surface subsidence under terrestrial habitat areas, which includes all land-based riparian areas and watercourses.

With respect to the Wangi Creek riparian corridor, part of the lower reaches of this watercourse contains some Riparian Melaleuca Swamp Woodland which corresponds to the Endangered Ecological Community known as Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (SSFCF). Upper reaches are mapped by House (2003) as primarily consisting of Coastal Plains Scribbly Gum Woodland. This vegetation currently experiences average daily discharges from Myuna Colliery of 5.3 ML/Day with a maximum of 13 ML/Day (as a combination of the maximum discharges through both LDP001 and LDP002). As a result of the Project, there is a potential for an increase in the average daily discharges (to a predicted rate of 8.5 ML/Day after 21 years) however the maximum discharge will remain constant in accordance with the limits nominated in EPL 366 (GHD 2010).

As the predicted increase in discharges will occur over time it is anticipated that the geomorphology of Wangi Creek will not be adversely affected. Monitoring will be required to determine if any geomorphological impacts are occurring and to allow remedial action if required.

The main effect on the Wangi Creek waterway of the existing mine is the discharge of mine water make into this watercourse. These discharges are in excess of the flows that would occur as a result of runoff generated by the catchment, These flows have been occurring for the past 29 years and as such, the existing environment within Wangi Creek has adapted to these flows (GHD 2010).

The existing water management program at Myuna Colliery will not undergo any significant change other than the increase in discharge which will occur over time. This discharge is expected to meet current volumetric limits for discharge (GDH 2010). As with the potential geomorphic impacts, monitoring will be required to determine if any hydrological impacts are occurring and to allow remedial action if required.

There is a potential for an increase in the average daily discharges (to a predicted rate of 8.5 ML/Day after 21 years) however the maximum discharge will remain constant in accordance with the limits nominated in EPL 366 (GHD 2010). The increase in discharge is not expected to result in any adverse impacts upon the EEC known as *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions* (SSFCF).

Monitoring of the hydrological and geomorphic status of Wangi Creek will be undertaken, to identify potential impacts to this watercourse. Should hydrological and geomorphic impacts be identified during the course of monitoring, an assessment of riparian vegetation condition and potential impacts associated with changes to hydrology and geomorphology would be undertaken. This approach will ensure that riparian corridors, lacustrine habitats, coastal floodplains and estuarine environments are not adversely impacted by the proposal and any associated increase in mine water discharge.

It should also be noted that the lowest reaches of Wangi Creek are actually not in a natural state, having previously been substantially modified for the now-decommissioned Wangi Power Station. These previous modifications have included channelling and concreting for a distance of approximately 1km inland from the lake (including to Wangi Power Station), above which the creek is affected by numerous tracks, electrical easements and other cleared areas. The lower channel also receives runoff from the Eraring Power Station ash tailings pond. Nevertheless, the remaining creekline still has ecological value and performs an important ecological function, particularly in protecting the water of Lake Macquarie. As stated above no significant impacts are expected to occur upon this ecosystem as a result of the proposal.

Riparian ecology within terrestrial watercourses is therefore unlikely to be significantly impacted by the Project due to the negligible surface subsidence proposed.

The groundwater assessment undertaken for the Project (GHD, 2010) predicted that significant changes in groundwater levels in the shallower alluvial aquifers will not occur as a result of the proposed Project. Therefore, it is considered that any potential impacts on alluvial aquifers and any GDEs that may depend on them will be negligible (GHD, 2010). The proposed Project is also unlikely to impact upon SEPP 14 coastal wetlands.

Given these negligible surface impacts, the proposed Project is not expected to significantly impact on terrestrial ecology.

Key Threatening Processes

An assessment of the Key Threatening Processes (KTPs) listed under Schedule 3 of the *TSC Act* relevant to the proposed Project was undertaken (refer to **Appendix L**)**.** A very minor level of vegetation clearing will be required for the proposed minor drainage works at the Surface Facilities Area, however this level of native vegetation clearing is unlikely to significantly contribute to the operation of the KTP – clearing of native vegetation.

Assessment of Key Thresholds

As required by the *Draft Guidelines for Threatened Species Assessment for Part 3A Applications* (Department of Environment and Conservation / DPI 2005), an assessment of Key Thresholds was undertaken for the EA (refer to **Appendix L).** The four Key Thresholds relate to the maintenance of biodiversity values; the long-term viability of a local population of any species, population or ecological community; the extinction of any species, population or ecological community or place them at risk of extinction; and critical habitat within the Project Application Area. This assessment concluded that the proposed Project is unlikely to significantly affect any of the four Key Thresholds.

10.7.4 Management and Mitigation Measures

As impacts to terrestrial ecology are not expected, mitigation measures will be limited to those prescribed for management of surface water at the Surface Facilities Area, which include construction of clean water diversions at the Surface Facilities Area, modification of the LDPs, monitoring of Wangi Creek and preparation of an Extraction Plan (refer to **Sections 9.0** and **10.2**). In the event that monitoring at existing subsidence monitoring points indicates that subsidence levels are greater than 20 millimetres on terrestrial areas as a result of the proposed Project, a review will be undertaken to identify potential ecological impacts.

Monitoring of geomorphological and hydrological impacts is also proposed (refer **Section 10.2.1**). If adverse impacts are identified, an assessment of riparian vegetation condition and potential impacts associated with changes to hydrology and geomorphology would be undertaken, and appropriate mitigation measures identified to avoid impacts to riparian vegetation.

10.7.5 Conclusion

As surface subsidence will be limited to a maximum of 20 millimetres and no surface cracking is expected to occur (Seedsman Geotechnics, 2010), minimal changes to sub-surface hydrology are expected (GHD, 2010) and existing infrastructure at the Surface Facilities Area will be utilised to service the proposed Project. The proposed Project is predicted to have negligible surface impacts and is unlikely to impact on any threatened species, endangered population or TECs.

As the Project proposes less than 20 millimetres of surfaces subsidence of land areas through the implementation of the mine design criteria, and based on the surface water and subsidence management measures outlined previously, negligible terrestrial impacts are likely and no residual consequences are expected.

10.8 Aboriginal Heritage

10.8.1 Background

A Cultural Heritage Assessment which incorporated an assessment of Aboriginal Heritage was prepared by RPS for the proposed Project and is provided in **Appendix M**.

The Project Application Area is located within the traditional area of the Awabakal people. The topography and hydrology of the Project Application Area indicate a favourable environment to past Aboriginal occupation, with freshwater available from creeks and a diverse local habitat providing a variety of food and other exploitable resources (RPS, 2010a). The Awabakal people of Lake Macquarie were considered to have led a nomadic existence moving between different resource zones in different seasons (RPS, 2010a).

The majority of the Project Application Area according to soil landscape data comprises flat areas and low slopes. These land surfaces have greater potential for sites to occur while steep slopes are considered to have low to nil potential.

The Cultural Heritage Assessment identifies Aboriginal heritage sites in the area, the potential impacts of the proposed Project on these sites and recommends mitigation measures for their management.

10.8.2 Methodology

In order to determine the potential impacts of the proposed Project on Aboriginal heritage, the Cultural Heritage Assessment incorporated a review of existing research, databases and survey results, along with Project-specific field surveys and consultation with local Aboriginal groups. The consultation process, field survey and preparation of the Cultural Heritage Assessment Report were undertaken in accordance with the DECCW *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*. The consultation log with registered stakeholders is provided in Appendix 2 to **Appendix M**.

Specifically, the assessment included:

- A desktop review of background research, including:
  - Review and compilation of existing literature, previous reports and historical records; and
  - A search of the DECCW Aboriginal Heritage Information Management System (AHIMS) database.
- Consultation with the local Aboriginal community, including:
  - Notifying the Aboriginal community of the proposed Project (through advertisement and letters) and inviting local Aboriginal parties to register their interest for further consultation;
  - Presenting the proposed Project to those Aboriginal parties who registered an interest;
  - Gathering information regarding cultural significance from the registered Aboriginal parties (at the presentation, through phone calls and at the field survey), regarding the protocol for sourcing and holding cultural information, and their views on potential management options); and
  - Enabling the registered Aboriginal parties to review and provide comments on the draft Cultural Heritage Assessment Report.
- Field surveys of accessible landform types within the proposed Project Application Area, including survey of the following areas (refer to **Figure 10.8.1**):
  - Myuna Bay and Buttaba Bay;
  - Buttaba Hills;
  - Point Wolstoncroft; and
  - Morisset Peninsula.

Field surveys were undertaken by RPS on 22, 24 and 28 June 2010, and 11 February 2011. The June survey was attended by two Aboriginal community members, Shane Frost of Awabakal Descendants Traditional Owners Aboriginal Corporation (ADTOAC) and Kerrie Brauer of Awabakal Traditional Owners Aboriginal Corporation (ATOAC). The February field survey was attended by Shane Frost (ADTOAC) as Kerrie Brauer was unable to attend on that day.

AECOM

ABORIGINAL HERITAGE SURVEY UNITS

Centennial Myuna Pty Ltd

Environmental Assessment

Figure 10.8.1

10.8.3 Results

Desktop Review

The *Lake Macquarie Aboriginal Heritage Management Strategy* (2009) maps culturally sensitive landscapes by identifying terrain and associated Aboriginal heritage site types. This Strategy identified Sensitive Aboriginal Cultural landscapes relevant to the Project Application Area as: *Estuarine Landscapes* described as being the Lake Macquarie foreshore extending up to 100 metres landward of the High Water Mark (HWM) and twenty metres into the lake; and *Freshwater (Creek Corridor) Landscapes* comprising creek corridors with reliable fresh water and abundant resources.

Excavations previously carried out in the local area (Besant, 2001), Officer, Navin & Saunders (1996) and Dallas, Navin & McConchie (1993) found that artefact deposits, including midden shell are often found on elevated terraces adjacent to the Lake shoreline and freshwater creeks. It is the presence of numerous middens on the lake foreshore that has resulted in *Lake Macquarie Aboriginal Heritage Management Strategy* (2009) regarding most of the Lake foreshore area as sensitive (RPS, 2010b).

A review of this Strategy indicated that the most common sites within the Project Application Area are likely to be middens (and to a lesser extent stone artefact/s and scarred trees) on the Lake foreshore. There is also potential for ceremonial sites, scared trees and artefact scatters on the mid slopes and upper slopes of the Project Application Area, and potential for artefact scatters, scarred trees and rock shelters with deposit along its ridgelines and crests. Based on this review, it was considered that scarred trees; rock shelters with deposit; and ceremonial sites were unlikely to occur within the Project Application Area.

Results of the AHIMS database search confirmed the Strategy's prediction that the most commonly occurring heritage site type associated with Lake Macquarie are middens. The AHIMS database search identified 11 middens, two isolated finds and one Potential Archaeological Deposit previously recorded across the Project Application Area, and a number of artefact scatters, open camp sites and scarred trees within the surrounding area (refer to Figure 5-1 of **Appendix M** for their location). Ethnographic evidence reviewed for the Aboriginal heritage assessment supports an archaeological record characterised by midden site types, and provides documentary evidence of the Aboriginal peoples' reliance on shellfish as a consistent and plentiful resource (RPS, 2010b).

Consultation

There were three registrations of interest from within the Aboriginal community arising from the consultation process: ADTOAC, ATOAC and Bahtabah Local Aboriginal Land Council.

Consultation with these three parties included a presentation of the proposed Project and ongoing discussions regarding the cultural significance of the Project Application Area, while representatives from ADTOAC and ATOAC attended the field survey undertaken for the Aboriginal heritage assessment.

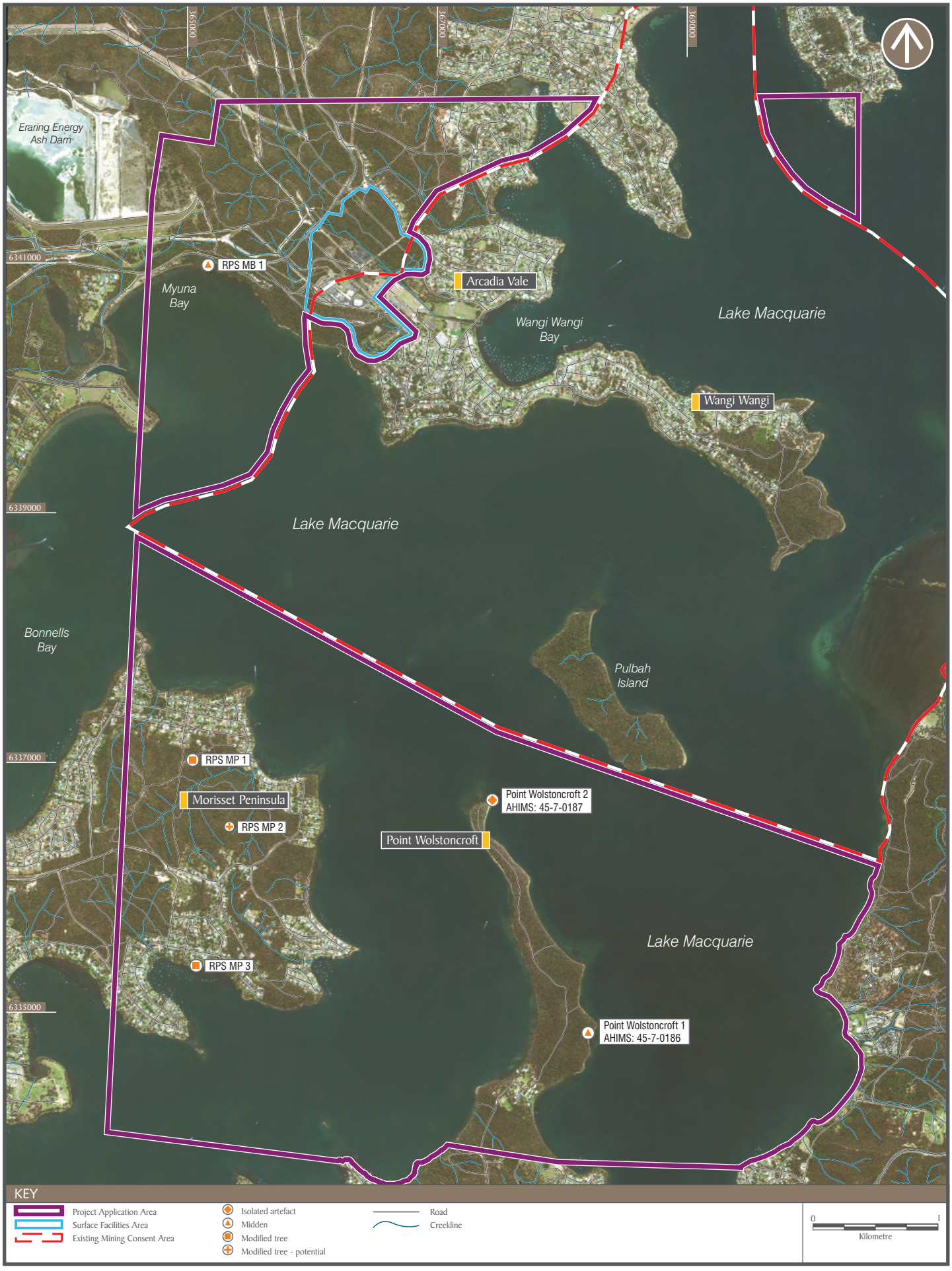
The three registered parties were given the opportunity to review and provide comments on the draft Cultural Heritage Assessment Report and the proposed management of impacts as a result of the proposed Project on Aboriginal cultural heritage recorded within the Project Application Area.

Further details regarding the specific dates and avenues of consultation undertaken for the Aboriginal heritage assessment are provided in Table 1-1 of **Appendix M.**

Field Survey

A field survey of the Myuna Bay, Buttaba Hills and Myuna Bay survey areas was undertaken on 22 June 2010, and the Point Wolstoncroft and Morisset Peninsula areas were surveyed on 24 June 2010 with an additional survey conducted on 11 February 2011. A survey of the area proposed for the clean water diversion works at Myuna Colliery's Surface Facilities Area was undertaken on 28 June 2010.

The field survey recorded six new sites (RPS MB 1; EPS BH 1; RPS PW 2; RPS MP 1; RPS MP 2; and RPS MP 3) and two previously recorded sites (AHIMS #45-7-0186 and AHIMS # 45-7-0187) which were noted as having additional material required to be included on the Point Wolstoncroft 2 AHIMS record (refer to **Figure 10.8.2**). Details on the recorded sites are provided in **Table 34**.



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ABORIGINAL HERITAGE SITES RECORDED DURING SURVEY

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Environmental Assessment

Figure 10.8.2

Table 34 Aboriginal cultural heritage sites noted and recorded during the field survey

Survey Unit	Site Name	Eastings	Northings	Site type	Description
1	Myuna Bay (RPS MB 1)	365025	6341071	Midden	*Anadara trapezia* on access track
2	Buttaba Hills (RPS BH 1)	*	*	Cultural site	Landform features
3	Point Wolstoncroft 1 AHIMS # 45-7-0186	368402	6334343	Midden	Previously recorded site. *Anadara trapezia* adjacent waterhole
3	RPS PW 1	*	*	Midden; artefacts; cultural site	Extensive *Anadara trapezi*a, few *Ostrea angasi*; stone artefacts; other items and landform features
3	Point Wolstoncroft 2 AHIMS # 45-7-0187	3647475	6336289	Artefact	Previously recorded site - to be amended to include 2 artefacts and revise midden extent
		367565	6336414	Artefact	
4	Morisset Peninsula (RPS MP 1)	364930	6336689	Modified tree	Modified tree
5	Morisset Peninsula (RPS MP 2)	365342	6336208	Modified tree – potential	Series of notches of potential Aboriginal origin
6	Morisset Peninsula (RPS MP 3)	365058	6335017	Modified tree	Modified tree

***** Indicates Addendum A & B – locations not available to any other party without prior permission of the principals ADTOAC and ATOAC

Two areas, RPS BH 1 and RPS PW 1, which were considered to be culturally sensitive to the Aboriginal community representatives who attended the survey, were identified within the Project Application Area. Due to this sensitivity, the representatives from ADTOAC and ATOAC requested that information regarding these sites (included in Addendum A and B of **Appendix M**) be restricted. CMPL respects the rights of the Aboriginal community to ensure that aspects of cultural significance are retained only by the Aboriginal community. As such, at the request of the registered stakeholders (documented through the consultation process (refer Appendix 6 of **Appendix M**), information on these sites (refer Addendum A and B) has been restricted to the authors, CMPL and relevant regulatory authorities including DECCW and DoP.

No sites of Aboriginal heritage significance in the area proposed for the clean water diversion works at the Colliery's Surface Facilities Area were recorded during the field survey, nor have sites previously been recorded.

10.8.4 Impact Assessment

Assessment of Archaeological Significance

An assessment of archaeological significance of the six recorded heritage sites was undertaken using criteria developed in accordance with the principals of the *Burra Charter* (ICOMOS 1999) and the DECCW *Aboriginal Cultural Heritage Standards and Guidelines Kit* (1997) and is detailed in **Appendix M.** The findings of the assessment undertaken for the recorded items within the relevant survey units are shown in **Table 35.**

Table 35 Assessed Levels of Significance for Aboriginal Sites

Site	Type	Significance scale	Overall Significance at this Scale
RPS MB 1	Midden	Local	**Low**
		Regional	**Low**
RPS BH 1	Cultural site	Significance statement provided in Addendum A*	
Point Wolstoncroft 1 (AHIMS 45-7-0186)	Midden and artefacts	Local	**High**
		Regional	**High**
RPS PW 1	Cultural Site	Significance statement provided in Addendum B*	
Point Wolstoncroft 2 (AHIMS 45-7- 0187)	Artefact	As per site card (refer Appendix M)	
RPS MP 1	Modified tree	Local	**Low**
		Regional	**Low**
RPS MP 2	Modified tree - potential	Local	**Low**
		Regional	**Low**
RPS MP 3	Modified tree	Local	**Low**
		Regional	**Low**

* Due to cultural sensitivity, and as requested by the registered stakeholders, information regarding these sites (included in Addendum A and B of **Appendix M**) has been restricted to relevant regulatory authorities.

Table 35 shows shows that the majority of sites have been assessed to have low to moderate significance at the Local and Regional level. RPS MP 2 at this stage is assessed as low pending further verification and assessment. The exception is RPS Pt Wolstoncroft 1 which is assessed as being of High Significance at both the Local and Regional level.

Impacts on Heritage Items

The Project proposes to restrict surface subsidence to less than 20 millimetres on land and foreshore areas within the Project Application Area. RPS concluded that this level of surface subsidence will have a negligible impact on the Aboriginal heritage sites recorded within the Project Application Area.

Similarly, as no sites of Aboriginal heritage significance have been recorded in the area proposed for the clean water diversion works at the Colliery's Surface Facilities Area, the proposed Project is unlikely to impact on Aboriginal heritage due to these works.

10.8.5 Management and Mitigation Measures

Due to the negligible level of land subsidence likely as a result of the Project, there will be minimal potential impact on heritage items within the Project Application Area. However, the following mitigation measures will be implemented to manage potential impacts on identified items of heritage significance:

- If first workings and/or secondary extraction is to occur under the culturally sensitive sites recorded in Addendum A and Addendum B of Myuna Colliery Extension of Mining Cultural Heritage Assessment (RPS, 2010b), an archaeological monitoring programme should be considered for the potentially impacted sites.
- If there is evidence of mine-induced damage to sandstone outcrops and rock overhangs as described in Addendum A and Addendum B of *Myuna Colliery Extension of Mining Cultural Heritage Assessment* (RPS,

2010b), then all mining works affecting the area should cease and notification be given to DECCW. Engagement of a suitably qualified archaeologist and the relevant Aboriginal stakeholders may be required so that the site can be adequately assessed and managed.

- Myuna Colliery will develop an Aboriginal Cultural Heritage Management Plan (ACHMP) for the for the identified Aboriginal heritage items within the Project Application Area, as well as, contingency strategies for any additional heritage issues which may arise. The ACHMP will comprise:
    - An assessment of the cultural significance of the Aboriginal heritage sites within the Project Application Area;
    - Identification of roles and responsibilities (Centennial, Aboriginal stakeholders, heritage consultant); and
    - Strategies for:
        - Management of identified Aboriginal heritage sites;
        - Review the management of Aboriginal heritage sites, should subsidence levels at existing monitoring points exceed 20 mm on land areas; and
        - Management of additional sites, if identified.

The Myuna Colliery ACHMP will be developed in consultation with the relevant Aboriginal stakeholders to ensure that Aboriginal cultural values are adequately addressed.

10.8.6 Conclusion

Potential impacts to heritage items within the Project Application Area are considered to be unlikely given the negligible land subsidence proposed and surface works are unlikely to disturb any heritage sites. There is considered to be no residual consequence to heritage items after the implementation of the above mitigation measures.

10.9 European Heritage

10.9.1 Background

The Cultural Heritage Assessment prepared by RPS incorporated an assessment of European Heritage for the proposed Project and is provided in **Appendix M**.

The first recorded evidence of Europeans visiting Lake Macquarie was in 1800. It is considered the area provided a favoured environment for European occupation due to the wide variety of resources and availability of fresh water. Logging of cedar and other valuable timbers occurred before settlers introduced cattle and cropping. Construction and expansion of the rail network led to expansion of the market for resources and product and villages were later established near logging areas (RPS, 2010b). However, when the rail network was completed the demand for timber collapsed. The following centuries saw the building of power stations and coal mines in the area, paralleled by growth in residential suburbs (Lake Macquarie City Council 1993:33).

Due to previous land use in the area, European heritage items most likely to occur within the Project Application Area are likely to be associated with historical farming, timber extraction, coal mining, habitation and power generation (RPS, 2010b).

10.9.2 Methodology

The European heritage assessment involved a review of existing research, databases and survey results along with Project-specific field surveys and consultation with local heritage groups. Specifically, the assessment included:

- Desktop review of literature and historical records (including the *City of Lake Macquarie Heritage Study,* 1993);
- Search of relevant databases including:
    - NSW Heritage Office;
    - Lake Macquarie City Council LEP 2004 and Draft LEP 2011; and
    - Wyong Shire LEP 1991.
- Consultation with local heritage groups and local Councils; and
- A field survey of the accessible landform types across the two separate and distinct sections of the Project Application Area: those bounded by Lake Macquarie (Myuna Bay, Buttaba Bay, Point Wolstoncroft) and those areas not immediately bounded by the Lake (Buttaba Hills, Morisset Peninsula). The survey was undertaken on the 22nd, 24th and 28th of June 2010.

The field survey was undertaken concurrently with the Aboriginal heritage survey as described in **Section 10.8.3** and **Appendix M**.

10.9.3 Results

Desktop Review

Searches of the Lake Macquarie LEPs, Wyong LEP and the *City of Lake Macquarie Heritage Study* (1993) returned no listed European heritage items within the Project Application Area, however, two items were recorded within close proximity:

- The decommissioned Wangi Power Station, which borders Myuna Colliery's Surface Facilities Area, listed on the NSW State Heritage Register (refer to **Figure 10.8.2**); and
- Threlkeld's original coal mine, established in 1843 at Coal Point is near the northern extent of the Project Application Area, listed on the NSW State Heritage Register.

Field Survey Results

The majority of the surveyed areas of the Project Application Area are obscured by dense vegetation and groundcover, therefore there is potential for undetected heritage items to be present. The field survey did however identify remnants of the now decommissioned Wangi Power Station railway line in the Buttaba Hills survey area. The majority of the railway line has been removed with only remnants of its moveable structure

remaining. These remnants, which were located during the field survey, include items associated with the railway such as portions of a rail bed, cuttings, culverts, rail lines, bolts and timber sleepers.

Assessment of European Significance

As the decommissioned rail line is not listed as being part of the Wangi Power Station item on the NSW State Heritage Register, clarification was sought from the NSW Heritage Office with regards to the significance of the rail line remnants. The NSW Heritage Office advised that, under the terms of the *Heritage Act 1977*, the rail lines will be defined as a 'work' (i.e. non-building structure) and will not be considered a European heritage 'relic' (Karen Stankwoski, Heritage Officer, 20 January 2010).

Under the *Heritage Act 1977* a 'relic' is defined as

"*any deposit, artefact, object or material evidence that*:

(a) relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and

(b) is of State or local heritage significance."

Based on this advice, the remnants of the rail line are not considered to be of State or local heritage significance.

As there are no listed items of European heritage recorded within the Project Application Area, no further assessment of European heritage significance was required to be undertaken for the Project.

10.9.4 Impact Assessment

Due to the negligible level of land subsidence proposed for the Project (less than 20 millimetres under all land areas and foreshores), and as there are no listed items of European heritage recorded within the Project Application Area, it is unlikely that there will be an impact on the remnants of the Wangi Power Station rail line or any unidentified European heritage items within the Project Application Area.

Threlkeld's original coal mine is located outside the Project Application Area and will not be impacted by the proposed Project. The listed former Wangi Power Station is located adjacent to the Surface Facilities Area (but outside the Project Application Area) and has been rezoned to permit a range of development including residential and mixed use development. The rezoning requires any future development to consider and mitigate against any potential impacts associated with the operation of Myuna Colliery.

For these reasons and due to the negligible level of land subsidence proposed for the Project, the proposed Project is unlikely to impact on these items of European heritage significance.

10.9.5 Management and Mitigation Measures

As no items of European heritage significance are likely to be impacted by the proposed Project, measures to mitigate any impacts are not considered necessary.

Should significant European cultural heritage items be identified within the Project Application Area during the course of mining and have the potential to be impacted by the Project, further investigations and mitigation measures will be developed and the NSW Heritage Branch will be notified.

10.9.6 Conclusion

The Cultural Heritage Assessment identified that the former Wangi Power Station, which is listed on the NSW State Heritage Register and is located adjacent to the Surface Facilities Area will not be impacted by the proposed Project.

As no European heritage items are likely to be impacted by the proposed Project, it is considered that there will be no residual consequence to European heritage.

10.10 Greenhouse Gas

10.10.1 Background

Human activities, such as the combustion of carbon-based fuels, increase the amount of GHGs in the atmosphere. This leads to greater absorption of heat and increases in atmospheric temperature, known as the Enhanced Greenhouse Effect.

The NSW Government has committed to a long term GHG reduction target of 60% reduction in GHG emissions by 2050 and a return to year 2000 GHG emission levels in NSW by 2025. There are, however, no legislative limits for emissions of CO_2, methane (CH_4) or nitrous oxide (N_2O).

The Kyoto Protocol is an international agreement created under the United Nations Framework Convention on Climate Change in Kyoto, Japan in 1997. The Kyoto Protocol aims to reduce the collective GHG emissions of developed countries by at least 5 % below 1990 levels during the period 2008 to 2012, which is known as the first commitment period. Australia ratified the Kyoto Protocol in December, 2007, with the action taking effect in March 2008. Australia has committed to ensuring its GHG emissions over 2008 to 2012 are no more than 8 per cent above 1990 levels.

An assessment of GHG emissions associated with the proposed Project was undertaken by AECOM. The assessment included a quantitative assessment of the potential scope 1, 2 and 3 GHG emissions from the proposed Project in relation to the following sources:

- Emissions from combustion of fuel by on-site vehicles used to transport personnel and materials associated with operations and to handle and manage the mine's small ROM coal stockpile (Scope 1);
- Emissions from the use of Liquefied Petroleum Gas (LPG), sulphur hexafluoride (SF_6), and oils and greases (Scope 1);
- Fugitive emissions from the extraction of coal (Scope 1);
- Fugitive emissions from post mining activities (stockpiled coal) (Scope 1);
- Electricity use (Scope 2 and 3); and
- Indirect emissions from the combustion of the coal produced at Myuna Colliery by Eraring Power Station (Scope 3).

The complete GHG assessment report prepared by AECOM is included in **Appendix O**.

10.10.2 Methodology

Three types of emissions were considered as part of the GHG assessment and are diagrammatically shown on **Figure 10.11.1**:

- **Scope 1**, which covers direct emissions from sources within the boundary of an organisation, such as fuel combustion and manufacturing processes;
- **Scope 2**, which covers indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation; and
- **Scope 3**, which includes all other indirect emissions that are a consequence of an organisation's activities but are not from sources owned or controlled by the organisation; that is, emissions associated with the production of fuels and emissions from the generation of purchased electricity (external emissions).

Scope 1 and Scope 2 emissions were estimated using:

- Data provided by CMPL, including:
  - historical electricity and diesel use for the period 2006/07 – 2008/09;
  - expected electricity and diesel use for the Colliery operating at 2 Mtpa;
  - coal seam gas emissions and balance as at August 2010; and
- Methods and emission factors specified in the National Greenhouse and Energy Reporting System (NGERS).

Indirect emissions (Scope 3) associated with the operation of the facility, namely those associated with use of the product coal, were estimated using National Greenhouse Account (NGA) Factors (Department of Climate Change; June, 2009).

Emissions were assessed for two scenarios:

- Existing production (2008/09 data); and
- Proposed maximum production (2 Mtpa).

10.10.3 Impact Assessment

Emissions estimates for the proposed Project from all sources described in **Section 10.11.1** are summarised in **Table 36**.

Table 36 Annual Greenhouse Gas Emissions Summary

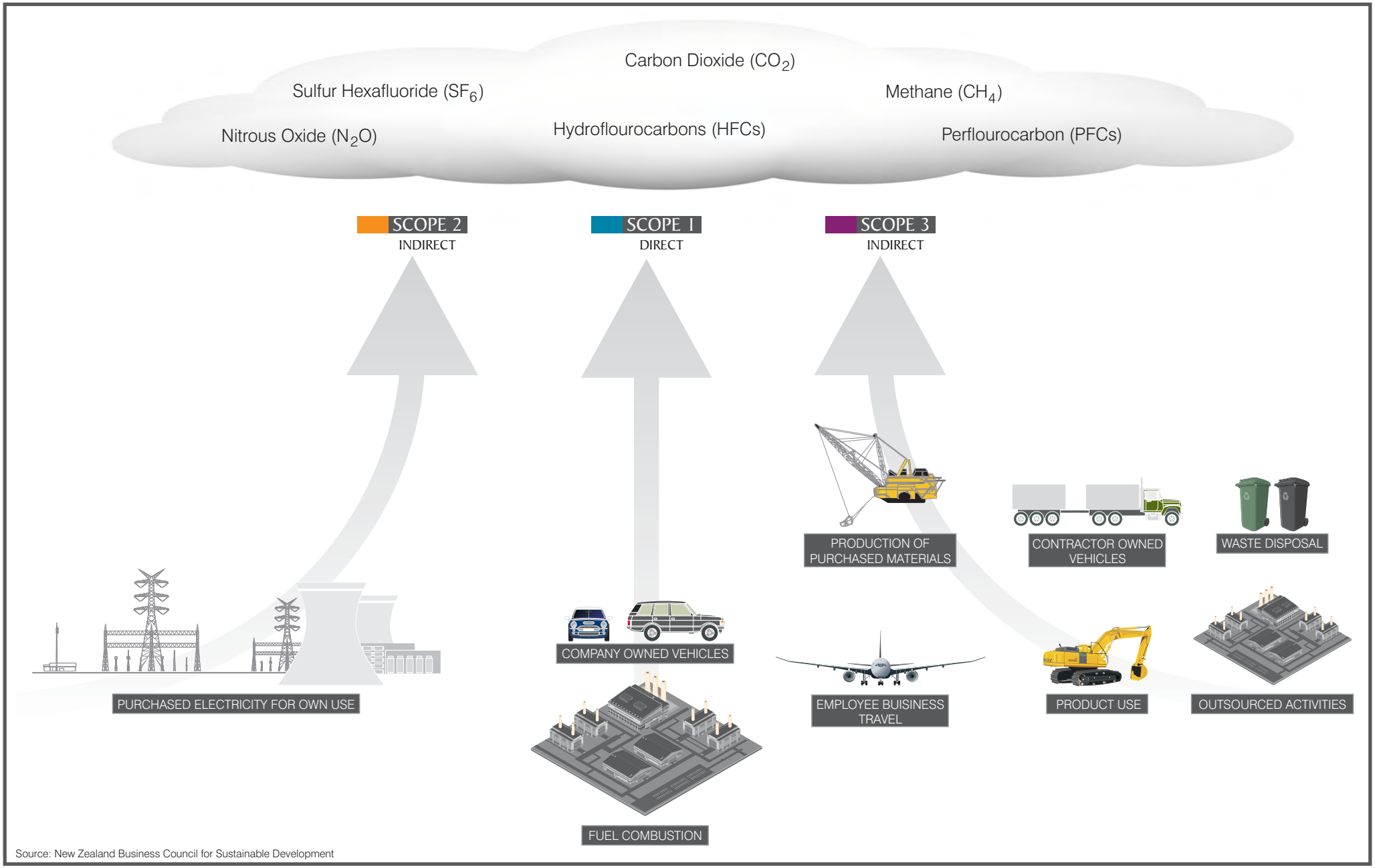
		Estimated Emissions (t CO_2-e)		
Scope	**Activity**	**Existing**	**Proposed**	**Difference**
1	On-site transport (diesel oil)	733	1,333	600
	LPG	1	1	0
	SF_6	0	0	0
	Oil and grease	391	689	298
	Extraction of coal	423,778	576,593	152,815
	Stockpiled coal	15,862	28,000	12,138
2	Electricity use	23,433	32,955	9,521
	Total (mine operations only)	**464,198**	**639,571**	**175,373**
3	*Electricity*	*4,739*	*5,282*	*542*
	Combustion of mined coal (by Eraring Power Station)	*2,705,100*	*4,775,220*	*2,070,120*
	Total	***3,174,037***	***5,420,073***	***2,246,035***

The existing mine operations generated an estimated 0.46Mt carbon dioxide equivalent (CO_2-e) for 2008/09. These emissions have been predicted to increase to approximately 0.64 Mt CO_2-e at the proposed maximum production rate of 2 Mtpa. This calculation has used a worst case scenario of future mining only occurring in the most gaseous seam, the Fassifern seam, however in actuality, future mining will occur across the three seams.

The greatest emission sources associated with the Project are those associated with the downstream combustion of the coal (Scope 3), the management of which is not in CMPL's control, followed by fugitive emissions from the mine (Scope 1), which are primarily associated with emissions from ventilation of the underground workings.

Fugitive emissions associated with the extraction of coal are the greatest source of Scope 1 emissions associated with on-site activities. The inclusion of indirect emissions, including Scope 3 emissions, increases total emissions for existing and future scenarios to 3.2 Mtpa and 5.4 Mtpa respectively.

Excluding Scope 3 emissions, the total additional emissions associated with the Project represent an approximate increase of 38% over existing site emissions, due to the gaseous nature and scenario of all future mining occurring within the Fassifern seam. These on-site emissions represent approximately 2 % of mining emissions in Australia and 0.1 % of total Australian emissions (based on 2008 data from Australian Greenhouse Emissions Information System, Department of Climate Change and Energy Efficiency).



Source: New Zealand Business Council for Sustainable Development

AECOM

TYPICAL GREENHOUSE GAS EMISSIONS SCOPES

Centennial Myuna Pty Ltd

Environmental Assessment

Figure 10.11.1

Global Warming Potential

Due to the complex interdependencies of environmental and atmospheric systems, quantification of the likely environmental effects associated with the GHG emissions released into the atmosphere as a result of the proposed Project cannot be made. In general terms, increasing GHG levels in the atmosphere results in increased average global temperatures. These temperature increases can result in changes in ocean levels (due to melting of glaciers and polar ice caps) and water temperatures and greater humidity. Changes in weather patterns are also associated with increased atmospheric temperatures, resulting in effects such as increased droughts in some areas and increased flooding in others.

The proposed Project will produce GHG emissions released at the site and during downstream coal combustion, which will contribute to these associated global environmental effects. The proposed increase in GHG emissions as a result of the proposed Project, however, will not substantially increase the total Australian emissions or impede emission reduction actions.

10.10.4 Management, Mitigation and Offset Measures

The most likely method of directly reducing Scope 2 GHG emissions from the site will be through the ongoing implementation of the site's Energy Saving Action Plan (ESAP). Investigations into opportunities for improvements in energy efficiency are assessed annually in CMPL's ESAP reporting, with emission reduction strategies developed that are cost effective and feasible. The ESAP will continue to identify where potential savings in fuel and electricity could be made, together with the subsequent implementation of energy efficiency strategies where practical. Potential mitigation measures that will be considered include:

- The use of low emission fuels where possible;
- Energy savings initiatives in the key focus areas of:
    - Power factor correction;
    - Metering and monitoring;
    - Compressed air;
    - Coal handling plant; and
- Keeping equipment in good operating order to maintain efficiency. Machinery, plant and equipment will be serviced and kept in good working order and service records will be kept.

CMPL has committed to mitigation and offset of Scope 1 emissions, specifically by:

- Undertaking research into reducing the emissions generated by ventilation air methane (VAM). This includes government funding to investigate VAM technology at Mandalong Mine, and if proven successful and cost effective, then this technology will provide opportunities for application at other mines.
- Committing to offset 10% of its Scope 1 and Scope 2 emissions per annum. This commitment will coincide with the reporting and auditing obligations outlined under the NGER Act, whereby the tonnes of CO_2-e offset each year will go through a rigorous verification process. These offsets will be located in Australia, will be accredited to a recognised scheme or standard (or in the process of achieving accreditation), will be independently verified, and will be undertaken in accordance with any relevant Australian Government policies and standards at that time. These offsets will be put in place where opportunities to avoid or mitigate emissions are not available, or until a National emissions trading scheme is imposed on the Colliery.

Such actions are in keeping with Centennial's commitment to GHG reduction strategies.

10.10.5 Conclusion

The proposed Project will result in a 38% increase in GHG emissions over existing site emissions based on predictions of existing mine operations with production up to 2 Mtpa, and represents approximately 2 % of mining emissions in Australia and 0.1 % of total Australian emissions. This calculation is based on a worst case scenario whereby future mining for the Project only occurs in the most gaseous seam, the Fassifern seam. Future mining is likely to occur however across the three coal seams and as a consequence the increase in GHG emissions will likely be reduced.

The increase in GHG emissions due to the proposed Project is not considered likely to significantly affect total NSW or Australian emissions or impede emission reduction actions. In addition, CMPL is committed to undertaking research into reducing and/or offsetting a portion of its Scope 1 and Scope 2 emissions to address the effects of its operations on the Enhanced Greenhouse Effect.

10.11 Economic Impacts

10.11.1 Background

A development is economically efficient and desirable on economic grounds if the benefits to society exceed the costs (James and Gillespie, 2002). For mining developments, the main economic benefit is the producer surplus generated by the mine and the employment benefits it provides, while the main economic costs relate to environmental and cultural costs (Gillespie Economics, 2010).

An economic assessment of the proposed Project was undertaken by Gillespie Economics (2010). The assessment quantified the costs and benefits and the economical impact of the proposed Project, and provides a justification of the proposed Project on economic grounds.

The assessment considered two important economic aspects:

- The economic efficiency of the proposed Project (i.e. consideration of economic costs and benefits); and
- The economic impacts of the Project (i.e. the economic stimulus that the Project will provide to the regional or State economy).

10.11.2 Methodology

The economic assessment was undertaken in accordance with the *Guideline for Economic Effects and Evaluation in EIA* (Planning NSW, 2002), where the guideline identifies economic efficiency as the key consideration of economic analysis. The assessment of economics impacts of the proposed Project included two types of analysis:

- A Benefit Cost Analysis (BCA); and
- An Input-Output economic analysis.

The complete economic assessment report is included in **Appendix N**.

10.11.3 Impact Assessment

10.11.3.1 Benefit Cost Analysis

A BCA is the method used to consider economic efficiency and weigh up the benefits and costs of a project.

BCA involves the following key steps:

- identification of the base case or “without” Project case;
- identification of the “with” Project scenario;
- physical quantification and valuation of the projects incremental benefits and costs;
- consolidation of values using discounting to account for the different timing of costs and benefits;
- application of decision criteria;
- sensitivity testing; and
- consideration of non-quantified benefits and costs, where applicable.

For the purposes of the BCA, the scenario for the base case included mining under the existing Development Consent (1977) and within the existing Development Consent Mining Area Boundary which will be able to operate viably for approximately another 5 years, with a decreasing production rate. In contrast, the proposed Project scenario involved an extension of mining within the Project Application Area over 21 years and an increase in ROM coal production up to 2 Mtpa. The BCA compared these two scenarios.

For mining developments, the main economic benefit is the producer surplus generated by the mine and the employment benefits it provides, while the main economic costs relate to environmental and cultural costs.

The benefits and costs of the proposed Project as identified by the economic assessment are summarised in Table 2.3 of **Appendix N** and have been quantified into value estimates to demonstrate the total costs and benefit of the Project.

The proposed Project will have net production benefits of $343M. This benefit will be distributed amongst a range of stakeholders including Centennial and its shareholders, NSW Government (through royalties) and the

Commonwealth Government in the form of Company tax. Local councils will also benefit through rates and development contributions.

The main external costs from the proposed Project relate to GHG generation which has been valued at an estimated $166M, and CMPL will internalise some of these costs by offsetting 10% of its Scope 1 emissions where opportunities to avoid or mitigate emissions are not available. External benefits associated with employment provided by the proposed Project have been estimated at $100M.

Net Present Value (NPV) is a standard method for using the time value of money to economically appraise long-term projects. A positive NPV generally indicates that the proposed Project will be desirable from an economic perspective for society to allocate resources to the Project, because the community as a whole will obtain net benefits from the proposed Project. It is estimated that the proposed Project will to have net benefits (NPV) of $278M and hence is desirable and justified from an economic efficiency perspective.

Sensitivity

A sensitivity analysis was also undertaken as part of the BCA (refer **Appendix N**). The analysis indicated that the results of the BCA overall, are not sensitive to reasonable changes in assumptions regarding identified variables. However, the results were most sensitive to increases in operating costs and decreases in the economic value of coal.

10.11.3.2 Input-Output Economic Analysis

Regional and State Benefits

The regional and State impacts of the Project were determined using an Input-Output analysis as detailed in **Appendix N**.

Regional Economy

The total and disaggregated annual impacts of the proposed Project on the regional economy in terms of output, value-added, income and employment (in 2010 dollars) have been determined. In total, the proposed Project will contribute the following to the regional economy:

- $159M in annual direct and indirect regional output or business turnover;
- $71M in annual direct and indirect regional value added;
- $53M in annual household income; and
- 451 direct and indirect jobs.

Flow-on spending as a result of the proposed Project is likely to economically benefit a number of different sectors of the regional economy including manufacturing (structural metal products, agricultural and mining machinery), electricity, health services, wholesale trade, retail trade, other business and the hotels, cafes and restaurants sector.

Businesses that can provide the inputs to the production process at Myuna Colliery and/or the products and services required by employees will directly benefit from the proposed Project by way of an increase in economic activity. However, because of the inter-linkages between sectors, many indirect businesses will also benefit.

State Economy

The total and disaggregated annual impacts of the proposed Project on the State economy in terms of output, value-added, income and employment (in 2010 dollars) have also been determined and is estimated to make the following contribution to the NSW economy:

- $222M in annual direct and indirect output or business turnover;
- $104M in annual direct and indirect value added;
- $71M in annual household income; and
- 732 direct and indirect jobs.

Through comparison of the regional economic impacts and the impacts on the NSW economy, it can be determined that the impacts on the State economy are greater, as the NSW economy captures mine and household expenditure both within the regional economy and the wider NSW State economy and as there is a greater level of intersectoral linkages in the larger NSW economy.

10.11.3.3 Project Cessation

The cessation of mining operations in the future will result in a contraction in regional economic activity. The magnitude of the regional economic impacts of cessation of the proposed Project will depend on a number of interrelated factors at the time. These factors are addressed as follows.

Movements of workers

The impact of mine closure will depend on whether workers and their families affected will leave the region. Should the mine closure result in a large number of workers leaving the region, the consumption-induced flow-on effects will decline and impacts will approximate the negative of the total effects in Table 2.3 of **Appendix N.**

Alternative Development Opportunities

It is considered that regional economic impacts associated with mine closure have the potential to be substantially ameliorated and absorbed by the growth of the region. Myuna Colliery is within the Newcastle economic region which is considered highly prospective in terms of coal resources. The region is therefore likely to support and encourage new mining developments which will have the potential to strengthen the economic base of the region and absorb several impacts related to the closure of the mine.

Economic Structure and Trends

The significance of the economic impacts of closure of the mine will ultimately depend on the economic structure and trends in the regional economy at the time. That is, impacts are likely to be more significant if closure occurs during a declining economy or conversely, impacts are likely to be less significant if the mine closes during a growing economy.

10.11.4 Management and Mitigation Measures

The economic implications of the proposed Project have been assessed, the results of which indicate that a positive net benefit will be expected, providing overall benefits to the local, regional and State economies. The project is justifiable in terms of economic efficiency and as such no mitigation measures are required.

10.11.5 Conclusion

The proposed Project will have a net benefit (NPV) of $278M, and hence is desirable and justified from an economic efficiency perspective, coupled with the fact that no mitigation measures are required, there will be no residual consequences of economic impacts as a result of the proposed Project.

10.12 Other Minor Issues

10.12.1 Rehabilitation

All surface infrastructure associated with Myuna Colliery's operations is located at the Surface Facilities Area. The Surface Facilities Area encompasses a footprint of approximately 89 hectares, of which 21 hectares includes the surface infrastructure. The 2009 AEMR has identified this 21 hectares as the total area currently requiring rehabilitation prior to mine closure. The remainder of the Surface Facilities Area is predominantly natural bushland vegetation, the Wangi Creek watercourse and existing cleared easement corridors.

CMPL undertakes progressive rehabilitation of disturbed areas within the Surface Facilities Area on an as required basis (refer **Section 4.8** and **5.10**). Areas are identified for rehabilitation as part of the AEMR and completed rehabilitation activities are reported on an annual basis to I&I as part of the AEMR process. **Section 4.0** of the EA details the most recent rehabilitation activities at the Surface Facilities Area. At present there is minimal rehabilitation to be completed.

The current MOP includes a conceptual final land use plan for the Surface Facilities Area. The final land use for the Surface Facilities Area will be determined in accordance with a REMP to be commenced within 5 years of the closure of Myuna Colliery. The REMP will be prepared to meet the requirements of I&I, and in relation to rehabilitation, will define the following:

- Rehabilitation objectives, methodology and monitoring programs,
- Performance standards and proposed completion criteria;
- Decommissioning and removal of surface infrastructure, including the sealing underground entries and boreholes, which would be in accordance with relevant government criteria at the time of decommissioning; and
- Nominated final land uses, having regard to any relevant strategic land use planning or resource management plans or policies.

The REMP will also address matters including linking the final landform with pre-existing land uses, options of restoring the natural ecology of the area, and establishing a clear set of rehabilitation criteria which includes short, medium and long term ecological criteria.

10.12.2 Land Capability

As discussed in detail in **Section 2.1**, the Surface Facilities Area is located on land owned by Centennial Fassifern Pty Ltd with Eraring Power Station land to the north-west. NPWS owns a large tract of land to the south across Summerhill Drive, at Myuna Bay, which is part of the Lake Macquarie State Conservation Area.

The residential areas of Wangi Wangi and Arcadia Vale exist to the east and south of the infrastructure at the Surface Facilities Area respectively, although are buffered by bushland of at least 500 metres. The infrastructure at the Surface Facilities Area is surrounded by vegetated ridgelines and is immediately adjacent to the now former Wangi Power Station.

The proposed Project will not result in a change to the existing land use, and as such the land capability of the Surface Facilities Area will not be affected.

The final land use for the Surface Facilities Area will be determined in accordance with a Mine Closure Plan to be commenced within 5 years of the closure of Myuna Colliery. The final land use for the Surface Facilities Area following the completion of mining will take into consideration the land capability of the site, while having regard to the surrounding land use of the area at that time.

10.12.3 Visual

As shown on **Figure 10.1.1**, the infrastructure at the Myuna Colliery Surface Facilities Area is surrounded by ridgelines which vary from 20 to 50 metres RL. The Surface Facilities Areas is bound in all directions by a natural bushland buffer and a road network, with the closest receivers over 500 metres away. Due to the nature of the bushland buffer, the infrastructure at the Surface Facilities Area is generally not visible at surrounding receivers or landuse activities. Further, plant and equipment at the Surface Facilities Area is coloured in hues of green analogous to the surrounding bushland.

The closest residences along Donnelly Road (Receivers R4, R5 and R6) sit at a higher elevation than the infrastructure at the Surface Facilities Area, but views to the site are obscured by mature vegetation. There are limited intermittent views travelling along Donnelly Road, however these views are transient and generally obscured by vegetation. Residences in Wangi Wangi are generally located at approximately 10 metres RL (Receivers R1, R2, R3, R7 and R8) to up to 50 RL in limited areas on Lakeview Road. View lines to the Surface Facilities Area from these residences are completely blocked by the surrounding ridgelines and vegetation (refer to **Plate 1**).

Plate 1 – View towards Wangi Point Road and Surface Facilities Area from R1

The Surface Facilities Area is not visible from Summerhill Drive or the eastern end of Donnelly Road. Extremely limited, intermittent views of the Surface Facilities Area may be experienced while travelling along the northern section of Donnelly Road, near R5 (see **Plate 2**).

Plate 2 – View towards the Surface Facilities Area from Donnelly Road, near R5

No modifications to existing, or construction of additional, infrastructure is sought as part of the proposed Project, and as such views from the surrounding environment to the Surface Facilities will remain unchanged to existing. Any ongoing maintenance to the Surface Facilities Area will continue to be undertaken with consideration of view lines to the site.

As the Surface Facilities is well shielded from passerby traffic and residences and contributes a very low visual impact to the area, no additional visual mitigation measures will be required as a result of the proposed Project.

Soils

The soil landscapes within the Project Application Area are characterised by the Awaba, Doyalson and Wyong Soil landscapes. Awaba and Doyalson are erosional landscapes while Wyong comprises poorly drained deltaic floodplains and alluvial flats.

The Doyalson and Wyong soil landscapes are located within the wider Project Application Area. The Doyalson soil landscape is part of the Narrabeen Group – Clifton Subgroup – Munmorah Conglomerate Formation. Topography is generally undulating rises with local relief to 30 metres and slope gradients of less than 10%. Similar to Awaba, rock outcrops are usually absent lenses of mudstone and siltstone may occur (Murphy 1993). In contrast the Wyong soil landscape, on Quaternary sediments, is situated on poorly drained floodplains with low slope. Low lying slightly elevated terraces are sometimes present. This soil type is commonly associated with drainage lines on the lake edge (Murphy 1993).

Surface soils in the Wangi area and proximate to the Surface Facilities Area are classified as part of the Awaba erosional landscape on the Lake Macquarie to Gosford 1:100,000 Map Sheet. The Awaba soil landscape is associated with the Munmorah Conglomerate Formation of the Narrabeen Group, and the Newcastle Coal

No modifications to existing, or construction of additional, infrastructure is sought as part of the proposed Project, and as such view lines to the Surface Facilities Area from surrounding areas are restricted.

As the Surface Facilities Area is generally well shielded from passerby traffic and residences and contributes a very low visual impact to the area, no visual mitigation measures are required for the proposed Project.

10.12.4 Soils

The soil landscapes within the Project Application Area are characterised by the Awaba, Doyalson and Wyong Soil landscapes. Awaba and Doyalson are erosional landscapes while Wyong comprises poorly drained deltaic floodplains and alluvial flats.

The Doyalson and Wyong soil landscapes are located within the wider Project Application Area. The Doyalson soil landscape is part of the Narrabeen Group – Clifton Subgroup – Munmorah Conglomerate Formation. The topography is generally undulating with rises up to 30 metres and slope gradients of less than 10%. Similar to Awaba, rock outcrops are usually absent lenses of mudstone and siltstone may occur (Murphy 1993). In contrast the Wyong soil landscape, on Quaternary sediments, is situated on poorly drained floodplains with low slope. Low lying slightly elevated terraces are sometimes present. This soil type is commonly associated with drainage lines on the lake edge (Murphy 1993).

Surface soils in the Wangi area and proximate to the Surface Facilities Area are classified as part of the Awaba erosional landscape on the *Lake Macquarie to Gosford 1:100,000 Map Sheet*. The Awaba soil landscape is associated with the Munmorah Conglomerate Formation of the Narrabeen Group, and the Newcastle Coal Measures. The topography of this landscape typically comprises low hills with short side slopes and numerous closely spaced drainage lines. Rock outcrops are usually absent and lenses of mudstone and tuff may occur (Murphy 1993). This soil landscape generally has a high erosion hazard.

The infrastructure within the Surface Facilities Area is located within a natural depression in the landscape. The majority of the infrastructure is situated on hardstand, and therefore has little exposure to erosion. The upper vegetated catchment within the Surface Facilities Area exhibits a significant degree of erosion and hence sedimentation downstream. Erosion tends to occur along access tracks, which are required for the management of bushfire risks, and in steeply sloping areas. Erosion and sediment control is currently managed through the Land Management Plan which forms part of the EMS for Myuna Colliery. The existing Land Management Plan is considered adequate for the management of erosion and sediment control.

Some contaminated areas of land have also been identified within the Surface Facilities Area. An assessment of site contamination was undertaken at the Surface Facilities Area in 2008, as reported in the 2009 AEMR. Potential areas of contamination were identified and mitigation and management measures identified. Ongoing investigations into contaminated land will occur over the life of the mine. Myuna Colliery has a Hydrocarbon Management Plan as part of the EMS which includes procedures for the management of potentially contaminating hydrocarbon materials. The Colliery uses diesel and a variety of oils and greases for both lubrication and energy.

As the proposed Project will not result in significant changes to the landscape within the Project Application Area, and in particular the Surface Facilities Area, significant impacts to the soil landscape are not expected.

10.12.5 Waste

Existing operations at Myuna Colliery generate a number of types of waste that are currently managed in accordance with the existing EMS, which includes a Waste Management and Minimisation Plan. All wastes generated on site are classified and separated in accordance with DECCW's *Waste Classification Guidelines* (DECC, 2008).

The Myuna Colliery Waste Minimisation and Management Plan (M-EMS-007) identifies waste streams and the appropriate contractor/licensed facility that accepts each type of waste. The M-EMS-007 identifies regulatory requirements and appropriate methods for disposal. Two full-time contractors are employed by Myuna Colliery to sort, collect and prepare waste for disposal.

Due to the mining method employed at Myuna Colliery only a small amount of waste rock is produced from the mining process. This is collected and stored on site.

Waste management at Myuna Colliery is also undertaken in accordance with EPL 366 issued by DECCW which contains certain requirements relating to the maximum quantity of certain types of waste that may be generated or stored on the site, and a Trade Waste Permit (permit number D-171027) issued by Hunter Water which regulates the discharge of certain liquid wastes to Hunter Water's sewerage system.

The classification, description and volumes of wastes likely to be generated by the proposed Project are provided in **Table 37**. The volumes are based on 2009 data, adding a 20% increase in operational resources, and 5% increase in office generated wastes.

Table 37 **Predicted** Wastes Generated by the proposed Project

Waste Classification	Predicted Volume	Description
General Solid Waste (putrescible and non-putrescible)		
General Solid Waste (putrescible and non-putrescible)	Putrescible – 2,200 m^3 Non- Putrescible - 170 m^3 + 280 rubber tyres Clinical – 130 m^3	General solid waste includes putrescible wastes such as organics, general litter and food waste, and non-putrescible waste such as glass, plastic, rubber, plasterboard, ceramics, bricks, concrete, wood waste and paper, as well as arrange of other wastes that meet the classification of General Solid Waste under DECCW's *Waste Classification Guidelines* that may be generated from time to time. This waste is placed into four general waste bins. Tyres are assessed for repair and reuse by contract company, if not feasible for repair tyres are disposed by licensed contractor.
Recyclable Waste		
Recyclable cardboard	1.89 tonnes	Cardboard is crushed into 50kg bails via a purpose built machine. The site generates approximately 4x50kg bails of cardboard /month. A service provider receives the bails for recycling monthly at no cost.
Ferrous and non ferrous metal:	240 tonnes	Separate bins are used for waste metal, and are collected by a licensed contractor as required.
Timber pallets and timber waste	-	All timber waste is stored in site until sufficient quantity is collected to have an on-site tub grinder break it down to reusable wood chip. This chip is used for on-site rehabilitation works.
Printer cartridges	160 litres	Recycled through Planet Ark.
Security documents	2,625 litres	Recycled through a security documents contractor.
Liquid and Hazardous Wastes		
Waste oil, oily water, grease, parts washer	14,400 litres	All waste oil is disposed through a licensed waste contractor and facility.
Oily rags Oil filters	500 kilograms 650 kilograms	Disposed through a licensed waste contractor and facility.
Batteries	130 mixed batteries	Used batteries are stored on a spill collection tray in a safe, dry, designated area prior to removal off site by an approved contractor and in accordance with relevant waste tracking guidelines.
Reusable oil drums	-	Spent oil drums are drained and crushed for recycling.
Waste water	1.85ML approx.	Discharge to sewer in accordance with Hunter Water Trade Waste Permit.

Existing recycling and reuse practices on site ensures minimal general waste is disposed to landfill. The removal of a former bulk rubbish bin as well as the provision of bulk scrap steel bins has greatly increased the amount of scrap steel being resold instead of disposed to general landfill. Training of employees in waste management practices has also meant that a greater portion of recyclable office waste is being separated and recycled.

The proposed Project will not result in a significant change or increase to the type or quantity of wastes generated on site. As such, the existing waste management practices are considered to be adequate for the proposed Project.

10.12.6 Hazards

10.12.6.1 Hydrocarbon Contamination

Myuna Colliery currently operates in accordance with a HSMS which provides the framework for the management of hazards and risks associated with the Colliery's operations. The HSMS identifies the process for identifying and managing hazards through the application of structured hazard analysis and risk assessment methodology.

Myuna Colliery operates several types of plant which rely on diesel, oils and greases for operation. The storage of fuels on the site is managed in accordance with the Hydrocarbon Management Plan, part of the Myuna Colliery EMS, described in **Section 4.6**. Management of fuels on site is undertaken in accordance with *Australian Standard 1940-2004 The storage and handling of flammable and combustible liquids* which guides the minimum acceptable safety requirements for storage facilities, operating procedures, emergency planning and fire protection.

As there are no significant changes to the type of operations undertaken at Myuna Colliery, the existing HSMS and EMS, including the Hydrocarbon Management Plan, will continue to be implemented for the proposed Project and updated as required.

10.12.6.2 Bushfire

Bushland vegetation surrounds the infrastructure at the Surface Facilities Area and provides a buffer between infrastructure and sensitive receptors. Myuna Colliery and community assets within 100 metres of the bushland vegetation are considered to face a bushfire risk. The frequency of fires in the vicinity of the Surface Facilities Area is between 2 and 5 years. In the 5 years prior to 2009 there were no recorded fires in the Centennial Myuna buffer zone.

Bushfire risk at Myuna Colliery is currently managed in accordance with a Bushfire Management Plan which forms part of CMPL's EMS. The Bushfire Management Plan has been developed to address the risk of bushfires and reduce severity of bushfire on land within and surrounding the Surface Facilities Area.

No significant bushfire impacts have been identified in relation to the proposed Project. The existing Bushfire Management Plan is considered to be adequate to manage bushfire risks associated with the proposed Project. The existing Bushfire Management Plan will be updated as required.

10.13 Residual Consequences

The risk assessment process for the proposed Project identified those environmental, social and economic issues where further information or investigation was required to address existing knowledge gaps or where improvements will be required to existing mitigation and management measures to ensure the residual consequence for the Project will be acceptably low. Specialist investigations were undertaken where the risks were considered unacceptable, or there was a knowledge gap in the information available.

The residual consequences of each of the environmental, social and economic issues assessed for the proposed Project have been identified in **Sections 10.1** to **10.11**. Generally, given the existing health, safety, environment and community management regime at Myuna Colliery, ongoing implementation of the Myuna Colliery EMS and related plans, it is considered that residual consequences will be adequately managed as a result of the proposed Project.

The EA has identified that the only environmental aspect likely to result in residual consequences is the generation of greenhouse gases. At present, there is no technology currently available to mitigate the generation of greenhouse gases emitted during the extraction of coal. In recognition of the requirement to offset these impacts, CMPL has committed to offset 10% of Scope 1 emissions annually where opportunities to avoid or mitigate emissions are not available, or until a National emissions trading scheme is imposed on the Colliery. In addition, Centennial is committed to addressing the effects of operations and is undertaking research and development into reducing emissions generated by VAM, as described in **Section 10.10.4**.

Based on the identified environmental effects of the proposed Project and the ability to confidently manage those effects to minimise harm to the environment, the proposed Project will present an overall minimal residual consequence, provided that the recommended mitigation, management and monitoring measures outlined in **Section 10** and the Statement of Commitments in **Section 11** are implemented. On balance, the benefits of the proposed Project, and with proposed management, mitigation and offset measures in place, are considered to outweigh the predicted residual consequences.

10.14 Cumulative Impacts

The cumulative impacts of the proposed Project have been considered in relation to each of the identified environmental issues in **Section 10** of this EA. Cumulative impacts of the extended operations at Myuna Colliery, particularly with respect to water, noise and air quality have been considered in each of the technical studies undertaken in respect of this proposal. A summary of the cumulative impact of each of the key environmental consequences of the proposed Project is provide below.

Air quality – cumulative air quality impacts, including dust generation have been assessed against background concentrations of pollutants within the local region. The annual average incremental impact of deposited dust and TSP resulting from the proposed Project are predicted to be negligible, and there parameters are not predicted to exceed DECCW criteria at sensitive receptors. The highest background concentration of PM_{10} used in the AQIA was in excess of the DECCW criteria for PM_{10}, however the incremental impact of PM_{10} emissions from the proposed Project is not predicted to result in significant cumulative impacts.

Water – the proposed Project is predicted to result in an increase of inflow of water make into the underground mine workings over the life of the mine. It is predicted this will result in an increase in the quantity of water extracted from underground and consequently discharged via LDPs to Wangi Creek, and Lake Macquarie. However the increased discharge of water to Wangi Creek is not predicted to result in significant impacts to water quality, hydrology or geomorphology within Wangi Creek. The proposed Project also incorporates features that will enhance the existing water management system and improve monitoring of water quality and volume of discharges from the Colliery. The overall cumulative impact to water is not predicted to be significant.

Acoustic – operational noise levels associated with the proposed Project are predicted to meet relevant project-specific noise criteria and will not result in cumulative impacts to the existing noise environment.

Aquatic Ecology – the proposed Project is not predicted to affect aquatic ecological impacts to seagrass, benthic macroinvertabrate assemblages, fisheries resources or threatened species within Lake Macquarie. No cumulative impacts are predicted.

Social – the proposed Project is not predicted to result in impacts that will have significant consequences for the social environment. Cumulative impacts that will result in consequences for the social environment are not predicted to be significant.

Traffic – the proposed Project will result in a marginal incremental increase in traffic movements associated with employee vehicle movements travelling to and from the Surface Facilities Area over the life of the mine. This cumulative increase in traffic is not anticipated to result in significant environmental consequences.

Terrestrial Ecology – disturbance to the land surface within the Surface Facilities Area will be primarily limited to the construction of additional clean water diversions, which will not affect threatened or endangered species, populations or ecological communities. The maximum 20 millimetres of subsidence within Mining Zone A will not result in impacts to endangered species, populations or ecological communities within the wider Project Application Area. Cumulative impacts to terrestrial ecology are not predicted.

Aboriginal Heritage – Aboriginal heritage items with significance ranging from high to low have been identified within the Project Application Area within Mining Zone A. Subsidence up to 20 millimetres is not predicted to result in impacts to identified heritage items, therefore cumulative impacts are not predicted.

European Heritage – no cumulative impacts are predicted.

Economic – no cumulative impacts are predicted.

Greenhouse Gas – the proposed Project will result in a cumulative impact in GHG emissions, with a predicted 38% increase from existing site Scope 1 and 2 GHG emissions, and represents approximately 2 % of mining emissions in Australia and 0.1 % of total Australian emissions, primarily as a result of ventilation emissions from the underground workings. The assessment of GHG emissions considered a worst-case scenario which predicted GHG emissions based on all extraction occurring within the most gaseous coal seam (Fassifern Seam), however mining will be undertaken in all three seams over the life of the mine therefore actual emissions are likely to be less than predicted. To reduce the residual impact, CMPL has committed to offset 10% of Scope 1 emissions annually where opportunities to avoid or mitigate emissions are not available, or until a National emissions trading scheme is imposed on the Colliery. In addition, Centennial is committed to addressing the effects of operations and is undertaking research and development into reducing emissions generated by VAM, as described in **Section 10.10.4**.

The overall cumulative impact of the proposed Project is not predicted to be significant.

11.0 Statement of Commitments

11.1 Environmental Management

Myuna Colliery has been operating for 28 years under an existing EMS and several key EMPs as described in **Section 4.6** of the EA. The existing environmental management measures within these plans will be continued for the proposed Project.

Existing EMPs which form part of Myuna Colliery's EMS that will be updated and augmented to incorporate additional environmental management requirements for the proposed Project are listed in **Table 38**.

Table 38 Gap Analysis of Environmental Management Plans for Myuna Colliery

Myuna Colliery Existing Environmental Management Plans		
Title	**Purpose**	**Timeframe**
Water Management Plan MM-EMS-3-001	The objectives of the Water Management Plan are to detail the water management system, and water quality monitoring in place at Myuna Colliery. The Water Management Plan will be updated to include the recommendations detailed within the Water Management Assessment in **Section 10.2**.	Within 6 months of Project Approval
Noise Management Plan MM-EMS-3-003	The objectives of the Noise Management Plan are to detail noise mitigation and management strategies and noise monitoring at Myuna Colliery. The Noise Management Plan will be updated to include the recommendations detailed within the Myuna Colliery Noise Impact Assessment.	Within 6 months of Project Approval
Stakeholder Engagement Management Plan MM-EMS-3-010	The objectives of the Stakeholder Engagement Management Plan are to identify relevant stakeholders and methods of engagement with these stakeholders. The Stakeholder Engagement Plan is regularly reviewed and updated to ensure all relevant stakeholders and consultation strategies are relevant and effective.	Within 6 months of Project Approval

In addition to the existing EMS and EMPs, this EA has identified a number of additional management plans that will be established for the proposed Project, which are outlined in **Table 39**.

Table 39 Myuna Colliery Proposed Environmental Management Plans

Myuna Colliery Proposed Environmental Management Plans		
Title	**Purpose**	**Timeframe**
Extraction Plan	The primary objective of the Extraction Plan is to detail the mine design methods for secondary extraction within Mining Zone B, identify potential effects of secondary extraction within mining Zone B and identify measures to mitigate or remediate potential impacts.	Prior to secondary extraction causing subsidence greater than 20 millimetres.
Seagrass Management Plan	The SMP will identify the management, monitoring and mitigation measures that will be undertaken within the Seagrass Management Zone, prior to the implementation of a mine design likely to cause subsidence greater than 20 millimetres.	Within 6 months of Project Approval
Aboriginal Cultural Heritage Management Plan (ACHMP)	This Plan will identify recorded Aboriginal heritage sites, cultural significance, management or monitoring methods required, and the management of additional sites (if identified) within the Project Application Area. The ACHMP will be developed in consultation with the relevant Aboriginal stakeholders.	Within 6 months of Project Approval.

11.2 Statement of Commitments

The EARs issued for the proposed Project require that the EA includes a Statement of Commitments (SoC) detailing the additional measures proposed for the environmental mitigation, management and monitoring for the proposed Project. **Table 40** and **Table 41** respectively, details the Statement of Commitments for the construction and operation of the proposed Project that CMPL will adopt through to the end of mine life should approval be granted under Part 3A of the EP&A Act. These Commitments are in addition to the environmental management measures, EMPs and EMS currently implemented onsite.

Table 40 Statement of Commitments – Construction

Desired Outcome/Commitment	Action
Clean Water Diversion Works	
Construction of the clean water diversions at the Surface Facilities Area undertaken in a manner that will minimise impacts to the surrounding environment.	1) Construction will be undertaken during the hours 7am to 6pm Monday to Friday, and 8am to 1pm on Saturdays. No construction work will be undertaken on Sundays or Public Holidays.

Table 41 Statement of Commitments – Operation

Desired Outcome/Commitment	Action
Hours of Operation	
Operations undertaken within the approved operating hours.	2) Mining and associated operations will be undertaken 24 hours a day, 7 days a week.
Subsidence	
Subsidence levels managed within predicted maximum levels.	3) An Extraction Plan, or equivalent document, which takes into account the existing information presented in this Environmental Assessment, will be developed for mining within subsidence Zone B, in consultation with the DoP, prior to secondary workings being undertaken in Zone B.
Groundwater and Surface Water	
Operations carried out in a manner that minimises potential impacts to groundwater.	4) Within 6 months of Project Approval, a variation to EPL 366 will be lodged with DECCW to: - Combine licensed discharge points LDP001 and LDP002 into a single licensed discharge point, LDP B, with a combined discharge volume of 13 ML/day; - Establish a licensed discharge point at the Emergency Coal Stockpile Sediment Dam, LDP A, for event-based discharges where rainfall exceeds 80 millimetres in the 24 hours. - Enable volumetric exceedances during rainfall events greater than: • 15 millimetres in the preceding 24 hours at LDP B; and • 140 millimetres in the preceding 24 hours at LDP A. 5) The Proponent will undertake an investigation of water reuse options at Myuna Colliery within 6 months of Project Approval.
Aboriginal Heritage	
Items and areas of Aboriginal sensitivity are not disturbed as a result of the proposed Project, where possible.	6) If first workings and/or secondary extraction is to occur under the culturally sensitive sites recorded in Addendum A and Addendum B of the EA, an archaeological monitoring programme is to be developed for the potentially impacted site(s). 7) If there is evidence of Myuna Colliery mining-induced damage to sandstone outcrops and rock overhangs as described in Addendum A and Addendum B of **Appendix M** to the EA, all mining works affecting

Desired Outcome/Commitment	Action
	the area will cease and notification will be given to DECCW. A suitably qualified archaeologist and the relevant Aboriginal stakeholders will be engaged as required. 8) Myuna Colliery will develop an Aboriginal Cultural Heritage Management Plan (ACHMP) for the for the identified Aboriginal heritage items within the Project Area, as well as, contingency strategies for any additional heritage issues which may arise. The ACHMP will comprise: - An assessment of the cultural significance of the Aboriginal heritage sites within the Project Area; - Identification of roles and responsibilities (Centennial, Aboriginal stakeholders, heritage consultant); and - Strategies for: - Management of identified Aboriginal heritage sites; - Management of Aboriginal Heritage sites, should subsidence levels exceed the maximum predicted subsidence of 20 mm; and - Management of additional sites, if identified. The Myuna Colliery ACHMP will be developed in consultation with the relevant Aboriginal stakeholders to ensure that Aboriginal cultural values are adequately addressed.
Life of Mine Rehabilitation	
Sufficient planning is undertaken for end of life of mine and rehabilitation.	9) The proponent will develop and implement a Rehabilitation and Environmental Management Plan within 5 years of completion of mining.

12.0 Project Justification

12.1 Project Benefits

The proposed Project will provide a range of benefits to both Regional and State economies, including continued provision of employment for Myuna Colliery's existing 175 employees, as well as providing employment for an additional 35 direct employees (and approximately 241 indirect) for a further 21 years (Gillespie Economics, 2010). Additional wages, royalties and flow-on effects with a net benefit of a total of $222M will be injected into regional and State economies as a result of the proposed Project over its 21 year life (Gillespie Economics, 2010).

The proposed Project also incorporates several measures that will improve efficiencies in water management at the Surface Facilities Area, which will result in improved environmental outcomes.

Based on the identified environmental effects of the proposed Project and the ability to confidently manage those effects to minimise harm to the environment, the proposed Project will present an overall minimal residual consequence, provided that the recommended mitigation, management and monitoring measures outlined in **Section 10** and the Statement of Commitments in **Section 11** are implemented. On balance, the benefits of the proposed Project, and with proposed management, mitigation and offset measures in place, are considered to outweigh the predicted residual consequences.

12.2 Ecologically Sustainable Development

Ecologically Sustainable Development (ESD) has emerged as a primary objective of environmental protection in NSW. ESD is an objective of the EP&A Act under section 5(a)(vii), and is defined under section 6(2) of the Protection of the Environment Administration Act 1991 as:

6(2) for the purposes of subsection (1)(a), ecologically sustainable development requires the effective integration of economic and environmental considerations in decision-making processes. Ecologically sustainable development can be achieved through the implementation of the following principles and programs:

a) the precautionary principle—namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation...

b) inter-generational equity—namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

c) conservation of biological diversity and ecological integrity—namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

d) *improved valuation, pricing and incentive mechanisms—namely, that environmental factors should be included in the valuation of assets and services*….

The overall objectives of ESD are to use, conserve and enhance natural resources. This ensures that ecological processes are maintained facilitating improved quality of life, now and into the future.

In addition to the four ESD principles above, the EPBC Act also identifies a fifth principle for consideration in environmental impact, namely:

> *Decision making processes should effectively integrate both long term and short term economic, environmental, social and equitable considerations.*

These five principles are interrelated and need to be considered both individually and collectively as part of determining whether or not a project will be consistent with the principles of ESD in Australia.

12.2.1 Precautionary Principle

The Precautionary Principle, in summary, holds that where there are threats of serious or irreversible environmental damage, the lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

A precautionary and conservative approach to mine plan development has been employed to prevent or minimise potential subsidence impacts to the surface environment and infrastructure, including the following:

- Identification of sensitive surface features within the Project Application Area and the implementation of mine design criteria that limit subsidence to less than detectable limits (20mm) in Zone A;
- No multi seam secondary extraction within Zone A;
- Specialist subsidence assessment by Seedsman Geotechnics (2010) for the proposed Zone A and Zone B;
- Establishment of a SMZ within which additional management actions will be undertaken;
- Detailed surface water assessment for the Surface Facilities Area to improve the management of water at the site; and
- A risk-based approach to subsidence impact assessment and management including specialist environmental studies for key environmental aspects as outlined in **Section 10**.

A detailed understanding of the issues and potential impacts associated with the Project has been obtained via consultation and assessment to a level of detail commensurate with the scale of the Project, industry standards and the legislative framework under which the Project is permitted. Specialist assessments, including the use of engineering and scientific modelling, have been undertaken for the design of the mine and for impacts relating to, groundwater, surface water, Aboriginal heritage, traffic and transport, subsidence, European heritage, noise, air quality (including GHG), and terrestrial and aquatic ecology. Assessment has also been undertaken for other issues, including hazards and socio-economic considerations. To this end, there has been careful evaluation undertaken in order to avoid, where possible, serious or irreversible damage to the environment.

12.2.2 Intergenerational Equity

Intergenerational Equity is centred on the concept that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations. There is a moral obligation to ensure that today's economic progress, which will benefit both current and future generations, is not offset by environmental deterioration.

The primary objective of the Project is to allow continued operations of the existing Myuna Colliery and maintain continuity of coal production from existing and proposed mining areas, optimising resource recovery for the life of mine in an environmentally and socially responsible manner. The engagement of suitably qualified and experienced consultants has ensured that the planning, design and environmental assessment phases of the Project have been transparent. The contents of this EA report (including appendices) has enabled the Myuna Colliery to understand the potential implications of the Project, and therefore identify the required management strategies, mitigation measures and monitoring activities to ensure potential for impact is appropriately minimised.

The management strategies, mitigation measures and monitoring programs have been identified to minimise adverse impact upon the local environment and nearby communities. Emphasis has been placed on anticipation and prevention of potential impacts, as opposed to undertaking later remedial action.

The only significant residual consequence identified in this EA is the generation of GHG emissions. The proposed Project will produce GHG emissions released both at the site, and during downstream coal combustion, which will contribute to the effects of global warming and climate change. The proposed increase in GHG emissions as a result of the proposed Project, however, will not substantially increase the total Australian emissions or impede emission reduction actions. The greatest emission sources associated with the Project are those associated with the downstream combustion of the coal (Scope 3), the management of which is not in CMPL's control, followed by fugitive emissions from the mine (Scope 1), which are primarily associated with emissions from ventilation of the underground workings.

At present, there is no technology currently available to mitigate the generation of Scope 1 GHGs emitted during the extraction of coal. In recognition of the requirement to offset these impacts, CMPL has committed to offset 10% of Scope 1 emissions annually where opportunities to avoid or mitigate emissions are not available, or until a National emissions trading scheme is imposed on the Colliery. In addition, Centennial is committed to addressing the effects of operations and is undertaking research and development into reducing emissions generated by VAM.

The most likely method of directly reducing Scope 2 GHG emissions from the site will be through the ongoing implementation of the site's ESAP, which will continue to identify where potential savings in fuel and electricity could be made, together with the subsequent implementation of energy efficiency strategies where practical.

These actions and initiatives will assist in ensuring that current and future generations can enjoy equal and equitable access to social, environmental and economic resources through the maintenance of the health, diversity and production of the environment.

12.2.3 Biological Diversity and Ecological Integrity

The principle of Conservation of Biological Diversity and Ecological Integrity holds that the conservation of biological diversity and ecological integrity should be a fundamental consideration for development proposals.

The potential environmental impacts of the Project, including upon ecological communities and habitat values, and measures to ameliorate these potential impacts are detailed within this EA. The Myuna Colliery has sought to avoid and minimise potential impacts on ecological values within the Project Application Area through a risk based approach that eliminates surface subsidence impacts on the surrounding ecology. A specialist ecological investigation was undertaken for the Project (including identification and assessment of any EECs), which indicated that there were no significant impacts identified on vegetation communities, threatened flora and fauna, or to the connectivity of habitats (RPS, 2010).

Notwithstanding this, in accordance with obligations under the EPBC Act (Commonwealth legislation), the Project will be referred to SEWPaC for determination.

12.2.4 Improved Valuation and Pricing of Environmental Resources

The principle of Improved Valuation, Pricing and Incentive Mechanisms deems that environmental factors should be included in the valuation of assets and services. The cost associated with using or impacting upon an environmental resource is seen as a cost incurred to protect that resource.

Whilst clear and widely accepted standards have not yet been established for the application of this principle (to date there are few widely accepted methods by which monetary values are attributed to environmental factors), Myuna Colliery acknowledges and accepts the financial costs associated with all the measures required for the mine to avoid, minimise, mitigate and manage potential environmental and social impacts for the Project.

Furthermore, if the extraction of 2 Mtpa of coal resources is not recovered by Myuna Colliery as part of the Project, the likelihood of the resource being extracted in the future is considered low. The high cost of re-establishing within the site, compared to the additional coal quantity, will likely result in that resource being isolated and sterilised. Myuna Colliery will optimise the valuation and pricing of the coal resources through continued use of existing infrastructure for the Project (including coal handling and preparation facilitates and existing off road transportation facilities).

12.2.5 Decision Making Process

The proposed Project requires approval under Part 3A of the EP&A Act. An assessment of the short, medium and long term impacts of the proposed Project, taking into account the principles of ESD is described in this EA. The mitigation measures detailed in **Section 10.0**, the existing Myuna Colliery EMS, and the Statement of Commitments, provided in **Section 11.0**, forms the environmental mitigation, management and monitoring requirements for the proposed Project.

The Project Approval process prescribed under Part 3A of the EP&A Act and subsequent environmental management frameworks ensure that decision making and monitoring of the Project will be undertaken in an integrated manner, having regard to relevant issues associated with the proposed Project within its context.

Additionally, transparency throughout the decision making process for the design, impact assessment and development of management measures has been carried out through consultation with regulatory authorities, Indigenous stakeholders, and other stakeholders during the preparation of the EA (see **Section 8.0**). This has allowed discussion regarding potential environmental impacts and proposed mitigation and management procedures.

Myuna Colliery has operated successfully since its development of operations in 1979, and submits AEMRs annually to I&I and DoP as part of ongoing compliance with the conditions of existing mining tenements. Myuna Colliery has an existing EMS that will continue to operate for the life of the proposed Project. The continued implementation of this EMS and annual reporting to the relevant departments will assist in the continued management of environmental impacts.

13.0 Conclusion

Project Approval is sought for the extension of an existing underground coal mine and use of an existing approved Surface Facilities Area within an existing mining lease area. Myuna Colliery is a well established underground coal mine which has been operating for over 28 years, with well defined surface and mining environments. As a result of historical operations, Myuna Colliery has a very good understanding of mine design principles and requirements for the protection of surface features, and the appropriate management of potential environmental impacts.

Myuna Colliery holds the current ML 1370, CCL 762 and MPL 334, which extend over a greater area than that approved under the existing 1977 Development Consent. Current underground mining within the mining tenements (outside the area approved under its development consent) operates in accordance with section 74 of the *Mining Act 1992* which, prior to its repeal, stated that nothing carried out under the EP&A Act or an environmental planning instrument, can prevent the holder of an operating mining lease from carrying on mining.

Development of Myuna Colliery commenced in 1977 and the Colliery has been operating within the Development Consent Mining Area and within existing mining lease areas since 1982. Mining within the lease areas of the Project Application Area (outside the existing Development Consent Mining Area) would continue but for the repeal of section 74 of the Mining Act on 16 December 2010.

Project Approval is therefore required to ensure Myuna Colliery maximises the extraction of coal under its existing mining lease, without which, mining would be restricted to within the Development Consent Mining Area. Cessation of mining at Myuna Colliery would result in early mine closure after approximately five years, the loss of some 175 jobs and the sterilisation of approximately 37 Mt of the coal resource.

The primary objective of the Project is to allow continued operations of the existing Myuna Colliery and maintain continuity of coal production from existing and proposed mining areas, optimising resource recovery for the life of mine in an environmentally and socially responsible manner. The engagement of suitably qualified and experienced consultants has ensured that the planning, design and environmental assessment phases of the Project have been transparent. This EA has enabled the Myuna Colliery to understand the potential implications of the Project, and therefore identify the required management strategies, mitigation measures and monitoring activities to ensure potential for impact is appropriately minimised.

The Project has been assessed utilising a risk-based approach to appropriately identify and assess environmental aspects relevant to the proposed Project. The assessment has also involved consultation with various regulatory authorities and Aboriginal and community stakeholders. The management strategies, mitigation measures and monitoring programs have been identified to minimise adverse impact upon the local environment and nearby communities. Emphasis has been placed on anticipation and prevention of potential impacts, as opposed to undertaking later remedial action.

The proposed Project meets environmental performance requirements, will result in direct and indirect economic benefits to the local community, and has been considered in accordance with the principles of ESD in order for the Project to be considered for approval.

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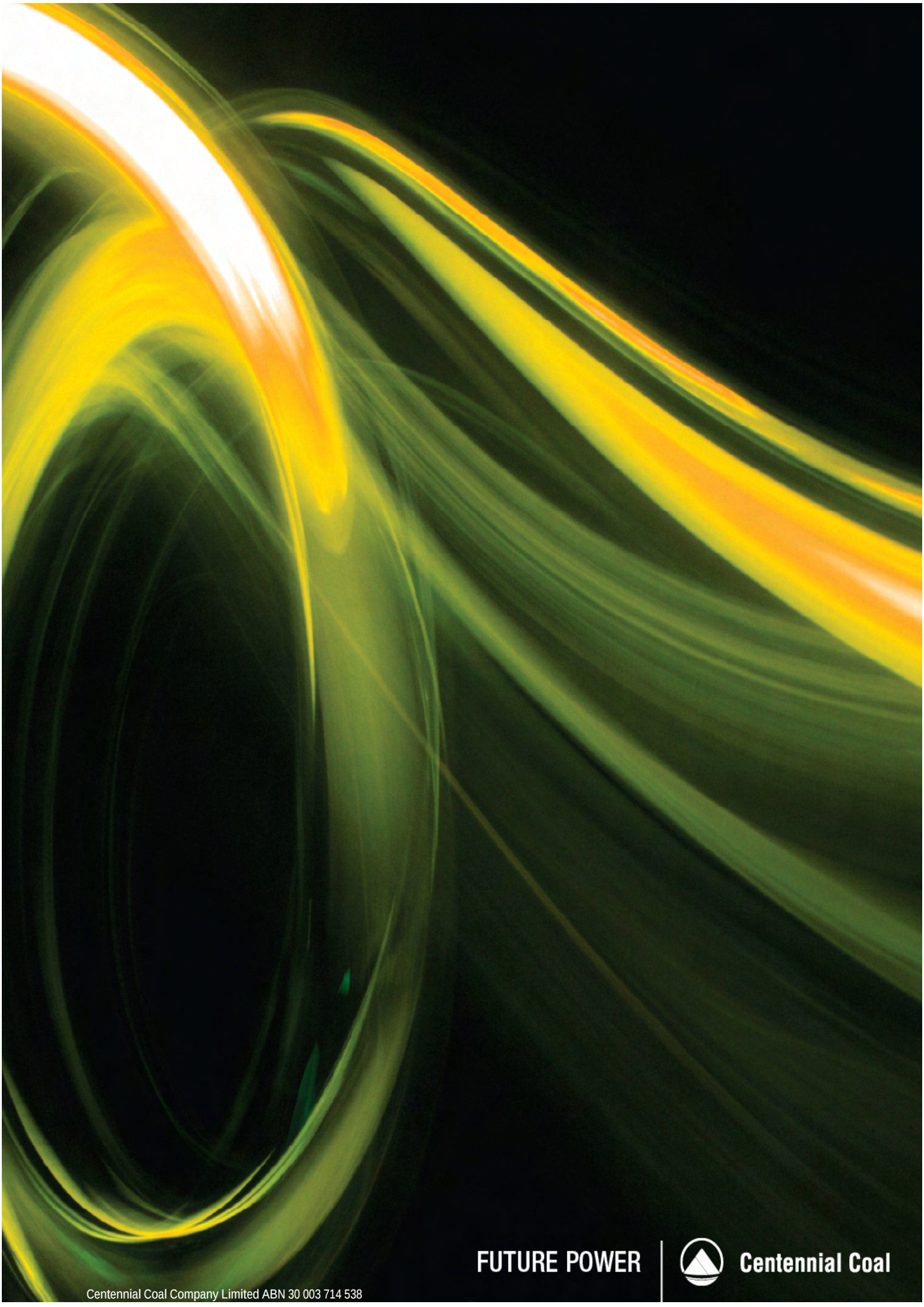

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